

MONITORING OF AQUATIC AND TERRESTRIAL BIRDS WITHIN EXPLOTATION ZONE OF INDUSTRIA SALINERA DE YUCATÁN S.A. OF C.V.

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The development of industrial activities is usually related to negative effects to nature, but in the case of solar saltworks, great extensions of modified wetlands contribute to create new habitats. The evaporator ponds and crystallizers are habitats of many microscopic species, reason why the food production generated, gives sustenance to major organisms like fish and water birds, the latter demonstrate the importance of these man-created new habitats.

The present study is based on a complete year of monthly bird surveys in all the salt ponds of Industria Salinera de Yucatán S.A. de C.V. (ISYSA). Twenty four points in 17 km of evaporators and crystallizers were located, where the salinity varies from 5-6 °Be to 24-30 °Be during the year. In total we observed 50 species of birds of which 29 are of aquatic habits and 21 terrestrial.

The most abundant birds were Caribbean Flamingos (*Phoenicopterus ruber*), which extend throughout all the system of evaporators, finding the major concentrations (5,500 individuals) in the low salinity ponds (5-6°Bé) due to the entrance of a great amount of fish larvae as effect of the brine pumped from the Río Lagartos Estuary to the saline system, and in the high salinity ponds (24-30°Bé) mainly because of the presence of Brine Shrimp (*Artemia* spp.) and insect larvae as the brine fly (*Drosophilla* spp.). Due to this important food production, the ponds are also critical feeding sites for water birds that arrive in their yearly migrations to the Yucatan Peninsula. During the month of February 2005, 10,000 individuals of these bird species were observed: Sanderling (*Calidris alba*), Wilson's Plover (*Charadrius wilsonia*), Semipalmated Plover (*Charadrius semipalmatus*), Semipalmated Sandpiper (*Calidris pusilla*) and Least Sandpiper (*Calidris minutilla*).

KEYWORDS: Saltworks, flamingos, water birds.

INTRODUCTION.

A fundamental problem for the conservation of the biological biodiversity is its magnitude. With the recognition of which exists just a short time and that the resources to avoid lost massive of species and the ecosystems are very limited and efforts have been increased to determine priorities of regional conservation at levels, national or global (e.g. Ceballos and Brown, 1995).

The majority of these efforts are concentrate in the identification of areas that by some characteristic can be considered of greater priority or importance. These methods have the objective to obtain a greater effectiveness in use of limited resources if these are destined to the areas that generally have a great wealth of species or ecosystems.

Against this background, to be able to realize a good handling of the present ecosystems in these areas it is important to know the biological processes of flora and fauna. The

flora and the fauna are the perfect indicators of the ecological imbalances that are happening by the intervention of different natural factors, as induced by the same man. For the monitoring of these processes Industria Salinera de Yucatan (ISYSA) it has taken like indicative factors the birds that have some mechanisms that can detect the biological changes in that ecosystems.

AREA OF STUDY.

Industria Salinera de Yucatan is immersed in the polygons of natural protected area called Reserva de la Biosfera Ría Lagartos (map 1) this area, is limited by a polygonal with a surface of **61,187.75** hectares and is located in the Eastern end of the coastal strip of Yucatan. In the north it limits with the Gulf of Mexico, to the south with the municipalities of Tizimín, Río Lagartos and San Felipe, to the east with Quintana Roo and the west with the municipality of San Felipe.

Map 1.



On the other hand, this protected area displays a great diversity of vegetal communities. 10 types of vegetation are counted in their interior. Between these types the coastal dune appears. This coastal dune is a sand bar that extends from San Felipe in the West side to Chipepte on the East side. The amplitude of the vegetation is very variable and is related to the width of the bar, the community are compose of tropical sand plants, dominated by small succulent and great palms. The characteristic species are: sisal (*sisalana Agave*), grape of sea (*uvifera Coccoloba*), nakax (*Coccothrinax readii*), palm chit (*radiata Thrinax*), palm kuká (*Pseudophoenix sargentii*), anacahuíta (*sebestena Cordia*), nopal (*Opuntia dillenii*), cactus (*Acanthocereus tetragonus*), sikil-ha'xiu (*involucrata Lantana*).

The palms Kuká, Chit and Nakax are classified in the category of threatened species, this last one is endemic of the region.

METHODOLOGY

Consists in a visit of with observing points previously located with GPS, and with the aid of binoculars and telescope the identifications of the species of birds are realized that are in the points, is important to mention that with the aid of the optical equipment we can cover more area, after to made the identifications, the count of individuals is carried out when they are smaller groups of 500 individuals, when the number is more than 500

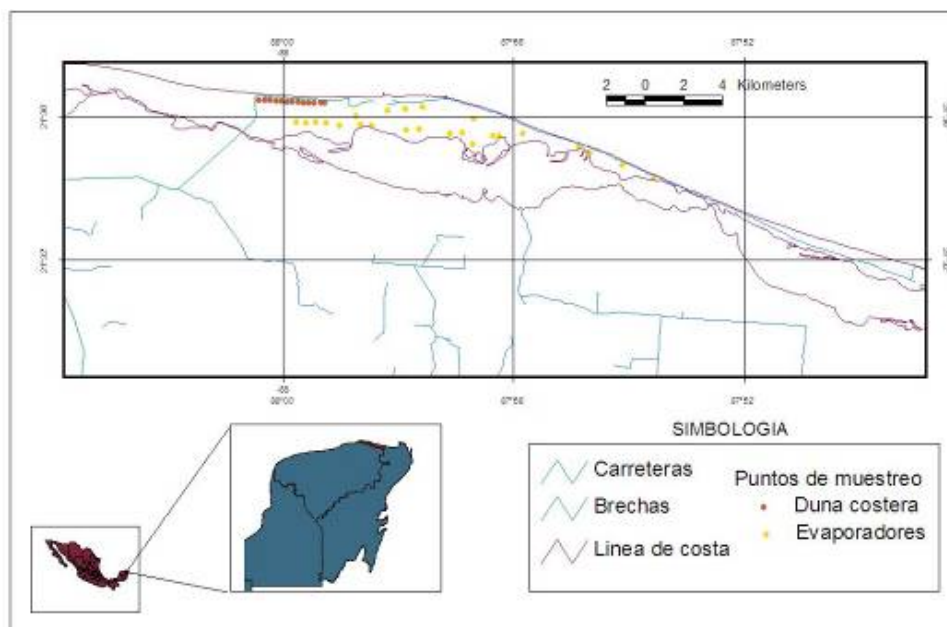
approximately is carried out an estimation of the individuals by group. This methodology was applied for the aquatic and sand birds.

For the terrestrial birds the method of counting by points that was realized consists of visiting a point already located in transects by intervals of 200 meters one of another one. The support equipment in this observations and identifications of the species was: binoculars Zeiss 10 x 40 and a Leica telescope of 15x-60x, Field Guides of Peterson "Field Guides of Mexican Birds" (Roger Tory Peterson/edgard L. Chalif), "Field Guide to the Birds of North American" (National Geographic), "Field Guide to Sibley" (National Audubon Society).

RESULTS

As first step, the points of count for the sand birds were located, in a transect that include a total of 17 kilometers. To cover all the evaporators system of ISYSA were located 24 observing points. The salinity in the evaporators ponds goes here of 5-6° Bé to 24-30°Bé in average during the year (map 2).

Map 2.



12 visits to both transects were realized observed a total of 35 species of birds of which 29 are of aquatic habits and 6 of terrestrial habits. This is described next.

The most abundant birds were without a doubt the flamenco, since these extend by all the system of evaporators, the major concentrations of flamenco are located in the ponds with less salinity (5-6°Bé) and in those with greater salinity (24-30°Bé) with an average of 5.500 individuals. Is the first time in 30 years of pursuit the flamenco populations in the Yucatan Peninsula, the registry on attempt of nesting inside salt ponds, in this site the flamenco constructed around 120 nests some of them with eggs, nevertheless the flamenco left the site, even though that ISYSA maintain monitoring of its vehicles by the zone.

Nevertheless within the crystallization and evaporation system some topographic depressions that form shallow waters that are used by the sand birds in its way by the natural protected area in its annual migrations. The number of individuals observed was 10.000 in the observations of February, in the transect of the evaporators ponds, the species observed in this group were Sanderling, Wilson's Plover, Semi palmated Plover, Semi palmated Sandpiper, Least Sandpiper, the abundance of these sand birds is due to

the great amount of Artemia and Ephidra diet that they require to consume to accumulate sufficient fat that will serve to them like energy for his migration.

Listing of birds found in the zone of ISYSA operation

Pelecanidae <i>Pecanus</i> <i>erithrorhynchos</i> <i>Pelacanus occidentalis</i>	Phoenicopteridae <i>Phoenicopterus to ruber</i>	Recurvirostridae <i>Hamantopus</i> <i>mexicanus</i>
Phalacrocoracidae <i>Phalacrocorax auritus</i>	Accipitridae <i>Pandion haliatus</i>	Scolopacidae <i>Tringa flavipes</i> <i>Tringa melanoleuca</i> <i>Catoptrophorus</i> <i>semipalmatus</i> <i>Calidris pusilla</i> <i>Calidris minutilla</i> <i>Calidris mauri</i> <i>White Calidris</i>
Ardeidae <i>Egretta rufecens</i> <i>Ardea herodias</i> <i>Egretta thula</i> <i>Casmerodrius albus</i> <i>Egretta tricolor</i>	Falconidae <i>Falcon peregrinus</i>	
	Strigidae <i>Asio flammeus</i>	
Threskiornithidae <i>Platalea ajaja</i>	Phasianidae <i>Hills nigrogularis</i>	Laridae <i>Larus atricilla</i> <i>Larus argentatus</i> <i>Caspian Sterna</i> <i>Maximum Sterna</i> <i>Sterna antillarum</i> <i>Rynchops Niger</i> <i>Sterna sandvicensis</i>
Cathartidae <i>Cathartes burrovianos</i> <i>Cathartes dawn</i>	Charadriidae <i>Squatorola Pluvialis</i> <i>Charadrius wilsonia</i>	

During the time of monitoring 3 important nesting sites of aquatic birds 2 for cormorant were detected double crest (*Auritos phalacrocorax*) in one considered of 230 pairs and the other of 450 pairs and 1 for real charan (*Sterna principle*) because the site where these birds nested was covered by graze and the size of the bird was impossible to do an estimation of the population of birds nesting.

CONCLUSION

The presence of a great number of species of birds in aquatic habits is related to the handling of waters and salinity that ISYSA realizes to obtain the salt formation, this handling begins from the extraction of the water of the coastal lagoon along with this enter larvae of fish and fish that are profiteers by the birds those that they have habits of hunters, as well as the filters.

In relation on the attempt of the flamenco nesting within the zone of operations of ISYSA, it must to the evaporators, in particular it is where is the greater amounts of Artemia concentrations (400 – 500 org/lt Ortiz, com. Reps.), it means food availability for the adult flamenco and for the raising of youthful, other factor that also could influence is that of the south side of ponds in the other side of the coastal lagoon, parallel to this area, is a strip of small fresh water lagoons and finally the material of the ground that is a determining factor so that the flamenco can nested (See photos in the Annex).

However the causes that originated that the flamenco did not nest are several and are related with their reproductive conduct: 1) The flamenco that tried can be their first year of reproduction reason why they do not know the sites with the characteristics that they require for their reproduction (security, visibility). 2) By other hand the minimum number of pairs that are required to consolidate a colony, these could both be factors that influenced so that the flamenco have a successful colony in Polcos area, nevertheless

nearby this site, in the east side of the coastal lagoon there is "Mulsunik" site was an important nesting area in the years 70's (Garcia, com. Reps.)

One of the conclusions is certain that ISYSA has created a specific habitat for a great number of fauna species of wild birds that depend much on the handling of the salinity in the evaporators and crystallizers ponds that the same industry maintain.

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ANNEX

Table 1. Representative flora of la Duna Costera.

Family	Sort and Species	Común name	Legal definition
Aizoaceae	<i>Sesuvium portulacastrum</i>		
Amaryllidaceae	<i>Agave sisalana</i>	sisal	
	<i>Agave angustifolia</i>	bab-ki	
Boraginaceae	<i>Tournefortia gnaphalodes</i>		
	<i>Sebestena Cordia</i>		
Cactaceae	<i>Opuntia stricta</i>	nopal	
	<i>Mammillaria gaumeri</i>	pol-tsakam	Pr
	<i>Opuntia dillenii</i>		
	<i>Acanthocereus tetragonus</i>		
Compositae	<i>Ambrosia hispida</i>		
Convolvulaceae	<i>Ipomea pes-caprae</i>	riñonina	
Euforbiaceae	<i>Croton punctatus</i>	wild boar grass	
	<i>Euphorbia buxifolia</i>		
Gramineae	<i>Sporobolus virginicus</i>		
	<i>Spicata Distichlis</i>	grass	
Leguminosae	<i>Canavalia rose</i>		
	<i>Cassia sp.</i>	Salché	
	<i>Pithecellobium keyense</i>		
Malvaceae	<i>Malvaviscus arboreus</i>	bizil	
Orquidaceae	<i>Cyrtopodium punctatum</i>	orchid	Pr
	<i>Schomburgkia tibicinis</i>	May flower	
Palmae	<i>Coccothrinax readii</i>	nakax	A
	<i>Radiata Thrinax</i>	palm chit	A
	<i>Pseudophoenix sargentii</i>	kuká	A
Poligonaceae	<i>Coccoloba uvifera</i>	grape of sea	
Quenopodiaceae	<i>Atriplex canescens</i>	grass	
	<i>Suaeda linearis</i>		
Solanaceae	<i>Lycium carolinianum</i>		
Surianaceae	<i>Suriana maritima</i>		
	<i>Lanceolata Cakile</i>		
	<i>Scaevola plumierii</i>		
	<i>Baumelia retusa</i>		
Teofrastaceae	<i>Jacquinia aurantiaca</i>	chaksik	
Verbenaceae	<i>Lantana involucrata</i>	has `xiu	

P-Danger de Extinción. **A**-Threaten. **R**-Rare. **Pr** -Special Protection



Location of the Count Points in Coastal Dune



**Census on the Evaporators Ponds
(transect of aquatic birds)**



Group of birds on the Crystallizers



Vegetation of a coast