

# Venezuela: Laguna de Tacarigua National Park

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**Date of most recent on-site evaluation:** July 2002

**Date posted:** August 2002

**Location:** Miranda State

**Year created:** 1974

**Area:** 39,100 ha

**Ecoregion:** Coastal xerophitic brush, Venezuelan coastal mangrove

**Habitat:** Coastal mangroves, littoral grassland, tropical dry forests and coastal lagoon



## Summary

### *Description*

Tacarigua Lagoon National Park is located in Miranda State on the northern coast of Venezuela. It was created in 1974 to protect an ecosystem made up of a permanent coastal lagoon dominated by mangrove forests and separated from the ocean by a 28.8 km shoal. The park also contains a 20,700 ha marine zone to the north, and an area of tropical dry forest south of the lagoon. In total the park spans 39,100 ha. Many important commercial fish species spawn in the lagoon. In 1996, this wetland was declared a Ramsar site because of its extraordinary importance as a reserve for food resources and biodiversity. In the past eight years, over 60 children have participated in a pioneer environmental education program in which they work as young park guards, helping to protect and defend the national park.

### *Biodiversity*

This park protects four sea turtle species that are threatened with extinction (*Chelonia mydas*, *Caretta caretta*, *Dermochelys coriacea*, and *Eretmochelys imbricata*). It is also Venezuela's most important refuge for endangered populations of the American crocodile (*Crocodylus acutus*). Another 15 reptile and amphibian species, 52 fish, 17 crustaceans, four mollusk species, approximately 212 bird species, and 22 mammal species have been documented in the park.

### *Threats*

Many problems combine to threaten the biodiversity of Tacarigua Lagoon National Park: high rates of sedimentation, solid waste contamination, water contamination, illegal fishing, poaching, and forest fires. For these reasons it has been classified as [vulnerable](#), even though the park has several notable strengths foremost being a dedicated staff.

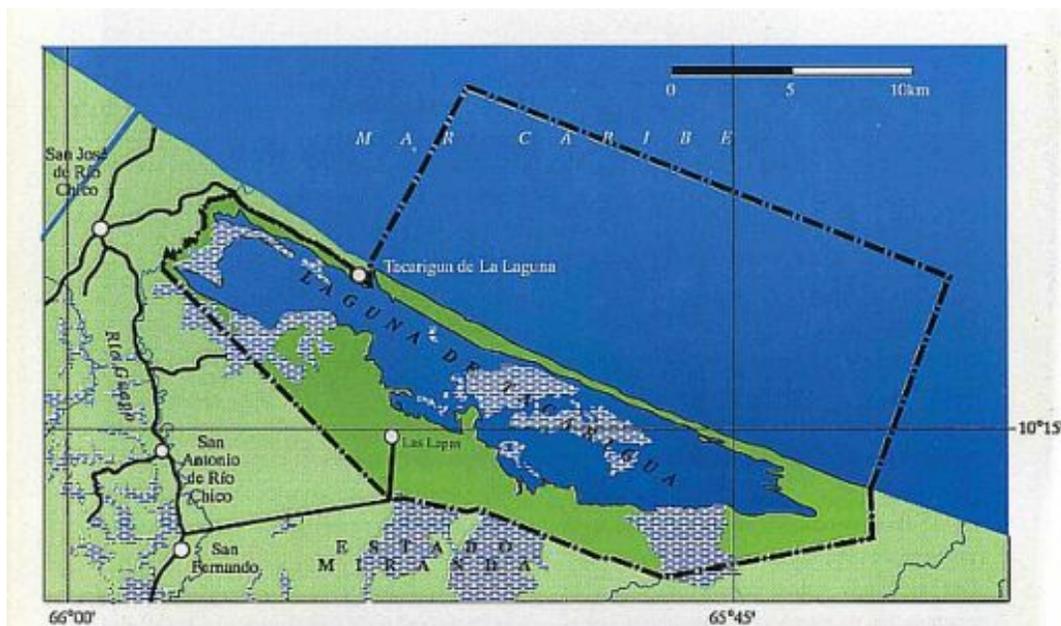
## Description

### *Physical description*

Tacarigua Lagoon National Park is found in Miranda State in north-central Venezuela between 10°11'30" and 10°20'20" north latitude and 65°41'10" and 65°57'20" west longitude. It spans a 7,800 ha permanent coastal lagoon with a 1.2 m average depth. This lagoon is separated from the ocean by a 28.8 km long and 300-1000 m

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wide shoal created by the east-west coastal current found here. An area dominated by dry tropical forest is found south of the lagoon, while to the north there is a 20,700 ha marine area. Altogether, the park covers 39,100 ha. Mangrove forests that grow on the shores and form dense islands in the lagoon cover approximately 4,000 ha of the park. The lagoon's main fresh water source is the Guapo River, although the Pirital, San Nicolás, San Ignacio canals and the Chaguaramal stream also drain into it. A mouth in the lagoon's northwestern sector connects the ocean with the lagoon. When the Guapo River watershed goes through intense droughts, the decrease in fresh water input and silt accumulation cause the obstruction of this mouth. Hence, the lagoon's water salinity increases.



Map of Laguna de Tacarigua National Park. Modified from INPARQUES (1992).

The lagoon's geological origin is relatively recent. The park and its surroundings are included in the Barlovento depression. This depression is a flood plain created in the past two to four million years with deposits coming from the central mountain range. The shoal, which separates the ocean from the lagoon, originated during the Caribbean transgression in the Holocene and sand deposition continues today. Tacarigua Lagoon is part of a coastal lagoon system that also includes the Unare and Píritu lagoons.



Satellite image of Tacarigua lagoon. Towards the northeastern sector there is a mouth that connects the ocean

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with the lagoon. The Guapo dam is located south of the lagoon. In light blue is the silt that results from the erosion of the coast (PDVSA 1992).

The park's climate is warm and humid with an average annual temperature of 26 °C (between 24.8 and 27.5 °C) and an average annual rainfall of 1,000 mm. Climate is bi-seasonal with a rainy season from June to December when 85% of the annual rainfall is observed. November is the rainiest month (165.5 mm) and March the driest (14.5 mm). The park is strongly influenced by the northeastern trade winds because of its location and orientation (285°) (Conde 1996).

In 1996, this wetland was declared a Ramsar site because of its extraordinary importance as a reserve for food resources and biodiversity.

### Biodiversity

The park includes three mayor ecosystems: a shallow brackish lagoon, a tropical dry forest area and a shoal. Tacarigua Lagoon is one of the most productive estuaries on the Venezuelan coast (Cressa et al. 1993). It is dominated by mangrove forests where four of the country's seven species can be found. *Avicenia nitida* is found in more stable and less flooded areas, *Conocarpus erectus* grows in sandy areas, *Rhizophora mangle* on the borders of the lagoon and *Laguncularia racemosa* can be found in both types of terrain (Álvarez 1996a). *Rhizophora mangle* is the dominant species covering up to 70% of the mangrove forest (Conde 1996).



*The park has a great diversity of ecosystems in an area of 30,100 ha.*

In the flood plains south of the lagoon, the dry forests are secondary growth forests with a canopy height of 10 to 12 meters and emergent trees of up to 20 meters. Some of the species found are the trumpet tree (*Cecropia peltata*), possumwood (*Hura crepitans*), pink tacoma (*Tabebuia rosea*), western soapberry (*Sapindus saponaria*), *Bauhinia megalandra*, *Bourreria cumanaensis*, *Caliandra caracasana*, *Cassia marginata*, *Inga punctata*, *Acacia micrantha*, *Thiriphasia trifolia*, *Spondia mombin* and *Crescentia cujete* among others (Álvarez 1996a). Grasses are the dominant vegetation in the Madre Casañas sector. Sandbar vegetation is mostly composed of halophilous grasses like marsh grass (*Sporobolus virginicus*), beach carpetweed (*Phloxeris vermicularis*) and saltwort (*Batis maritima*), along with shrubs like the beach grape (*Cocoloba uvifera*) and milo (*Thespecia populnea*), and coconut palms (*Cocos nucifera*) (Álvarez 1996a).

Four species of sea turtles nest in Tacarigua Lagoon: *Chelonia mydas*, *Caretta caretta*, *Dermochelys coriacea*, and *Eretmochelys imbricata* (Álvarez 1996a). According to IUCN criteria, the first two are globally threatened

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(EN A1abd), and the latter two are critically threatened with extinction (CR A1abd, CR A1abd+2bcd). The American crocodile (*Crocodylus acutus*) is also in danger of extinction (Rodríguez & Rojas-Suárez 1999). In the park's Integral Protection Zones (Puerto Escondido and Pirital, San Ignacio and San Nicolás canals), this species can be found in densities of up to 6 individuals per hectare, and populations are growing. This makes Tacarigua Lagoon the most important American crocodile refuge in the country (Alfredo Arteaga, pers. comm.). Another 15 reptile and amphibians, 52 fish, 17 crustacean and four mollusk species have been reported (Lentino & Bruni 1994).



*The park is a refuge for the American crocodile (*Crocodylus acutus*) and as a nesting site for *Dermochelys coriacea* and other three marine turtle species.*

Lentino (1990) documented 136 bird species of which 35 are migratory, 80 are resident species and 20 are regular visitors to the area. A recent unpublished report by the ornithologist Gustavo Jimenez increases this number to 212 bird species. Waterfowl are common, including herons, ibis, seagulls, terns, shorebirds, flamingos and pelicans, although in the forest there are a large variety of songbirds. Several species that are considered vulnerable in the Red Book of Venezuelan Fauna (Rodríguez & Rojas-Suárez 1999), inhabit the park. Among them are the clapper rail (*Rallus longirostris*), the scarlet macaw (*Ara macao*), the greater flamingo (*Phoenicopterus ruber*) and the rusty-flanked crane (*Laterallus levraudi*), the latter being endemic to Venezuela. The yellow-knobbed curassow (*Crax daubentoni*) globally classified under low extinction risk (LR/nt), can also be found. In 1984, Lentino (1990) estimated a population of 2,500 flamingos, although with no sign of reproductive activity. Nevertheless, park guards report seeing flamingo nests in the past three years.

Over 20 mammal species can be found in the park (Boede 1982). Among them are the red brocket deer (*Mazama americana*), fishing bat (*Noctilio leporinus*), crab eating racoon (*Procyon cancrivorus*), wedge-capped capuchin (*Cebus olivaceus*) red howler monkey (*Alouatta seniculus*), the largest rodent in the world, the capybara (*Hydrochoerus hydrochaeris*) and the ocelot (*Leopardus pardalis*) that is considered vulnerable to extinction (Rodríguez & Rojas-Suárez 1999). The bush dog (*Speothos venaticus*), classified as vulnerable, has been seen close to the park limits (Rodríguez & Rojas-Suárez 1999), hence might also inhabit the park.

### Management

The National Parks Institute (INPARQUES) is in charge of the park's management and administration. Since 1991 this park has a management plan in which the following seven management zones are outlined:

- **Integral Protection Zone:** Access is restricted and only INPARQUES supervised monitoring and research projects are allowed. In Tacarigua Lagoon this zone includes Las Lapas and Caño San Nicolás sectors, Manatí mangrove forest, Caño Obispo and its mangrove forest and a seasonal integral protection zone on the shoal, where sea turtle nesting occurs. From May to October this beach is an integral

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protection zone, the rest of the year it is managed as a primitive zone.

- **Primitive Zone:** Includes Caño El Mono lagoon and navigation canals, the sandbar's seasonal primitive zone, and all mangrove areas of the lagoon (except those which are classified as an integral protection zone).
- **Managed Natural Environment Zone:** Includes the lagoon's body of water (except the area included in other zones), the sector of the sandbar that extends south of the coconut palms to the edge of the lagoon and the marine area of the park. Recreational activities and traditional methods of fishing are allowed, but are regulated.
- **Natural Recovery Zone:** Made up of three sectors that were affected by human activities before the area was declared a national park and are in need of restoration.
- **Recreation Zone:** Includes a sector of the shoal that is close to the mouth of the lagoon and certain areas around INPARQUES' offices.
- **Service Zone:** Contains an area east of the shoal and lagoon with infrastructure for tourism, and Las Lapas town towards the south of the park.
- **Special Use Zone:** Includes the Club Miami tourist lodge, a 50 m wide by 350 m long sector of the shoal that was developed before the park decree. Its recreational use is limited to the months of November through April when sea turtles are not nesting.
- **Buffer Zone:** Made up of a 400 m long and 150 m wide strip between La Porfía and El Botalón sectors in order to buffer the effect of human activities close to the park.

The Park's management plan regulates access to the park, boat use, recreational and tourism activities (including sport fishing), research, traditional fishing methods using nets and solid waste disposal in the park. Access of commercial fishing boats to the marine zone is strictly prohibited. Traditional fishing regulations and harvestable species are clearly outlined.

The park has 21 park guards that take care of vigilance, education and crocodile and sea turtle nest monitoring. Eight people are in charge of administrative duties and another two of cleaning. For the past eight years a volunteer brigade of young park guards has existed. Today, it has integrated 46 school children between the ages of 7 and 16 who help guard and monitor wildlife.



*A volunteer brigade of young park guards helps guarding and monitoring wildlife and it works as an educative tool in the surrounding villages*

Presently, the park has very good facilities, among which are five guard posts spread out over the land perimeter. Administrative headquarters is in a two-floor building with sleeping quarters, a library, an information center, a telecommunications center and the young park guards meeting center. Each park guard

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has a radio and there is audiovisual equipment for environmental education activities. However, the number of vehicles is insufficient. There are two four-wheel drive vehicles, one of which was rendered useless in 1999 due to engine trouble. There are two 25 hp outboard motors and only two out of the four aluminum boats work. A seven-meter fiberglass boat with two 40 hp motors is not working either. There is a mountain bike used to monitor the beach. Important liaisons for lagoon vigilance have been made with Miranda Marine Police, and they patrol the area every night. Likewise, the Municipal Police arrest wildlife smugglers and confiscated animals are handed over to INPARQUES.



*Although there is good infrastructure, the park does not have enough vehicles for transportation. This vehicle is out of service since 1999.*



### *Human Influence*

Tacarigua Lagoon is in an area of intense tourism, fishing and agricultural development. The park is surrounded by the towns of Machurucuto (4 km), El Guapo (12 km), and Río Chico (3 km), while the town of Tacarigua de la Laguna is close to the main entrance. During the 1980's there was a great deal of development in tourism and recreational infrastructure. This led to the construction of a number of hotels and recreational facilities close to the park. However, the small hotels and tourist facilities on the sandbar, presently part of the national park, had already been built by the 50's. At present, very few visitors come to these hotels and their activities are regulated by park authorities. Most of the park's problems are related to the intense human activity in the surrounding areas.

### Park inhabitants

There were only two small human settlements inside the park when it was created. During the 1980's, one of these was entirely relocated and inhabitants were paid for their homes. The other small settlement of Las Lapas, with only 15 homes and 46 inhabitants (OCEI 1994), was never relocated and is still within the national park. Fishing and coconut farming are the main economic activities in Las Lapas. The park guards believe that because of the aid given to the people of this community by INPARQUES during the catastrophic floods of 1999, relations with them have improved substantially. In order to find solutions to the park's environmental problems, the current coordinator has maintained close relations with the people from Las Lapas and Tacarigua de la Laguna since April of 2002. Aside from the people of Las Lapas, there are four summer homes on the sandbar that are occasionally occupied by their owners. These homeowners have not received offers from INPARQUES to buy their properties.

### Fishing

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Fishing is the main economic activity of the town of Tacarigua. The park's lagoon has always been the most important fishing site. Between 1975 and 1982 the mean annual harvest was 383,282 kg, however, productions of over a million kilograms have been reported (Conde 1996). In the year 2000, 1,046,164 kg of fish and crustaceans were harvested. The species with the most demand were mullet (*Mugil lisa*), white mullet (*Mugil curema* and *M. brasiliensis*), the common, swordspine, fat and tarpon snooks (*Centropomus undecimalis*, *C. ensiferus*, *C. paralellus* and *C. pectinatus*) and the blue land crab and mangrove tree crab (*Cardisoma guanhumi*, *Aratus pisonii*) (Espinoza 2001). In 2000 fishing revenues were Bs 950,932,400 (US\$ 1,293,785) (Espinoza 2001). The park's code of use describes all regulations that pertain to the traditional method of fishing in the lagoon, the permitted methods and harvestable species. Fishing is affected by the changes to the lagoon's physical and chemical characteristics caused by the periodic closure of the mouth. Fish die and capture rate decreases when the mouth closes. Under these conditions, fishermen resort to methods of mass extraction like gillnets, which are illegal.



*The main economic activity of the surrounding villages is traditional fishing with thrownets. Fishing with gillnets is forbidden inside of the park.*

### Tourism

Boating through winding mangrove canals, enjoying the broad tropical beach, bird watching and observing traditional fishermen are among the park's mayor ecotourism attractions. However, tourism has not been developed in the park and is almost non-existent. In the year 2000, the park received 4,751 visitors, 461 of which were foreigners. In the previous two years, the park had over 6,000 tourists mainly over the Easter holiday and school breaks in August and December. Most visitors are beach goers; they stay in one of the five hotels built before the 50's that still operate in the park. Club Miami, a modest two-floor building with ten rooms, is the hotel with the most visitors. The entrance fee to the park is Bs 500 (US\$ 0.50) for adults and Bs 250 (US\$ 0.25) for children. From 1997 to 2000, money received from entrance fees barely amounts to Bs 10,000,000 (US\$ 10,000). There is a dock in the park where you can take a boat for a ride or to go sport fishing in the lagoon. Four local tourist operators offer this service, and each of them has four boats. Park authorities regulate the cost of these boat trips and they range from Bs 20,000-30,000 (US\$ 20-30). Sport fishing is permitted inside the park and it has recently attracted more anglers. The potential the park has for sport fishing should be developed as a source of income. Unfortunately, this activity has not been promoted, even though it is duly addressed in the park's management plan.

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*The park has a great potential for ecotourism, but it is visited by less than 1,000 people a year. Club Miami was built in the fifties and it is still open. The presence of infrastructure would facilitate an ecotourism program.*

### *Conservation and research*

Beginning back in the 1940's, the park has been a popular site for research activities. Most of these projects have pertained to geology, geomorphology, sedimentology, fishery science, limnology and wildlife inventories. However, these studies have not been comprehensive and so there still exist many gaps in information about Tacarigua (Conde 1996).

Professor Chacartegui, of the Venezuelan Sedimentology Association is the author of a sedimentation study of the lagoon and conducts annual research expeditions to the lagoon. The Universidad Central de Venezuela Tropical Zoology Institute takes student groups to the lagoon to monitor water quality.

The National Park System Monitoring Handbook was published in 1998 with sponsorship from Econatura, the Wildlife Conservation Society (WCS) and the European Commission. The wildlife monitoring part of the handbook was inspired by an experience in Tacarigua Lagoon where park guards were trained on measuring simple indicators of the environmental quality of the park.

Alfredo Arteaga has studied the American crocodile for the past 10 years and his results indicate that the park harbors one of the country's most important crocodile populations. Abundance was estimated in many areas of the park by nocturnal and diurnal surveys. Nesting activity was followed, the effects of human and natural predation were studied, and juvenile and adult mortality together with their causes was quantified. Research was carried out with support and participation from the Foundation for the Defense of Nature (FUDENA), INPARQUES, Club Miami and WCS.

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During the last decade, the Econatura association has financed six projects on such subjects as plankton taxonomy, bacterial characterization of the lagoon, and the use of birds as environmental quality indicators. In order to stimulate a conservationist attitude among inhabitants and visitors, the environmental organization Provita recently developed an environmental education outreach campaign in the town of Tacarigua de la Laguna. Provita also carries out a sea turtle conservation program in the Barlovento region that includes the national park.

Since the tragic floods of 1999, many international organizations have carried out programs to improve environmental health and reduce the risk of contamination and disease. Among these are the Agencia Italiana de Cooperación Internacional, the Comité Internacional para el Desarrollo de los Pueblos (CISP) and the United Nations Program for Development (PNUD). To accomplish their goals they have restored drainage canals and collected waste and rubble left by the massive floods. The European organizations have promoted information and awareness campaigns for adequate solid and liquid waste management in many communities. They have also financed dredging and cleaning of drainage canals with support from the communities of Las Lapas and Tacarigua de la Laguna.

### **Threats**

Many problems threaten biological diversity conservation in Tacarigua Lagoon National Park. The level and seriousness of these threats has been controlled somewhat by the strengths of the park: good facilities and ample and excellent personnel. Of all the parks visited by ParksWatch-Venezuela, Tacarigua Lagoon is the only one where we observed wildlife monitoring activities or educational programs like the young park guards. However, a great number of environmental problems that originate outside of the park and affect the park's ecosystem could get worse in the near future. For this reason we have classified the park's conservation status as vulnerable. It is necessary to recognize those problems that originate outside of park boundaries and can change the park status if left unresolved. The primary threats are:

- Sedimentation
- Solid waste contamination
- Water contamination
- Illegal fishing
- Poaching
- Forest fires

### ***Current Threats***

#### ***Sedimentation***

Due to the geological characteristics of the lagoon and its surroundings, this landscape is continually changing because of the accumulation of sediments coming from the coastal mountain range. This natural process has accelerated because deforestation and subsequent erosion of tributary watersheds have increased the amount of sediment discharged into the lagoon. The Madre Casañas canal was built in 1963 to divert the Guapo River towards the lagoon, which increased sediment discharge. Present day sediment discharge of rivers is 150 m<sup>3</sup>/year, while the oceans discharge reaches 3x10<sup>6</sup> m<sup>3</sup>/year (Conde 1996). About 300 ha of the lagoon had disappeared by 1975 due to the formation of a delta in the Madre Casañas outlet. This delta grows 1 km per year (Lentino & Bruni 1994, Conde 1996). The natural tragedy that produced massive landslides on the coastal mountain range during December 1999 (see El Ávila National Park profile), destroyed El Guapo dam, an entire forest, many human settlements and huge amounts of sediment that all ended up in the lagoon. The lagoon's average depth has decreased from about seven meters in the beginning of the twentieth century to less than two meters today, because of the accumulation of marine and fluvial sediments (Conde 1996). The mouth's natural

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closing cycle has been disturbed and in recent years it has closed more often, producing floods and other ecological disasters. Since closing of the mouth increases the lagoon's salinity, it produces changes in the lagoon's ecology. The accelerated increase in sedimentation is one of the park's most serious and complex threats.



*Aerial view of the mouth of the lagoon when is open(upper left). A sand delta and silt can be observed. To the left is Tacarigua village located outside of the park. When the mouth of the lagoon is closed, vehicles are able to access the protected beach.*

### ***Solid waste contamination***

Even though the lagoon is almost entirely free of solid waste, the beach north of the lagoon is seriously contaminated. Most of the waste is plastic and tree trunks carried by the ocean and left on the beach by the tide. The presence of such waste is an important problem because it restricts beach access to the four sea turtles species that nest here. The lagoon mouth is also highly contaminated by solid waste that comes mostly from the rivers or canals that empty in the lagoon.

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*Accumulation of garbage on the park's beaches. The majority of garbage is brought by the sea to the beach but it accumulates as a result of the lack of maintenance.*

### ***Water contamination***

Surrounding the park are many towns with high tourist influx and recreational hotel complexes. Apparently, hotels do not have adequate treatment facilities for wastewater; it is dumped into El Burro canal, a small brook that flows out to the sea through the mouth of Tacarigua Lagoon. The untreated waters of Tacarigua and nearby neighborhoods are also dumped into this brook. Water quality sampling of this brook, provided by the Ministry of the Environment's Department of Water Quality, indicate bacterial and coliform bacteria densities of up to 16,000 for every 100 ml. This is over three times the limit considered intolerable by law. Similar results have been found in other brooks that end in the lagoon like Pirital and Madre Casañas, and in treatment plants of several hotels and nearby factories. The ocean water from beaches far from the lagoon's mouth were not contaminated, not even the busiest ones.

### ***Illegal fishing***

Small-scale traditional fishing with thrownets is allowed inside the park. Nevertheless, many fishers use illegal gillnets that catch enormous amounts of fish irrespective of size or species with little effort. Illegal fishing is very frequent and represents the most serious problem for administrators. In 1996, 23 illegal fishermen were arrested and seven illegal fishing criminal reports were filed (Álvarez 1996b). Presently, approximately 60 gillnets are confiscated each month by police authorities and park guards. Some species are threatened with extinction due to overfishing. The lagoon use to harbor oysters like the pearl oyster (*Pinctada imbricata*), arkshell or turkey wing (*Arca zebra*) and the mangrove oyster (*Crassostrea rhizophorae*). Overharvesting has wiped out these species, a common case in other mayor tourist areas (Rodríguez & Rojas-Suárez 1999). Police officials and park guards believe that illegal fishing is related to a serious drug consumption problem in the town of Tacarigua. Apparently, some addicts resort to illegal fishing to pay off their drug consumption.

### ***Poaching***

The park's protected woodland area has become much like a wildlife refuge due to intense fragmentation and destruction of forests surrounding the park. Town inhabitants take advantage of the forest and the relative ease with which some game species are found. The extraction of wildlife is done not only for subsistence purposes but also for commerce. Even though birds are the most affected by wildlife smuggling, some mammals like three-toed sloths (*Bradypus variegatus*), wedge-capped capuchin monkeys (*Cebus olivaceus*) and red howler monkeys (*Alouatta seniculus*) are also targeted. During our visit, ParksWatch-Venezuela saw the Municipal Police hand over to INPARQUES two troupials (*Icterus icterus*) that were confiscated from a local wildlife smuggler. We also saw three red howler monkeys that were being kept in park facilities. There is also a high

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capture of blue land crabs (*Cardisoma guanhumi*) for commercial purposes. Police authorities informed us that over 3,000 crab trapping cages have been confiscated this year. There is a certain level of sea turtle and crocodile nest poaching although it is not as widespread as in other places.



A howler monkey (*Alouatta seniculus*) recently confiscated to fauna smugglers

### ***Forest fires***

Forest fires are relatively frequent to the south of the park. Dry forests with a certain level of intervention and a large portion of savannas dominate this area. Fires are caused mostly by agricultural activity in farms outside of the park. However, they have begun to affect Tacarigua Lagoon forests and savannas. Even though forest fires are not as serious a problem as in other national parks, this park does not have all the equipment needed to fight them.

### ***Future Threats***

#### ***Disturbance of the lagoon's ecological cycle***

Environmental degradation of the park's surroundings has caused important changes in the lagoon's ecological dynamics. Changes in the lagoon's hydrologic regime date back to the 1940's when the course of the Cúpira River was changed. This river flowed into the east of the lagoon and was its mayor source of fresh water. In the 1960's, when the Guapo River's course was diverted towards the lagoon and erosion in other tributaries increased, sediment discharge towards the mouth increased and the lagoon's depth decreased and its evaporation, salinity and temperature increased. These problems are magnified whenever the mouth closes, which is occurring more frequently. Regardless of how much is invested in park's management and care, while surrounding environmental problems are not dealt with, the park will continue to be degraded.

Overfishing and physical, chemical and biological changes in the lagoon have caused a decrease in fishery production. Because of this, many fishermen from local communities have proposed introducing certain fish species into the lagoon. This idea is supported by townspeople, and promoted by certain politicians with ties to municipal and state government. However, proponents of the plan have ignored the legal regulations and ecological consequences of such a decision. INPARQUES personnel do not seem to support the idea. Regardless, any decision made without first conducting adequate studies on ecologic and economic

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ramifications, could easily backfire and add to the park's degradation, instead of solving any problems.

### *Sea turtle nest destruction*

Even though turtle nests are well protected and monitored, some degree of accidental destruction occurs when people drive their vehicles on the nesting beach when the mouth is closed. During the day, there is a certain amount of vigilance, however, many vehicles access the beach at night. ParksWatch-Venezuela witnessed two vehicles that drove at night at least 7 km down the beach from the mouth of the lagoon. Because the lagoon mouth is closing more often and for longer periods of time, vehicles on the beach may become a more significant threat to sea turtles in the near future.



*Vehicle tracks in the surroundings of Club Miami. Vehicle transit is more frequent every day and it represents a threat to turtle nests.*

## **Recommended Solutions**

### *Current Threats*

#### ***Sedimentation***

Sedimentation is a complex problem that can be solved by attacking environmental problems in the areas surrounding the park. The most important and noteworthy consequence of this problem is the increasing frequency with which the lagoon's mouth closes. The ultimate solution would be to close the Madre Casañas canal that was used to change the course of the Guapo River. Since this solution is not feasible, other alternatives that tend to reestablish the water's original course should be considered. Dredging the mouth has been proposed as a solution many times. Nevertheless, dredging must be periodic otherwise wave action from the ocean would tend to fill the mouth with what was removed. Another solution would be the construction of jetties outside the mouth to reduce silt accumulation and periodically eliminate sediment deposited on the inside. In order to reduce settling of suspended matter, mangroves must be trimmed in a controlled fashion. This will keep the lagoon's waterways and natural drainage canals open helping water circulation, and will control the growth of islands. Experts on the subject must be called in to evaluate possible solutions to this problem and an agreement with the Fluid Mechanics Institute should be renewed. This institute recently received funding from the Ministry of Science and Technology in order to solve problems related to the natural tragedy of 1999.

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### ***Solid waste contamination***

There are few places to dump waste in the park and its surroundings. A cheap way of reducing solid waste at the lagoon mouth is to increase the number of garbage containers and carry out cleaning campaigns with people from Tacarigua. Every year on World Beach Day, Fudena organizes a beach cleaning campaign. During high tourist season, the Miranda State Government also gets together volunteers for clean up. It is possible to take advantage of the local government's interest in such events to organize cleaning campaigns more frequently with a larger number of volunteer personnel, perhaps with help from environmental organizations and local businesses.

### ***Water contamination***

Water quality is monitored every year by university researchers or the Ministry of the Environment. However, hotels and nearby businesses are not adequately treating their wastewater, and furthermore, they are not being sanctioned according to the Penal Law of the Environment. Law enforcement must be improved. To accomplish this there must be lawyers and judges in the region familiar with environmental legislation and cooperation from the government's environmental agencies.

### ***Illegal fishing and poaching***

Settlers must be offered better economic alternatives in order to solve illegal fishing and poaching. Environmental education and self-regulation will probably not solve this problem. The presently undeveloped tourist industry might be an alternative. The park's untapped potential for bird watching and sport fishing may represent an escape from the use of gillnets for commercial extraction. To develop nature oriented tourist attractions in the beach zone, cooperative plans between the Miranda State Government and the Club Miami owner, for example, can be developed. Guided visits to sea turtle nests, bird watching excursions and crocodile observation are some activities that can be developed with INPARQUES. Additionally, the local government is building the Miranda Marine Museum close to the park. This museum is an important tourist attraction that will generate jobs for locals and serve as an educational forum. There is a similar museum in Margarita Island, sponsored by the Polar Foundation.

### ***Forest fires***

The park's forest fire fighting capacity must be improved. INPARQUES can take advantage of the fact that there is no fire station in the area to ask the local government for a forest fire brigade. This brigade would serve the park as well as local agricultural communities. Another possible funding source for this is the United Nations Program for Development (UNDP), which funds other projects in the area. The creation of a forest fire brigade might also improve relations with the community.

### ***Future Threats***

#### ***Ecological cycle disturbance***

Long-term hydrology and sedimentology studies of the lagoon should be encouraged, as should research of commercial fish species' biology and ecology. Monitoring programs in the park should be strengthened and research in ecology, ecologic economy, fishery science, agronomy, tourism and sustainable development should be promoted. The only way to find solutions to external problems that affect the park is by knowing the socio-economic and ecologic dynamics of the region.

#### ***Sea turtle nest destruction***

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Presently, INPARQUES' guards posted at the lagoon mouth, control vehicle access to the beach. Drivers are stopped and informed about the reasons for restricted access. Children from the young park guards do most of this work with assistance from adult guards. The post is kept all day, however at night the beach is unprotected. The construction of a permanent post with personnel on watch throughout the night is necessary. Also, a gate to prevent vehicle access should be built.

### **Conclusions**

Tacarigua Lagoon National Park has devoted and capable employees, as well as strong, strategic alliances with official agencies like the Municipal Police and the Miranda State Government. In addition, programs like the young park guards help solve present and future environmental awareness problems, and strengthen relations with local communities. However, the presence of threats like accelerated sedimentation, illegal fishing and contamination threaten the fulfillment of the park's objectives. Because most of these threats originate outside of the park, and there is great potential for solving them, we have classified the park as vulnerable. We encourage the government to support immediate studies to solve the sedimentation problem and the changes in the lagoon's hydrological cycle. It is also necessary to support programs like the young park guards, and to begin taking advantage of the park's huge potential for ecotourism.

### **Links**

[Venezuelan Sedimentology Association](#)

[Fudena](#)

[INPARQUES](#)

[Wildlife Conservation Society](#)

[Provita](#)

[Agencia Italiana de Cooperación Internacional](#)

[Comité Internacional para el Desarrollo de los Pueblos \(CISP\)](#)

[The United Nations Program for Development \(PNUD\)](#)

[Fluid Mechanics Institute](#)

[Polar Foundation](#)

[Red List of the UICN of Endangered Species](#)

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