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## Information Sheet on Ramsar Wetlands

1. Date this sheet was completed/updated: 31 August 2001

2. Country: Mexico

3. Name of wetland: Marismas Nacionales

4. Geographical coordinates:

21° 32' – 22° 45' North latitude

105° 15' – 105° 50,' West longitude

5. Altitude: 0-200 metres above sea level

6. Area: 200,000 hectares

7. Overview: This is a large complex of brackish coastal lagoons, mangroves, mudflats and marshes covering the areas of Agua Brava, Las Cabras, Marismas Nacionales, San Blas and Teacapán. It is fed by the following seven rivers of seasonal flow: Acaponeta, Baluarte, Bejuco, Cañas, San Pedro, San Blas and Sauta rivers. It is located on the southern coast of Sinaloa and on the northern coast of Nayarit. It communicates with the Pacific Ocean through the Boca de Teacapán, Cuautla, El Colorado and the deltas of the Santiago and San Pedro rivers. This region has 113,000 hectares of mangroves and estuaries (15 to 20 per cent of all the mangroves in the country), tropical forests with timber (*cedros*, *encinos* and *amapas* among others), non-timber-producing trees (oil palm, coconut palm, and white, red, black and *chino* mangroves) and grasses. There are 14 species of native flora that are vulnerable (endemic, endangered or vulnerable). The species of fauna in the region (mammals, birds, reptiles and amphibians) make up a total of 99 endemic species with 73 endangered or vulnerable species.

8. Wetland type:

Marine-coastal: A, E, F, G, H, I, J and K

Continental: M, N, Q, R, Sp, Ss, Tp and Ts

Artificial: 1, 2, 4 and 5

Types of wetlands by decreasing order of importance:

A - Permanent shallow marine waters;

E - Sand, shingle or pebble shores; includes dune systems;

F - Estuarine waters;

G - Intertidal mud, sand or salt flats;

H - Intertidal marshes; includes salt marshes;

I - Intertidal forested wetlands;

J - Coastal brackish/saline lagoons;

K - Coastal freshwater lagoons;  
M and N - Permanent and seasonal intermittent/irregular rivers/streams/creeks;  
Q and R - Permanent and seasonal/intermittent/saline/brackish/alkaline lakes;  
Sp and Ss – Permanent and seasonal/intermittent saline/brackish/alkaline marshes;  
Tp and Ts -- Permanent and seasonal/intermittent freshwater marshes/pools; ponds;

Grasslands subject to flooding, seasonally flooded grasslands and woodlands;

Artificial wetlands have been created as fish and shrimp ponds, farm ponds, seasonally flooded farmland, reservoirs, dykes and canals;

9. Ramsar criteria: 1, 2, 4 and 5

Criteria that best characterize the site: 1 It is a representative wetland that plays a significant hydrological, biological and economic role in the natural functioning of a water basin or large coastal system of marshes that covers two states.

10. Map of site included? Please tick yes -or- no

11. Name and address of the compiler of this form:

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12. Justification of the criteria selected under point 9, on previous page:

Criterion 1: It is of special value in maintaining the genetic and ecological diversity of the regional.

Criterion 2: It sustains a significant group of species of rare, vulnerable or endangered wild fauna and flora.

Criteria 4 and 5: It regularly sustains a population of 20,000 aquatic birds and is the winter refuge for more than 100,000 migratory aquatic birds.

13. General location: The area of Marismas Nacionales is made up of Agua Brava, Las Cabras, Marismas Nacionales, Teacapán and borders on the north with Río Baluarte and on the south with Bahía de Matanchen. It covers eight municipios: Rosario and Escuinapa in the state of Sinaloa; Acaponeta, Santiago Ixcuintla, Tecuala, Tuxpan, Rosamorada and San Blas in the state of Nayarit. The main towns in the state of Nayarit are El Novillero, Quimichis, Mexcaltitán, Palmar de Cuautla, Santiago Ixcuintla, Sentispac, Santa Cruz de las Haciendas, Pescadero, Pimientillo, Pericos, Tuxpan, San Vicente, Pesquería las Coloradas and San Blas.

#### 14. Physical features:

**Soils:** The most abundant geological forms are sedimentary volcanic rocks from the Cenozoic and recent alluvial deposits. The area of Marismas Nacionales has poorly developed unconsolidated mineral soils of colluvial-marine origin, moderately subject to erosion and salinization or formation of sodium. There are also soils with accumulated soluble salts with a high sodium content and corrosive soils whose salt and sodium content affects to various degrees the materials used in construction, which remain in direct contact with those soils.

**Geomorphology:** There are lowlands formed in the Quaternary surrounding mountain ranges (the Sierra Madre) and delta formations of platforms and oceanic portions with land sediment. Following a geomorphologic classification of the coasts, the region has tidal-accreting coasts with floodplains, mangroves and sea marshes. Towards the north, there are accreting coasts of low sandy beaches and coastal bars (former beaches).

**Climate:** The general climate for the region corresponds to warm sub-humid Aw1(h') with annual precipitation above 150 millimetres, influenced by wet monsoon-type winds from the sea. Average annual temperature is 26° to 28° C with a maximum average temperature of 30° to 34° C. Total annual precipitation is 300 to 1000 millimetres and 800 to 1200 millimetres with annual average relative humidity of 75 per cent and total annual evaporation of 1800 to 2000 millimetres. The coastal plain is within the Gulf of California tidal region with mostly semidiurnal mixed tides. On the coastal plain, there is abundant inland water, for which reason it is called the estuarine region of Nayarit. It is formed basically by swamps that together with water from the drainage of several rivers and streams form lagoons (*albuferas*) covering an area of 920 square kilometres.

#### 15. Hydrological values:

**Hydrology:** The coastal plain is crossed by many rivers and streams that begin in the Sierra Madre Occidental and empty into several lagoons or the Pacific Ocean. They form fertile valleys, where the population is concentrated. All the rivers of Nayarit belong to the Pacific slope, such as the Acaponeta, San Pedro Mezquital and the Huaynamota, a tributary of the Santiago. They begin in the state of Durango and form very deep canyons in their middle reaches. The main rivers that cross the region from north to south are the Acaponeta, San Francisco, Rosamorada, Bejuco, San Pedro, Río Grande de Santiago and the San Blas (Sauta).

The coastal lagoons of Nayarit are highly permanent estuaries. A mixture of sea and fresh water creates conditions that make them the most productive in northwestern Mexico. They sustain fishing in the lagoons and in the ocean. The small lagoons are highly productive ecosystems and form a corridor that is important for migratory birds and a refuge for endangered species. On the coastal plain, there are abundant bodies of water, which has led this area to be considered the Nayarit estuary. It is formed mainly by swamps, which together with runoff from rivers and streams forms lagoons (*albufera*), which cover an area of 920

square kilometres.

#### 16. Ecological features:

The Nayarit mangroves are the most extensive on the Mexican Pacific coast, especially the Teacapán-Agua Brava-Marismas Nacionales-San Blas system. These ecosystems are the most productive. However, large areas have been disturbed by productive activities. In general, the vegetation is tropical savannah, mangrove, palm groves, medium-height sub-perennial forest, introduced grassland that spontaneously grows when the original vegetation is removed, halophytic and aquatic vegetation and coastal dune vegetation that is dominated by creeping plants such as *Ipomoea pescaprae*.

The mangrove is characteristic of the edges of the swamps, river mouths and other bodies of coastal water. They occur in areas with soil of alluvial origin periodically flooded by brackish to saline water. This type of vegetation lacks herbaceous elements and is dominated by *Avicenia germinans*, *Conocarpus erectus*, *Laguncularia racemosa* and *Rhizophora mangle*. The mangrove forms dense thickets that can reach up to 25 metres in height. Other conspicuous species, such as *Ficus* sp., are found sporadically.

The intermediate sub-perennial forest is distributed in patches throughout the area of distribution of low deciduous forest, usually in areas with greater availability of water and from 0 to 1000 metres above sea level. There are two arboreal strata and between 50 and 75 per cent of the species in the canopy lose their leaves during the dry season. The most conspicuous species in this vegetation are the *cedro macho* (*Sciadodendrom excelsum*), *ramón* (*Brosimum alicastrum*), *palma de coquito* (*Orbignya guacoyule*) and *primavera* (*Tabebuia donell-smithi*). The fruit and seeds of *Orbignya* are used for extraction of oil and soaps and by the local inhabitants as food. The trunks are often used for building houses, but most benefit is obtained from the leaves, which are the preferred material for roofs and are widely used for weaving bags, *petate* hats and handicrafts. The areas of *Orbignya guacoyule* are often substituted by coconut plantations, because the ecological conditions seem to suit this cultivated species.

The halophyte vegetation is located along the coast below altitudes of 10 metres above sea level, on flat land subject to flooding by the sea where there are depressions in which there is a high accumulation of salts and drainage is slow. The most common species of halophytic plants are *Batis* spp., *Salicornia europaea*, *S. spp.*, *Sesuvium portulacastrum*, *Suaeda brevifolia* and *S. ramosissima*.

The aquatic vegetation is formed by cosmopolitan species of wide distribution. There are three types of communities: *tular*, which is a monocotyledon, one to three metres in height with broad leaves or that lack foliar organs, rooted to the bottom in shallow bodies of water and with a slow current. The most frequent associations are dominated by *Cyperus* spp., *Scirpys* spp. and *Typha* spp. The floating vegetation, which is plants that float on the surface of the water either rooted or lacking means of fixation, is distributed in fresh or slightly brackish, slow-flowing water. The most important are *Eichornia crassipes* and *Nymphaea* spp. In

Laguna de Agua Brava, there are many algae among the roots of the mangrove, for example, *Bostrychia radicans*, or floating next to the shore in more or less large clumps of *Enteromorpha dathrata* or *E. plumose*.

Land tenure: There are no accurate data for the region. Nayarit is made up basically of *ejidal* and communal property. *Ejidal* possession covers 43 per cent, communal land is 42 per cent and small properties make up 8.6 per cent. In relation to the number of producers, the land tenure structure is 64,520 persons, of which 76 per cent are *ejidatarios*, 20 per cent are *comuneros*, and 3 per cent are *colonos* and 0.7 per cent small owners.

#### 17. Noteworthy flora:

The arboreal vegetation of a large part of the region corresponds to large and extensive mangroves, which are optional halophytes that can grow in salinities ranging from zero per cent (freshwater) to hyper saline, but grows best in brackish water. In the region, there is *Avicennia germinanas*, *Laguncularia racemosa* and *Rhizophora mangle*. In several tidal areas (Esteros de San Blas), there are matorrales of scattered mangroves combined with crawling halophyte vegetation in the *Batis* and *Salicornia* genera. Likewise, near San Blas there are areas of low perennial forest combined with oil palm (*Orbygnia* sp.), considered endangered. This is also distributed in small woodlands near Laguna de Agua Brava. An aesthetically attractive area because of small hills with low deciduous forest at the edge of the sea is the region of Sierra de Las Cabras. It is also surrounded by mangroves.

#### 18. Outstanding fauna

On the coastal plain, outside the aquatic environment, there are representative populations of iguana, bat, jaguar, armadillo, hare, rabbit, fox and deer (Anguiano, 1992). This fauna is now classified as neotropical. It is diverse with a large number of endemic and migratory species that are endangered and of economic importance. The diversity of fauna is associated with the environmental heterogeneity of the area. In Sinaloa and Nayarit, there are 408 and 343 species of vertebrates, respectively (see figure). Of these, at least 60 are endangered, especially from overexploitation and destruction of habitat, and 51 species are endemic. Among the relevant species are the jaguar (*Panthera onca*), American crocodile (*cocodrilo de río*) (*Crocodylus acutus*), lilac-crowned amazon (*cotorra guayabera*) (*Amazona finschii*), military macaw (*guacamaya verde*) (*Ara militaris*) and four species of sea turtles (*Chelonia mydas*, *Dermochelys coriacea*, *Eretmochelys imbricata* and *Lepidochelys olivacea*) (Borjórquez Tapia L., 1998).

In the Sinaloa-Nayarit coastal region, 98 species of mammals (22 per cent of the national total) have been recorded in eight orders, 21 families, 75 genera and 165 species (Atlas Nacional de México, 1990). Out of the total number of species, 86 have been recorded in Sinaloa and 79 in Nayarit. At least 12 species are endemic to Mexico and nine (10 per cent of the total) are endangered. Among these are the North American otter (*nutria de río*) (*Lontra canadensis*), peccary (*Tayassu tajacu*), puma (*Puma concolor*), jaguar (*Panthera onca*), ocelot (*Leopardus pardalis*), tree ocelot (*Leopardus wiedii*) and white-tailed deer (*Odocoileus*

*virginianus*).

The Pacific coast forests are a unique winter habitat for 110 species of song birds (*aves canoras*). There are 252 species of birds, of which 60 per cent are resident and the rest migratory. The migratory aquatic species include species in groups such as *chorlitos*, *zancudas*, ducks and pelicans. They usually visit in the winter, and their local distribution is restricted to bodies of water that provide refuge and food. There are important species such as arboreal ducks, black-bellied whistling-duck (*Dendrocygna autumnalis*), stork (*Mycteria americana*) and fish eagle (*Pandion haliaetus*). At least 12 species of migratory ducks find refuge in this area. Because of their importance for conservation, there are concentrations of ducks in the swamps of Laguna Agua Brava-Marismas Nacionales.

The migratory forest species are a group made up of about 110 species of Passeriformes. The density of these migratory birds in the low forest is the highest recorded in the world. In addition, there are 36 endemic species, including the *cotorra guayabero* (*Amazona finchii*), the *perico atolero* (*Aratinga canicularis*) and the *catarinita* (*Forpus cyanopygius*). This is the regular habitat for 20,000 aquatic birds.

The species of reptiles and amphibians in the area are diverse, and most of them require defined habitats (García, 1980). In the area, there are at least nine endemic species and 13 endangered species. Among the endangered species are the scorpion (*Heloderma horridum*), green iguana (*Iguana iguana*), American crocodile and four species of sea turtles. The poisonous species in the region include the scorpion, the rattlesnake (*Crotalus basiliscus* and *C. atrox*), the *cantil* (*Akistrodon bilineatus*), *coralillo* (*Micrurus distans*) and a sea snake (*Pelamys platurus*) (Bojórquez Tapia L., 1998). The following figure gives information on representative fauna and its status.

#### Wild Vertebrate Fauna

	Total	Endemic	Vulnerable	Endangered	Endangered endemic	Total by type
Mammals	51	19	2	10	-	31
Birds	347	22	2	34	3	61
Reptiles	60	29	4	1	-	34
Amphibians	23	1	-	-	17	18
Total	481	71	8	45	20	144

Total endemic species (99)

Total vulnerable or endangered (73)

Source: SEPESCA, 1990

19. Social and cultural values: -

20. Land tenure/ownership of:

Land tenure: There are no accurate data for the region. Nayarit is made up

basically of *ejidal* and communal property. *Ejidal* possession covers 43 per cent, communal land is 42 per cent and small properties make up 8.6 per cent. In relation to the number of producers, the land tenure structure is 64,520 persons, of which 76 per cent are *ejidatarios*, 20 per cent are *comuneros* and 3 per cent are *colonos* and 0.7 per cent small owners.

## 21. Current land use:

The most important economic activities in Sinaloa and Nayarit are fishing, agriculture, ranching, the raising of shrimp and tourism. In both states, agriculture contributes the most to the primary gross domestic product. The greatest employment is generated in the areas of communal, personal and social services.

Farming activities: Most of the primary gross domestic product is generated in both states by agriculture. The most important crops grown on the coastal plain are maize, beans, tobacco, cotton, sugar cane, *jitomate*, chilli pepper, oil palms, plantains, pineapple, avocado, plums, mangos and other tropical fruits (Anguiano, 1992). On the national scale, Sinaloa stands out because of irrigated farming there. Agricultural yields are above the national average, with the most important crops being soya bean, safflower (*cártamo*), sorghum, wheat and maize. In general, Nayarit does not play an important role in national production by sector, but several products are important, namely tobacco and sugar. Farm yields are below the national average, because seasonal agriculture is the most common. The most important crops in Nayarit are beans, maize, tobacco, sorghum and sugar cane (Bojórquez Tapia L., 1992).

Fisheries: In Nayarit, coastal fishing is the most important with pelagic fishing being much less important. The species in the largest quantities are *lisa*, *pargo*, *robalo*, *sierra*, *corvina*, turtle, *constantino* and *guachinango* (Atlas Nacional de México, 1990). Figure 4 describes the place occupied by Nayarit at the national level in production of several species.

Figure 4. Fishery production in the state of Nayarit (1985)

Rank	Product	Percentage of volume of total catch
4th	<i>langostino</i>	13.7
	<i>barrileto</i>	1.7
5th	<i>lisa</i>	7.0
7th	<i>mojarra de mar</i>	3.8
8th	shrimp	2.9
	<i>sierra</i>	2.4
	oyster	1.3
9th	<i>huachinango</i>	5.0

The live-weight volume of catch is 142,000 tons for Sinaloa and 15,000 tons for Nayarit. This represents more than 11 per cent of the total catch for Mexico

(INEGI, 1990). Fishing is regulated by seven fisheries offices, of which the most important are San Blas, Tecuala and Tuxpan (Pacheco and Guevara, 1990).

**Aquaculture:** In the states of Nayarit and Sinaloa, there large interests in the development of aquaculture, especially shrimp farming (National Development Plan, 1989–1994). Although shrimp farming itself is an important economic activity, development without appropriate planning emphasizing conservation of the environment as first priority, especially in the cases of mangroves and water quality, can be counterproductive for traditional fisheries and shrimp farming. Parts of the San Blas swamp (San Cristóbal, El Pozo and El Rey) have been transformed into shrimp farms and exert pressure for expansion to 2902 hectares of tanks. So far, 900 hectares of mangrove have been affected. According to Flores-Verdugo et al. (1992), in the area of Laguna de Agua Grande, there are plans to protect 5,845 hectares of tidal lands and install about 9,240 hectares of shrimp farms. However, according to the criteria for hydrological capacity expressed by EPAC (1991) the region has a capacity of only 995 hectares for developing aquaculture. For the tidal area of Las Cabras, COSMOCOLOR (1990) estimates a potential aquiculture of 910 hectares for the northern part of Laguna de Cerritos (2,500 hectares) and 1600 hectares for the eastern part of Laguna Grande (approximately 5000 hectares). According to the EAPC criteria (1991) concerning the hydrological capacity (10 per cent), aquaculture installations should not exceed 250 hectares for Cerritos and 500 hectares for Laguna Grande.

**Grazing:** The most important aspect of grazing is the fattening of beef cattle. In the northern part, pigs are raised, and chickens and bees are raised in Tepic. Nayarit has 900,000 head of cattle, and Sinaloa has more than 2,000,000. Together, they represent more than 4 per cent of the total herd in the country (INEGI, 1990).

**Tourism:** The main tourist centre in Nayarit is San Blas, and in Sinaloa it is Mazatlán, which although outside the area in question, receive approximately 240,000 tourists per year (INEGI, 1990).

Figure 5: Number of settlements and their population for the area of Marismas Nacionales

<b>State</b>	<b>Municipio</b>	<b>Number of settlements</b>	<b>Population</b>
Sinaloa	Rosario	3	4,904
	Escuinapa de Hidalgo	9	12,741
Nayarit	Acaponeta	15	9,985
	Rosamorada	14	21,389
	San Blas	14	21,329
	Santiago Ixcuintla	41	74,321
	Tecuala	11	43,401
	Tuxpan	6	9,730
<b>Total</b>		<b>113</b>	<b>197,800</b>

In Marismas Nacionales, there are settlements with as little as 100 to more than 1500 inhabitants. The degree of concentration of serious environmental problems is very high, with the effect of water, air and soil pollution and degradation of biotic



resources. In 1988, a stabilization pond was constructed, and five to eight wastewater treatment plants were built (Atlas Nacional de México, 1990). The land-use capacity around Marismas Nacionales is:

Limited agriculture with seasonal infrastructure. Limiting factors are humid to semi dry climate, 2–15 per cent slope, 25–100 centimetres in depth, 0 to 35 per cent surface stones with slow drainage with 10–60 or 2–16 mmho/centimetre of sodium salts;

Limited forest with or without infrastructure for development of forestry with a humid or sub dry climate, 15 to 100 per cent slope of 10–25 centimetres of soil;

Limited grazing with or without infrastructure for extensive grazing, sub humid, semi arid and arid climate with 0–40 per cent slope and 10–25 centimetres of soil (Atlas Nacional de México, 1990).

22. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land use and development projects:

In the area surrounding the watershed, there is the Aguamilpa hydroelectric project with a ecology and environment component with plans for an environmental protection programme, which is carrying out several activities aimed at reforestation of areas affected by the construction of a wall (*cortina*), study of water quality, conservation of fauna and flora in the reservoir area and promotion of fishing and aquaculture. However, there are no plans for aspects related to effects on the coastal area. Furthermore, the project intends to irrigate 30,000 hectares of flood land and incorporate 75,000 hectares of land subject to flooding through clearing and use of agrochemicals.

Widespread construction of large aquaculture farms encouraged by national and international interests involves construction of dykes, which in relatively flat areas, such as the coastal plains of Northern Nayarit, have caused changes in the hydrological pattern by the resulting diversion of freshwater surface runoff. These changes prevent runoff from reaching areas subject to flooding, such as tidal areas and mangroves, causing flooding in areas such as the lower parts of the coastal plain (usually farming areas or low forest ecosystems) or increasing the period of permanence of water in the tidal areas and mangroves. The dykes also prevent the tides from reaching this area, causing relatively widespread mortality of the mangroves. In the case of the area of La Tovara in the municipio of San Blas, the environmental impact on the mangroves is alarming because of heavy cutting of woodlands, constant clearing for growing mangos, avocados and plantains, as well as expansion of agriculture of beans, maize, vegetables and introduced pasture for creating traditional pastures. This has led to a process of erosion, the drying-up of streams and lagoons and the disappearance of springs and bodies of water important for migratory birds, both for nesting and wintering. At the same time, two canals have been opened in the region that allow direct entry of seawater. One canal is almost 3.5 kilometres long and approximately one kilometre wide south of Palmar de Cuautla and the other recently created north of Río San Pedro, is 15 metres wide and 5 kilometres long. In the canals, there are wooden traps to catch larvae and shrimp.

In Nayarit, attempts have been made to control predators chiefly during the early stages of development of the aquaculture activity. A mistake was made to use occasionally poisons such as cyanide, rotenone (for killing fish) and derivatives of several plants, such as seeds from San Juanico (the castor oil plant). Fishermen from Agua Brava feel that the heavy mortality of fish in 1983 was the result of the use of these poisons. Likewise, the elimination of resident and migratory birds from sites of shrimp ranching is completely uncontrolled and sometimes indiscriminate. This is reflected by the fact that endangered species or protected species, such as the fish eagle (*Pandion haliaetus*), blue heron (*Ardea herodias*) and others are eliminated by law. Furthermore, use of firearms causes accumulation of lead in the sediment of the tanks with the risk of increasing its concentration in the water and its being incorporated into the food chain, including shrimp, with well-known results. Another of the factors leading to the loss of mangroves is the construction of the Novillero highway to the fishing camp of Pericos in Nayarit, which has prevented the tide from reaching the area of mangroves, causing loss of the structure as forest and its transformation into tidal areas with scattered groves of mangrove over an area of approximately 2500 hectares (Flores-Verdugo et al., 1985).

In the sub humid regions, such as southern Nayarit, the construction of highways and roads can cause the period of permanence of the fresh water to increase in some of the tidal areas and replace this ecosystem with freshwater marshes. The distribution of species of mangrove (zonation) depends on the number of days of flooding in a specific area. When these periods increase or decrease because of anthropogenic or natural causes, the mangroves begin a process of succession or in extreme cases die.

In this region, it is possible to find vulnerable or endangered species such as the jaguar (*Panthera onca*) and the American crocodile (*Crocodylus acutus*). Their geomorphologic peculiarities make them one of the rare regions in the world with these geo-environmental characteristics. This ecosystem is characterized by the presence of a series of parallel barriers (157) covered with mangroves and coastal lagoons resulting from transgression in the Holocene beginning 7000 years BC (Curia, 1969 in Flores Verdugo, Bojórquez, 1992). On several sandy barriers, there are small groves of oil palm (*Orbygnia* sp.), also considered endangered. The area is an important refuge for migratory birds and wildlife.

Important human communities have been established here since pre-Hispanic times, whose main activity was related to the gathering and fishing of marine organisms as demonstrated by the clam (*Tivela* sp.) shell mounds (*conchales*), distributed throughout the system (Curry, 1969).

In summary, the change in the hydrological pattern has caused saline intrusions in the surrounding areas both toward the floodplain (cultivated areas) and toward the mangroves, increasing soil salinity where there are mangroves already stressed by salinity, especially in arid and semi-arid areas. This can cause major loss of structure and even death. Cintrón et al. (1978) and Snedaker (1988) in Flores Verdugo and Bojórquez (1992) reported decreased forest structure in the mangroves surrounding the banks of shrimp ponds than those not affected by this activity. The same effect can be expected from construction of the highway. In the case of the railroad, the

current highway and a perimeter highway have caused isolation of the marsh edges that have been transformed into salitrous plains totally lacking vegetation.

23. Conservation measures taken:

There are 14 wildlife conservation management units (UMAS) for the management, conservation and sustainable use of mangrove, *Orbygnia*, waterfowl and ecotourism.

Project linking communities, wetlands and migratory birds: Within the framework of the project linking communities, wetlands and migratory birds run by Wetlands International and the Federal Office of SEMARNAT in Nayarit, four North American sites are connected in the Hemispheric Network for the Reserve of Shorebirds (RHRAP), site of migratory shorebirds on their migration from Mexico to Canada. These sites include Marismas Nacionales in Mexico, the Great Salt Lake in Utah and Lakes Chaplin and Quill in Saskatchewan, Canada. This project plans to link the sites through education, communication and conservation based on tourism. Development of ecotourism will provide basic support for the communities and will ensure long-term conservation of the habitat and education about migratory birds among the youth of these areas. Currently, the communities of La Libertad, San Blas, Pimientillo, Rosamorada and Isla de Mexcaltitan are involved.

24. Conservation measures proposed but not yet implemented:

Project for declaring the Singayta-La Tovar-La Los Negros protected nature area.

25. Current scientific research and facilities:

Project for conservation and protection of the river crocodile. There is a crocodile breeding centre in La Palma with installations for the management of crocodiles, which is owned by SEMARNAT in cooperation with the Association Ecological Environmental La Palma, Ejido La Palma, Municipio de San Blas Nayarit, where research, conservation, reproduction and exhibition of crocodiles takes place.

26. Current conservation education:

A project linking communities, wetlands and migratory birds.

27. Current recreation and tourism:

A project linking communities, wetlands and migratory birds and the La Tovar tourist trail.

28. Jurisdiction:

Territorial: The governments of the states of Nayarit and Sinaloa

Administrative: Secretariat for the Environment and Natural Resources

29. Management authority: -

### 30. References: