Morrocoy National Park Report
State of Environment, Projects and Stakeholders Analysis

Report prepared as a voluntary work for Europäisch- Karibische Gesellschaft e.V. (EKG Association), Konstanz.

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Preface

This report was written as an initial step to explore the potential of Morrocoy National Park on the subject of environmental management in association with the NGO Europäisch- Karibische Gesellschaft e.v. – EKG. In order to carry out a general evaluation of this protected area, an internet research was performed, and also a compilation of bibliographic material from different stakeholders linked to the environmental and conservation activities in Morrocoy. Prior the completion of this document various institutions were contacted with the purpose of coordinating meetings with the representative of EKG. A number of organizations’ members were particularly helpful in the process of assembling information, these were: INTECMAR, FUDENA, La Tortuga Foundation, and CIMAR. The first institution facilitated a wide and relevant document called “Agenda Morrocoy”, which is a piece of work from the association of different institutions in Venezuela, and it was one of the most important sources of information for this report. On the other hand the other organizations collaborated providing information through electronic correspondence and sending diverse bibliographic sources.

The following document seeks to raise the level of awareness in the international community concerning the current state of environment in Morrocoy National Park, and to make the information available for a wider audience outside Venezuela such as international NGOs, academic institutions, research institutes as well as investors that might be interested to gain knowledge about what has been done in Morrocoy, its limitations regarding public governance, and its potential as a tourist destination. The ultimate goal will require subsequent research and efforts from local organizations, and it is to activate a functioning network amid the stakeholders; public, private and independent organizations involved in the national park’s management to collaborate and pursue sustainability in Morrocoy.
Introduction

In the recent past, the management of national parks in Venezuela has been characterized by the lack of monitoring and control of protected areas, outdated legislation and unrealistic sanctions for those who breach the law. Besides, other factors such as scarce information available, combined with the disinterest of citizens, these have led to environmental problems such as high level of soil, water and air pollution.

Venezuela is one of the top ten most biodiverse countries in the world (The Nature Conservancy [TNC], 2007), its protected areas represent 15% of the national territory, and the marine protected areas represent 4.3% (TNC, 2007). Lately, some organizations such as research institutions, universities, public institutions and foundations in pro of conservation have actively recognized the necessity to modify the management of these protected areas. Nevertheless, the importance of institutional capacity and cooperation between different types of agencies is essential to improve the state of environment in locations such as Morrocoy National Park.

Morrocoy has presented severe environmental negative impacts resulting, for instance, in the depletion of the marine ecosystems’ health. Amongst the environmental aspects existing in Morrocoy there is effluents (lack of sewage systems), pesticide discharges, increment of the sedimentation rate, unsustainable tourism practices in the different basins’ upstream (Ministry of the Popular Power for the Environment [MPPE], 2011). This report aims to compile and proportionate the most updated information available concerning the current factors influencing the environmental conditions in the Morrocoy National Park, as an initial step to fill the knowledge gap regarding the state of environment in this protected area.
1 Brief Characterization of Morrocoy

Morrocoy National Park was declared by the Decree °113 on May 26th of 1974. Later on, the territory of the park was extended by the Decree °944 in the year 1975; in addition, the territorial planning document was created in May of 1995 (INPARQUES, 2011). Besides this legislative mandate, within Morrocoy there is another legal entity; it was declared as a protected area called Cuare Wildlife Refuge in 1972, and it became a part of the RAMSAR Convention on Wetlands in 1988, with 99.68 km² (Secretariat of the Convention on Wetlands, 2011). In image 1, the map of: Venezuela, Falcón State, and Morrocoy National Park with its islets is illustrated.


This park is located in the west coast of Falcón State, Venezuela; its geographic location is 10°52’N, 69°16’W, and its land area is 320.9 Km² (INPARQUES, 2011). Morrocoy is one of the nine national marine protected areas, and it represents the coastal marine zone most complex and relevant in the country (Bone et al. 2005). Among other aspects, 52% of the park is composed by the marine area, 42% by a continental sector and 6% of Morrocoy is composed by islets or cayos (cays) (BRV Government online official website, 2011). The Park is also situated in the “Triste”
Gulf central region, within the Bonaire basin, which is composed by the Falcón, Yaracuy, and part of Carabobo and Aragua States (Almarza, 1997).

1.1 Climate
The climate is characterized by an average media temperature of 27.2°C, being 22°C the minimum and 29°C maximum, the rainfall is scarce (VenezuelaTuya, 2011). The wet season (winter) starts between the month of June-July, and lasts until December, as well as the dried season begins in the end of December until May. The precipitation mean annual value is 1 213 mm (Bone and Vieitiz, 2002). The area of the national park is influenced by the trade winds from the Northeast to Southwest course within the period between December and April; the average speed of the wind is 4.4 m/s (Bone et al., 2005).

Concerning the hydrodynamics of Morrocoy, it is relevant to mention the existence of five different marine currents in the park, classified by zones, nonetheless, for the purpose of this paper, the zone “B” which is the “Ensenada de Morrocoy” will be described. The current simulates an equilateral triangle, and its northern limit is the Chichiriviche hill; the east-southeast of the current limits with the Boca Seca cay, and a mangrove area in the west. The main quantity of water provided in the current zone is almost entirely oceanic (Bone et al. 2005). The area of this current zone is 15 km2, with an east-west axis of 5.3 kilometers and 4.4 km from north-south (Bone et al 2005).

The importance of these currents is because of the large volume of water exchange among the diverse sectors, stabilizing the temperature and nutrients; these are environmental indicators of the health of the existing marine ecosystems in the park, nevertheless, the Morrocoy water seems to be poor in nutrients and with a propensity to be oligotrophic. In regards to the water temperature, it varies from 38°C (Cuare Gulf) to 20.3°C (Las Luisas), with a considerable annual variation of 18°C (Bone et al 2005). The salinity also substantially differs; the minimum value is 3‰ and the maximum 42‰, thus these values can change from high salt content waters to brackish waters, in the same way, the oxygen content also differs,
nevertheless the average value is 5.57±1.04 mg/l, and the pH of the waters is stable with a slight tendency to alkaline values (Bone et al. 2005). In addition, the content of the effluents from the different communities negatively affect the water quality of the Cuare Gulf, varying from sewage, heavy metals, suspended solid particles and pathogens bacteria from faecal matter (Chirinos, 2011).

1.2 Geophysical characteristics
The majority of the National Park belongs to the quaternary/recent Pleistocene geological period. There are three different landscapes and marine physical elements that prevail in the park. The first is the continental zone, which is characterized by the presence of the karstic hills of Chichiriviche (altitude of 285 m.a.s.l); the second one is the mangrove in the coastal frontiers and lagoons, and the third is the shoal and sandbars in the islets and cays, additionally to the coral reefs in the seabed with *thalassia* meadows (Venezuelatuya, 2011).

In consonance with Bone et al. (no dated paper) “The gulf lies south of the Bonaire trench, the central region of the Venezuelan Basin, and is the submerged part of an extensive sedimentary deltaic-alluvial plain resulting from sediment dispersal by the Yaracuy and Aroa Rivers” (Bone et al., n.d). The most relevant cays and their characteristics will be described in the subsequent section (2.3), nevertheless, it is important to mention that in the last decade it was observed the progressive sinking, and in the current time the Pelón Cay is covered by water. This was affirmed by various NGOs members in the region, by locals and visitors (Chirinos, 2011).

1.3 Ecosystems and biodiversity
Morrocoy represents a conglomerate of heterogeneous marine ecosystems, as the physical characteristics previously mentioned before. The existing ecosystems are the following: semi-deciduous forests, grasslands, coastal sage scrub, xerophitic coastal forest, coastal mangroves, coral reefs and seagrass beds (BRV online Government official website, 2011). According to the Holdridge life zone classification system, the area of Morrocoy National Park is categorized in the dry tropical forest, as portrayed in figure 2.
Before going into details regarding the description of species in Morrocoy, it is relevant to highlight that Venezuela is the country occupying the seventh position worldwide of biodiversity with more than 137,141 species categorized within 1775 families of living organisms and 9,200 genera (Bone et al. 2005). Moreover, in the document “Agenda Morrocoy”, these authors reported 1,167 species in the National Park, from which 643 belong to the flora component and 524 categorized by fauna (Bone et al. 2005).

In reference to the vegetation (flora), 523 of the species are from marine ecosystems, and 120 species belong to the terrestrial environments. Concerning the latter categorization, it represents the 19% of the flora diversity in the park (terrestrial species); 92 of them are registered in the mainland, and 55 of the species reported in the islands or cays (Bone et al, 2005). Furthermore, Morrocoy embraces species related to the evergreen plants, such as the sp. *Caparis* and semi-deciduous species *Bursera simaruba*, commonly known as “Indio Desnudo” (BRVG, online Government official website, 2011). There are species which have a high rate of resilience to changes of salinity rate; an example of this is the *Batis maritima* and *Salicornia fruticosa*. 
In the east of Chichiriviche hill, at the Mayorquina sector, it can be found the xerophitic species from the cactaceae family such as *Opuntia Ficus*, and *Trichocereus pasacana*. Other vegetation species are such as: *Salicornia fruticosa*, *Sesuvium portulacastru*, *Coccoloba uvifera*, amongst the arboreal species. In the semi-deciduous forest, it is common to find the *Platymiscium diadelphum* (family of oak trees), (BRVG official website, 2011).

In respect to the marine species, 340 correspond to the phytoplankton and 183 to the algae and seagrass, which all together form 53% of the flora diversity of the national park. It was reported that the phytoplankton community is represented by 211 of diatoms, 102 of dinoflagellates, 19 toxic dinoflagellates, 5 cyanobacteria, 3 coccolithophores; *Spiniello and Arocha* (Bone et al. 2005). Concerning the algae, 46.6% were reported in the coral reef ecosystems, 18.09% in the seagrass environments, 10.47% attached to rocks, 14.76% en the mangrove roots, and 10% in sandy ecosystems (Bone et al. 2005). In regards to the mangroves, there are four reported species: *Rhizophora mangle* (commonly known as red mangrove), *Avicennia germinans* (Black mangrove), Lencularia racemosa (known as white mangrove) and *Conocarpues erectus* (“Botoncillo” mangrove) (INPARQUES, 2011).

The subaquatic vegetation is composed by the following species: *Thalassia testudinum*, which is the favourite feeding alga of the green turtles (*Chelonia mydas*). Also, there are certain endemic species such as *Justicia Falcónensis*, *Aspilia Falcónensis*, maritime *Phthiruse*, *Lorantaceae* and *Pitcairnia steyermarki*. These species have been subject of new discovery in the last decade by the different entities that have performed research projects in Morrocoy National park, and there have not yet been reported anywhere else worldwide (INPARQUES, 2011).

Concerning the fauna, there is a large range of species; nevertheless, in the research done by Bone et al. (2005), the species taken into account were the one
associated with the marine environment. Figure 1, illustrates the percentage of fauna species in Morrocoy. Concerning the coral reef species, the following were detected in the park: *Montastraea faveolata*, *M. cavernosa*, *M. franksi*, *M. annularis*, *Colpophyllia natans*, *Diploria strigosa*, *D. clivosa*, *D. labyrinthiformis*, *Porites astreoides*, *P. porites*, *Acropora palmata*, *A. cervicornis*, *Stephanocoenia intercepta*, *Madrcis decactis* y *Siderastrea sidereal* (MPPE, 2000).

![Figure 1. Percentage of marine fauna species in Morrocoy. Source: Modified from Bone et al. (2005).](image)

In another bibliographic source (INPARQUES, 2011), it was stated that in Morrocoy the existing class Aves is represented by the following species: *Pelecanus occidentalis*, *Pandion haliaetus*, *Phoenicopterus ruber*, *Eudocimus ruber* and *E. albus*, *Fragata magnificens*, *Phalacrocorax olivaceus*, *Crax pauxi*. In addition, there are 50 species of migratory birds that seasonally coexist with the rest of the communities, representing 78% of the migratory birds that can be found in the national territory. Among mammals, in the Chichiriviche Hill it can rarely be found two deer species (*Mazama Americana* and *Odocoileus virginianus*), a wild cat species (*Felis pardalis*), there are various species of Delphinidae in Morrocoy, as well as “araguato” monkey (*Alouatta seniculus*) (Venezuela Tuya official website, 2011). In addition, there are species such as the American crocodile (*Crocodylus*...
acutus), species of Chelonioida or marine turtles; Chelonia mydas, Eretmochelys imbricata, Dermochelys coriacea (Venezuela Tuya official website, 2011).

It is relevant to highlight that the different studies compiled in the document from Bone et al. (2005) are the results of joint sub-projects that the group of scientist elaborated, thus, there is an assumption that there could be more species that have not been taken into account in the projects, owing to the lack of information from the public agencies regarding the updated number of species of the National Park, thus, the work carried out by Bone et al. is tremendously valuable since a record of species is kept.
2 Economy of Falcón State: diversified but unsustainably planned

Falcón is the State with the most extended coastal area in Venezuela; this fact deeply influences its economy. On the other side, 90% of its soils have a low agriculture and forestry potential, and the hydrographic resources are concentrated in the “San Luis” mountain chain (Connatura, 2002). The population of Falcón is 760,335 (national census 2001). Moreover, 34% of Falcón’s territory is classified as protected areas, but it is visible the lack of integrated planning in order to preserve the fragile ecosystems in this State. The tourism industry does not strongly define policies which should promote the sustainable development of this sector; fact that needs to be addressed by many stakeholders, but primarily by the government. In this section, a brief summary of Falcón’s economy is shown, besides the importance of Morrocoy in the State economy.

2.1 Summary about Falcón’s economy

As Falcón has a large coastal extension, fishery is an important activity, with an annual production of 30,471 tons of fish and diverse seafood (crustacean, molluscs, and shellfish) (GBRV, 2011b). The major ports in the State are the following: Las Piedras, Carirubana, Puerto Cumarebo, Zazárída, Chichiriviche and La Vela de Coro, and in the Eastern Coast of Falcón there are 35 piers (CORFALTUR, 2011). Table 1 shows the different natural resources and existing products in Falcón; this data was taken from an official webpage from the Government, nevertheless, there is an absence of figures regarding the quantity and production rate of each sector.

Table 1. Natural Resources and products in Falcón State

<table>
<thead>
<tr>
<th>Sector</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fishery</td>
<td>Tuna, catfish, mako, Corocoro (<em>Haemulidae</em>), lisa (<em>Mugil Chelon labrosus</em>) crustaceans and molluscs</td>
</tr>
<tr>
<td>Agriculture and Livestock</td>
<td>Sugar cane, salt, coconut, corn, melon, ñame (<em>Colocasia esculenta</em>), sorgo (<em>Sorgohum vulgare Pers</em>) ocumo (<em>Xanthosoma Sagittifolium</em>), poultry, cattle, goats, porcine, and dairy products.</td>
</tr>
<tr>
<td>Forestry</td>
<td>Candelero (<em>Pinus sylvestris L</em>), cedro (<em>Cedrela angustifolia</em>), cuji (<em>Prosopis juliflora</em>), guamo (<em>Inga codonantha</em>), jabillo (<em>Hura crepitans</em>) y vera (<em>Aloe vera</em>).</td>
</tr>
<tr>
<td>Minerals</td>
<td>Sand, limestone, coal, chromite, gravel, phosphate rock, petroleum.</td>
</tr>
</tbody>
</table>

Source: modified from GBRV (2011b)
On the other hand, the most active area within the mineral sector (petroleum extraction) is the Peninsula of Paraguaná, where the refineries Amuay and Cardón can be found, being the largest refinery facilities of oil processing, with the highest capacity rate in the Latin American Region of daily production of 940 000 barrels, responsible for 70% of the national production (GBRV, 2011b). In respect to coal extraction, there are significant deposits in Falcón, with approved reserves to be exploited; approximately 20 million metric tons, besides the estimated reserves calculated in 120 million metric tons in a range of 50 000 Ha (GBRV, 2011b).

Furthermore, because of the dry and arid climate, there are five saline production areas under the management of Salina de la Cumaraguas industry and 220 000 Ha of land suitable for the enhancement of salt industrialization, the rest of the saline production is carried out in a small scale. The other groups of Falcón’s industries are formed by the ceramic, fertilizers, pharmaceutical, cement production, and in a minor rate, painting and pottery items, which are the financial support of small communities in some parts of the State. Additionally, the commercial sector is exponentially growing because of the free zone (tax free) in some parts of the State, facilitating the commercial trade among other States outside Venezuela (GBRV, 2011b).

In contrast, tourism has been a large source of financial activity in Falcón for a long time. According to CORFALTUR (2011) the tourism influx of 2010 was 4 755 553 of visitors, a lower value in comparison from the figure from 2009 (4 842 464 visitors). It can be assumed that although tourism has been the economic sources from more than five decades, this industry in Falcón is in a process of expansion (not necessarily positive aspect), because of the natural scenic areas that the State possesses, and the increasing amount of people visiting the coast every year, that is why more planning of this important economic sector is essential to effectively head toward sustainability.

Finally, the artisanal fishing forms part of the financial income of some inhabitants in Falcón State, in the subsequent section, the artisanal fishing activity in the area of Morrocoy will be described.
2.2 Morrocoy and its influence in Falcón’s economy
In line with to FUDEMA (2004), the poverty index in the Jose Laurencio Silva, Monseñor Iturriza and Acosta Municipality is 60%; Acosta Municipality does not form part of the Morrocoy National Park, but it is a coastal location with similar socio-economic characteristics as Silva and Iturriza. In addition, the population of Iturriza (Chichiriviche) Municipality is 28 642 (census 2001), while a more recent source of information (Paolini, 2006) shows that the population in Silva (Tucacas) Municipality is 47 765 inhabitants.

2.2.1 Tourism
Morrocoy is one of the most popular touristic and protected areas visited in the national territory; it is mostly visited by Venezuelans and in a minor rate by foreigners. The statistics for the year 1999 pointed out that Morrocoy was visited 4.28 more times than other parks, and in the year 2007 it was visited by 1 500 000 people (Cartaya, 2007). For the year 2001, the generated permanent jobs were 5 051, and for the peak season there were 1 719 more; in total, 6 730 employment opportunities were created, which approximately is 50% of the job prospects in both Municipalities (Silva and Iturriza) within Morrocoy.

In terms of other communities outside both Municipalities, 80% of the families depend on the tourism income, but just 58% of the employees are formally working in the tourism sector (Cartaya, 2007), fact that evidences the lack of planning of this economic sector. A more recent information source (Strategic Plan for Development of Tourism in Falcón State 2011-2020) from CORFALTUR (2011), affirmed that in the Eastern Coast of Falcón, there are 13 associations of boatmen, and they count with 40 units of transportation (boats).

In the subsequent graphic, it can be appreciated the activities an occupations of all of the members of the families in both Municipalities (Monseñor Iturriza and Silva), the occupation as boatman and fisherman are the prevailing activities. Moreover, the line between a formal occupation and informal sector in Venezuela is hard to establish, and in the coastal areas there are no exceptions, since the income varies.
according to the seasonal peak, and many people have to look for parallel activities, some of them related or not to tourism (Cartaya, 2007).

![Occupation of the members of families in Morrocoy](image)

Figure 2. Occupation of the members of families in Morrocoy (Silva and Silva Municipality) from Cartaya (2007).

The non-registered financial activities are proliferating; plus it is likely that the informal sector is growing in a vertiginous way since the recent legislation approved (2011) by this government administration; the Law of Just Prices (Supply and Demand Law) will negatively affect many medium and small merchants, since it is meant to control the prices of all the businesses of any nature to stop inflation (which is the highest in the Latin American Region with a 26%). Besides, this regulation will deeply affect the population, since it will increase the shortages of supplies (Paullier, 2011).

Going back to tourism, it is perceptible the importance of the sector for the communities in Falcón State, and Morrocoy is a key protected area that attracts many visitors. The following table from a previous work of the above mentioned author (Cartaya et. al, 2001) illustrates what are the activities related to tourism and how many people depend on it. One should take into consideration that these figures are from 10 years ago, thus, the number of employees involved in the tourism sector most likely is larger, since the artisanal fishing industries are decreasing their
production rate because of environmental negative impacts from diverse anthropogenic sources.

Moreover, in the year 2001 the population living within Morrocoy was 2,260 and its density was 7.04 inhabitants per Km2, nonetheless, this number do not correspond to the previous number given in reference to the population of both Municipalities that share territory of Morrocoy, due to the fact that the geographic extension of the Iturriza and Silva Municipality is wider and it has also non-coastal areas specially in the western part of each municipality.

Table 2. Number of employees at Morrocoy National Park in the different tourism sectors during the year 2001.

<table>
<thead>
<tr>
<th>Number of employees at Morrocoy in the different tourism sectors (2001)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
</tr>
<tr>
<td>Restaurants and informal food establishment</td>
</tr>
<tr>
<td>Hotels and accommodation centres</td>
</tr>
<tr>
<td>Independent fishermen (selling oysters and lobsters)</td>
</tr>
<tr>
<td>Aquatic sports</td>
</tr>
<tr>
<td>Beach maintenance</td>
</tr>
<tr>
<td>Tender processes (construction and commercial sector)</td>
</tr>
<tr>
<td>Diverse tourism services</td>
</tr>
</tbody>
</table>


The abovementioned author observed in her research the profile of the visitors of some of the National Park in Venezuela. It is interesting the comparison among some of the National Parks in the South; Canaima National Park attracted 25,648 (72% of visitors) foreigners in 2001 (Cartaya, 2007), while the number of Venezuelans who visited the same protected area was 9,974 (28%); the type of visitors is a defining factor, according to the author, since foreigners seem to respect the norms more than the local population who are constantly visiting Morrocoy National Park, as well as other protected areas. The author does not specifically have figures for Morrocoy; nonetheless, the author affirms that the number of foreigner visitors is much less than in other national parks.
Furthermore, the author stated that in Morrocoy, people who visit the beach coast of Punta Brava and Suanchez have a more reduced purchasing power than the visitors of the small islands or cays. This fact may seem irrelevant; however, it has been observed for many years that the state of environment in the islands or cays is evidently in better conditions than in the beach coast of Punta Brava, for instance, the solid waste generation in the cays is less abundant than in Punta Brava (Cartaya, 2007). Additionally, in the year 2007 the average spending rate was EUR 104, for a period of 2 days.

Further, the National Park Authorities established a series of allowed and prohibited activities in the Morrocoy cays, thus, all the terms bellow correspond to the small islands (INPARQUES, 2011). Among the former mentioned, we can find the following:

- **Kayak and pedal boating**: Suanchez Lagoon.
- **Snorkeling, scuba diving**: Peraza, Pelón, Sombrero, Pescadores, Boca Seca, Playuela and Playa Mero.
- **Open water sailing**: Borracho, Sal, Muerto and Sombrero, Boca Seca.
- **Acuatic ski**: between Varadero and the Zorro Lagoon.
- **Windsurf**: Paiclá, Sombrero, Muerto, Sal and Suanchez Lagoon.
- Surfing, swimming, bird watching, climbing, psicobloc, exclusionism and jogging, in all the above mentioned locations without disturbing other visitors’ rights.

Among the prohibited activities the most relevant in term of conservation are (INPARQUES, 2011): hunting, long-line fishing, carrying weapons inside the park that could cause injuries or damages in the ecosystems, collection of any flora species, anchoring on coral reefs, use of Jet Ski. Also, bonfires, selling and consuming alcohol, introducing exotic species (flora and fauna), bring domestic animals to the marine areas, perform excavations, establish political advertising, use of large stereo that could disturb other visitors, use of insecticides, leave solid
waste outside the deposit binds, among others: do research inside the park, take photographs and film with commercial purposes without authorization.

The park is managed through a schedule and tariff fee, to access to the cays it is necessary to go to the different ports from Tucacas or Chichiriviche. Additionally, an authorization is needed in order to stay in any of the cays (INPARQUES, 2011).

2.2.2 Artisanal fishery
The largest communities that perform artisanal fishery in Morrocoy are: Tucacas, Agua Salobre, and Chichiriviche (Bone et. al, 2005), in the rest of Falcón State, it is also a common activity, nevertheless, for the purpose of this study; the previous mentioned communities are taken into consideration. In annex 1, it is illustrated the areas where each of these three communities perform their fishing activities (taken from Bone et. al, 2005). Concerning the way artisanal fishing is carried out, the members of the different communities remain using the same instruments and material as past generations (Bone et. al, 2005).

Moreover, within the Triste Gulf zone, the communities of Chichiriviche, and Agua Salobre occupy the 3rd and 4th position in the fishing productive areas (Yallonardo et al. 2001). These authors determined that there were 30 boats utilized for fishing, while in Agua Salobre had only 10, the study did not include the community of Tucacas. In Agua Salobre, it was determined that the products form part of 36 species, and 11 of these species represent 97.6% of the total product (Yallonardo, et. al 2001). Along with the conclusion of this study; the authors revealed that the annual media production was 64 736 Kg, with line fishing technique, nonetheless, this type of method was prohibited in the year 2009, thus, it is likely that these rates have varied, although there are not further scientific studies in the recent time (after 2005) in the National Park that would show the decrease or increase of the fishing industry production.

In concordance with Bone et al. (2005), in the last 2 decades the number of people who exclusively work in fishery has decreased from 85% to 30%, mainly owing to the
lack of government support, but also because of the lack of a professional organization amongst fishermen, or labour union party.

Another important feature about fishery within the communities studied by Bone et al. (2005) is that 64% of the fishermen are the owners of the boats or the vehicle engines, and 75% of them own the material and instruments necessary to use for the artisanal fishery. At the same time, there is a new stakeholder that has gained importance amongst this economic sector; the caver or intercessor, who is the person that finances the cost of all the productive process of fishery (Bone et. al, 2005).

Concerning sport fishery, it is performed mostly in Sombrero and Cayo Norte islets, and there are also other zones where fishery is intensively carried out, putting pressure on certain commercial species, such as fishes, and molluscs.

2.3 Cays in Morrocoy National Park
This section of the report is meant to deliver information regarding the islet in the National Park, details about commercial activities, tourism in the area and also particularities of each cay in the Morrocoy archipelago. This section can be useful to provide the reader with the touristic potentialities of the different areas, as well as characteristics to be improved within the park. In the annex 5 (images of cays), it is possible to find pictures of the different cays in Morrocoy by the letter assigned to the description of each site; this images were taken from Venezuela Tuya website, which is a website that promotes sustainable tourism, in Morrocoy and other protected areas in Venezuela.

A) Sombrero Cay: it is one of the most favourite cays in the National Park, and it counts with two large sandy bays which visitors frequent, since it possesses a significant number of palm trees that provide with shade. Snorkelling is regularly practiced because it is not necessary to swim far from the beach to observe various species of fishes and coral reefs. In Sombrero it is allowed to camp, commercial activities are popular in the islet, such as selling different sea food traditional
products, and women accessories (informal sector), also there are two small sea
food restaurants (Tourist Cooperative Norway R.L., n.d)

**B) Pescadores Cay:** it is the farthest islet; seldom visited. There is scarce
vegetation and a large marine area which is clean and shallow, additionally; there
are very low waves, because of the coral reef barriers which makes it to be
abundant of fish species. There are no commercial services in the cay, since it is not
a frequently visited site and it is difficult to be transported to the place, as a person
from the informal sector and as a visitor. (Venezuela Tuya website, 2011b).

**C) Los Juanes site:** it is commonly known as the natural “swimming pool”, and it is
frequently visited by the owners of yacht and small boats. It is surrounded by
mangroves, it does not possess either a bay or beach, and the water maximum level
is up to 1.30 meters. Snorkelling is not practiced in this site the constant arrival of
boats putting the divers in danger, the visitors regularly play very loud music and
there is a high rate of alcohol consumption (despite it is prohibited), and in the near
past late afternoon or night parties took places in *Juanes*. There are abundant
commercial activities in *Juanes*, and the visitors can even pay for food,
accessories, or any other product with credit card (Venezuela Tuya website, 2011b).

**D) Playa Azul:** it is one of the most visited cays in Morrocoy, because of its beauty
and clear water. There are many services since this islet is very close to *Boca

**E) Tucupido:** It is one of the smallest cays in Morrocoy, seldom visited, there is no
service offered to the visitors. To be able to arrive to this islet one has to know very
well the zone, and the engine of the boat has to be lift up since there are very shallow

**F) Boca Seca:** it is a cay which is well protected by the national park authorities
and snorkelling can be practiced there offering a nice spot to do this sport, there is a
quiet large number of palm trees which makes this site very pleasant for visitors who
frequent as a relaxation site. There is commercial activity managed by the bigger
hotels of the area (a restaurant) (Venezuela Tuya website, 2011b).
G) **Playuela**: it is the most visited islet, after Sombrero cay. A restaurant provides visitors with beach chairs for rent, and there is an abundant commerce (informal sectors); within the cay there is another smaller islet called “Playuelita”, where visitors regularly practice sport diving. The two islets have a copious number of palm trees (Venezuela Tuya website, 2011b).

H) **Mero cay**: it is one of the less visited islets in Morrocoy. In order to arrive to this area, it is necessary to walk 200 meters. The services are scarce in the cay, and although there is vegetation in the area, it is rare. This place is ideal for the visitors who are looking for a quiet destination (Venezuela Tuya website, 2011b).

I) **Paiclá cay**: it is a very suitable place for visitors with very young kids, since the water is shallow within a large diameter around the islet. In Paiclá there are services such as restaurants, and it is very close to the Morrocoy and Tucacas Port (Tourist Cooperative Norway R.L., n.d).

J) **Punta Brava Beach**: it is the bay closest to Tucacas port, a bridge was built and a toll was installed by the INPARQUES authorities in order to create the access of cars and automobiles for a fee. It is one of the most visited areas in Morrocoy during the weekends; it has a scarce number of palm trees, although other vegetation species are abundant in the beach. There are many services, rent of beach chairs, awnings, rent of pedal boats and kayak (Venezuela Tuya website, 2011b).

K) **Mallorquina Beach**: the access to this beach is by boat, and the cost is EUR 7.5 (equivalent to parallel value of BsF. in EUR). There are no services in the beach (Tourism Cooperative Norway R.L., n.d). In Mayorquina, the sand is white, and at the farthest point in the beach, there is a geological formation of limestone rock, which is often used for practicing climbing and also psicobloc (variant of climbing; maximum height is 5-6 meters without protection, but the water to cushion the fall) (Inversiones Climbing Venezuela website, 2011).

L) **Muerto Cay**: it is the nearest islet to Chichiriviche and “Cayo Sal” (5 minutes by boat), with the largest number of palm trees (Venezuela Tuya website, 2011b). There are many services in the cay; restaurants, rent of beach chairs, abundant
commerce of food products, women accessories, among other personal items (Tourist Cooperative Norway R.L., n.d).

M) Pelón Cay: it is the smallest islet of the National Park, currently disappeared and in the recent past it was a sandbank, located in Chichiriviche, with no services. Its name indicate (Bald cay), it was an area devoid of palm trees or any other type of vegetation, with white sand as well as it is surrounded by a coral reef barrier (Venezuela Tuya website, 2011b). This islet has been converted in the last decade in a sandbank, amongst various factors such as climate change, but an earthquake was an natural event that affected Morrocoy in 2009, the augment of precipitations, decreased the level of salinity in the water, and the constant discharges of effluents in the Cuare Gulf have affected the health of this area within the national park (Chirinos, 2011b). In section 3.5.1, it is briefly discussed about the disappearance of this sandbank.

N) Peraza Cay: it forms the small group of islets in Morrocoy, without any services. The vegetation is abundant, it is surrounded by a coral reef barrier, and it has white sand. The water in Peraza is calm and crystal clear, ideal for relaxing. This islet is famous among fanatics of nudist beaches (Venezuela Tuya website, 2011b).

Cuare Wildlife Reserve: within this Natural Reserve, there are other sites to visit such as “Cueva del Indio”, the “Sanctuary of the Virgin” and the areas where there are oysters’ farms, and places dedicated for bird watching. These are areas that are less visited because of the restriction and vigilance by the national park authorities, it is possible to access to them through Chichiriviche. In annex 2 pictures of these two sites in the National Park are shown. The following image (3) is a map illustrating all the cays and islet in Morrocoy National Park, in the website of Venezuela Tuya (link available in the reference of this document). This interactive map created by this organization (Venezuela Tuya) provides the reader (and potential visitors) with useful information about each cay (as it was presented in this section). The red line in the map vaguely shows the road where it is possible to find different ports used to transport the tourists from Tucacas or Chichiriviche to the cays.
3 Environmental Issues

Prior discussing the environmental problems in Morrocoy; annex 6 is an image taken from the TNC Report (2007) that illustrates the key environmental threats in the Venezuelan coasts and marine environment. Regarding Morrocoy, the existence of various environmental problems has seriously threatened the ecosystems for decades; in this section of the report, the most relevant issues were discussed in line with the information found. In the following image (4), it is illustrated the environmental sensitivity of the Falcón State, and among other zones, it is highlighted in blue colour that the Monseñor Iturriza and Silva Municipality has a high level of environmental Sensitivity (Proyectos Connatura, 2002). The approximate area of the Morrocoy National Park is highlighted with a black cycle.

3.1 Destruction of marine ecosystem and biodiversity

Before going into detail regarding the current state of the marine ecosystem in Morrocoy, is essential to reference an event that took place in January of 1996, defined as the most important ecological catastrophe in the Venezuelan coasts ever
reported. As affirmed by the MPPE (2000), Solana et al. (2004), Bone et al. (2005), and public news sources, the event caused the mortality of almost 90% of the coral reefs in Morrocoy; other authors such as Croquer and Bone (2003), affirmed that the rate of the coral reef destruction in the national park was 98%, along with the mortality of fishes, crustaceans, molluscs, echinoderms, annelids, sponges, and cnidarians (Bone et al., n.d). Likewise, these authors also stated that the rest of the organisms mortality, besides corals, was caused by asphyxiation which is defined as “obstruction of respiratory mechanisms by a thick layer of mucus” (Bone et al. n.d), and anoxia; “reduction of dissolved oxygen by decomposition of organic matter” (Bone et al. n.d).

After more than a decade of this negative event, the causes have not been precisely determined, but there is a general consensus among the cited authors and the national park managers that the mass mortality catastrophe was originated by a combination of natural and anthropogenic effects; the augment of the volume of sediments and suspended matter dissolved in water (the majority of this material was coming from the chemical industries and the refinery which is very close to the coast).

On the other hand, the natural factors acting upon the phenomenon such as high precipitation levels during the week of the event, lowered the temperature (approximately 10°C), and affected an area of 160km2 in Morrocoy (Bone et al. 2001), and also it caused a variation on the salinity and pH of the water, all these elements together created an “unusual calm” in the marine activity (Solana et al. 2004). An example of the consequences and the magnitude of the impacts can be referred to what happened in areas such as Caiman Beach (Playa Caimán); less than 1% of the coral reefs were alive (Bone et al., n.d). Another example was Sombrero Cay; 35% of the corals were alive, but in 2001 a diseases among these animals (corals) was detected causing another mortality effect (Croquer and Bone, 2003).
The three major damages among the corals were detected in the research of the previously mentioned authors; these were yellow band, white plague and dark spots. Amid other effects of the 1996 event, it was found algae overgrowing, depredation among plankton species and damages because of the use of anchors in Sombrero Cay (Croquer and Bone, 2003), the results of this research indicated that within the 35% of surviving coral species after the 1996, the 60% (585 colonies) were in healthy conditions in Sombrero Cay.

The MPPE (2000), in its report about biodiversity affirmed that the most abundant species in the park were Montastrea faveolata, M., cavernosa, M. franksi, M. annularis, Colpophyllia natans, Diploria strigosa, D., clivosa, D. labyrinthiformis, Porites astreoides, P. porites, Acropora palmata, A., cervicornis, Stephanocoenia intercepta, Madrcis decactis y Siderastrea sidereal. Some other zones of Morrocoy besides Sombrero Cay were affected by another event in the year 2001; Tucacas Bay, Sal Cay, Cuare Gulf, Boca Seca (MPPE 2011). The phenomenon consisted in an oversized enriched water with nutrient and effluents, and unusual upwelling event that caused the reproduction of toxic plankton and organisms such as dinoflagellates, putting in jeopardy not just the health of the ecosystems but also affecting the inhabitants of Tucacas, by the contamination of the water supplies (MPPE, 2011).

Consistent with the report elaborated by the MPPE and INPARQUES (2007), there were problems related to the sewage system, and its effects in the upstream, middle, and downstream level of the river basin, which in turn are connected to the loss of mangrove in the national park (MPPE, 2007). The hydrological system is formed by a karst system with surface runoff; its groundwater maintains the floodplain and the saline exchange cycle in the wetlands and lagoons, which determines the buffer zone of the mangrove in Morrocoy. In the year 2007, the MPPE had affirmed that 30% of the coastal mangrove had disappeared, since the lagoons had a hyper saline level, owning to the low levels of fresh continental waters.
At the present, there is a serious problem regarding biodiversity, and it is the absence of herbivore species (fishes, molluscs, sea urchins) because of overfishing has brought a disproportion in the overgrowing of *Thallassian* banks, and marine macro algae (MPPE, 2011). Another problem associated with loss of biodiversity is the incessant elimination of the different communities of mangroves, owing to the expansion of the constructions for resorts and tourism. This eradication has contributed to the spread of sediments; this makes waters more turbid which interferes with the photosynthesis process of some organisms. Moreover, if the water is not clear enough, the mangroves and other Plantae species stop absorbing solar energy; these perish (El Nacional, 2011).

In the year 2010 an interview to the specialist Andrés Osorio (Carreño, 2010) revealed the precarious conditions of the environment in Morrocoy, one of the problems exposed was the extinction of coral reefs; the specialist assured that the main reason for this event is the disproportionate extraction of a molluscs for commercialization (Carreño, 2010); this animal is the predator of an algae which is damaging the coral reefs because of the biotic competition between algae and zooxanthellae, for space and sunlight that both of these organisms need for their photosynthetic functions (Castro and Huber, 2000).

Moreover, the coral reefs are highly fragile to chemical agents existing in the different effluents discharges from the industrial sector of Iturriza and Silva Municipality; firstly since the chemical contaminants are able to produce the coral death because of their toxicity, and in second place, the temperature of the waste water discharge can be a deathly as toxic pollutants as the corals cannot tolerate drastic changes in the water temperature (Castro and Huber, 2000).

**3.1.1 Highlighting deforestation as part of biodiversity loss**

The biological importance of the mangrove population is not just because these are part of one of the most productive ecosystems around the planet earth, but also because these living organisms are able to retain sediments that are originated by terrigenous (terrestrial mass displacement) processes, also, the accumulation of
organic material in mangroves form part of other species’ diet (Bone et al. 2005). Consistent with these authors, the salt content of the Southern zone of the Chichiriviche Mountain surroundings have increased because of the elimination of mangrove populations, thus, the extension the marine area has taken place. Furthermore, in the western part of Chichiriviche, the decline of the mangroves, deeply affects ecosystems such as estuaries’ areas, and the reason of the deforestation is the construction of touristic infrastructures (Bone et al. 2005). *Punta Brava* Beach is one of the areas that has been intensely affected, since the tourist activities, such as the amplification of surface for recreational area. It has slowly reduced the mangrove population, and according to the information gathered from Bone et al. (2005), within the time period of 1951-1998, 1.02 km2 of surface covered by mangrove has been eliminated.

Likewise, following the ideas of national report of protected areas (MPPE/INPARQUES, 2007); it affirmed that 30% of the mangrove population has been subject of deforestation. Among the most severe environmental impacts, firstly there is the disappearance of wetland ecosystems in the park, secondly, the alteration of hydric systems, for instance diversion of streams. It is pertinent to establish the control and supervision of activities such as stockbreeding, agriculture, extraction of wood and urban development, because these anthropogenic actions have already created a large negative impact in Morrocoy’s Park vegetation; if they remain without any type of regulation, soon the inhabitants will witness larger environmental impacts. Image 5 was extracted from the Agenda Morrocoy report (Bone et al. 2005), and this represents the zones with a high level of intervention.
Going back to the interview with the specialist Andrés Osorio (oceanographer, and specialist in environmental chemistry), there is a factor related to oyster/molluscs farming and mangrove disappearance, and it is due to fishermen cutting the mangrove and leaving the stems to easily extract the oysters (Carreño, 2010).

Another case of severe deforestation is located in the Triste Gulf; the headwaters (or upstream waters) of the Aroa and Yaracuy rivers. This is a grave issue, since the less vegetation there is in the headwaters the more sediments, agrochemical substances that will be flowing in the river and sea. It affects water supplies, plus the hydrological system resilience is altered not being able to balance the nutrients in contaminated water. Also the resilience of fresh water stream is affected because the discharge of sewage and its contents of faecal matter (Bone et al. 2005).

3.1.2 Invasive species- Brief case of *Pterois volitans*

In the last three years the presence of two lionfish species (*Pterois volitans* and *p. miles*) has been reported in the national coast of Venezuela, to name some, in islands such as Mochima, Los Roques, Las Aves as well as in Morrocoy National Park (Lasso and Posada, 2010; La Prensa de Monagas 2011; Perez 2011). Originally these species are from the Indo-Pacific Region (Lasso and Posada, 2010) but as stated by Hamner et al. (2007), nowadays, it is believe that the spread
of the lionfish (\textit{Pterois volitans} 93\%, and \textit{Pterois miles} 7\%) was due to a release of the species in an aquarium in Florida in 1992. Since then, it has caused the decrease of biodiversity in localities where the lionfish is considered an invasive species affecting the health of marine ecosystems (Bervoets, 2009).

The reason of the major disappearance of other local fish species is due to the lack of predators of the lionfish; \textit{Pterois volitans} is a potential poisonous fish with a capacity to voraciously consume smaller fishes that in turn control the algae populations, if algae grow without any control agent, it may affect coral reefs because of the competition of space, solar light and nutrients (Posada, 2010). In Morrocoy lately there were eighteen lionfish reported (CBM, 2011), as illustrated in image 6.

![Image 6. Number of last reported Pterois volitans seen in Morrocoy years 2009-2011 (18 fishes)](image6)

To conclude this part of the report, it is important to underline that this phenomenon has been widely studied since it is an ecological disaster that many States in the Atlantic face, in the case of Venezuela, the CBM has greatly collaborated creating a data base network for future studies, as well as informing the community, since this
fish is a threat to human health specially to tourists because of its poisonous gland; it is not deadly but it can be considerably painful. The initiative that CBM took is a very positive example of how to tackle the issue in a local scale and also nationally (see section 5.5.2). Another positive example of local actions is the Response Plan of St. Eustatius National Marine Park (Bervoets, 2009) is a potential guideline to develop a document for the coastal and marine spaces in Venezuela affected by the lionfish.

3.2 Pollution by heavy metals, and hydrocarbon

3.2.1 Presence of heavy metals
A study carried out by Caldera, Gutierrez, and Polanco (2005) aimed to determine the pollution levels and concentration of heavy metals such as Arsenic, Cadmium, Chromium, Cooper, Mercury, Nickel, and Lead, prevailing in the national park. In the research 17 stations were established, plus including measurements in three river basins (Aroa, Tocuyo, and Yaracuy Rivers). Samples were taken in the wet and dry season, in the Silva Municipality (Chichiriviche) and Silva Municipality (Tucacas), and the results of this study demonstrated the following: Copper, Chromium, Nickel, Lead, and Vanadium presented a higher concentration rate, in comparison to other metals; these were found in the sediments and in the three affluent rivers. On the other hand, the concentrations of Nickel, lead, Vanadium, cadmium and Arsenic were close to the limit values in international standards, considered as risky for estuaries and marine ecosystems (Caldera et al. 2005), and the values did not exceed this criterion.

The following table (3) shows the results from Caldera et al. (2005). It illustrates the fluctuation rate of the metal concentration in Morrocoy. In line with the legislation, the concentration of metals exceeds what is stipulated for marine areas (type 3, corresponding to the Decree 883, 1995) which correspond to the shellfish and molluscs breeding for raw/crude consumption. Another statement done by these authors is that the waters destined for recreational activities and beach resorts (type 4, same decree as above mentioned), are not supposed to have any measurable metal content, in other words, the concentrations should not be detected;
nevertheless, the subsequent table shows the presence of these metal elements (Caldera et al. 2005).

Table 3. Seasonal Concentration Rate of metals in the water and sediments of the Morrocoy

<table>
<thead>
<tr>
<th>METAL</th>
<th>Water (mg/L)</th>
<th>Sediments (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dry Season</td>
<td>Wet Season</td>
</tr>
<tr>
<td>Cadmium (Cd)</td>
<td>0.75-5.50</td>
<td>0.85-13.50</td>
</tr>
<tr>
<td>Cr (Chromium)</td>
<td>1.50-11.60</td>
<td>1.50-5.30</td>
</tr>
<tr>
<td>Cu (Cooper)</td>
<td>39.50-81.35</td>
<td>21.80-68.75</td>
</tr>
<tr>
<td>Ni (Nickel)</td>
<td>6.95-80.70</td>
<td>6.35-176.20</td>
</tr>
<tr>
<td>Pb (Lead)</td>
<td>5.60-76.25</td>
<td>1.45-151.80</td>
</tr>
<tr>
<td>Vanadium (V)</td>
<td>11.30-90.40</td>
<td>1.90-58.80</td>
</tr>
<tr>
<td>Arsenic (As)</td>
<td>0.60-2.30</td>
<td>0.40-0.73</td>
</tr>
<tr>
<td>Mercury (Hg)</td>
<td>0.60-1.10</td>
<td>0.60-1.00</td>
</tr>
</tbody>
</table>

Source: Caldera, Gutierrez and Polanco (2005).

On the other hand, in the Agenda Morrocoy Report (Bone et. al, 2005), other results are discussed; in the three rivers above mentioned (Yaracuy, Aroa, and Tocuyo) concentrations of Zinc and Mercury were observed. Moreover, in the different stations (39, see annex 2) it was found levels of Cooper, Mercury and Zinc in the internal sections of the National park (assuming these zones are: Cuare Gulf and the area where there are a prominent number of mangroves). Annex 2 shows the map created by Bone et al. (2005) to indicate to the reader the spatial location of the different sampling stations, not just for measuring the concentration of metals and hydrocarbons in the park, but to carry out different monitoring in other topics discussed in the Agenda Morrocoy.

Additionally, information from diverse sources was found (Chirinos, 2011; Marrero et al. 2011; Cohen, 2009; Rojas et al., 2007; Red ARA 2011), in regards to a location which has been a subject of mercury discharges for many decades. The exposure of concrete figures (amount of mercury in tons) and the time period when the continuous events have happened is not shown in this report due to the various data presented by these five sources. Further, all of them refer to a different period and different quantities of the toxic metal discharged in the Alpargaton stream waters. Nonetheless, two authors stated that this event has affected Morrocoy's
ecosystems due to the marine currents which have distributed this mercury along coast (Chirinos, 2011; Red ARA 2011).

Finally, these authors concluded that there are homogenous amounts of Cadmium, Chromium, Lead and Vanadium, distributed around the area of Morrocoy National Park (Bone et. al, 2005). Both groups of authors consider that the chemical industrial activities around the Triste Gulf, the effluents from the tourist activities, and the fresh water from the three rivers flowing in the area of Morrocoy have been factors altering the health of the ecosystems. These are some of the crucial factors to enrich the sediments, which as observed by Bone et al. (2005) are transformed in sludge containing toxic metal amount and then these substance is transported and distributed lengthwise the national park.

The most recent researches found concerning metal pollution in water and sediments in Morrocoy (Garcia et al. 2008; Garcia et al. 2011), indicated that the level of Cadmium in the protected areas at very high, taking into consideration the guidelines values from NOAA. It is suggested that the industrial effluents discharge and the production of fertilizers could be one of the reasons for the metal concentrations in the area.

3.2.2 Hydrocarbons
More than a decade ago, Rada and Losada (2000) conducted an integrated research in respect to the water, sediment and biota quality in a specific area of Morrocoy, adjacent to a fuel dispenser. The research contemplated characteristics such as: dissolved oxygen, saturation percentage, oil and grease content, coliform bacteria, among other aspects. In the sediments, the amount of Vanadium, Lead and hydrocarbons were also measured. Concerning the results on total residual petroleum hydrocarbon of each site, these were below the detection value (0.8/ml), nonetheless, very close to the limits in consonance with the international standards (Rada and Losada, 2000).

Moving forward, in the Agenda Morrocoy Report (Bone et al. 2005), it was found more recent information in regards with the hydrocarbon, grease and oil pollution in
the national park. Amongst the measured sites there were: Sal and Sombrero Cay with an elevated rate of oil/grease of 243 mg/l; Caño Capuchinos was one of the most affected areas with a media of total residual petroleum hydrocarbon of $82.6 \pm 54.3$ mg/L. Further, a maximum value of 234.3 mg/L was found in Punta Brava site, Playa Sur and Las Luisas, in a lower level than Caño Capuchinos, but still detectable by the scientists (Bone et al. 2005).

In accordance with the experiment and analysis done by Bone et al. (2005), these authors affirmed that the petroleum residues and hydrocarbons are currently extended in the majority of the territory of the park; these substances are distributed among the zone by hydrodynamic processes such as the river flows, then these hydrocarbons are deposited, in the form of sediments, in the most deep seated areas of the Morrocoy, as in the same manner heavy metals are deposited as sludge. With reference to the causes of contamination by hydrocarbons, oil and grease pollution, the Agenda Morrocoy refers to some of the polluting sources as unsuitable state of the boats used for massive transport of tourists within the national park, and the lack of environmental management of the fuel dispenser inside Morrocoy (Bone et al. 2005).

In reference to the bibliographic material from Klein et al. (2008), the national oil industry in Venezuela (PDVSA) holds plans to explore the potential oil deposits outside the coast. This economic activity, if performed, it would have a major impact in marine ecosystems, if not planned well; this is why it is suggested to carry out an environmental evaluation based using geographic information systems (GIS) as an essential tool, to permit the understanding of the which areas are more vulnerable and need more conservation efforts and what areas have the potential to start building proper infrastructure to explore oil deposits.

3.3 Waste management in the park
In the case of the two municipalities studied, the solid waste generation and effluents is strongly connected to tourism activities. The discharge of untreated effluents in freshwater bodies, the vast generation of solid residues, and its inappropriate final
disposition is an existent problem in all the municipalities of Venezuela, nevertheless, in Tucacas and Chichiriviche the impact of the visitors worsen the situation and the tourism industry is a key factors that define the severity of the environmental impacts caused in the territory of the Morrocoy National Park.

3.3.1 Solid Waste
In the two Municipalities within Morrocoy (Iturriza and Silva) there are four solid waste disposal sites, none of them are classified as landfill, although the Chichiriviche and Tucacas dumps were supposed to function as controlled landfills. Additionally, according to Connatura (2002), all type residues which are collected are mixed, even the biological hazardous waste coming from the Iturriza Ambulatory station.

Moreover, a research performed by Zamorano et al. (2009) addressed the state of landfills in Venezuela, and the development of a methodology to evaluate the environmental conditions in solid waste final disposition site, including open-air dumps in Falcon State. Moving forward, the following table (4) describes the general characteristics of waste generation in the two Municipalities within Morrocoy. Additionally, in accordance with Connatura (2002), there are no private companies of waste transport and disposal working in Iturriza, and the service the community currently receives is irregular, taking from one to two weeks for a vehicle (which is hired by the municipality and not owned by a company) to perform the public service. In Silva Municipality the PAICLA, C.A. is responsible for the waste collection but in this case the members of the community also have complained negatively through the media (radio, and newspapers) about the quality of the service delivered to them.

Table 4. Waste Generation in Silva and Monseñor Iturriza Municipality.

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Population Census 2001</th>
<th>Generation (Ton/day)</th>
<th>Collection rate Percentage</th>
<th>Percentage of urban sweeping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silva</td>
<td>28,642</td>
<td>40</td>
<td>50%</td>
<td>30%</td>
</tr>
<tr>
<td>Monseñor Iturriza</td>
<td>17,736</td>
<td>20</td>
<td>75%</td>
<td>30%</td>
</tr>
</tbody>
</table>

Source: Connatura (2002).
In the same source of information (Connatura, 2002), it was found information regarding the characterization of solid waste in the two municipalities relevant to the report, as well as Acosta, Silva, Monseñor Iturriza, Cacique and Manaure Municipalities. This accentuate the necessity of carrying out a more exact research in order to differentiate the residues production by each municipality, since these do not share same characteristic, at least concerning tourist visits per year. Table 5, shows the solid waste characterization of these five municipal entities.

Table 5. Characterization of solid waste in Acosta, Silva, Monseñor Iturriza, Cacique and Manaure Municipalities.

<table>
<thead>
<tr>
<th>Type of waste</th>
<th>Percentage of weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic matter</td>
<td>46.60%</td>
</tr>
<tr>
<td>Plastic</td>
<td>13.10%</td>
</tr>
<tr>
<td>Paper</td>
<td>11.30%</td>
</tr>
<tr>
<td>Cardboard</td>
<td>2.40%</td>
</tr>
<tr>
<td>Metals</td>
<td>4.40%</td>
</tr>
<tr>
<td>Glass</td>
<td>10.90%</td>
</tr>
<tr>
<td>Debris</td>
<td>3.20%</td>
</tr>
<tr>
<td>Particles smaller than 20 mm.</td>
<td>2.10%</td>
</tr>
</tbody>
</table>

Source: Connatura (2002).

Connatura (2002), documented the location of the four open-air dumps inside Morrocoy, in image 7 the green triangles show where these places are located, and it demonstrate the lack of urban planning since Tucacas is a more modern tourist location in terms of infrastructure, and more visitors go there instead of Chichiriviche. The main final disposition site in Iturriza is located 3.8 km from a touristic infrastructure (Hotel La Garza); the area does not count with a fence, public signs or a guardian (Connatura 2002), and it possesses a plain topography, and the quantity of waste deposited is 12 tons/day.

Further, this waste does not received any type of treatment (no compaction), and residues are burned in the presence of vultures, and generally the average number of scavengers is 10 individuals; this people essentially collect glass, aluminium, and copper. The recyclable material is exchanged in a storage facility. In addition, this group of individuals collect organic residues, which is given to pigs, dogs and
poultry animals such as birds (Connatura, 2002). The life expand of this open-air dump by 2002 was 1 year; this means than it surely reached its maximum capacity 8 years ago. Connatura (2002) suggested in their work the closure of this final disposition site.

Concerning another open-air dump in Iturriza, it is located 2.2 km from the main public square of the community, and the owner of this area is unknown. There are signs prohibiting dumping of waste, but there are no guardians, no presence of scavengers, and inexistence of domestic animals. The estimations of waste collection was 6.5 tons/day, its life expand was 2 years in 2002, and waste do not received any treatment. Since floods usually occur in this location, when a natural event happens, the residues are taken to the site previously described (Connatura, 2002). These authors affirmed that although the third site was not visited, there is a high probability that the conditions are the same as the second site. It was suggested the sanitation and closure of the dump (Connatura, 2002).

![Image 7. Map of Falcon State, highlighting Iturriza and Silva Municipality (left), and the four official uncontrolled dumps in the two Municipalities (right). Source: Connatura (2002b)](image)

In reference to the Silva Municipality, the waste management counts with a better infrastructure and organization than in Iturriza, nonetheless, it does not fully comply with the legislation. The final disposition site is located 5.8 Km from Tucacas city, the approximate area utilized is two Ha, and it has a fence, and the collection service is not performed by a company but an individual who is also the owner of the two Ha (Connatura, 2002). In the high season, the number of scavengers is more
than a hundred, and the main recyclable materials are: metal scraps, aluminium, glass, and cardboard. The quantity of waste disposed is 40 ton/day, and there is no differentiation among the type of waste (biological hazardous waste), with no previous treatment and the area is vulnerable from floods (Connatura, 2002). In 2002, the life expand of this site was 2 years, thus the authors suggested also building a new and proper disposal site.

In a more recent research (Paolini, 2006), the author shows a different generation rate (lower than the results from Connatura 2002), nonetheless, information about Iturriza Municipality is not provided since the scope of her research did not include landfills in this Municipality. Table 6 show her calculations.

Table 6. Silva Municipality Solid Residues data.

<table>
<thead>
<tr>
<th>Municipality (Capital)</th>
<th>Population 2006</th>
<th>Per Capita Generation (Kg)</th>
<th>Production (Kg/day)</th>
<th>Production (ton/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silva (Tucacas)</td>
<td>47 765</td>
<td>0.46</td>
<td>21 972</td>
<td>8 020</td>
</tr>
</tbody>
</table>

Source: Paolini 2006.

In the same order of ideas, the figures given by INPARQUES (2003), show that the weekly solid waste production in the national park in low season is 22 500 kg, and in the high season approximately 27 000 kg of solid waste are generated per week. It was observed that the most common recyclable material generated in the cays is glass (bottles) and plastic, in third place metal cans (INPARQUES, 2003). In relation to the transport of residues in the cays, INPARQUES brings aid to collect the waste, and there is a storage facility in a station Suanches; afterwards all the waste is taken to the open-air dump in Tucacas. In consonance with INPARQUES (2003), the Suanches storage facility functions without any operative supervision, situation that seems to remain the same, since there is no information to the public in regards to the improvement of this facility.

In national newspapers the environmental deterioration of the park has been discussed because of incorrect waste management, for instance, the percentage of
solid waste recuperated from the Cays. The local inhabitants affirmed that only 30-40% of the visitors bring the residues they generate (El Universal, 2010). Another source, divulge that the amount of waste collected by the INPARQUES authorities and volunteers from the cleaning campaign in Morrocoy this year was 5 tons of solid and organic residues in three days. Moreover, 1.5 tons of these amounts were glass and plastic. If this figure is taken into consideration, an estimation of 1.67 tons per day is produced in the park (Notitarde, 2011). Besides this, the locals also stated that the Cays most affected by the inappropriate waste management are: Sal and Muerto Cay (El Universal, 2010).

It is relevant to highlight that the conditions of Morrocoy concerning solid waste have not changed from the year 2003, owing to the number of complains and the fact that even after the economic resource allocation for the creation and implementation of an integrated plan of waste management, the locals seem to be as dissatisfied as 8 years ago. The Morrocoy National park still does not adequately integrate planning, administration, economic resource allocation, capacity building activities or improvements of technology to the waste management system, and it is reflected in the inefficient service provided to the community and also the deterioration of the park itself. The president of CIAC within FUDENA (Narciso, 2011) affirmed that the inappropriate waste management still is the most important socio-economic and environmental problem existing in the Eastern Coast of Falcón.

3.3.2 Effluents
The rapid and continuous growing of the urban construction associated with the massive tourism in Tucacas and Chichiriviche is an environmental aspect deeply affecting the natural drainage system, the hydrodynamic in the zone, and the mangrove population. The served waters in both Municipalities (Silva and Iturriza) are not treated and frequently these flow to fresh water streams inside protected areas of Morrocoy (Vitalis, 2007). In addition, there is a sea current from south-east to north-east in the national park surroundings, which has transported pollutants from the petrochemical and oil refineries from Morón area known as El Palito. Finally, the load of agrochemical contaminants flow from the rivers Yaracuy, Boca de Aroa and
these have a negative impact in the estuaries waters, and the bays’ waters of Morrocoy (Vitalis, 2007).

In the Agenda Morrocoy report (Bone et al. 2005), it can be found very detailed information in regards the intervention of the three rivers (Aroa, Yaracuy and Tocuyo) flowing towards Morrocoy area. Amid the aspects to underline from the Agenda, it is the confirmation of the high intervention of these three rivers. In the first place, these are used to extract water for human consumption and irrigation, nonetheless, the riverbeds are the receivers of many type of effluents (as discussed before). Also, the authors observed that the rivers are distributional agents of: sediment, organic matter, chemical and suspended solid contaminants.

Thereafter, a water characterization was carried out, and among other elements, it was determined that the river streams usually have a stable temperature that ranges between 28-29.3°C, their salinity level is almost imperceptible (except Aroa River); their pH is slightly alkaline and there is a significant content of suspended solids in all of them, particularly Tocuyo River (Bone et al. 2005). As a final point, the presence of coliform bacteria was diverse, in some cases, being greatly elevated, which was the case of the Yaracuy River exceeding the 40 mg/kg as an annual media value for the year 2000 (Bone et al. 2005).

Further, an excessive use of different boat types, such as sport boats and the very old type commonly used for transportation of the visitors, it is contributing to the water pollution by hydrocarbons. Besides, the effluent discharges from the commercial vessels that carry out this type of negative practice without any supervision, and slowly the marine currents take this contaminated water to Morrocoy’s bay (Vitalis, 2007).

Another severe environmental problem in the nearby communities affecting the hydrodynamics of the park is the lack of wastewater treatment plant, and the constant problems that the sewage system presents, not in the two municipalities within the park but in Falcón (El Nacional, 2011). There is an urgent necessity to
improve the manner to deal with the effluents, since it cannot be said that there is any water management system installed, thus, the government should allocate some economic resources to this issue; many of the tourist buildings, particularly in Tucacas do not have a sewage facility and as a consequence the effluents are discharged in the same zone where the buildings own the beach areas (El Nacional, 2011).

In various media channels such as the national newspapers (El Nacional and El Universal) the local inhabitants have complained many times because the sand at the Varadero Beach has become black owing to the lack of wastewater systems, and the sewage system is not supervised by any public entity. In respect to the same issue, in the interview with the Specialist Osorio (Carreño, 2010), he stressed the total inoperability of the treatment plants installed in some of the new buildings in this decade, and there is no law enforcement by the local authorities. Moreover, the specialist (Osorio), made emphasis in a research done in previous years which led to the conclusion that the oysters extracted from the Cuare Wild Fauna Refugee, for raw consumption were contaminated by a group of bacteria that is commonly found in sewage and waste water.

In this same interview Osorio affirmed that in a more recent study, it was observed that the oysters regularly consumed by visitors of Morrocoy contained the bacteria causing the cholera disease (Carreño, 2010). In the same topic, the government took a long time to stop the commercial activities of these products, but it was after a series of reported diseases in Chichiriviche and Tucacas.

3.4 Unsustainable tourism

As reported by MPPE (2000), the year 1974 was a crucial year for the communities of Chichiriviche and Tucacas; it was the year that the coastal areas surrounding these municipalities became protected areas, the Morrocoy National Park started to attack many visitors. After near four decades of development, the inhabitants of these two small cities have had to adapt to the environmental changes produced by the tourism industry (MPPE, 2000). The investment of the construction industry for
tourist facilities has poorly benefited the locals and the many people responsible for the instalment of the infrastructures during the 80’s, 90’s and this this last decade have paid little attention to the natural conditions of this coastal region.

Equally important is the environmental impacts caused by the practices of unsustainable tourism, nonetheless, it cannot be described as an isolated issue, by reason of all the ecological interactions existing in a complex system as the coastal marine areas, since the tourism industry generates effluents, solid waste, and deforestation amid other effects that are interconnected. To name some of the issues, it is relevant to underline that in line with the Decree 675 (1995), it is prohibited to build residences within the territory of the National Park, with more than one floor. Moreover, in the recent interview with the Specialist Osorio by Carreño (2010), it is stated that amongst the violation of the legislation of the Iturriza and Silva Municipality linked to tourism, it is the construction of buildings, not respecting this regulative distance from the bay, with more than 14 floors and with no proper sewage system (Carreño, 2010).

In agreement with the local inhabitants who depend on tourism, they affirm to be witnesses of the environmental degradation, for instance, the increase of the turbid waters where they used to be crystalline before, the less people willing to swim in the bays and rather go to cays, and finally they are witness that the marine water content more suspended solids (El Nacional, 2011). Amid the projects carried out in Morrocoy, there was information found in concordance with the consultancy work done by Connatura (2002); in this document they stressed some aspects about the tourism practices in Morrocoy. First of all, the access to the park is not entirely controlled, and among the violations of visitors, it can be mentioned the overnight stays in cays and Punta Brava bay, where it is prohibited (El Nacional, 2011).

Secondly, there is no control of how much is charged to the visitors by the individuals that transport tourists by small boats; this association is not formally registered. In third place, the inefficiency of the national park authorities was reported by Carreño (2010); it was stated that in the Ministry of Environment, there are three vehicles, and the boat for transportation inside the Morrocoy wasters is not damaged. Moreover,
INPARQUES (2003) carried out an environmental vulnerability study for the Management Plan of Morrocoy. The different cays were categorized conforming to its potential of environmental impacts due to the tourism industry. In table 7, it is illustrated the level of vulnerability of the islets, bays and other coastal formations in Morrocoy. This information should be taken into account at the moment of developing any sort of project, either if it is within the construction sector or if further research concerning environmental conditions of Morrocoy National Park.

<table>
<thead>
<tr>
<th>Categorization</th>
<th>Description</th>
<th>Cays* / Bays** and other areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>High risk of EI and high ES</td>
<td>Sombrero* Boca Seca*</td>
</tr>
<tr>
<td>High</td>
<td>High risk of EI and medium and low ES</td>
<td>(Same as above mentioned)</td>
</tr>
</tbody>
</table>


### 3.5 Other environmental aspects and their effects

Among the other environmental issues threatening Morrocoy, there is the disappearance of islets due to the local incidence of global warming, the illegal but common practice of long line fishing, as well as the illegal land occupation and use (Vitalis, 2007). Another increasing problem is poaching/illegal hunting of wildlife, including, marine, terrestrial and also plant species. On the other hand, Vitalis (2007) observed in its evaluation of the National Parks in Venezuela that the locations with more relevant environmental problems are the coastal zones, and amid the one of the reasons is the lack of river basin management in the middle and upstream.
3.5.1 The submergence of Pelón Cay
This is perhaps the environmental impact most perceived by visitors due to many local factors acting together, and the direct effects of global warming. The local newspapers affirmed that the scientific community has studied the phenomenon, and they affirmed that the reason why Pelón Cay disappeared was because all the coral reefs surrounding Pelón Cay islet died, yet, it is scarce the information found by direct scientific source that can deeply explain the phenomenon.

Keeping this in mind, it is pertinent to cite a similar incident in India and Sri Lanka (Parameswaran, 2011; Chandrasekar 2011); the sinking of Mannar Marine National Park islets (Poomarichan and Vilangusalli) was due to the illegal and extensive coral extraction. Many information sources (among them the previous cited) stated that the National Park authorities have consistently sustained that climate change had a minor incidence in the submergence, but the major reason was the mining of coral reefs, which used to protect the islets from tidal pressure and erosion; now the cays have disappeared in the absence of the living organisms (Parameswaran, 2011; Chandrasekar 2011).

It is relevant to notice that although sea level rising may not be occurring as generally believed (not a single research was found on this matter in the case of Morrocoy), still climate change can directly influence life equilibrium in the coral reefs (Castro and Huber, 2000), the rise or drastic decrease of the sea water temperature can cause stress and a decline of zooxanthellae densities in the coral, causing bleaching and afterwards death of reefs (Majluf, 2002).

Moving forward, the scientific community in India and Sri Lanka, deny that the islets sinking is due to rising of sea water levels, since the rising mean rate per year of sea level augment has been 1.8 mm (Chandrasekar 2011), they have insisted that the national authorities have stated this since the government does not want to be blamed because of the illegal practice of mining carried out in this national park. Going back to the case of Morrocoy, further observation on the submergence of Pelón Cay needs to be addressed since the death of the coral reefs is the main reason why this islet was slowly disappearing, nonetheless, it still remain uncertain
how the dead corals, surrounding the cay created the sinking, since the physical barrier of coral (bleached and dead) still exists.

3.5.2 Public Health
In regards to this topic, it was found statistic data in Silva Municipality, from the Ministry of Health in Falcon (2002) by Paolini, nevertheless, it was not found any figures for the Iturriza Municipality. Furthermore, for the year 2001, it was reported 14 171 victims of diseases transmitted by contaminated water and food poison. In the case of asthma, it was reported 5 450 diseased people. In regards to rhinopharyngitis; 5 752 individuals suffered from this, and 4 783 people were affected by tonsillitis (Paolini, 2002). Among other illnesses, it was reported that 3 279 had otitis; 4 577 diseases of the esophagus, intestines were found and 4 339 individuals suffered from urinary infections.

In consonance with Paolini (2002), one of the most important aspects to evaluate when determining existing diseases in a region is the monitoring and observation of the final disposal waste sites, since this is one of the elements directly affecting public health in general. According to the data collected by Paolini (2002) from the Ministry of Health in Falcon, all the diseases previously mentioned, are connected to the improper solid waste management. In addition, it is relevant to highlight that within the same document there was data from the previous year (2001), and five of the different diseases (diseases transmitted by contaminated water and food poison, asthma, rhinopharyngitis, intestine illnesses, and urinary infections) incremented (1 000 more ill individuals in the year 2002), number which could bring to a conclusion that if the trends by these year are similar to the subsequent time periods, now the number of diseased individuals could reach the 10 000.

3.5.3 Environmental education and civic participation
The citizen participation in defence of the Morrocoy National Park is precarious; the efforts to gather members of the community and take part in the proper management of the park come from the different NGOs and scientific institutions that for more than three decades have existed in Morrocoy. FUDENA-CIAC is one
of the institutions that present information in its webpage concerning the projects that involve the local inhabitants of Morrocoy; in section 4.1 these will be described. The promotion of education towards sustainable development, environmentally sound of resources, is a key element to propel an economy based on ecotourism, sustainable fishing as well as the empowerment of communities to demand to industries that for decades have contaminated the rivers flowing to the Marine areas of Morrocoy to stop polluting the environment of the protected areas.
4 Projects and Activities in Morrocoy
In this chapter, the projects implemented and linked to the environmental management of the national park are going to be discussed, as well as some of the regulative elements that have not been effectively developed. Additionally, the activities and projects that have been planned but yet not executed will be discussed in this part of the report.

4.1 Activities in Morrocoy - The Past and Present
In this section, the most relevant projects implemented in Morrocoy will be discussed; it is relevant to clarify that these programmes are not the only activities taking part in Morrocoy, but the ones that have been planned, monitored, and publically disseminated.

Costa Oriental de Falcón Project
This study was partly financed by the Government of the Falcón State, and carried out by the Simón Bolívar University, as well as the Francisco De Miranda National Experimental University, during the decade of 1990. The scope of this program was to determine the environmental issues in this region, studying pollutants exiting in the marine and coastal ecosystems (Bone et al., 2005); the location of the research was the Northern part of Morrocoy (San Juan de los Cayos) and the Yaracuy river mouth (coast). Subsequently, the evaluation of contaminant agents would be useful as a baseline to create corrective actions and control, mitigate and eliminate the source of pollution in the coast (Bone et al., 2005). The public information about this project was scarce, nevertheless, in the FUDENA website it can be found smaller projects related to the Eastern Coast of Falcón State, which will be subsequently described in this section.

Inter-American Foundation/ FUDENA Projects
In association with FUDENA, this institution has collaborated in socio-economic projects in the coastal areas as well as in other regions of the country (IAF, 2011). In order to avoid the entire disappearance of the invertebrate species in the
Morrocoy and Cuare Reverse (Crassostrea rhizophorae, Melongena melongena and Astraea caelata), this project was started in 1994 (FUDENA, 2011). Thus, in the first project carried by the IAF (VZ-074), it was assigned EUR 17,673 for disseminate resource management and environmental education, and participation in sustainable economic development among the community (farmers and fishermen) located in the Cuare Reserve (IAF, 2011).

Further, the individuals dedicated to aquaculture that received aid from FUDENA and IAF, were divided in three different sub-groups for the assessment of their labour and subsequent assistance by the two institutions. Firstly, the fishermen dedicated to the farming of Quigua (Astraea tecta, A. Caelata) species represented the 25% of the group of participants, secondly the individuals extracting Casco de Mula (Melongena melongena) were the 15 %, and in the final and most relevant (in number) group of fishermen represented the 60% and these people extracted oysters (Crassostrea rhizophorae) (FUDENA, 2011). For further information in the characterization of the different sub-group of fishermen visit FUDENA (2011) public source.

Another project initiated by this institution in 1999 was project VZ-178, in 1999; essentially dedicated to the sustainable environmental training programme for 270 individuals with micro-businesses extracting molluscs in the Cuare Reserve. The training consisted in the spreading of better practices concerning the handling, preparation and market of the local molluscs’ species, commonly known as: Ostra Mangle (Crassostrea rhizophorae), Casco de Mula (Melongena melongena), Quigua (Astraea tecta y Astraea caelata). Subsequently, the monitoring and stabilize molluscs population was carried out; in total EUR 69,023 were invested in this project for three years.

Moreover, the project VZ-190 was carried out from 2000 to 2003; it involved the women community whose primary income was the marketing of shellfish, and different fishes. The project required an investment of 277,061 from IAF, and it
consisted in the analysis of shellfish marketing process, assessment of different economic activities other than shellfish exploitation and education among the community (IAF, 2011).

In the same order of ideas, this project had three major action areas; the socio-economic, ecological, and geographic component. The first involved the women participation as previously described; the second component involved the study of characteristics in the reproduction cycle of the three molluscs species and capacity of the semi-intensive molluscs farming (FUDENA, 2011). The third action area (geographic component) consisted in the detailed geographical location of communities and the individuals dedicated to the molluscs farming (FUDENA, 2011).

**VECEP/UE Project**

The diagnosis of the artisanal fishing in the *Triste* Gulf and the adjacent areas (*Puerto Cabello, Choroni, Ocumare de la Costa, Tucacas and Chichiriviche*) was a project financed by the European Union in 1995, involving the *Simón Bolívar* University (USB), as the institution implementing the study (UE-VECEP, Official Website 1998). In this project, Morrocoy National Park was part of the studied area; nevertheless, the benefactors were more than 1 500 fishermen dedicated to the artisanal fishing, including the *Triste* Gulf zone.

The main goal of the research was to determine the level of exploitation of these resources, to understand the efficacy of the methods used by the locals and the benefits for the communities. Amid the specific objectives of the project was to identify: the areas for fishing, the species captured, seasons when these species are abundant, the index of catch per unit effort (usually used for determining the abundance of the species and recovery period), estimation of the production, marketing, the income estimation according to the type of boat utilized. Among other objectives, it was carried out: the elaboration of inventories according to the characteristics of the boat, the fishing gear and other tools, sample collection of commercial species (UE-VECEP, Official Website 1998). Some of the results of
this macro project, specifically concerning Morrocoy area were discussed in a bibliographic summary of a conference (Yallonardo et al. 2001) previously described in section 2.2.2 of this report.

Coral reef Restoration Programme
This study was carried out by a scientist group that formed part of the Agenda Morrocoy (Villamizar, et al 2005), within one of the sub-projects of the Agenda (96001754). The project was also referenced in the First Report on Biodiversity (MPPE, 2000) as part of the priority areas nationally, by the Oceanology Commission, after the event of mass mortality of corals in Morrocoy in 1996. It consisted in the evaluation of seven reefs’ physical and biological structure along the arc formed by islets from Sombrero Cay and Punta Brava Beach (Bone et al. 2005). Afterwards studying the potential solutions for the improvement of coral reefs in the areas, there was a minor scale pilot test performed; a coral reef was restored in areas where the severe coral reef damaged was found (Bone et al., 2005).

The method implemented was the transplant of reef colonies from other sites, adhering to natural and artificial substrata. Amid the results of this study, the rate of coral reef survival was 61.68%, mainly by meandroids and cerebroids coral reef families. From the species transplanted, in Punta Tucacas 47 out of the 60 survived and 50 out of the 59 transplanted in Bajo Caimán also survived. Additionally, various biological indicators were identified by the team, related to the ecosystem conditions but also according to the techniques of restoration employed in the study (Bone et al., 2005).

CARICOMP
One of the first initiatives in the coastal areas of the Caribbean, including Morrocoy National park was the CARICOMP (Caribbean Coastal Marine Productivity). This association was founded by UNESCO in 1982, carrying out a series of workshops in the Virgin Island of St. Croix, and afterwards it expanded their scope by placing marine laboratories and research stations (in 29 sites, and 22 countries) around the Caribbean (CARICOMP, 2001). Concerning the CARICOMP site in Morrocoy
National Park, it is located in the Triste Gulf, and run by INTECMAR. This institution started a long period biological monitoring programme of coral reef, seagrass and mangrove since 1992, and this project was divided into five different sections; meteorological monitoring, measuring the water physic and chemical composition, quantifying the biomass and algae (T. testudinum) productivity, also measuring the productivity of mangrove populations, and the last section monitoring the state of the coral reef and benthic species (Bone et al., 2001).

As a highlight of the various achievements of the monitoring process of nine years, it was reported that the physical and chemical characteristic of the water were similar to other laboratories in the Caribbean. Moreover, after the mass mortality in Morrocoy the year of 1996, the corals in Sombrero Cay maintained a high biodiversity values with more than 20 species of stony corals, in comparison with other coral reefs in the park (Bone et al., 2001). In reference to the water transparency Morrocoy presented lower values than other laboratories. Concerning biomass and algae productivity, the recorded values were lower (in Las Luisas station) than the results obtained in Mexico. On the other hand, it was stated that the composition of the mangrove was stable during almost a decade of monitoring.

In a more recent research from CARICOMP (Croquer et al., 2010), it was compared the coral reefs and its fauna of a cay in Morrocoy (Norte Cay) and two other station in Los Roques National Park. The difference between these protected areas is that the first represents coastal coral reefs and the second characterizes oceanic coral reefs; the results reflected that the state of coral reefs in oceanic sites is not always in better conditions than in coastal areas, while the commercial species of fishes were found more abundant in Los Roques than in Morrocoy (Croquer et al., 2010).

**International Coastal Clean-up Day in Morrocoy**

Amongst the activities that are currently celebrated in Morrocoy every year, the “International Coastal Clean-up Day” ["El Día Mundial de las Playas] excels. This has been done for more than two decades, normally, carried out the third week of September. It is coordinated by INPARQUES authorities, FUDENA, and many
volunteers such as NGOs, academic institutions, environmentalist, diving clubs, and private businesses that contribute to this cause in order to clean the solid residues from the bay, cays and also the waste which is submerged (Chirinos, 2010). The participants keep written record of different type of residues recuperated; at the end of the day, the material is weighted, and there is a final meeting of all the volunteers of the marine protected area, and a summary of activities (including how much waste was collected) is discussed by the coordinating institutions (Chirinos, 2010).

In accordance with FUDENA (2011b) this event of coastal clean-up, is also celebrated in Zulia, Carabobo, Sucre, Anzoátegui, Aragua, Delta Amacuro, Vargas State, along with members of FUDENA from other non-coastal states that also participated in the activity (FUDENA, 2011b). Additionally, it is stated that since 1991 until 2010, there have been 257 576 volunteers. The data concerning the amount of object collected residues in each State is a very positive indicator that the volunteers are keeping record; nevertheless, for the purpose of this report it would be shown in table 8 just the amount in Falcon State and in the total in the national territory. In annex 4, it is described the material which belong to each classification of waste in table 8.

Table 8. Number of collected objects in IBCD classified by location and activity.

<table>
<thead>
<tr>
<th>State/Location</th>
<th>Coast R/ WG recreation</th>
<th>Ocean R, fresh water streams</th>
<th>WC smoking</th>
<th>WC thrown</th>
<th>Medical waste</th>
<th>Various material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falcon</td>
<td>16 508</td>
<td>270</td>
<td>1 510</td>
<td>104</td>
<td>268</td>
<td>59</td>
</tr>
<tr>
<td>NT</td>
<td>243 571</td>
<td>10 085</td>
<td>23 719</td>
<td>2 748</td>
<td>4 990</td>
<td>7 648</td>
</tr>
</tbody>
</table>

WC= waste generated  NT= National territory  R= Residues

Source: Fudena (2011b).

Moreover, concerning the quantity collected this year (September 2011); in the Northern area of the park, it was gathered approximately 14 tons of waste (Narciso, 2011). Nevertheless, the results for this year’s clean-up day have not been yet published; it is relevant to highlight that if records are kept, there is a potential research topic such as recycling, as a new economic resource for inhabitants in Morrocoy. As stated by Chirinos (2010), this event is not just carried out to collect the residues from coastal areas; it is an activity which promotes environmental
education amid the visitors of the protected areas. The whole year this event is reminded to people to volunteer and also the private sector finances campaigns to prevent tourists to throw garbage in the beach (Chirinos 2010).

In reference to documents and legislation created for the improvement of the environmental management of Morrocoy National Park, there were found two specific bibliographic material that show the efforts from public, academic and other organizations but the national authorities did not approve the implementation of these, and subsequently, the documents are not in use. In the next section, some of the institutional barriers and limitations concerning financial resources will be addressed, as well as a summary of these two documents that could be useful for the future of the park’s environmental management.

**Water Quality Monitoring Programme of Morrocoy and Cuare**

*La Tortuga* Foundation is responsible for this programme (Project 2008IC13-1) that was stipulated for the period 2010-2011. It consisted in the evaluation and monitoring of the water quality from three different states (Carabobo, Falcón and Yaracuy), since there are various river streams flowing to the marine areas of the Morrocoy National Park and *Cuare* Wildlife fauna Reserve. The main objective of the project is to give guidelines for the implementation of a sewage system, attributed to the industrial and urban growth (*La Tortuga* Foundation website, 2011). In consonance with the previous cited source, in the process of the development of the programme, the results will be discussed with the community and stakeholders from different sectors (government, industries, and fishermen, among others). Also, workshops are going to be carried out to raise awareness amid the coastal community; according to the same source, the programme will benefit 25,000 inhabitants, especially to people dedicated to tourism (*La Tortuga* Foundation website, 2011).

4.2 Limitations and Barriers of the park’s administration

Moving towards sustainability represents a major challenge for many developing countries, especially when the nations deal with institutional incapacity, corruption,
and lack of continuity of the projects implemented. In this sense, it should be underlined that efforts have been made in order to reach an improvement of Morrocoy National Park, but in some cases the determination of local institutions and regional government authorities is not enough to propel different policies and plans that have a potential high benefit for the communities, since the national authorities do not allocate enough financial resources, or simply because the politician in power (in this case Silva and Iturriza Municipality) does not have any interest on conservation or environmental management, but rather on unsustainable growth regardless the future impact of their decisions making.

In the research carried out by Connatura (2002), it was stated that the park approximately generates an amount of EUR 1.22 Million per year, by the concept of: entrance fee, access fee for vehicles, tariffs paid by the people that sell food, and services in the different cays, fee for the permission to stay overnight, among other payments. Nevertheless, these financial resources are not invested in the improvement of the park’s management, since the money is directly transferred to the INPARQUES national authorities, and from the national office it is decided how the financial resources are allocated among all national parks, and other protected areas which are managed under a different legal regime in the national territory (Connatura, 2002).

One example of the lack of continuity of projects by public authorities is the study carried out by (Connatura, 2002) and financed by the MPPE; it was the Operative Plan of Integrated Solid Waste Management for Falcon. The data exposed involved a wide range of topics; from environmental characteristics of the State, quality of public services, public health indicators, the education rate per municipalities. In the subject of waste, it was gathered collection rates by type of waste, and also the current conditions of waste management per municipal entity. This document is one of the plans that remains publically unknown and without execution because of the budgetary deficit in Falcon State.
In the year 2003 INPARQUES directed efforts towards the elaboration of an Integrated Plan for the management of Solid Waste in Morrocoy National Park, but the project remained as a document of “Terms of Reference”. Similarly, the Decree of Management and Use Plan of Morrocoy National Park was created by the current government administration in 2002. It was an attempt to update the Plan from 1995, but its application is somehow controversial, since this plan is not publically known, but according to the World Commission on Protected Areas Report of Venezuela (2007), the document is used internally by the members of INPARQUES and it is a relevant instrument for future planning in the Park (Comisión Mundial de Areas Protegidas, 2007).

As a major barrier that slowed the process of officially executing this Decree was the public complain about Articles 43, and 44, which prohibited the same use of boats from artisanal fishing and transport of tourists. Moreover, different representative of communities in Tucacas and Chichiriviche organized themselves and presented public complains about these norms, claiming the potential threat to their economy if the plan (2002) was implemented (El Nacional, 2002).

On the other hand, one of the problems related to public administration in Morrocoy and unsustainable tourism growing is the uncertainty of land management, more closely, the numbers of false or illegal property deeds which are used by different stakeholders within the marine park’s territory to carry out the constructions of tourist resorts (Diaz et. al, 2007). Moreover, on the issue of tourism development at the national level, the executive representative of the current government administration created the Law of Tourism (GBRV, 2008), providing a more adequate legislative framework for the touristic activities implemented in the national territory, and being an attempt to propel a new organized structure of the tourism system.

Regardless of the creation of the legal instrument, it can be perceived still the disorganization level in the tourism public institutions, since the political instability in the power position of deputy minister has changed in the last three years over four times, and none of these individuals have started a national tourism master plan which is one of the norms stipulated in the Law of Tourism. This change in public
authorities deeply affects the way Municipalities (such as Silva and Iturriza) and States (such as Falcon) manage their tourism activities, since as it is established in the Article 9 (numeral 1), the planning process of tourism will be performed in a centralized manner, and subsequently, the Minister of Tourism will coordinate and orient the elaboration of regional and local plans of development (numeral 2). In the same way, the fund for capacity building and promotion of tourism is being managed by the authorities in Caracas.

Going back to the case of Morrocoy, the Decree n° 675 is the current norm that was created on May 26, 1995. It is the legislative instrument in current use and publically known. The purpose of this document is the establishment of guidelines and concrete norms to properly management the marine park. In the following section, it is described part of the content of the Decree and how the different areas of Morrocoy National Park are classified according to their zone use.

4.2.1 Zoning of Morrocoy National according to use
In the Decree n° 675, Morrocoy National Park’s areas are categorized by their use and environmental vulnerability. In the categorization, it is perceived that same areas belong to different groups, and this is because of the diverse activities such as commerce, tourism activities and conservation that take place in same islets, thus, it could be suggested the update of the determination of the zones of use. The data provided in this section is from the Decree n° 675, National Gazette n° 4 911. These are the following use zone of the park:

- Recreation zone: this area involve the use of activities linked to tourism, the construction of infrastructures for the recreation use of the zone and the monitoring of its visitors; integrated by Sal, Muerto, Pelón, and Sombrero Cay. Playa Norte, Playa Sur, Boca Seca, Playuelita, Playuela, Playa Mero, Paiclás Cay, Punta Suanchez, laguna de Suanchez and Punta Brava Beach.

- Service zone: in this zone the activities allowed are: environmental conservation, environmental education and research, also, construction of
buildings for the protection of the National Park, and those which support the activities previously mentioned. Additionally, the instalment of signposting, and educational and informative signs. The service zone covers: Mountain El Silencio, and Las Antenas, San Rafael, Varadero Beach, Playa de Mallorquina, Pescadores, Mountain Mallorquina, sector Los Italianos, Las Luisas, Station Los Manglares, Sal, Muerto, Sombrero, Playuela, Paiclá Cays, Punta Suanchez and Punta Brava Beach. Boca de los Caños and Boca Grande. In Article 66 it can be found the type of constructions allowed in this zone.

- Zone of Speleology interest: parting from the fact that speleology is the science that studies caves (Oxford online dictionary, 2011), the activities allowed are research, environmental conservation, and guided visits (groups of six people maximum). The places are: Playa Norte and the Mallorquina Caves. Also any type of grout or cave recently found in the park will be part of the zone.

- Damping/cushion zone: areas where agriculture could take place respecting the slope limits (30%), applying agro-ecology methods; the slopes with soil erosion and higher than 30% are destined to be recuperated. Additionally, the inhabitants are allowed to stay in the zone, complying with the type of dwelling established in the legislation. It is permitted commercial artisanal activities. The areas are: Guacabana, Brisas de Sanare, Tibana (excluding the populated areas), and the borders of the national park.

- Zone of autochthonous population use: in this zone research and environmental education activities are allowed. Also the construction of dwelling of owners that have a legal residence permit within the National Park, the construction of tourist lodging, restaurants, cafeterias, small groceries suppliers (not super markets), under the approval of INPARQUES authorities. Along with this, the agro-ecology, and artisanal activities are also permitted. This zone is composed by: Tibana, La Soledad, Caño león, Los Claveles, Lizardo and Agua Salobre communities.
- **Special use zone:** formed by marinas, infrastructure for services, access roads. The areas are: Marinas Indunave, Morrocoy II, Las Canoas; Puerto del Medio, El Ancla, La Cazanga, Morrocoy 1, Costa Azul, Caribe y La Cuevita, and all the rest located in the Morrocoy bay. The service areas are: Las Luisas pier, power line infrastructures localted in Chichiviriche Mountain, the public company’s buildings of CANTV, CORPOVEN and CADA FE, and finally, roads such as: *La Soledad-Agua Salobre road*, *Mata Palo, Altos de Lizards*, *embarcadero Las Luisas* and Punta Brava emergency road.

- **Zone of full protection:** the activities permitted are the ones linked to conservation, research, environmental monitoring for temporal or long term. The actual territory in Morrocoy designed for this purpose is not mentioned in the decree, thus, it could be inferred that the categorization of this use is temporal.

- **Primitive marine zone:** the purpose of this zone is to promote environmental education and conservation activities as well as research. The signs posted in this area have to be approved by INPARQUES, and the recreation is limited to guided visits. Exclusionism is allowed as well as creating trails for the practice of this sport. The group of excursionist cannot be larger than 10 individuals and staying overnight is prohibited. This zone is composed by: *Peraza, Pelón, Sombrero, Pescadores, Boca Seca, Playuelita, Playuela y Playa Mero Cays*. In addition, artisanal fishing is allowed, in *Tigre, León, Las Burras, El Ocho y Paiclá sector*.

4.3 **The Future activities in Morrocoy**

In the attempt of trying to elucidate the future events and projects taking place in Morrocoy, it was found a non-official document called “Socio-economic Development Plan of Silva Municipality 2009-2013”, this document’s date of publication on the website is in 2008, and nevertheless, it remains as a draft text without an author (perhaps a public entity). Nonetheless, because of its content, it is
relevant to discuss some of the sections of this text; the first and major aspects to be developed according to the plan are: economic and urban development of Silva, the environmental sanitation, safety, and improve of life quality of its inhabitants (CNE, 2008). Public transportation expansion is another goal of the project which will communicate several of the small communities that had difficulties because of the current lack of efficient transportation. The document does not count with a set of specific actions points, neither deadline nor indicators.

Further, on the environmental sanitation area, there are strategies such as (CNE, 2008):

- The construction of the recycling unit of solid waste treatment as well as effluents treatment.
- Improve of waste management in the river streams coming from Aroa River.
- Endowment of six collection and transport units for solid waste, and three mechanical sweepers. As well as the distribution of waste deposit units according to the Municipality’s climate.
- Enforcement of Morrocoy cleaning regulation in terms of the imposition of sanctions.
- The creation of the Environmental Protection Municipality Award to incentive the private sector, professional associations, academic institutions (public and private school, as well as universities) to implements projects related to any field linked to environmental management and conservation.
- Elaboration of educative material concerning environmental protection and dissemination of this within Falcon State.

With reference to the development of tourism (CNE, 2008):

- The re-organization of the Municipal Institute for Tourism and Environment, regarding designing the Strategic Plan of Tourism for Silva Municipality.
- Re-organization of the Fund for Tourism and Fishery, giving priority to endowment of credits for the construction of hotels, and commercial stores, the creation of TV channel and communication to foster tourism, as well as allocation of money for capacity building for fishermen.

- Design of three touristic routes within Silva Municipality; the agro-route, Morrocoy National Park route, and fluvial route, with the purpose to show the different sceneries that there are in the Municipality.

These are some of the activities presented in the 2009-2013 Silva Municipality Plan, nevertheless, they are discussed in this section because the majority of them have not been carried out, perhaps since these are not well planned and it is unclear how to execute it.

In the same order of ideas, there is a shorter document than the previous described called “Management Programme Period 2009-2012, Iturriza Municipality”, by (Caro, 2008). This programme has brief sections dedicated to education, safety, and transport as well as a section for tourism and environmental health; characteristics to be improved in the Municipality. The first set of goals (4) refers to the environment and subsequently the goals for development of tourism will be described (Caro, 2008):

- Consolidating the open-air dump “Caiman”, and the establishment of a transfer station for solid waste for the San Jose de Sanare community.

- Continuation of the programme “Do not leave trash in your cay”, hanging out plastic bags to tourists and locals that operate boats during the weekends.

- Rescuing the areas surrounding Cuare Wildlife fauna Reserve which are affecting the protected zone due to a non-controlled open-air dump located in the Cocos beach.

- Programme for environmental raising awareness with the institutions specialized in conservation.
- Development of the International Marina Simón Bolívar, in Las Aves Island, with a capacity of 350 yachts, intended to promoted international tourism, and commercial activities the whole year around.

- Propel the construction of tourism infrastructure in the Cocos Beach, and the beginning of the credit programme “touristic productive dwells”.

Moreover, the future activities in relation to the environmental management of the national park remains publically unknown, since there are not recent official programmes or document that would contemplate actions to be taken after 2013. Concerning future actions in 2012 from public entities, in collaboration with NGOs such as FUDENA, there will be the discussion of the new Management Plan and Regulation of Use of Morrocoy National Park. According to Narciso (personal communications, 2011), the government authorities have moved the discussion for 2012.

As a final point, the State authorities of Falcón affirmed the creation of a Tourism Fund for Falcón (GBRV, 2011c), which will be the financial source for the implementation of the “Strategic Plan of Tourism Development in Falcon State 2011-2020”. This Plan was publically presented in February of 2011, based in the “Simón Bolivar National Plan” that considers proper environmental management, conservation, and sustainable tourism as some of the guidelines (GBRV, 2011c). Nevertheless, this document should not be consider as an proper policy instrument to improve the tourism sector, since it is not clearly expressed in the document how to implement the strategies or how to reach the objectives stated in the Plan. This document should be considered as a guideline to create further documents with deadlines.

As a final element to discuss about the “Strategic Plan of Tourism Development in Falcon State 2011-2020” (SPTF, 2011-2020), is the organization of the document, since there are action points to execute but these do not correspond to an strategy or objective; these are expressed in the document as action points to be accomplished in the zone, which is the Eastern Coast of Falcón; in the
document there is no differentiation of the area use for tourism purpose of Morrocoy as a protected marine national park. In annex 7 it is illustrated the indicators used in the State Plan.
5 Stakeholders Linked to Morrocoy

The final chapter of the report is meant to highlight the role of main institutions (according to the source of information on the internet) that have been involved with the environmental management of Morrocoy National Park. The main purpose of the discussion is to how the stakeholders have been linked to Morrocoy, and perhaps how these could enhance their presence in the zone.

5.1 FUDENA and Other NGOs/ Foundations

The Foundation of the Defence of Nature (FUDENA) was created in 1975, initially with the financial support of the World Wildlife Fund (WWF) and the Venezuelan government, to study and gather data about endanger species such as marine turtles, caimans, cardinals amid other birds, manatees, orchids, Spectacle bears. Nowadays, it rises as an independent institution dedicated to natural resource conservation and the promotion of sustainable development (FUDENA, 2006). In 1988 FUDENA started a conservation project in the Cuare Wildlife Reserve with monetary aid from MacArthur Foundation and the CIAC (Centro de Investigación y Atención a la Comunidad); now FUDENA has an office at Iturriza Municipality (FUDENA, 2006). Among the concrete actions FUDENA has accomplished in the Coast of Falcon it could be highlighted (FUDENA, 2004):

- The establishment of permanent biological stations for monitoring purposes such as the coral reefs monitoring and inventory of the flora and fauna.
- Monitoring of birds and molluscs species.
- Starting the management plan for the Cuare Wildlife reserve.
- Construction of docks such as the ones located at the Cuare Gulf, Virgen del Valle sector, pedestrian paths, signs to the Cuare Wildlife reserve, and informative panels of the Indio Cave.
- Establishment of the hydrometeorological variables.
- Determination of the traffic impacts in Morrocoy.
- Creation of the environmental directive in the Iturriza Municipality.
La Tortuga Foundation

Created in 2005, La Tortuga Foundation is an NGO that has allocated efforts concerning environmental protection, scientific research, and environmental education, as well as raising awareness about marine–coastal ecological systems as well as the insular areas (La Tortuga Official website, 2011). Because of the great importance that the biotic system that exist in the coasts of Venezuela, this organization emerged from a small group of multidisciplinary professionals such as scientist and managers that had a common goal; to save the natural marine resources, and protect the quite extensive variety of species that coexist in the protected areas (La Tortuga Official website, 2011). In the year 2009 this organization counted with more than a thousand members (amid volunteers, staff, and linked agencies) in the national territory (La Tortuga Foundation Institutional Video, 2009).

Further, the projects carried out are coordinated by the foundation members and the government authorities. Amid the scientific research done it is relevant to mention the oceanographic and biological characterizations, design and execution of programs to protect endanger species, and design and implementation of management plans for natural resource (La Tortuga Official website, 2011). Additionally, La Tortuga Foundation has disseminated information in the communities of the different coastal areas, addressing the subject of recycling, and the importance of the correct waste disposition (La Tortuga Official website, 2011). In Morrocoy, this institution has participated in projects along with FUDENA.

Other NGOs

RED- Manglar is an International NGO founded in Ecuador in 1993. It expanded its scope of action amid South America and Alianza por los Litorales Manglares Aguas y Suelos (ALMAS) - RED Manglar Venezolana was created on 2 February 2006 (Fundación La Tortuga, 2007). This agency fosters the conservation of the littoral and marine ecosystems strengthening the community participation and its head office is shared with the CENAMB- UCV (Integrated Centre of Environmental
Studies- Universidad Central de Venezuela) (RED-Manglar, 2006). ALMAS stated in its statute (2006) the different goals and its relation to the Morrocoy National Park parts from the fact that this organization has disseminated various informative materials about the state of environment in Morrocoy (RED-Manglar, 2011).

Another NGO that is also connected to RED-Manglar is AEPA (Asociación Ecologista para la Preservación Ambiental); this organization currently has made some public claim and expressed rejection of some actions taken by the government regarding the expansion of oil refineries in Falcón (Fundación Foro Ambientalista, 2011). This agency has not provided enough data about its institutional profile, nevertheless; the scarce information in its only website (blog) shows that this organization was founded in 2002 and it is dedicated to conservation in the Falcon State through “environmental activities promoted in collaboration with the community organizations and education institutions” (citation from the AEPA internet blog).

As a final comment, it is important to highlight the importance of diving clubs either from different Universities or individuals that share the diving practitioners; these people have volunteered in many occasions that public and NGOs have organized activities in pro of conservation. Moreover, it is outstanding the effort some diving clubs, have independently created a data base to inform the authorities and research centres of the existence of the lionfish (*Pterois volitans*), as a way to mitigate the problematic situation with species which is a major threat to the marine ecosystems in the Atlantic.

5.2 Public Sector/ Research Centres

These stakeholders are described in the same section by reason of the cooperation among them; in some of the cases the state provides financial aid for projects, and the academic institutions and research centres deliver the organization and execution of programmes.
5.2.1 Public Institutions

**INPARQUES and the Ministry of Environment (MPPE)**

Created in 1973, the National Park’s Institute (INPARQUES) is the public national entity responsible for the management of the national park system in Venezuela. This institution is supervised by the MPPE, and among its mission and vision it is stated that INPARQUES will guarantee the conservation, proper administration of national parks, natural monuments and recreational parks (INPARQUES, 2011b). Also, amid the tasks of INPARQUES is to control activities related to research, environmental education, and eco-tourism in line with the current legislation. In this order of ideas, in 1978 it is passed the Law of the Institute (National Gazette° 2290) in which the legal status of the protected areas is established.

The presence of this public institution in Morrocoy has been notable; in the participation of common activities with NGOs and other entities as well as in the elaboration of documents concerning updating management plan of the park (INPARQUES, 2011B). As a recent initiative, during the second part of 2010, INPARQUES announce a public competition for private companies specialized in the maintenance of recreational areas to implement the services in the insular area of Morrocoy (INPARQUES, 2010), nonetheless, a further data source of this project has not been found, perhaps because the activity has not been performed.

On the other hand, it is important to reflect on the impact that INPARQUES has in the behaviour of the tourists that constantly breach the law; in this sense there is a lack of human capital to control the illegal activities that the vast number of visitors carried out, but also there are not enough authorities to regulate the other stakeholders altering the natural marine habitats by creating environmental aspects in the coastal areas or affecting the streams that flow towards the Morrocoy sector.

In reference to the MPPE and as stated by TNC (2007), the MPPE “is Venezuela’s highest environmental authority, is responsible for environmental regulation and policy, supervision of Environmental Impact Assessment (EIA) processes, and coordination of territorial land use planning”. Further, referring to the link to national
parks such as Morrocoy, this institution is the public authority that allows or prohibits any activity in the park, and also financial resources are allocated to the improvement of Morrocoy through the MPPE, nonetheless, the entity that carries out the measures and tasks is INPARQUES. The information exposed in the MPPE website (MPPE, 2011) confirms that this institution does not currently have any projects of its own related to conservation or environmental management, but activities coordinated with INPARQUES and other agencies.

The Municipalities

In the context of the Municipalities (Monseñor Iturriza and Jose Laurencio Silva) it is essential to indicate that none of these public entities have an official website where they display the information about current activities or projects. Additionally, efforts were made in order to contact both institutions and the contact information shown in various websites is incorrect. Moreover, these entities do not seem connected at any level with institutions that have a presence in Morrocoy, and as stated before in section 4.2, there is an enormous limitation of government organizations, especially at the Municipal level because the financial status does not permit to enhance the tangible scope of actions.

FUNDACITE/ FONACIT- Falcón

It is known as “Fundación para el Desarrollo de la Ciencia y la Tecnología” (Foundation for the Science and Technology). This public institution has a national presence. More specifically, the agency in Falcon State was established in 1991, and it is the institution responsible to promote the development of science and technologies, as well as improve the life quality of the communities of Falcón State (FUNDACITE, 2011). The following projects were developed by FUNDACITE and other agencies (FUNDACITE, 2011b): Design and application of an ecological toilet system integrating anaerobic treatment of wastewater, using Eolic and solar energy in Sal Cay (Iturriza Municipality)- year 2010, Artisanal production of “Mangle” Oyster in Cuare and Morrocoy zone (in Collaboration with CIAC).
On the other hand, FONACIT- Fondo Nacional de Ciencia, Tecnología e Innovación (National Found for the Science, Technology and Innovation) has been another important stakeholder in Morrocoy since it has contributed with quite a few researches carried by other institutions being the agency which finances the programmes. Both of these agencies are attached to the Ministry of Science and Technology (FUNDACITE, 2011b).

5.2.2 Research Centres/ Universities

INTECMAR

INTECMAR is a research institution within the Simón Bolívar University (USB), it was founded in 1970 as part of a research unit at the Biological Sciences Department, dedicated almost entirely to oceanographic studies (Department of Information and Media USB, 2010; Bone 2011). More recently (2010), INTECMAR has expanded its action radio by getting involved with topics such as fishery, environmental characterisations and eco-toxicology (Department of Information and Media USB, 2010). The most relevant document related of INTECMAR-USB about Morrocoy, in collaboration with other organizations and public entities was the “Agenda Morrocoy” (2005); a multidisciplinary group of eighteen professionals contributed with different researches within this mega project which resulted in a nourish piece of work gathering specific data about various fields connected to environmental conditions and also socio-economic factors influencing Morrocoy National Park.

Furthermore, the Centre of Marine Biodiversity (CBM) is an organization attached to INTECMAR, and along with the studies of the marine biodiversity of the Caribbean and the Atlantic front of Venezuela, and the update of cartographic material (CBM, 2006) such as annex 8 (section of the map extracted). Nowadays is involved in a significant project concerning the lionfish (Pterois volitans). The CBM not only has created a data base where individuals can report the fish, but also the institution has shared relevant amount of bibliographic data and informative material for public awareness of the invasive species, crucial for the control and monitoring of this
phenomenon that has negatively affected several population of fishes not just in Morrocoy but in the Atlantic Ocean (CBM, 2009; Lasso and Posada, 2010).

CIMAR

The Centre of Marine Researches (Centro de Investigaciones Marinas) is an agency which belongs to the UNEFM (Universidad Nacional Experimental Francisco de Miranda), founded in 1980 under a different name. In 1984 the main office changed its location to the city of Coro, and afterwards the marine ecology laboratory is built, dedicated to do research on fishery and mariculture (Bitter, 2011). Further, its main objective is to generate and disseminate scientific researches that could contribute to solving the regional issues concerning the marine and coastal zones in the Falcón State. In line with activities performed in Morrocoy, according to the information shared by Di Donna (2011), the CIMAR was one of the entities participating in the Agenda Morrocoy during 2000-2002, doing research on molluscs and echinoderms, afterwards, participating in a characterization of Thalassia testudinum in the Park (Di Donna, 2011).

In the year 2005 CIMAR and FUDENA shared the project “Innovative and Productive Network” which was implemented in Morrocoy and Cuare. Another project done in 2006 was the bio-chemical, nutritional quality and metal content in the oyster species Crassostrea rhizophorae (Di Donna, 2011; CIMAR 2009). Moreover, in 2007 the design and instalment of a laboratory for the production of larvae was implemented.

CIAC

The Centre of Research and Community Aid (Centro de Investigación y Atención Comunitaria) was created in 1993 with the support of FUDENA to support capacity building activities for individuals involved in conservation, sustainable development activities and researches linked to tackle the environmental issues in the Eastern Coast of Falcón State (FUDENA, 2005). In this order of ideas, CIAC provides the students from careers connected to marine ecosystems to do research and be interns at the agency. This organization also counts with a research laboratory of
hydro-biological resources (FUDENA, 2011), a malacofauna (molluscs) collection for educational purpose, and a station where hydrometeorological data is recorded.

5.3 Private sector involvement
In regards to the participation of the private sector in the improvement of the environmental conditions in Morrocoy National park, it has to be stated that currently in Venezuela there are quite scarce incentives for companies to enhance their Corporate Social and Environmental Responsibility system. It is minute the number of businesses that keep track of their actions concerning conservation activities, reforestation or residues collection events. Amongst the ones that report, it can be found the international company MRW; in its annual report from 2010 (MRW, 2010), it was stated that the company was recognized by INPARQUES for MRW collaboration with the International Beach Clean-up Day (IBCD) cooperating in Morrocoy, nevertheless, in the document it is not specified how the company contributed.

Likewise, supporting this well-known event (IBCD) the Venezuelan company EPA is also a participant. This corporation has collaborated with the national campaign of IBCD since 2008, opening a donation period for the customers to contribute. In the year 2010, 26 000 plastic bags were donated, and a total amount of money equivalent to EUR 43 516 for logistic purposes (Entorno Inteligente, 2011). These are other private businesses linked to the same event (FUDENA, 2005): CANTV, INELECTRA, Ford, General Motors, Sabenpe, Exxon Mobil, Movistar, Cotécnica, Polar, and Bridgestone. None of the last source of information specified what was assigned to Morrocoy or other coastal areas for the IBCD.

In terms of research and development, the CBM (2011) admitted that CHEVRON and Conoco-Phillips form part of the sponsors’ group, nevertheless, it was not found information about allocation of efforts specifically in Morrocoy. Concerning eco-tourism, there are some hotels and inns claiming to be environmentally sound managed, nevertheless, it cannot be confirmed through internet. One of these inns is “Posada La Acacia” situated 8 km far from Tucacas; the information exposed in
their website is very limited and it does not count with any environmental certification. Amid the high number of hotels in Tucacas and Chichiriviche, this is the only inn which promotes itself as “environmentally sound”, which means that there is a potential market to exploit concerning eco-touristic infrastructure.

5.4 Summary of the current contacts in with Morrocoy
In the table 9 it is presented the results of the earlier research concerning the different institutions involved in the environmental management of the Morrocoy National Park done in the months between June and August 2011. In total, there were 14 different entities, and 25 different representatives found in connection with Morrocoy National Park Management. It was possible to establish contact with some of these people; nevertheless, not all of the individuals were successfully reached, thus, this is a future activity; establish contact with all of these entities and expand the contacts particularly in the private sector. The entire table is presented in order to facilitate the differentiation amid entities and provide the contact information. The full name of each institution/contact by number is in the annex 3.
### Summary of Contacts in Morrocoy National Park

<table>
<thead>
<tr>
<th>Responsible Entity</th>
<th>Action area</th>
<th>Name of the Contact</th>
<th>Email</th>
<th>Entity's address</th>
<th>Tlf. (0058) - within VE add (0) to call outside the State</th>
<th>Contact Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) FUDENA-CIAC</td>
<td>CIAC Director</td>
<td>Samuel Narciso</td>
<td><a href="mailto:samuelnarciso@gmail.com">samuelnarciso@gmail.com</a></td>
<td>Calle Carabobo, Casa FUDENA, Chichiriviche</td>
<td>259-8151480</td>
<td><a href="http://www.fudena.org.ve/contactanos.htm">http://www.fudena.org.ve/contactanos.htm</a></td>
</tr>
<tr>
<td>2) FUDENA</td>
<td>CEO</td>
<td>Deborah Bigio</td>
<td><a href="mailto:dbigio@fudena.org.ve">dbigio@fudena.org.ve</a></td>
<td>Av. Principal de los Cortijos de Lourdes con 2º transversal / Edif.Centro Empresarial Senderos Piso 5, Ofic. 505 . Caracas - Venezuela</td>
<td>212-2320866</td>
<td><a href="http://www.fudena.org.ve/contactanos.htm">http://www.fudena.org.ve/contactanos.htm</a></td>
</tr>
<tr>
<td>3) INTECMAR centre</td>
<td>Director</td>
<td>David Bone</td>
<td><a href="mailto:dbone@usb.ve">dbone@usb.ve</a>, <a href="mailto:intecmar@usb.ve">intecmar@usb.ve</a></td>
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<tr>
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<td>Assistant</td>
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<tr>
<td>5) UNEFM-CIMAR</td>
<td>Assistant</td>
<td>Angela Martino</td>
<td><a href="mailto:amg.martino@gmail.com">amg.martino@gmail.com</a></td>
<td>Complejo Docente El Hatillo Carretera Morón- Coro, Municipality: Santa Ana de Coro, Falcón State.</td>
<td>268-2513776 (University)</td>
<td><a href="http://cimarunefm.blogspot.com/">http://cimarunefm.blogspot.com/</a></td>
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<tr>
<td>6) UNEFM-CIMAR</td>
<td>Research Assistant</td>
<td>Gennaro Di Donna</td>
<td><a href="mailto:gennarodidonna@hotmail.com">gennarodidonna@hotmail.com</a></td>
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<td>7) UNEFM-CIMAR</td>
<td>Researcher</td>
<td>Ricardo Bitter</td>
<td><a href="mailto:rbitter@reacciun.ve">rbitter@reacciun.ve</a></td>
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<td>8) UNEFM-CIMAR</td>
<td>Director of the Centre</td>
<td>Profesor Soraya Alvarez</td>
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<td>Alejandro Alvarez</td>
<td><a href="mailto:alvareziragorry@gmail.com">alvareziragorry@gmail.com</a></td>
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<td>Coordinator of the Tourism Program</td>
<td>Sonia Abi Samre</td>
<td><a href="mailto:abisamrasonia@yahoo.es">abisamrasonia@yahoo.es</a></td>
<td>Prolongación Av. Táchira, edificio Nucleo LUZ, modulo B, planta baja Punto Fijo</td>
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<td>Jorge Naveda</td>
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<td><a href="mailto:Presidencia.corfaltur@gmail.com">Presidencia.corfaltur@gmail.com</a></td>
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<td>President of the Environmental Commission</td>
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<td>Henderson Colina</td>
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<td>20)</td>
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<td>Alberto Boscari</td>
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<td>268-2508000/268-2508040</td>
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Conclusions and Recommendations

To conclude this report, the comments concerning each section will be expressed in bullet points as guidelines, and also to further research work that should be done in the National Park. The environmental characteristics make of this protected area, a unique location which currently presents the urgent necessity of the implementation of strategic planning. Moreover, the tourism sector needs to be organized, as well as the other financial activities such as artisanal fishery, and industries. In the recent past, the socio-economic dynamic processes within Morrocoy have created a series of negative environmental impacts in the protected areas owing to the lack of planning, monitoring and also the correct application of the norms within Morrocoy, thus, as general conclusions, we can elucidate the following:

- In Morrocoy National Park there is an increasing tourism sector which currently is not well organized in spite of governmental efforts to create institutions to support this sector such as CORFALTUR and MINTUR.

- Although fishery used to be the largest economic activity for decades, now it has diminished the number of people who performed this activity since the natural resources such as population of fished are diminished.

- Amongst institutional barriers and limitations affecting the park, these are: lack of political will, corruption among public entities in the national level, lack of continuity of projects. The diversion of financial resources that Morrocoy generates diminishing incentives to improve the tariff and fee system in the Park.

- In terms of the development of Tourism, the “Strategic Plan of Tourism Development in Falcon State 2011-2020” is the first and relevant planning tool created by CORFALTUR. This document addresses the organization of tourism, and within the plan there are objectives, goals and tasks properly structured to form an important policy document that will shape the future of tourism in the State, and it could become a guideline for other governments to improve the tourism sector. Nonetheless, its action points are vague and
broad, thus, there is not clear explanation about how to start implementing the plan. On top of that, CORFALTUR lacks of interinstitutional communication, the plan has not been properly disseminated among stakeholders in Morrocoy, or INPARQUES authorities in Morrocoy, since a check-up was carried among the representatives of various in Morrocoy, and none of them expressed to know about the Plan.

- In regards to the legal aspects, there are discrepancies between the Morrocoy National Park Management Plan and Regulations official and public document (1995) and the more recent (2002) document approved by the National Assembly. The latter is used internally by the Park Managers, but the majority of its content has not been implemented.

- Some institutions have stated the creation of management plans, which are not publically available, thus, to corroborate this affirmation, the organization should either make accessible the material. It is very important to publically share the information regarding current and future management plans, since this administration has affirmed the creation of various agencies, and the approval of several projects, among them, activities related to conservation, nevertheless, at the moment of finding evidence of such projects or written documents describing the mentioned activities, there is a lack of information and lack of willingness to share information about programs from public authorities was perceived in the process of writing this report.

Perhaps one of the most important conclusion is to find out that some of the planning documents created by government agencies, the term sustainability is used but disarticulated with the content of the text, since it is stated the importance of expanding construction and projects related to urban development but scarce text addresses the “how” sustainability will be implemented. One example is the project to develop a Marina in Las Aves Island, which goal is to promote tourism internationally, and take advantage of the full capacity of the future infrastructure disregarding the environmental impact that the project may have in the marine habitat.
Recommendations

After a final analysis of the information collected in this report, the subsequent text expresses the recommendation as a conjunct group of actions that may be perceived as corrective steps, but also these are planning guidelines that should be further developed, perhaps in an integrated plan. It is also essential to highlight that a successful planning instrument has to follow a specific organization pattern to achieve effectiveness; this is the description of objectives, goals and specific action points that will be set in concrete locations, should meet deadlines, and the responsibility should be allocated to a specific stakeholder(s). Besides this, a policy should provide the regulative instruments and the “how to” implement the plan, along with indicators to measure the success or failure of the policy.

This is an effort in which all stakeholders should participate because the existing institutions working in the marine park need financial support, political will, as well as the participation of the communities that benefit from Morrocoy (tourists and local inhabitants). Thence, here there are the following ideas:

- Implement an effective monitoring system and alert system to rapidly answer to events such as the ones from 1996, and permit authorities and researches to find out the causes of these events.

- Concerning the case of invasive species such as the lionfish (Pterois volitans), more financial resources should be allocated to mitigate the impact of this species in national marine parks such as Morrocoy.

- As there is a program to monitor the concentration of hydrocarbon in some of the National Park such as Mochima, Los Roques and other coastal protected areas, Morrocoy National Park should be included in the program, since it is not only one of the most visited national parks, but also because its adjacency of the oil refineries and industrial facilities.

- Seek financial aid for NGOs from different stakeholders (private sector and government) in order to begin the socio-economic and environmental
characterization of the insular zone (the total number of cays), since the current data available to the public is scarce and the information is limited to tourism activities but there are no official documents that provide relevant scientific or statistic data regarding the cays of Morrocoy.

- Solve the discrepancies between the official/public and the newest document about the park management, in order to establish an eloquent set of regulations clear to all visitors and disseminate its content. Improve inter-institutional communication among Morrocoy’s stakeholders.

- Stimulate more research in the field of waste management to determine the economic and potential of recycling in the Morrocoy National Park.

- Implementing GIS as one tool to identify the zones which need more environmental protection and which have potential areas that will have less environmental impacts need to be carried out prior installing any infrastructure outside the coast.

- Parallel to the previous action Prompt the involvement of academic institutions, specially the geographic department of universities for the design of a project to effectively generate cartographic data by using GIS technology, concerning the coastal and insular areas of Morrocoy, in order to have an objective stakeholder (besides the oil industry agencies) to carry out an environment assessment of Morrocoy.

- Augment economic stability in Iturriza and Silva Municipalities by increasing the number of employed people in the formal sector, since 22% of the population in both entities, by 2007 were obtaining income from informal economic activities related to tourism, it can be assume that there is a more elevated rate since the plans created by the Municipalities after 2007 have not been executed.

- Among the recommendations within the fishing industry and artisanal fishery, it is suggested to update the information about the sector, since the last
published material concerning the topic was from 2005, and this document referred to the sector in a broad manner, with the purpose to describe some of the economic activities of the National Park, thus, it is appropriate to generate information regarding the captured species, followed by a monitoring scheme that would permit creating a balance to improve the health of the marine habitats.

- Create a new Planning legislative instrument or update the Decree °675, in terms of the definition of each area and the determination of each zone of the part, since currently same areas belong to different categorization, making difficult to establish the correct use for the zone.

- Arrange the inconsistencies and develop the project designed by INPARQUES (Integrated Plan for the Management of Solid Waste in Morrocoy National Park) in collaboration from different academic institutions with the financial support from private companies that exist in Morrocoy.

- Taking a closer look at the guidelines of the already existing plans concerning tourism and urban development, to correct some of the approaches regarding sustainability and proper and integrated planning development, because in terms of policy analysis the current plans do not provide goals, specific actions and deadlines, which is vital for organizing events and activities related to development.

- Promote the concept of eco-tourism and be consistent with it. This means, the creation of environmentally sound touristic infrastructure which will not only be energy efficient, but also encourage visitors to adopt eco-tourism practices when they go to Morrocoy National Park. Building eco-efficient inns and hotels is a potential market that it has not been exploited in the National Park Morrocoy (eco-tourism).

- In reference to some of the goals for improvement of environmental health of the Programme for Iturriza, the government authorities should correct the scope of the activities since there should be more actions dedicated to
improvement the state of the coastal areas, and also the authorities should correct the terms used.

- The data exposed in many of the websites visited, such as FUDENA and other organizations is not updated, thus, it is a very important institutional aspect of all the agencies, to keep the public informed about the current events, and in this way more participation on projects could be excepted, not just from the community members but also from external agencies such as EKG which are aiming to collaborate in Morrocoy.
References


El Universal (Diario, 2010). Acusan acumulación de basura en Parque nacional Morrocoy [Denouncement of accumulation of rubish in the Morrocoy National Park]. Caracas, Saturday, 11


Narciso, S. (2011). Personal communication (via email- samuelnarciso@gmail.com) Date: October 27, 2011; December 16, 2011.


Annexes

Annex 1. Area where artisanal fishing is carried out by the three major communities in Morrocoy.
Source: Bone et al. (2005)

Annex 2. Location of the all sampling stations (except #23) for the Agenda Morrocoy Report.
Imagine taken from Bone et al (2005) [Next page]
Annex 3. Full Name of Institutions

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<td>Universidad Nacional Experimental Francisco de MirandaCentro de Investigaciones Marinas</td>
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<td>LUZ</td>
<td>La Universidad del Zulia</td>
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<td>Instituto Nacional de Parques</td>
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<td>Asociación Ecologista para la Preservación Ambiental</td>
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<td>recreation</td>
<td>Metal caps, clothes, plastic utensils for eating, wrapping paper, plastic can rings, straws, toys</td>
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<td>Ocean, fresh water streams</td>
<td>Packages, floats, domestic cleaning bottle products, traps for crabs, lobsters and fishes, boxes, chemical lights, fish lines, lubricants, plastic sheets, and packing tape.</td>
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<td>WC smoking</td>
<td>Lighters, cigarette holder, cigarette filters, plastic packages of cigarette</td>
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<td>WC thrown garbage</td>
<td>Domestic appliances (refrigerators, washing machines), debris, automobile parts, tires, barrels</td>
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<td>Medical waste</td>
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<td>Various waste</td>
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Annex 5. Images of Morrocoy’s Cays as assigned by description in section (1.2.3) Major source: Venezuela Tuya Website (otherwise indicated on top of image).

Image A. Sombrero Cay. Source: Sky Scrapers City - Forums

Image B. Pescadores Cay. Source: Venezuela Tuya

Image C. Los Juanes Site. Source: Venezuela Tuya
Morrocoy National Park Report

Image D. Playa Azul (Blue Beach). Source: Noticias 24 website.

Image E. Tucupido Cay. Source: Venezuela Tuya.

Image F. Boca Seca Cay. Source: Viajeros.com (blog)
G. Playuela Cay. Source: Venezuela Tuya

Image H. Mero Cay. Source: Venelogia (blog)
Image I. Paclás Cay. Source: Venezuela Tuya.


Image M. Pelón Cay. Source: Venelogia (Blog).

Image N. Peraza Cay. Source: Venezuela Tuya website.
Image O. Cuare Natural Reserve. Source: Venezuela Tuya website.

Image P. “Cueva del Indio” (left) and entrance of “Sanctuary of the Virgin” (right). Source: Venezuela Tuya.

Image Q. National Park Morrocoy (Sign: camping prohibited)
Annex 7. Indicators used in the “Strategic Plan of Tourism Development in Falcon State 2011-2020”. Source: CORFALTUR

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<td>3 193 020 393</td>
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<td>State Collection BsF (1%)</td>
<td>2 384 227</td>
<td>2 741 861</td>
<td>3 153 140</td>
<td>3 626 111</td>
<td>4 351 333</td>
<td>5 221 600</td>
<td>6 265 920</td>
<td>7 519 104</td>
<td>9 022 924</td>
<td>10 827 509</td>
</tr>
<tr>
<td>Official Tourist operators</td>
<td>550</td>
<td>632</td>
<td>727</td>
<td>836</td>
<td>961</td>
<td>1006</td>
<td>1271</td>
<td>1462</td>
<td>1682</td>
<td>1934</td>
</tr>
</tbody>
</table>