

**FERNANDO DE NORONHA ARCHIPELAGO/
ROCAS ATOLL
TROPICAL INSULAR COMPLEX**

**Nomination for Inclusion as an
UNESCO World Heritage Natural Site**

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2. Justification for Inscription

2a. Statement of Significance

Among the marine protected areas currently in existence in the Atlantic Ocean, the Fernando de Noronha / Rocas Atoll complex is unparalleled in its characteristics. This complex comprises an unique submerged and emerged oceanic system of the Tropical South Atlantic which rises from the seafloor from depths of around 4,000 meters, comprising part of a submarine volcanic mountain range known as the Fernando de Noronha Chain.

The 18 islands of Fernando de Noronha and the two islands of Rocas Atoll are the emerged portions of the Fernando de Noronha Chain. Besides these emerged formations, two submarine banks rising up to some 50 meters below surface between Noronha and Rocas are also noteworthy elevations in this submarine mountain system.

The oceanic island condition of these noted emerged portions determine peculiar aspects of its fauna, flora and ecosystems, enough to differentiate them from all other environments on Earth.

This insular complex constitutes an unique environmental and geomorphologic system in the South Atlantic Ocean, one of enormous importance as a source area for the dispersion, towards the continental platform of Eastern South America, of marine organisms of vital environmental value, such as corals and algae, as well as great economic importance, such as lobsters and fish.

The Fernando de Noronha / Rocas Atoll tropical insular complex is considered an oasis of marine life in the otherwise relatively barren open ocean. The insular system generates great biological productivity and an abundance of life forms, thanks to the existence of substrate in the depths reached by sunlight and to the presence of a holographic resurgence born of the contour of submarine mountains.

The floristic composition of the islands includes four endemic terrestrial species, the only oceanic island mangrove of the entire South Atlantic, and the macroalgae *Chondria tenuissima* (Rhodophyta) and *Feldmannia indica* (Phaeophyta), both recorded at this single site in the western parts of the South Atlantic. Besides the endemisms of the flora, the fauna is greatly diversified and peculiar. Endemic species of birds (passeriformes), an impressive diversity of fish and invertebrates, and a resident population of spinner dolphins merit special mention, together with massive breeding colonies of seabirds.

The presence of a resident population of spinner dolphins (*Stenella longirostris*) in Fernando de Noronha constitutes a particularly valuable biological asset that is a rare event worldwide. In 90% of the days a group of dolphins, which can range from 5 to an astonishing 1,200 individuals (with 270 as an average) enter the Bay of Dolphins at Fernando de Noronha Island. The average arrival time for the first group is 06:10 h and the average departure time of the last group is at 13:50 h. The number of animals, time of permanence inside the bay and their frequency are directly correlated to natural factors such as wind speed, daily sunlight period, sea state and food availability in the surrounding sea, and inversely correlated to rainfall and water turbidity inside the bay. The occupation of this latter by the dolphins is higher during dry season, from August to January, when environmental conditions are more favorable.

Spotted dolphins (*Stenella attenuata*, another oceanic species), also live around the archipelago and seek the calmer waters around the insular complex to rest during 5% of the days in the year, in groups averaging 50 individuals.

The landscape features of the insular complex is recognized as one of the most beautiful Brazilian natural areas, and the terrestrial areas are joined by a system of submarine landscapes which, thanks to water transparency in the area, is unparalleled in the whole South Atlantic Ocean.

To complement the unique environmental features, the insular complex of Fernando de Noronha Archipelago / Rocas Atoll has important historical features as well, ranging from catalogued shipwrecks to an 18th century fortress.

The effort to research, conserve and adequately manage this invaluable heritage is materialized in a regular presence of scientific crews; in the establishment of legally protected areas and implementation of their respective management plans and documents; and in the effective presence of technical, managerial and enforcement staff especially designated to protect the heritage and make it available to the public in an orderly and sustainable manner.

It is in the access of visitors to Fernando de Noronha, complemented by the access of *bona fide* researchers to Rocas Atoll, that the social-economic values of this unique natural system is materialized, making it generate vital knowledge and irradiate education and awareness for the protection of the marine environment and its inherent universal values.

It is to be noted that both the archipelago of Fernando de Noronha and Rocas Atoll are considered Relevant Geological Sites recognized by the SIGEP (Brazilian Paleontological and Archeological Sites) Committee.

Fernando de Noronha and Rocas Atoll is a key area for the conservation of biodiversity in the Western South Atlantic. The submarine mountain chain of this insular complex provide the cradle for repopulation and dispersal of several species of marine organisms which attain enormous economic and ecological value for the entire Eastern seaboard of South America and also the Caribbean.

Rocas Atoll is the first marine protected area established in Brazil (1979). It is classified as a National Biological Reserve and as such the only human activity allowed on-site is scientific research. The atoll is an elliptic reef with an area of some 7.5 sq. km. Its wider axis (E-W) has 3.7 km and the smaller (N-S) some 2.5 km. An algal crest limits the reef plateau, which is dominated by an association of coral, vermetid gastropods and foraminifers, growing in the form of discrete linear crests. Fernando de Noronha National Marine Park, comprises 18 islands of volcanic origin and was created in 1988, being the cradle of many endemisms and an unique haven for marine life in the Tropical Atlantic.

These unique characteristics make the tropical insular complex of Fernando de Noronha / Rocas Atoll an unparalleled and indeed the most environmentally valuable site in the Western South Atlantic, a repository of natural riches of universal value, thereby justifying its proposition for inclusion in the Natural World Heritage List.

2b. Possible comparative analysis (including state of conservation of similar sites)

It is worth noting that there is a difficulty in trying to establish comparisons between the site covered in this proposal and other relevant areas, mainly due to the uniqueness of this oceanic archipelago and atoll system which, due to its natural features and geographic location in the Atlantic Ocean, has no actual similar site. For an approximate comparative analysis, nevertheless, environments and sites elsewhere, in the North Atlantic, Pacific and Indian oceans, may be worth to look at.

In the Atlantic Ocean north of the equatorial line a parallel can be pursued with the National Park of Archipiélago de los Roques in Venezuela, with 31 islands and three reef barriers, and the National Park of Garajonay, Canary Islands, Spain. In both cases there exists an intensive use of natural resources, different levels of urbanization and intense visitor pressure. In the Canary islands, some 100 km from the African coast, the conservation status is highly impacted due to the intense use of the resource basis, including the urban centers of Gran Canaria and Tenerife with its harbor infrastructure; Lanzarote, Fuerteventura and La Palma are found to be much better conserved. Such specific cases are rather distinct from the area being proposed under this document.

Los Roques, Venezuela, is much closer to the proposed area of the insular complex, especially due to the biogeographic proximity (it is located in the Caribbean province), differing however from Fernando de Noronha / Rocas Atoll in being much closer to the mainland and lacking the atoll formation as part of the system. Another differentiating factor is the biotic composition, mainly of the bentonic species. The coral reef formations of Los Roques are quite distinct from those recorded at Fernando de Noronha / Rocas Atoll.

In the Pacific Ocean comparisons can be attempted with the following sites: Hawaiian Islands (North Pacific), Galapagos Archipelago (Equatorial Pacific) and Society Group in French Polynesia (South Pacific).

Hawaii, USA, has a common denominator with Fernando de Noronha in the existence of a leeward bay in the main island where spinner dolphins (*Stenella longirostris*) frequently use for resting, mating and nursing their calves away from predators. Nevertheless Kealakekua Bay in Hawaii and the Bay of Dolphins in Fernando de Noronha present several differences. The Hawaiian archipelago is composed by a much larger number of islands and several which are much larger than those of the Fernando de Noronha / Rocas Atoll insular complex. While the spinner dolphins of Hawaii are known to use several other bays and atolls of the Pacific to rest, in the entire South Atlantic Ocean the only resting place for spinner dolphins is Noronha's Bay of Dolphins. This is probably the reason why the occupation of this latter by dolphins is much higher numerically than that of Kealakekua; while the average number of these dolphins seen daily in Kealakekua is 64 individuals, the number in Fernando de Noronha averages 270 animals and may reach an impressive 1,200 animals in a single day.

Hawaii is under an intense occupation regime, heavy utilization of natural resources and intense boat traffic, including Kealakekua Bay where the entry of boats is allowed, in contrast to Noronha's Bay of Dolphins where boating have been banned since March 10, 1987. Therefore, as the occupation of Kealakekua Bay by spinner dolphins has decreased 70% over the last ten years, the number of animals at Fernando de Noronha has not changed much (105,316 sightings events in 1991 and 103,475 in 1999).

The Galapagos Islands, some 1,000 km away from the mainland of Ecuador, is composed by 48 islands, protected by a National Park and a Biosphere Reserve and already recognized as a World Heritage Site. It faces a growing visitor pressure and currently is impacted by serious problems with introduced exotic species and fishing conflicts. The uniqueness and biogeographical distance between Galápagos and Fernando de Noronha / Rocas Atoll make these two sites hardly comparable and definitely distinct from other archipelagos in the planet. The species of flora and fauna in the Galápagos and the Fernando de Noronha / Rocas Atoll complex are in its great majority different.

The Society and Marquesas Groups, French Polynesia, are also distinct from other sites mentioned here. Apart from being an insular complex and having an intense tourism and occupation regime, any other parallel seems ill-founded. These islands have lacked sufficient legal protection for its natural environments, thus having been greatly impacted over the last decades; moreover, there are environmental impacts resulting from recent military

experiments. Biological composition of these areas is also quite distinct from that of Fernando de Noronha / Rocas Atoll.

In the Indian Ocean, near Madagascar, there is an insular system, which is somewhat similar to the one described in the present proposal: the Aldabra Atoll and Mahe Archipelago. Both are recognized as World Heritage Sites and encompass a total of 23 islands, an analogous situation to that of Fernando de Noronha / Rocas Atoll. However, both biogeographical differences between the Indian and Atlantic oceans and the longitudinal distance confer natural attributes to these areas that are rather apart from one another, justifying an interest in the preservation of both sites.

When compared to other sites as those mentioned, the proposed insular complex of Fernando de Noronha / Rocas Atoll clearly demonstrates that it harbors the necessary attributes related to the maintenance of unique and well preserved natural features, and to foster the development of relevant research in many scientific fields (geology, biology, oceanography, archeology, natural resource management).

As for its biodiversity significance, besides its many endemic species, the insular complex is the most important oceanic area of the Tropical Atlantic for the reproduction and dispersal of dolphins, birds, marine turtles, fish and invertebrates.

From the comparison with these relatively similar other sites, it can be concluded that the Fernando de Noronha / Rocas Atoll insular complex presents does offer enough natural attributes to be awarded special recognition as a World Heritage Site.

2c. Authenticity / Integrity

The tropical insular complex of Fernando de Noronha / Rocas Atoll constitutes the most peculiar archipelagic system of the Western South Atlantic, with invaluable geomorphologic, biological, historical and landscape attributes that must be preserved for the benefit of this and future generations.

Acknowledging this need, Brazil has been adopting in recent decades several management measures to ensure the integrity of these attributes (including the establishment of a National Biological Reserve and a National Marine Park), resulting in a situation of integrity of the environmental systems capable of recommending the insular complex to the highest degree and recognition hoped to be attained in the framework of the World Heritage Convention. It deserves to be noted that, in the case of Fernando de Noronha, the growing visitor numbers is being tackled by studies and regulations aimed at ensuring the sustainability of tourism, including *inter alia* an evaluation of its carrying capacity¹ in face of the current utilization regime. In the last ten years, as Fernando de Noronha experienced a little growth in its numbers of visitors and residents, the government measures aimed at adapting the infrastructure and providing for adequate management and enforcement have been improved accordingly.

The system is, therefore, integrally protected. It is furthermore ensured full complementary protection under the new National Protected Areas Law, approved by the Brazilian Congress in 2000, and by the Federal Constitution of 1998. It also has the necessary structure to ensure its integrity both physical and biological.

¹ The carrying capacity was analyzed *vis-a-vis* the available land space, occupation planning, existing infrastructure and the maintenance of ecological processes according to responses of the organisms and biotic communities. The method employed was developed by MRS Environmental Studies adapted from Stankey *et al.*, 1985, *Limits of Acceptable Change - LAC*.

2d. Criteria under which inscription is proposed (and justification for inscription under these criteria)

2di "Outstanding example representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of land forms, or significant geomorphic or physiographic features;"

Fernando de Noronha presents the particular relief of an oceanic island system of volcanic origin. In the central portion of the main island there is a low plateau some 30 to 45 meters above sea level which results from an erosion surface sculpted in volcanic rifts. From this plateau rise spectacular phonolitic² rock hills, of which the highest is Pico Mountain (321 meters), showing an uniquely eroded profile caused by the fall of great juncture blocks.

Adjoining the southern and eastern borders of the main island, more exposed to the waves originated by the winds, there are lava cliffs with algal reefs of *Lithothamnium* framing sandy beaches. These latter are more developed in the northern portion of the island. Active dunes exist in these sandy beaches and ancient sea levels are presumed or recognized in parts of the main island.

Rocas Atoll is an extremely relevant geomorphologic site, being the only atoll in the South Atlantic and one of the smallest in the world; it is geologically outstanding as, being a reef formation atop a submarine mountain chain rock substrate, it is representative of a carbonate deposition resulting from the building activity of benthonic organisms in response to factors such as available light, hydrodynamics and variation of sea level; and it is a site of paleontological interest due to being constructed predominantly by coralline algae and only secondarily by corals. This is a rather relevant fact because there is widespread belief that coralline algae have no potential to erect or otherwise be the primary reef builders in the Quaternary period.

2dii "Outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals;"

The insular complex of Fernando de Noronha / Rocas Atoll is the most important dispersal site for marine organisms in the Tropical South Atlantic, and thanks to the high productivity of its waters it is utilized as a feeding ground by many species of migratory animals such as tuna, billfish, sharks, marine turtles, and many others. It can be considered the only site in the world capable of ensuring the survival of an entire population of spinner dolphins (*Stenella longirostris*). One of the most singular aspects of this insular complex is indeed its spinner dolphin population. These animals utilize the entire region for feeding and use the Bay of Dolphins in Fernando de Noronha for resting, mating, nursing their calves and avoiding predators.

Marine turtles *Chelonia mydas* and *Eretmochelys imbricata*, both threatened with extinction over wide areas of the planet, also utilize the insular complex for feeding and breeding.

As a dynamic site, Rocas Atoll, of biogeological origin, is both the reflection of the continuous growth of marine organisms as of the tectonic/volcanic evolution of the planet.

² A volcanic rock containing much alkali feldspar and nepheline.

The very existence of the site as it is depends on the building performed by the organisms capable of calcareous deposition, the key process in the formation of the atoll, and in the formation of reefs and accumulation of biogenic sediments, thereby constituting a remarkable, active and continuous process of interaction between biotic and non-biotic elements. The use of this location as a breeding ground is another dynamic process, which is fundamental to the recruitment in many populations especially for seabirds, fish and invertebrates that will disperse to constitute an important segment of marine fauna on both the South and North Atlantic.

The endemisms verified in the flora, the single occurrence of benthonic macroalgae species for the Western South Atlantic and the endemic bird, fish and mollusk species recorded so far are indicators of the dynamic processes observed in Fernando de Noronha / Rocas Atoll related to evolution and the composition of biodiversity.

2diii "*Contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance*"

The spectacular landscape-related aspects of Fernando de Noronha / Rocas Atoll are intimately linked to its geomorphology and biological richness, resulting in a beauty and attractiveness that, though difficult to measure objectively, is undoubtedly unparalleled in the South Atlantic.

The vegetation of Fernando de Noronha presents a seasonal exuberance, adding its bright green colors during rainy season to a composition of yellow and red flowers such as those borne by the mulungu tree (*Erythrina velutina* v. *noronhae*). The contrasts of the blue sky with the black rock hills and cliffs, the green, red and yellow tones of vegetation and whitish sand beaches framed by a blue and green sea compose an outstanding scenic beauty, which is quite difficult to describe.

Underwater, the insular complex is characterized by the best diving conditions of the South Atlantic, being mentioned in the specialized diving literature as one of the top diving sites of the world. This is largely due to the average water temperature of 24° C, visibility of up to 50 meters and light extinction depth of 87 meters, which allows the visitors to adequately see and enjoy magnificent views of the geological features and marine biodiversity.

To the surface observer the sea in the whole area of the insular complex offers an impressive gradient of colors, which ranges from emerald green to near violet. In shallow waters, the mix of the blue sky reflections with the yellowish sand of the bottom, in an almost entirely transparent water, produce the unique "emerald waters" which earned Fernando de Noronha its nickname, "Emerald of the Atlantic". As depth increases, the sand color influence is reduced and blue takes over until it acquires a deep, near violet tone in the deepest regions.

The underwater landscapes of Fernando de Noronha are highly diversified thanks to the existence of several geological formations such as tunnels, caves, grottos, vertical walls, shoals, isolated rock formations and natural tidepools.

Living creatures cover the great majority of the underwater rock formations of Fernando de Noronha: algae, sponges, corals and many other invertebrates, giving the substrate a multicolored layer of life. These sessile organisms compose micro-environments that provide shelter and nourishment for mobile species such as octopi, shrimp, fish and marine turtles, resulting in living scenarios of incomparable beauty.

The Rocas Atoll National Biological Reserve presents its unique landscapes in two different scenes: high tide and low tide. During high tide, only two sandy islands with a maximum height of three meters above sea level and some isolated calcareous formations, the "rocas", stand above water. Farol (lighthouse) Island, the larger of the atoll, has a stretched "S" form, with approximately 1,000 meters in length and 200 meters of average width.

All the sand in these islands is biodetritic (calcareous) and white, constituted by rather large grains and rests of reef organisms. At the islands, the concentration of seabirds both landed and circling is enormous - more than 150,000 birds - which in a raucous assembly unequivocally define their presence in the landscape and highlight the omnipresence of life in Rocas Atoll.

During low tide, besides the two islands the reef ring of the atoll is also exposed - a natural wall some 1.5 meters high and bordered by several sandbanks. Inside the atoll, a large lagoon, several shallows less than 1 meter deep and a multitude of tidepools are formed, some being more than 5 meters deep. During the tide changes a gradient between the two scenarios can be observed. This is another area of the complex offering a spectacular natural beauty which is rather difficult to describe.

2div "Contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation."

In the National Marine Park of Fernando de Noronha, besides the exuberant marine life, there are dozens of species of seabirds which make the islands their refuge for resting, feeding and breeding. Apart from these, Noronha harbors two species of endemic land birds: sebito (*Vireo gracilirostris*) and cocuruta (*Elaenia ridleyiana*). These two passeriformes only survive in the archipelago in the areas covered by Atlantic Forest, being rather sensitive to environmental change.

Around the islands of Noronha, algae such as *Gellidium pusillum*, *Caulerpa fastigiata*, *Bryopsis pennata*, *Centroceras clavulatum*, *Herposiphonia tenella* and *Celidiela acerosa* grow over rocks in the shallows. In deeper parts, dense populations of *Sargassum* spp. And *Dictyota* spp. Thrive above a layer of articulated calcareous algae that serve as substrate for epiphytic species such as *Chaetomorpha aerea* and *Nitophyllum wilkinsoniae*.

The reef formations off the "outer" (southern) face of the islands are basically fringe reefs of calcareous algae, mainly *Lithothamnium* spp., with vermetid gastropods, especially *Dentropoma* spp. . The concentration and diversity of sponges, recovering large areas of rocky surfaces, is also to be noted. Among the marine endemisms is also worth mentioning *Acmaea noronhae*, a mollusk still awaiting further studies of its natural history.

There are preciously few oceanic archipelagos in the South Atlantic and only a single atoll, Rocas. The proposed insular complex encompasses therefore more than 50% of the oceanic islands in the South Atlantic. This literal deficit in rocky substrate for the fixation of larvae of benthonic organisms (such as coral, sponges and algae) imposes upon the insular complex of Fernando de Noronha/Rocas Atoll an extraordinary biological importance as a repository for the maintenance of biodiversity at the ocean basin level.

The National Biological Reserve of Rocas Atoll is the single most important site for tropical seabirds in the whole Atlantic, harboring both the largest diversity of species and the highest numbers of individuals. At least 32 species among residents, migrants and occasional visitors have been recorded. Approximately 150,000 birds utilize the atoll for resting, nesting and feeding, and 11 species regularly nest there, including the largest South Atlantic colonies of sooty terns (*Sterna fuscata*), brown noddies (*Anous stolidus*) and masked boobies (*Sula dactylatra*).

In the waters that surround Fernando de Noronha and Rocas Atoll a great many species of economically relevant fish can be found, such as albacore, tuna, billfish, striated grouper, marine bass and others. Mollusks and crustaceans such as lobsters are also very abundant.

Fish species found at the National Marine Park of Fernando de Noronha are also mostly found at the National Biological Reserve of Rocas Atoll, with 24 families and 45 species of residents and migrants so far identified, including two endemics of the insular complex: *Stegastes rocasensis* and *Thalassoma noronhonum*. Among cartilaginous fish living in the insular complex, the sharks *Ginglymostoma cirratum*, *Carcharinus peresi*, *Negaprion brevirostris*, *Sphyrna* spp. and *Rhincodon typus* plus the rays *Dasyatis americana*, *Aetobatus narinari* and *Manta* sp. are worth mentioning due to their regular occurrence.

The lemon shark (*Negaprion brevirostris*), in particular, is a species that utilizes the environments of Rocas Atoll for feeding and breeding, and recent studies led by international teams have shown that this site is of special relevance for the conservation of the species in the Atlantic as a whole.

Of the several cetacean species recorded in the waters of Fernando de Noronha / Rocas Atoll, dolphins are the most regularly seen, in particular the spinner dolphin (*Stenella longirostris*) and the spotted dolphin (*Stenella attenuata*). Thousands of individuals of both oceanic species are found around these islands.

The daily cycle of spinner dolphins at Fernando de Noronha includes night feeding in deeper waters, a morning visit to the Bay of Dolphins, and a departure in the afternoon towards the feeding grounds again. Inside the bay, their resting behavior can be observed - a slow ascending-descending movement between surface and bottom - mostly between 10:00 h to 14:00 h.

As for the mating behavior, females are courted by one to ten males each; the one closer to the female turns upside down under her and mates very fast, later giving way to another suitor. Mating is usually seen more frequently in early mornings.

Nursing is also observed in the bay and can be seen from a distance, when the calf positions itself sideways and rubs the mother's mammary slit with his beak, thereby eliciting her response in the form of a stream of fatty milk. Nursing is also seen more frequently in the Bay of Dolphins in the first hours of the day.

Of the island fauna, there are three endemic species other than the birds already mentioned: the mabuya lizard (*Mabuya maculata*), the two-headed lizard (*Amphisbaena ridleyana*) and the yellow terrestrial crab (*Gecarcinus lagostoma*).

The scientific importance of the insular complex is immense, both for the attributes it harbors and for the effective protection granted to it, allowing for long-term investigation of undisturbed areas. It is also worth mentioning the facilities available for research which allow scientists to work in these almost untouched, unique and little-studied environments.

The research projects recently undertaken and currently under way allow for the development of comparative models of fundamental importance to the monitoring of other marine areas, including those either degraded or exposed to strong human impact.

As for its biodiversity significance, besides its many endemic species, the insular complex is the most important oceanic area of the Tropical Atlantic for the reproduction and dispersal of dolphins, birds, marine turtles, fish and invertebrates.

3. Description

3a. Description of Property

The submarine mountain chain which originated the tropical insular complex of Fernando de Noronha / Rocas Atoll is located north of the Brazilian Continental Shelf margin. In this region, the shelf extends only to the isobaths of 40 to 70 meters. Fernando de Noronha is the easternmost portion of this volcanic chain which begins near the city of Fortaleza, in Ceará State; this submarine alignment follows approximately the parallel of 03° 50' S and has rocks of an alkaline nature, emerging from the sea both at Noronha and at the Rocas Atoll. This alignment of seamounts pertains to a ramification of the Meso-Atlantic ridge. It is considered that the rock substrate of the atoll, located farther away from the ridge and W of Noronha, is more ancient than that of the Noronha archipelago.

The region is one of tropical climate with two well-defined seasons: a dry one from August to January, when rainfall does not reach more than 8 cu. mm./day; and a rainy one from February to July, when it may reach 193.3 cu. mm./day. Air temperature vary between 23.5° C and 31° C and has an average thermal amplitude of 4.1° C. Predominant winds are from Southeast and East. Relative humidity has an average of 81.5%, with the maximum in April (84.7%) and the minimum in October (78%). Average annual insolation is 3,212 hours, with a maximum known for November and December (316 hours) and minimum for April and May (217 hours).

The insular complex of Fernando de Noronha / Rocas Atoll is located in the bifurcation of the Southern Equatorial Current which runs in a westward direction and is characterized by waters with low concentrations of sediments, organic matter, nutrients and plankton.

Water transparency in the region is very high, with the light extinction depth at 87 meters. Average water temperature is 24° C with a surface amplitude of 4° C. The temperature profile for deep waters in the complex area follow the general pattern of low latitude areas. From the surface down to approximately 50 meters, the temperature is almost constant, beginning to decline at around 60-75 m down to 200-300 m. Deeper than this there is a well-marked stratification of temperatures in the deeper waters. The greatest temperature gradient is found between 100 and 150 meters of depth (10° C per 50 meters on average). Near Fernando de Noronha and Rocas Atoll this gradient is found around 80 meters, indicating a resurgence of deeper waters in the area.

The archipelago of Fernando de Noronha is volcanic in origin and has some 18.4 sq. km of emerged areas, 90% of which constitute its main island. Besides this one, 18 smaller islands show themselves above water as part of a small insular platform that tops the volcanic massif down to about 100 meters deep. Fernando de Noronha shows a modest relief for an open-ocean volcanic island, with Pico mountain (321 m) being its higher point. The volcanic rocks forming the archipelago are of Miocene and Pliocene origin, a substrate of pyroclastic rocks penetrated by a large variety of alkaline magmatic rocks that, after a long time, were recovered by the flowing of ultrabasic lavas and pyroclasts. The islands present a small number of sediment deposits, pertaining to cycles from the Quaternary to the present days.

In the main island, eleven distinct bodies of phonolitic rocks can be recognized. Also numerous lamprophitic sodium-laden rock dikes and other rare types are found.

The Quixaba Formation is a toppling of black lava flows alternated with pyroclasts formed by the lava's own components. It is visible on both plateaus of the main island, and in the eastern side it is some 180 meters wide above sea level. It also constitutes some of the secondary islands such as Rata Island. The little islands of São José, Cuscuz and de Fora, near the end of the northern peninsula of Santo Antônio in the main island, are all formed by the same horizontal flow of basalt which original width was in excess of 25 meters.

The first volcanic cycle exposed on the main island dates from the Upper Miocene. The Quixaba volcanism would have happened between approximately 3.3 and 1.7 million years b.p. , therefore in the Upper Pliocene. The characteristic rocks found there determine that Fernando de Noronha is considered as one of the most alkaline among the open-ocean volcanic islands of the world.

After the end of the Pliocene volcanism, an erosive cycle followed, destroying the external volcanic features and carving the island platform. With the sea level oscillation in the Pleistocene, this platform was covered by sand and gravel deposits, coralline algae reefs and marine sands.

During the Pleistocene, with sea level some six meters below its present mark, there were large sandy beaches south and southeast of the archipelago. The southeastern winds, blowing as today, moved these sands forming dune fields which may have attained 20 meters in depth, linking present-day Rata Island to Santo Antônio Peninsula in the main island. Smaller dune areas, such as in the entrance of Sueste bay, were also formed locally in the southeastern coast of the main island.

With the rise of sea level, most of these sand fields were submerged, and those above water consolidated in present-day Caracas calcareous sandstone. This sediment, of a light cream color, is almost entirely made of calcareous grains, in the majority of Coralinnaceae algae, the rest being minerals from magmatic rocks.

The archipelago of Fernando de Noronha is the remainder of a vast volcanic building which was formed approximately 12.3 million years ago, with the very last volcanic events dating from some 1.7 mya . The bottom of this mountain is some 4,000 meters deep, 60 km wide and oriented in N-NE and S-SE directions. The secondary islands around the main one are part of a shallow platform with no more than 4-5 Km of width, beyond which depths increase almost vertically.

From the last volcanic events until today, the erosion processes (winds, sea currents and wave action) and the resistance of the geological structure redesigned the area in steep elevations, plateaus, valleys, plains, escarpments, consolidated sandstone, pebble and sandy beaches.

The northeastern side of the islands, called " Mar de Dentro" (inner sea), is protected from the predominant winds. In the " Outer Sea", the southeastern face, the sea is rougher. Most of the shoreline is made of cliffs and escarpments, with few beaches in between.

Phonolitic hills rise from a plainer base (over which the main island's airfield was built). This central plateau is surrounded by two areas of smooth relief which rise to 150-200 meters. Both are composed of pyroclastic rocks alternated with ultrabasic lava flows. They appear in sequence obeying the smooth flow declivity, and end in a moderated talus towards shore, or in elevated cliffs. The valleys, normally dry, have their design strongly influenced by the geological structure and are originated in the phonolitic hills.

Adjoining the southern and western limits of the main island there are lava escarpments; algal reefs formed by *Lithothamnium* are abundant and sandy beaches are scarce there, being more developed in the northern shores. Ancient sea levels are presumed or indicated in the main island, the highest being responsible for sculpting the central plateau - it would then be about 30 meters higher than current sea level.

Another level is indicated by the presence of marine limestone originated from *Lithophyllum* algae in the vicinity of the harbor, in the peninsula of Santo Antônio. Beach deposits containing pebbles and remains of fish, coral and other marine organisms are also found at this peninsula some seven meters above present-day sea level and some 70 meters away from the current seashore. Similar deposits in other parts of the island can be recognized up to 12 meters above current sea level. The Caracas calcareous sandstone recovers these deposits, being therefore younger than it.

The terrestrial vegetation of the National Marine Park of Fernando de Noronha is basically subxerophitic, with few tree species and many shrubs and herbs. There are endemics, the fig tree *Ficus noronhae*, mulungu *Erythrina velutina* v. *noronhae* and burra-leiteira *Sapium scleratum*. Continuous arboreal masses of considerable height (10 to 15 meters) are found in the elevations and plateaus. In the plains, which in the past were most impacted by man, shrubs and herbs compose most of the communities.

Though the Southern Equatorial Current, which reaches Fernando de Noronha, is not rich in nutrients, the existence of the insular complex allows for great productivity and abundance of marine life.

Filamentous algae, *Sargassum*, epiphytic and calcareous algae predominate in the marine flora. The reef formations of "Mar de Fora" are basically fringe reefs formed by calcareous algae and vermetid mollusks. In the "Mar de Dentro" reefs, true coral formations are predominant.

The very high concentration and diversity of marine invertebrates covering the rocky surfaces, such as corals and sponges, or living in the crevices of reefs, such as lobsters and octopi, are typical of the Fernando de Noronha / Rocas Atoll insular complex.

The fish fauna of the complex is very similar throughout the area, comprising both resident and migratory/passing species.

In the vicinity of the islands, young individuals of the highly endangered hawksbill turtle (*Eretmochelys imbricata*) and green turtle (*Chelonia mydas*) are found and the area constitutes a vital feeding ground for them. Females of the green turtle seek the sandy beaches of the complex to lay eggs. This species attains an adult size of about 1.2 meters and may weigh up to 300 Kg. Its breeding season begins in December, when the first groups of adults approach Fernando de Noronha / Rocas Atoll for mating. The egg laying can be observed there from January to July, with its peak during rainy season, in March/April. In Fernando de Noronha, the main nesting beaches are Leão, Sancho Bay and Boldró. At Rocas, nests are concentrated in the western side of Farol island.

The National Marine Park of Fernando de Noronha has records of sightings of many cetacean species, but its most well-known resident is the spinner dolphin (*Stenella longirostris*) which, as already stated, can be seen in groups of 5 to 1,200 individuals in the Bay of Dolphins during 90% of the days.

Three endemics compose an important part of the terrestrial fauna of Fernando de Noronha, the mabuya lizard (*Mabuya maculata*), the two-headed lizard (*Amphisbaena ridleyana*) and the yellow terrestrial crab (*Gecarcinus lagostoma*).

The insular complex harbors the most important breeding colonies of seabirds in the Tropical Atlantic, both in diversity of species and number of individuals. Four species of Laridae (*Anous tenuirostris*, *A. stolidus*, *Gygis alba* and *Sterna fuscata*), six species of Pelecaniformes (*Sula sula*, *S. dactylatra*, *S. leucogaster*, being the only place in the world where these three species coexist.; *Phaeton lepturus*, *P. aethereus* and *Fregata magnificens*), one Procellariidae (*Puffinus assimilis*).

Puffinus assimilis was found nesting in Morro do Leão Island, inside the National Marine Park of Fernando de Noronha. One of the smallest seabirds in the world, this species had only being known to nest in the Canary Islands and around Antarctica.

Three endemic terrestrial species (*Zenaida auriculata noronhae*, *Vireo gracilirostris* and *Elaenia ridleyana*) compose the birdlife breeding on the insular complex, which is also used as resting area and feeding ground for some other 21 species of migratory birds, 13 of which are shorebirds (mainly plovers) and eight of waterfowl and egrets.

The National Marine Park of Fernando de Noronha, a federal protected area under the jurisdiction of the National Institute for the Environment and Natural Resources - IBAMA, comprises approximately 55% of the main island of Fernando de Noronha, all the other islands in the archipelago and most adjoining waters to the 50 meters isobath, in a total area of 11,270 hectares.

Rocas Atoll is also the highest point of a submarine high relief in the same proportions of Fernando de Noronha, with maximum depths in the vicinity of 3,000 meters and its peak leveled by the sea, resulting in the profile covered by coral reefs, calcareous algae and the organic detritus resulting from these. The atoll is an elliptic reef with approximately 7.5 sq. Km. An algal crest limits the reef plateau, which is dominated by an association of coralline algae and vermetid gastropods, growing in the form of small linear crests.

In the reef front, its crevices and nooks, in the pools and the internal lagoon, the corals *Siderastrea stellata*, *Montastrea cavernosa* and *Porites* spp. can be found. Seismic refraction profiles revealed the existence of two subsurface strata; in a profile 11.6 meters deep, taken from the western part of the reef, it is found that the Holocenic sequence of Rocas was built primarily by coralline algae followed by corals, the foraminiferan *Homotrema rubrum* and vermetid gastropods. The low level of competition and low degree of herbivory may be the main factors that provided for this intense growth of incrusting coralline algae in Rocas.

The reef growth has probably begun before 4,800 years ago, with the layering rate being between 1.5 to 3.2 meters per thousand years. The unique chalices or "rocas", permanently seen above sea level, and beach sandstones found in one of the two islands of the atoll, are witnesses to past sea levels in the Holocene.

Though its relatively small dimensions and the lack of a deep lagoon have been used as arguments against considering Rocas a true atoll, its present-day morphology shows several characteristics that do exist in the atolls of the Caribbean and Indopacific regions, among which the presence of a shallow lagoon and sandy beach to windward of the reef, as in the Caribbean atolls; the existence of an algal crest in the reef fringe, which also happens with Indopacific atolls; and the largest extension of the reef ring to the leeward of the atoll, something typical of both regions mentioned before. This reef front is a rather vertical cliff with a pebble and grit deposit in its base, the rest of the seamount crest being covered by sandy sediments and small reef columns.

Rocas Atoll has a dense island vegetation which is typically herbaceous, salt-resistant, adapted to high levels of light and constant tide action. The calcareous composition of the soil, mixed with animal and plant debris plus bird guano, provides for still further narrowing of the species composition, restricted to halophytes. Predominant in this context are *Portulaca oleracea* (Portulacaceae), *Sesuvium portulacastrum* (Aizoaceae), *Cyperus ligularis* (Cyperaceae) and *Eragrostis prolifera* (Poaceae). Coconuts (*Cocos nucifera*) and casuarinas (*Casuarina equisetifolia*), introduced by seamen as an aid to navigation around the atoll, still exist as a few scattered individuals.

Plants such as *Blutaparon* spp. (Amaranthaceae) develop their prostrate branches towards the sea and present structures which resist being buried in sand, such as rhizomes and stolons which grow continually and form veritable mats. During exposure caused by the removal of sand in high tides, these plant parts sprout new branches with leaves. This species occupies the very first line of vegetation of the atoll islands. *Portulaca* spp. advances farther inland, forming "islets" which alternate plant cover with the Cyperaceae, Graminae and Amaryllidaceae species.

Coral reefs are some of the ecosystems with the highest known concentrations of biomass. With a very high primary productivity, all energy levels of the trophic pyramid are widened. For seabirds this represents a huge concentration of food, facilitating its appropriation and therefore the raising of young. Other factors making Rocas Atoll important as a breeding site are the small but nevertheless useful shadow provided by the shrubs and the very low levels of predation.

The reef front appears in two distinct shapes. In the eastern and southern parts it is abrupt, an almost vertical wall, which drops from the reef fringe to 10 meters where a tallus deposit extends down to 15 meters. At that level there is a horizontal terrace inhabited by non-skeletal algae and coralline algae, corals and sponges, which continues for some 1,000 meters away from the atoll towards the East and South. Though mainly covered by green and brown algae and with little sediment accumulation, in this platform corals such as *Mussismilia hispida* and the hydrocoral *Millepora alcicornis*, besides several species of sponges and rhodoids, can be found. This is most likely the top of the platform which serves as the rock substrate for Rocas Atoll. In the western and northern parts the reef is characterized by a chain of pontoons and gorges from the reef fringe down to approximately 18 meters deep.

The reef plateau is the more or less plain surface of the internal, higher portion of the reef, circumscribed by its external fringes and above sea level during low tide. The reef ring is interrupted in its northern and western faces by two channels, called respectively Barreta Grande and Barretinha. The ring is therefore divided in a windward arch and a leeward arch.

Rocas Atoll hosts the largest concentration of seabirds in the complex, including a huge colony of sooty terns *Sterna fuscata*. More than 150,000 seabirds of the abovementioned species depend on the insular complex for their survival.

3b. History and Development

It is officially recognized that the archipelago of Fernando de Noronha was discovered by Americo Vespucci in 1503, in an expedition sponsored by the Portuguese nobleman Fernão de Loronha, who was granted these islands by the King of Portugal as a reward for his effort. This donation, in the form of a Hereditary Captainship (*Capitania Hereditária*), was never made effective and the archipelago was later used frequently by French, Dutch and British ships seeking water, food and timber.

Subsequently a short period of French occupation happened in 1736, until the Portuguese took material possession in 1737 through the Captainship of Pernambuco, which established the settlements of Vila dos Remédios and Sambaquixaba in the main island and began the building of the first fortified positions. From that date already, Fernando de Noronha was to be used as a correctional prison for ordinary criminals.

In 1938 the archipelago is transferred from the Province of Pernambuco to the federal government, which establishes a political prison in the main island. In 1942 it acquires the status of Federal Territory the first airfield is built, which not only improved the replenishment of vital goods but also began to bring the very first tourists from the mainland.

In 1943, during World War II, the Brazilian government turned the archipelago into a military outpost, managed by the War Ministry. In 1946 the Brazilian Air Force Detachment of Fernando de Noronha is established. Military presence was a determinant factor in the creation of the social structure in Fernando de Noronha.

In 1981, jurisdiction is transferred to the Air Force Ministry, followed by transfer to the Armed Forces Joint Command in 1986. Shortly after, the first civilian governor of Fernando de Noronha, Fernando César Mesquita, was appointed by then President José Sarney.

1986 would also see the first organized attempts to properly manage the tourism influx of Fernando de Noronha, through an agreement between the local government and the Ministry of Commerce and Industry (under which the National Tourism Authority, EMBRATUR, is managed).

The proposition of marine protected areas is in direct proportion of the need to protected representative ecosystems, in Brazilian jurisdictional waters, from the negative effects of human action. Following this principle, in 5 June, 1979 Rocas Atoll was declared a National Biological Reserve, and in September 14, 1988 the National Marine Park of Fernando de Noronha is established, this one followed a worldwide campaign for its protection spearheaded by Brazilian environmentalists. The new Federal Constitution of 1988 granted all protected areas special status, preventing them from being reduced in area or de-gazetted without formal authorization from the National Congress.

The relatively slow growth of the local economic has been beneficial for the conservation of the island ecosystems and to allow for the implementation of an actually sustainable tourism in Fernando de Noronha, as no large investments by external groups have been made and local people are becoming gradually more professional in tourism enterprises. Tourism in Noronha is locally conducted by small businesses, in its majority established on the island more than ten years ago.

Today, about 2,100 people inhabit Fernando de Noronha Island, the only one with permanent residents in the whole complex. Tourism and government service are the main economic occupations.

The island has an hospital, school, postal agency, markets, pharmacy, souvenir shops, a bank agency with online services, and Police detachments both civilian and military. Fixed and mobile phone services are available and there are data transmission lines for Internet access.

Transportation of passengers to/from Noronha is mainly done by airplane, from Recife or Natal airports in the mainland, but private sailboats and a few cruise ships also call on Fernando de Noronha. Cargo is generally carried by boats from Recife and Natal.

Potable water is supplied by the Pernambuco State Water Department - COMPESA. Due to the volcanic origin of the archipelago, springs are non-existent, and the drinking water comes from rainfall captured in small dams and wells. A de-salination plant capable of delivering 500,000 liters/day is under construction.

The Pernambuco Power Company - CELPE provides electricity in 220 volts on a permanent basis; two wind-propelled turbines generate approximately 30% of the energy (the rest being from an oil generator) and experiences are being carried out to provide power and water heating using solar energy.

Rocas Atoll, on the other hand, was first charted in the 16th century map of Cantino. The first detailed chart of Rocas was done in 1852 by Capt. Lieutenant Phillip Lee. By then the atoll was still known as Rocas Shallow or Goats' Shallow. It would be only in the bathymetric map of Commander Vital de Farias, issued in 1858, that Rocas was to be acknowledged as an atoll.

Its first mention by a naturalist happened in the late 16th Century, when Jean de Lèry did a brief and rather general description of its features from a distance, upon his return to France from his prolonged travels in Brazil. After the establishment of the Biological Reserve in 1978, motivated by its uniqueness, fragility and biological importance, but also by the almost complete lack of knowledge about its ecological processes, the federal government began to organize scientific expeditions to Rocas Atoll. The first such expedition was carried out in 1989 and gathered the first scientific data on the populations of marine turtles and birds of the atoll, besides providing for the production of a documentary showed the astonishing beauty and biological richness of that national heritage to the general public.

In 1990 another official expedition was carried out with a multidisciplinary team which studied the several sedimentary environments, seabird populations, fish, crustaceans, marine turtles and cetaceans. In parallel to the scientific effort, enforcements operations were implemented in order to curtail illegal trawling, spearfishing and tourism then plaguing the site.

From 1990 onwards several relevant biological aspects of Rocas Atoll have been elucidated by comprehensive efforts such as the continued studies on migratory and resident seabirds through banding and demography surveys undertaken by the National Migratory Birds Research Center - CEMAVE, monitoring of sea turtle nesting by the TAMAR Marine Turtle Project, and several surveys and detailed studies of fish, crustaceans, benthonic organisms such as macroalgae and gastropods.

In January 1991 effective on-site implementation of the National Biological Reserve began, under the responsibility of the National Institute for the Environment and Natural Resources - IBAMA and with the creation of specially designated staff to provide for monitoring and enforcement of the Reserve.

3c. Form and date of most recent records of site

The documents and management instruments for the protected areas of the complex which consolidate relevant information are the Management Plan of the National Marine Park of Fernando de Noronha (September 1990), the Implementation Plan for the Rocas Atoll National Biological Reserve (September 1992), the Planning Program for the Fernando de Noronha Environmental Protection Area (September 2000) and the Study on the Carrying Capacity of Fernando de Noronha (September 2000).

The Brazilian Marine Turtle Project - TAMAR began activities in the insular complex in 1984 and has since maintained an updated database on marine turtles in the region.

The Spinner Dolphin Project located in Fernando de Noronha studies behavior and population dynamics of *Stenella longirostris* on a long-term basis and its group of associated researchers has already produced an M.Sc. thesis, four undergraduate conclusion monographies, more than 50 papers and communications presented in national and international scientific meetings, a CD-ROM, and a video documentary. Presently two Ph.D. dissertations are being developed. Like TAMAR, the Spinner Dolphin Project also maintains an updated database on these animals.

The fish fauna of the insular complex has been the subject of two M.Sc. theses and one Ph.D. dissertation, and two other Ph.D. works are under way, being coordinated by the Zoology Museum of the São Paulo University. Likewise, the same University's Department of Zoology is involved in two Ph.D. studies aimed at the seabirds in the region.

Two M.Sc. theses were already presented on the geology of Rocas Atoll, and recently surveys of cartilaginous fish and coralline algae were undertaken, together with an in-depth analysis of the reef structure of the atoll.

3d. Present state of conservation

Fernando de Noronha and Rocas Atoll are protected under specific legal instruments (federal decrees establishing the National Marine Park and the National Biological Reserve respectively), tailored to the protection of the unique natural attributes of the complex.

The National Marine Park of Fernando de Noronha covers the majority of the main island and all the smaller islands in the archipelago, and the rest of the main island is managed under an Environmental Protection Area statute. Rocas Atoll is entirely within the limits of a National Biological Reserve which extends down to the 1,000 isobath, effectively protecting all the upper reaches of the seamount from which it emerges (please see maps for visualization).

The Brazilian Federal Constitution ensures in its Article 225 that "*everyone has a right to an ecologically balanced environment, a common use asset for the public and essential to a healthy life, being the responsibility of the Public Service and all collectivity its defense and preservation for present and future generations*". The special status of protected areas is reaffirmed in the passages that follow, forbidding its alteration without specific National Congress authorization.

This legal protection is effectively enforced by the permanent presence, in Fernando de Noronha and Rocas Atoll, of teams from the national environmental authority charged with enforcing the norms and regulations pertaining to these very special protected areas. It is therefore possible to affirm not only that the present conservation status of the complex is very good, but also that there are human and material resources *in situ* which ensure the necessary and continued protection of that invaluable natural heritage.

3e. Policies and programmes related to the presentation and promotion of the property

The archipelago of Fernando de Noronha, being in its majority a National Marine Park, allows for and can sustain a visitor influx; as such, over recent years the Park has been recognized as one of the most well-known and most visited protected areas in Brazil. It is estimated that some 400,000 tourists visit the Park annually, providing a gross income for the island of approximately US\$ 8 million/year.

This public demand has provoked the development of several initiatives aimed at interpreting and adding educational value to the natural heritage of the site, undertaken both by government authorities and private institutions which operate in Fernando de Noronha, such as the TAMAR Project and the Spinner Dolphin Project, both with fieldwork stations there and working in strict cooperation with the National Park management.

Supported by information and instruments developed in this context, the private sector involved in tourism - local guides and agencies - can act as multipliers of environmental awareness, also directing visitors to the regular educational events hosted at the Park headquarters and distributing educational and informative materials produced by the abovementioned institutions.

Rocas Atoll, being a National Biological Reserve and therefore a strictly protected site, does not allow for general public access, though it receives a meaningful influx of scientists for the development of research projects and programs previously approved by the environmental authority. Nevertheless, the need to disseminate information about this unique protected area prompted the federal government to establish in 1999 an Internet site, <http://rocas.speedlink.com.br>, which allows for the general public to pay a virtual visit and learn about the scientific and environmental importance of the site.

The proposed recognition of the tropical insular complex of Fernando de Noronha / Rocas Atoll as a World Heritage Site would open new opportunities and challenges towards developing an integrated valorization and interpretation program for the natural heritage contained in this unique system.

Such a program would need to be aimed at two different sectors: the general public, so that it may know and understand the universal values contained in these protected natural sites, and the scientific community, stimulating and facilitating researchers' access in order to accelerate the building of a solid basis of scientific knowledge upon which management action and conservation measures can be designed.

4. Management

4a. Ownership

The Federative Republic of Brazil is the sole owner of the areas contained in the National Marine Park of Fernando de Noronha and the Rocas Atoll National Biological Reserve, as well as of the marine areas proposed as buffer zones in this document. Part of the main island of Fernando de Noronha, outside the National Park boundaries, is owned by the State of Pernambuco, including the urbanized areas which are occupied under concession.

4b. Legal status

Rocas Atoll is a National Biological Reserve - the first marine reserve to be established in Brazil - and was created by Federal Decree 83,549 of July 5th, 1978. According to the National Protected Areas System Law (Federal Law 9,985 of July 18, 2000), a Biological Reserve is the strictest protected area, aimed integrally at the conservation of biodiversity.

No recreational activity or exploitation of resources is permitted inside such areas. However, guided visits aimed at research and education can be allowed in special cases, with previous authorization of the National Institute for the Environment and Natural Resources - IBAMA.

The National Marine Park of Fernando de Noronha was established by Federal Decree 96,693 of September 14, 1988, encompassing about 70% of the total area of the archipelago, and is also managed by IBAMA.

A National Park according to the Protected Areas System Law is defined as a category aimed at protecting natural ecosystems of great environmental importance and scenic beauty, allowing for scientific research and the development of environmental education and interpretation, nature-oriented recreation and ecotourism.

4c. Protective measures and means of implementing them

The National Marine Park of Fernando de Noronha and the Rocas Atoll National Biological Reserve are legally protected by its abovementioned federal decrees of creation.

The Federal Constitution of Brazil, in its Article 225 which defines measures to ensure an adequately balanced environment and quality of life for the Brazilian people, determines *inter alia* as a common responsibility:

" II - Preserve the diversity and integrity of the genetic heritage of the Country and and monitor the institutions dedicated to research and manipulation of genetic materials;"

and

" III - Define, in all the Units of the Federation, territorial spaces and its components to be placed under special protection, its alteration or suppression being allowed only through Law, being forbidden any utilization which may compromise the attributes which justified its protection" .

The fauna and flora of the insular complex are protected under the Environmental Crimes Law (federal Law 9,605 of February 1998).

Spinner dolphins are especially protected by Edicts no. 05/95 and 117/96 from IBAMA and by Normative Instruction 04/99 of the Administration of the State District of Fernando de Noronha. The government-endorsed Action Plan for the Aquatic Mammals of Brazil also determines as priority actions for the species the determination of its distribution and population size, photo-identification of individuals and behavioral studies.

The National Marine Park of Fernando de Noronha is also protected through its Management Plan and the Master Occupation Plan for the rest of the main island, which conditions the demographic and tourism growth of the site to its carrying capacity, recently defined in the scope of the Management, Ecotourism and Sustainable Development Plan.

The Rocas Atoll National Biological Reserve has an Implementation Plan, developed by the Ecosystems Directorate of IBAMA, which guides the actions needed for its proper management and conservation.

4d. Agencies with management authority

IBAMA, through its Department of Conservation Units, is the responsible institution managing both federal protected areas proposed for nomination in this document.

To provide support and cooperation for the management of some species of the local fauna, IBAMA counts on the Brazilian Marine Turtle/TAMAR Project, the Aquatic Mammals Research, Management and Conservation Center and the Spinner Dolphin Project.

The management of the non-federally protected areas in Fernando de Noronha is the responsibility of the State District of Fernando de Noronha, installed *in situ* and with offices in Recife, Capital of the State of Pernambuco.

4f. Agreed plans related to property

The National Marine Park of Fernando de Noronha has a Management Plan prepared in 1990 and aimed at providing a framework for long term management actions to safeguard the Park and maximize its enjoyment by the public in a sustainable manner. The part of the main island not covered by the Park is managed under the guidelines contained in the Sustainable Development and Ecotourism Management Plan –First Phase (Carrying Capacity), prepared in July 2000 and under implementation by the District Authority. The Plan prescribes several lines of action to address current need and also to tackle potential management challenges in the future.

The Rocas Atoll National Biological Reserve is managed in accordance with its Implementation Plan issued in 1992 and which provides guidelines on management topics (eg enforcement, monitoring and educational/extension policy).

4g. Sources and levels of finance

Maintenance funding for both the National Marine Park of Fernando de Noronha and the Rocas Atoll National Biological Reserve are provided by IBAMA and the Ministry of the Environment as determined yearly by the Federal Budget. Specific projects related to research and/or additional conservation initiatives in the area have been funded sporadically by the National Environment Fund - FNMA, a source managed jointly by the Ministry of the Environment and civil society representatives through a Council which examines and approves such projects (eg. research and education related to spinner dolphins in Fernando de Noronha). Other third party conservation projects developed in the insular complex, such as the Brazilian Marine Turtle Project (TAMAR) receive both government funding and private enterprise sponsorship in varying degrees.

4h. Sources of expertise and training in conservation and management techniques

Managers and staff of the National Marine Park of Fernando de Noronha and the Rocas Atoll National Biological Reserve receive training in management, enforcement and conservation techniques through specific workshops and courses organized by IBAMA.

Additionally, researchers from the Spinner Dolphin Project, TAMAR Marine Turtle Conservation Center and CEMAVE – National Migratory Birds Center have been available over the years for the exchange of information and provision of specific knowledge regarding these wildlife groups in the insular complex.

4i. Visitor facilities and statistics

The National Marine Park of Fernando de Noronha is the only one of the two national protected areas in the complex which is open to visitors. Fernando de Noronha has received a growing influx of visitors, from 4,435 in 1991 to 47,450 in 2000.

The National Park has a Visitor Center with permanent and temporary exhibits on the nature and history of the site, and a lecture room used regularly for educational events, lectures and talks about the natural features of the Park.

In the main island, outside the Park boundaries, 100 hostels and inns offer approximately 1,000 beds, and there are 33 restaurants able to cater for visitor needs. Three diving operators offer diving packages including Park areas.

4j. Site management plan and statement of objectives

As already stated, the National Marine Park of Fernando de Noronha has a Management Plan issued in 1990 and the Rocas Atoll National Biological Reserve has an Implementation Plan issued in 1992. Both documents are annexed to this proposal.

The objectives of these categories of national protected areas are stated in the National Protected Areas System Law (Federal Law 9,985 of July 18, 2000), viz:

National Park - Aimed at the preservation of natural ecosystems of outstanding environmental and scenic values, providing for the development of research, education and environmental interpretation, as well as for outdoor recreation and ecotourism.

Biological Reserve - Aimed at the strict protection of biological communities and all other natural attributes of a site, without direct human interference or environmental alterations, with the exception of those measures necessary for the restoration of degraded areas and management action for the preservation of natural balance, biological diversity and natural environmental phenomena.

4k. Staffing levels

The National Marine Park of Fernando de Noronha has as staff of 21: one Unit Manager, one technical, eight administrative and eleven general services personnel.

Rocas Atoll National Biological Reserve has a staff of two, one Unit Manager and a support/administrative person, and receives additional manpower for enforcement from the Regional Office of IBAMA in Natal, State of Rio Grande do Norte, plus occasional contract workers in a hired boat for reprovision and maintenance of the Reserve structure at the atoll.

5. Factors Affecting the Site

5a. Development pressures

Fernando de Noronha has a present day stable population of approximately 2,100 inhabitants. Tourism was consolidated since the 1970's, and today there are daily flights from Recife and Natal. However, several factors contribute to restrict tourism and impose upon it the need to be managed in a sustainable way, such as:

- Distance and physical isolation from the continent;
- The lack of a large tourism infrastructure on the island, with only one hotel with 100 beds and approximately 100 guesthouses, totaling some 1,000 beds available for visitors;
- An environmental tax which is imposed on visitors (called the Permanence Tax - TPA), levied daily on an increasing fare and which effectively limits the number and length of stay of the tourists;
- The number and size of tour boats, which has stabilized four years ago;
- The restrictions on new inhabitants. Only first degree relatives of local families or those with a definite job can stay on the island for more than 10 days without paying the Permanence Tax, which as said increases - geometrically - in proportion to the length of stay.

During the development of studies leading to the determination of the carrying capacity for Fernando de Noronha it was found that the average number of tourists during the peak season is 770 (average stay of four days). The simultaneous number of tourists on the island in its off-season, taken from May 1999, was 250 (average stay of three days).

5b. Environmental pressures

Environmental pressures are mostly a result of human impact over the centuries, with particular note to the suppression of vegetation in parts of Fernando de Noronha island, and the introduction of exotic species of fauna and flora, which are dangerous to the fragile equilibrium of the sites and are being managed over the years with an aim to their final elimination.

5c. Natural disasters and preparedness

As natural disasters only the risk of fires during dry season is actually a concern. This problem is considered under control and is monitored by a specific IBAMA program called PREVFOGO.

5d. Visitor/Tourism pressures

Tourism activity involving the insular complex is not new, and only began to improve in 1963 when Brazilian Air Force planes and some commercial cargo flights regularly began bringing tourists on a weekly basis. The political events of 1964 led to the designation of the island, once more, as a political prison, and it wouldn't be until ten years later that the government would convince a national company, TRANSBRASIL, to begin regular passenger flights to Fernando de Noronha. At the same time the Esmeralda Inn was created, in the installations of the old North American military base.

In the 1980's several actions contributed to highlight the site as a tourist destination, including the development of a survey by the Ministry of Commerce and Industry on the its potential and the proposition of the first regulations for tourism in Fernando de Noronha; the establishment of the National Marine Park of Fernando de Noronha; and the creation of its adjoining Environmental Protection Area.

At that time, accommodation on the island did not reach 100 beds. In the last years, however, guest houses were opened by the local islanders, from the very simple to more sophisticated ones, catering for the needs of a larger number of visitors and its increasing diversity.

Broadly publicized as a natural paradise, Fernando de Noronha became a dream destination for the holidays of many Brazilians.

The airport of Fernando de Noronha handles five regular daily flights, three by TRIP Airways (from Natal) and two by Nordeste Linhas Aéreas (from Recife), with a possibility of inserting extra flights during national holidays, which in any case must be previously authorized by the proper authorities.

Regular maritime cruises including Fernando de Noronha in its route have been undertaken since December 1990 when the cruise ship *Funchal* started to call at the island's harbor. Currently there are more ships bringing tourists to Fernando de Noronha during summer (December to March) and on average some 200 to 400 tourists disembark to see the island up close. As the ships usually stay for two days, tourist numbers are distributed in a variety of available activities. For instance, those doing land walks in the first day will take the boat sightseeing and dolphin-watching tours on the second, and vice-versa. This system has reduced the jamming of natural attractions by huge numbers of people, avoiding conflicts between cruise ship passengers and airline visitors, and diminishing the impact on the environment. A cruise ship like *Funchal* has a passenger capacity of 800 people, though it usually calls on the island with an average of 300 per trip.

Upon arrival, all visitors are requested to fill a form with personal data, declare the length of stay and pay the corresponding Permanence Tax.

The Permanence Tax - TPA was instituted by the State of Pernambuco by State Law 10,430 of December 29, 1989, altered by State Law 11,305 of December 28, 1995), with the aim of contributing to the environmental protection of the Fernando de Noronha archipelago. It is imposed upon visitors to the State District and may vary from a one-day visit value of R\$ 21.28 to R\$ 1,775.77 for 30 days.

This Tax is levied on every non-resident on a recreational trip and is justified by the use by said tourists of the District infrastructure and the enjoyment of the natural and historical heritage of the archipelago.

Those tourists arriving in a cruise ship also are requested to pay a Social Contribution Tax of R\$ 30.00 per person for the development of social projects on the island. The District Council controls these funds. Besides these taxes, visitors to the National Marine Park pay an R\$ 9.00 entrance fee, charged by IBAMA.

In 1999 an increasing growth was observed in the number of tourists in every month of the year, with a peak in July when 5,376 tourists were recorded, with an average stay of 3.6 days. A higher frequency of visitors coincides with school vacations (July, January and February), though in September and October some increase can also be seen, probably as a result of prolonged national holidays such as the National Week (September) and Childrens' Day next to Teacher's Day (October).

Besides ordinary tourists, the islands receives workers or resident families' visitors, which can be exempted from the Permanence Tax once approved by the District Administration. There is concern over cases in which extended permanence has resulted from an initial temporary stay, lured by the potential job availability with the increase in tourism activity. These people, sometimes better professionally qualify, compete with the locals for these jobs, something which has already been recorded as a problem in the Galápagos Islands.

Positive impacts of tourism in Fernando de Noronha can also be mentioned: the activity developed into a new way of life for some 70% of the local population, which is directly or indirectly involved with it; contributed to increase the perception of natural heritage value by the locals and the general public (paradise island in opposition to the prison/hell island vision of the past); generated the birth of environmental awareness; highlighted the island at State and Federal levels, improving the destination of public funds towards its community needs and facilitating the development of better infrastructure (e.g. paving of roads and expansion of airport, water and sanitation); promoted the preservation of historic and natural sites; increased State income with the Permanence Tax; and promoted the development of plans and projects including the studies on carrying capacity.

Negative impacts worth mentioning are the polarization of the tourism activity as a main economic alternative, competition and conflict between occupations (fisherman or tour boat pilot), an increase in crime rates and in the production of garbage.

5e. Number of inhabitants within site, buffer zone

There are no inhabitants inside the areas proposed for inscription as a World Heritage Site. The available population records refer only to the buffer zone in part of the main island of Fernando de Noronha and are taken from the population censuses of 1970, 1980, 1991 and 1996, and from the State District survey of 2000.

In the ten years between 1970 and 1980 the population growth was of only 2.6 %. In the following eleven years it grew 32% between 1991 and 1996 it grew 11.6% and between 1996 and 2000 it kept the same approximate increase rate.

The acceleration of these rates happened in the 1980's, with a noted decrease in the 1990's. In the last few years the average population growth rates for Fernando de Noronha were higher than the national average of 1.36% for 1991-1996 and than that for the State of Pernambuco, of 0.75% for 1991-1996. This is due to the influx of people seeking job opportunities associated with the island's image.

At Rocas Atoll there are no permanent residents, only research and enforcement teams that rotate regularly, and as said previously no general public access is allowed.

6. Monitoring

6a. Key indicators for measuring state of conservation

The term *indicator* refers to a specific variable that, alone or in a group of others, may be taken as indicating the condition of a given area. These indicators provide information about changes and change rates and serve as instruments to highlight problems and detect trends, besides serving as alert signals to predict future conditions. Indicators may signal the need for corrective management action, evaluate the efficiency of several alternatives and help determine if the protected area objectives are being achieved.

A group of criteria was used as basis to select indicators to be monitored mainly in Fernando de Noronha, though some of them are also valid for Rocas Atoll. Such criteria are related to the following items:

- Trails
- Lookouts
- Beaches
- Dive sites
- Presence and abundance of fish species
- Presence and abundance of marine turtle species
- Presence and abundance of mammals
- Presence and abundance of top predators in the food chain
- Diversity of benthonic communities

The development and application of these criteria in the field is an ongoing process and will need refinement over time as the local reality is evaluated and similar experiences in management develop in other specially protected areas.

6b. Administrative arrangements for monitoring property

Both Management staff at the National Marine Park of Fernando de Noronha and Rocas Atoll National Biological Reserve are charged with the duties of monitoring these sites and taking proper management action should the need arise.

Additionally, university research groups continually visit the insular complex and provide additional information on specific biological parameters, taxa of flora and fauna and other aspects relevant to the proper management of the site and its unique natural features.

As regards marine turtles, seabirds and dolphins, the specific permanent research programs already mentioned continue to develop a long term monitoring program that accumulates more data on the life history and conservation needs of these wildlife groups.