

Swans of Uruguay, contributing to the conservation of the protected area 'Laguna de Rocha', Uruguay
FINAL REPORT

Summary

Laguna de Rocha (34° 33' S, 54° 22' W) has been internationally recognized as an important bird area. However, the committee in charge of elaborating the management plan for Laguna de Rocha, as the new National System of Protected Areas establishes, lacks sufficient information about how the birds use the lagoon. This project addressed the study of water birds that mainly use Laguna de Rocha as a food resource. We analysed the distribution of *Cygnus melancoryphus* (Black-necked Swan) and *Coscoroba coscoroba* (Coscoroba Swan) through feeding habitat selection. The habitat supply of Laguna de Rocha was studied based on several environmental variables: submerged macrophytes (aquatic plants), invertebrates associated to the sediment (benthic invertebrates), water depth, temperature and salinity. The distribution of the birds was studied through aerial census. The results of this project have provided relevant information about the ecology of local populations of two scarcely known species and contributed to the creation of a trophic model of this ecosystem (another ongoing project at Laguna de Rocha). This information is also essential to establish management guidelines for the water birds of the Atlantic area of Uruguay.

Introduction

Laguna de Rocha

A main characteristic of Laguna de Rocha is the diversity and high abundance of birds that are usually observed. It presents a large number of resident species and it also presents particular environmental characteristics that determine the presence of migratory birds of both hemispheres throughout the year. Some authors consider Laguna de Rocha as a site of singular importance in Uruguay, especially for nearctic migrants during the southern summer. The Common Tern (*Sterna hirundo*), Greater Yellowlegs (*Tringa melanoleuca*), Lesser Yellowlegs (*Tringa flavipes*), Solitary Sandpiper (*Tringa solitaria*), American Golden Plover (*Pluvialis dominica*), Buff-breasted Sandpiper (*Tryngites subruficollis*), Sanderling (*Calidris alba*), Pectoral Sandpiper (*Calidris melanotos*) and the White-rumped Sandpiper (*Calidris fuscicollis*) are some of the migratory species that are commonly recorded in summer. The Rufous-chested Dotterel (*Charadrius modestus*), Two-banded Plover

(*Charadrius falklandicus*), Band-tailed Gull (*Larus atlanticus*) and the South American Tern (*Sterna hirundinacea*) are some of the migratory species that visit Laguna de Rocha in winter. Due to the number of migratory species recorded in the lagoon and to the abundance of several gregarious species (Black-necked and Coscoroba Swans, and several species of Coots) it has been proposed as one of the IBA (Important Bird Areas for BirdLife International) of Uruguay. It is also being considered to incorporate Laguna de Rocha to the Western Hemisphere Shorebird Reserve Network.

The Swans:

The Black-necked Swan (*Cygnus melancoryphus*) and the Coscoroba Swan (*Coscoroba coscoroba*) constitute the group of the large anatids of Laguna de Rocha and are the most charismatic species of the lagoon. Both species present conservation problems in the region but there is little biological information about either of them. These birds mainly use the lagoon as a trophic resource, among other activities. To eat they open and close their bill through the water surface or sink their neck up to the chest to reach the sediment. For this reason, if there are no food resources on the water surface, the maximum depth they can feed is approximately 0.6 meters (the length from their bill to their chest). However, until this study, there was no information about how they use the trophic resource of Laguna de Rocha. Their distribution in the lagoon is not regular; they avoid some areas and abound in others. Due to the turbidity of the water, it was not possible to observe the items they consume, nor the characteristics of the sites they use for feeding. It was also unknown if they shared the same trophic resource or if they use different component of it. All these questions are related to the use of the resource, both at the spatial level and at the trophic level. To know how they are spatially distributed will allow us to understand how they use the lagoon and what are the most important variables to fulfil their trophic needs.

The Management Plan:

Laguna de Rocha is part of the national park "Parque Nacional Lacustre y Área de Uso Múltiple" (Law 260/77) since 1977 and was declared a protected area in 1992 (Law 527/92). Presently, it has been proposed as a pilot area to be incorporated to the National System of Protected Areas (SNAP in Spanish) which has been recently created. The system establishes the creation of local committees (LC) composed of local stakeholders for each protected area. Each LC will elaborate and implement a specific management plan for each protected area. For Laguna de Rocha, the LC has been working since 2003

and has achieved important milestones such as the identification of main conflicts in the area and the elaboration of a preliminary management plan for the lagoon. However, this committee has no information about how the birds use the lagoon. The only information refers to the southern area of the lagoon and consists of lists of species which are inappropriate to create management guidelines.

Both swan species are appropriate to create guidelines because they use most of the lagoon. On the other hand, these species are easy to identify and localize, which in turn makes it easy to study and monitor them.

Objectives

To understand how the Black-necked and the Coscoroba Swans are spatially distributed in Laguna de Rocha through the selection of feeding habitats.

Specific objectives

- to identify the most important feeding areas of the swans
- to determine essential management guidelines for the conservation of waterbirds in Laguna de Rocha

Methods

Study Area

Laguna de Rocha (34° 33' S, 54° 22' W) is a shallow coastal lagoon located in the Eastern region of Uruguay, an area characterized by lagoons, wetlands and palm fields. Its average and maximum depths are 0.6 and 1.60 meters, respectively. The lagoon has an area of 7200 ha and communicates with the ocean through a sand bar that is temporarily opened by the sea during storms and is closed again due to the winds. The sea intrusions create an saline gradient increasing from south to north. The sand bar dynamic provides particular conditions that maintain a high diversity of fishes, aquatic invertebrates, phytoplankton and birds.

The lagoon has four main areas. The North receives the discharge of three main rivers: Rocha, Las Conchas and La Palma and has an irregular coast. This is an area where fresh water conditions are predominant. The West is a large embayment that receives the discharge of Los Noques River. This area is also dominated by fresh water conditions and has an irregular coast. Instead, uniform coast lines characterize the Central area which

presents the greatest depths of the lagoon and a strong saline gradient. The South is dominated by the influence of the sea when the sand bar breaks; it presents high changes of salinity and with it, a changing community as the water condition changes with each intrusion.

Activities carried out:

Population size estimations through aerial census:

Three flights were performed in Spring 2006 (September, October and December) and three other flights in Summer 2007 (February and March) in order to estimate the population size of the Black-necked and the Coscoroba Swans at Laguna de Rocha. A Piper J-3 or a Cessna-150 airplane was used for this purpose and flights were carried out right after sunrise or just before sunset. A map of the lagoon was used to record the location of the groups and the estimated number of birds observed. This task was carried out by a trained observer in every flight. Binoculars 10x50 were used when necessary.

Population size estimation for each species:

The aerial census did not allow independent counts for each species. This is because the birds are usually feeding and have their neck under water which is the only characteristic that provides a quick clue for their differentiation. In addition to this, the airplane travelled at an average of 137 meters of altitude (400-500 feet) with a velocity of 112km/hr (70 miles/hour), which makes it difficult to count the birds for both species independently. To record the proportion of the species in the different areas of the lagoon, four point counts were carried out from an artisanal fishing boat and four to seven point counts were carried out from the coast. We performed three replicates for each point using a 60x60 telescope and a 10x50 binocular. These bird counts were carried out only in February 2007.

Behaviour Study:

The following behaviour categories were identified after performing a pilot study using the *ad libitum* method: resting, preening, moving, searching food and feeding. The frequency of observation of the each category was quantified through instantaneous scan counts every 15 minutes for 48 hours (observations were made during sunlight hours). To perform this study we camped at Laguna de Rocha and used a 60x60 telescope. This study was carried out in February 2007.

Aquatic plants and benthic invertebrates:

Twelve samples were collected in four areas of Laguna de Rocha with an Ekman dredge using a pneumatic boat. The samples were sieved using a 0.5 mm mesh with constant water flow at the field station of the Limnology Department (School of Sciences - University of Uruguay) in La Riviera (Rocha). Aquatic plants were separated from the benthic invertebrates and sediment. Then they were weighted (wet weight) and stored for their transportation to the limnology laboratory at the School of Sciences (Montevideo). The benthic invertebrates were preserved in alcohol 70% for its further analysis in the laboratory. These samples were collected in Spring 2006 (September) and Summer 2007 (February).

Analysis of samples in the laboratory:

The plant samples were dried in the Limnology Department laboratory and then weighted to calculate the aquatic plant biomass (g). The benthic invertebrate samples were analysed with a magnifying glass to count and identify the taxonomic group of each specimen and calculate their density (individuals/m²).

Results

Swans

During the entire study, the swans were observed in the littoral zone of the lagoon (Figure 1). This is consistent with the fact that it is a low water depth area and therefore an area where the submerged aquatic plants are accessible to the swans. We found that in spring, the swans were homogeneously distributed along the littoral zone of the four areas of the lagoon and varied between 2122 and 3687 individuals (Table 1, Figure 2). In summer the birds were mainly found in the littoral zone of the Central area of the lagoon (Table 1, Figure 2), particularly in an eastern bay where we counted 1500 swans during the aerial census of date 02/25/2007. The maximum number of birds in summer reached 5289 (Table 1).

Table 1. Abundance of swans counted in the aerial census performed in Spring 2006 and Summer 2007.

	09/15/2006	10/28/2006	12/23/2006	02/24/2007	02/25/2007	03/13/2007
West	254	579	596	777	929	156
North	771	1567	638	344	578	601
Centre	636	855	1407	2613	3390	168

South	461	686	399	1217	392	257
TOTAL	2122	3687	3040	4951	5289	1182

The last aerial census was performed after a rainfall that substantially changed the depth of the lagoon. The total number of birds in this census decreased notoriously and this difference was specially observed in the centre of the lagoon. For this reason a large standard deviation is observed in the rest of the results calculated.

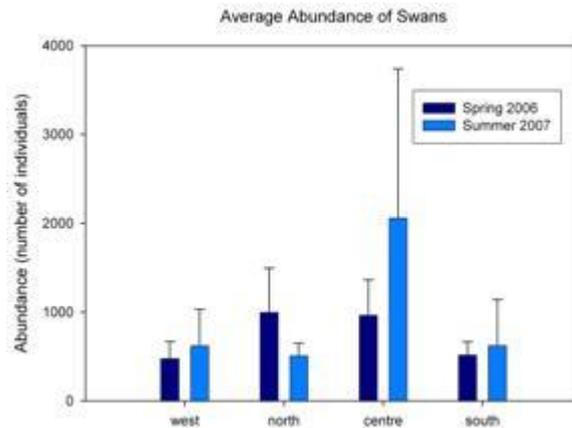


Figure 1. Average abundance and standard deviation of swans in four areas of Laguna de Rocha (West, North, Centre and South).

The counts performed in Summer 2007 to record the proportion of each swan species in the different areas of the lagoon are presented in Table 2. These results allowed us to calculate the average proportion of each species for each area and therefore estimate the population size of each species in Laguna de Rocha (Figure 3).

Table 2. Number of swans counted in four areas of Laguna de Rocha (West, North, Centre and South) to know the proportion of each species. Each area has two columns, the left column represents the abundance of Black-necked Swans, and the right column is the abundance of Coscoroba Swans for three replicate counts.

West		North		Centre		South	
6	14	64	224	34	50	780	289
469	69	6	355	306	202	308	526
658	39	203	365	293	166	192	258

The average abundance estimated for the Black-necked Swan during Summer 2007 in Laguna de Rocha was 2294 (standard deviation = 1374) and for Coscoroba Swan it was 1514 (st. dev. = 906).

Estimated Abundances for Black-necked and Coscoroba Swans

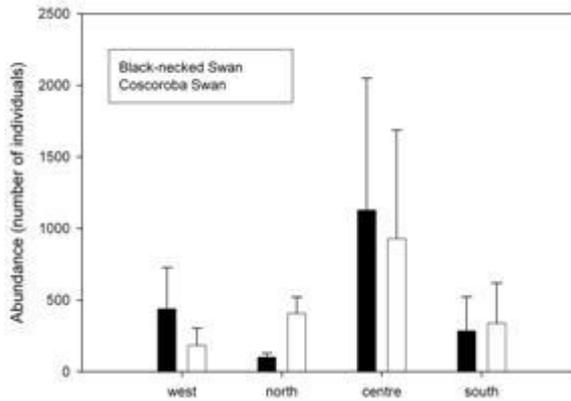


Figure 2. Average abundance of Black-necked and Coscoroba Swans in four areas of Laguna de Rocha during Summer 2007.

Aquatic Plants

The aquatic plants found in this study were submerged macrophytes that do not grow enough to reach the surface; their maximum height is approximately 10 cm above the sediment. The most abundant and frequent plant species was *Ruppia maritima*. Our results indicate that in Spring the western area of the lagoon presents greater aquatic plant biomass, followed by the North of the lagoon. The Centre and the South presented very low plant biomass (Figure 4). However, in Summer, the greater plant biomass is located in the Centre and the North of the lagoon, followed by the South in a lesser degree (Figure 5). It is important to note that not only the areas with greater biomass change but also the average total biomass found in this season is greater than in Spring (467.94 and 221.48, respectively).

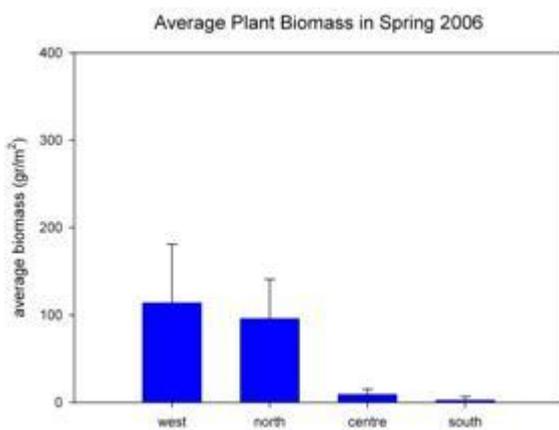


Figure 3. Average plant biomass during Spring 2006 in four areas of Laguna de Rocha.

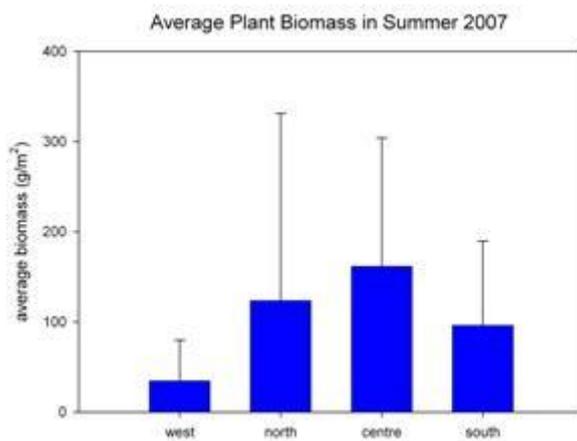


Figure 4. Average plant biomass during Summer 2006 in four areas of Laguna de

Benthic Invertebrates

The benthic invertebrate samples analysed indicate that the Centre of the lagoon presents the highest density (Figure 6) during Spring with a maximum of 16580 individuals/m². The next important area in decreasing order is the South and in all areas the snails are the dominant group and are represented by a single species: *Heleobia australis* (Figure 7).

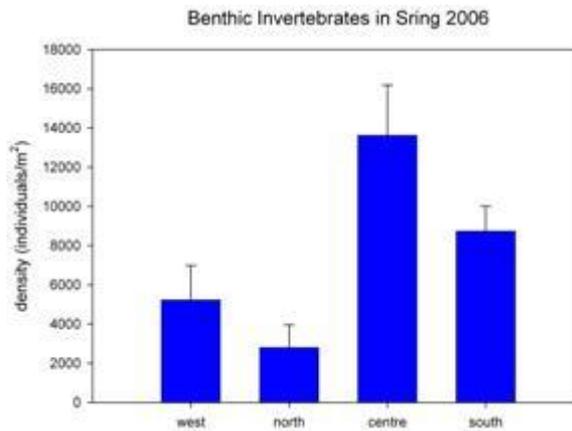


Figure 5. Average benthic invertebrate density (individuals/m²) during Spring 2006 in four areas of Laguna de Rocha.

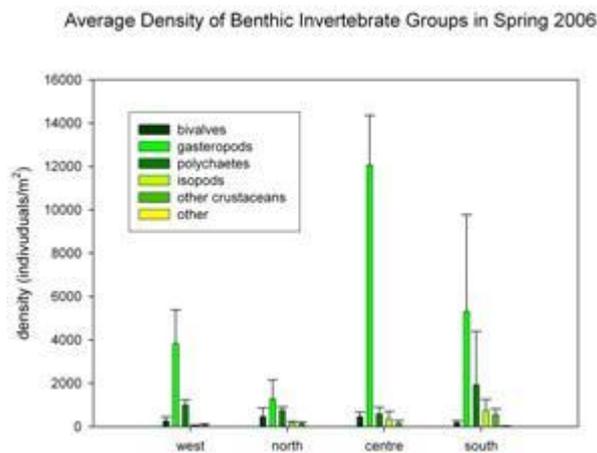


Figure 6. Average density of main benthic invertebrate groups during Spring 2006 in four areas of Laguna de Rocha.

In Summer, the area that presents the highest density is the South with a maximum of 26083 individuals/m² (Figure 8). The second important area is the Centre with lower densities than in Spring. As in Spring, *H. australis* is the most abundant species in all four areas of the lagoon (Figure 9).

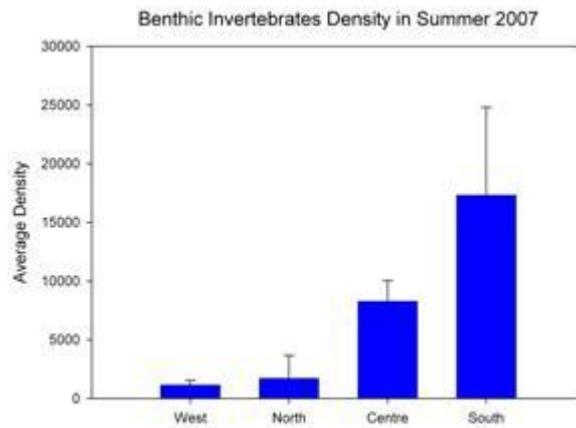


Figure 7. Average benthic invertebrate density (individuals/m²) during Summer 2007 in four areas of Laguna de Rocha.

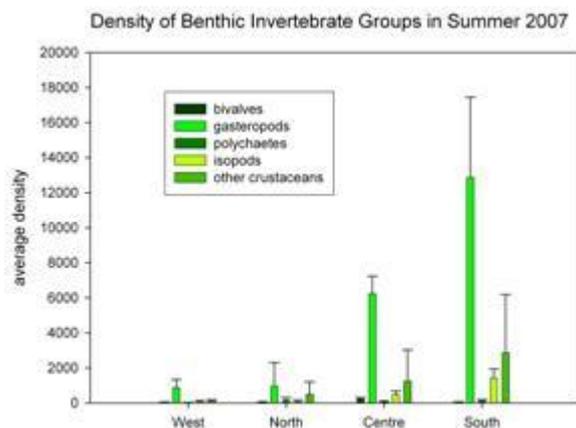


Figure 9. Average density of main benthic invertebrate groups during Spring 2006 in four areas of Laguna de Rocha.

In general, we found that the distribution of the swans responds to the plant biomass rather than to the benthic invertebrates' density. We believe that the important feeding areas for the Black-necked and Coscoroba Swans vary in time, in relation to the amount of resources available in each site. These sites are identified in Figure 1 and are mainly located in the North and Centre of the lagoon. The South presented a reduced but important area where approximately 1200 swans were counted in one opportunity. The lower aquatic plant biomass during Winter and Spring are probably responsible for the uniform distribution of the swans throughout the littoral zone of the lagoon. However, Laguna de Rocha is a constant source of food during the year and this is the reason such large numbers of swans are found year round. In Summer, the productivity of the lagoon is at its highest and it can sustain a larger number of swans. We also believe the birds have

an important impact on the plant and therefore move within the lagoon from one site to another as they deplete the resource.

Behaviour Study

The behaviour study was performed in a total of 117 scans. Black-necked and Coscoroba Swans presented the same proportion during the behaviour study. The results confirm that feeding is the main activity of these species in Laguna de Rocha. This activity was more frequently observed in Black-necked Swans than in Coscoroba Swans (Table 3). However, this behaviour was observed in a higher average of individuals of Coscoroba Swans (19.15) than Black-necked Swans (13.83). These results indicate that Laguna de Rocha is a relevant ecosystem for these species.

Table 3. Frequency of behaviour categories for Black-necked and Coscoroba Swans during 48 hrs of observations with 15 minutes intervals in Laguna de Rocha.

	Black-necked Swan	Coscoroba Swan
Resting	0.27	0.56
Preening	0.50	0.58
Moving	0.64	0.44
Searching	0.23	0.18
Food		
Feeding	0.86	0.63

Management guidelines

All the areas identified as feeding areas for swans should be protected and it should be acknowledged that these areas vary in time and space, and therefore the important bird sites too. It should be noted that other water birds also use submerged vegetation as a food resource and therefore these areas are important for them too. The eastern bay located at the Centre of the lagoon is a very important feeding area, together with the North of the lagoon and a particular site of the South of the lagoon. It is clear from this study that the areas with high plant biomass are crucial for maintaining a large population of swans in Laguna de Rocha. A simple monitoring plan may be designed using the information of the distribution of the plants. This monitoring plan may consist of a visual

control of the plant patches in the lagoon using a pneumatic boat or aerial census. The areas with largest amounts of plants should be the areas where the birds will concentrate in summer. This information may be used to decide tourist routes within the lagoon. The local community is beginning to offer bird watching tours and thus knowing where the birds are becomes very useful information. However, there should be clear recommendations for birdwatchers about the distance to be kept from the birds, the noise and behaviour.

A pilot experience to cultivate native shrimps was carried out two years ago by the local fishermen families. If this productive activity should be repeated, it should not be located in any of the important feeding areas identified. Aquatic motor sports, fishing with cages or nets in these areas should also be prohibited, not only because they are important areas for birds but also because they are important areas for invertebrates that could be preyed by fish and crabs (both are being commercially exploited in the lagoon).

Any activity that leads towards the eutrophication of the lagoon should be paid close attention. For example, the use of agrochemicals, the loss of natural vegetation and the forestation of the draining basin with exotic trees are serious threats to the high water quality of Laguna de Rocha. Algal blooms have already been reported in the lagoon and if this situation continues the aquatic plants will be certainly affected. The loss of aquatic plants will automatically reduce the number of swans feeding in the lagoon.

Dissemination of the results up to this date

We participated in the IBAs Workshop 2006 (Important Bird Areas) organized by Aves Uruguay and Birdlife International contributing with our data for Laguna de Rocha. This lagoon is one of the sites proposed as IBA because it presents high abundance of migratory and gregarious species.

The behaviour data was presented during the First Uruguayan Meeting of Animal Behaviour. This event took place in Montevideo, November 30 – December 1, 2007.

On October 13, 2007, we collaborated with Sociedad de Amigos de La Laguna de Rocha (an NGO working for the protection of Laguna de Rocha) in the organization of the 2nd Dissemination Workshop for Laguna de Rocha. The local communities represented by school teachers, high school students, local press, TV and radio, land owners, and public in general were invited and participated during the workshop. Official representatives of

the Municipality of Rocha and the SNAP (National System of Protected Areas) also participated with presentations of their work in the lagoon and attended the rest of the presentations, including the one we presented about our project.

The workshop was successful in reaching a wide variety of stakeholders related to Laguna de Rocha and inform about what has been done in the past 5 years in terms of academic research, local communities development (specially fishermen families living in the lagoon), legislation, management, and conservation. A good climate of discussion allowed identifying main topics for future workshops. These topics are related to critical areas of conflict within the lagoon where development and conservation seem to be on opposite sides. The lack of a final management plan for Laguna de Rocha generates these ambiguities and tensions and through this workshop we have contributed to make progress towards the elaboration of a management plan that integrates all the information available and the different activities and interests related to Laguna de Rocha.

Up to the date, the lagoon has been declared a pilot area for the newly developed SNAP. The following step for the formalization of the lagoon as a protected area is a public hearing. We will be present in this hearing a will express our interest and conviction about why Laguna de Rocha should be a protected areas making emphasis on its value for water birds and biodiversity in general.

Interviews to the local community of Laguna de Rocha

We interviewed some of the most experienced fishermen of the local community of Laguna de Rocha. This is a very close-minded community and they are rarely willing to be interviewed. We obtained these interviews thanks to Freddy Seijas, a fisherman who is part of this working team and worked very hard to make this a successful project. The interviews allowed us to understand how they relate to the lagoon, their appreciation of a natural resource and their opinion about conservation policies. They also shared their knowledge about water birds, what they eat, where they breed, the season they arrive in large numbers to the lagoon, and how they taste (several of them confessed to have killed and eaten different species of water birds during long fishing days and nights in which they did not have anything else to eat). Let us remember that the artisanal fishermen in Uruguay are usually poor and do not have any formal training, they usually learn to fish from their fathers.

These interviews were very successful in opening a dialog between two different cultures (academic-fishermen) which must be in close contact for the effective conservation and management of Laguna de Rocha. The management guidelines cannot ignore the traditional way of life of the local community and the local community must understand that reasonable guidelines must be followed to maintain the ecosystem that has given them a way of life.

These fishermen and others were invited to attend the dissemination workshop but could not attend due to transportation difficulties. We look forward to solve this obstacle for the next public hearing that will be held to declare Laguna de Rocha a protected area.

Conclusion

We met the overall aim of this project which was to contribute substantial information on water bird ecology for the protection of "Laguna de Rocha" and the conservation of two swan species. This project has identified the most important feeding areas of the swans as well as determined essential management guidelines.