MANAGEMENT AND CONSERVATION PLAN FOR A BOTTLENOSE DOLPHIN (*Tursiops truncatus*) POPULATION IN THE FIRST MARINE PROTECTED AREA PROPOSED IN URUGUAY

FINAL REPORT FOR RUFFORD MAURICE LAING FOUNDATION
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SUMMARY AND PROGRESS GENERALLY

The bottlenose dolphin *Tursiops truncatus* is the only small cetacean that can be observed from shore in Uruguay. However, a substantial decrease in the occurrence of the species has been observed in the estuarine coast since the last 15 years. No systematic studies have been conducted in Uruguay until 2002. Our studies during the past three years indicate that La Coronilla-Cerro Verde (33°38' S-53°24' W) is one of the few zones with high presence of this dolphin in Uruguay. However, there is a lack of information about residence and local movements of the population. This project studied the distribution, residence and social organization patterns of bottlenose dolphins occurring between Cabo Polonio and La Coronilla-Cerro Verde (Uruguay). The first catalogue of photo-identified bottlenose dolphins of Uruguay was made and compared with the catalogues from southern Brazil, where there is evidence of high mortality due to interactions with fishing operations. Currently the Uruguayan government is implementing a National System of Protected Areas (SNAP) (Law 17.234) and La Coronilla-Cerro Verde was recently nominated as the first marine protected area in the country. In this context, these investigations serve as a basis to develop criteria and guide lines to supervise the protection of this species, before the elaboration of a management plan for the area. Moreover, this study allowed a great advance in the knowledge on this species in Uruguayan waters and enabled us to have a more exact idea of their presence and use of this habitat, as well as the residence patterns of the population, with the possibility of eventually determine if it is a local population, or if we are dealing with the same individuals that occur in neighbouring areas. This is crucial to make joint decisions and to establish integrated conservation steps with the other countries involved.

This study started on January 2006 and was carried out in a very well manner. The sampling design has shown to be accurate, as we were able to conduct a significant number of boat surveys, and identify more than 40 individuals. We have noted that it's feasible to take good quality photos of individuals from land, so we have included land photo identification sessions as well. The local inhabitants of Cabo Polonio and La Coronilla, fishermen, bay watchers and storeowners, have cooperated with our project sharing their empirical knowledge about the area and the dolphins, and also through occasional dolphin sighting records. Furthermore, DINARA (National Direction of Aquatic Resources) and SERBA (Army and Lighthouse Service) provided housing and other services during the Cabo Polonio surveys.

GENERAL OBJECTIVES

- Determine distribution, residence and social organization patterns of bottlenose dolphins occurring between Cabo Polonio and La Coronilla-Cerro Verde (34º 23´S, 53º 46´W - 33°38' S, 53°24' W), Rocha, Uruguay

- Integrate the obtained information in a regional manner to determine the subdivision patterns of dolphins occurring in the region, and coordinate efforts for the management and conservation of the species.

SPECIFIC OBJECTIVES

- For photo-identified dolphins, determine: residence pattern, home range, use of habitat, local (short and long-term) movement patterns, site fidelity, social structure and association patterns among individuals.

- Elaborate the first photo-identification catalogue in Uruguay and compare it with those from southern Brazil.

METHODS

The study area covers approximately 100km of uninterrupted coastal beaches between Cabo Polonio and La Coronilla-Cerro Verde (34º23´S, 53º46´W - 33°38' S, 53°24' W) (Figure 1).

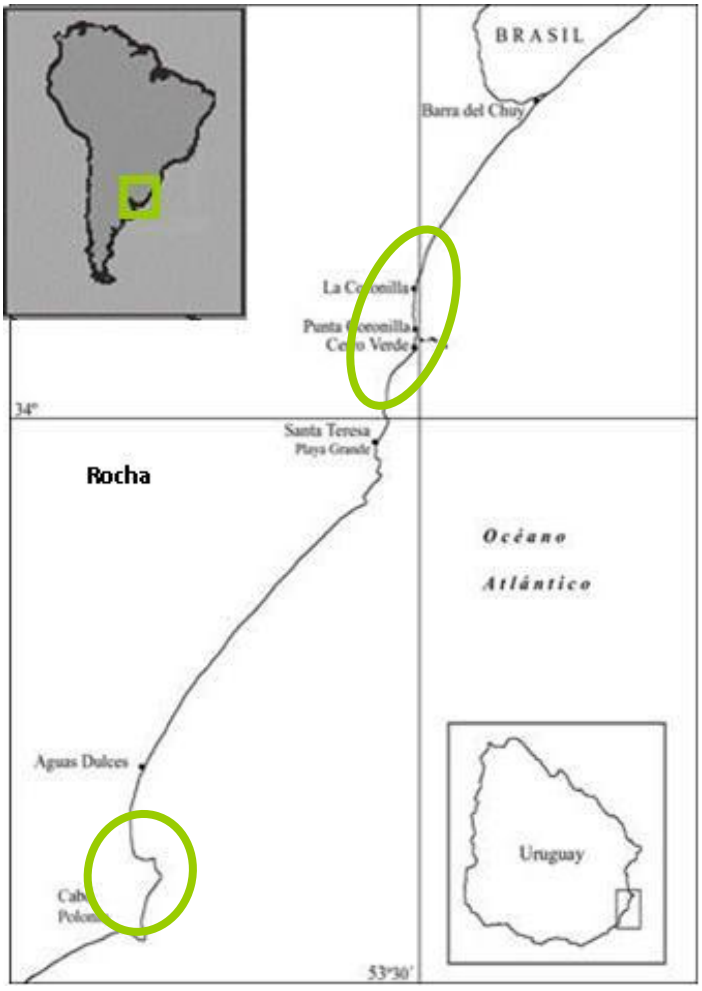


Figure 1. Study area of bottlenose dolphins along Uruguayan coast. To the north La Coronilla-Cerro Verde beaches and to the south Cabo Polonio.

La Coronilla-Cerro Verde

Cabo Polonio

This area is an open coast with small entrances, open bays, rocky points, and river discharge zones where water mixture occurs, generating regions with salinity ranges. It is part of the Biosfera de Bañados del Este, a RAMSAR site (Herzig 1994) and is planned to be part of the SNAP.

Since January 2006, boat and land surveys are being conducted. When boating is not allowed by weather and sea conditions, only land surveys are held. The boat surveys are conducted from a 5m- boat, equipped with a 25 HP outboard, and there is a minimum of 3 surveys per month (Figure 2).

Figure 2. a) Boat and b) fix-point from which surveys are conducted in La Coronilla-Cerro Verde. c) Lighthouse of Cabo Polonio and d) DINARA's boat used in Cabo Polonio.

The entire area is scanned using binoculars. Once a group is sighted from land, a photo identification boat survey is launched. One person takes the photos using a Nikon D70 digital camera with a Nikon zoom lens 80-400 mm, and another person is in charge of recording the following data: date, time and duration of the sighting; geographical location (with a GPS); depth; environmental conditions; size and composition of the group (Figure 3). Group follows goes on until it is assumed that all the individuals from that group have been photographed or, more commonly, until sea conditions turn unfavourable.

Figure 3. Photo-Id session from boat and from land in La Coronilla-Cerro Verde (a and B) and Cabo Polonio (c), Uruguay.

Photo Analyses

At the end of each survey, the pictures are downloaded to the computer, saved in folders named after the type of survey (land-T or boat-B), survey number, zone (CP: Cabo Polonio, LC: La Coronilla), date and group number. (Examples: B01LC_050106G1; T03CP_130606G2).

Procedure for Catalogue construction

Firstly, all the photos taken for each group are counted and visually inspected. Later, there is a selection of good quality photos, followed by the temporal identification of each individual from each group sighted each day. The identification of the individuals is made through the visual analysis of the pictures, using Photoshop 7.0.

The basic criteria taken into account when selecting the photographs are:

1- sharpness;
2- absence of glitter and/or foam;
3- proportion of the dorsal fin that is exposed;
4- angle with regards to the animal's body axis

Following these criteria, the photographs are classified into three categories:

1- low quality
2- medium quality
3- good or excellent quality

Only the photographs in category three are taken into account for the identification of individuals and the catalogue construction.

The identification is based on notches, scars and shape of the fin, as well as coloration patterns. In these preliminary analyses, only individuals with evident marks, such as deep notches and particular notch patterns, were included.

Each identified individual is assigned a number and a nickname that describes the characteristics of its marks. Subsequently, we count the individuals identified per group and each one is compared to all the individuals previously identified. A file is created for each individual that includes the best photograph of its dorsal fin, the nickname and identification number.

Residency Patterns

In order to determine the residence pattern of each individual, a residence index (RI) is calculated. It relates the total number of sightings of an individual to the total number of months in which this individual was seen (Karczmarski 1999).

$$RI = SxM/100$$

where: RI = residence index, S = total number of sightings of an individual, and M=total number of months in which this particular individual was seen.

The degree of residence is also described in terms of three parameters: the number of times an animal is sighted in the study area (La Coronilla-Cerro Verde and Cabo Polonio), the time between the first sighting and the last resighting of an animal, and the average number of days between sightings for a particular animal (Ballance 1990). The combination of these parameters, reduces the bias produced by using each one separately. A high number of resightings, a long period of time between the first sighting and the last resighting, and a short time interval between adjacent sightings describes an animal with a high degree of residence.

Movements

The local movement analysis is performed considering the surveys held in La Coronilla and Cabo Polonio. Occasional photographs taken in La Paloma and Cabo Polonio by local inhabitants previously trained, were included only when resulting in excellent quality photographs (category 3) (Figure 4).

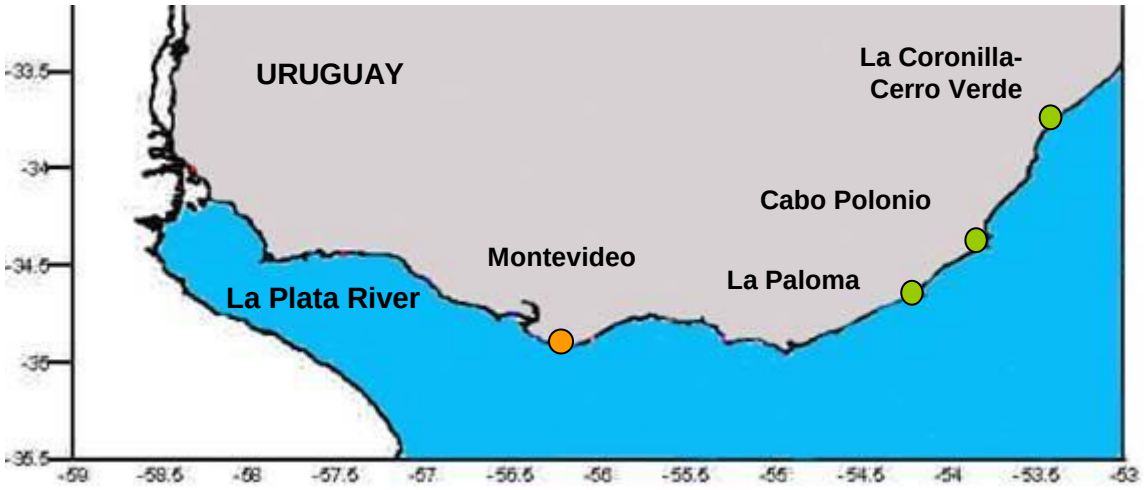


Figure 4. The three different coastal areas where photo-Id sessions are carried out along the Uruguayan coast (green circles); Montevideo is the capital city of Uruguay (orange circle). La Paloma is an occasional area of photo-Id session.

Social structure

A group is defined as any aggregation of more than one dolphin, including every age class, occurring within the visual range of the observers at any given time. In general, the individuals of a group are observed in apparent association, moving in the same direction, and often but not always, engaged in the same activity (Karczmarski 1999; Shane 1990).

Group size is estimated through direct counting of group members, assigning a maximum, minimum and best number of individuals.

Three categories are defined according to group composition: female with calf, adults and juveniles and mixed groups (all age classes included) (Karczmarski 1999).

The association pattern between members is quantified using a simple ratio association index (Ginsberg & Young 1992), which is here referred to as an association index (AI):

$$AI = \frac{x}{x+y_a+y_b}$$

Simple relation index: number of sightings when A and B are observed together, divided by the total number of sightings, minus the number of times when neither A nor B were sighted.
x: Nº of sightings where A and B were observed together
y_a: Nº of sightings where only A was observed.
y_b: Nº of sightings where only B was observed.

The AI relates the number of sightings in which two individuals are observed together to the total number of sightings in which they are observed separated. It provides an estimate of the time they spend as members of the same group.

PROGRESS OF THE PROJECT

Survey effort and encounter rates

From January to June 2006, a total of 92 surveys were conducted in La Coronilla and Cabo Polonio. Of these, 69 were land surveys: 34 performed in Cabo Polonio and 35 in La Coronilla. The 23 remaining surveys were conducted from boat in La Coronilla (n=22) and Cabo Polonio (n=1). The boat survey in Cabo Polonio was conducted using DINARA´s boat and we have already coordinated with that institution to continue using its boat during the next year. During January and February we did not have access to housing in Cabo Polonio, so no surveys could be conducted during that period. Unfavourable weather conditions also limited the survey effort we wanted to accomplish in this area.

Survey effort totalised 497.5 hs., 61.7 hs. of which were spent in direct observation and in photographing 112 dolphin groups (29 groups during boat surveys and 83 groups during land surveys). Twenty six groups of dolphins were sighted in Cabo Polonio and eighty six in La Coronilla during 248.7 hs in each area. Dolphin-sighting frequency in Cabo Polonio has shown to be lower than in La Coronilla (0.1 vs. 0.3 groups/hs. of survey effort).

Identified individuals and resightings

Until now, 2996 photographs were taken and a minimum of 64 different individuals were identified in 92 groups. From those 64, only 42 individuals that could be easily re-identified because of evident notch patterns were included in the analysis.

Of these 42 individuals, three had been identified during a previous pilot study (summer 2004 and 2005) conducted by us in La Coronilla (individuals #007, #009 and #016). However, pilot study data was excluded from this analysis.

Rates of discovery and occurrence patterns

The rate of discovery graph was created for both joint areas (Figure 5). A large number of individuals were identified over a short period of time during the beginning of the investigation, between 24th and 31st January. By the end of February and beginning of March most of the animals sighted in La Coronilla had previously been identified.

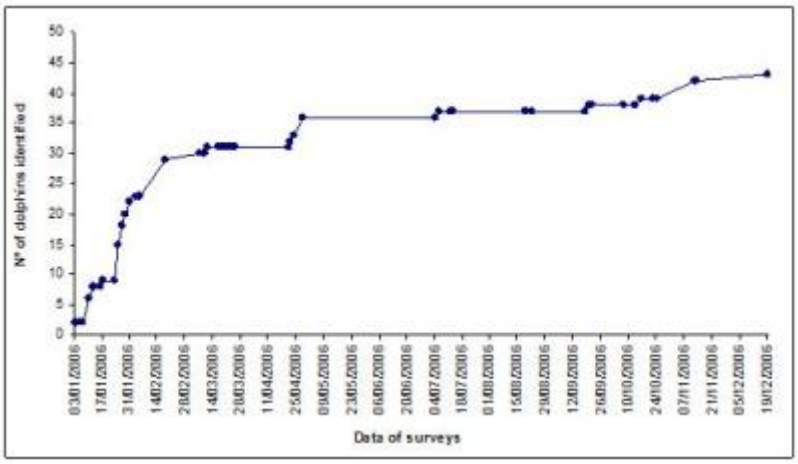


Figure 5. Rate of discovery of new individuals by survey date. Circles along the curve represent dates in which new animals were identified.

There is a second lighter peak in the discovery curve at the end of April. The trend of the rate of discovery demonstrates a slight increase in the number of identified individuals within time. Between April and December a few dolphins were discovered, however the discovery curve is not established yet, indicating that we could be dealing with an open population.

Residency Patterns

The number of sightings for the 43 identified dolphins ranged from 1 to 17 (Figure 6). Thirty two dolphins (74%) were sighted more than once. Seven dolphins were only identified in Cabo Polonio and 20 only in La Coronilla. Sixteen dolphins were observed in both areas during the study period.

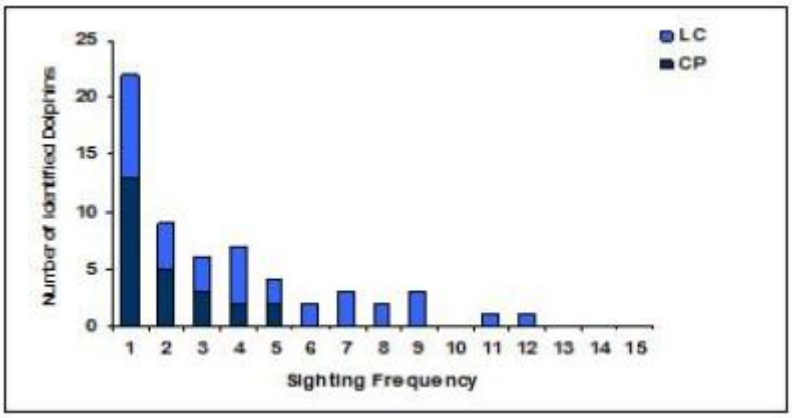


Figure 6. Sighting frequencies for dolphins identified in La Coronilla and Cabo Polonio (n=42).

The data suggests a high presence of many individuals in the study area: 24% were sighted once, 14% were re-sighted once, and 60% re-sighted more than once (Table 1).

The individuals with the highest RI were # 006 (1.0) and # 009 (0.66), followed by individuals # 007 (0.6), # 019 (0.56), # 012 (0.54), # 002 (0.45) and # 008 (0.42).

The time interval between the first sighting and the last resighting of any one dolphin ranged from 1 to 345 days. Excluding resightings made within the same day, the average time between first and last sighting was 211.3 days (s=113 days).

The average number of days between adjacent sightings for an individual was 43.8 days (s=47.1, median= 32.7; range 1 - 267 days).

By combining the results of each analysis, we can determine that dolphins sighted in La Coronilla exhibited all degrees of residence. Some dolphins were sighted only once, but most of them were resighted more than once. Many dolphins were sighted over a few days period, yet many were sighted over a period of 345 days. Therefore, this society could be relatively open, at least with respect to residence in this area.

Table 1. Occurrence pattern and residency index of 42 photo-identified bottlenose dolphins in La Coronilla and Cabo Polonio (Rocha-Uruguay) between January and December 2006. Shaded boxes represent identification of an individual in the corresponding area during the designated month. Black colour shows at least five sightings.

	LA CORONILLA											CABO POLONIO											
Id-Nº	Jan	Feb	Mar	Apr	Jul	Aug	Sep	Oct	Nov	Dec	RI	Jan	Feb	Mar	Apr	Jul	Aug	Sep	Oct	Nov	Dec	RI	Nº sightings
001											0,12											0,01	7
002											0,45											0,12	13
003											0,08												4
004											0,24											0,02	8
005											0,14											0,01	8
006											1,12												16
007											0,6											0,1	17
008											0,42												7
009											0,66											0,08	15
010											0,15												5
011											0,28											0,01	8
012											0,54											0,01	10
013											0,27											0,03	12
014											0,01												1
015											0,01												1
016											0,12												5
017											0,12											0,01	5
018											0,06											0,15	8
019											0,56											0,09	11
020											0,16												4
021											0,16											0,01	5
022											0,16											0,01	5
023											0,32											0,04	10
024											0,09												3
025											0,01												1
026											0,02												2
027											0,04												2
028											0,01												1
029											0,01											0,01	2
030											0,02												2
031											0,06											0,01	4
032											0,02												2
033											0,01												1
034																						0,01	1
035																						0,01	1
036																						0,01	1
037											0,01											0,01	1
038											0,01											0,02	3
039											0,01											0,02	3
040																						0,02	2
041																						0,03	3
042																						0,01	1
= 5	4	3	2	1	0																		

Local movements

Five identified dolphins were sighted in all three locations along 120 Km of coast (Figure 7).

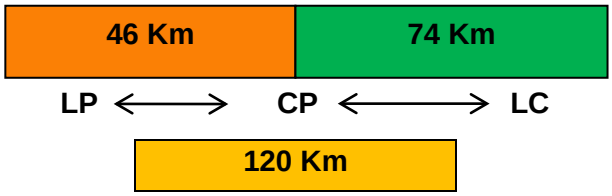
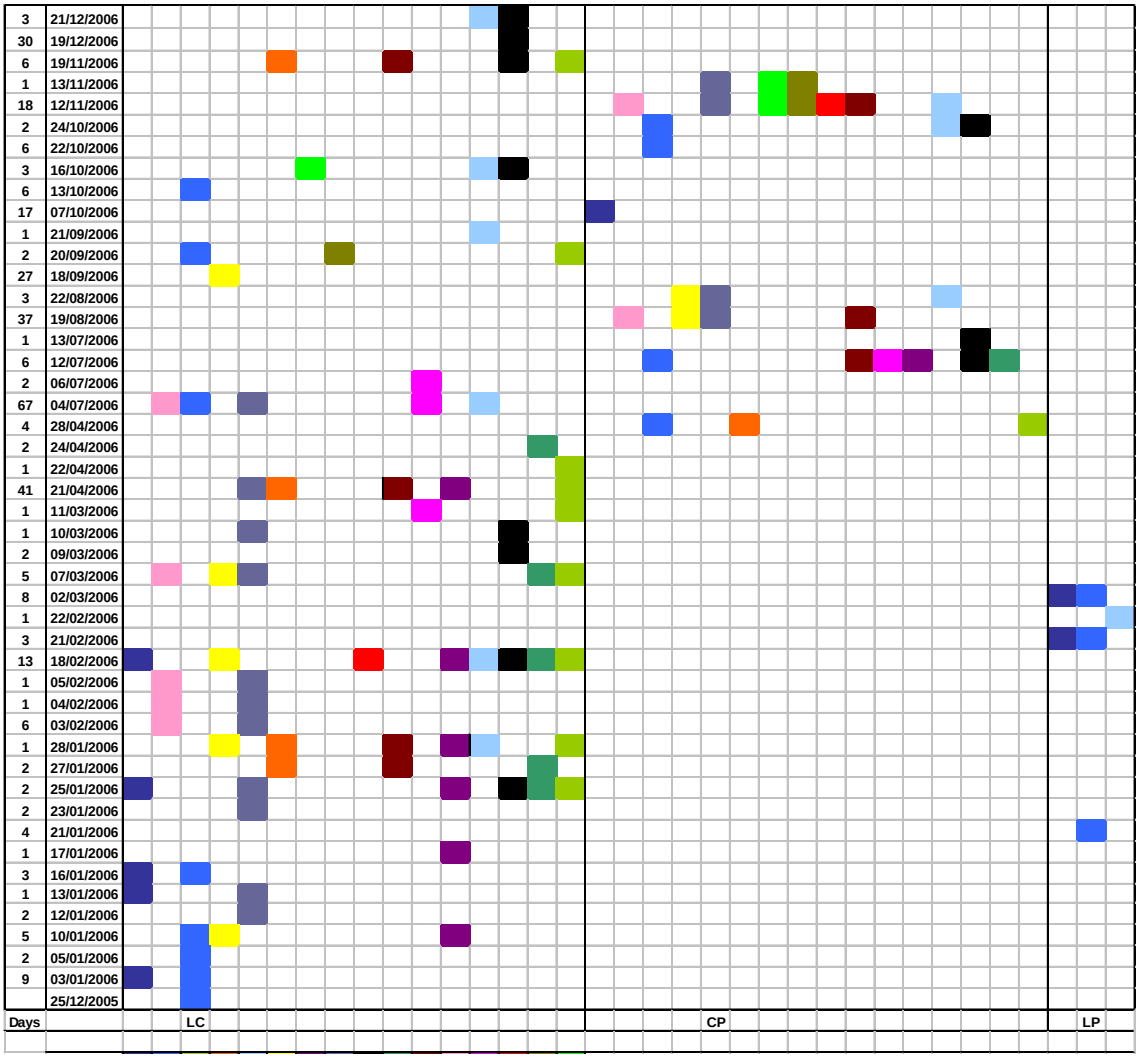


Figure 7. Distances between the three coastal areas from which photo sessions took place. LP: La Paloma, CP: Cabo Polonio and LC: La Coronilla. Period from December 2005 to December 2006.

Sixteen individuals sighted in Cabo Polonio had previously been sighted in La Coronilla, 74 Km south (Table 2).

Table 2. Movements of 16 identified dolphins between La Coronila (LC), Cabo Polonio (CP) and La Paloma (LP). Each colour indicate an individual. "Days" column indicates the number of days between each sighting.



By considering the occasional photo sessions in neighbouring coastal areas we were able to determine the movements of three individuals sighted in La Coronilla, Cabo Polonio and La Paloma (Table 2). Minimum time period between consecutive sightings in La Coronilla and La Paloma was three days for individual # 001, four days for # 017 and five days for # 002. Between La Coronilla to Cabo Polonio the minimum time period was three days for individual # 002, four days for # 017, six days for # 012 and for # 031, and eight days for # 019.

These movements indicate that dolphins are using a large coastal area along Uruguayan coast. Moreover, recent information from artisanal fishermen shows that several groups of dolphins are occurring in the estuary of La Plata River (San Luis and Playa Malvín), more than 100 Km south of La Paloma, in Montevideo, the capital city (see Figure 4).

Social structure

Considering only the 105 groups analyzed in this study, 68.6% were composed of adults and juveniles and 16.4% were mixed groups. Within the latter 25 included only one calf and 7 included 2 calves. The overall mean group size was 6.2 individuals, being 6 individuals in Cabo Polonio and La Coronilla (n=104).

Only the individuals that were sighted five times or more were included in the association pattern analysis (n=19). The association index varied between 0 and 0.33 (Table 3).

Table 3. Association matrix of 19 individuals sighted at least five times in La Coronilla and Cabo Polonio between January and June 2006.

ID Nº	007	006	013	002	009	012	019	023	004	005	011	018	001	008	021	010	016	020	022
# 007	x	0,23	0,16	0,03	0,07	0,00	0,08	0,30	0,19	0,09	0,09	0,14	0,04	0,05	0,10	0,00	0,00	0,00	0,05
# 006		x	0,12	0,12	0,11	0,08	0,17	0,14	0,20	0,04	0,14	0,00	0,05	0,21	0,11	0,05	0,00	0,11	0,11
# 013			x	0,04	0,04	0,05	0,10	0,11	0,05	0,00	0,05	0,18	0,00	0,06	0,21	0,00	0,06	0,00	0,06
# 002				x	0,08	0,08	0,13	0,04	0,05	0,11	0,05	0,05	0,16	0,05	0,05	0,05	0,05	0,00	0,11
# 009					x	0,05	0,16	0,00	0,05	0,18	0,11	0,05	0,06	0,00	0,06	0,00	0,00	0,06	0,06
# 012						x	0,05	0,05	0,12	0,06	0,06	0,06	0,00	0,07	0,15	0,15	0,15	0,15	0,07
# 019							x	0,11	0,19	0,06	0,06	0,00	0,00	0,29	0,07	0,00	0,00	0,07	0,14
# 023								x	0,20	0,00	0,13	0,13	0,14	0,15	0,07	0,00	0,00	0,00	0,07
# 004									x	0,14	0,23	0,14	0,00	0,08	0,08	0,18	0,08	0,33	0,00
# 005										x	0,23	0,07	0,15	0,00	0,08	0,08	0,00	0,08	0,08
# 011											x	0,14	0,15	0,00	0,08	0,08	0,08	0,08	0,08
# 018												x	0,00	0,00	0,08	0,08	0,08	0,08	0,08
# 001													x	0,00	0,00	0,09	0,00	0,00	0,00
# 008														x	0,00	0,20	0,09	0,20	0,09
# 021															x	0,11	0,11	0,11	0,11
# 010																x	0,25	0,25	0,11
# 016																	x	0,11	0,00
# 020																		x	0,11
# 022																			x

The highest AI was found among individuals #004 and #020 (0.33), and among #007 and #023 (0.30) (Table 3). The most frequent AI category was 0.01-0.19 (Figure 7).

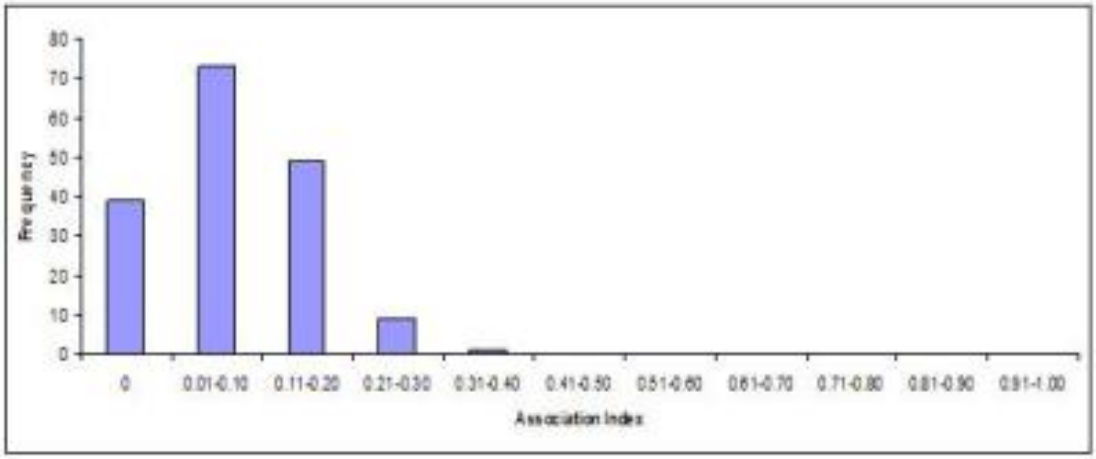


Figure 7. Histogram of association indices for pairs of dolphins that were observed together between January and December 2006 in La Coronilla and Cabo Polonio. Only individuals that were sighted at least five times were considered for the association analyses.

Eventhough these index values are low, as is commonly documented for the species, we understand that they may be underestimated, due to the difficulty for identifying all the individuals within a large group (more than 20 animals) and to the high number of low quality photographs that did not enable us the identification.

Catalogue Comparison

In order to accomplish one of the goals of our project, which is to obtain a broad idea of the situation of this species occurrence and residence pattern on a regional basis, we set a meeting with our colleagues from Lagoa dos Patos, to compare their catalogue with the one we are constructing. This meeting took place in Cabo Polonio, at the end of May.

The comparison involved ten boat-based surveys conducted in Patos Lagoon (August to October 2005) and 17 in La Coronilla (January to April 2006), totalising 74hs. and 45hs. of direct observation, respectively. Furthermore, 23 individuals sighted in 1998 in Patos Lagoon but not resighted in 2005 were also considered in the comparisons.

Only clear photographs of distinctive dorsal fins were used to establish a "type specimen" to which all other photographs were compared. Three categories were created based on identifiability of notches: (1) severe and deep; (2) evident and (3) subtle. In order to avoid false positive resightings category 3 was excluded from the analysis.

Fourty-four individuals from Patos Lagoon (1998: category 1, n=8; category 2, n=6; 2005: category 1, n=20; category 2, n=10) were compared against 25 individuals from La Coronilla (category 1, n=13; category 2, n=12). No matches were found between these sites. This analysis suggests that these two populations might be ecologically isolated; however, further comparisons need to be made on a longer time scale.

These results were presented at the 12th RT/ 6th SOLAMAC meeting that was held in Mérida, Mexico between 5th and 9th of November, 2006.

Implication for conservation management

An adequate identification of key habitats within a population's home range, and core areas where biologically and socially important behaviours concentrate, is an important

part of understanding the species' ecology and crucial for the conservation and management of any wild animal population.

In recent years, many studies of distribution have aimed to identify critical habitats for cetaceans (Gregr &Trites 2001; Harwood 2001; Ingram & Rogan 2002 Hastie *et al.* 2003) and, in several cases, such data have been used to support the establishment of marine protected areas (Dawson & Slooten 1993; Hooker *et al.* 1999). The success of designated areas depends critically upon the quality of information available, not only for defining boundaries to such areas but also to understanding how these areas are used by the animals and what factors affect their distribution and abundance. Such data can also provide a key to understanding other aspects of the population's ecology such as social structure (Emlen & Oring 1977).

In Uruguayan waters, The National Direction of Environment (DINAMA) is implementing a National System of Protected Areas and currently the first two marine protected areas (MPA) were recently designated: La Coronilla-Cerro Verde and Cabo Polonio. Both areas are part of our study area related to the ecology and distribution of bottlenose dolphin.

The results of this study have shown that La Coronilla-Cerro Verde is used heavily by the population of bottlenose dolphins in Uruguay. In terms of conservation effort, this area clearly deserves protection as it represents feeding grounds as well as a socializing area (Laporta 2004). Our study of behaviour and occurrence of bottlenose dolphin in this area has shown that the use

of this area has been increasing in the last four years, and also being highest during the summer (Laporta *et al.* 2006). Although, the specific reason(s) for the intensified use is unclear, it is certain that the survey area did not encompass the whole range of this population. Animals were frequently observed in other parts of the Uruguayan coast (e.g. in Cabo Polonio and La Paloma) and were sighted but not identified sporadically in the estuarine coast (San Luis and Playa Malvín). The observed rapid movements of individuals between these areas (Cabo Polonio and La Coronilla-Cerro Verde) confirm that these animals must be considered as belonging to the same population unit. Although the importance of the other coastal areas is unknown and should not be ignored, applying effective conservation action to the La Coronilla-Cerro Verde dolphins should serve to improve the status of the whole population.

Regarding social interests and needs in the designation of a MPA in La Coronilla, our experience during this year study was not good at all. When the government came to the area to inform local people about the designation of a MPA in La Coronilla, the community started to worry about activities that they could or could not keep doing. Such activities included: tourism, sport and artisanal fisheries, surf, extraction of aquatic resources, beachrides in vehicles, getting charged for the entrance to the beach, among others. The government could not satisfy the people's questions and until there is a big wondering regarding this issue. Toninas Project got interested in explaining and listening to the local people's worries about the designation of the MPA. We had many non formal meetings with different persons and we intend to show our idea about the MPA and to include the people's needs and interest in the management plan of the area.

As a result of this problematic we participated in the meetings about the MPA in La Coronilla, organized by the SNAP and discuss with the DINAMA the next steps to follow regarding the designation of the MPA. The idea is to create a local advising commission which will be in charge of joining all the interests and needs of the community and to generate discussion meetings to get trough a participative and common management plan.

FUTURE PLANNED ACTIVITIES

The Toninas Project started on September 2002 and has conducted systematic land surveys for studying occurrence, social structure and behaviour of bottlenose dolphins in La Coronilla-Cerro Verde until now.

It is very important to continue with this study on a long-term basis. After the protected marine area is established, it will be essential to continue working on a year basis, in order to closely follow the dolphin population and to update and improve the settled management guidelines. For this reason, our future plans are to continue the study of the distribution and residence patterns study trough land and boat based photo-identification sessions during the following year; in order to compare it with the last year and to get a more exact idea of the population dynamics.

Catalogue comparison between Uruguay and Southern Brazil will continue so as to determine the regional movements of the individuals and identify subpopulations or management units among the countries involved. These movements may change as the years pass, making it important to maintain continuous investigations. Since cetaceans are long-lived animals, the most accurate studies must consider many years of investigations. Currently the Brazilian research group is making survey effort out of the Patos Lagoon, and they are identifying new individuals. Thus, the comparison should continue during the following year.

We are presently trying out a hydrophone that was acquired from a parallel research that one of our team members is conducting. The aim is to eventually implement this instrument on communication studies, and relate it to behavioural patterns and sociality. We will work with another Brazilian colleague Dr. Lilian Sander Hoffman from the Universidade Federal do Rio Grande (UFRG), in order to determine the vocalization patterns of bottlenose dolphins in Uruguay and compare it with several Brazilian locations. At the end of November, she came to conduct a one-week course on Cetaceans Bioacoustics in the Faculty of Sciences of the Universidad de la República (Uruguay).

In brief, our perspectives for the following years are:

1. Estimate the population size along the Uruguayan coast trough mark-recapture techniques, to star a monitoring of the population dynamics in a long lasting period.

2. Continue with the study of the distribution pattern of the species, extending the area through the estuary of La Plata River, an antique area of high use for bottlenose dolphins in Uruguay. We aim at determining the temporal changes in the relative distribution of dolphins along our estuarine coast, as well as, the distribution limits and habitats preferences of this species in Uruguayan coast.

3. Determine the biological and environmental causes of the occurrence and habitat preferences for bottlenose dolphin along Uruguayan coast.

4. Identify the critical areas for bottlenose dolphin population in Uruguay.

5. Record and analyze bottlenose dolphins vocalizations for the characterization of acoustic patterns of this population on a social and behavioural context.

FINANCIAL REPORT

Heading	**Details**	**Spended (£)**
Boat Surveys	Fuel and oil	**1128**
	GPS and batteries	**169**
	Chronometer	**19.8**
	Thermometer	**2.82**
	Depth register	**28.2**
	Salinometer	**28.2**
Photo-Identification equipment	Digital Photographic Camera Nikon D70, Lens Nikon AF-S 300mm f/4.0 ED-IF, Lens Teleconverter Nikon TC 14E Memory Card Batteries and charger for the camera Energizer ER-C590 Camcorder Battery Polarized Filter	**1760**
OFFICE SUPPLIES	Paper, Ink cartridges colour and black and white Laser prints, 100 CDs for photographs store	**113**
TRANSPORT	Travel tickets: 3 persons/12 month/ £ 11,8 /ticket	**427**
LODGING	Food: 3 researchers/10 days/month £7,5/day	**900**
FEES	Boat driver £ 17/month	**204**
Total		**4780**

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