Review and Conservation of Sea Turtles in Uruguay

Foraging habitats, distribution, causes of mortality, education and regional integration

Proyecto Karumbé

FINAL REPORT
July 2001 - June 2003

Geographical location
Atlantic Ocean and Río de la Plata, Uruguay

Proyecto Karumbé
Tortugas Marinas del Uruguay

Uruguay, Montevideo, October 27, 2003.

Marianne Dunn
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Dear Marianne Dunn,

Enclosed please find two original copies of our final report entitled " Review and Conservation of Sea Turtles in Uruguay: Foraging habitats, distribution, causes of mortality, education and regional integration " and two copies of a compilation of our published work. Also you will find two CD's containing lecturers and presentations in power point format, PDF files (Final Report, posters and extended abstracts), JPEG pictures and a quick time video of the kids of San Luis. On a separate folder you will find copies of the material utilized for educational activities and communication purposes. Finally the package contain printed photographs as well as magazines and journals where our research activities were published.
If you need any extra information on this matter, please do not hesitate in contact us.

With warm wishes,

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With warm wishes,

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INDEX

ABSTRACT

The data collected along with the activities and studies performed from July 2001 to June 2003, allowed us to obtain valuable information about the present conservation status of the four sea turtle species that occur in Uruguayan waters. We detected that sea turtles in Uruguay are particularly subject to a number of threats; including recreational, artisanal and commercial fisheries, collision with boats, ingestion of marine debris and the illegal trade of carapaces. Among the natural threats we observed that a number of turtles were affected by fibropapilloma tumours, and hypothermic stunning events. We determined that the major threats to sea turtles in Uruguay are fisheries and that each species is affected by more than one fishery. Today, the green turtle is the only species impacted by fishing lines and coastal nets from recreational fishermen, either by the incidental capture or by the loss of fishing gear that creates deadly traps for this species at sea. Data collected from the artisanal fishery showed that 94.5 % of the captures corresponded to the species *C. mydas,* 49.3 % of which were found drowned in gillnets. Entanglement nets used by artisanal fishermen in Cerro Verde, Rocha (CV) and San Luis, Canelones (SL) highly interacted with green turtles, and were highlighted as the sites with the greater incidental capture of green turtles along the coast. Commercial fisheries as the coastal trawl fishery fleet that operate in the Río de la Plata and South Atlantic Ocean highly interacted with sea turtles, a first evaluation revealed that 19 turtles were captured by three coastal vessels. The longline fishery fleet also showed a great interaction with sea turtles. A number of 192 turtles were incidentally captured by this fishery between 1998 and 2000; most of the loggerheads were discarded alive (90%), but the leatherbacks were always discarded by cutting the lines so their final health status was not evaluated. The principal species affected by the commercial fishery (trawlers and longliners) were *C. caretta,* followed by *D. coriacea.* 163 was the total number of stranded turtles were reported during the period of study, most of which occurred during summer months. *C. mydas* was the most frequently encountered species followed by *C. caretta* and *D. coriacea.* Even though the cause of death could only be determined for a small number of turtles, we observed that most of the strandings coincided with the intense fishing effort performed by the trawl fishery fleet and the artisanal fishery during the different seasons. CV and SL where identified as the most important feeding areas for juvenile green turtles. Turtle sightings performed in Cerro Verde allowed us to determine that their presence varied seasonally. Feeding habits of green turtles at CV and SL were assessed by analyzing stomach contents of dead turtles and by gastric lavage samples from a small number of live-captured turtles. The diet of the individuals was composed primarily by algae. Differences in the composition of prey species were detected between the two localities. The activities carried out by Karumbé were included within an awareness' campaign using several mass media (newspapers, magazines, radio and television), and also through the internet. Further to this, regional experiences regarding local projects were shared and crucial integration advances were attained between southern countries (Argentina, Brazil and Uruguay). Also an environmental education programme was developed with great success. Schools of 13 different communities along the coast were visited with the participation of 1600 children. We offered several courses to the observers "on board" from the DI.NA.R.A. (National Direction of Aquatic Resources), and training workshops directed to commercial fishermen. As a result the first "On Board Tagging and Data Collection Programme" was created with great results. A total of 135 turtles were tagged thanks to the collaboration of the observers, trained fishermen and members of the project. Finally, other studies and activities were carried out during this period; including genetic analysis of juvenile green turtles, diet studies of leatherbacks and loggerheads, investigation of possible brumation, studies of diseases and rehabilitation of sea turtles.

I. INTRODUCTION

The four species cited for Uruguay are: the leatherback turtle *(Dermochelys coriacea),* loggerhead turtle *(Caretta caretta),* green turtle *(Chelonia mydas)* and olive ridley turtle *(Lepidochelys olivacea)* (Achaval 1997). For the olive ridley turtle only 3 records are available (Estrades & Achaval *in press*).

The olive ridley, the leatherback and the green turtles are listed as "endangered" and the leatherback turtle as "critically endangered" by the World Conservation Union (UICN) (Hilton-Taylor 2000). All four species are included in Appendix I of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). Similarly, the Convention for the Conservation of Migratory Species and Wild Animals (CMS) and the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC) of which Uruguay is part and signatory respectively, acknowledge their decline and take measures to protect them. Nationally, the sea turtles are protected by a presidential decree 144/998 (1998) that adopts measures to reduce mortality of sea turtles in the different fishing gears and the use and commerce of the species in the Uruguayan territory.

Lack of information about the distribution (spatial and temporal), size composition, stock management units, foraging behaviour and migration/movements of sea turtles utilizing Southwestern Atlantic habitats prevents research institutes, NGO's and governmental personnel from developing and implementing management plans and mitigation strategies which protect endangered species and their habitats.

Up until the beginning of 1999, there were no programs of research and conservation of sea turtles in Uruguay. In very few opportunities specific studies were accomplished (Achaval 1968, Frazier 1984, Achaval *et al.* 1998), although a high number of sea turtles were dying every year victims of fishing operations (artisanal and commercial) along the Río de la Plata and Southeastern Atlantic Ocean. This reality was being reflected on many of the number of dead sea turtles stranded on beaches along the coast. Primary research surveys performed by Karumbé identified that fisheries in Uruguay affect sea turtle species and life stages in different ways. Commercial fisheries affect juveniles and adults of *D. coriacea* and *C. Caretta*, while juveniles of *C. mydas* get tangled and drown in gill nets of artisanal fisheries and also on abandoned hook and line that turn out to be deadly traps. Other problems detected that affect the survival of these sea turtle populations in Uruguay were boat strikes, illegal trade of carapaces and meat, cold stunning events and marine pollution (Estrades *et al.* 2002).

The purpose of the present work was to obtain a comprehensive understanding of the status: the biological and ecological aspects and threats of the different sea turtles species that occur in Uruguayan waters, targeting the following goals and objectives:

- Collection of data on class composition by size and distribution of the different sea turtle species;
- determination of the major threats and causes of mortality by conducting stranding surveys and collecting information from artisanal and commercial fisheries;
- identification of foraging grounds of green turtles so as to offer a basis for future investigations on more specific subjects, that will guide decisions regarding the designation of critical habitats;
- teaching and distribution of information about sea turtles, (their conservation problem and laws that protect them) to coastal communities and corresponding authorities;
- communication of this information to the Uruguayan society using all mass media (newspapers, magazines, radio and television), and also through a Web page;
- integration of regional projects and policy issues among southern countries (Argentina, Brazil and Uruguay) with the purpose of starting joint mitigation research studies by the creation of a Regional Action Plan for the Southwestern Atlantic populations of sea turtles.

III. STUDY AREA

The study area comprises the coast and waters of the Rio de la Plata Estuary and Atlantic Ocean, including the Exclusive Economic Zone (EEZ) of Uruguay (34° - 38° S and 50° - 58° W) (Fig.1 and Fig. 2).

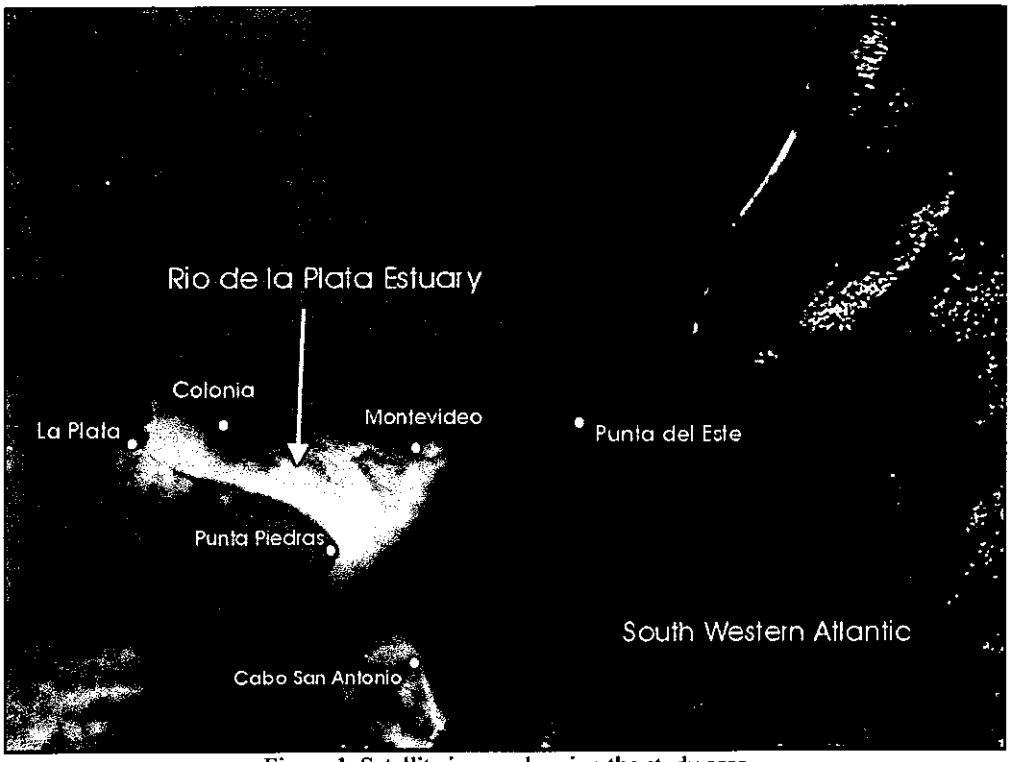


Figure 1. Satellite image showing the study area

Río de la Plata Estuary

The Rio de la Plata is located on the Eastern coast of South America, between 34°00'- 36°10' S and 55°00' - 58°10' W. It is nearly 25 km in length, and covers and area of about 38,800 km^2 and draining a 3,170,000 km^2 basin (the second largest one of the continent). The cross section expands towards the southeast starting with 32 km between Colonia (Uruguay) and La Plata (Argentina), to 100 km between Montevideo (Uruguay) and Punta Piedras (Argentina) and finally 230 km between Punta del Este (Uruguay) and Cabo San Antonio (Argentina) (Fig. 1) (López-Laborde 1997).
The annual mean river inflow is 25.000 $m^3.s^{-1}$, with a maximum in June and a minimum in January. Tides are semidiurnal with diurnal inequalities, with an amplitude of about 40 cm at the Uruguayan coast. The estuary tidal river is used for commercial fishing and angling, shipping to and from several major ports, recreation and tourism, especially along the sandy north shore. It serves as important wildlife habitat for marine mammals, seabirds and sea turtles among others. The waters of the Rio de la Plata are a depository for many raw wastes and effluents from industries, cities and towns, and from the disposal of dredging spoils. The river also receives runoff from land and oily wastes from maritime traffic (Nagy *et al.* 1997).

Southwestern Atlantic Ocean

The Southwestern Atlantic Region is influenced by several hydrographic processes that lead to great diversity in biological systems. This region experiences great variations of water temperature and salinity throughout the year, with cold water coming from the South (Malvinas Current) in autumn and winter; and warm water coming from the North (Brazil Current) in spring and summer. The composition of the fauna in this area shows a combination of warm-temperate and cold-temperate origin. If we add the influence that the Rio de la Plata has on the study area, we may understand why this relatively small geographic area comprises such a high biodiversity (Klappenbach & Scarabino 1969). The Exclusive Economic Zone (EEZ) of Uruguay has an extension of 200 nm (Fig. 2).

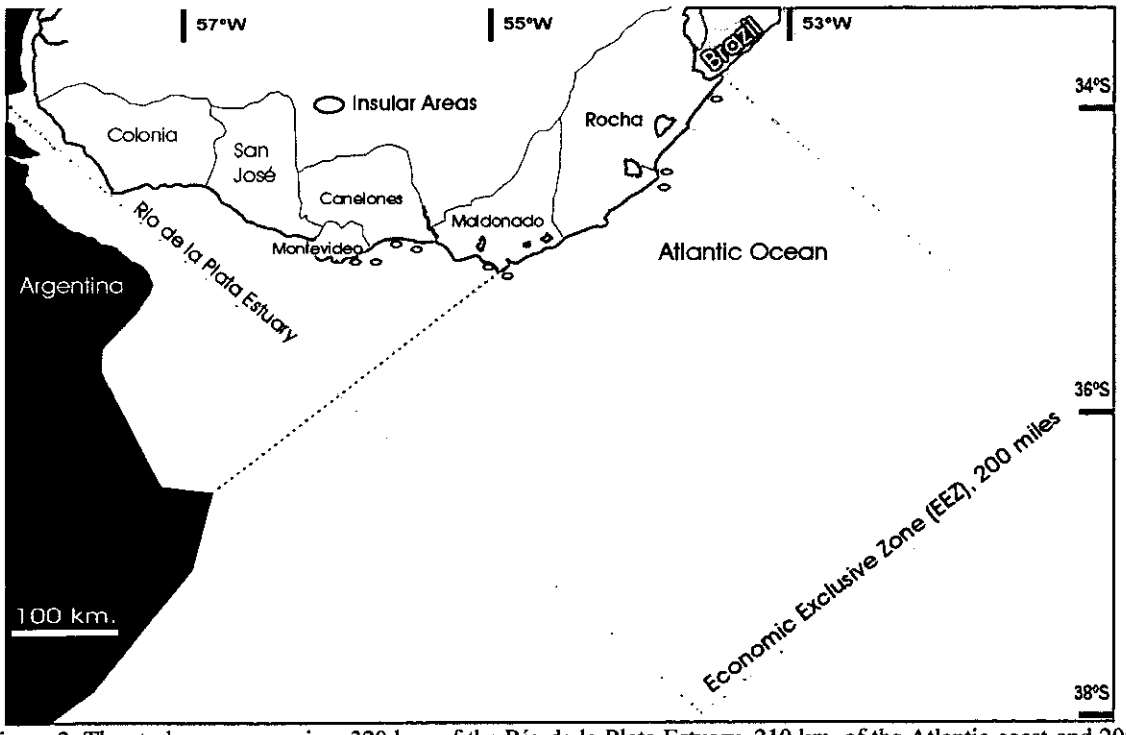


Figure 2. The study area comprises 320 km. of the Río de la Plata Estuary, 210 km. of the Atlantic coast and 200 miles of the EEZ.

Coastal islands

There are seven groups of islands in Uruguay: the Coronilla Islands, the Castillo Grande Islands, the Torres Islands, Lobos Island, Gorriti Island, the Flores islands, and Las Toscas Island. The diameter of these islands range from 100 to 1000 meters (Fig. 3)

Seasons of the year

Summer			Fall			Winter			Spring		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Set	Oct	Nov	Dec

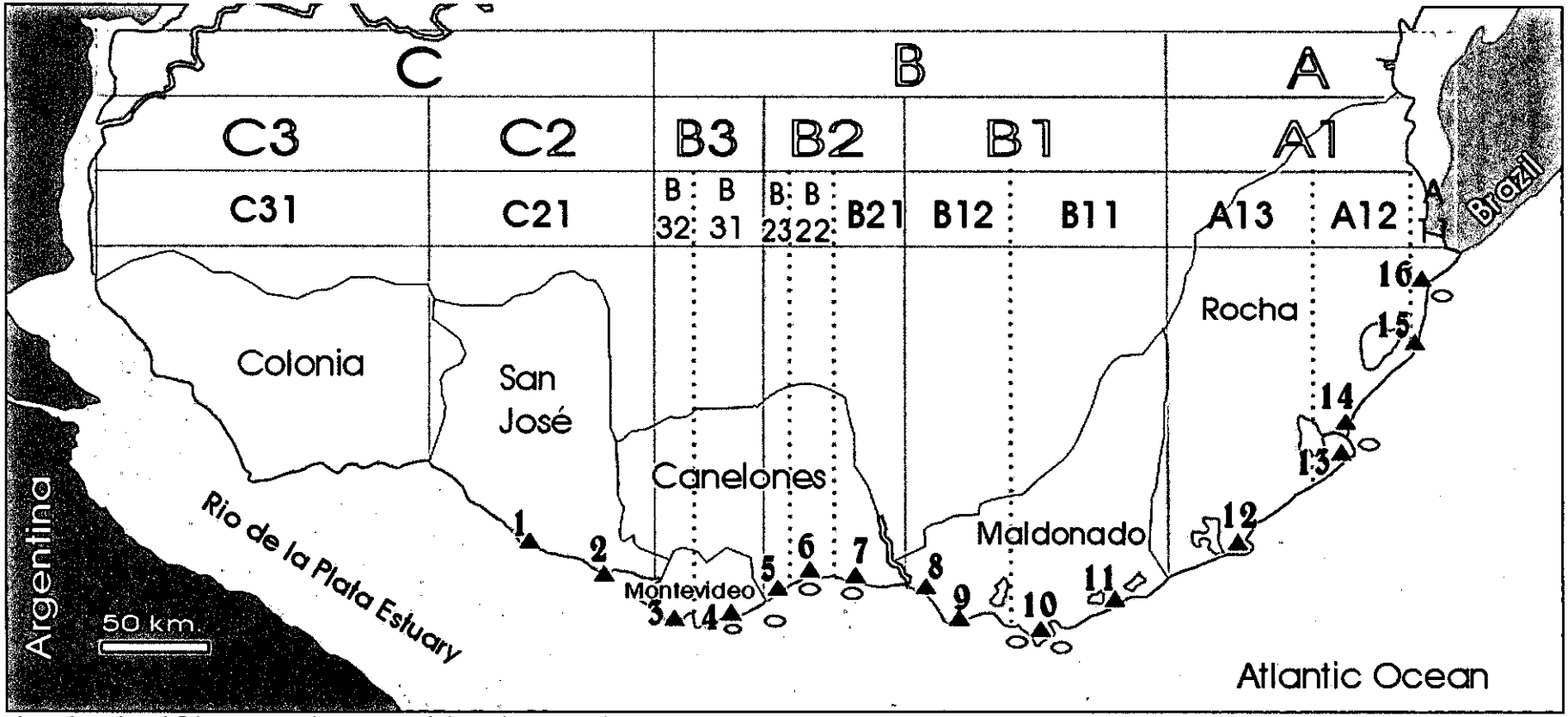
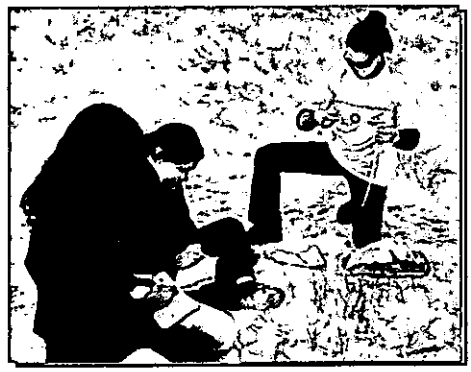


Figure 3. Artisanal fishermen's settlements: 1. Kiyú; 2. Playa Pascual; 3.Western Montevideo (Santa Catalina, Pajas Blancas); 4. Eastern Montevideo (P. Carretas, Buceo, Mulata); 5. Costa de Oro coast (Lagomar, Solymar, Pinar); 6. Atlántida; 7. San Luis (St. Lucía del Este), 8. Western Piriápolis (Solís, Playa Verde, Playa Hermosa); 9.Eastern Piriápolis (Punta Fría); 10. Punta del Este (La Barra); 11. José Ignacio; 12. La Paloma; 13. Cabo Polonio; 14. Valizas; 15. Punta del Diablo; 16. Santa Teresa (Cerro Verde, La Coronilla). Red circles indicate coastal island locations. Zone A: Department of Rocha - Zone B: Department of Maldonado and Department of Canelones - Zone C: Department of Colonia and Department of San José.

III. TURTLE DATA COLLECTION METHODS

Between June 9th and 10th, 2001, the Karumbé members held a standardization workshop on turtle data collection methods, and decided the kind of information and the way it would be collected.



Identification of species

When the species was not recognized at sight, we decided from then on to use the identification keys (Pritchard & Mortimer 1999)

Measurement procedures

To proceed with standardized measurements recognized worldwide we used the Bolten methods (Bolten 1999).
We took three different kinds of measurements for hard-shelled turtles: curve carapace length, minimum curve carapace length and carapace width.

1) Curve carapace length was measured from the nuchal notch to the posterior tip of the supracaudals using a flexible tape measure (CCLn-t, Fig. 1 A).
2) Minimum curve carapace length was measured from the nuchal notch to the posterior notch between the supracaudals using a flexible tape measure (CCLmin, Fig. 1 B).
3) Curve carapace width was measured at the widest point using a flexible tape measure (CCW, Fig.1 C).

Measurements from stranded turtles with cracked carapaces or missing parts of the shell were not included in statistic analyses. We also measured head width and plastron length and width (Fig. 1. D, E). Mass measurements: live turtles were weighed using a spring scale (± 100 grams).

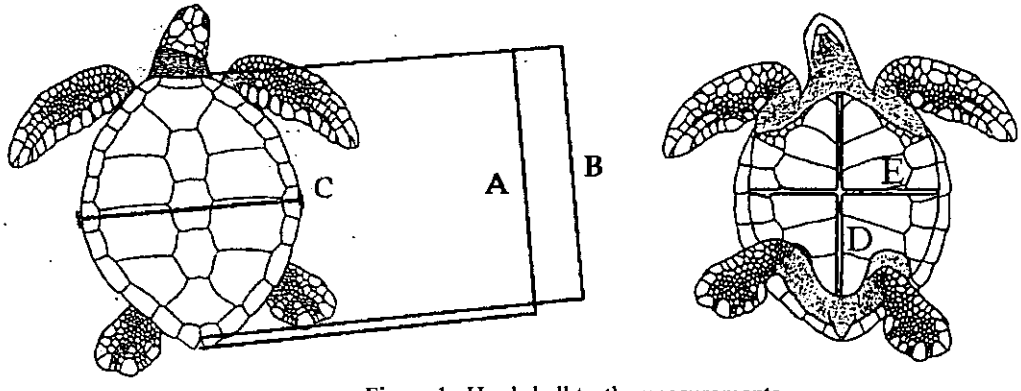


Figure 1. Hard shell turtle measurements
A: Curve carapace length (CCLn-t), **B**: Minimum carapace length (CCLmin),
C: Curve carapace width (CCW), **D**: Plastron length, **E**: Plastron width

Curve carapace width (A) of leatherbacks were measured from the first to the seventh ridge crest and curve carapace length (B) was measured from the nuchal notch to the posterior tip of the caudal peduncle allowing the tape to follow a natural position alongside the central ridge. (Fig. 2).

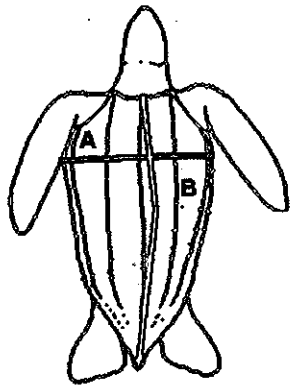


Figure 2. Leatherback measurements

Externally applied tags

In order to have an identification number of each turtle and thus determine possible migrations and/or residency, in July 2001 we created the National Marine Turtle Tagging Program (see chapter XIV). Live turtles captured were tagged on the front flippers, with the exception of leatherbacks, which were tagged on the hind flippers because in this case the tag loss is minor (Sarti *et al.* 1993).

We used Inconel tags (style 681) provided by the Cooperative Marine Turtle Tagging Program, which belongs to the Archie Carr Center for Sea Turtle Research (ACCSTR).

We checked over each one of the flippers of every stranded or captured animal to identify possible tag marks or scars from missing tags. (Fig. 3).

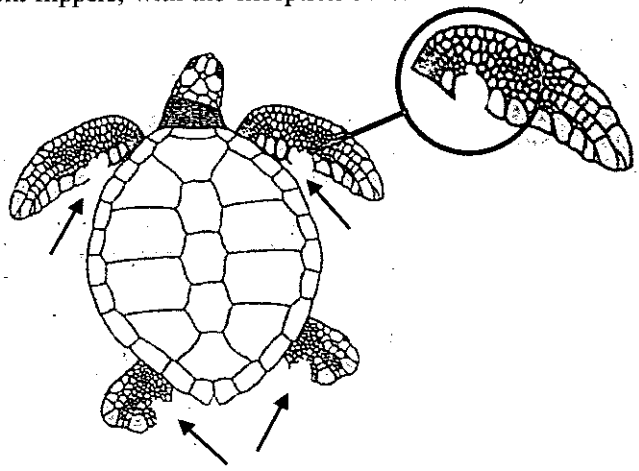
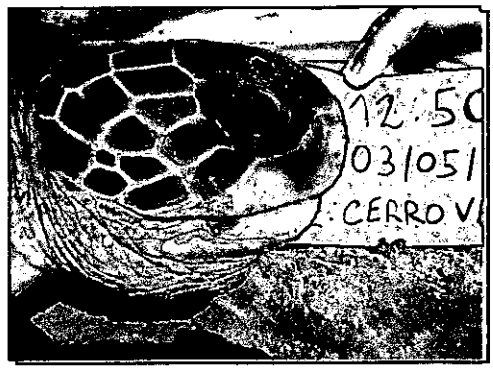


Figure 3. Position of tag scars of missing applied tags

Photo identification

Head profile (scales pattern) of the turtles was photo-identified in order to be able to identify possible recaptured individuals with tag scars (Richardson 1998); because the scales pattern of the head profile is unique for each individual.



Maturity status

Maturity status of the turtles captured was based on CCLt-n. We used the subjective criterion of minimum size of the nesting females (at the closest rookery) to distinguish maturity status.
Green turtles. Based on minimum nesting size at the Trinidade Island rookery (Brazil) (Moreira *et al.* 1995), we classified all turtles with CCL < 101 cm as immature and all turtles with CCL ≥ 101 as adults.
Loggerhead turtles. Based on minimum nesting size of female turtles at Brazilian nesting beaches (TAMAR unpubl. data.) we classified all turtles with CCL < 83 cm as immature and all turtles with CCL ≥ 83 as adults.
Leatherback turtles. Based on minimum nesting size of female turtles at French Guyana nesting beaches (TAMAR unpubl. data.), we classified all turtles with CCL < 137 cm as immature and all turtles with CCL ≥ 137 cm as adults.

Identification of turtle sex

This is normally not a problem in adult turtles since males develop secondary sexual characteristics during puberty (e.g., tail length, morphology of the nails on the front flippers). Adult males develop large tails, which extend well beyond the carapace, while the tail of the females is short and project only slightly beyond the edge of the marginal scutes (Wibbels 1999). To determine the sex of fresh dead juvenile turtles we performed a necropsy to look at the gonads (Work 2000).

Necropsy

Necropsy procedures were performed in relatively fresh animals stranded on the beach or drowned in fishing nets to determine: the probable cause of death, and to collect digestive tracts (esophagus, stomach and intestinal tract) to study feeding habits and parasites.

Esophageal lavage

An esophageal lavage (flushing of recently ingested food items) was practiced following the procedure described by Forbes & Limpus (1993). This technique allowed us to characterize the diet and feeding habits of live-captured green turtles.

Esophageal lavage

Other data collected

Tumors and epibionts (10% formalin)
Tissue samples for genetic studies (ethanol).

IV. FORANGING AREAS

In order to identify foraging areas for *C. mydas* the study was performed in different stages, according to the techniques used by Diez & Ottenwalder (1999).

Interviews

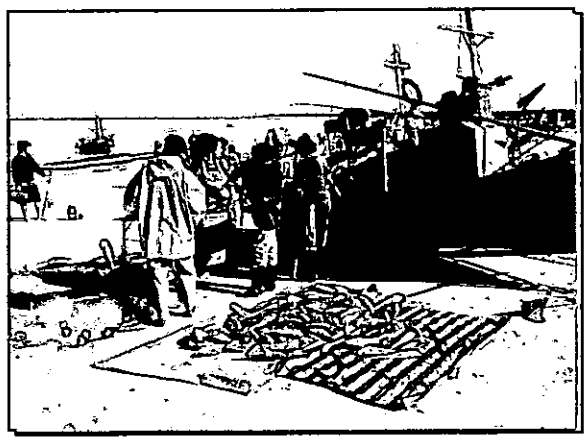
To carry out this stage two technicians proceeded to interview local inhabitants, as fishermen, divers and lifeguards (Areas A,B,C). Questions were asked on the presence or absence of turtles, size stage (juvenile or adults), presence of turtles close or far from the shore, number of turtles incidentally captured, seasonal patterns of abundance and sale of sea turtle products. The information compiled was used to obtain data about the potential feeding areas of green turtles.

Artisanal fishermen

During the year 2001, 36 interviews to fishing communities were performed in 19 small communities in the areas of the artisanal fishermen ports (Arazati, Kiyú, Playa Pascual, Pajas Blancas, Buceo, La Mulata, Solymar, Atlántida, San Luis, Sta. Lucía del Este, Playa Verde, Punta Fría, Punta del Este, José Ignacio, La Paloma, Cabo Polonio, Valizas, Punta del Diablo y La Coronilla).

The main activity of these communities is the artisanal fishery, which operate within the first 5 nautical miles, using two different arts of fishing: artisanal longlines and coastal gillnets.

Artisanal fishermen emboding their longlines



Artisanal fishermen repairing its coastal gillnets

A total of 86% of the fishermen interviewed said that turtles get incidentally caught during fishing operations, whereas 14% of the total had no interaction with sea turtles (Fig. 1). Also, 97% of the fishermen whose answer was positive, confirmed that the most commonly captured species was the green turtle, followed by leatherbacks and loggerheads. All of them said that turtles get caught in entanglement nets. Only one case reported that a loggerhead turtle was captured by an artisanal longline.

All of the 36 interviewed said that they released the turtles when they were trapped alive. When they were asked about what they did when the turtle was dead, 76 % answered that they used them, 15 % that they threw them back to the sea and 9 % did not answer (Fig.2). Those who used the turtles did so for personal consumption and carapace sale.

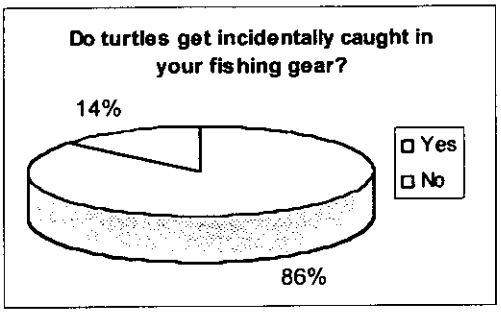


Figure 1. Artisanal fishery interview

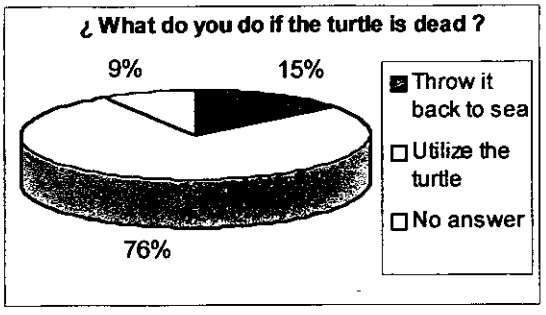


Figure 2. Artisanal fishery interview

Sport fishermen

Sporting fishermen were interviewed during field trips performed throughout 2001, (n: 32). The principal question was: Have you ever seen sea turtles while fishing? 78 % of the interviewed answered "yes" and 22 % answered "no" (Fig. 3).

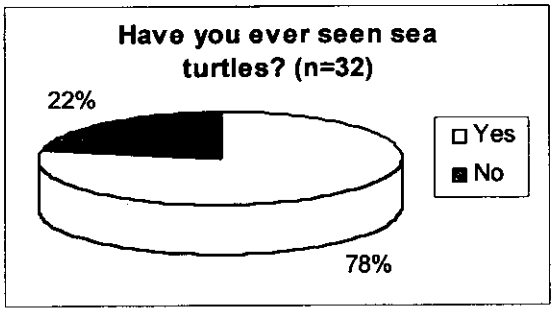


Figure 3. Sport fishermen interview

Divers

Poor visibility in the Rio de la Plata and part of the Atlantic Ocean makes underwater observation and sighting of sea turtles very difficult. In spite of this, several habitual divers remarked the presence of green sea turtles in the following areas: Cerro Verde, La Pedrera, Valizas, Cabo Polonio and Punta Colorada.

One of the remarkable facts (noticed by many divers) was the observation of turtles entangled (dead and alive) in fishing lines and hooks. In addition, a few divers said that some of the turtles were seen feeding or resting along the areas previously mentioned.

Season of the year and localities of greater presence of sea turtles

55 recreational and artisanal fishermen were interviewed. 78% of the interviewees said that summer (January to March) was the season with most presence of turtles (Fig. 4).

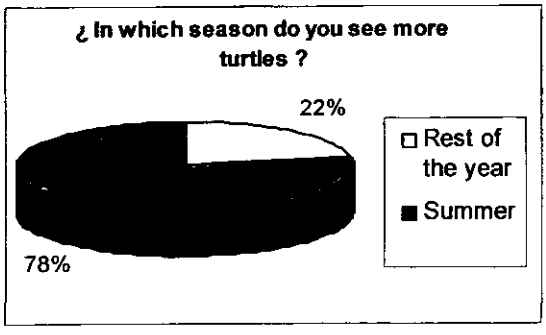


Figure 4. Artisanal fishermen interview

Preliminary survey

In agreement with the information obtained from the interviews, the areas where the incidental captures and the observation of turtles was greater (Table 1) were subjected to a monthly monitoring during 4 months. To identify possible feeding grounds of green turtles, "ad libitum" observations (Martin & Bateson 1991, Lenher 1979) of the individuals were made. Thus, juvenile individuals of *Chelonia mydas* were identified. The above-mentioned observations allowed us to set the basis and identify the area(s) with greater density of individuals where the efforts would be focused. All the points of observation were recorded using a GPS.

After identifying the most important areas with presence of green turtles, sightings and surveys were performed in those areas/ localities as shown in the following Table:

Table 1. Data obtained through different sources (Interview, Strandings, Incidental captures and Sightings) by locality.

Localities	**Presence of** *Chelonia mydas*			
	Interviews	Strandings	Incidental captures	Sightings
Kiyú – Playa Pascual	√	√	√	?
Montevideo (west and east)	√	√	√	?
Costa de Oro (Lagomar, Solymar, Pinar)	√	-	-	?
Atlántida	√	-	√	?
San Luis	√	√	√√	√
Piriápolis (west and east)	√	√√	√	√
P. del Este – J. Ignacio	√	√	-	√
La Paloma	√	√	√	√
Cabo Polonio	√	√	-	?
Valizas	√	√	√	√
Punta del Diablo	√	√	-	√
S.Teresa (Cerro Verde - La Coronilla)	√	√√	√√	√√

√ = record; √√ = important number of records, - = no record, ? = unknown/ not evaluated

Even though the observations were performed in different months and the information was not registered for a statistical analysis, the data shows clearly that Cerro Verde is the place that has the highest concentration of individuals, which can be observed easily throughout the year.

Pilot sampling

Based on the data collected from surveys (strandings, sightings and areas with the highest fishery interaction) we identified the two most important feeding areas, where we then focused our sampling efforts: **Cerro Verde** (Santa Teresa, Rocha – A11) in the Atlantic Ocean and **San Luis** (Canelones – B21) in the Río de la Plata.

SITE 1: Cerro Verde - Santa Teresa, Rocha

Cerro Verde area and surroundings is the first rocky shore heading south from the Brazilian border. Different kinds of habitats are present whitin this area, as sandy beaches, rocky shores, sandy dunes among others. This area also comprises three different islands (Fig. 5) with a high diversity of fauna and flora (e.g. fransiscana dolphins, *Pontoporia blainvillei*; bottlenose dolphins, *Tursiops truncatus*; right whales, *Eubalaena australis*; sea lions, *Otaria flavescens* and *Arctocephalus australis*; migratory sea birds, *Thalasseus maximus, T. sandivensis eurignatha, Sterna hirundinacea,* etc.). This area is included within a Ramsar site "Bañados del Este and Coastal Fringe" in Rocha.

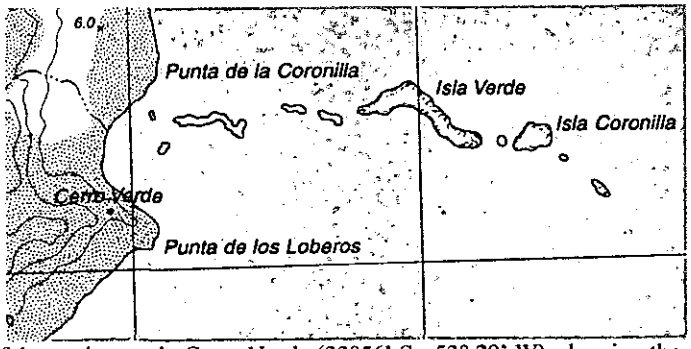


Figure 5. Map of the study area in Cerro Verde (33°56' S - 53° 29' W), showing the group of islands.

Cerro Verde area, showing the green hill

Green Island (Isla Verde) in the Cerro Verde area

Five turtle camps were set up at the Cerro Verde during the four seasons of the year. To monitor the presence of turtles in the area and collect biological data we used two different techniques:
a) systematic sightings, and **b) turtle capture in entanglement nets**.

a) Sightings

The sightings were performed from three viewpoints (observatories) located on the Cerro Verde, from an altitude of about 25 meters above sea level: **Verdoso Observatory** (33° 56′ 43″ S, 53° 30′ 24″ W), **Rocoso Observatory** (33° 56′ 39″ S, 53° 30′ 30″ W) and **Zorro Observatory** (33° 56′ 36″ S, 53° 30′ 33″ W) (Fig. 6).

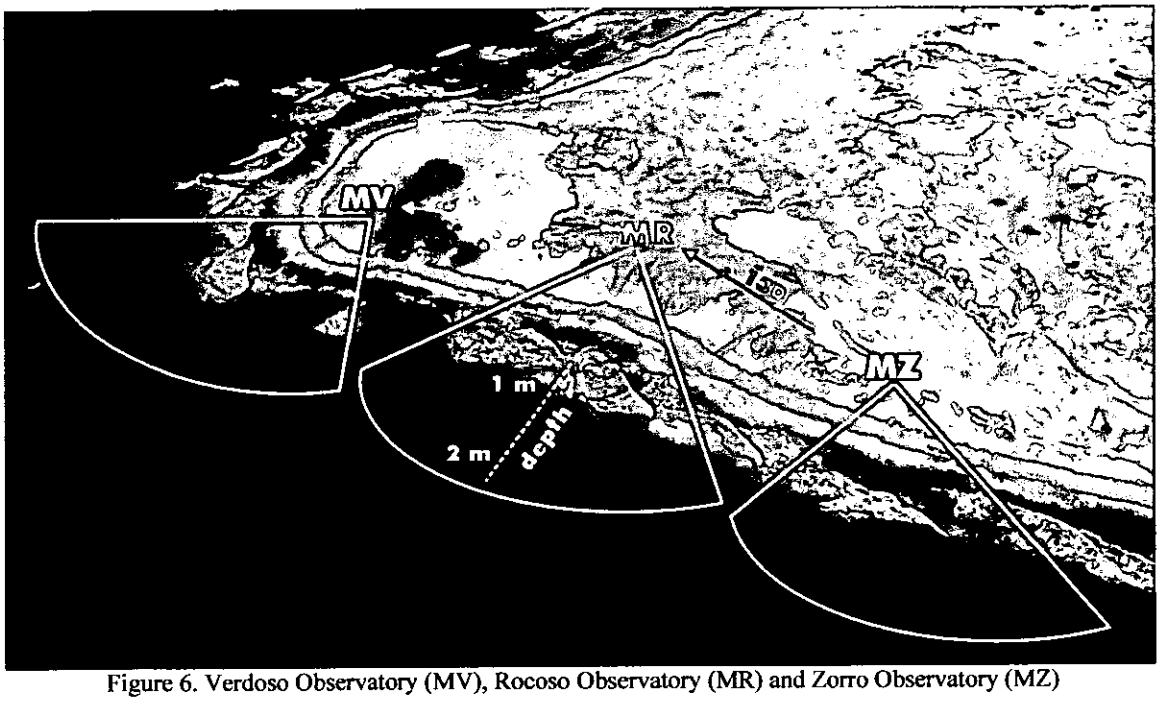


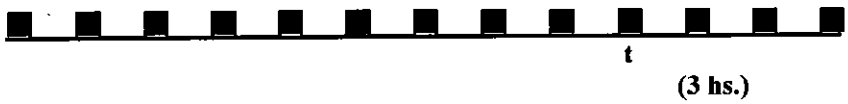
Figure 6. Verdoso Observatory (MV), Rocoso Observatory (MR) and Zorro Observatory (MZ)

The collection of behavioral data was improved by the implementation of a new sheet, which allowed us to take the data in a standardized way for statistical analyses. This new sheet was used from Nov. 29, 2002 to May 1, 2003. The objective was to examine if there were differences regarding turtle activity between observatories, between hours of the day (morning and afternoon) and between months.

Scan sampling was used as a sampling method. This method is just an instantaneous sampling in which several individuals are "scanned" at predetermined points in time and their behavioral state are scored (Lenher 1979).

Time sampling was used as a registration method. When a time sampling method is used, the observer has to record whether the behavioral state of the animal(s) during sampling points or the behavioral state (or event) occurred during the sampling interval delineated by points in time (or sampling points) (Lenher 1979).

In our case, the sheet was adapted specifically for the taxon under study, having into consideration that the work was going to be carried out on the field instead of in a lab. As a result, the sampling intervals had a duration of 10 minutes and the sampling point, where the behavioural data were collected, had a duration of 5 minutes, as showed:



Black squares indicate sampling points, and spaces (lines) show the sampling intervals. The individual activity was registered at each sampling point. As activity criteria, we used the number of times that an individual emerged from the water. At each sampling point we calculated the frequency of appearance or occurrence (ej: 15/5'= 3), after that, we calculated the frequency average based on the 3 hours of sighting.

The sampling period was divided in two: 3 hours of sightings in the morning, beginning at 9:00 am, and 3 hours of sightings in the afternoon, beginning at 3:00 pm., at each observatory. As a result six variables were generated, two for each observatory. Normality and homogeneity of variance of continuous variables were tested using Kolgomorov- Smirnov and Cochran C-test, respectively.

Var. 1= Zorro in the Morning (ZM). N = 27; mean = 6.246; median = 0.307; Standard Deviation = 1.184; Range = 6.20. Its distribution was approximately normal ($p < 0.1$).

Var. 2= Zorro in the Afternoon (ZA). N = 25; mean = 0.514; median = 0.276; Standard Deviation = 0.107; Range = 1.969. Its distribution was not normal (p = n.s).

Var. 3= Rocoso in the Morning (RM). N = 30; mean = 0.696; median = 0.415; Standard Deviation = 0.827; Range = 3.95. Its distribution was approximately normal ($p < 0.20$).

Var. 4= Rocoso in the Afternoon (RA). N = 33; mean = 3.711; median = 3.711; Standard Deviation = 2.233; Range = 7.392. Its distribution was not normal (p = n.s).

Var. 5= Verdoso in the Morning (VM). N = 28; mean = 1.483; median = 1.092; Standard Deviation = 1.382; Range = 4.477. Its distribution was not normal (p = n.s).

Var. 6= Verdoso in the Afternoon (VA) N = 25; mean = 1.466; median = 0.676; Standard Deviation = 1.722; Range = 5.692. Its distribution was not normal (p = n.s).

Results from Cochran-C test showed that Ho was rejected (C = 0.407; p = 0.0000), indicating that the variance between the variables was not equal. So, because some of the variables were not normal and the variance was not equal we used Non-parametric to test differences between observatories and time periods.

We used a **Kruskal-Wallis** test to detect significant differences between the six variables (median values). Results indicated that there were significant differences between variables ($H_{5,168} = 53.020$; p = 0.0000). Rocoso in the afternoon showed the highest value in the rank sum (Table 2). Figure 7 shows that Rocoso in the Afternoon (RA= variable 4) is clearly separated from the rest, regarding to the median.

Table 2: Kruskal-Wallis ANOVA by ranks for the 6 variables.

	Code	Valid N	Sum of Ranks
Zorro M	1	27	1539.000
Zorro A	2	25	1465.500
Rocoso M	3	30	2049.500
Rocoso A	4	33	**4399.500**
Verdoso M	5	28	2582.000
Verdoso A	6	25	2160.500

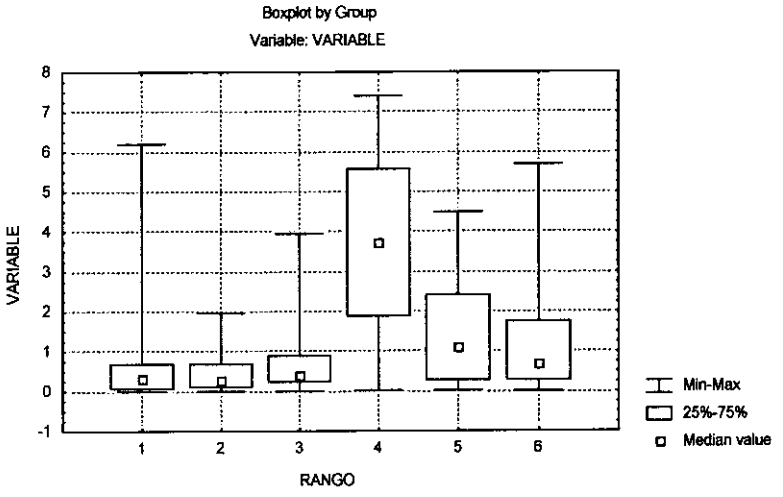


Figure 7. Boxplot of each one of the variables, showing median values, 25%-75% confident limits and range. 1 = Z M; 2 = Z A; 3 = R M; 4 = RA; 5 = V M; 6 = V A.

Kruskal-Wallis test showed that there were significant differences ($H_{2,\ 85} = 9.109883$; $p = 0.01$) when comparing the three observatories during the morning, Verdoso displayed the highest value in the sum of ranks (Table 3). Figure 8 showed that Verdoso in the Morning (VM) was separated from the rest.

Table 3: Kruskal-Wallis anova by ranks for the 3 variables.

	Code	Valid N	Sum of Ranks
Zorro M	1	27	918.000
Rocoso M	2	30	1231.500
Verdoso M	3	28	**1505.500**

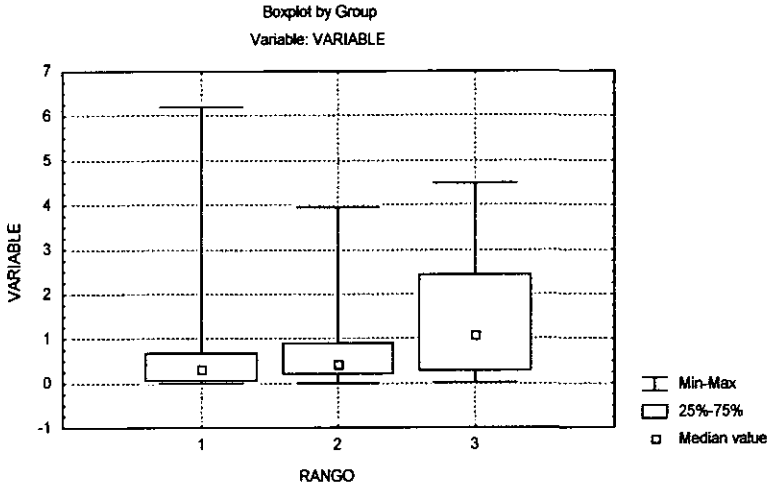


Figure 8. Boxplot of each observatory in the morning, showing median values, 25%-75% confident limits and range. 1 = Z M; 2 = R M; 3 = V M.

Kruskal-Wallis test showed that there were significant differences ($H_{2,83}$ = 33.85221; p = 0.000) when comparing the three observatories during the afternoon. Rocoso displayed the highest value in the sum of ranks (Table 4). Figure 9 showed that Rocoso in the Afternoon (RA) was clearly separated from the rest.

Table 4: Kruskal-Wallis ANOVA by ranks for the 3 variables.

	Code	Valid N	Sum of Ranks
Zorro A	1	25	594.500
Rocoso A	2	33	**1978.000**
Verdoso A	3	25	913.500

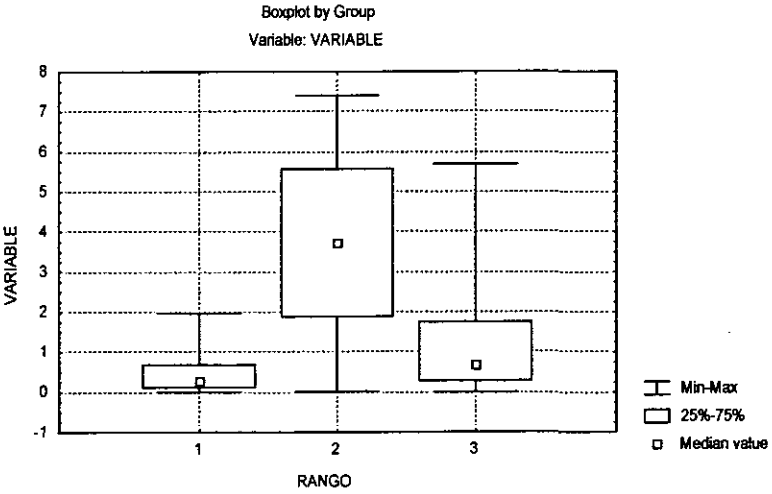


Figure 9. Box plot of each observatory in the morning, showing median values, 25%-75% confident limits and range .1 = Z A; 2 = R A; 3 = V A.

There were significant differences in the activity of the turtles between observatories between mornings and afternoons. Verdoso in the morning and Rocoso in the afternoon displayed the highest median values. But, when comparing all the variables, the variable Rocoso in the afternoon had the highest median value showing that from that viewpoint during the afternoon the individuals showed the greatest activity.

Thus, we determined that Rocoso in the afternoon is the best candidate to continue with the sightings throughout the year in order to evaluate the annual activity of the individuals.

Estimation of turtles during summer turtle camp, Jan.2003

At the same time that the activity data was being recorded, the number of sea turtles was also estimated at each sampling point. After that, the number of individuals per observatory and per day was calculated. In Figure 10, each variable was plotted independently, while in Figure 11 the number of individuals was averaged by observatory.

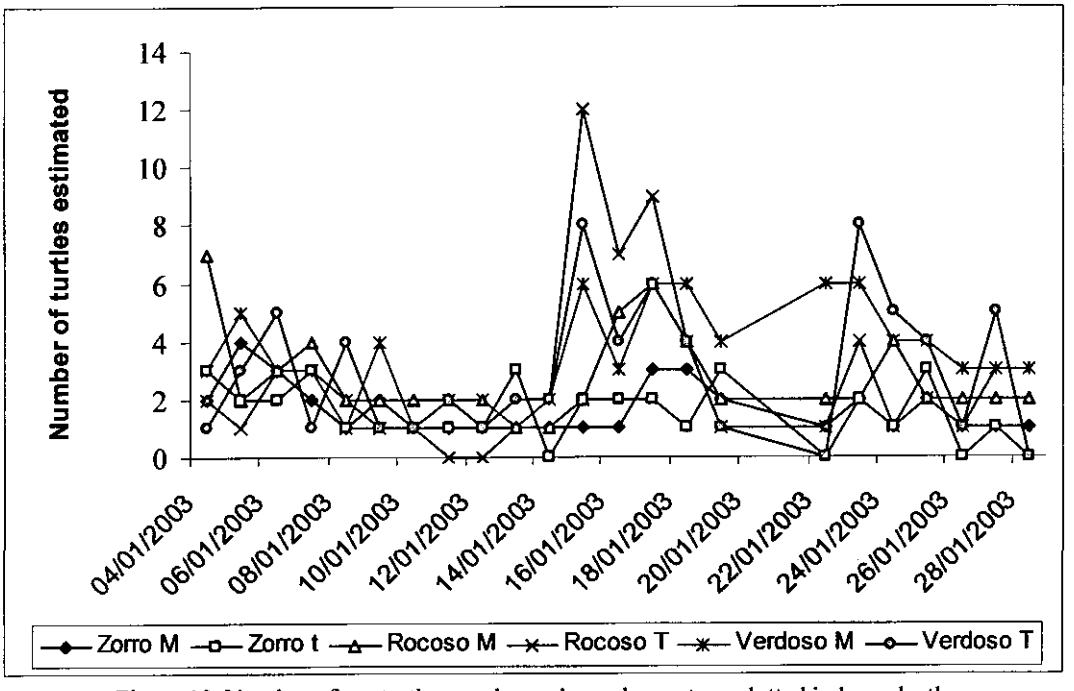


Figure 10. Number of sea turtles per day and per observatory plotted independently

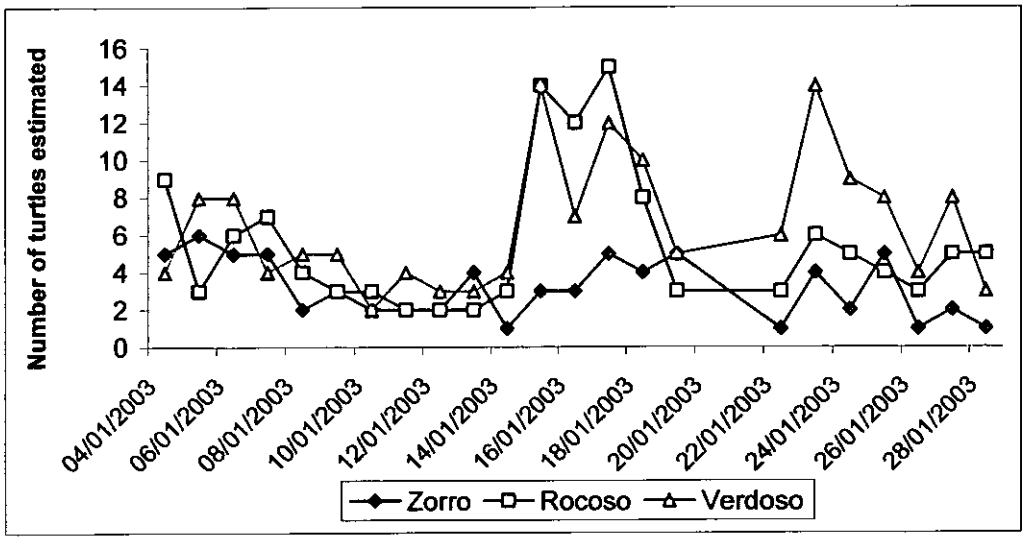
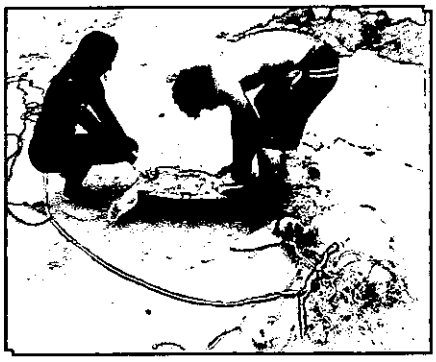


Figure 11. Number of individuals averaged by observatory

As Figure 10 and Figure 11 clearly show, the number of individuals decreased between day 6 and 14. However, starting on day 15 the number of individuals estimated increased significantly for the Rocoso and Verdoso observatories. These two observatories showed the highest number of turtles, while Zorro observatory showed a constant and low number of individuals throughout the month. The number of individuals estimated ranged from 7 (day 10 and day 12) to 32 (day 17). It is important to point out that on January 15 the number of individuals was 31.

b) Turtle capture

We captured green turtles with an entanglement net (30 m x 2.5 m; mesh size = 36 cm) placed along the area, next to the shore (Fig. 12). The net was set manually from the beach or by boat and monitored continuously until a turtle was captured. Entangled turtles were removed from the net and transported to the beach where they were measured and tagged. We used a Student's t-Test to analyze differences in CCL of turtles captured by Karumbé net and fishermen nets.



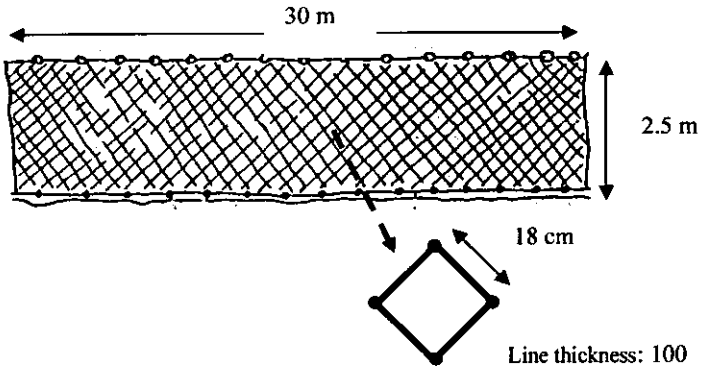
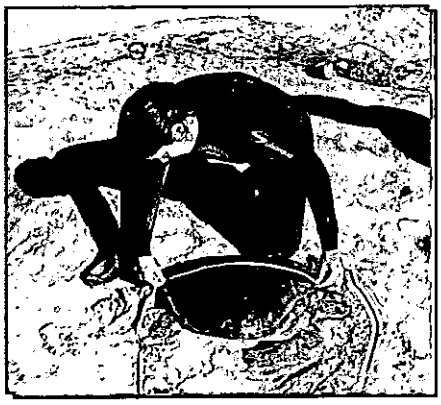


Figure 12. Entanglement net dimensions



A total of 47 turtles, *C. mydas*, were captured in Cerro Verde and adjacent waters during the period of study. All the turtles captured were immature individuals (CCL < 101 cm). Curve carapace length (CCLn-t) of the green turtles captured ranged from 32.9 – 57.0 cm (mean = 42.8 cm, SD = 6.7; n = 47) (Fig. 13). Of the 47 turtles captured, 27 were captured by nets set up by members of Karumbé, while 20 were incidentally captured by fishermen's nets, only 12 (60%) of these 20 turtles were found alive and released after being tagged and measured, the other 8 (40%) were found dead (drowned in nets). Mean CCL of turtles captured by Karumbé net (44.5 ± 6.5 cm; n = 27) were slightly greater (t_{45} = 2.0, p = 0.05) than the turtles captured by fishermen's nets (40.6 ± 6.3 cm; n = 20).

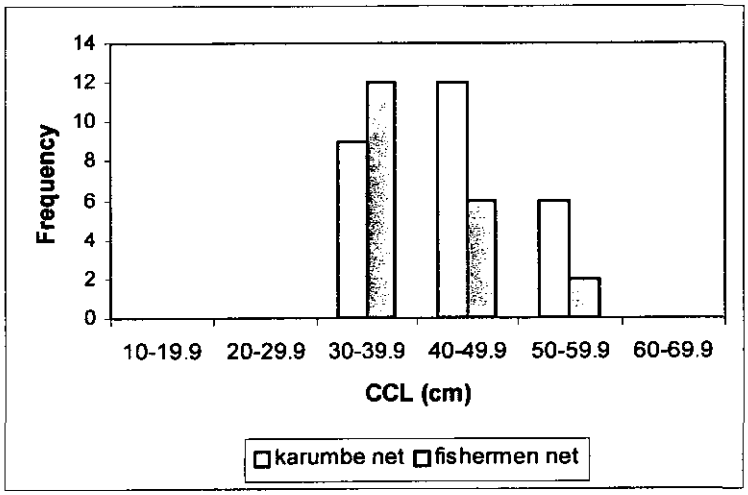
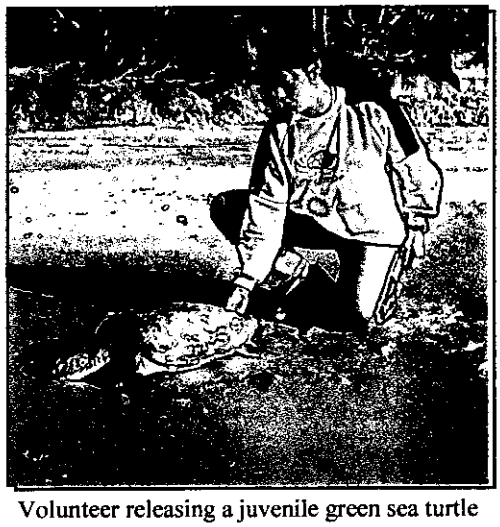


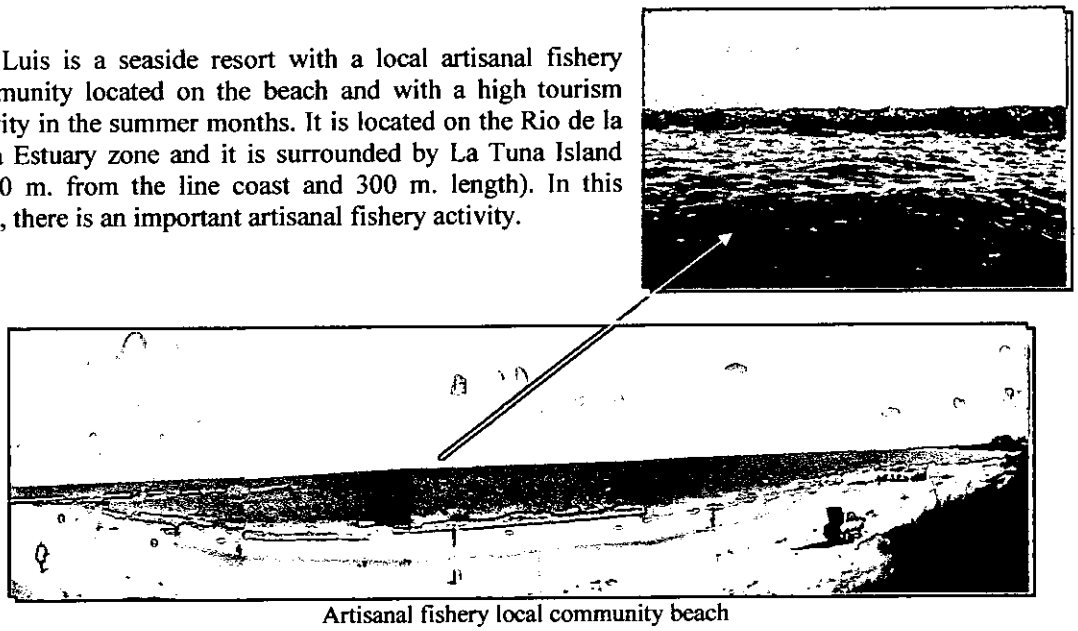
Figure 13. Size frequency of the turtles captured in Cerro Verde, by nets deployed by Karumbé and fishermen's nets.



Volunteer releasing a juvenile green sea turtle

SITE 2: San Luis, Canelones

San Luis is a seaside resort with a local artisanal fishery community located on the beach and with a high tourism activity in the summer months. It is located on the Rio de la Plata Estuary zone and it is surrounded by La Tuna Island (1500 m. from the line coast and 300 m. length). In this zone, there is an important artisanal fishery activity.



Artisanal fishery local community beach

We could not set up turtle camps in this area due to logistic reasons that prevented us from having good results regarding turtle capture and sightings. Thus, the sampling efforts were performed through the active participation of fishermen. A net of information was created, so that each time that a turtle was captured (dead or alive) by an entanglement net, one person contacted us immediately by making a phone call. After that, one of our field technicians traveled to the area in order to collect all the data.

Turtle capture

A total of 20 turtles, *C. mydas*, were incidentally caught by fishermen's gill nets in San Luis, Canelones. All the turtles captured were immature individuals (CCL < 101 cm). Curve carapace length (CCLt-n) of the green turtles captured ranged from 33.3 – 51.3 cm (mean = 40.5 cm, SD = 4.7; n = 19) (Fig. 14). 7 (35 %) of the turtles captured were found drowned in nets wile the other 13 (65 %) were still alive. Two of these 13 turtles were killed and eaten by fishermen, and the other 11 were released after being tagged and measured by members of Karumbé.

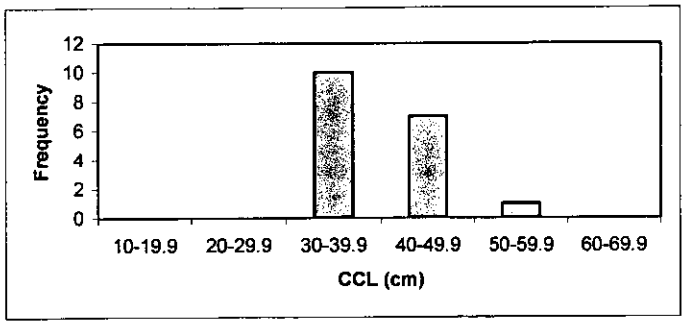


Figure 14. Size frequency of the turtles captured in San Luis by the artisanal fishery.

Seasonal Surveys

From November 2001, to January 2003, we performed a seasonal survey in Cerro Verde at the Rocoso observatory. This viewpoint was chosen for being the one with the greatest amounts of sightings of green turtles.

Preliminary results (January 2002 – December 2002) showed that the presence of green turtles in Cerro Verde was greater during warm periods (summer and fall), when the sea surface temperature of the water was high (Fig. 15).

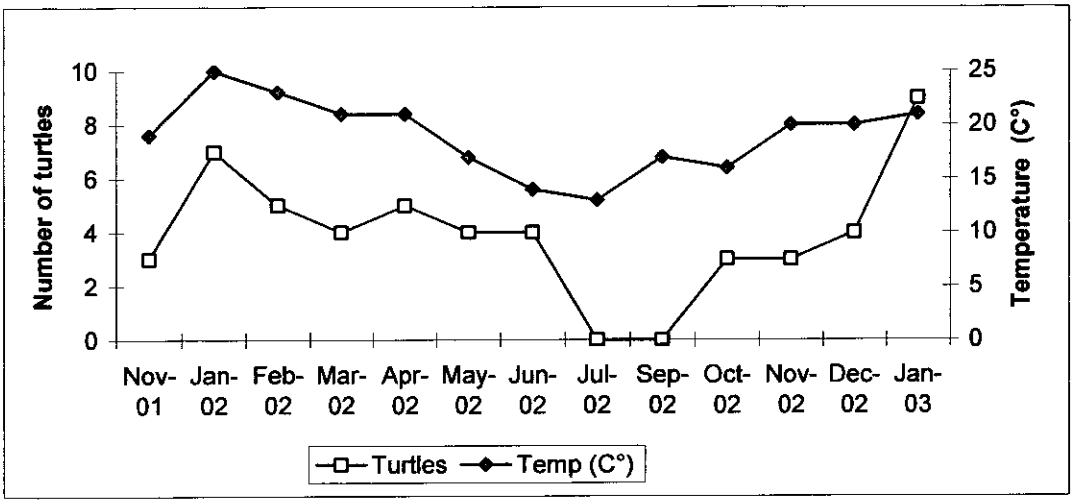
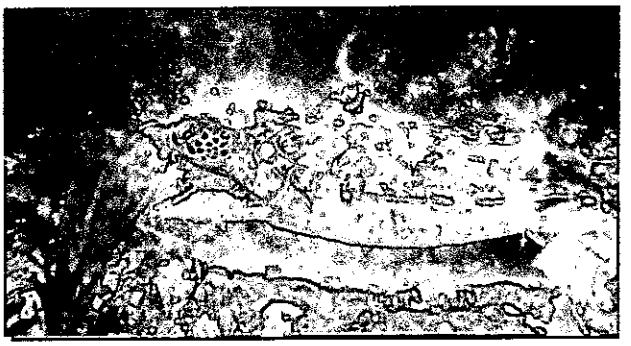


Figure 15. Number of turtles and surface temperature variations along the different months



Green turtle swimming surrounded by algae

Diet Analyses

From December 2002, to March 2003, we collected intact stomachs from green turtles that had incidentally drowned in fishery nets set along insular areas and adjacent coastal waters of Cerro Verde (Rocha) and near San Luis (Canelones).

Food items were identified to the lowest possible taxonomic level based on a combination of taxonomic keys. Food items were identified to the lowest possible taxonomic level based on a combination of taxonomic keys from Joly (1965) and Baptista (1977). Diet items were quantified by volume (V), measured to the nearest ml, and frequency of occurrence (F).

The diet of green turtles in Cerro Verde was composed of 8 species of algae, but only 5 of these species were considered major diet constituents (volume ≥ 5 % in at least one sample; Garnett *et al.* 1985) : *Ulva* sp., *Pterocladiella capilacea, Chondracanthus tedii, Grateloupia doryphora* and *Petalonia* sp. (Table 5). Three additional diet items (*Chondracanthus acicularis, Grateloupia filicina* and *Polysiphonia virgata*) were present in trace amounts.

Diet of green turtles in San Luis was composed of 7 prey items (6 species of algae and fragments of mussel shells), all of these items were considered major diet constituents (volume ≥ 5 % in at least one sample; Garnett *et al.* 1985): *Ulva* sp., *Enteromorpha* spp, *Gelidium pusillum, Gymnogongrus griffithsiae, Chondracanthus tedii, Chondracanthus acicularis* and mussel shells (Table 5).

Stomachs of the turtles from Cerro Verde were dominated by the green algae *Ulva* sp.(V= 39.1% ; F=100%) followed by the red algae *Pterocladiella capilacea* (V= 27.5; F= 100), interestingly in San Luis the green algae *Ulva* sp. (V=53.5 %; F=83.3%) was the most abundant and frequent component of the diet, as well. Secondly in importance were the red algae *Gymnogongrus griffithsiae* and the green algae *Enteromorpha* spp (Table 5).

Green turtle in a foranging area

Table 5. Mean relative volume (V%) and frequency of occurrence (F%) of prey groups recovered from stomachs analyzed from Cerro Verde (Rocha) and San Luis (Canelones). SE= Standard error.

	Cerro Verde (n = 5)			San Luis (n = 6)		
	V%	No.	F%	V%	No.	F%
Diet item	Mean (SE)			Mean (SE)		
Chlorophyta (green algae)						
Ulva sp.	39.1 (15.9)	5	100	53.5 (15.7)	5	83
Enteromorpha sp.	-	-	-	15.4 (10.9)	2	33
Rhodophyta (red algae)						
Pterocladiella capilacea	27.5 (14.9)	5	100	-	-	-
Chondracanthus acicularis	T	1	20	2.9 (2.9)	1	17
Chondracanthus tedii	21.1 (12.7)	4	80	2.6 (2.6)	1	17
Polysiphonia virgata	T	1	20	-	-	-
Gymnogongrus griffithsiae	-	-	-	19.2 (13.4)	2	33
Gelidium pusillum	-	-	-	3.8 (3.8)	1	17
Grateloupia doryphora	12.0 (10.8)	3	60	-	-	-
Grateloupia filicina	T	1	20	-	-	-
Phaeophyta (brown algae)						
Petalonia sp.	1.1 (11.0)	1	20	-	-	-
Mollusca						
mussel shell fragments	-	-	-	2.6 (2.6)	1	17

If we compare both localities (Cerro Verde and San Luis) we can observe that of the 11 species found in stomach samples, only 3 of them (*Ulva* sp. and the two species of *Chondracanthus*) were recovered from turtles of both localities. Thus, we can see that probably the turtles were feeding over a different array of species determined by specific habitat characteristics that distinguish these two areas.

The diet of green turtles in Cerro Verde was also assessed by performing esophageal lavages. In this case, we were able to analyze the diet composition of three turtles only. The most abundant and frequent species collected from lavage samples (n=3) was *Ulva* sp., followed by *Chondracanthus acicularis*, which was present in two of the three diet samples, and *Hypnea musciformis* that was recovered from one of the diet samples (Table 6).

Table 6. Relative volume (V%) and frequency of occurrence (F%) of the diet items recovered from lavage samples of green turtles in Cerro Verde.

	Cerro Verde (n = 3)				
	V (%)			No.	F (%)
Diet item	Turtle 1	Turtle 2	Turtle 3		
Chlorophyta (green algae)					
Ulva sp.	50	40	100	3	100
Rhodophyta (red algae)					
Chondracanthus acicularis	50	50	0	2	67
Hypnea musciformis	0	10	0	1	33

Due to the small number of turtles analyzed through this procedure, comparisons between techniques (stomach sample analysis and gastric lavages) were not possible. Still, we can notice that two of the algae recovered by gastric lavage samples were also present in the stomachs analyzed in Cerro Verde. The red algae *Hypnea musciformis* was only recovered from lavage diet samples.

Members of the project identifing algae species

Conclusions

Cerro Verde (CV) and San Luis (SL), where identified as the most important feeding areas for juvenile green turtles.

All the green turtles captured (fishermen's nets and Karumbé net) were juveniles. Curve carapace length ranged from 32.9 to 57 cm.

It is important to highlight that the nets deployed by members of Karumbé in Cerro Verde resulted in the capture of 27 turtles, which denotes that this method of capture works very well in this area. In addition, this activity allowed us to collect an important amount of biological data, perform new sample techniques (gastric lavages) and tag a higher number of turtles.

Turtle sightings performed in Cerro Verde allowed us to identify the Rocoso observatory as the best place to continue monitoring the behavior and seasonal presence of the juvenile green turtles. We were able to detect their presence during summer, fall and spring. Only during winter months the turtles were apparently absent.

We also identified an important interaction between green turtles and the artisanal fishery that operates next to CV and SL. It is worth noticing that the mortality of green turtles in gill nets was 35 % in SL and 40 % in CV.

The feeding habits of 14 green turtles were assessed through stomach sample analyses and gastric lavage technique. The diet of the turtles was composed primarily by algae. A total of 11 species of algae and fragments of mussels were recovered from stomach samples of turtles captured in CV and SL, but only three of these species were consumed by the turtles from both localities. *Ulva* sp. was the most abundant and frequent prey species recovered.

Perspectives

- To keep working with the fishing communities so as to reduce the incidental capture and turtle mortality by gill nets in CV and SL, and other localities.
- Long term monitoring of the presence, activity and seasonality of the turtles in Cerro Verde from "Rocoso" observatory.
- To study diet selection and diet preferences of green turtles by the assessment of the vegetation present along insular and peninsular regions near Cerro Verde and San Luis and the diet samples obtained by gastric lavage.
- To include turtle movement and activity patterns studies in Cerro Verde, which will complement the existing data in order to make grounded decisions regarding the designation of marine protected areas.

V. STRANDINGS

To determine the number of annual strandings and the possible causes of mortality we based on the data obtained from the turtles stranded all along the coast. The information on the strandings (species, cause of death, date, location, size, etc.) was registered on standardized sheets that were completed by any collaborator of the project. A "data collection network" was created according to Shaver & Teas (1999). This technique included a specific phone number where members and collaborators reported any stranded turtle. Necropsies were performed by field technicians. After that the data was processed and registered on a database for evaluation.

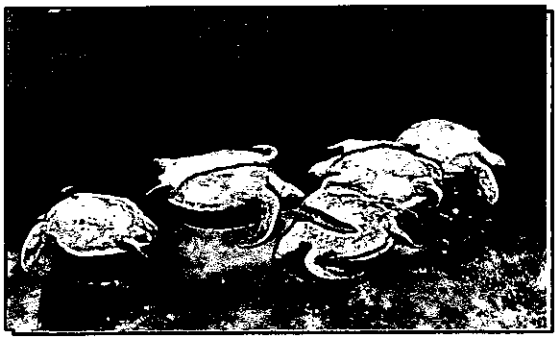
Sea Turtle Stranding Network

We offered several workshops regarding the collection of data on stranded sea turtles in which different materials (species identification guides, data collection sheets, measuring tapes, etc) were delivered to every participant and organization related to the "Sea Turtle Stranding Network".

- Prefectura (Navy)
- Artisanal fishermen and their families.
- PROFAUMA - NGO dedicated to the rehabilitation of marine animals
- REM- Eco-maritime Rescue
- SOS - Rescue of Marine Fauna, Maldonado
- NGO- Vida Silvestre
- South Right Whale Project, Dolphins Project, Sea Lion Project
- Museo del Mar (Museum of the Sea), Maldonado
- National Association of Lifeguards
- Rangers from Valizas, La Paloma, and Cabo Polonio
- Sector Medio Ambiente de la Junta Local de Juan Lacaze, Colonia. Intendencia
- Cleaning beaches organizations: IMM (Montevideo), Aseo Urbano (Maldonado)
- Students from Science School and Vet School, Universidad de la República
- NGO Línea Verde (Environmental emergency phone)
- 0900 2020 (General information telephone number)

5000 transfers and 2000 posters with photos of the 4 species of marine turtles that occur in Uruguayan waters were distributed along strategic places (fish markets, central bus stations, museums, tourist centers and supermarkets), as part of the 2001-2002 campaign directed to alert and inform people and the media about the importance of reporting stranded sea turtles along the coast (540 km.). From a total of 163 stranded turtles, 83 (51%) were reported by members of the "stranding network" and local inhabitants that knew about the Project through different media.

Strandings results



A total of 163 stranded turtles were recorded between July 1, 2001 and June 30, 2003 (Fig. 1). *Chelonia mydas* comprised 60 % (n=98), *Caretta caretta* 31 % (n=50) and *Dermochelys coriacea* 9 % (n=15) of the stranded sea turtles. Rocha was the department with the greatest amount of strandings (Fig. 2). All the stranded sea turtles were identified to the species level, even when only bones where found. Dead turtles were necropsied whenever possible depending on the state of the turtle (fresh, advanced state of decomposition, dried up or bones). As a result we were able to perform 40 necropsies.

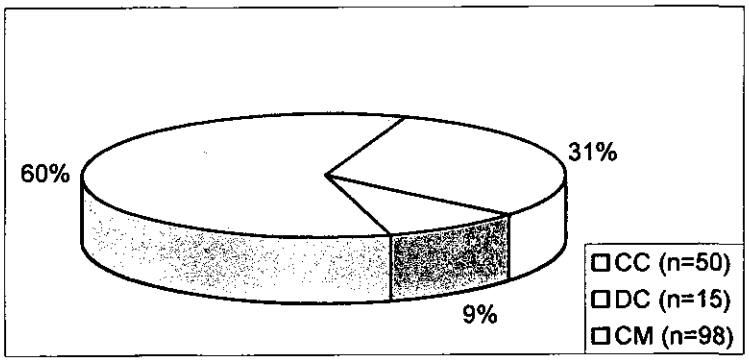


Figure 1. Percentage of stranded sea turtles per species, between July 2001 and June 2003.

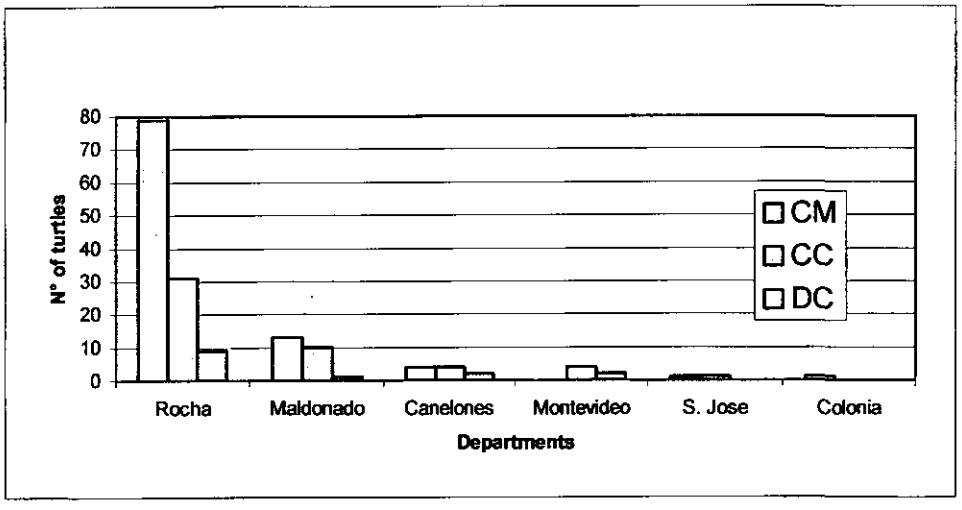


Figure 2. Number of stranded sea turtles per species in each Department.

Chelonia mydas

100% of the stranded individuals were juveniles (see section III), CCL of the turtles ranged from 32.5 to 57 cm (Fig.3). Most of the strandings occurred during spring (Oct-Dec) and summer (Jan-Mar) with a peak in January (Fig.4). 80 % of the total strandings were from the Department of Rocha (Fig. 5), 65% of which were found between Barra del Chuy and P. del Diablo (Zone A11).

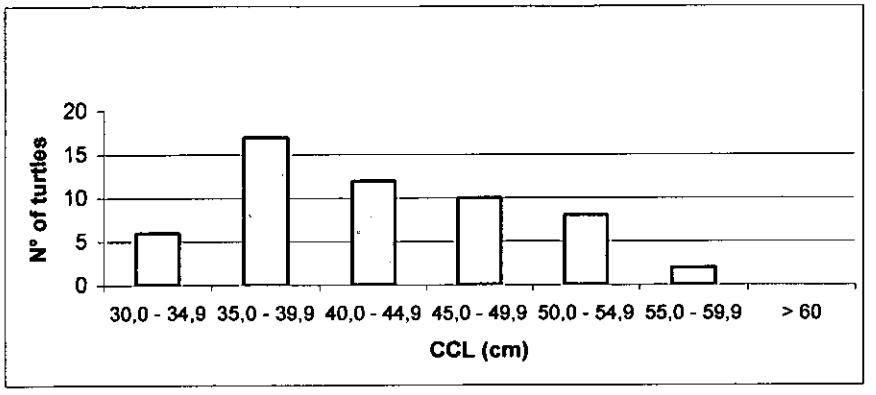


Figure.3. Size frequency of stranded *C. mydas* (n=55)

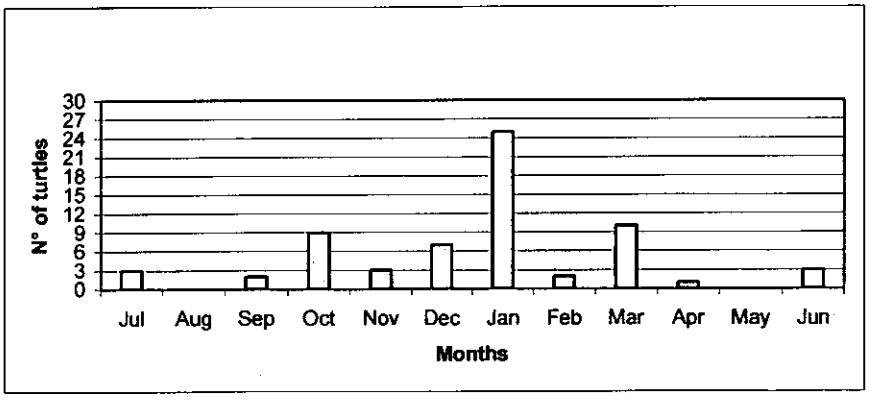


Figure 4. Number of *C. mydas* strandings per month (n=65)

Green turtle stranding locations along the entire coast were taken using GPS (Fig. 5; Fig. 6; Fig. 7).

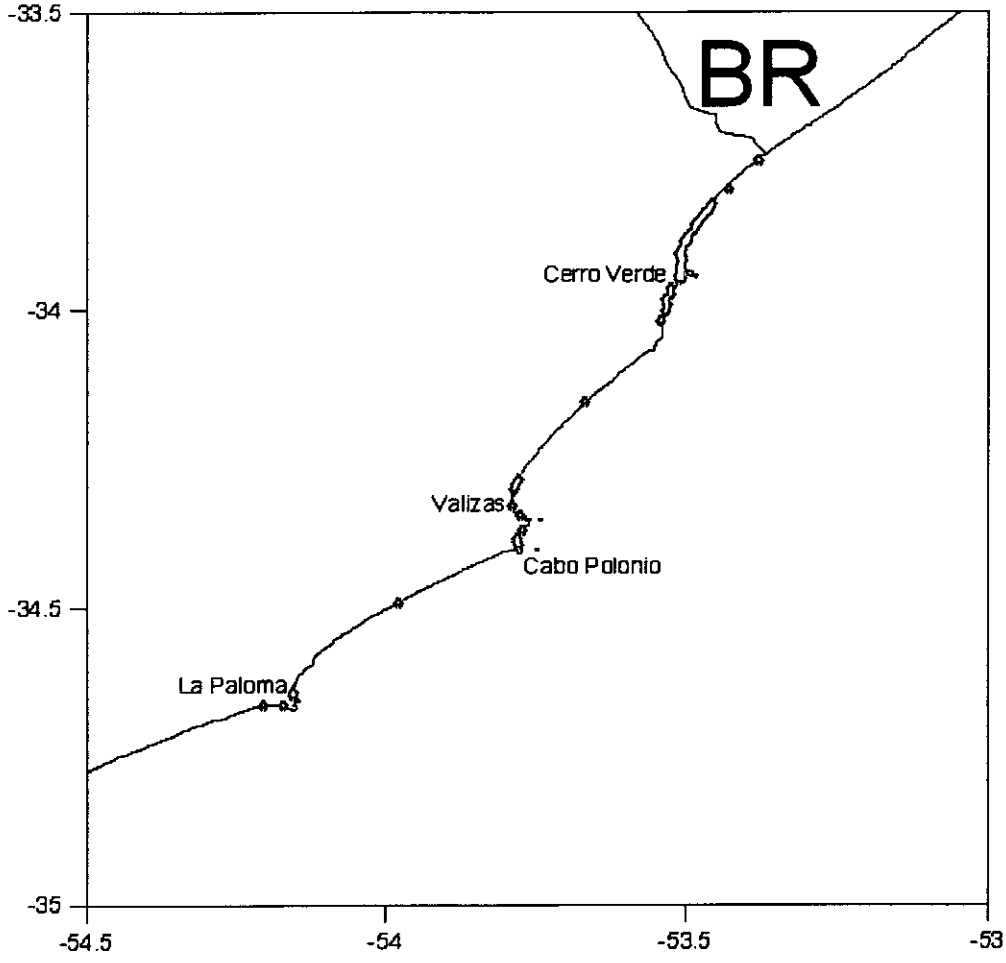


Figure 5. *C. mydas* stranding locations in **Zone A**

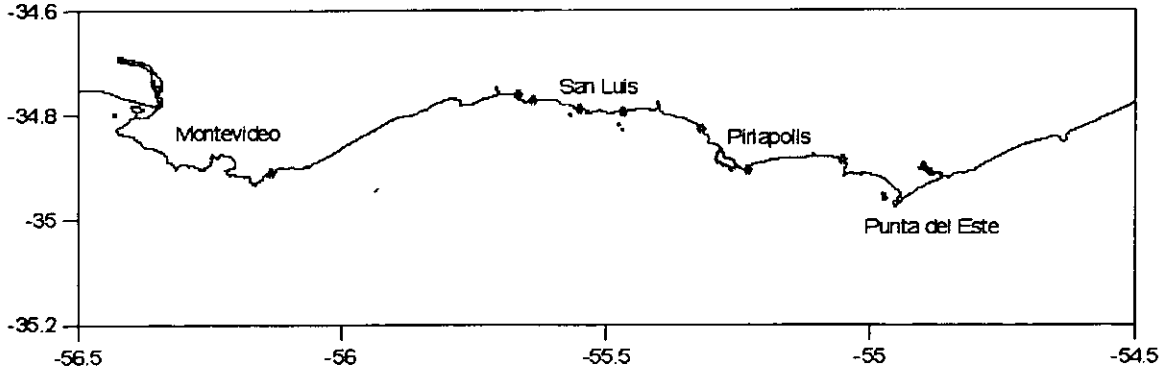


Figure 6. *C. mydas* stranding locations in **Zone B**

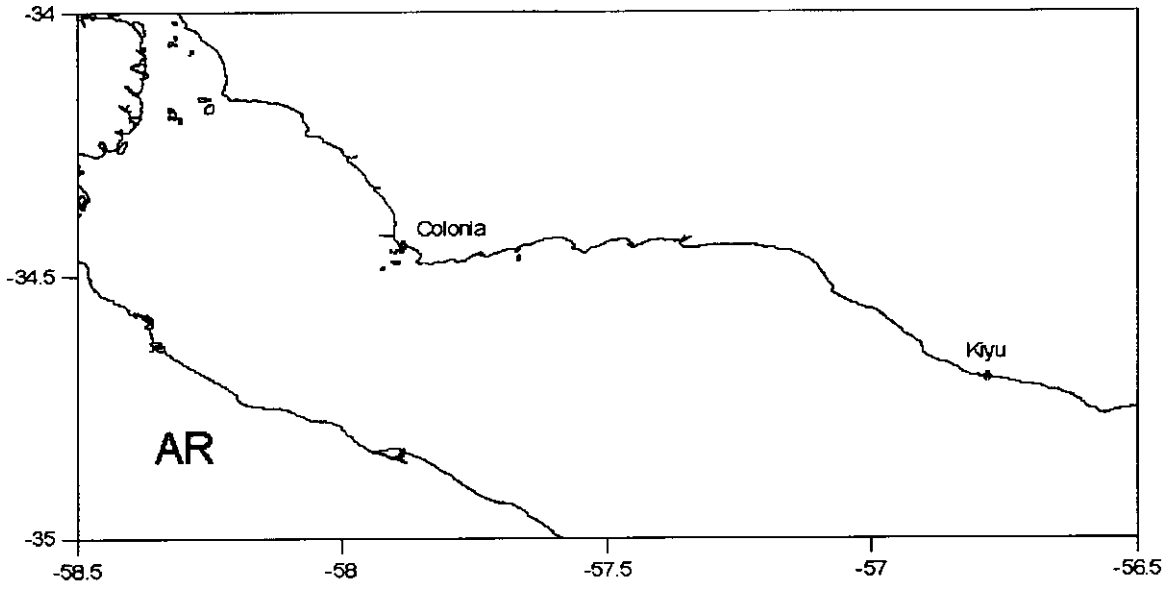


Figure 7. *C. mydas* stranding locations in **Zone C**

Caretta caretta

Stranded loggerheads ranged in CCL from 57 to 108 cm, 64% of the stranded individuals were considered juveniles and 36% were considered mature based on the minimum size of nesting females at the closest major rookery (see Chapter III) (Fig. 8). Most of the strandings occurred during the summer (Jan-Mar) and fall (Apr-Jun) with a peak in April (Fig. 9). Zone A was the area with the greatest records of strandings, followed by Zone B (Fig. 10 and 11).

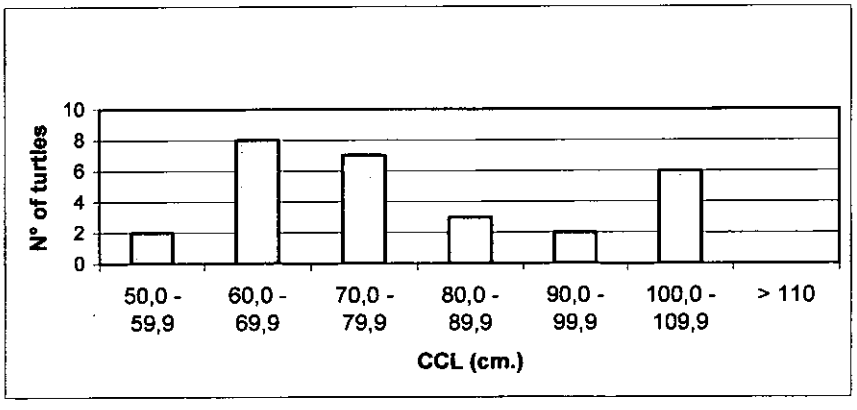


Figure 8. Size frequency of stranded *C. caretta* (n=28)

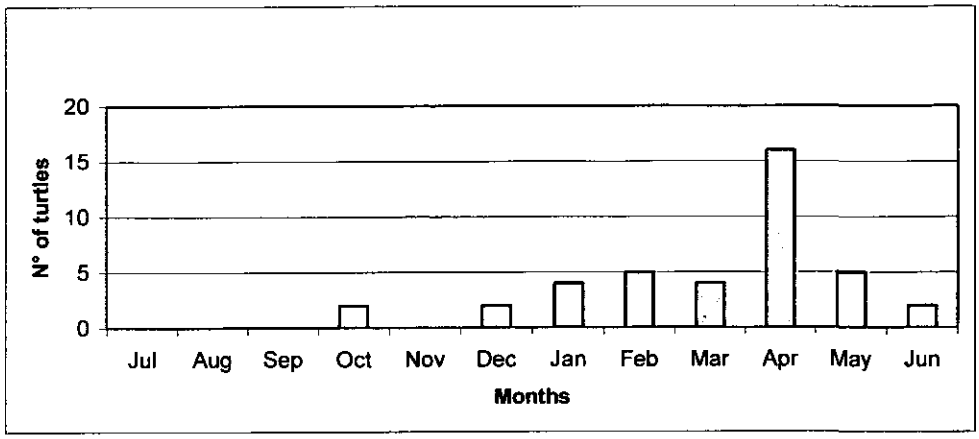


Figure 9. Number of *C. caretta* strandings per month (n=40)

Loggerhead turtle stranding locations along the coast were taken using GPS (Fig. 10; Fig. 11; Fig. 12).

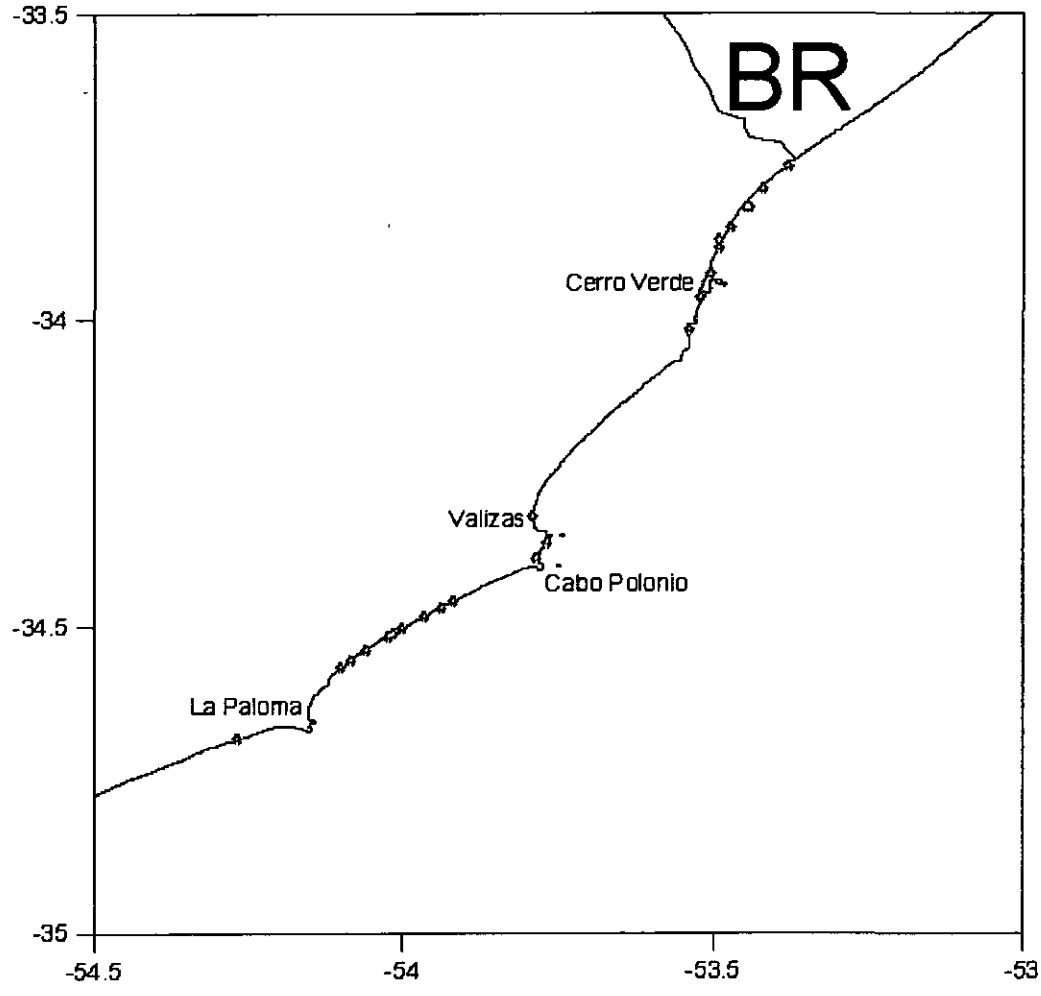


Figure 10. *C. caretta* starnding locations in **Zone A**

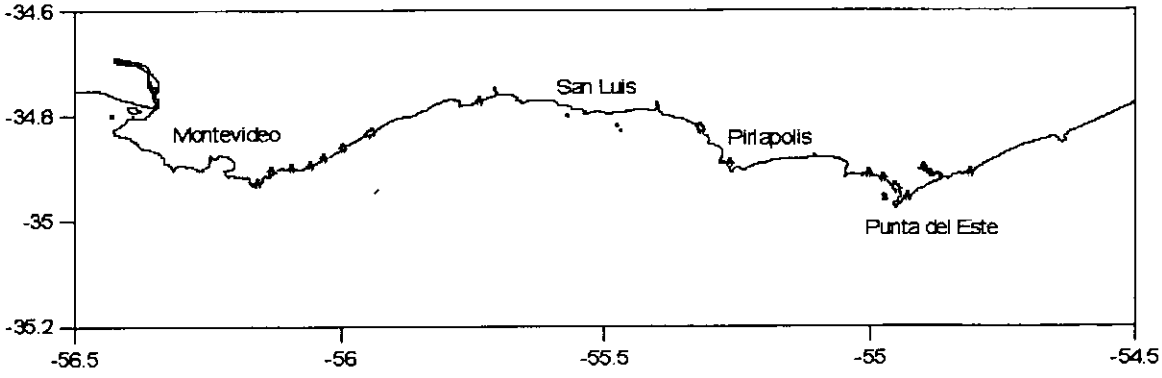


Figure 11. *C. caretta* stranding locations in **Zone B**

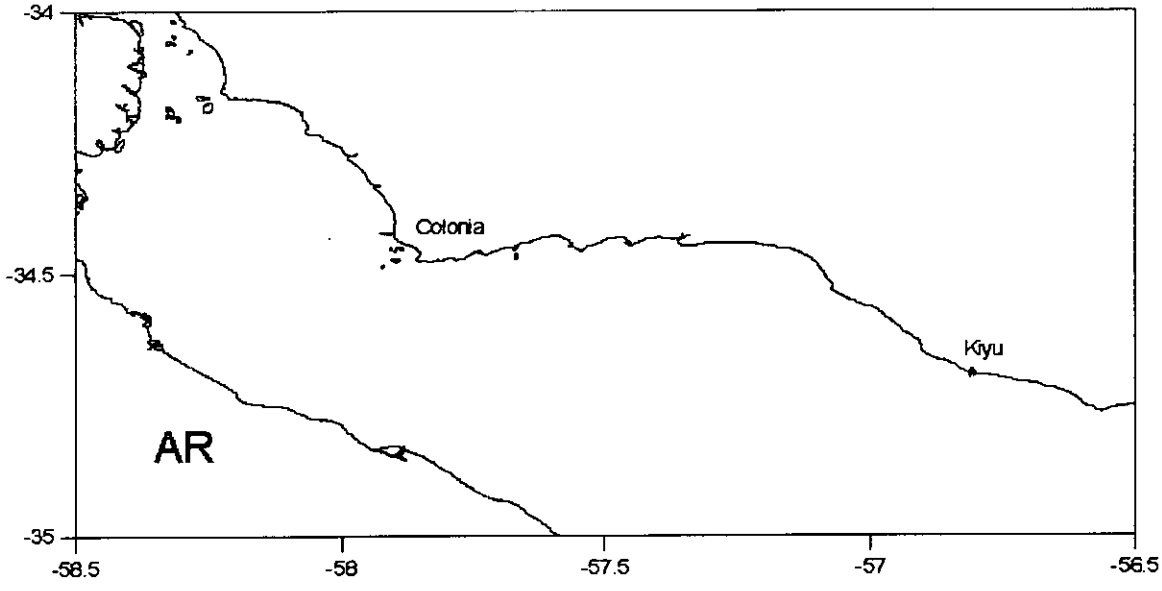


Figure 12. *C. caretta* stranding locations in **Zone C**

Dermochelys coriacea

A total of 15 stranded leatherbacks were recorded along the Uruguayan coast. But only two of these turtles were accurately measured due to the fact that the carapace of the leatherbacks deteriorates faster than hard-shell turtles. Figure 13 shows the temporal distribution of the stranded leatherbacks. No stranded leatherbacks were recorded in Zone C.

Unusual case

At the end of May, 2002 an adult leatherback was found dead 2 m above the level of the water and 10 m away from the riverbed of the Arroyo San Carlos (creek) in Punta del Este, Maldonado (Fig. 15). The turtle swam 14.5 km from the mouth of the creek and got tangled on a wire fence as a result of the high tide and then died. This is the first case of this nature reported for Uruguay.

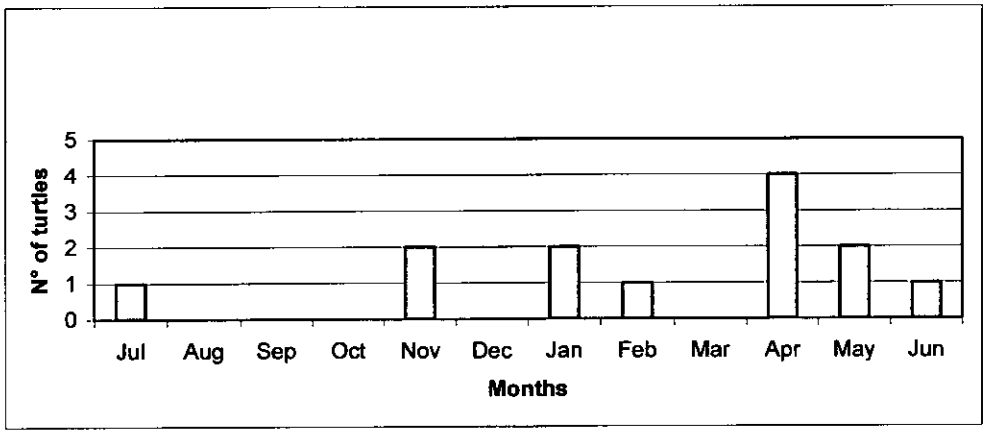


Figure 13. Number of *D. coriacea* strandings per month (n=13)

Leatherback turtle stranding locations along the coast were taken using GPS (Fig. 14; Fig. 15).

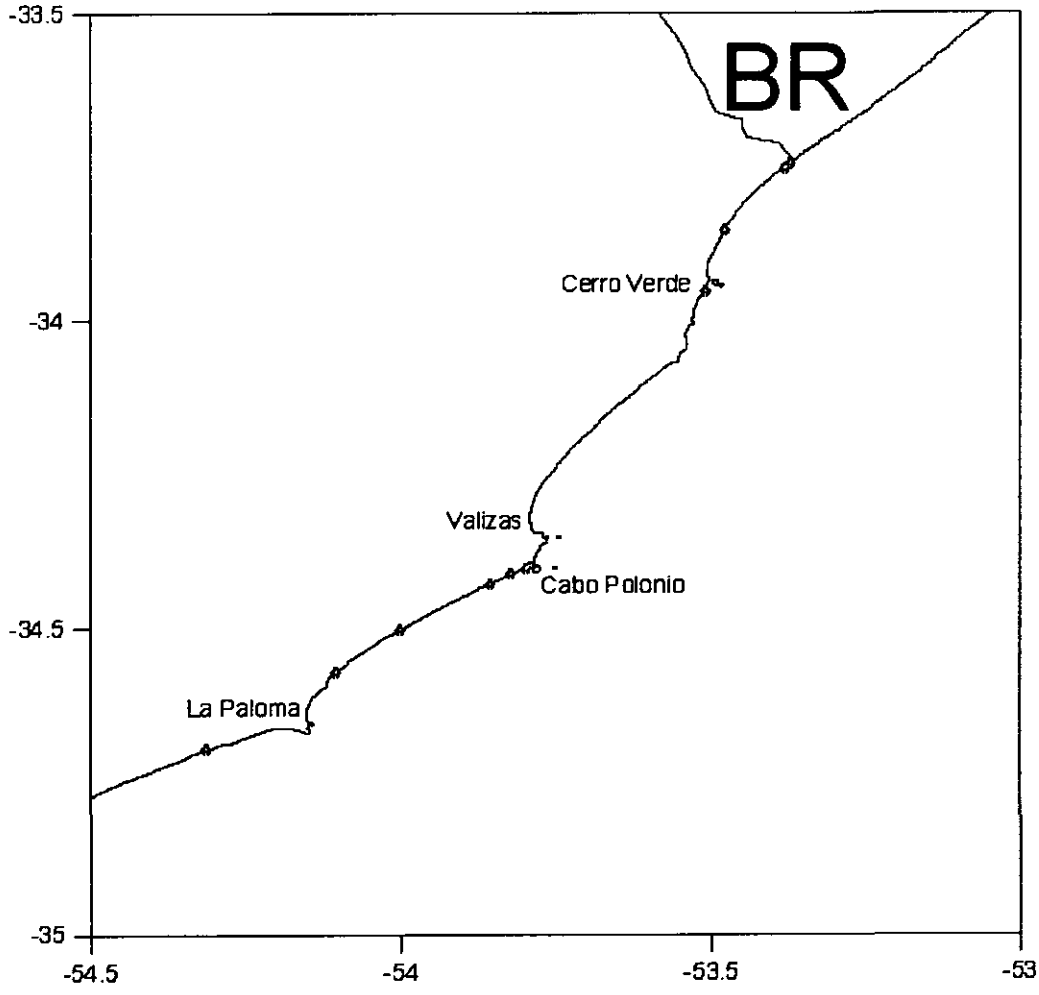


Figure 14. *D. coriacea* stranding locations in **Zone A**

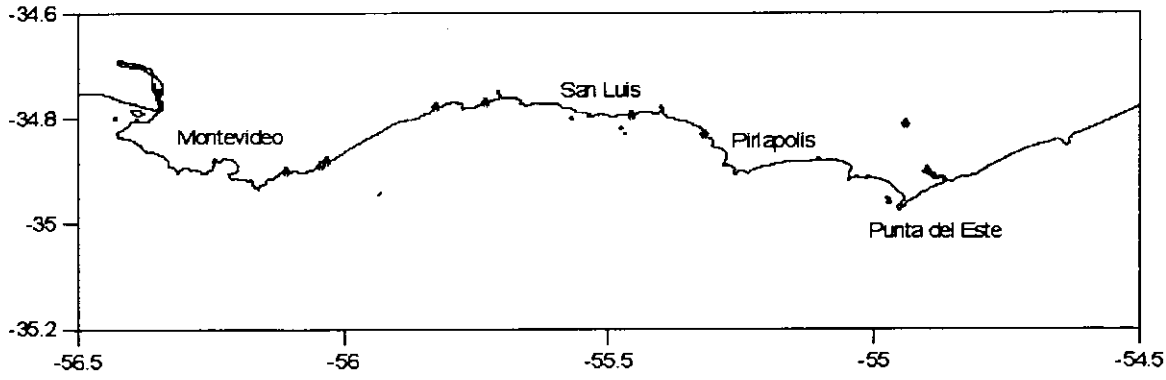


Figure 15. *D. coriacea* stranding locations in **Zone B**

Causes of death

Despite the attempts to determine the cause of death of the turtles, we could not establish it in most of the cases due to the advanced state of decomposition or because there was no evident signal of the cause of death.

Table 1. Causes of turtle strandings (dead or live) found along the Uruguayan coast.

Sp	Fishing gear	Cold-Stunned	Unknown	Total
CM	7	1 (8*)	82	98
CC	3 (1*)	0	46	50
DC	1	0	14	15

(*) indicate the number of live stranded turtles

Sex ratios

Table 2. Sex ratio of stranded turtles determined by necropsies or sexual dimorphism.

Sp	Male	Female	UNK	Total
CM	5	5	88	25
CC	5	10	35	13
DC	1	3	11	2

Necropsy Workshop

A necropsy workshop was offered by Veterinary Nuria López (Spain) and Ma. Victoria Pastorino (Karumbé) at the Sciences Faculty, on May 13, 2003. Thirty students and volunteers of the Project attended.

Training an artisanal fisherman

Carlos Romero is an artisanal fisherman who lives by the sea very close to our scientific base located in Rocha. This area represents one of the most important feeding grounds for juvenile green sea turtles (*Chelonia mydas*) along the Uruguayan coast. Carlos used to fish with gillnets near the rocky islands, which is one of the places selected by juvenile green turtles to forage over algae. Many of these turtles were tangled and most of them died (drowned) because gillnets remain in the water for many hours.
In the past, Carlos used to eat turtle meat and clean carapaces for sale, but many things have changed since we met him three years ago. The first step was to share the information of our Project with him. We started to integrate Carlos in our research by teaching him some fieldwork techniques, and we learned a lot from his own fishing experience. At that time, he started to change his mind and habits.
He was a solitary person who lived alone, but nowadays he enjoys our company and feels very happy helping us during our fieldwork activities.

Artisanal fisherman (Carlos Romero) collecting biological data of sea turtles

Now, he has stopped eating turtles, and he rehabilitates weak sea turtles when found. He started to check his nets with more frequency to reduce sea turtle mortality. During winter and fall months, he makes beach surveys, looking for stranded turtles in order to collect biological data for us.
At the present, we are working with him to reduce sea turtle mortality in gillnets during summer months.
Recently, we bought a small boat in order to be able to study the turtles close to the islands, and Carlos will be our captain. Nowadays we consider him another team member of the Karumbé Project.

Conclusions

- 163 was the total number of stranded turtles reported during the period of study, which is an important number, due to the fact that we estimate that for every stranding reported, there is another one missing.

- Most of the strandings of *C. mydas* occurred during summer months, while the number of strandings of *C. caretta* and *D. coriacea* were higher during the fall.

- Most of the strandings occurred in Rocha and Maldonado (coastal departments along the Atlantic), probably because the fishing effort is greater along these areas.

- Even though the cause of death could only be determined for a little number of turtles, we observed that most of the strandings of *C. mydas* occurred when the artisanal fishery fleet was using gill nets (summer months), and that the high number of strandings of *C. caretta* and *D. coriacea* coincided with the intense fishing effort of the trawl fishery fleet during the fall.

Perspectives

- To implement a new tagging system for those dead turtles incidentally captured by the different arts of fishing in order to identify the source of those turtles, once they appear stranded along the coast.

- To expand the stranding network including new members in order to increase the flow of information.

- To reduce the sea turtle mortality due to cold stunning events by developing a faster response treatment and rehabilitation programme.

VI. SPORT FISHERY

There are two sport fishing gear types in Uruguay: with hooks and lines (rod and reel) and with sport nets. In order to evaluate the interaction of this fishery with sea turtles, we interviewed sport fishermen. To the fishery that used line the most relevant questions were: "Have you ever captured a sea turtle with your line? How many lines do you lose per month?" The objective to this question was to evaluate if the lost of nylon lines represents a problem for the turtles, due to the important number of reports received about existence of stranded turtles with nylon lines around its body (Estrades *et al* 2002). The use of sport coastal nets by recreational fishermen was monitored for the first time by performing some informal interviews. As a result, we obtained a preliminary overview of this type of fishing gear.

Sport fishing with hook and line (rod and reel)

A total of 32 interviews were performed to sport fishermen, 84% of the interviewed said that they had never captured (hooked) a turtle (Fig. 1). The rest (16%) also indicated that they had experienced some kind of interaction between turtles and their fishing gear, as turtle flipper entanglement and partially bitten baits. In addition, more than 75% of the fishermen lose theirs lines while fishing (Fig. 2), the loss of lines occurs mainly on rocky shores. Lines and hooks are commonly seen tangled on rocks along with algae.

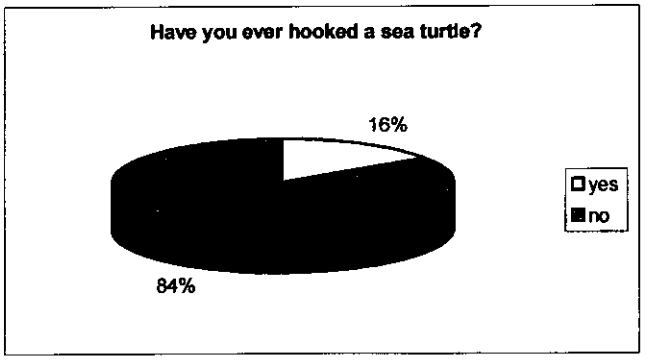


Figure 1. Results of interviews with sport fishermen

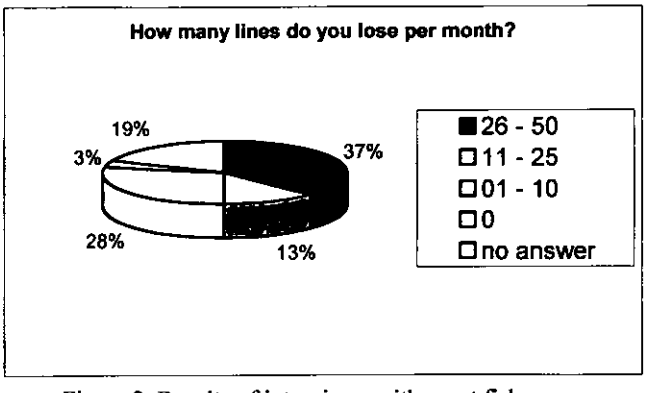
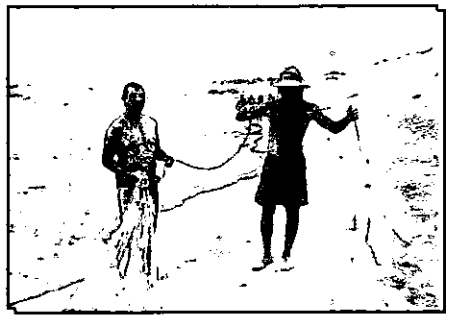


Figure 2. Results of interviews with sport fishermen

On February 2002, a sport fisherman captured a green turtle with his fishing line in Pajas Blancas (B32). The fisherman gave the turtle as a gift to a poor family (for consumption). The aforementioned family decided not to consume the animal and contacted our team members. Thanks to this action, members of the Karumbé project released the turtle.

Sport fishing with coastal nets

During summer months, the use of coastal entanglement nets by sport fishermen is frequent. Few people perform this activity for self-consumption. However, due to the economical crisis that the country has suffered since 2001, we noticed an important increase of this type of fishing because the sea offers an alternative source of food.



The target species of these nets are fish. However, on January 2002, in Valizas (A12), we established that there were incidental captures of sea turtles. For example, one tourist that used to fish using this type of gear (50 m x 1.5 m; mesh size = 16 cm) captured four turtles during a period of 20 days (the net was set for 12 hours each night). Only one of the turtles was alive, while the other three were found dead. The family released the live turtle, but consumed the dead ones.

All the turtles captured by sport fishermen (using coastal nets and lines) were juvenile individuals of the green turtle (Table 1).

Table 1. Data collected from turtles captured by sport fishermen

Species	Date	Locality	Fishing gear	CCL (cm)	State
CM	8/01/02	Valizas	Coastal net	40	Dead
CM	25/01/02	Valizas	Coastal net	41.3	Dead
CM	26/01/02	Valizas	Coastal net	34.1	Dead
CM	27/02/02	P. Blancas	Line and hook	34.6	Alive

Conclusions

- Today, the green turtle is the only species impacted by fishing lines from recreational fishermen. Even though the percentage of turtles captured by this fishery is and was low, an increment of the fishing effort was observed.

- The increment of the fishing effort is also negative for the turtles, because it intensifies the carapace utilization and sale, and increases the loss of lines creating deadly traps for juvenile green turtles.

- Coastal nets have also resulted in a new threat for green turtles that feed near the coast.

Perspectives

- A better understanding of the interaction between turtles and this type of fishing gear, and the environments that turtles prefer can be useful in developing future methods to reduce mortality.

VII. ARTISANAL FISHERY

The aim of this study was to evaluate the mortality due to incidental capture by the artisanal fishery of the marine turtles that inhabit Uruguayan waters. This information will allow adopting efficient management plans to reduce the impact in the future.

All the fishing centers along the Uruguayan coast were contacted (families, groups, cooperatives, etc.) in order to gather information about this fishery.

Artisanal Fishery in Uruguay

In our country artisanal fisheries is an activity of capture and extraction of sea products by means of heavily manual labor and the use of simple gear. (Altez *et al.* 1988, Crossa *et al.* 1991). The capture of fish and the effort vary because they are highly dependent on weather conditions and available fish (Altez *et al.* 1988). Artisanal fisheries use static gear like gillnets and artisanal longlines along coastal areas.

A gillnet consists of a rope with sinkers attached at regular intervals in the lower part and a rope in the upper end where buoys are attached. In this way, the gillnets form a barrier in the water where fish get tangled (Fig. 1a).

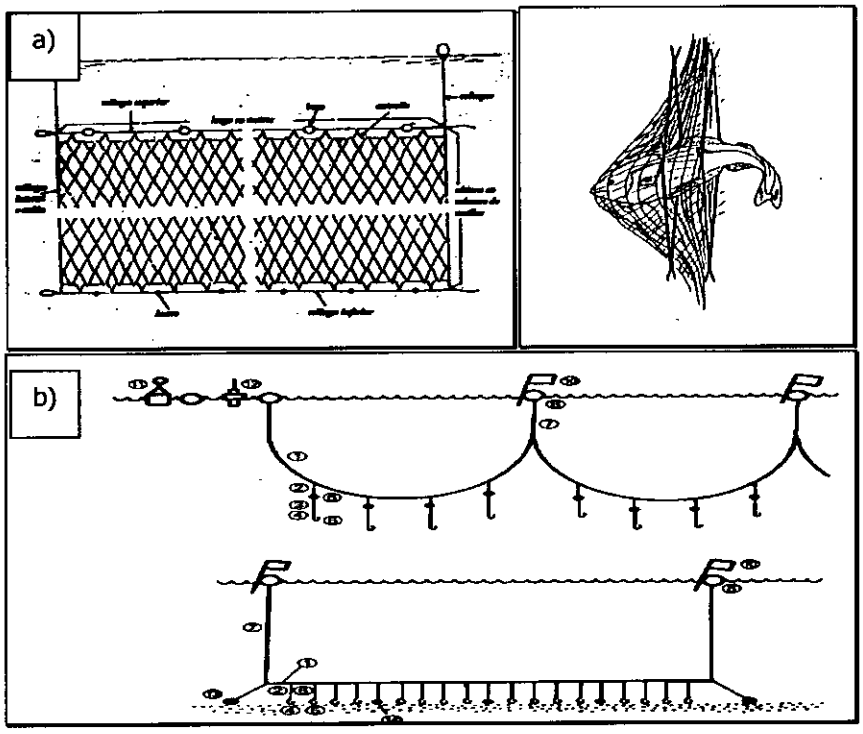


Figure 1. Diagram of the gear used by the artisanal fishery fleet of Uruguay: a) gillnets and b) artisanal longlines.

Artisanal longlines consist of a main horizontal line of 100 m. in length with secondary lines to which baited hooks are attached at regular intervals of 1 m. (Altez *et al.* 1988, Crossa *et al.*1991) (Fig. 1b). Both gears are settled underwater by means of two weights attached at both ends.

Regional Backgrounds

In South America, the studies on sea turtle interaction with fisheries include those carried out in Chimbote port, Perú (Alfaro *et al.* 2002), where 90 % of the turtles incidentally captured in the nets of artisanal fishermen was *Chelonia mydas.* It is estimated that 652 turtles died during the study period (January 1999 – April 2001).

In Chile, there are several reports of incidental capture of sea turtles by the swordfish fisheries (CPPS 2001). This fishery consists of an artisanal fleet that uses gillnets and is responsible for 90 % of the accidental captures; and of an industrial fleet, responsible of the remaining 10 %.

In Rio Grande do Sul, Brazil, Ott *et al.* (1999) studied the interaction between artisanal fisheries using gillnets and sea turtles. In this case, four species were captured: *Chelonia mydas, Caretta caretta, Dermochelys coriacea, Lepidochelys olivacea.* Moreover, they noted that the entangled turtles were occasionally consumed by the fishermen. Also in Rio Grande do Sul, 63 artisanal fishermen were interviewed, and they pointed out that *Caretta caretta* was the most captured species (81.6 %) followed by *Chelonia mydas* (13.1 %) and by *Dermochelys coriacea* (5.2 %). The authors found that the incidental capture of these animals occurs mainly in summer (76.8 %) because in this season most of the fishermen use bottom gillnets (Studzinski *et al.* 1999). Brosig (2003) registered that in the region of Almofala, Brazil, the artisanal fishery of lobster captured most frequently the juveniles of *Eretmochelys imbricata* and of *C. mydas.* 60 % of the interviewed fishermen use these sea turtles food. Oravetz (2000) noted that in Brazil the sea turtle mortality through coastal gillnets is more important than in trawler nets.

In Uruguay Achaval *et al.* (1998) studied the incidental capture of sea turtles with oceanic pelagic longlines and found that there were two the species captured: *Caretta caretta* (68.9%) and *Dermochelys coriacea* (30.2%). Laporta and Miller (*in press*) reported important incidental captures of juveniles and adults of *C. caretta* and *C. mydas* and adults of *D.coriacea* for trawler fisheries. Even though there is no study of the incidental capture of *C. mydas* and *C. caretta* by artisanal fisheries, Karumbé Project noted that these species are commonly captured by this kind of fishery. Moreover, there are a few reports of leatherback turtles captured by artisanal fishermen. One of them occurred in Kiyú, Rio de la Plata, where artisanal fishermen incidentally captured a leatherback turtle in their nets (Achaval & Prigioni 1988). In San Luis another case was reported, where three leatherback turtles drowned in artisanal nets and their meat was used for human consumption (Fallabrino *et al.* 2001). Finally, in May 2002, members of Karumbé Project registered the capture of a leatherback turtle by artisanal fishermen in Valizas, Rocha (Fallabrino *et al. in press*)

Monitoring of incidental capture at San Luis, Piriápolis and Valizas

Methodology

According to the 36 interviews performed at the artisanal ports during the first year of study (see Chapter IV), three localities were chosen to evaluate the mortality of the sea turtles captured by artisanal fisheries, by a monitoring made onboard.

The ports of San Luis (Canelones), Piriápolis (Maldonado) and Valizas (Rocha) were chosen to be monitored, as there were numerous reports of interaction between the artisanal fisheries and sea turtles (see Chapter IV).

A total of 34 direct observations were made on board between October 2002 and May 2003. During these trips a total of 41 "fishing operations" were performed. We define a fishing operation as a fishing activity using a certain type of gear. Because the fishing areas are not the same, and the effort performed by each gear is also different, the data should be treated separately.

The presence and number of incidentally captured sea turtles was recorded during these trips. In addition, we recorded information about the total catch (in Kg), features of the gear used (net surface area or number of hooks), period of the gear in the water, as well as the geographical position of the fishing area and the superficial temperature of the water (°C).

The following data was taken of each sea turtle that was captured: species, cause of death, presence and/or number of identification tags, weight and morphometric measures (see Chapter III). Whenever individuals were found alive and without identification tags, we proceeded to tag them. When found dead, a necropsy was performed, during which stomach content was collected, tissue samples were taken (see Chapter III), and carapace and skull were conserved for collection.

Data analysis

With the information of the number of turtles captured, period of gear in the water, type and number of the used gear, the capture per unit of effort (CPUE) was calculated for each fishing event according to the following formula:

$$CPUE = N/t/A$$

Where: "N" is the number of individuals captured, "*t*" is the time of gear in the water, measured in hours and "A" is the number of hooks (when artisan longlines were used) or the net area (m^2) (when gillnets were used). CPUE is an index that provides useful data about relative density when it is obtained from standardized capture conditions throughout different areas and periods (Caughley 1977, Gulland 1983). In the case of a species affected by incidental capture this index is of great importance to evaluate the impact in the different study areas. The areas where the incidental captures were greater will be estimated by calculating the CPUE.

Results

Interviews (see Chapter IV).

Fishery fleet description

Table 1 shows the main characteristics of San Luis, Piriápolis and Valizas fishery fleets. We must point out that in the San Luis port; we found 70 boats throughout the year, except during the months of December and January, when only four boats remain in the port. This is because during December and January, most of the boats travel to Pajas Blancas looking for the white croaker (*Micropogonias furnieri*) as the target specie.

Table 1: Number, kind of propulsion, length and number of crew in boats used by the fishery fleets of San Luis, Piriápolis and Valizas.

	SAN LUIS	PIRIAPOLIS	VALIZAS
N° of boats	4 – 70	15	7
Kind of propulsion	Outboard motor	Outboard motor or rowing boat	Outboard motor or internal motor
Motor horse power	15 HP	15 HP	20-30 HP
Length	4.4 - 6	4.7 - 6.2	7-10
N° of crew	2 a 3	2 a 3	3

The gears used in San Luis and Piriápolis are gillnets and artisanal longlines. On the other hand, in Valizas fishermen do not use artisanal longlines. They use exclusively gillnets.
The use of one or other gear varies throughout the year, because the fishery effort is made seasonally upon different species, depending on the feeding habits and on their behavior. Thus, in San Luis and Piriápolis the artisanal longline is used mainly in autumn and winter when the fishing activity is directed to the capture of *Urophysis braziliensis* ("Brazilian codling"). The fishing activity with gillnets occurs mainly in spring and summer associated to the capture of *Mustelus schmitti* (Narrownose smooth-hound), *Micropogonias furnieri* (white creaker) and *Cynoscion striatus* (seatrout).

In Valizas, gillnets are made of different mesh size according to the target specie, from 11-14 cm mesh for Narrownose smooth-hound and white croakers, to 26-32 cm mesh for Sandtiger shark and other big sharks. The Narrownose smooth-hound capture is seasonal, with greater captures in October, November and December.

During the period of study, the greatest captures were registered in Piriápolis, followed by Valizas and finally by San Luis (Table 2).

Table 2: Mean and standard deviation of the captures by unit of effort (CPUE) in each locality and for each gear. Gear: L: artisanal longlines; G: gillnets

		CPUE	
LOCALITY	**GEAR**	**X**	**SD**
San Luis	L	0.0065	0.0036
	G	0.0073	0.013
Piriapolis	G	0.0085	0.0087
	L	0.0248	0.0184
Valizas	G	0.0079	0.0123

X= mean; SD= Standard deviation

Sea Turtle incidental capture

All the incidental captures of sea turtles observed between October, 2002 and May, 2003 at the three localities occured with gillnets. The capture per unit of effort of sea turtles was bigger in Piriápolis followed by San Luis (Table 3). The fishing areas where the artisanal longlines and gillnets were deployed, were registered using GPS. During the monitoring made onboard, 21 turtles were captured; 20 of them were *C. mydas,* and one was a *C. caretta.* All the green turtles were incidentally captured in the ports of San Luis and Piriápolis, in the rocky areas and near the coast. The *C. Caretta* captured was from Valizas where the fishing area is more oceanic. Of the 21 turtles captured, 10 (47.6%) were found dead and 11 (52.4%) were found alive, and released afterwards. In Playa Verde, Piriápolis, two of the dead turtles captured, were used for food and their carapace was used for decoration. None of the captured turtles had any identification mark, or a scar of previous marks.

The only *C. caretta* that was captured showed the following measures: CCLn-t = 77 and CCW = 69.5. It was a late juvenile individual.

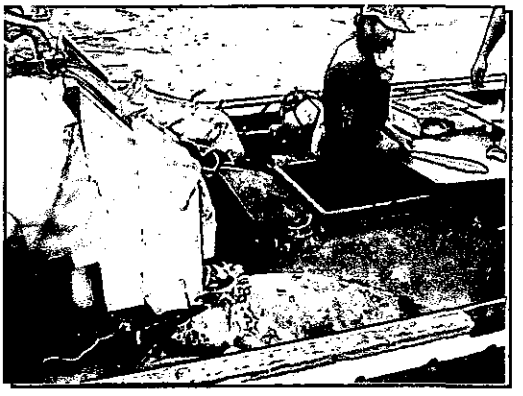


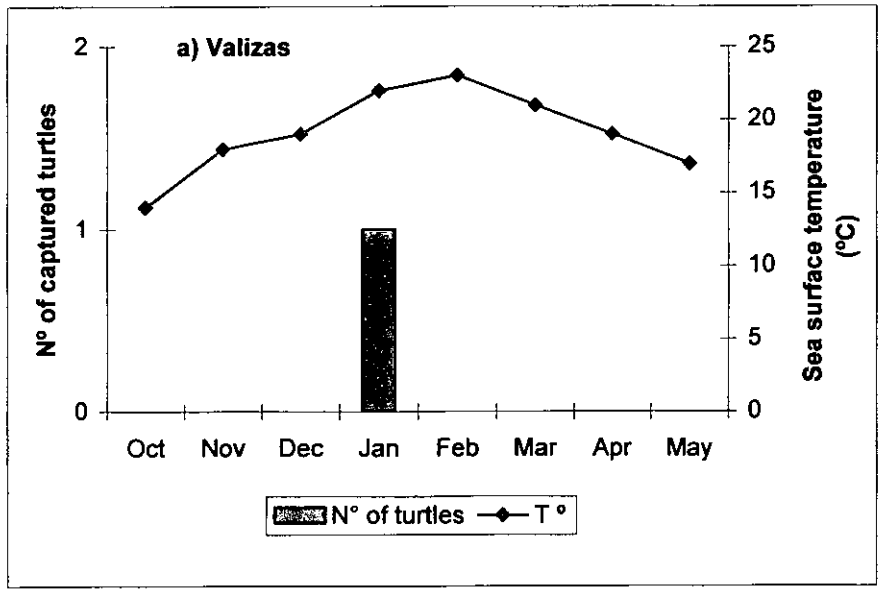
Table 3: Mean and standard deviation of the captures per unit of effort of sea turtles captured with gillnets in each locality.

LOCALITY	CPUE (x100)	
	X	SD
San Luis	0.0208	0.0222
Piriápolis	0.1424	0.2571
Valizas	0.0001	0.0002

Table 4 shows the superficial temperature of the sea registered during the months of study in the three ports. San Luis and Piriápolis are two ports very close to each other so the temperature of the water was the same, as a result they were grouped together in Table 4. As it can be seen in Table 4, Valizas has remarkably colder waters in relation to the other two ports.

Table 4. Mean sea surface emperature (SST) registered for each locality during the months of study.

	Mean SST (°C)	
Month/Locality	San Luis/Piriápolis	Valizas
October	17	14
November	20	18
December	24	19
January	25	22
February	25	23
March	25	21
April	19	19
May	17	17



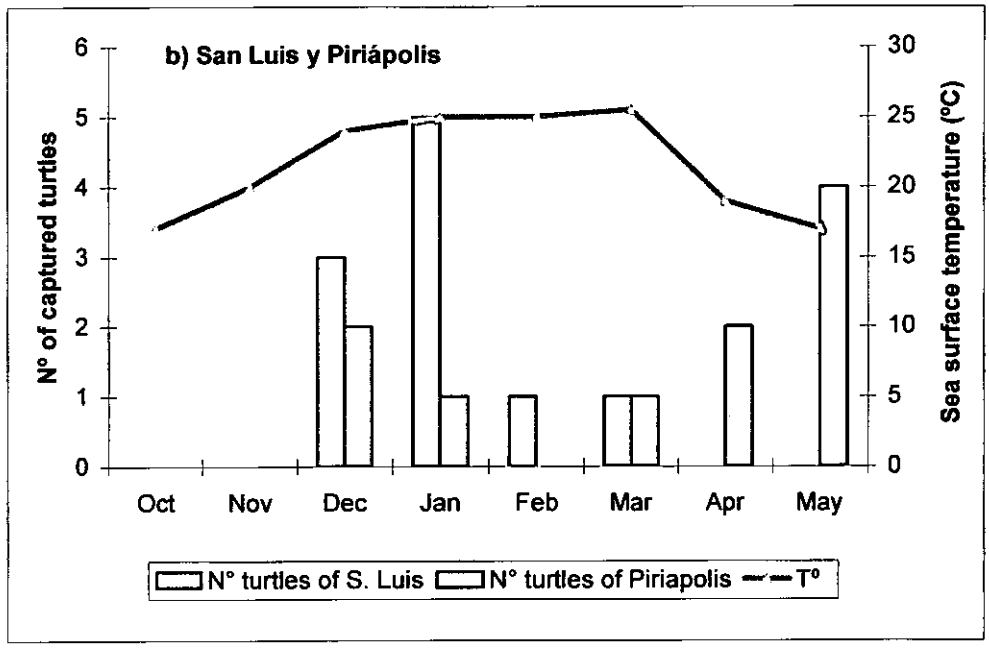
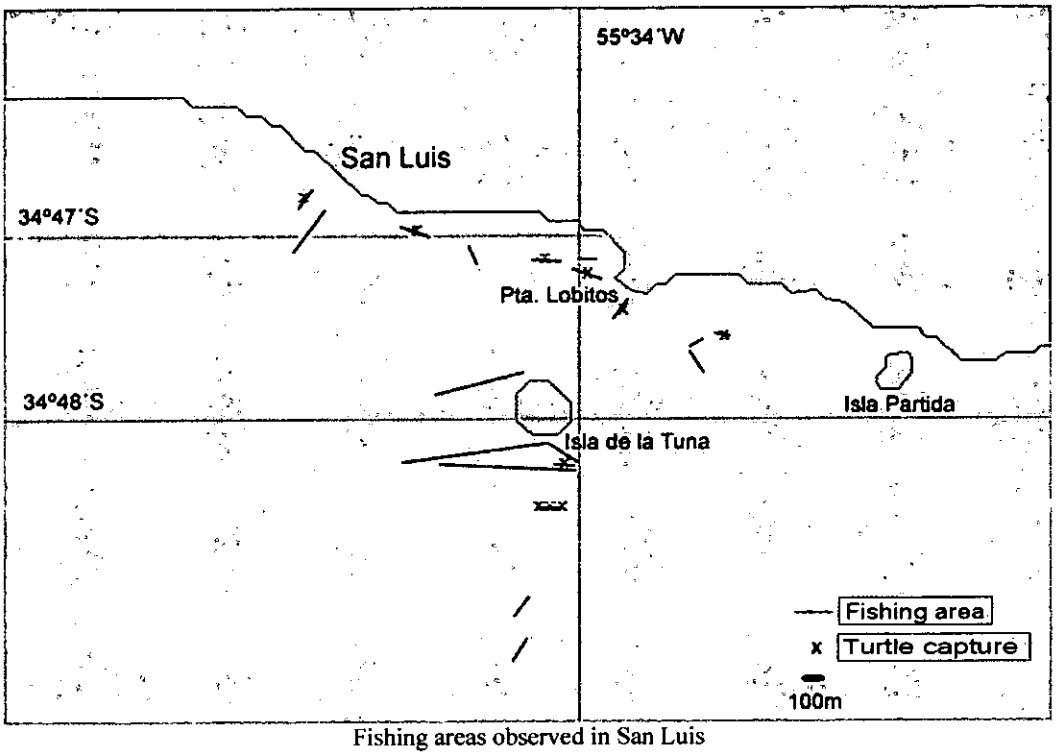
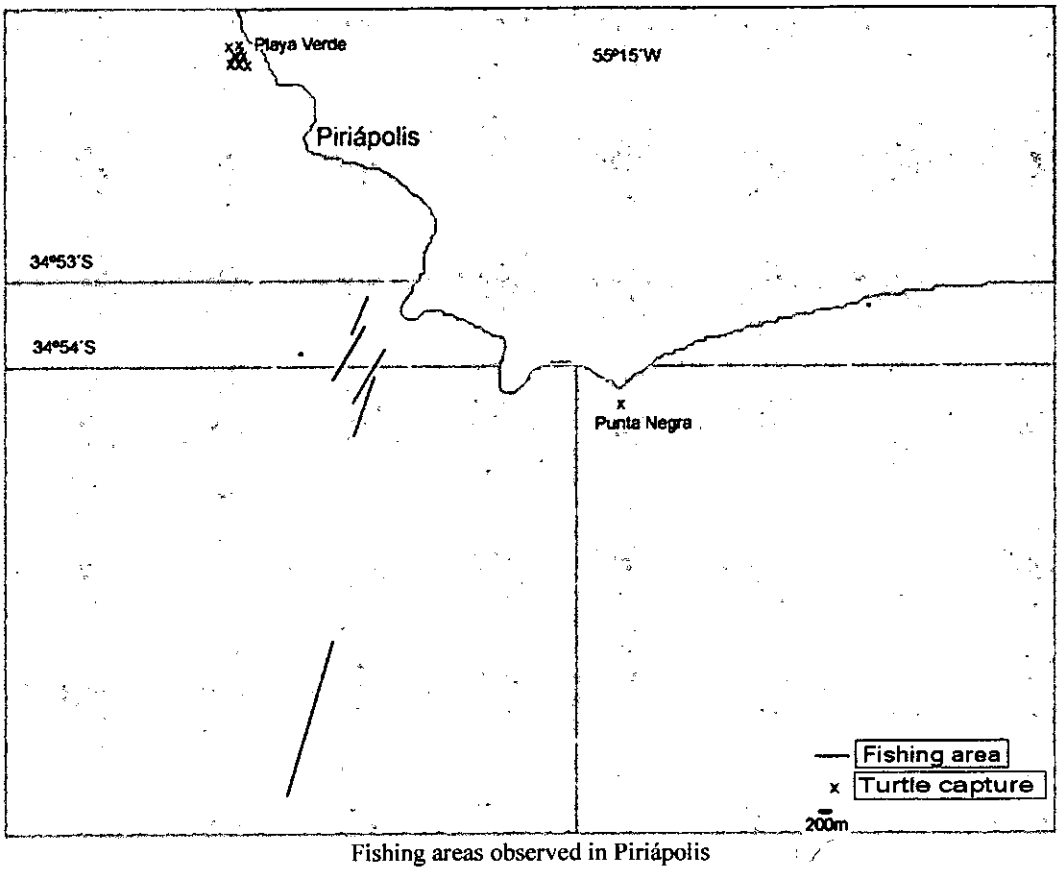


Figure 2. Number of sea turtles captured and sea surface temperature along the different months of study. a) Valizas and b) San Luis and Piriápolis

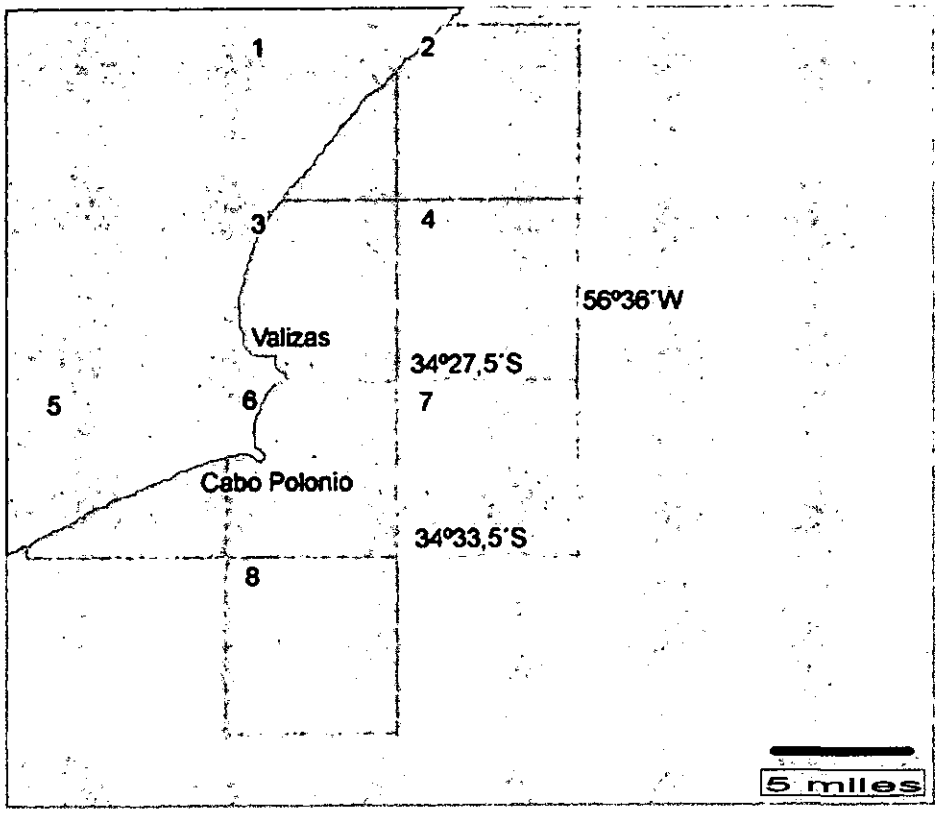
The following maps show the fishing areas and the geographical positions of the places where the sea turtles were captured.



Fishing areas observed in San Luis



Fishing areas observed in Piriápolis



Fishing areas observed in Valizas

- In this map the fishing areas are not shown in the same way as in the previous ones, because we did not have enough precise positions taken with GPS. The fishing areas are represented by quadrants taken in relation to the islands and rocky points of the coast. Zones 4, 7 and 8 correspond to onboard observations. Zone number 7 (highlighted in pink), was where the only turtle of Valizas was captured during the period of study.

Report of incidental capture

Another way for the recovery of information of incidental captures was based on the reports made by collaborators of the project as well as by the same artisanal fishermen. Each report was supervised by a technician of the Project, who collected the data corresponding to each turtle capture. Turtles captured alive were also tagged before being released.

Results

During the study period, 73 incidental captures of sea turtles were reported by artisanal fishermen of the coast. The map in Figure 3 shows the areas where the incidental capture was higher.
Of the turtles captured, 69 (94.5 %) were *C. mydas*, 3 (4.1 %) *C. caretta* and 1 (1.4 %) *D. coriacea*.

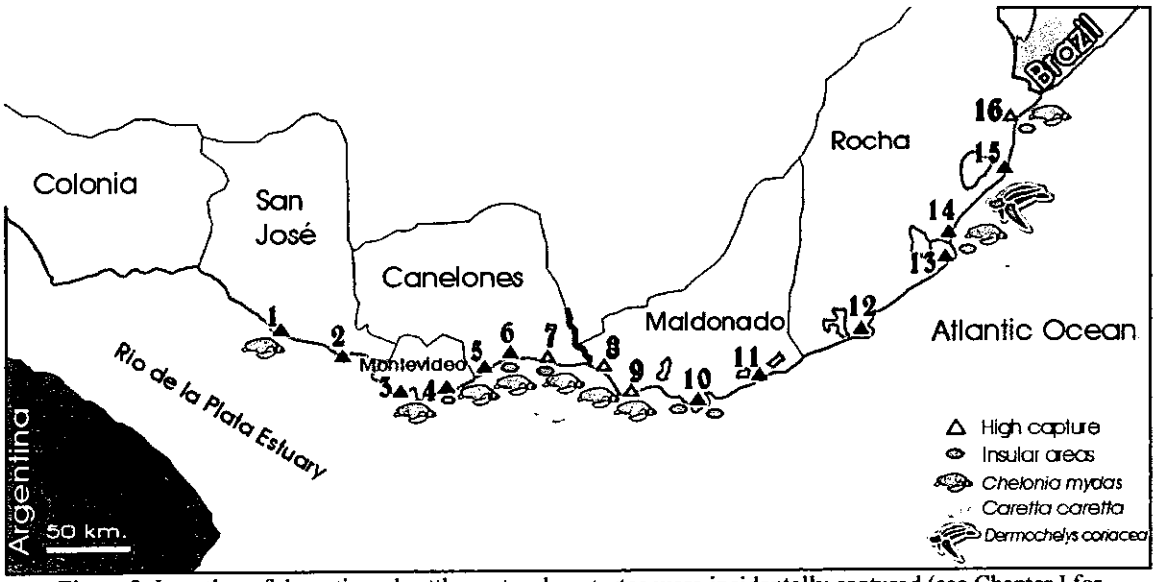
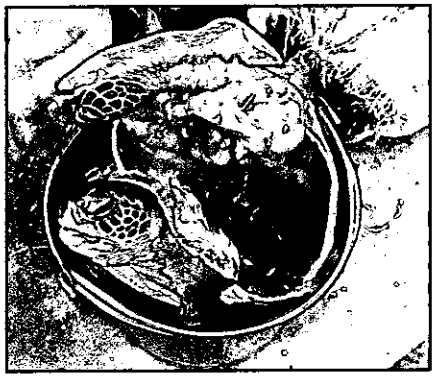


Figure 3. Location of the artisanal settlements where turtes were incidentally captured (see Chapter I for referenced names). Areas with higher capture of turtles are highlighted.

50.7 % of the sea turtles captured were found alive and released afterwards with the exeption of three (two green and one loggerhead) that were killed for food, whereas the remaining 49.3 %, were found drowned in nets. 19.4 % of these were used by the fishermen for food.



The three loggerhead turtles were subadults, one was a female and the other two of indeterminate sex. They were captured in Valizas and San Luis. The only leatherback turtle was an adult female captured in Cabo Polonio (next to Valizas).
San Luis and Santa Teresa - Cerro Verde have the highest percentage of green turtles captured (29.0%), followed by Piriápolis (27.6%) (Table 5).

Table 5. Number of green turtles, *C. mydas*, incidentally captured (dead or alive) in each locality.

Department	Locality	Alive	Dead	Total	Total (%)
Canelones	Atlántida	1	0	1	1.5
Canelones	**San Luis**	**13**	**7**	**20**	**29.0**
Canelones	Shangrilá	1	0	1	1.5
Canelones	Neptunia	0	1	1	1.5
Maldonado	Piriápolis- Playa Grande	0	2	2	2.9
Maldonado	**Piriápolis - Playa Verde**	**7**	**5**	**12**	**17.4**
Maldonado	Piriápolis- Pta. Fría	2	2	4	5.8
Maldonado	Piriápolis- Pta. Negra	1	0	1	1.5
Montevideo	Pta. Carretas	0	1	1	1.5
Rocha	Chuy	2	0	2	2.9
Rocha	**S. Teresa - Cerro Verde**	**12**	**8**	**20**	**29.0**
Rocha	Valizas	0	3	3	4.4
San José	Kiyú	1	0	1	1.5
TOTAL		40	29	69	100.0

The green turtles incidentally captured can be classified as juveniles based in their morphometric measures (CCLn-t and CCW, see Chapter III) (Table 6).

Table 6: Mean, maximum, minimum and standard deviation of the morph metric measures (CCLn-t and CCW) of the green turtles captured.

	X	SD	MAXIMUM	MINIMUM
CCLn-t	40.86	5.15	56.8	32.9
CCW	37.2	4.92	51.2	27

X= mean; SD= standard deviation

A 58 % of the captures of *C. mydas* occurred during the summer, 27 % during the fall, 13 % in spring and the remaining 2 % in winter (Fig. 4).

Green turtle drawned in a gillnet

Fisherman releasing an entangled green turtle

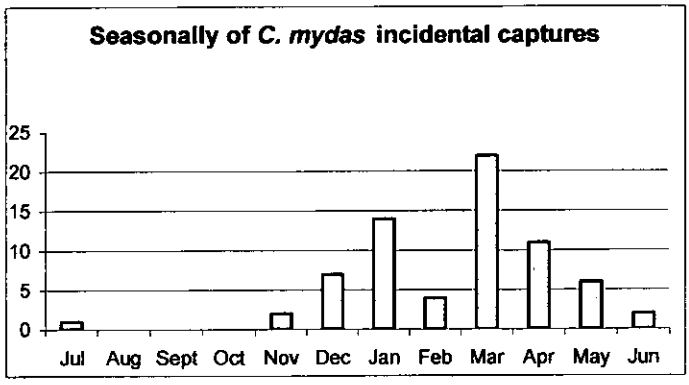


Figure 4: Incidental capture of *C. mydas* showed per month.

Discussion

According to the surveys made to artisanal fishermen we observed that the incidental capture of sea turtles with gillnets is a problem we face all along the Uruguayan coast. We must point out that during the study period 94.5 % of the captures corresponded to the species *C. mydas*. This result also coincided with what was said by the fishermen, 97 % of whom indicated that the green turtle was the species more frequently captured. A similar percentage was found by Alfaro *et al.* (2002) in Perú where 90 % of the turtles incidentally captured in the nets of the artisanal fishermen were *C. mydas*.

The fact that only one leatherback turtle was captured and that only three captures of loggerhead turtles occurred, is probably due to the pelagic life habits of these two species. The leatherback turtle was captured in Cabo Polonio and two of the three loggerhead turtles in Valizas, places where the fishing area is more oceanic and where it is common for fishermen to fish in depths of more than 15 meters. During the monitoring made onboard, in coastal areas of Valizas, no incidental capture of green turtle was registered, which apparently is related with the fishing areas used by the Valizas fleet, which rarely fish less than 2 miles from the coast. This is one of the differences between this fishery and the artisanal fishery in the ports of San Luis and Piriapolis, that fish near the coast and in shallow waters.
During the period of study 58 % of the incidental captures occurred during the summer, and this coincided with observations of artisanal fishermen along the Uruguayan coast as well as in Rio Grande do Sul according to what Studzinski *et al.* (1999) pointed out. As it was expected, the greatest superficial temperatures of the water were registered during the summer months (December – March) for the three localities, being greater (3 to 5 °C) in San Luis and Piriapolis than in Valizas. Also, during these months an increment of algae proliferation takes place (mainly in rocky and insular zones) (Javier Coll, pers.com.) which constitutes the main food item of the green turtle (see Chapter IV). This would explain why the incidental captures of green turtles by artisanal fisheries in San Luis and Piriapolis occurred in rocky and shallow areas during the summer.

50.7 % of the sea turtles captured where found alive and released later, which is a lower percentage than the one found in Brazil (Lima *et al.* 2002), where a total of 82 turtles were captured by artisanal fishermen, and 80.5 % where found alive. This could be due to the fact that in Uruguay the fishermen leave their gears in the water for longer periods than in Brazil, causing that sea turtles that get tangled in nets are found drowned. During this study we registered gillnets that were left underwater for two days and even more.

76 % of the surveyed fishermen pointed out that the sea turtles found dead in their nets were used for food and/or for the sale of their carapace, which is an alternative income (see Chapter IV). During the period of study, 19.4 % of the turtles drowned in the nets were used for food by the fishermen. Also during the monitoring made in Piriapolis, we observed that in Playa Verde two turtles found drowned in fishermen's nets, were also eaten. Similar practices were observed also in Brazil (Ott *et al.* 1999, Brosig 2003) and Peru (Alfaro *et al.* 2002) where the sea turtles are occasionally consumed by

fishermen or used as bait. We must have in mind, that in our country, any use of sea turtles is prohibited by law N° 144/98. Although during the present study, most of the individuals used (for different purposes) were already dead, we observed that three of them were sacrificed. Moreover, low incomes of the fishermen could incite to sacrifice these animals, so we consider of vital importance the accomplishment of teaching programs to fishing communities, as well as the creation of alternative income resources for fishermen.

Based on the morphometric measures all the green turtles captured were juveniles, they could be classified as juveniles (Estrades & Achaval *in press*), which is considered as an extremely valuable life stage for the recovery and stability of populations (Crouse et al., 1987). With the information recovered during the present study, we can affirm that in Uruguay the green turtle occurs along the entire coast, mainly in areas where algae are abundant, as in rocky and insular habitats. The high concentration of green turtles in some of these areas, throughout the year, suggests that they represent important developmental and foraging ground for this species in Uruguay.

Some measures to reduce the incidental capture of sea turtles in gillnets are: to promote the setting of the nets in areas where the presence of turtles is less probable, to limit the depth and length of nets, to reduce the period of time the gear is in the water and the time interval between net checks, and to use a net mesh which may reduce the probability of capturing turtles (Oravetz 2000).
For San Luis and Piriapolis we suggest that a way to mitigate the mortality of sea turtles in nets could be to reduce the time that gillnets are kept in the water, or to check the nets more often. At the same time, it is necessary to accurately establish the critical foraging/developmental areas of the green turtle in our coast in order to protect them and thus reduce the incidental capture of turtles. Last, but not least, we consider of great importance to continue with the studies of the incidental capture of sea turtles by artisanal fishery in different localities along the Uruguayan coast, to count with greater information that could be used in the future to implement appropriate management measures.

Recommendations

- To start long term studies of the incidental capture of sea turtles in different localities along the coast.
- To suggest and evaluate mitigation measures that minimize the impact on sea turtle populations and at the same time enhance the fishery activity.
- To identify and promote the protection of the developmental/foraging areas of green turtles in our country.
- To create permanent educational programs in fishing communities.

VIII. TRAWL FISHERY

In April 2002, we received a report from a trawler fisherman of a recaptured loggerhead sea turtle, which was incidentally caught by a coastal trawl-fishing vessel of Montevideo. This report motivated us to look for an answer to the following question: What is going on between sea turtles and trawl fisheries in Uruguay? Therefore, we started looking for information, mainly by interviewing fishermen. Our research includes the information collected during that period.

Introduction

Up to today, there are no published papers on incidental capture of sea turtles by trawlers operating in the Southwestern Atlantic. Most of the studies regarding the interaction between sea turtles and trawling activities have been directed towards shrimp and flounder fisheries (Anonymous 1992), and the implementation of TED's in the Gulf of Mexico and the Southeastern U.S. coast (Graham 1995, Harrington 1995, Kennelly 1995, Perret 1995). In Australia, efforts have been conducted to implement TED's and BRD's in the Northern prawn trawl fisheries (Robins 2002).

In Uruguay, shrimp are not caught by trawler nets. All trawling efforts are directed to catch fish and mollusks. There are just a few studies about the interaction between fish trawlers and sea turtles. Laurent *et al.* (2001) published the results of their research about the interaction between trawl fisheries directed to fish and sea turtles in the Mediterranean Sea.
All Uruguayan fishing vessels operate in oceanic and estuary zones all around the year (Fig.1). As the target species are distributed in the entire water column, there are different types of trawling fisheries.

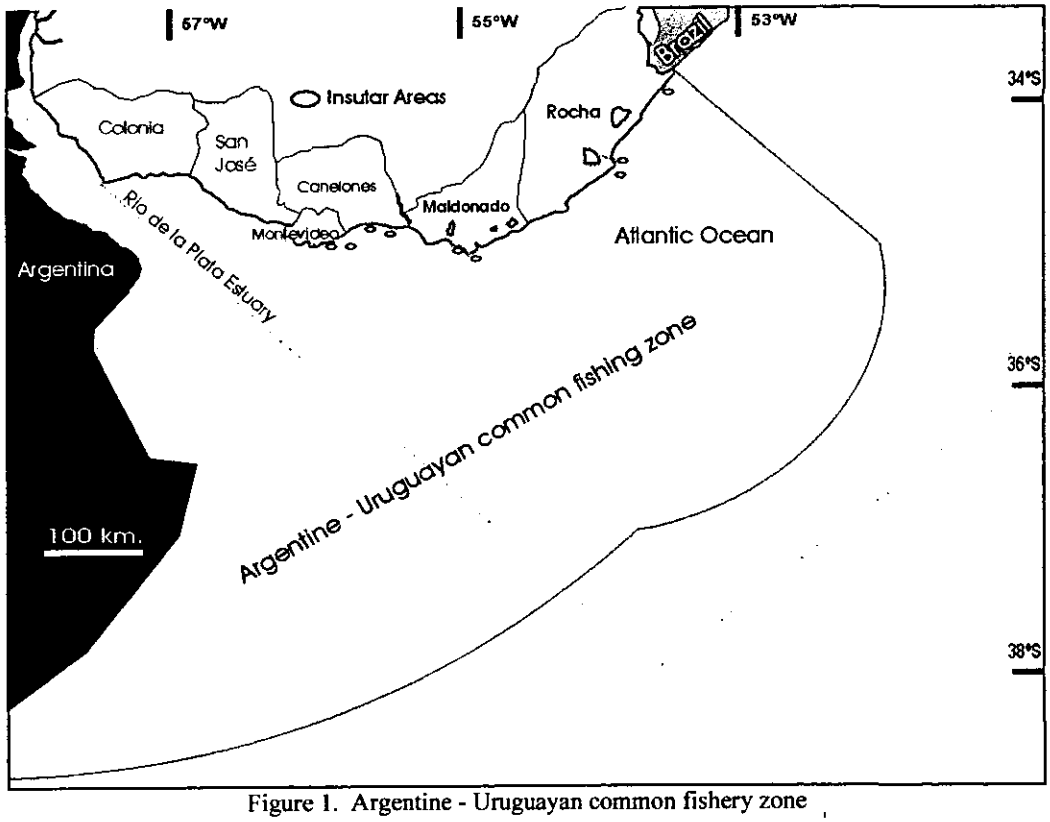


Figure 1. Argentine - Uruguayan common fishery zone

Coastal fishery targets three species, Croaker (*Micropogonias furnieri*), Seatrout (*Cynoscion guatucupa*) (Arena & Rey 1994), and the fine snail (*Zidona dufresnei*) (Riestra & Fabiano 2000). This fishery operates at depths from 4 to 20 meters in the case of fish, and from 30 to 60 meters in the case of snail. Trawling operations within 7 miles from shore are prohibited.

High sea fishery is directed to catch Argentine hake (*Merluccius hubbsi)* (Norbis 1999) and Squid (*Illex argentinus)*. Depth range at the fishing ground varies from 50 to 400 meters.

There are 45 coastal fishing vessels operating in the country, 33 of which are directed to catching fish. These last ones have an average of 25 meters LOA and 126 GWT, and a crew of 10 fishermen (DINARA 2003). Most of them use the Montevideo Port as base. The minimum legal mesh size opening at the cod end is 100 mm. The average net dimensions are 2,5 meters of vertical aperture, 77 meters of horizontal aperture, and the length from the opening to the cod end is 97 meters. The vast majority of these fishing vessels operate as pair trawlers, and just a few operate as otter bottom trawlers. The haul duration is estimated at an average of 4 hours, but when the capture is scarce, the haul may extend to up to 10 hours. The speed during haul is between 3 and 4 knots.

Among the non-target species that interact with these fisheries, are juveniles of green turtle (*Chelonia mydas*), juveniles and adults of loggerhead turtle (*Caretta caretta*), and adults of leatherback turtle (*Dermochelys coriacea*).
The objective of this work was to describe and have a preliminary understanding of the incidental capture of sea turtles by the Uruguayan trawl fishery fleet.

Materials and Methods

In order to obtain good quality information, it was decided to work with information provided directly by the protagonists: the fishermen and scientific onboard observers. They are the ones who are in direct contact with the day-to-day interaction with sea turtles.

First, the main task was to get acquainted with the fishermen. Therefore, different ports were visited and personal contact was established, in order to gather preliminary information about the situation of sea turtle interaction with trawl fisheries. This approach was also very helpful in order to obtain information regarding fishing methods and data regarding the fishing fleet. This was achieved by interviewing fishermen on the dockside, asking them about the fishing maneuvers and the characteristics of the fleet, and the occurrence of sea turtle incidental captures.

At the same time, the Technical Maritime School was visited. Fishermen with many years of experience attend special courses indicated by local legal requirements in this School. A couple of workshops aided with videos and slides were offered to the fishermen, in order to explain our project and finally they were asked for their support and collaboration. Most of these seamen showed interest in the project, and were, therefore, instructed on the necessary skills to obtain scientific data on board their vessels. To recruit more volunteers, we used the same criteria as Robins *et al.* (2002), asking the volunteers to recruit other fishermen who found the project interesting and wished to take part in it.

The fishermen were trained and equipped to collect the following information: species identification; biometric measurements; tagging; skin tissue sample collecting; tumors and epibionts sample collecting.

Other training consisted in reanimation techniques for comatose turtles, and photo identification.

These already trained fishermen are the foundation and first members of our "Onboard Tagging and Data Collection Programme". The program started on November 1, 2002, with three equipped fishermen. Up to date, there are four volunteers working and three more almost ready to start.

Fishermen tagging a loggerhead

Results

Based on the interviews to fishermen, we concluded that the coastal fleet directed to catch fish is the one which most interacts with sea turtles.
During the period of observation, which started in April when the first volunteer reported a sea turtle recapture, 19 sea turtles were captured by three coastal fishing vessels and a research vessel from the National Direction of Aquatic Resources (DINARA). The four volunteers that worked to this date in this programme only recorded data from coastal fishing vessels (directed to catch fish). No observation could be attained from snail or hake fishing vessels, so as a result the gathered data is restricted to the coastal trawl fishery fleet (Fig. 2).

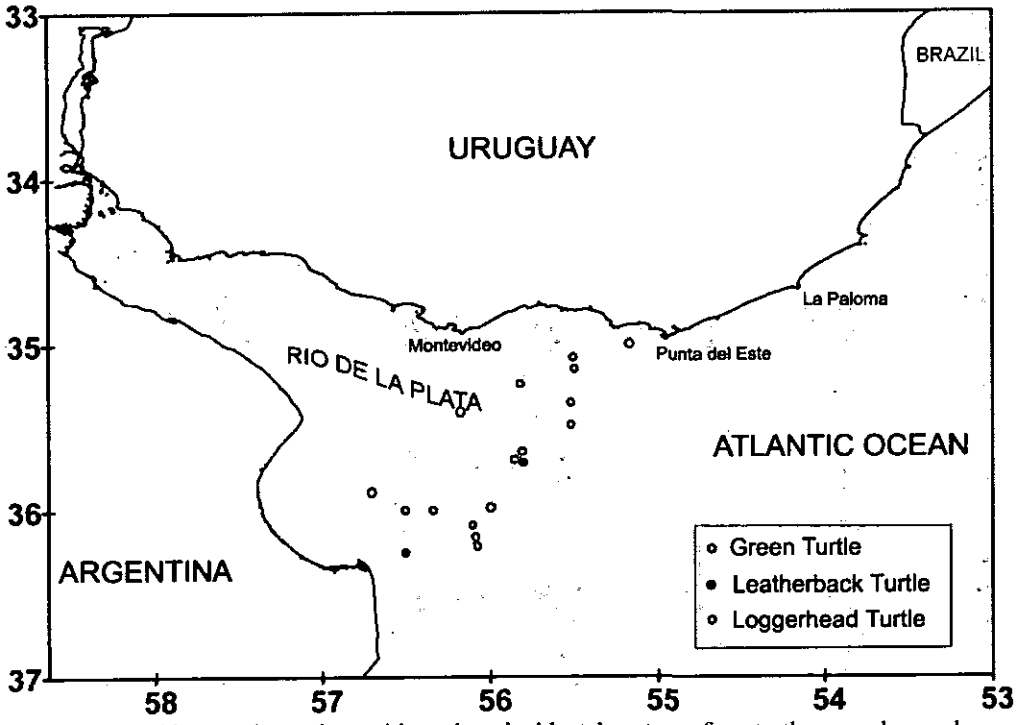
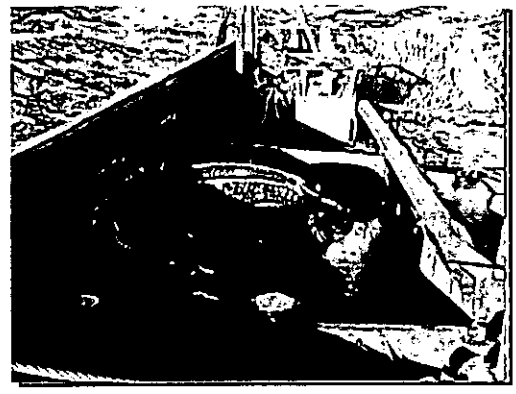


Figure 2. This map shows the position where incidental capture of sea turtles was observed.

Of the 19 captured turtles, 16 were tagged and released alive successfully, and the remaining three individuals died on the deck.

This preliminary work is not intended to be a quantitative analysis of sea turtle incidental capture. In order to perform such a study, it would have been necessary to collect several other data, which was beyond the original objective of the project. It was decided to limit data collection to identify how, where and when sea turtles are incidentally caught by trawler nets. A very conservative estimation, based on data obtained on board of just one single fishing vessel, during a period of 9 consecutive months, suggests an incidental yearly catch of 352 turtles, by all the 33 vessels of the coastal fleet. This estimation is because all 33 vessels produce a similar fishing effort, operate on the same fishing ground, and therefore the incidental capture of sea turtles should have no seasonal variation.



A remarkable fact is that, all the volunteers have mentioned that when a leatherback turtle has to be disposed of from deck, it is winched and swung overboard, many times hitting heavily the gunwale. This helped us to understand why so many of the stranded leatherbacks have their skull cracked and a tight-knotted rope in a posterior flipper.

Discussion

The "Onboard Tagging and Data Collection Programme" has been a success since its creation and implementation. Relationship with all the volunteers is excellent. They show great commitment to the Programme, and they are generating good quality information. They are also respectful with the sea turtles that are incidentally caught.

Based on the preliminary results of this on going research, we understand that it is extremely urgent to expand the number of trawler vessels and crewmembers participating in this project. This will allow collecting more data, which will help us to fully understand the magnitude of the impact, caused by this fishery in the sea turtle populations.

As soon as this is achieved, we will be in a better position to suggest measures, such as geographical and/or temporal fishing bans, and the implementation of a device, similar to the TED's utilized in shrimp trawls, which could help to mitigate this impact, thus helping the conservation of sea turtles.

We also strongly suggest the urgent development of a suitable device to lower the leatherback turtles into the water without problems. We are at present developing a backpack-style device, which could help to return the leatherbacks safely back to the water with the aid of the winch.

A significant fact is that by doing this research we detected another problematic originated in the fisheries, like by catch of other species (La Plata Dolphin *Pontoporia blainvillei* and Sea Lion *Otaria flavenscens*), and the many tons of discarded fish. We strongly believe that these problems have to be urgently considered and solved.

Plans for the Future

- To expand the number of trawler vessels and crewmembers participating in the Programme, in the fleet that is currently being studied as well as on the snail fleet and on the recently developed Cutlass fish (*Trichiurus lepturus*) trawling activities.

- To quantify the Catch per Unit of Effort (CPUE) to make a better assessment of the incidental capture of sea turtles.

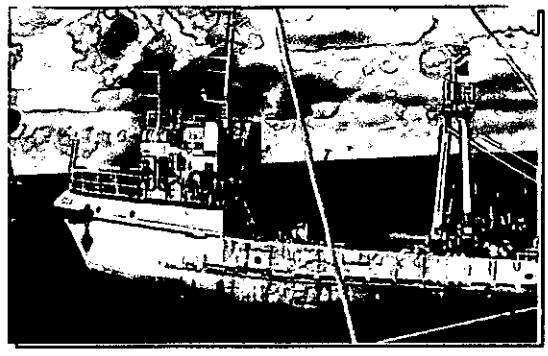
- To test the effectiveness of using TED's adapted to the Uruguayan fisheries, in order to reduce the incidental capture of sea turtles.

- To adopt measures to minimize the post capture mortality rate of sea turtles.

- To implement an Educational Programme directed to fishermen, captains and onboard observers, with the objective of generating awareness, teaching facts, and stimulating the analysis of the situation of sea turtles and their problematic with fisheries.

IX. LONGLINE FISHERY

The longline fishery in Uruguay



The Uruguayan longline fleet operates in the Economic Exclusive Zone (EEZ) and adjacent international waters. The tuna fishery began in 1968, with a single vessel bought by the SOYP (Servicio Oceanográfico y de Pesca – Oceanographic and Fishing Service) from Spain. This ship operated from 1969 to 1974 (Nion 1999). From 1975 to 1980, there was a gap in tuna fishing. The fishery recommenced in the early '80's with a longline fleet consisting mainly of Japanese vessels. In 1992, Japanese vessels were gradually replaced by Spanish and American longliners (Mora 1994, Domingo *et al.* 1996). Nowadays, the Uruguayan fleet is composed by nine vessels, mainly fresh product vessels, of between 15.8 and 42.5 mts. in length and directs their effort principally to the swordfish (*Xiphias gladius*), tuna (*Thunnus obesus, T. albacares* and *T. alalunga*) and sharks (*Prionace glauca, Isurus oxyrhinchus* and *Carcharhinus* fins.). The art used by the tuna fleet is the American longline type, with a monofilament. The hooks used are always curve N° 9/0 and, in general, squid (*Illex argentinus)* is used as bait, and whenever it is possible, chemical light-sticks are used at the last gangion line. In some cases, the bait is dyed (Domingo 2000).

On Board Observers National Programme of the Uruguayan Tuna Fleet (PNOFA)

Ever since 1998, the On Board Observers National Programme of the Uruguayan Tuna Fleet (PNOFA) has been developed by the D.I.N.A.R.A. (National Direction of Aquatic Resources). One of the objectives is the quantification and description of the capture, principally to obtain data about fish species with the greatest economical impact. This information is essential for designing an adequate management for those species.

Incidental capture of sea turtles background for the Southwestern Atlantic area

Works related to pelagic longline-sea turtle capture interactions are few. Achaval *et al.* (2000) analyzed the captures obtained in Uruguayan and Southwestern Atlantic waters by two vessels with foreign flags, which operated with experimental fishing permits in the Economic Exclusive Uruguayan Zone (ZEEU). They used an art different to that of the Uruguayan fleet and, in some cases and according to the area, tried two different types of operation (Spanish and American longlines). The work of Kotas *et al.* (in press) is based on the vessels, which operate in the Economic Exclusive Brazilian Zone (ZEEB) and use similar art and areas to the Uruguayan fleet. The observations took place during three trips with a total of 34 throws, at different times during the same year. There are no records about works on sea turtles with information collected in vessels with the Uruguayan flag, operating with pelagic longlines. That is the reason why, since July 2001 and together with the Pelagic Resources Area of DINARA, Karumbé started a joint work with that office, organizing the following activities: training onboard observers for PNOFA, sea turtle tagging and analysis of the data registered between 1998 and 2000.

Training Onboard Observers for collecting data on sea turtles

On December 2001 and again on December 2002, the Karumbé Project accomplished workshops for training onboard observers from the D.I.N.A.R.A. (National Direction of Aquatic Resources). The workshops consisted of the standardization of data collection methods, and training to tag and recognize other type of tagging. The interest of the observers onboard was evident, when later on, they provided us with substantial information on the incidentally captured turtles during longline fishing operations of National and International vessels. A manual, identification guide and CD with relevant data and bibliography were delivered to every participant.

National Marine Turtle Tagging Program

Ever since July 2001, with the beginning of the NMTTP, the observers onboard tagged and released a total of 49 loggerheads *C. caretta* (see Chapter IVX).

Longline interaction with sea turtles by the Uruguayan fleet (1998, 1999, 2000)

This data was obtained by the Uruguayan Tuna Fleet onboard Observers National Programme (PNOFA). Ten trips took place between April 1998 and November 2000, in longliners belonging to the National Fleet, which direct efforts principally to swordfish. There were a total of 153 fishing operations and 143.695 hooks deployed. The surveys were done in six different vessels that varied between 17.5 42.45 meters in length and its Brute Register Tons (TRB) from 79 to 284. The area where they operated was the Economic Exclusive Zone and International adjacent waters from 26° a to 37° Southern Latitude. The greatest fishing effort in Uruguayan Territorial Waters is in winter. Environmental parameters as superficial temperature of the water (Celsius), atmospheric pressure, clouds, direction and intensity of the winds, were registered with specific equipment from the vessel. Data on capture that was catched, lost, discarded (dead or alive), net and unloaded was registered, as well as number of hooks, the use of light-sticks and general characteristics about the fishing art. The capture was analyzed in number of individuals, the effort in number of hooks and the CPUE every 1000 hooks, monthly, every three months and during the year for both species. The CPUE values were related to the average temperatures of superficial water, obtained during each longline throw, and also at the longline deployment.

Results

The work performed by scientific observers onboard from PNOFA totalised 153 fishing operations distributed as follows: 60 in 1998, 71 in 1999, and 22 in 2000. The fishing effort during the trips was distributed as follows: 4 trips in 1998 totalising 58.455 hooks, 3 trips in 1999 and also in 2000 with 66.390 and 18.850 hooks, respectively.

Data was obtained between fall and spring. No observations took place during the summer, when the activity of the fleet decreased and only small vessels operated.

A total of 192 sea turtles were captured (Fig. 1), 170 loggerhead, 21 leatherback and one green turtle which was captured alive in 1998, approximately 200 nautical miles from the coast (with the hook in the mouth). All the turtles were released.

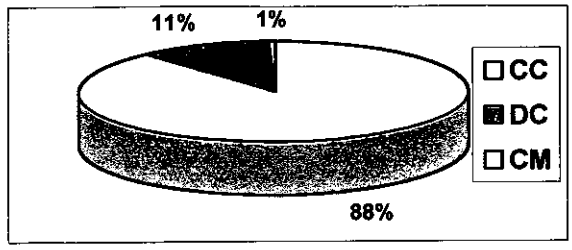


Figure 1. Distribution of species captured

The capture was higher in 1998 for both species, with a total of 111 turtles (100 loggerhead and 11 leatherback). The greatest number of captures for 1998 and 1999 was observed during the fall. No data was registered for this season in 2000. The capture percentages for leatherback rose from 10% to 25% in 2000 (Fig.2).

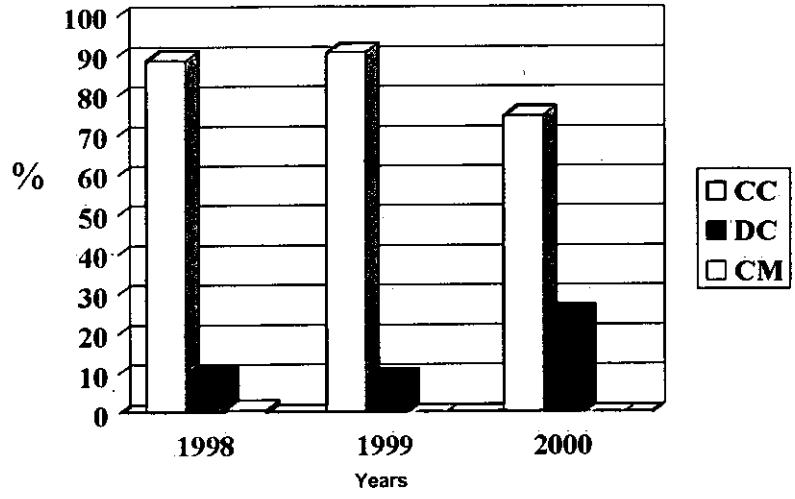


Figure 2. Percent of turtles captured in longline per year

Percentages of alive/dead individuals discarded were analyzed exclusively for loggerhead turtles because leatherback turtles were always discarded with hook and line (Fig. 3). It was not always possible to determine the conditions in which leatherback turtles were discarded because they were not taken aboard due to their size. Percentages of individuals discarded alive changed from 87% to 100%, from 1998 to 2000.

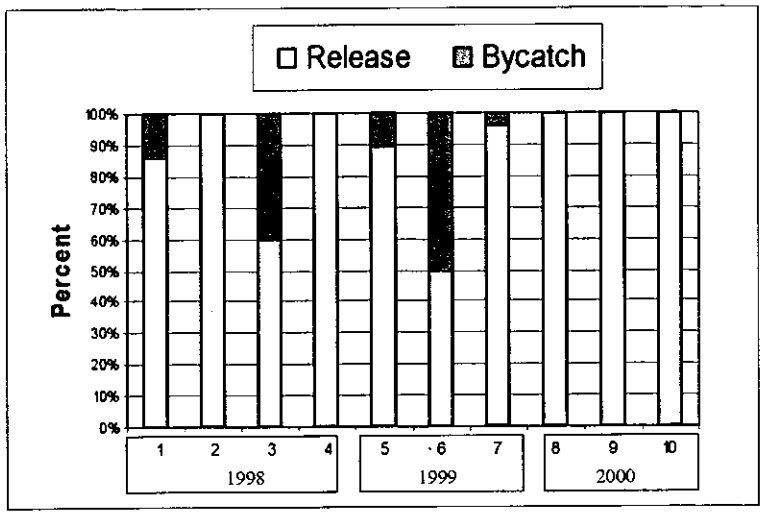


Figure 3. Percent of turtles release (returned to the sea alive) and bycatch (discarded at sea dead).

By analysing the data from the whole period, we concluded that CPUE values of loggerhead turtle are correlated with mean sea surface temperatures (Fig. 4).

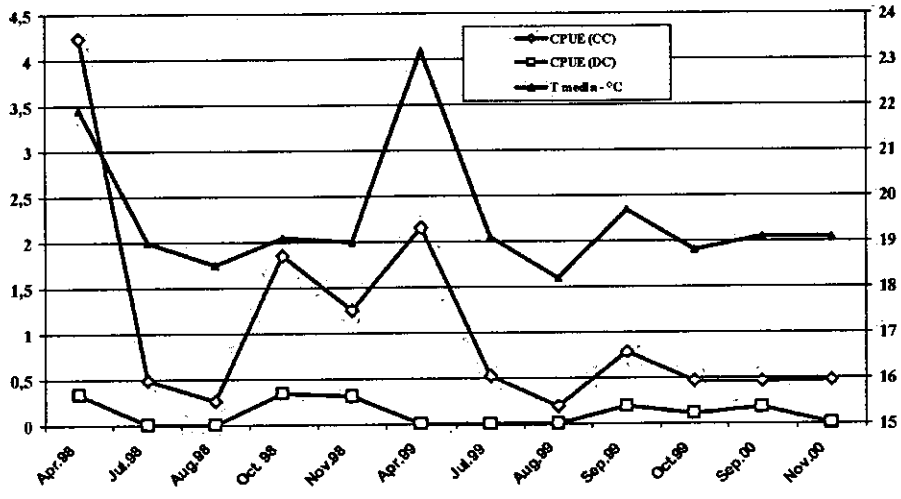


Figure 4. CPUE per month related to surface temperature

Longline fishermen releasing a juvenile loggerhead after the hook was removed

Considering the temperatures by intervals, we can observe that the greatest effort was done under the coldest temperatures, which could have caused the low CPUE values (Fig. 5).

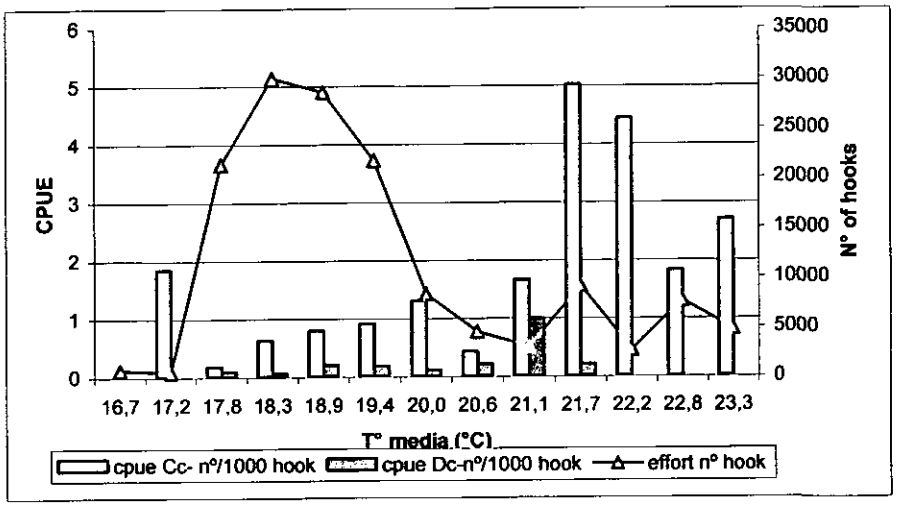


Figure 5. CPUE and N° of hooks related to surface temperature

Conclusions

- 100% percent of the turtles captured were discarded. 90 % percent were released.
- Leatherback specimens are usually large; consequently they are always released by cutting the line.
- No hooked leatherback specimens were found.
- The highest CPUE values for loggerhead turtles were recorded in the fall and are probably associated to higher mean sea surface temperatures (between 21° and 23° C).
- For leatherback turtle the highest CPUE values occurred with temperatures between 20.5° and 21.5° C.
- The incidental capture of turtle decreased with low sea surface temperatures, even though the sampling effort was higher.

Perspectives

- It is necessary to continue with this study to determine the real impact of longline fishery on sea turtles and to implement effective conservation measures to reduce the capture and post capture mortality of sea turtles. For example: modification of hooks, baits.
- To extend the education and training program of onboard observers, captains and fishermen to the entire Uruguayan longline fishery fleet.

X. ILLEGAL TRADE AND USE OF SEA TURTLES

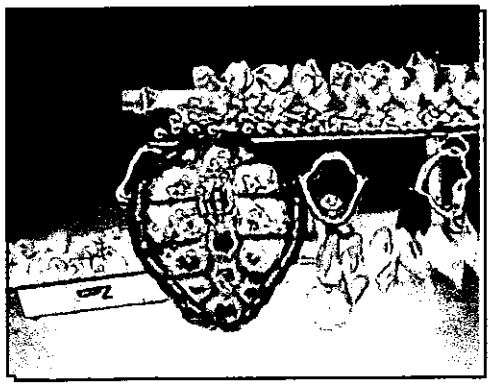
Situation in Uruguay

For many decades Uruguay has used turtle carapaces as decoration in private homes, restaurants, fishing clubs and hotels (Frazier 1984, López *et al.* 2001). Most of them corresponded to green and loggerhead turtles, although leatherback turtle carapaces have also been reported. The origin of those carapaces is mostly from dead turtles that appear in artisanal fishermen's nets and fishing gears of industrial vessels. Tourists and local people also take carapaces from the turtles that appear stranded on the beach. Turtle meat is used as food, prepared in the famous 'turtle soup' or as fried steaks.

In Uruguay there are 5 laws protecting fauna in general, including sea turtles (N° 9481, 13833, 14484, 16320, 16736). More specifically, sea turtles are protected by the 144/998 decree (1998) in order to reduce their mortality. However, at present the population in general is unaware of these laws. Uruguay is a country strongly concerned in protecting and respecting the environment. Internationally, our country signed the 'Convención Internacional de Especies Migratorias' (International Convention of Migratory Species) (BONN) (Law 16062) and CITES (Law 14205, 15626). In December 1998, Uruguay signed the Interamerican Convention for the Protection and Conservation of Sea Turtles (IAC), which is being ratified.

During the first stages of the project (July-December 2001), artisan fishermen were interviewed and asked about the use of turtles that were incidentally captured (Chapter IV). In the two years of monitoring (July 2001- June 2003), we identified the sale of sea turtle products in places as: seaside resorts, fish markets, crafts-shops and fishing communities. When a sale was detected, we proceeded to collect information (species, biometric measures, origin, cost of the product), and if it was possible, a photograph was taken. Salesmen were persuaded to stop doing so, and fishermen were invited to participate of the project by studying incidental capture or selling natural hand made products. A national campaign was started, informing people about the illegal condition of both selling, and buying sea turtle products in Uruguay and the importance of conserving these animals.

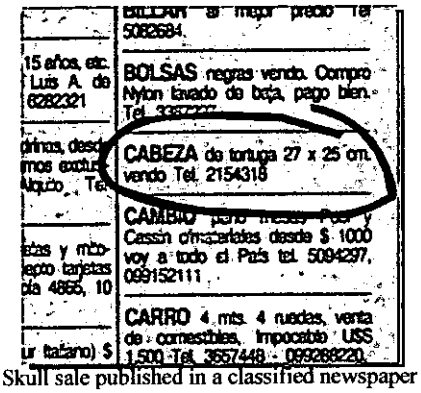
Sale of sea turtle parts: carapaces and skulls



A total of 27 carapaces for sale (20 *Chelonia mydas*, 6 *Caretta caretta* and 1 *Lepidochelys olivacea*) were detected in crafts shops, fishing clubs and stands along the coastline (Fig.1). Prices varied between 10 and 350 dollars, with an average of 55 dollars per carapace.

New modalities of sale were detected. The capital, Montevideo, has not been an important carapace- selling point. However, we found carapaces for sale at two different markets of the capital city. The sellers were fishermen and regular people who decided to sell carapaces that they had at home as decoration, probably motivated by the economical crises that our country is going through.

We could also detect the sale of turtle parts through classified advertaising (see photo below); the creation of lamps using turtle carapaces and handicrafts made with turtle bones.



Skull sale published in a classified newspaper

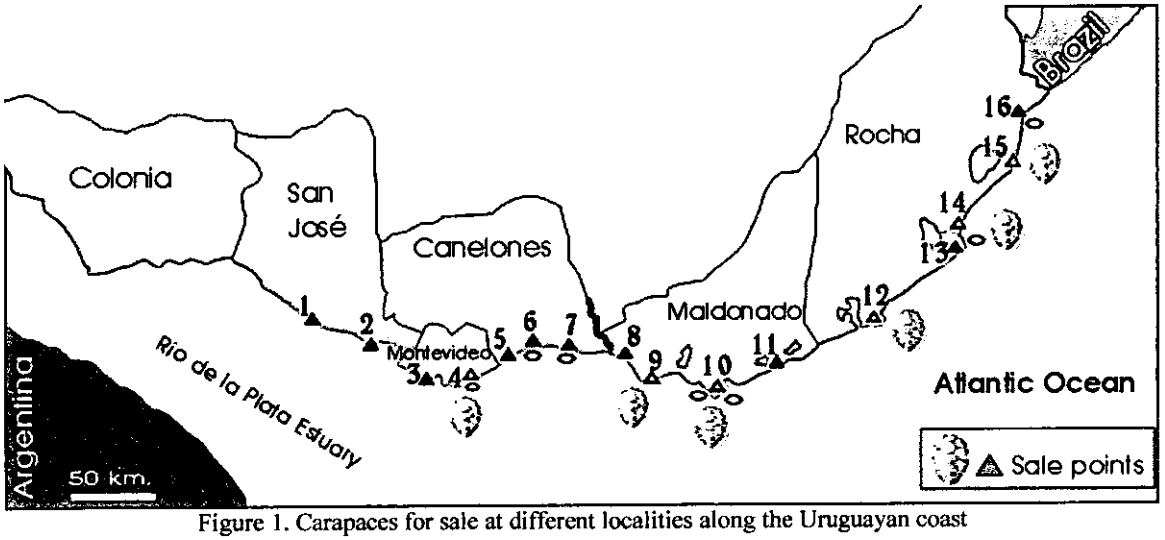


Figure 1. Carapaces for sale at different localities along the Uruguayan coast

Sea Turtle uses: decoration

Eighty carapaces, 5 skulls and 2 embalmed bodies were found used as decoration (Table 1). Most of these items came from incidental captures in fisheries and from stranded individuals used as decoration items at different locations.

The size range of the carapaces found for sale or as decoration (Fig. 2) were within those described for Uruguay previously (Estrades & Achaval *in press*).

Some of owners of the carapaces, decided to donate them to the project, some of which were also donated to the Vertebrates Collection of the Facultad de Ciencias (Faculty of Sciences), Montevideo. Two of them a *D. coriacea* and a *L. olivacea* carapace, were new for that collection. Jack Frazier published the first record of a *L. olivacea* for our country in 1984. Another *L. olivacea* was found in a restaurant of Punta del Este, the same one had been found in La Paloma 20 years ago.

Table 1. Number of carapaces, skulls (*) and embalmed bodies (**) used as decoration, classified per species.

Places	*C. mydas*	*C. caretta*	*D. coriacea*	*L. olivacea*
Restaurants	6 (1**)	9 (1*)	(1*)	2
Fish-shops	7	3	-	-
Fishing Clubs	-	2	-	-
Hotels	3	(1**)	-	-
Fishermen Houses	13 (1*)	8	-	-
Private Collections	-	-	(1*)	-
Private Houses	18	7 (1*)	-	-
Ice-cream Shops	2	-	-	-
Total	51	32	2	2

Karumbé donating the first *L. olivacea* carapace to Prof. F. Achaval
From the Facultad de Ciencias, Montevideo (Faculty of Sciences)

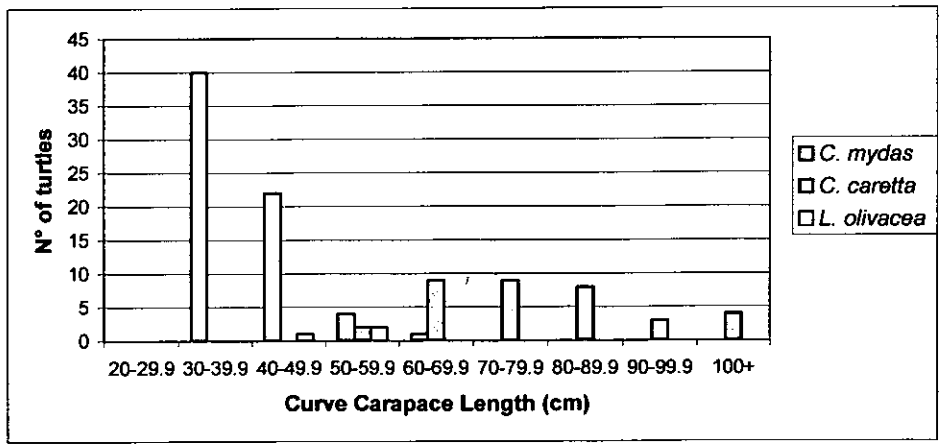
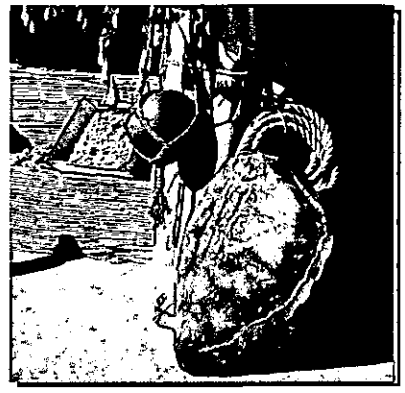


Figure 2. Length frequency per species detected for sale and used as decoration in public places between July 2001 – June 2003.

Zero Carapace Campaign

We carried out the Campaign called "Zero Carapace", which included: the distribution of fliers to prevent the commercial sale of carapaces and sea turtle products and the creation of wood turtles (equipped with information about sea turtles and laws) which were installed along different tourist points around the country. We also shared general information about sea turtles and the legislation that protect them in our country and internationally with customs authorities, Navy and Uruguayan Rural Guards.



Carapace Confiscation Operations

Three reports against the illegal sale of carapaces were made in July and September 2002 and January 2003.

1- Punta del Este, Maldonado: Peñarol craft store (July 2002). The 'Seccional 10 de Policía' (Police Office Number 10) proceeded with the confiscation of two green turtle carapaces.

2- Puerto del Buceo (Buceo Port), Montevideo (September 2002).
The loggerhead carapace was seized by 'Dirección Fauna' (Fauna Direction) and donated to Facultad de Ciencias (School of Science), Universidad de la República.

3-La Barra, Punta del Este, Maldonado (January 2003).
The sale of carapaces in three new craft stands was reported to the authorities. The Rural Police confiscated one green turtle carapace and one loggerhead turtle carapace.

Carapaces confiscated by environmental policemen

Sea turtle meat consumption

As it was mentioned in the interview section, we detected the consumption of green turtles that were found dead in fishermen's nets (sport and artisanal nets), and in some opportunities, individuals that were sacrified. The meat was prepared in different ways: soup, fried steaks, or in stew. The consumption of turtle meat was detected all along the coast, especially in artisanal fishermen ports. (Fig. 4). Regarding the sale of turtle meat, two fishermen from Montevideo said that in one occasion that kind of sale had taken place.

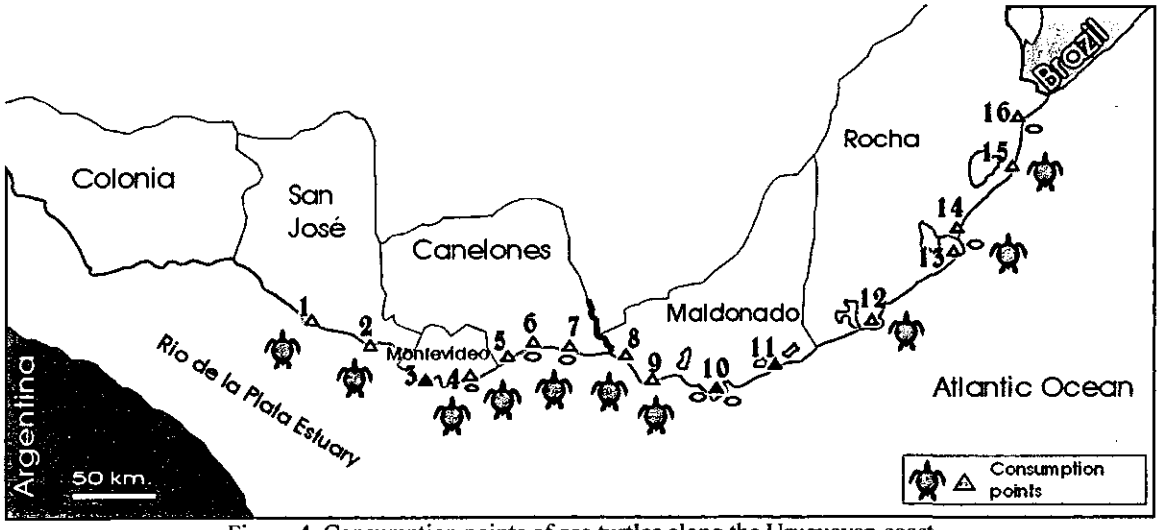


Figure 4. Consumption points of sea turtles along the Uruguayan coast


Local women cooking sea turtle fried steak


The "traditional" sea turtle soup

Report published in the Environmental News Service in the internet, about the confiscation of carapaces performed by the Uruguayan Rural Guards at a local artisanal market of Punta del Este, Maldonado.

ENVIRONMENT NEWS SERVICE
INTERNATIONAL DAILY NEWSWIRE WE COVER THE EARTH FOR YOU!

http://www.ens-news.com/ens/jul2002/2002-07-29-19.asp

Police Seize Sea Turtle Shells at Uruguayan Market

PUNTA DEL ESTE, Uruguay, July 29, 2002 (ENS) - A conservation organization working to protect marine turtles is encouraged by the seizure of three green sea turtle shells by police from a market in Punta del Este, Maldonado state.

On July 20, the police of Sectional 10 in Punta del Este confiscated the carapaces based on information provided by the Karumbé Project, which is currently developing a program to reduce the sale of sea turtle carapaces in Uruguay.

The carapaces, which came from juvenile turtles, were offered at US$20 in a crafts market, where other sea products, such as snail shells and shark teeth, were also for sale.

Karumbé says the use of sea turtle carapaces by the Uruguayan people is a tradition that goes back many decades. "In the 1990s there was a considerable reduction of the sale of turtle carapaces," the organization says, "but due to the economic crisis that is affecting our country, this commerce has increased because fishermen are selling the carapaces of sea turtles that get caught by trawling activities."

Sea turtles in Uruguay are protected by the 144/98 decree, which says in its first article "It is forbidden to capture, hold, transport, commerce, use and processing of sea turtles."

Discussion

López *et al.* (2001) reported between the years 1999 and 2000, high prices in carapaces exposed for sale and suggested that if the economic crisis continued there would not be a decrease in the sale of these products. New modalities of trading were detected, finding two embalmed turtleheads for sale, at very high prices.
In the period 2001-2003 we could confirm what López *et al.* (2001) had noticed: an increase in carapace sales, consumption of turtle meat and new modalities of sales, due to the general economic crisis that the country has been going through.

The new modalities of trade would include advertisements in the newspapers, sales in markets and bone trade, which is a new modality in our country. Artisans and fishermen are increasing their offer of sea turtles products, encouraging the illegal trade.

By performing educational workshops along the coast, we saw the change of attitude of several craftmen and fishermen, along with the eradication of the sale of carapaces in some fishing communities (Atlántida, Cabo Polonio, Valizas, P. del Diablo and La Coronilla). But sadly the illegal trade of turtle parts has moved to other zones (La Barra and Montevideo). In spite of the fact that in most of the cases the origin of the carapaces is from dead individuals this trade encourages fishermen to sacrifice new sea turtles.

Future Actions

- A massive awareness campaign about the situation of sea turtles in our country.
- To discourage meat consumption and use of carapaces as decoration.
- Workshops about laws protecting our fauna, directed to authorities (policemen, judges, police rural guards, Navy).
- Workshops directed to artisans and fishermen, motivating them to create crafts allusive to sea turtles and other sea animals of our coast, as a way to diminish the illegal trade of carapaces and bones.
- Campaigns of inspection to industrial vessels (trawl and longliners) to avoid carapace trade coming from these fisheries.

XI. COMMUNICATION

Communication and Advertising

One of the objectives of the project, proposed as one of our principal goal was to implement a massive information campaign, with emphasis on local communities that commonly interact with the turtles. The principal communication strategy carried out at different public and private schools, and fishing communities were accomplished through a series of workshops and educational talks, complemented with informative and educational material that was handed out.

All the activities carried out regarding regional and international news related to marine turtles, were published in the Web page of the Karumbé Project (www.karumbe.8k.com).

In order to encourage consensus among the Uruguayan society we provided information through different mass media (e.g., radio, television, newspapers and magazines) about the importance of sea turtle conservation, in order to discourage people from buying sea turtle products.

Karumbé Project did not ignore the fact that the life of many persons, especially those living in the small fishing communities, depended on selling crafts that are sometimes made with material that belongs to marine turtles. Therefore, we offered workshops for craftsmen proposing ingenious alternatives to create original crafts of the area, with no incidence on turtles. We also contacted the local authorities and delivered copies of the laws (national laws and international conventions) referred to the protection of marine turtles.

It is important to emphasize that all the activities carried out by the Karumbé Project, thanks to the support of several foundations and donors, were presented in various symposia, congresses and meetings of regional and international participation, celebrated in the last two years. The participation of Karumbé Project in all these events

Magazines

- SOMOS (from UTE's Environment Department). April 2001.
- Bañados del Este (PROBIDES). May 2001.
- Colegio Greenland School. July 2001.
- Costa de Oro y Barrios de Montevideo HOY. (Cultural information). October 2001.
- ¿Que hacemos hoy? (Tourist information, Punta del Este). February 2002 (Prepared for the Museum of the Sea).
- El Escolar (Magazine for primary school children). April 2002.
- Purpose Rescues (Information about the environment in Uruguay). December 2002.
- Ruta News (Tourist Information). April 2003.

Newspapers

National:

- Ultimas Noticias (September 10, 2001).
- Semanario Búsqueda (January 25 and September 20, 2001).
- El Observador (January 30, 2002 and January 6, 2001 editions).
- La Republica (March 1, 2002).
- El País (June 23, August 14, October 26, 2002 and July 2, 2003).

Local:

- El Este (Rocha) (January 15, 2003).
- Vecinos (Montevideo) (February 2002).
- Semanario del CHUY (Rocha) (April 2003).

Television

- *Caleidoscopio*. Channel 10 (April and May 2001).
- *Buen Día Uruguay* and *De Igual a Igual*. Channel 4 (January 2002, January and February 2003).
- *Al Aire Libre*.Channel 5 (October 2002).
- TV Cable from La Coronilla (September 2002, January and June 2003).
- *Informativo, Cerro Rural*. Chanell 7 (September 2001 and January 2002).
- *La Ciencia en Uruguay*. VTV (Cable) (April 2003).
- TV 6 Cable. Canelones (June 2002).
- *Hola Gente*. Canal 12 (March 2003).
- *Por Menores*. Tv Cable Montevideo (June 2003).

Radio

AM Radio Stations:

- *El Dedo en el Ojo*. CX 30 (April 2001).
- *Cabeza de Papagayo*. CX 38 (April 2001).
- CX4 Rural Radio (September 2001).
- Radio Maldonado (January 2002).
- *Planetario*, El Espectador. (January and April 2002, March 2003).
- CX 38 Sodre, *ENTRE TODOS* program (November 2002).
- Sarandi 890 (December 2002).

FM Radio Stations:

- Setiembre FM. (August 2001).
- La Marea FM (Community Radio) (September 2001, January 2002).
- Del Sol (January 2002).

- Esteña (January 2002).
- La Coronilla (January 2002 and 2003, April 2003).

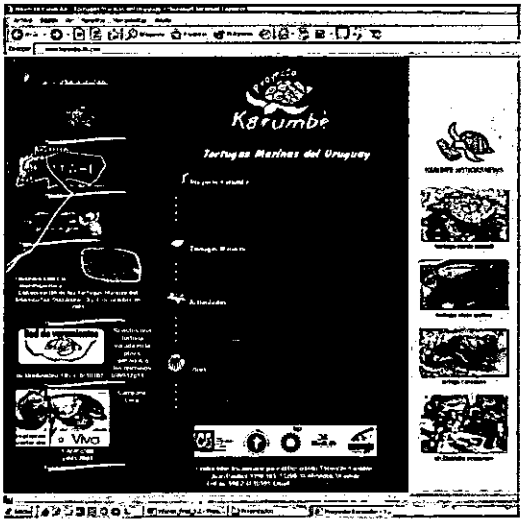
TV and radio interviews and publications during the period (Table 1).

Table 1. Karumbé Project activities diffusion along the years.

	2001									2002											2003			
	a	m	j	J	a	s	o	n	d	j	f	m	a	m	J	j	a	s	o	n	d	J	f	m	a
Magazine	1	1		1			1				1		1								1				1
Newspaper						1				2	1	1	1		1	1	1		1			1			1
Television	1	1				1				2					1			2	1			1	1	1	1
Radio	2				1	2				6			1							1	1	1		1	1

Webpage's

Karumbé WEB - www.karumbe.8k.com



This Web page was created in 1999, and in 2002 it was upgraded and renovated giving it a more dinamic format. The page includes the history of the project, the specific studies that are in process, the biology of marine turtles, things that the Uruguayan society can do to help marine turtles, list of publications, monthly news, opportunities for volunteers and a place for children with interactive games and material to paint and learn. The page is very easy to navigate; it is quick, with many photos and live colors. It has shown to be one of the most effective ways to spread information about marine turtles in Uruguay, the efforts carried out for their protection and the information regarding the national and international laws that protect them.

Karumbé has been included as a link by other Web pages, thus getting international recognition. Some of these web pages are:

National

- Magazine about tourism adventure of Uruguay
  - www.zonaventura.net/Notas/ecologia.htm
- Antawa Magazine
  - www.geocities.com/antawa
- Project Natur
  - www.geocities.com/proyectonatur/tortugasmarinas.htm
- Information of Chuy, Rocha
  - www.chuynet.com/portalrocha/Karumbé.htm
- Magazine about Uruguay
  - www.uruguay.com/laonda/LaOnda/105/Salvemos%20las%20tortugas%20marinas.htm
- Information about volunteering in Uruguay
  - www.uruguaysolidario.org.uy/historias.html

- Information on interesting notes
  - www.comcosur.com.uy/edi_anteriores/aldia/2002/30-04/notas.htm

- Information of Punta del Diablo, Rocha
  - www.portaldeldiablo.com.uy/main.html

International

- ENS NEWS, Information about the environment (World)
  - www.ens-news.com/ens/jul2002/2002-07-29-19.asp

- Information in Catalan (Spain) about conservation projects
  - www.bcn.es/medciencies/latalaia/n4/cat/docs/des%20dels%20centres.doc

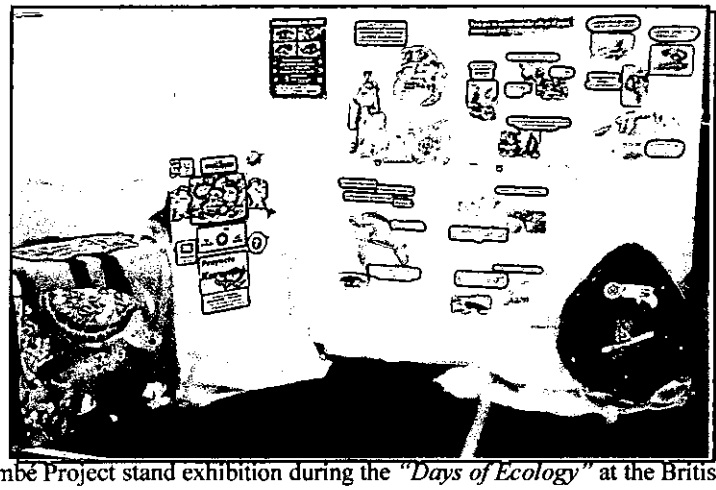
- Information about marine turtles in the world
  - www.iespana.es/TortugasMarinas/centrosrecuperacion.htm

Exhibitions

Publication of the activities performed by the NGO C.I.D. and Karumbé Project by the exhibition of posters displayed in a stand during the celebration of an Agro-Industrial and Technology event "Expo-Prado" between September 7 – 23, 2001. This Exhibition takes place every year in Montevideo, being visited by more than 100.000 people. In 2001, the Karumbé Project stand was one of the most visited by children; some of the drawings of marine turtles performed by these children have been published in the Web page of the Project.

Other exhibitions:

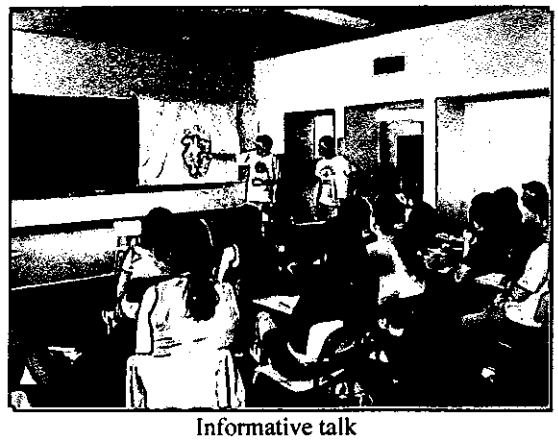
- *Days of Ecology* at the British School (October 2002).
- Participation with a stand and lectures in the Expo-feria carried out in the Santa Teresa National Park, Rocha (November 7-10, 2002).
- "Environment Week" in Montevideo (June, 4-16, 2002).
- *XVII Feria Nacional de Ciencia y Tecnologia Juvenil* held at the I.P.A. (Artigas Institute of Professors). Ministry of Education and Culture (October 24, 2002).
- We set up an information stand on marine turtles for tourists in a restaurant owned by an artisanal fisherman in the Valizas area (January 2002).
- Craftsmen from Valizas were encouraged to make *2002 Organizers* with information on turtles and handmade ceramic turtles.
- All the tourist information centres along the oceanic coast received a panel with the shape of a turtle that held pamphlets with general information of the Karumbé Project and sea turtle conservation in Uruguay.



Karumbé Project stand exhibition during the *"Days of Ecology"* at the British School

Informative talks about Sea Turtles of Uruguay

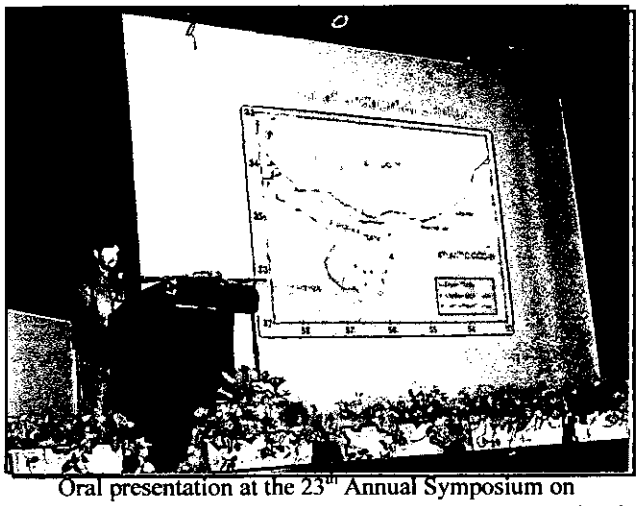
- For tourists and the fishing community. Participation of 60 people, Valizas, Rocha (January 2002).
- Ecotourism Course, Montevideo (October 30, 2002)
- IAVA Museum, Montevideo (October 31, 2002)
- Vida Silvestre NGO, Montevideo (July 10,2002)
- Rotary Paso Molino, Montevideo (August 8, 2002)
- Regional Center of Professors, Colonia (October 25, 2002)
- Maravillas Hotel, La Coronilla, Rocha (April 17, 2003)
- Environment Week - Alfredo Moreno Theater, Montevideo
- Huracán Buceo Club, Montevideo (June 1- 8, 2003).



Informative talk

Conferences and Meetings Attended
Oral Presentation and/or Poster (national and international)

2001	- International Environment Day, PROBIDES (Biodiversity and Sustainable Development in the Estern Wetlands Conservation Program), Rocha, Uruguay. June 5. (oral) - Participation in the "Days of Work on Health and Environment in Primary Education" (MECAEP Project). August 23-24. (oral) - Jornadas de Zoologia del Uruguay (Days of Zoology in Uruguay), Science Faculty, Univ. de la Republica, Montevideo, Uruguay. September 17-21.(oral, poster) - I° Seminario Uruguay Maritimo, Montevideo, Uruguay. Setiembre 26. - III Meeting on Wild Animals, Sustainable Development and Environment. Rescue of Marine Fauna Session. Vet Faculty, Univ. De la República, Montevideo, Uruguay. November 3-5, 2001. (oral) - ECOPLATA's International Conference (Integrated Management of the Coastal Uruguayan Zone of the Rio de la Plata), IMM (Municipality Management Administration of Montevideo), Montevideo, Uruguay. May 14-15. - I Southamerican Workshop on the Conservation of Albatrosses and Petrels, Punta del Este, Uruguay. Setiembre 24-28 - PROBIDES 10 years, Fac. de Arquitectura, Montevideo, Uruguay. Diciembre 12.
2002	- IX Meeting of Latin American Sea Turtle Specialists, Miami, Florida, USA. April 2-3. (oral) - Twenty-second Annual Symposium on Sea Turtle Biology and Conservation, Miami, Florida, USA. April 4-7. (oral, poster) - First Congress on National Ecoturism, La Paloma, Uruguay. Abril 12-14. (oral poster) - "First Days on the Conservation and Sustainable Use of Marine Fauna". Organized by PROFAUMA and the Navy School, Montevideo, Uruguay. September 26-27. (oral) - Social Forum: "Towards a sustainable management and administration of fishing resources in Uruguay". Debate about the impact of over exploitation of marine resources. , Fac. Ciencias Sociales, Montevideo, Uruguay. Noviembre 15-17. (oral) - "Congress on Protected Areas". Marine Protected Areas Session. Science Faculty, Univ. de la Republica, Montevideo, Uruguay. November 22. (oral)
2003	- VI Latin American Congress of Herpetology, Lima, Perú. Enero 19-23. (oral) - X Meeting of Latin American Sea Turtle Specialists, Kuala Lumpur, Malaysia. March 16-17. (oral) - Twenty-33 Annual Symposium on Sea Turtle Biology and Conservation, Kuala Lumpur, Malaysia. March 17-21. (oral, poster) - Second Ecotourism National Congress, Nueva Helvecia, Uruguay. May 8-10. (oral)



Oral presentation at the 23rd Annual Symposium on
Sea Turtle Biology and Conservation, Kuala Lumpur, Malaysia

Workshop and courses

- Participation in the workshop entitled the "National Coastal Policies ".The idea was to propose a sustainable development of the all the coastal area, including Río Uruguay, Río de la Plata, Atlantic Ocean and the Laguna Merín. This was organized by the Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente. May 2003.
- Karumbé Project was designated by the Uruguayan Committee of the IUCN as "Observer participant". One of the activities of the IUCN committee was the elaboration of National Red Lists. Members of Karumbé provided information for the chapter of reptiles.
- The Project was invited to participate in the Preparatory Workshop of the Inter-American Biodiversity Information Network (IABIN). Montevideo, Uruguay. October 29, 2002

Reports

Reports regarding the Research and Conservation of Sea Turtles in Uruguay were presented at the:

- COP1-InterAmerican Convention (IAC) that was held in San José, Costa Rica, on August 6 - 8, 2002. Uruguay is a signatory country of this convention, therefore we will continue to keep track on this metter to ensure its ratification by the corresponding Uruguayan authorities.
- Seventh Conference of the Parties to the Convention on Migratory Species (CMS - COP-7) Bonn, Germany; 18-24 September 2002
- 6ème séminaire "Tortues Marines du plateau des Guyanes" 17 au 20 novembre 2002, Guyane
- Second International Fishers Forum 2002 -Hosted by the Western Pacific Regional Fishery Management Council, Honolulu, Hawaii, November 19-22, 2002.

Books, manuals and guides

- Geo Juvenil book – PNUMA – Jovenes en Accion. This is a book focused on ecological subjects developed by young people.
- A Rehabilitation Manual for marine turtles (available at our website) www.geocities.com/karumbe1999/publicaciones/manual_rehabilitacion.pdf
- Guide for onboard observers on fishing vessels.
- Photographic guide for the identification of sea turtles and their observation from vessels, to improve the identification of turtle species by fishermen & Karumbé technicians.
- Postage stamps of sea turtles from the National Post Office (Dirección Nacional de Correos). Scheduled to be released by the end of October, 2003.

Published Abstracts, articles and notes

2001

Estrades, A. 2001. Antecedentes de las Tortugas Marinas en Uruguay y su Distribución Geográfica en el Periodo 1898 – 2000. Act. VI Jorn. Zool. Uruguay. p. 40

Fallabrino, A., M. López, A. Estrades, M. Hernández, N. Caraccio, C. Lezama, M. Laporta, V. Calvo, V. Quirici & A. Bauzá. 2001. Actividades y Resultados de las Primeras Investigaciones del Proyecto Karumbé - Tortugas Marinas del Uruguay 1999-2000. Act. VI Jorn. Zool. Uruguay. p.41

Fallabrino A., M. López, C. Lezama, N. Caraccio, V. Calvo, M. Laporta, M. Hernández, A. Bauzá, V. Quirici, A. Estrades & A. Aisenberg. 2001. Proyecto Karumbé: Estudio y Conservación de las Tortugas Marinas en Uruguay. Act.VI Jorn. Zool. Uruguay. p.41

Fallabrino A., López M., Lezama C., Caraccio N., Calvo V., Laporta M., Hernández M., Bauzá A., Quirici V., Estrades A. & A. Aisemberg. 2001. Proyecto Karumbé: Estudio y Conservación de las Tortugas Marinas en Uruguay. Zoológica Latinoamericana. Año 1 N°2, Octubre 2001. Pag. 5-8

López, M., A. Fallabrino, A. Estrades, M. Hernández, N. Caraccio, C. Lezama, M. Laporta, V. Calvo, V. Quirici & A. Bauzá. 2001. Comercio ilegal y formas de uso de las Tortugas Marinas en Uruguay. Act. VI Jorn. Zool. Uruguay. p.50

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Fallabrino A., López M., Estrades A., Hernández M., Caraccio N., Lezama C., Laporta M., Calvo V., Quirici V., Bauzá A.& A. Aisemberg. 2002. Estudio y Conservación de las Tortugas Marinas del Uruguay: Pasado, Presente y Futuro. Memorias de la IX Reunión de Especialistas en Tortugas Marinas de Latinoamérica, 2-3 de abril de 2002, Miami, Florida.

Calvo V., Lezama C., López M., Fallabrino A. & J. Coll. *In press*. Stomach Content Analysis of Stranded Juvenile Green Turtles in Uruguay. In: J.A. Seminoff (comp.) Proceedings of the 22° International Symposium on Sea Turtle Biology and Conservation. U.S. Dep. Commer. NOAA Tech. Memo.

Domingo, A., Fallabrino A., Forselledo R. & V. Quirici. *In press*. Incidental Capture of Loggerhead (*Caretta caretta*) and Leatherback (*Dermochelys coriacea*), Sea Turtles in the Uruguayan Long-Line Fishery in Southwest Atlantic. In: J.A. Seminoff (comp.) Proceedings of the 22° International Symposium on Sea Turtle Biology and Conservation. U.S. Dep. Commer. NOAA Tech. Memo. ().

Estrades A. & F. Achaval. *In press*. A Sea Turtle Century in Uruguay: Antecedents & Geographic Distribution. . In: J.A. Seminoff (comp.) Proceedings of the 22° International Symposium on Sea Turtle Biology and Conservation. U.S. Dep. Commer. NOAA Tech. Memo.

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Estrades A., M. López, , C. Lezama, Ma. N. Caraccio, V. Calvo, M. Laporta, M. Hernández, A. Bauzá, V. Quirici, A. Aisemberg & A. Fallabrino. 2003. Investigación y Conservación de las Tortugas Marinas en Uruguay: Proyecto Karumbé 1999 – 2002. VI Congreso Latinoamericano de Herpetología, 2003, Lima – Peru. Museo de Historia Natural Universidad Nacional Mayor de San Marcos - CIMA. p. 111

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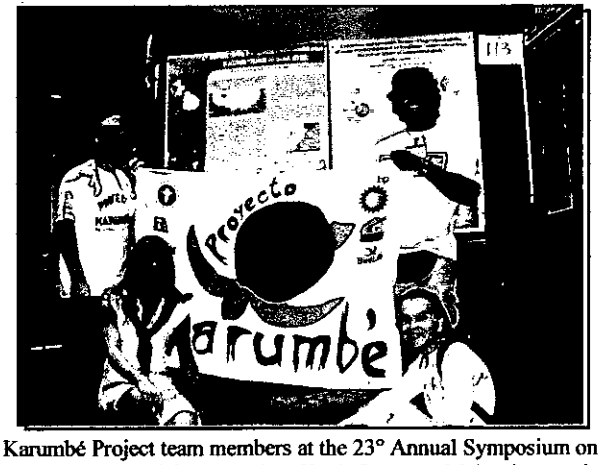


Karumbé Project team members at the 23° Annual Symposium on
Sea Turtle Biology and Conservation, Kuala Lumpur, Malaysia, march 2003

XII. EDUCATION

In the period between July 2001 and July 2003, with the objective of making a first evaluation on the general consciousness of the situation of the sea turtles that inhabit our seas, Karumbé Project surveyed thirteen locations along the coastline covering 530 Km. from Río de la Plata Estuary to the Atlantic Ocean, with a participation of 1600 children (Fig. 1 and Fig. 2).
Karumbé worked with the schools in the most important fishing communities, organizing talks and interactive activities with children and teachers. In some cases, talks and follow-up activities were organized outside the school limits with the fishermen and their families. In addition, schools and high schools farther away from the coastal area were visited after being invited.
Relevant information was collected in order to design an Educational Programme for the critical areas.

School visiting

At first, we introduced Karumbé Project and then we presented the topic: sea turtles, differences between tortoises and turtles. After that, we showed slides about the four species that occur in our seas and how we can identify them, feeding habits, investigations in process and causes for their critical situation. We also explained how we work a turtle dead or alive, the activities thet we perform at the feeding areas, as well as the information we collect, and why it is important to do so.

For this first approach we motivated children to participate actively in the talks, trying to make them discover the importance of sea turtles in natural balance, and what could happen if these animals were driven to extinction, affecting the whole planet. Our goal was not just exposing features but also making children aware of the problem and helping them find their own solutions.
Later on, we projected videos showing the liberation of three turtles, explaining how the turtles were rehabilitated and all the previous work that we performed and registered: measurements, weigh, identification photographs and tagging.

Finally, follow-up activities were organized which varied according to the number of children. They consisted of two main activities prepared for two stages: pre-schoolers and children of first, second and third grade (from four to eight years old) painted a drawing with the most frequent turtles species found in Uruguay eating their food; children of fourth, fifth and sixth grade (from nine to eleven years old) worked on the construction and decoration of a paper leatherback turtle. Children were also motivated to make their own drawing or writing poems and stories expressing their feelings for these animals.

We detected that many children of the Cabo Polonio (Rocha) fishing community did not attend to their school classes. In that case we decided to organize another workshop outside the school, where we worked during two days: the first day for exchanging information and molding ceramic turtles; and the second day for decorating the turtles and receiving prizes such as stickers, posters and sweets for the nicest ones (all of them!).

Talks given outside the coastal area were: Erwy School (Montevideo), motivated after a teacher reported a stranded leatherback turtle on the beach, and the Teachers' Institute in Colonia del Sacramento (Colonia), where the interest appeared after the stranding of a green turtle. These presentations contributed to widespread information of our project among these localities.

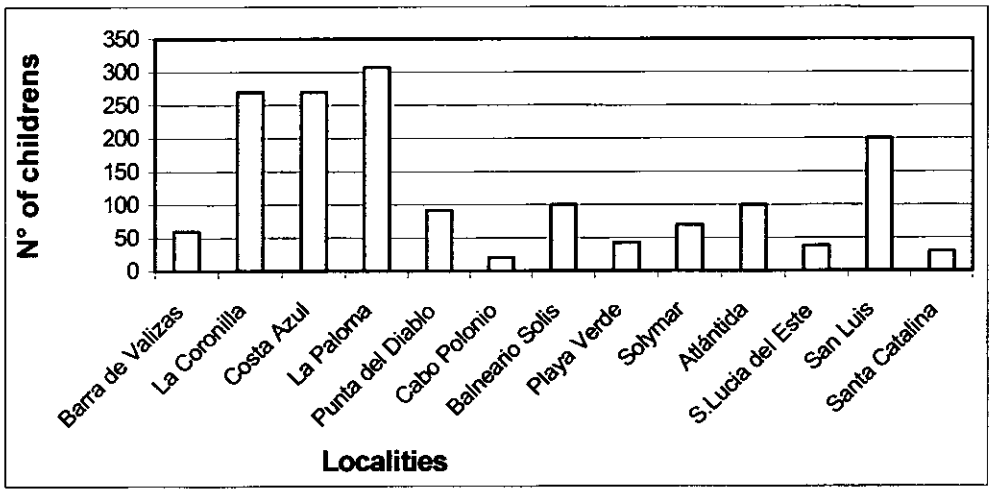


Figure 1. Number of children that attended in the different localities

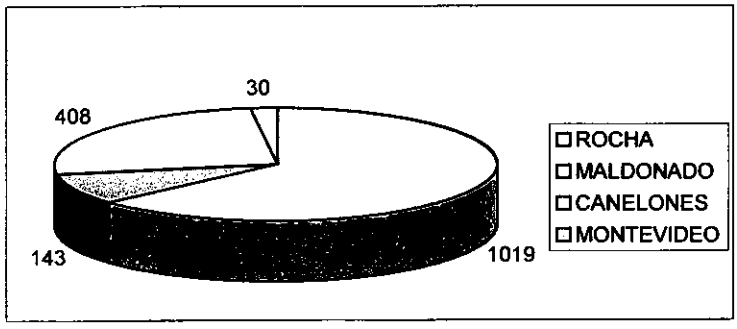
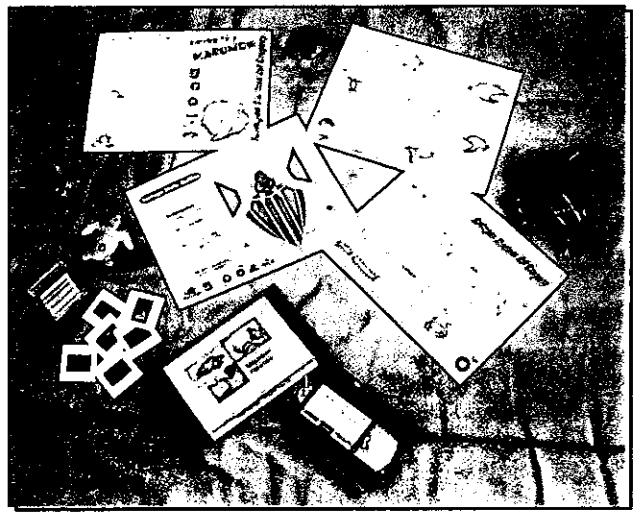


Figure 2. Number of children that participated per department

Educative material edited

- Descriptive booklet about the sea turtles of Uruguay
- Paper leatherback turtle for assembling
- Sea turtles for painting



Our findings

- Most of the studied communities presented scarce resources. Some of them such as San Luis (Canelones), Cabo Polonio (Rocha) and Piriápolis (Maldonado), were in extreme poverty facing housing problems and adequate food.

- As a consequence of the previous fact, in these communities we found the greatest impact on sea turtles, because of the consumption of turtle meat and/or selling of carapaces. Children from these areas had already seen turtles from rocky points, stranded dead or alive on the beach, and as part of a meal.

- Some communities are located in places where it is difficult to access, which has contributed to the social isolation from the population in general and from eventual state benefits. It is very easy to "forget them". These communities increment their activities during the summer, time when tourists arrive to spend their holidays. This is the case of some communities as Cabo Polonio, Punta del Diablo, Valizas or La Coronilla, all of them in Rocha.

- Children showed enthusiasm for learning more about these animals. In addition, both fishermen and craftmen were willing to collaborate with the project, satisfied with the work shared with their kids.

- A first approach was established with the educational institutions, with a promess of a future shipment of complementary information material and new talks.

- The projection of the video resulted very positive because children observed other kids releasing rehabilitated sea turtles, so this motivated them to contact us whenever they find a stranded turtle.

Projections

- According to the data obtained regarding the incidental capture and the one obtained from our visits to fishing communities, it was possible to detect the localities with the highest impact on sea turtles. From now on, our environmental education will be focused on those critical areas.

- San Luis was one of the communities whith greatest impact on sea turtles. Thus, Karumbé is planning to set up a two-year environmental educational programme for this locality. The objective is to find out a new approach for this problem so that the community will be aware of the critical situation of these species, and instead of eating turtles and/or selling carapaces, they will become leaders in the conservation of sea turtles. We pretend to provide a local identity through the green turtle and encourage these communities to benefit from newly alternatives (for example the production of allusive crafts to marine turtles, sustainable eco-tourism) and science tourism). It is our aim to extend the present project to other fishing communities along our coast in similar conditions.

- The project is planned to continue its approach to schools along our coast, presenting new activities as puppet shows, clay workshops, guided visits to Cerro Verde, reading and writing of turtle stories. We will also be sending new material as booklets, videos or posters and encouraging those communities to organize a Sea Turtle Festival.

XIII. REGIONAL INTEGRATION

Succesful conservation of large marine animals, particularly those species that present a wide distribution such as sea turtles, need to be addressed at a regional level (multinational). Applying conservation plans in isolation at a national level are inadequate to effectively arrest persistent declines, because non-sustainable activities in a neighbor country may be negating such conservation efforts. Nations that share marine resources, must also share the challenge of effective conservation (Trono and Salm, 1999), in other words, the management of far ranging-species must transcend the geographical barriers.

The **Southwestern Atlantic Ocean (ASO)** is comprised of Argentina, Uruguay and Southern Brazil. This region include developmental/foraging habitats and migratory corridors for five of the seven species of sea turtles: *Caretta caretta* (tortuga cabezona, tartaruga cabeçuda, loggerhead turtle), *Chelonia mydas* (tortuga verde, tartaruga verde, green turtle), *Dermochelys coriacea* (tortuga laúd, tartaruga de couro, leatherback), *Eretmochelys imbricata* (tortuga carey, tartaruga de pente, hawksbill), *Lepidochelys olivacea* (tortuga olivácea, tartaruga oliva, olive turtle).The same ones are considered endangered or in critical danger of extinction due to human related causes such as habitat modification and incidental and direct fisheries capture of juveniles and adults.

Ever since 2001 up to today, we have organized several activities involving the three countries that are part of the ASO to encourage the development of tri-national managament strategies.

Argentina

First thesis on sea turtles in Argentina

During the month of September 2002, at the Camping of Valizas (Rocha), Natalia Irurita and Mercedes Barbará (Universidad del Salvador – USAL, Buenos Aires, Argentina) were trained as field assistants of Karumbé Project. After that they continued the training in San Clemente del Tuyú and Mar del Plata (Argentina), studying the different situations that affect sea turtles, collecting information from interviews and from carapaces and skulls used as decorations. Museums from the area were also visited to obtain data from the sea turtles that are part of those collections. The information collected enabled the development of two thesis on sea turtles.

Peyú Project

With the foundation of the first project on sea turtle research and conservation in Argentine in 2001 (Peyú Project), a series of exchanges between Karumbé and Peyú took place.

- October 2001: Field work at Mar del Plata port. Interviews to fishermen and collection of data about sea turtle presence.
- January 2002: Participation of nine volunteers from Argentina in the camping of the Parque Nacional Santa Teresa, Rocha, Uruguay.
- August 2002: Creation of a standardized data base between Argentine and Uruguay.
- October 2002: Oral presentation by Andrés Estrades (Karumbé Project) and Laura Prosdoscimi (Peyú Project) at the Acuario Nacional de Buenos Aires (National Aquarium of Buenos Aires), regarding the information collected about sea turtles in the Southern Atlantic.

Fundación Aquamarina (Aquamarine Foundation) and Acuario Nacional de Buenos Aires (National Aquarium of Buenos Aires)

Several visits to the National Acquarium of Buenos Aires took place, making contact with Dr. Diego Albareda, responsible of the sea turtles area in the institution. A lot of information was exchanged, which helped in the work they had in comon, among others: comparative study of blood in green turtle and loggerhead turtle and standardization of tagging methodologies.
The Fundacion Aquamarina invited A. Fallabrino as expositor in the course: "Biología y Medicina de la Conservación" (Biology and Medicine of the Conservation) promoted by the Ministerio de Educación (Ministry of Education) by the resolution # 184/01, in November 2001.

INIDEP, Fundacion Mundo Marino, Mar del Plata Aquarium and Mendoza Aquarium

Karumbé Project visited the INIDEP, Fundación Mundo Marino, Mar del Plata Aquarium and Mendoza Aquarium to invite them to work together. There was a rich exchange of opinions about the sea turtle situation, including different solutions that each institution offers.

Manual of recommendations for the rescue of birds, turtles and marine mammals

Assessed by the 'Secretaría de Ambiente y Desarrollo Sustentable' (Secretary of Environment and Sustainable Development), 'Dirección de Recursos Ictícolas y Acuícolas' (Direction of Fishing and Water Resources) and 'Dirección de Flora y Fauna Silvestres'(Direction of Wild Flora and Fauna), a manual of recommendations for the rescue of birds, turtles and marine mammals' was written.

www.medioambiente.gov.ar/documentos/fauna/publicaciones/manual_rescate.PDF

Rio Grande do Sul

In April 2003, Milagros López and Alejandro Fallabrino visited NEMA (Núcleo de Monitoramento e Educação Ambiental) in Rio Grande and Msc. Leandro Bugoni (Museu Oceanográfico Eliézer de Carvalhos Rios), brasilian researchers who are working with sea turtles, near the Uruguayan border. They agreed to work together in order to standardize data collection methods between the two countries. Therefore, during the beguining of June a workshop regarding this topic took place at the Scientific Base of Cerro Verde, Uruguay, where the juvenile green turtle population is being monitored.

Workshop held at Scientific Base of Cerro Verde with the Brazilian team

In February 2003, Karumbé also contacted the group GEMARS which works with sea turtles in Northern Rio Grande do Sul.

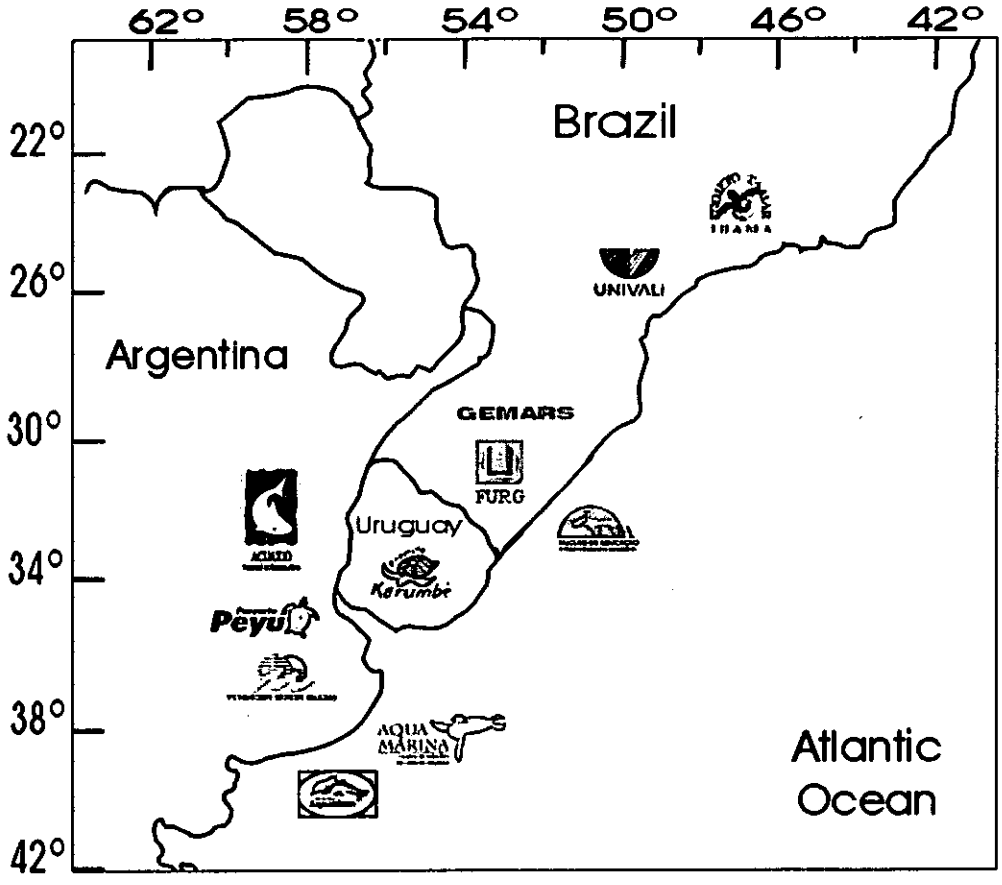
Base Ubatuba, TAMAR

Alejandro Fallabrino visited this Tamar base in May 2002. Several topics were discussed with the General Coordinator of the base, Berenice Gallo, with the objective of defining action plans and exchanging working methos between both projects.

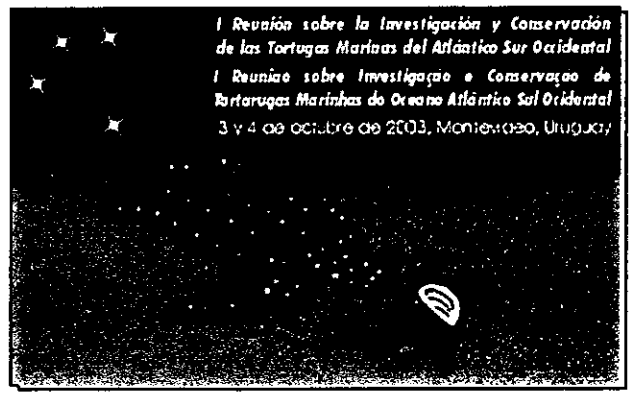
During the months of August and September 2002, Ma. Victoria Pastorino (student of the Faculty of Veterinary) was trained on sea turtle rehabilitation by the veterinaries of the base.

Andrés Estrades (Field-work Coordinator) and Antonia Bauzá (Education Coordinator) visited this base in February 2003, participating in different activities: Practical explanations of rehabilitation activities by the veterinary Max Rondon, exchange of information with the Education Coordinator of the base, who gave educational material to be used in Uruguay. Karumbé Project gave an oral presentation for technicians and volunteers of the base. The fishing community of the area was visited and a green turtle (*Chelonia mydas)* was liberated with the community, being transmitted by a national TV channel.

The following map shows the geographical distribution of the different sea turtle projects contacted in the Southwestern Atlantic Region.



Future activities



After two years of survey and permanent communication with other projects in the area we decided to organize the First Meeting on Research and Conservation of Sea Turtles in the Southeastern Atlantic Ocean (ASO) to be held at the Escuela Naval (Navy School), on October 3 and 4, 2003, as part of the II Meeting on Conservation of the Marine Fauna in Uruguay. The ASO meeting pretend to encourage other researchers and programs (involved in the conservation of sea turtles) to present project advances, discuss related activities, learn and share new techniques and ideas as well as new proposals and investigations between participants. Also, we pretend to standardize working methods between the 3 countries (Argentina, Brazil and Uruguay). The importance of this meeting lies in the necessity to attain Tri-National projects and agreements and to develop an Action Plan and a series of protocols for the protection and conservation of sea turtles in the Southeastern Atlantic Ocean. During the meeting we will announce the inaguration of the ASO Web page.

XIV. NATIONAL TAGGING PROGRAMME

Since July 2001, the "Programa Nacional de Marcaje de Tortugas Marinas" (Sea Turtle National Tagging Programme) or PNMTM is being developed. The PNMTM in Uruguay is coordinated by Karumbé Project, with the participation of onboard observers from the Departamento de Recursos Pelágicos, DINARA (Pelagic Resources Department); trawl fishermen from the "Onboard Tagging and Data Collection Programme"; artisanal fishermen and field assistants of Karumbé.

The objective of this programme is to collect useful data through the tagging of sea turtle individuals in order to allow its identification. Metallic tags are useful for obtaining information about movements, mark-recapture data, distribution and growth rates of the tagged individuals.

The PNMTM uses serial metallic tags Inconel (Style 681C, National Band and Tag Co., Newport, KY, USA) donated by the "Cooperative Marine Turtle Tagging Program (CMTTP)", directed by Archie Carr Center for Sea Turtle Research (ACCSTR) from the University of Florida, USA.

From July 2001, to June 2003, a total of 135 sea turtles were tagged: 74 green turtles (*C. mydas*), 59 loggerhead turtles, (*C. caretta*) and two leatherback turtles (*D. coriacea)* (Fig. 1).

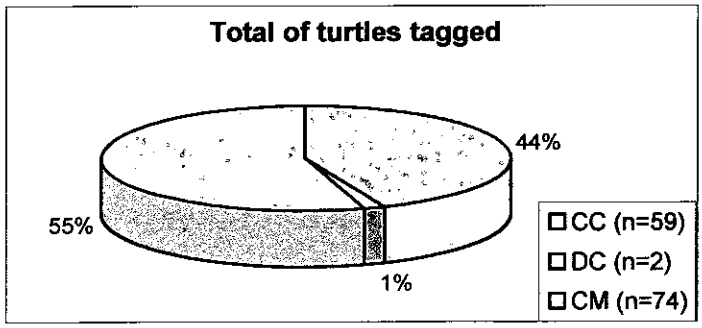


Figure 1. Total number per species of sea turtles tagged

Our tagging programme differs from other tagging programs which work with females or hatchlings at nesting beaches, because the PNMTM had to accept the challenge of capturing individuals at sea. Thanks to the cooperaction of many members of the program, and collaborators, we tagged an important number of individuals through the use of different techniques and fishing gears (Table 1).

Table 1.Number of individuals tagged through different echniques and fishing gears at 4 consecutive six-month periods, between July, 2001 and June 2003.

	Stranded	Camps	Artisanal	Trawl	Longline	Sport	**Total**
2001 (Jul-Dec)	2	0	4	0	9	0	**15**
2002 (Jan-Jun)	2	3	9	4	17	1	**36**
2002 (Jul-Dec)	0	5	1	5	11	0	**22**
2003 (Jan-Jun)	1	19	24	6	12	0	**62**
TOTAL	**5**	**27**	**38**	**15**	**49**	**1**	**135**

Recapture of sea turtles tagged in Brazil

In this period of study we found two turtles that were tagged in Brazil, by TAMAR.

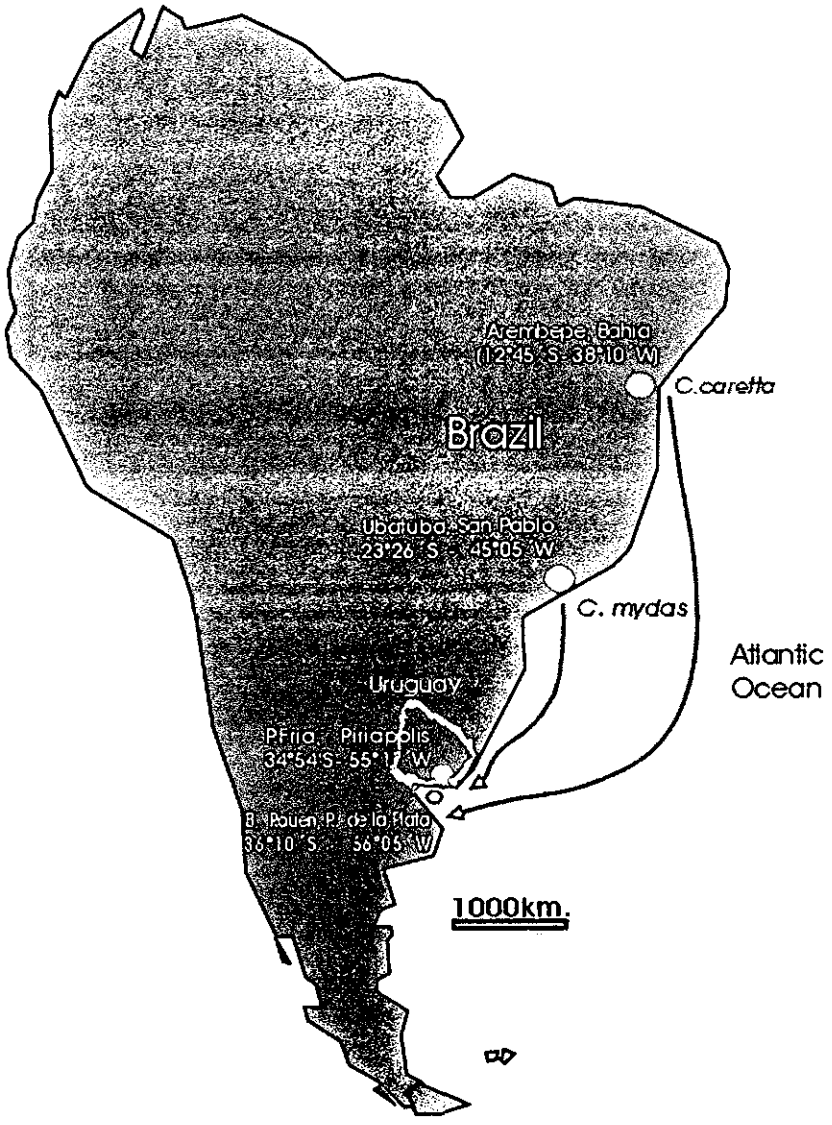
First case

On March 22, 2002 the groundfish trawler *Besugo II* incidentally caught an adult female loggerhead sea turtle (*Caretta caretta*) in waters of the Argentinian-Uruguayan Common Fishing Area (36°10'S and 56°05'W), near Rouen Bank, Southwestern of Montevideo. The turtle was dead when the net was hauled bearing only one tag with the number BR12309. This turtle was originally tagged in Arembepe, Bahia (12°45'S 38°10'W) by members of Projeto TAMAR, on October 21, 1995. The turtle was not observed during the next 7 years. At the time of tagging, the turtle measured 107.5 cm CCLn-t. and 95.5 cm CCW. Measurements taken by the Karumbé Project seven years later were identical. Both projects use the Bolten method (1999). This is the second record of a loggerhead turtle tagged in Brazil and subsequently captured in Uruguay, but it's the first loggerhead recovered that was originally tagged in the state of Bahia.

Second case

On March 26, 2003, a juvenile green turtle (CCLn-t = 43.1) was captured by an artisanal gill net deployed in Piriápolis (34°54'S 55°17'W). The turtle was found drowned bearing flipper tags (BR30917 on the front right flipper and BR30918 on the front left flipper) from Projeto TAMAR. The turtle was originally released in July 2002 at the Camboriu beach, a fishing community near Ubatuba, State of Sao Paulo, Brazil.

Poster about the identification tags prepared for the stranding network


Arembepe, Bahia
12°45' S - 38°10' W
C.caretta
Brazil
Ubatuba, San Pablo
23°26' S - 45°05' W
C. mydas
Atlantic
Ocean
Uruguay
Piriapolis
34°54'S - 55°17' W
Pouen, P. de la Plata
36°10' S - 56°05' W
1000km.

XV. OTHER STUDIES AND ACTIVITIES

Preliminary mixed stock analysis of juvenile green turtles

The mitochondrial DNA control region is commonly used in phylogeographic studies of these species in the Atlantic. This region of DNA is a molecular tag that reveals molecular evolution, population structure, reproductive behavior and migratory patterns (Bowen *et al.* 1992, Allard *et al.* 1994, Lahanas *et al.* 1994, Encalada *et al.* 1996, Lahanas *et al.* 1998). Mitochondrial DNA evidence can also be used to define management units for consevation (Moritz 1994). The work was carried out in the Biodiversity and Environmental Process Research Group at Cardiff University (UK).We analyzed 20 tissue samples from juvenile green turtles (*Chelonia mydas*) collected in Uruguay. These consisted of beach strandings, incidental captures by artisanal fisheries and captures from our netting efforts. Following DNA extraction, we sequenced a 486 base pair fragment of the mitochondrial DNA control region. Sequence editing and alignment showed that our samples exhibited 6 different haplotypes (CM5, CM6, CM8, CM9, CM10, CM24), all previously described and occurring in Atlantic nesting populations. In addition, we carried out mixed stock analysis using the program BAYES to obtain estimates of the proportion of nesting populations contributing to the juvenile stock. Preliminary results indicated that the main contributor was the Ascension Island rookery followed by, among others, Matapica (Suriname) and Aves Island (Venezuela). The secuence obtained provided enough information to presume that Uruguay is an area hosting green turtles from several nesting beaches in the Atlantic Ocean. Thus, mortality due to fishing activities in Uruguayan waters may be depleting endangered nesting populations elsewhere in the Atlantic. This work furthers our understanding of the distribution and migratory routes of green turtles in the southern Atlantic region and confirms the importance of international cooperation in conservation.

Leatherback and loggerhead diet studies

We have recently started a systematic study of stomach contents of leatherbacks and loggerheads. For the *C. caretta* we started to analyze esophagic and stomach contents of stranded turtles along the coast, with the cooperation of F. Scarabino (DINARA specialist on marine invertebrate fauna).
Information on cnidarians in Uruguay is scarce thus the jellyfishes stranded on the beach are collected so as to study the feeding habits of *D.coriacea*, who feeds exclusively on these jellyfish. Thirteen individuals of different species were given to Lic. Gabriela Failla (Fac. de Ciencias), the only specialist on cnidarians in the country. We will continue collecting the stomach contents of stranded leatherbacks to be able to determine their diet among these latitudes.

Brumation

Brumation can be defined as the state of lethargy or dormancy of the ectoterm organisms during the winter months as a response to low temperatures (15° C), to reduce the energy cost during prolonged periods of inactivity. In temperate counties like ours, where seasons are clerly defined, it is believed that this condition is used as an alternative behaviour (besides the well known migrations) to be able to survive the gradual reduction of the temperature during winter months.
Same clear evidence made us think of possible brumation of green turtles in the Uruguayan waters, as the presence of unusual species of invertebrates on the carapaces as barnacles, mussles and macroalgae. It has also been observed that these individuals presented a reduced level of activity and an "unhealthy look". We believe it is necessary to perform more studies that may include a closer monitoring of *C. mydas* along the Uruguayan coast, during cold-winter periods, as well as to perform fisiological analysis.

From October 2001 to June 2003, 6 *Chelonia mydas* and 1 *Caretta caretta* were treated. In six cases (5 CM and 1 CC) the rehabilitation was a success, while the remaining *C. mydas* died after two months of treatment.

CMV087 was found at the beach in Montevideo, in February 2002 very injured with the bone structure visible in various regions of the body, very weak and emaciated. Septicemia was diagnosed. It was treated with antibiotics, and the wounds were treated with antiseptics, germicides and vitamins. It was also hydrated. In spite of all these efforts the turtle died in April 2002.

The other six turtles that were rehabilitated presented different clinical situations:

CMV066 and **CMV067**, two *C. mydas,* were found stranded, very thin. These turtles were mantained in rehabilitation during one month and the treatment consisted of food, water and vitamins and the response was immediate. They increased their weight and their energy. The two turtles were released in the same place they were found, in presence of members of the local community in November 2001.

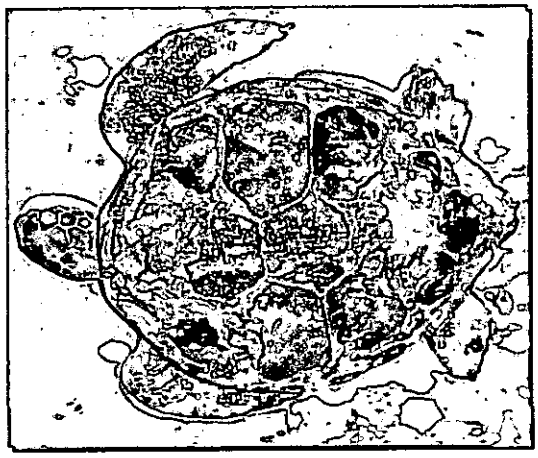
Another case was **CMV072,** a *C. mydas,* who was kept by a family as a pet during 20 days without food and in poor conditions. Karumbé received the turtle very thin, dehydrated and very weak. The turtle was fed including water, vitamins and calcium in its diet. After that the turtle recovered weight and was released 45 days later.

CMV138, in January 2003 another *C. mydas* was found stranded, breathing with difficulty and with clear signs of dehydration. It had epibionts on the carapace. The body was cleaned and then hydrated. The turtle recovered and after a week of rehabilitation, was released.

CCV038, a *C. caretta,* which was captured by artisanal fishermen in January 2003. It had a lot of marine leech. It was placed in sweet water to kill the external parasite. It was hydrated and fed with squid and crabs. It was monitored during two days and then released.

Finally, **CMV247**, a *C. mydas* captured with an artisanal gillnet. It was very weak, with a generalized edema and a slight respiratory difficulty. The turtle was treated with a diuretic and then hydrated. It responded well to the treatment and three days later (with no signs of illness), was released in the same place it was previously captured. In all the cases the turtles were kept in adequate conditions (regarding water temperature and salinity).

Species	Tag number	Date	Beach	Measures
Chelonia mydas	XXQ610	01-10-01	Cabo Polonio	CCL: 42.3cm
Chelonia mydas	XXQ611	06-10-01	Cabo Polonio	CCL: 34.4cm
Chelonia mydas	XXQ609	04-11-01	Barra del Chuy	CCL: 35.0cm
Chelonia mydas	----------	31-01-02	Puerto Buceo	CCL: 39.9cm
Chelonia mydas	XXQ663-XXQ664	02-01-03	Aguas Dulces	CCL: 39.5cm
Chelonia mydas	RRJ528-RRJ529	16-05-03	Playa Verde	CCL: 40.5cm
Caretta caretta	XXQ665-XXQ666	17-01/03	Valizas	CCL: 59.0cm



CMV087

Fibropapilloma

The fibropapillomatosis is a benign tumoral illness, but it is weakening and potentially fatal for sea turtles, affecting mainly the green turtle all around the world. The ethiology is unknown although a herpvirus (Herbst 1994, Herbst *et al.* 1995) and a retrovirus (Casey *et al.* 1996) have been implied as possible ethiological agents. The size of these tumors varies from a few millimeters to several centimeters (aprox. 25) and it may appear in any parts of the skin. The most frequently affected areas are the axilar and inguinal region of the fines, eyes and neck and less frequent the carapace, plastron and internal organs.
During 2003, in the Histopathology Section of the Faculty of Veterinary, Karumbé processed two samples of tumors of two green turtles, *C. mydas*, captured in the area of Cerro Verde (A11). The tumors were located at both front and hind flippers, the size of the tumors ranged from 0.5 cm. to 2.0 cm, shaped as a cauliflower. The color of the tumors varied from gray, to rose and violet. The histopathological results of the tumors showed *papilloma* with no malignity. It presented irregular acanthosis or pseudocarcinomatose and hyperkerathosis of the laminar type.
This is the first diagnosis of papilloma for sea turtles in Uruguay.

Caraccio *et al.* (2001) previously determined the presence of tumors in green turtles, however, the papilloma could not be confirmed. Thus, these two cases are considered the southernmost records (33° 56'S; 53° 30'W) within the Southwestern Atlantic Ocean to this date.

XVI. ACHIEVEMENTS AND RECOMENDATIONS

Achievements

- Karumbé project has become a consolidated team, working many aspects of biology, ecology and conservation biology of marine turtles and habitats of special concern of the different problematics that affect these species in Uruguay. We have created several research lines to define and focus our future work in order to propose conservation actions for the recovery of these endangered populations: sea turtle interaction with fisheries (artisanal, sport, trawl and longline), environmental education, ecology and ethology, genetics, veterinary and illegal trade.

- Throughout the last two years of research we determined the total number of stranded individuals by species and by location. The stranding network and the intense work performed with the different fisheries helped us to understand the composition and distribution of these species in our waters, seasonally patterns, size-classes distribution at sea and use of habitats. We identified the principal foraging areas for *C. mydas* along the Uruguayan coast. And we also performed the preliminary genetic analysis of juvenile green turtles in Uruguay, which was a remarkable step because the data obtained provided enough information to presume that Uruguay is an area hosting green turtles from several nesting beaches in the Atlantic Ocean.

- People awareness about the situation of sea turtles was achieved with special emphasis along coastal communities.

- The onboard data collection programme allowed us to evaluate its own performance as a reliable tool and also to identify the most important causes of mortality and threats of sea turtles populations in each area. This important programme also helped us to highlight the most relevant areas of interaction between humans and sea turtles.

Recommendations

- Strengthen the onboard data collection programme and the stranding network as to maintain the quality of data gathered to the present.

- Continue with the investigation and conservation actions performed to the date principally along the artisanal fishermen's communities in order to mitigate the high sea turtle mortality.

- Introduce an innovative Environmental Education Programme directed to local communities and settlements of artisanal and commercial fishermen to reinforce the local participation in conservation activities.

- Continue with the research along juvenile green turtle foraging areas with the purpose to generate solid data that will guide protection strategies as the designation marine protected areas at their critical feeding grounds.

- Determine nesting origins for sea turtles populations as to form the basis for stock management and thus prioritize mitigation efforts.

XVII. FINANCIAL REPORT

Items	BP Conservation funds* July 2001 to June 2003 (US $)	Other project funds** July 2002 to June 2003 (US $)	CID/CEUR NGO funds July 2002 to June 2003 (US $)	Total (US $)
Equipments	**3000**	5118	-----	8118
Travel	**2920**	5054	-----	7974
Food - Supplies	**2900**	4544	-----	7444
Salaries	-----	6600	5400	12000
Administration costs	-----	-----	5093	5093
Total (US $)	**8820**	21316	10493	**40629**

*** BP conservation funds:** First payment £ 4542 = US$ 6447
Second payment £ 1458 = US$ 2373
Total **£ 6000 = US$ 8820**

****Other project funds:** National Fish and Wildlife Foundation (NFWF) – US$ 18990
IDEAWILD – US$ 508
PNUD/ Frente Maritimo – US$ 1818
Total **– US $ 21316**

XVIII. TEAM MEMBERS PERSONAL DEVELOPMENT

Team members

Alejandro Fallabrino. Due to his long experience in the field of sea turtles conservation he was designed General Coordinator to the X Latin American Sea Turtle Specialist Meeting at Kuala Lumpur, Malaysia in March 2003. Now, he is the General Coordinator of Karumbé Project and he is backing up other conservation movements in Uruguay. He will be the President of the First Sea Turtle Specialist Meeting in the Southwestern Atlantic Ocean - 2003 (ASO).

Milagros López-Mendilaharsu. Designated member of the Marine Turtle Specialist Group MTSG/SSC/UICN. Archie Carr Award: Follow-Up "Best Biology Poster" XXII Ann. Symp. on Sea Turtle Biol. and Conserv. Miami, U.S.A., April 2002. MSc. in the "Use, Managements and Preservation of Natural Resources", CIBNOR, La Paz, B.C.S., México. *Thesis title*: "Ecología alimenticia de *Chelonia mydas agassizii* en Bahía Magdalena, B.C.S., México". (S. C. Gardner, advisor), September 2002. Actually about to start a research on the ecological movement of green turtles in Uruguay.

María Antonia Bauzá. Graduated as Primary School Teacher in September 2002. Environmental Education Coordinator of Karumbé Project since 2001. In February 2003, she carried out an exchange of activities and educational materials with Projeto Tamar at the base of Ubatuba (San Pablo, Brazil)

Andres Estrades. Ever since July 2001, he has worked in the coordination of the PNMTM. During 2001-2002 he participated in the elaboration of "National Red List - Reptiles" of the IUCN Uruguayan Committee.In January 2003, he organized and led the Marine Turtles Mini Symposium, held in the VI Latin American Congress of Herpetology, Lima, Peru.

María Noel Caraccio. In October 2002, she won a scholarship from the British Embassy to perform a research at the School of Biosciences of the University of Cardiff, Wales, UK. She received training in the genetic analysis of samples of *Chelonia mydas*. Graduate in Biological Sciences in February 2003. Now, carrying out the Master's in Sciences: Population Structure of green turtle, *Chelonia mydas* in Uruguay, at the School of Science, Universidad de la República, Uruguay.

Martin Laporta. He graduated from the Biological Science (October 2003). In December 2002, he took the Scientific Observer Onboard Course at the National Direction of Aquatic Resources. Up to today, he has been working in different fishery fleets (longline, trawl) and with the Army research vessel reaserching the interaction of sea turtles. He was the General Coordinator of the sea turtle camp in January 2003. He gave an Oral Presentation in the 23th Symposium of Sea Turtle Biology and Conservation on sea turtle interaction with trawl fishery, in Malaysia, in March 2003.

Victoria Calvo. She is performing her MSc. studies "Wild Fauna Management" at the Center of Applyed Zoology, University of Cordoba, Argentina. She is on a scholarship. From September 2001, to May 2002, she worked at the Biological Labs of the Ministerio de Ganadería Agricultura y Pesca de Uruguay.

Cecilia Lezama. She graduated from the Biological Science School, specialized on Vertebrate Zoology de Vertebrados, at the Universidad de la Repùblica, Uruguay, in October 2002. She presented a work in the 10ª Reunión de Trabajo de Mamíferos Acuáticos (SOLAMAC) presenting the results of her graduate based on the study and interaction of the Southamerican sea lion *(Otaria flavescens)* and the artisanal fishery in Piriápolis. She was responsible for the investigation of the interaction between the sea turtle and the artisanal fishery.

Veronica Quirici. She has begun her MSc at the school of Science, Universidad de la República. She is involved in the study of animal behavior in general and animal communication in particular. *Thesis project*: investigation on the way two burrowing tarantula spiders communicate during courtship. In January 2002, she won a scholarship to participate in the *International Course on Experimental Approaches in Neuroethology* (Chile). In June 2003, she won a scholarship supported by LARC-IBRO for a short stay at the Santiago de Chile University.

Martin Hernández. At the present, he is finishing his under graduate studies and specialization in Genetics in the Evolutionary Genetic Section of the School of Science, in which he develops investigation tasks in cytogenetic of Triatominae (Hemiptera, Reduviidae). He participated actively in the activities developed by Karumbé related to the genetics of sea turtles.

Anita Aisenberg. She graduated from the Biological Science School, specialized in Ethology, at the Universidad de a República, Uruguay, in August 2003. She won a scholarship to work in investigations at the Instituto de Investigaciones Biológicas Clemente Estable (period October 2003- October 2005).

Philip Miller had the experience of being Local Coordinator of Valizas (Rocha), during theinvestigation period that extended from October 2002, to February 2003. He was the first research-team member to go onboard with the artisanal fishermen of that location. He also had the opportunity of being onboard of the R/V Oyarvide (Uruguayan Army) during a scientific survey in September 2002. He is currently a guest aboard the School Vessel Capitan Miranda of the Uruguayan Navy, in a round trip of 3 months from Uruguay to Brazil, Spain and Portugal.

Jessica Castro received training by members of the "Hawksbill project" regarding the collection of data and methods used during in-water studies, Puerto Rico, September-November, 2002. The project is supported by Departamento de Recursos Naturales y Ambientales de P. Rico (Area: Species in Risk of Extintion), and by the NGO Chelonia directed by Carlos Diez & Robert Van Dam. At the present, she is carrying out a winter dormancy investigation in the juvenile green sea turtles at the Cerro Verde feeding area.

Mariana Rios received training in the educational area, giving talks to children in the coastal schools. She worked as onboard observer in the artisanal fishery fleet studying the interaction between sea turtles and gillnets. At the present, she was selected by the "Green Sea Turtle Project" at Tortuguero, Costa Rica, supported by the Caribean Conservation Coorporation (CCC) and directed by Sebastian Troeng. She will be patrolling nesting beaches to determine the number of nesting females in the September–November 2003 season.

Diana Perez took the "Oceanic Challenge" course (2003), which consists on a training program that offers the students an intensive instruction on theory and practice of vessel operations and coastal navigation. Diana had the opportunity to experience many journeys aboard artisanal fishing vessels of Piriápolis in 2002-2003. She also had the experience of giving an oral presentation to boys and girls of a school of a coastal community in 2002, and she also took part in an oral presentation in the frame of Semana del Mar in June, 2003.

María Victoria Pastorino Advanced student in veterinary medicine. She received training by members of the "TAMAR Project" regarding veterinary studies and rehabilitation techniques of sea turtles in the Ubatuba base, in Brazil between August and September 2002. Now, she is in charge of sick juvenile green turtles, suffering from fibropapillomas that were found in their feeding area. She has also rehabilitated several of the sick sea turtles.

Juan Rapetti received training by members of the "Green Turtle Project" regarding the collection of data and methods used during nesting studies in Tortuguero, Costa Rica, in September-November, 2001, supported by the Caribean Conservation Coorporation (CCC) directed by Sebastian Troeng. At the present, he is involved in the work against the illegal trade of sea turtles, developing a database with the number of carapaces commercialized at local artisanal markets.

XIX. ACKNOWLEDGMENTS

Volunteers: Pablo "Cabeza" Sanchez, Luis "Vaca" Ordeig, Silvana Pereyra, Maite Pons, Lucia Bartesaghi, Maria Jose Andrade, Valeria Perez, Helena Landaver, Florencia Doño, Carolina Crisci, Matias "Polako" Abreu, Pamela, Matias Feijoo, Adolfo Folle, Karen Iglesias, Elisa Darré, Guillermo Guarino, Paula "Negra" Franco, Sebastian, Leticia, Pablo Lucian, Andrea, Franchesca, Popi, Vicku, Iza, Nuria, Analia, Santiago Baeza, Gabriela, Andrea, Adrian, Martín, Federico Castro, Nicolas "Tornillo" Torelli, Martín Bauza and Hugo.

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BP Conservation Programme: Marianne Dunn (BP Conservation Manager).

NFWF: Eloise Canfield and Marcela Cuartas (NFWF USA) and Megan Hill (NFWF Guatemala).

IDEA WILD: Matt

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Maldonado: Pablo Etchegaray (Museo del Mar), Richard Tesore (SOS); Tamara Ronqui, Juan, Coco & family (Playa Verde); Alfredo, Marcelo, Juan, Tatita & Punta Fría artisanal community.

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Montevideo: Andres Vidal, Gustavo de Leon and Ernesto; Red uruguaya de ong's ambientalistas; British Embassy; and Brazil Embassy.

San José: Libertad Lauzarot, Arazati & Kiyú artisanal fishery community.

Colonia: Inst. Prof. Colonia.

Photos credit: Karumbe photos & Andres Domingo (longline photos)

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