



## World Heritage Sites

Protected  
Areas and  
World  
Heritage



## GALÁPAGOS ISLANDS ECUADOR

*Isolated in the Pacific Ocean 800-1100 km west of Ecuador at the confluence of three ocean currents, cold and warm, these islands, which are subject to ongoing volcanic and seismic activity, and the surrounding marine reserve, are a natural museum of geological, ecological and evolutionary processes. Their varied climates, oceanographic regimes and extreme isolation, have produced one of the world's highest concentrations of endemic species including unusual animals such as the land and marine iguanas, giant tortoises and the many types of finch that inspired Darwin's theory of evolution following his visit in 1835. One-third of the archipelago's vascular land plants are endemic, as are nearly all the reptiles, half the breeding land birds, and almost 18% of the marine species of the archipelago. They have been called a living museum and showcase of evolution.*

*Threats to the site: Invasion by large-scale tourism and unsustainable fishing by mainland fishermen financed by foreign companies supported by authority, is waging permanent opposition to the restrictions of the National Park. In 2005 the International Galapagos Tour Operators Association noted that fishermen numbered 1,000 out of a population of 25,000, and their industry brought in \$6 million compared with \$150,000 million from tourism. The growth in population, unplanned urbanisation, pollution, damaging invasion by exotic species and the resulting degradation of habitats is unplanned for and inadequately controlled at present. Government agencies are not coordinated and the Park had 12 Directors between 2005 and 2008.*

### COUNTRY

Ecuador

### NAME

Galápagos Islands  
(*El Parque Nacional de Archipiélago de Colon*)

### NATURAL WORLD HERITAGE SERIAL SITE

1978: Inscribed on the World Heritage List under Natural Criteria vii, viii, ix and x.  
One of the first four natural World Heritage sites to be established.

2001: Extended by inclusion of the Galápagos Biological Marine Resources Reserve.

2007: Entered on the list of World Heritage sites in Danger due to the threats of invasive species, burgeoning tourism, increasing immigration and poor governance.

2010: Site removed from the list of endangered sites.

### INTERNATIONAL DESIGNATIONS

1984: The *Archipiélago de Colon (Galápagos)* designated a Biosphere Reserve under the UNESCO Man and Biosphere Programme (14,761,844 ha);

2002: The *Humedales del Sur de Isabela* designated a Wetland of International Importance under the Ramsar Convention (872 ha);

## IUCN MANAGEMENT CATEGORY

Galápagos Islands National Park:

II National Park

Galápagos Biological Marine Resources Reserve:

VI Managed Resource Protected Area

## BIOGEOGRAPHICAL PROVINCE

Galapagos Islands (8.44.13)

## GEOGRAPHICAL LOCATION

The Galápagos (or Colon) Archipelago lies in the eastern Pacific Ocean 800-1100 km west of mainland Ecuador. The equator runs through Wolf Volcano on Isabela Island. The Marine Reserve includes all the water within a circumferential zone 40 nautical miles wide: 1°40'N to 1°36'S by 89°14' to 92°01'W.

## DATES AND HISTORY OF ESTABLISHMENT

1936: The Galápagos National Park (GNP) established by Executive Decree 31;

1959: Boundary ratified by Decree 17, to include all islands except those colonised on 20 July, 1959;

1968: Boundaries finally established: effective management began; 1971: published in Official Registry;

1971: Marine Reserve (7,990,000 ha) baseline joining the outmost points of the Islands ratified by Official Registry 265;

1984: The islands designated a UNESCO Biosphere Reserve;

1986: The Galápagos Biological Marine Resources Reserve (GMRR) established by Executive Decree 1810-A to include all waters within 15 nautical miles of the baseline and establishing a quarantine system and immigration controls; 1987: zoning plan drafted;

1992: A management plan for the GMRR was approved;

1998: The Special Law for the Galápagos 278 published but not enforced, extending the GMRR to 40 nm from the baseline: it provides the legal administrative framework for the whole site;

2001: The Marine Resources Reserve included within the World Heritage area;

2002: The *Humedales del Sur* on Isabela Island declared a Ramsar Wetland Site;

2007-2010: Listed as endangered due to inadequate planning, law enforcement and governance, invasion by uncontrolled immigrant fishermen and the ever-increasing pressure of commercial tourist boat and air traffic which introduces exotic flora and fauna.

## LAND TENURE

State. Administered by a tripartite commission of the Galapagos National Park Service of the Ministry of the Environment, the National Fisheries Department and the Navy.

## AREA

Total: 14,066,514 ha. Land: 766,514 ha (97% of the islands' area). Marine Reserve: 13,300,000 ha.

## ALTITUDE

From -180m underwater to 1,707m (Cerro Azul or Wolf Volcano, Isabela I.).

## PHYSICAL FEATURES

The rugged volcanic archipelago of Galápagos rises from a submarine platform on the junction of the Nazca and Cocos tectonic plates. It consists of 15 islands larger than 1,000 ha and 115 smaller ones.

The largest islands are Isabela (458,800 ha), Santa Cruz (98,600 ha), Fernandina (64,200 ha), San Salvador/ Santiago (58,500 ha), San Cristobal (55,800 ha), Floreana/Santa Maria (17,200 ha), Marchena (13,000 ha), Española (6,000 ha) and Pinto (5,900 ha) (Glynn & Wellington, 1983). There is considerable variation in altitude and area between the islands which, with their physical remoteness, has contributed towards the species diversity and endemism of the archipelago.

Geologically, the islands are young, formed by the underlying plate moving slowly eastward over a hot spot in the Earth's crust, forming a succession of volcanic islands. The oldest island furthest east, San Cristobal, is 2.4 to 3 million years old, the youngest, Fernandina in the west, 700,000 years old. Most of the larger islands are the summit of a gently sloping shield volcano, some rising over 3,000m from the ocean floor though Isabela is formed of five volcanoes. The western part of the archipelago experiences intense volcanic and seismic activity, culminating in collapsed craters or calderas: in June 1968, the southeastern floor of the Fernandina caldera dropped some 300m, the second largest caldera collapse since Krakatoa's in 1883. The highest peak on Isabela, Cerro Azul, erupted in 1977, 1986 and 1998; and Chico in south Isabela erupted in 2005. The summits are studded with parasitic vents a few tens of metres high, and frequently flanked by lava flows. Long stretches of shoreline are only slightly eroded, but in many places faulting and marine erosion have produced steep cliffs and lava, coral or shell-sand beaches. Other landscape features include crater lakes, fumaroles, lava tubes, sulphur fields and a great variety of lava and other ejecta such as pumice, ash and tuff (UNDP/UNESCO, 1974). The terrain is generally composed of uplifted marine lava flows which form an uneven surface, strewn with a deep layer of rounded or angular boulders. Soils are very poor. Freshwater is limited and among the inhabited islands, only San Cristobal has an adequate perennial supply for human consumption. Seasonal springs occur on Santa Cruz and Floreana, and brackish water is available on all islands.

The principal habitats of the Marine Reserve are the rocky sea shore, the vertical rock walls, the sandy beaches, the mangroves and a few coral reefs: a coastline of 1,336km (Carrasco, 2000). The marine environments are highly varied and are associated with water temperature regimes differing in nutrient and light levels. Detailed descriptions of these currents are given in Glynn and Wellington (1983). The main surface current affecting the islands is the South Equatorial current that moves from east to west. This is fed from the southeast by cold waters from the Humboldt Current and from the northeast, by the moderately warm sub-tropical waters from the North Equatorial counter-current via the Peru Flow. The most important undercurrent is the Equatorial Undercurrent that flows from the west, producing upwellings of cool water rich in nutrients near western shores (Carrasco, 2000). The seasonally fluctuating North Equatorial Front, which separates tropical and subtropical water masses, lies just south of the small northernmost islands of Darwin and Wolf for much of the year, and these islands are the most tropical in their marine biota, with extensive fringing reefs. In western Isabela and Fernandina, upwelling of cool plankton-rich water from the Equatorial Undercurrent is often intense, particularly between June and December, adding to the islands' diversity of habitats and species. This is caused by deep currents hitting the underwater base of the islands and submarine volcanoes (*bajos*) which rise to near the surface. This upwelling may also influence the southern islands of Floreana and Española, especially their western shores. The central zones, comprising the east coast of Isabela, Santa Cruz, San Salvador and perhaps Marchena and Pinto, undergo moderate seasonal temperature fluctuations of about 10°C (Glynn & Wellington, 1983).

## CLIMATE

The Galápagos Islands' climate is strongly influenced by oceanic currents and is very variable: its two seasons result from the shifting of these currents. The relatively cold Humboldt Current flowing from the Antarctic flows around and through the islands most of the year. This current converges on warm tropical waters from the Gulf of Panama at a point north of the archipelago. From January to May the convergence moves south and the warm current surrounds the islands. The dry season, caused by the Humboldt current, is characterised by cool temperatures (17°C-22°C), a fairly persistent fog (*garua*) that envelopes the highlands of the larger islands in mist and drizzle, together with southeasterly winds. The variable shorter hot season caused by the warm current has warmer temperatures (23°C-27°C), light easterly winds and seasonal rains, though on the peaks temperatures decline by some 0.9°C for every 100m of altitude. At the wettest place at sea level, the mean annual precipitation is 356mm, whilst at 200m above sea level the equivalent figure is 1,092mm. But the rainfall is variable: approximately every

four years El Niño creates a major warm water flow during this season, bringing heavy rainfall, and in 1982 and 1997-8 this warm downpour caused great loss of marine-dependent sea birds and marine iguanas (UNDP/UNESCO, 1974).

## VEGETATION

According to McFarland & Cifuentes (1996): "The Galapagos are still one of the most unspoiled areas remaining on the planet"...with..."approximately 5,500 - 6,000 already identified species"...the islands probably harbour 7,000 to 9,000 species", and "at least 96% of the original biological diversity of the Galapagos remains intact" (Snell, 1999). In 2001 the entire endemic flora was added to the IUCN Red List of threatened species. Seven genera are endemic and 19 show adaptive radiation, mainly from nearby mainland species (Wiggins & Porter, 1971). There are approximately 560 native plant species, subspecies and varieties native to the islands. 175 (31%) are now known to be endemic. Nearly 10% are critically endangered, 50% endangered and 40% vulnerable, generally due to their very small ranges (UNESCO/IUCN, 2007). The native vegetation occurs in one to three zones on the lowland islands: coastal, arid (80-120m), and transitional (100-200m) which cover the largest area, and three to four more on mountainous islands: closed forest (200-500m), mossy open forest and mossy scrub (500-1000m) and summit pampa above 1000m. All benefit from the surrounding coastal waters through nutrients dropped by marine birds. However, 748 species are also non-native introductions (UNESCO/IUCN, 2007). This is an eight-fold increase in the last 35 years, in a very fragile ecosystem. These occur predominantly around human settlements and in the cultivated zone.

Coastal vegetation occurs along beaches, salt-water lagoons and low, broken, boulder-strewn shores. Protected coves and lagoons are dominated by red, white, black and button mangrove swamps of *Rhizophora mangle*, *Avicennia germinans*, *Laguncularia racemosa* and *Conocarpus erecta* with the halophytic herbs *Sesuvium* spp. which are rich nursery and breeding grounds for fish, invertebrates and birds. The arid zone is found immediately inland from the littoral zone, and is the most widespread formation in the islands. The principal species are xerophytic and include the cactus species *Bursera graveolens*, *Brachycereus nesioticus*, *Croton scouleri*, *Jasminocereus thouarsii* and *Opuntia echios*.

The humid zone emerges above the arid zone through a transition belt in which elements of the two are combined. This is a very damp zone maintained in the dry season by thick *garua* fogs which accumulate through most of the night and last well into each day. It is dominated by the *pegapega* tree *Pisonia floribunda*. Other forest species include sunflower trees *Scalesia* spp. and Galápagos guava *Psidium galapageium*, bearing epiphytes. Above this is a zone dominated by the cats-claw tree *Zanthoxylum fagara*, then a zone once dominated by the shrub *Miconia robinsoniana* where low trees are replaced by a dense shrub cover. These zones were most extensively developed on Santa Cruz Island, but have been almost totally altered by man for farming and grazing, and only small areas remain in a natural state. A fern-grass-sedge pampa covers the summit areas of the larger islands where moisture is retained in temporary pools and sphagnum moss. Here there are 11 native orchid species, and endemic tree ferns *Cyathea weatherbyana* occupy collapsed lava tubes and other small potholes.

Several introduced plants have had a heavy impact on the landscape of inhabited islands. Large highland areas on all four inhabited islands have been invaded by guava *Psidium guajava*. Orange and lemon trees *Citrus* spp. are widespread on San Cristobal and Floreana, *Lantana camara* also occupies the humid and lower transitional areas of Floreana. Quinine tree *Chinchona succirubra* and mora *Caesalpinia bonduc* have altered parts of the humid zone of Santa Cruz and San Cristobal. Blackberry *Rubus adenotrichis* is rampant, elephant grass *Pennisetum purpureum*, African kikuyu grass *Pennisetum clandestinum* and other grasses and shrubs have taken over many areas of the inhabited islands, especially Santa Cruz.

## FAUNA

The Galápagos is a distinct biogeographic province the endemic biota of which includes 24 vertebrate, and 2,000 invertebrate species. 311 species of the flora and fauna are listed as critically endangered and it is feared that 50% of the native fauna may be in danger of extinction (UNESCO/IUCN,2007). These flourish best on the four largest uninhabited islands (Snell, 1999). There are few indigenous mammals but 35 endemic reptiles. Best known are the Galápagos giant tortoise *Chelonoidis nigra* (VU), with eleven subspecies on different islands, all of which are threatened. Others include Galápagos land

iguana *Conolophus subcristatus* (VU), Santa Fe land iguana *C. pallidus* (VU) and marine iguana *Amblyrhynchus cristatus* (VU) which is the world's only sea-going lizard and feeds on seaweed. The endemic snakes are the Galapagos racers *Alsophis dorsalis*, *A. slevini* and Galapagos land snake *Philodryas biserialis*. There are numerous lava lizards of the genus *Microlophus* and geckos *Phyllodactylus* spp. The islands are important for two species of sea turtle: green turtle *Chelonia mydas* (EN) and hawksbill turtle *Eretmochelys imbricata* (CR) which are common in the surrounding waters, with the former nesting on sandy beaches. The leatherback *Dermochelys coriacea* (CR) and olive ridley turtles *Lepidochelys olivacea* (VU) sometimes occur. Two tortoises, the green iguana *Iguana iguana*, the lowland tree frog *Scinus quinquifasciata* and tilapia fish *Oreochromis* species, are introductions.

The native mammalian fauna includes seven species: Galapagos fur seal *Arctocephalus galapagoensis* (EN), Galapagos sea lion *Zalophus wolfebaeki* (EN), Galapagos rice rat *Aegialomys galapagoensis* (VU) on Santa Fé, and on Fernandina, two rice rats *Nesoryzomys fernandinae* (VU) and *N. narboroughi* (VU), hairy-tailed bat *Lasiurus brachyotis* and Hawaiian hoary bat *L. cinereus* (Stone *et al.*, 1987). There are over 1,600 insect species on the islands, 900 being endemic, but these have been little studied. Of 543 introduced invertebrates, 71 may become a threat to the islands' biodiversity (UNESCO/IUCN, 2007). There is at least one endemic scorpion species, 80 spider species, several of them endemic, and a number of endemic centipedes. There are also 80 species of small land snail species, with *Bulimulus* represented by over 60 species. Some snails are endemic to individual islands and others to vegetation zones on several islands (Jackson, 1985).

The native avifauna includes 57 residents, of which 28 (49%) are endemic and 31 are regular migrants; a number of vagrants are also present (McFarland & Cifuentes 1996). Endemic taxa include the 14 species of Darwin's finches in four different genera, including the medium tree finch *Camarhynchus pauper* (CR) on Floreana island and mangrove finch *C. heliobates* (CR) on Isabela. Other noteworthy species include Galapagos penguin *Spheniscus mendiculus* (EN) which is threatened by avian malaria, Galapagos petrel *Pterodroma phaeopygia* (CR), Galapagos flightless cormorant, *Phalacrocorax harrisi* (EN), lava heron *Butorides sundevalli*, Galapagos hawk *Buteo galapagoensis* (VU), greater flamingo *Phoenicopterus ruber*, Galapagos rail *Laterallus spilonotus* (VU), lava gull *Larus fuliginosus* (VU), swallow-tailed gull *Creagrus furcatus*, Galapagos dove *Zenaida galapagoensis*, Galapagos martin *Progne modesta* (VU), Floreana mockingbird *Mimus trifasciatus* (CR) and Galapagos flycatcher *Myiarchus magnirostris* (Stone *et al.*, 1987). Other threatened birds include the waved albatross *Phoebastria irrorata* (CR), often drowned on fishermen's long lines, Markham's storm-petrel *Oceanodroma markhami* and white-vented storm petrel *Oceanites gracilis*. The status of seabirds nesting in the Galapagos was reviewed by Perry in 1984.

The marine environment has some 2,900 species formed in the convergence of ocean currents which have transported marine biota from tropical and subtropical regions of Central and South America and the Indo-Pacific. The level of endemism is 18% (Barry, 1995). There are some 460 species of fishes, at least 51 species (11%) being endemic, including the Pacific goliath grouper *Epinephelus quinquefasciata* (DD). There are 12 species of sharks and 6 species of rays. The interaction between the terrestrial and marine environment is particularly important for the marine iguana and for 27 of the islands' 57 bird species, especially the flightless cormorant, the Galapagos penguin and large numbers of nesting seabirds (Carrasco, 2000).

Dolphins and the endemic sea lions and fur seals are abundant. Several species of baleen whales, among them the fin and humpback whales *Balaenoptera physalus* (EN) and *Megaptera novaeangliae*, and toothed whales, including sperm *Physeter macrocephalus* (VU), pilot and killer whales are regularly seen. There are 650 species of sea shells, 200 sea-stars and urchins and 120 crabs (Galapagos Conservation Trust, 2000). Sea cucumbers flourish, one species, *Isostichopus fuscus*, being extensively harvested for the oriental market for food and supposed aphrodisiac properties. The colorful Sally lightfoot crab *Grapsus grapsus* is a distinctive shoreline species (UNDP/UNESCO, 1974). Due to the cool waters of the Humboldt Current during 4 to 6 months per year, the Galapagos is a marginal environment for coral reefs; 120 species however, are found in its warmer waters, though three recently became critically endangered as a result of disturbance by El Niño. Accounts of the archipelago's coral reefs are given in Glynn & Wellington (1983) and UNEP/IUCN (1988).

## CULTURAL HERITAGE

According to the writings of Miguel Caballo de Balboa in 1586, the islands were first discovered by the Incas in the middle of the 15th century. In 1535, the Bishop of Panama christened them *Las Islas Encantadas* (the later *Galápagos* is the name for a saddle) and from then on they were used as a stop-off by sailors, buccaneers and whalers who introduced foreign species and hunted down tortoises and seals. They were annexed by Ecuador in 1832. In 1835, Charles Darwin visited the islands while on his voyage in the survey ship *Beagle*, and his observations while there on species diversity between the islands, were later to support his theory of evolution. Despite visits by passing ships, the islands remained largely unsettled until the second half of the last century (UNDP/UNESCO, 1974).

## LOCAL HUMAN POPULATION

In 1949 the population was 800, in 1990, 9,785 and between 1990 and 1995 grew by 7.8%: 6.1% from immigration and only 1.7% through natural increase. In 2004 it was about 25,000 (Campbell, 2005). It occupies around 3% of the land area of the islands. Agriculture is the main form of income for 8-10% of the population though the best farmland lies where the islands' highest biodiversity is also found, in the islands' humid middle to higher elevations. Cattle and fishing were the basis of the islands' economy. In 1974 there were 3,000 cattle on southern Isabela and 300 on Floreana (UNDP/ UNESCO). This economy is now greatly augmented by tourism which employs some 40% of the population and producing food for the large numbers of cruise ships is a growing source of income. However, the entry of illegal immigrants attracted by hopes of prosperity, is now estimated at 20% of the population. Migration to the islands is said to be controlled by laws of the Republic (Carrasco, 2000) but there is little accountability for or effective control of the inflow (UNESCO/IUCN,2007). Some 80% live on the islands of Santa Cruz and San Cristobal where tourist facilities are based, on Floreana and on Isabela island for the fishing (McFarland & Cifuentes, 1996). By 2015 it is estimated that the population will grow to 40,000.

During the 1960s, outsiders introduced unsustainable, illegal and now universal methods of fishing. Many fishermen are now economically dependent on resources in the Marine Reserve, having come from the mainland in search of a living after 1989 due to the collapse of their industry through overfishing. There are now some 1,000 of these, drawn by the lucrative trade in sea cucumbers, lobsters and groupers, a resource which was already by 2005 also beginning to collapse through overharvesting (Campbell, 2005). One 1994 survey showed that the 73% of the population which had arrived since 1986 were either little-skilled economic refugees (*peperinos*) or transient businessmen. Neither value the environmental quality of the islands, both agitate for the land and marine parks to be opened up for development and are strongly opposed to protected area regulation. Although revenue from tourism far exceeds that from fishing, fishing interests are vigorously represented by the islands' two congressmen who are politically influential.

## VISITORS AND VISITOR FACILITIES

The basic attraction of the islands is the abundant fearless wildlife. From 1967 to the late 1990s, commercial tourism increased by 8% a year: from 3,000 in 1969 and an acceptable maximum target of 20,000 in 1985, to 40,000 in 1991, an annual average of 62,000 from 1995 to 1999, and 96,672 in 2006 (Vice-Minister for tourism, quoted in UNESCO/IUCN, 2007). Of the visitors in the 1990s, 76% were foreigners who arrived in 95 tourist vessels (McFarland & Cifuentes, 1996). Land-based visits at the main airport increased from 5,000 in 2003 to 25,000 in 2009 (UNESCO,2010). The value of Galápagos tourism to the national economy is estimated at US\$150 million, of which US\$6 million are generated by entrance fees paid by visitors (now \$100 per entry) which is the same as the value of the local fishery (International Galapagos Tour Operators Association (IGTOA), 2005). However most of the profits go to large mainland tour companies influential on the national scale rather than to the local people. Visits are led by qualified guides authorised by the GNP and the Navy. The pressure of tourist numbers means that the guiding is being done by temporary little-qualified guides from the mainland since guide-training has been discontinued by the government in 1997 in favour of guides from the Navy (IGTOA, 2005). The unlicensed opening of hotels and guest houses and recreational operationsThe basic infrastructure is well established. Hotels, lodges and restaurants are proliferating on Santa Cruz (Carrasco, 2000) but there is a lack of adequate water, sewage disposal and medical facilities.

Tourists come to the islands in large (up to 500-passenger) cruise ships, or by air and use 6 or 12-passenger tour boats, a traffic said to have increased by 26% (aircraft) and 15% (ships) in 2006 (UNESCO/IUCN, 2007). They are admitted (for the day only) into three of six zones. There are 21 Intensive Visitor Zones on fifteen islands, where a maximum of 90 people are allowed on shore at one time. 15 Extensive Visitor Zones on seven islands are open to groups of up to 20. There also are 19 Recreational Zones on the four main inhabited islands. To preserve vulnerable animal life and fragile sites the use of licensed guides and marked trails is obligatory. There are also 64 marine sites. Tourist scuba diving and snorkelling is increasing and there are several major dive sites (Robinson, 1983). There are two interpretation centres, one in the National Park and the Charles Darwin Research Station (CDRS) on Santa Cruz and the other in San Cristobal. Sport fishing has become very popular: 17 boats recently held an international sport fishing event without the permission of the National Park Service and two boats remained. Local fishermen who guided such sportsmen in the past fear that mainland interests will take it over (UNESCO/IUCN,2007). There are two airports, at Villamil on Isabela Island and on Baltra Island.

### **SCIENTIFIC RESEARCH AND FACILITIES**

Alerted in 1954 by the ethologist Eibl-Eibesfeldt, the IUCN established the Charles Darwin Foundation in 1959 and its Charles Darwin Research Station (CDRC) was inaugurated on Santa Cruz Island in 1964. It is jointly supported by the Government of Ecuador, IUCN and UNESCO. Funding comes from a variety of European and US conservation bodies and from private donations. It advises the government on conservation, educates the public, trains scientists and managers and secures international support. Particular emphasis is placed on work programs which will assist in the management of the park. According to McFarland & Cifuentes (1996), there had been to that date over 700 scientific missions to the Galápagos using the CDRS as a base, and over 6,000 scientific publications. There have been research projects including studies of the island ecosystems; the ecology of and conservation strategies for the fauna and flora; geomorphology and climate; and studies of introduced plant and animal species. A wide ranging account of the islands was given by Perry in 1986. Research conducted in 1997 by visiting scientists included studies on human impacts on patterns of biological diversity, and the effects on fauna of heavy metal contamination (CDRS, in litt.,1997). Many universities run field courses on the islands and hundreds of Ecuadorian students have conducted research for undergraduate or post-graduate theses (Carrasco, 2000). Publications of the Research Station are available on the islands and at the University of Ecuador, Quito. Between 1999 and 2004 the program 'Control and Eradication of Invasive Species: A Necessary Condition for Conserving Endemic Biodiversity of the Galapagos World Heritage Site' was funded by the GEF to establish a systematic approach to the problem.

Among the studies of the marine environment, those by G. Wellington, who assisted GNP and CDRS from 1973 to 1975 to evaluate its resources, are notable. His report recommended the creation of a marine park and the increase in size of the protected zone around the islands. In the 1980s the major part of the marine investigation was done jointly by the National Institute of Fisheries (INP) and the CDRS. This partnership produced more than 30 reports which contributed to the creation of the scientific database for the management of the resources in Galápagos. Oceanographic studies were also carried out by the Oceanographic Institute of the Navy with CDRS. Since 1994, research has been directed more towards providing information to help with the management, conservation and protection activities. Some of the more important initiatives have focused on the diversity and abundance of marine life, to identify zones which should have priority for protection. Marine studies since 1998 have covered currents, marine mammals and iguanas, whale sharks, lobsters, sea cucumbers, fish larvae and corals (WCPA, 2002). The Research Station advises the National Park Service on protective programmes for the biota, tourism policies and environmental education programs.

### **CONSERVATION VALUE**

At the confluence of three major ocean currents, cold and warm, and combining sub-Antarctic with tropical biota, these volcanic islands and the surrounding marine reserve are the largest, most diverse almost pristine archipelago remaining in the world, a natural museum for the study of geological, ecological and evolutionary processes. Their varied climates, ongoing vulcanism and extreme isolation, has produced one of the highest concentrations of endemic species in the world including unusual animals such as the land and marine iguanas, giant tortoises and the many types of finch that inspired

Darwin's theory of evolution following his visit in 1835. One-third of the archipelago's vascular land plants are endemic, as are nearly all the reptiles, half the breeding land birds, and almost 30% of the species in the waters around the archipelago. The Park lies within a Conservation International-designated Conservation Hotspot, a WWF Global 200 Marine Eco-region, in one of the world's Endemic Bird Areas and is a Centre of Plant Diversity. It also contains a Ramsar wetland site, lies within a UNESCO Biosphere Reserve and is an IMO Particularly Sensitive Sea area (PSSA).

## CONSERVATION MANAGEMENT

Until 1959, little importance was given to the conservation and preservation of the islands and several species came to the verge of extinction. But since 1960 the Government of Ecuador has been helping to maintain this living museum by outlawing hunting, particularly of tortoises and seals; eliminating pests such as goats that have destroyed flora, particularly *Scalesia* woodland; controlling the pigs that reduced the tortoise population; and controlling the invading fire ant *Wasmannia auropunctata* which kills young birds and the native ant. Successful breeding programs for the threatened tortoise and land iguana populations were developed. The first management plan for Galapagos was approved in 1974 and revised in 1984 and 1997. The current plan was submitted for approval in 2005. Six land use-zones are established: Absolutely Protected (Fernandina, Espanola and Santa Fé Islands), Primitive, Special Use, Extensive Visitor, Intensive Visitor and Recreational (Developed). A series of plans were also prepared for the technical offices at San Cristobal, Isabela, Santa Cruz and Floreana in 1996.

The Galápagos Biological Marine Resources Reserve (GMRR) was established in November 1986 for the surrounding waters and in 1987 a draft zoning plan for the Marine Reserve was produced by the Sub-Secretariat of Forestry and Renewable Natural Resources (INEFAN) then in charge of conservation on the islands. Four marine zones were proposed: a General Use Zone for sustainable use of the reserve; Artisanal and Recreational Fishing Zones for the benefit of residents; National Marine Park Zones for human activities where natural resources are neither damaged nor removed; and Strict Nature Reserves where human access is not permitted (Jennings *et al.*, 1994). A final version of this plan was published in August 1992 by government decree. In 1996 the Reserve was integrated into the National System of Forests and Natural Protected Areas and its administration ceded to the Galápagos National Park Service (GNP), providing it with the legal authority to patrol the marine areas against illegal fishing (Valverde, *in litt.* 1997; UNESCO, 1997). In April 1997 an emergency decree was issued by the President of the Republic imposing restrictions on immigration and non-artisanal fishing and requiring Congress to draft a Special Law for the Galápagos to provide a clear legal framework for the management of both terrestrial and marine parts of the islands. The Special Law for the Galapagos was published in March 1998 extending the outer marine reserve from 15 to 40 km offshore and establishing a 13,500 sq.km reserve for the conservation of marine biodiversity. It proposed four Special Regulations: to regulate artisanal fishing, regulate tourism in protected areas, quarantine and eradicate introduced species and impose environmental controls. A moratorium was placed on new permits for cruise ships until the year 2005 (Valverde *in litt.*, 1996). However, in 2006 these had still not been applied and the marine reserve area therefore effectively remained 7,990,000 ha in area (WHC, 2006).

The 1997 management plan provided for the establishment of participatory and adaptive management, the definition of land uses and responsibilities for reserve management, regulations and a zoning system. Activities permitted under regulation include fishing, tourism, scientific research, conservation, boating and military manoeuvres. The Multiple Use zone consists mainly of the area of deep water located inside the baseline; the Limited Use zones comprise the coastal waters that surround each island and other shallow waters (typically less than 300 meters deep). It was hoped also to create local public awareness and skills, and to control immigration. The National Park, as well as managing the Marine Reserve, had jurisdiction over its natural resources. It coordinated the preparation and supervised the implementation of the management, conservation and sustainable use plans for the Marine Reserve and the other policy and planning instruments. The plan was revised by INEFAN and the Research Station staff but never implemented. A Participatory Management Board was created as the forum for users and stakeholders of the GMRR to encourage effective participation and responsible management by the users. It is composed of representatives of the artisanal fishing sector, the Galápagos Chamber of Tourism, the CDRS and the National Park. A Charles Darwin Research Station (CDRS)/Park Service project partly financed by WWF drew up an ecological monitoring system and a

list of introduced species. In 1999 the System of Inspection and Quarantine for Galapagos (SICGAL) allied with other organisations to start to control biotic invasions such as canine distemper.

Ecuador negotiated a loan of about US\$10 million from the Inter-American Development Bank to develop the management capacity of the Park Service to execute and maintain certain activities. These were: a) management, direction and administration; b) control, surveillance and rescue; b) investigation and monitoring; c) education, communication and training; and d) administration of the use of natural resources (Carrasco, 2000). By 2002, projects funded by UNESCO/UNF, CDF, GEF, UNDP and the Bank had made some progress on invasive species (particularly cushiony scale), marine conservation, quarantine and institution strengthening. But the Special Regulations passed in 2003, needed before implementation of the Special Law for the Galapagos could be enforced, had still not been promulgated in 2006 (WHC,2006). In late 2002 the *Poza de las Diablas* pool on the south coast of Isabela Island where flamingo and diablo fish breed, was declared a part of the Ramsar Wetland where management aims to limit overfishing and invasion by kikuyu grass. Also in late 2002, partly in response to the movement of shark fishermen to the Cocos Islands, a marine conservation and sustainable development corridor was launched between the Galapagos and the Cocos Islands (800 km north), by WHC with CI, IUCN and the governments of Ecuador, Costa Rica, Columbia and Panama. In 2003 the Japanese Agency for International Cooperation (JICA) began to fund a five year project to support education, conservation and local development. In 2004 a Park Service plan to clean up tourist and other garbage was launched with WildAid to provide an adequately paid alternative to fishing while complementing the monitoring and patrolling activities of the Service (WildAid, 2004). There are now 12 international NGOs based on the islands which has led to some confusion over conservation priorities. In April 2007, a high level UNESCO/IUCN delegation visited, meeting stakeholders on site and government ministers in Quito. Ecuador's President was persuaded of the gravity of the threats to the islands.

## MANAGEMENT CONSTRAINTS

Since the park's establishment there has been economic conflict between the fishing industry, tourism companies and conservationists, which have made its governance extremely challenging. The Islands are faced with three major threats to their conservation. Chief among these is that governmental authority in the islands is divided, causing a steep decline in the maintenance of law and authority, at present flouted and aggravated by a minority of influential islanders, especially from the fishing industry. The approximately 1,000 immigrant mostly illegal fishermen, supported by influential members of the government, exercise the highly profitable right to harvest the islands' seas commercially without control: it was not possible to implement the Management Plan for the Marine Reserve for several years. Second is the ease with which lack of regulation at the islands' many points of entry has let in hundreds of alien species along with the visitors: the existence of two airports and four marine ports receiving commercial traffic direct from the continent makes quarantining and regulation of invasive species very difficult. The islands' unique ecological isolation is at risk. Third is the increasing pressure of tourism of all kinds. The commercial operators are usually far ahead of the Park Service's existing measures of control and like the fishermen, are supported by members of the government (UNESCO,2010; McFarland & Cifuentes,1996).

In 1994, the National Fisheries Development Council, a body which developed from the commercial industry, lifted the ban on fishing, allowing 'experimental' fishing of sea cucumbers, lobsters, sharks, groupers and other species, creating an economic pressure, sustained by political influence, to maximise short-term profits from fishing (J.Barry,pers.comm.,1994). Large industrial tuna-fishing ships from abroad, often with official permits and supported by mainland fishing companies and buyers, especially from the port of Manta, increased the pressure on fishermen both local and mainlanders to harvest the marine resources unsustainably. These brought in 1995 over 23% of Ecuador's foreign earnings, much of it from the Oriental market for luxuries and aphrodisiac foods such as sharks fins and sea cucumbers (J.Barry,1995; McFarland & Cifuentes,1996). Conservation is seen as the enemy of this trade which, until the recent overharvesting, has been very lucrative. Shark-finning remains so, with 13,000 fins being exported between 2002 and 2006 (Galapagos Conservation Trust, 2006). Politically the stability of the government has been dependent on the support of representatives of the fishing industry, including the local congressmen (Campbell, 2005). but in 2005, in response to international

pressure, the President of Ecuador visiting the islands banned shark fishing - except for animals caught as by-catch.

The Park's own legal basis for maintenance and control of the marine sites is weak. Marine biodiversity has been particularly threatened by the uncontrolled illegal fishing in pelagic zones by large ships owned by mainland or Asiatic fishing companies, often inside the Marine Reserve, using high technology methods such as long-lining. These encourage the local fishermen themselves to exploit the resources for the international market (McFarland & Cifuentes, 1996). Lifting the ban on fishing led to large-scale exploitation; the sea cucumber limit was exceeded 20 days into the fishing season. Fishermen illegally collected other commercially valuable species such as sea horses, snails, sea urchins and black coral. The Sub-secretary of Fisheries therefore officially ended the 'experimental' fishing season in mid-December 1994. In response, in early 1995, sea-cucumber fishermen (*peperinos*) took over the Park buildings and Research Station and threatened to sabotage conservation services, harm staff and critically endangered species, and to interrupt tourism services unless the fisheries were reopened (McFarland & Cifuentes, 1996). Further unrest occurred in 1995 after the Ecuadorian President vetoed a law passed by the Ecuadorian National Congress which would have politicised the Park Service, giving management authority over the National Park to local politicians and special interest groups. This was followed by a second series of hostage takings guided by two elected officials and a small group of island residents. The Mayor of the capital threatened to take tourists hostage and set the Park on fire. Government property was damaged and stolen, municipal property was taken over, entry to the CDRS was blocked and the staff prevented from working. Equipment and supplies belonging to illegal fishermen which had been confiscated by the Park Service were returned to the fishermen on orders from higher authority. No significant penalties for illegal harvesting of marine resources or destruction of the terrestrial habitat were levied. However, it must be said that most of the native residents of the islands did not support this agitation.

In March, 1997 a Park warden was shot and seriously wounded by illegal fishermen while trying to inspect an illegal fishing camp and sea-cucumber processing plant on the west coast of Isabela Island (E. Cruz, in litt. 1997). These illegal campers cut down for fuelwood mangroves which are the habitat of the rarest species of Darwin finch. The area of densest sea cucumber populations has already been heavily impacted, decreasing its economic attraction. Many sharks, rays and marine mammals are caught as by-catch of driftnet and longline fishing. There are fears that this type of unsustainable gold-rush fishing will continue to exacerbate social problems when the source of income dries up for the more than 800 fishermen attracted to the island by these opportunities. In 1999 the government again issued limited permits for sea cucumber and shark fishing, and again, in November 2000, the National Park Service buildings and the Charles Darwin Research Station were sacked by fishermen agitating for an increased fishing season and quotas. In 2001, a leading conservationist was jailed and the illegal fishermen he was restraining were released from custody. In 2004 the government, impelled by political necessity, set a quota of 4 million sea cucumbers, but only 3 million could be harvested before the crop ceased to be commercially viable (Campbell, 2005).

The second major threat to the integrity of Galapagos biodiversity is the lack of adequate inspection facilities and regulation of invasive exotic species at entry points, via foreign tourist and commercial ships, aircraft and inter-island boats. A limit on the number of these points and vehicles would make control more practicable. The terrestrial ecological balance of the islands is being changed by the introduction of predators, competing species and alien plants many of which invade the territory of native species on abandoned farms. Agriculture is the main form of income for 8-10% of the population and the best farmland is where the islands' highest biodiversity is also found, in the islands' humid middle to higher elevations. Here, the natural habitats have been changed and fragmented over some 60% of the land. Exotics such as guava, citrus, lantana, quinine, elephant grass and blackberry have been introduced. Over the past decade alone it is estimated that over 750 species of alien plants have entered the islands and even worse problems have been caused by goats, pigs, dogs, cats, rats and their parasites. Insects such as moths also come in on the fishing boats, attracted by their lights. Fernandina is one of the largest undisturbed islands in the world, currently devoid of introduced vertebrate species. However, fishermen illegally camping on shore have increased the risk of introducing rats, ants, other insects and seeds. Recently goats were re-introduced on Pinta, an island where the Park Service and CDRS spent over 20 years removing 40,000 goats. The Park's funding was

cut in 2004, putting several species-eradication programs at risk. But feral pigs will soon be eradicated and goat numbers diminished on Santiago island (IUCN, 2002). The Frankfurt Zoological Society's Project Isabella is a campaign to eradicate the goats of Isabella and Santiago Islands which compete with the tortoises for food, especially the *Scalesia attractyloides* tree, groves of which are fenced off (FZS,2004).

The third major threat is from the too successful tourism industry. The increase in tourist as well as the local population is increasing beyond the power of the existing Park facilities to cope with it, and threatens the islands' wildlife. The Park is under pressure from tour operators and the increasing numbers of large commercial vessels owned by outsiders, whose permits to visit the islands are issued by the Merchant Marine, not by the Park Service. The displacement of locals by wealthy outsider companies is depriving islanders of their power of influencing decisions about the islands. Very little tourist guiding is now led by Park staff. The zoning system that used to protect the islands from tourism is outdated and does not cater for new forms of tourism such as sport fishing, jet skiing, diving, and helicopter tours (McFarland & Cifuentes, 1996). Other problems include litter and waste disposal, difficult in the thin soil, and fires. There has been a decline in agricultural holdings as the economic dependence on tourism grows, and unplanned building has occurred around the tourist bases. Demands for infrastructural services has outstripped capacity, and dissatisfaction amongst residents is growing (McFarland & Cifuentes, 1996). Inadequate services, pollution, environmental degradation and crime have followed the unplanned growth of the past two decades. If government control is not imposed, the unique resources of the National Park may be irremediably degraded by exploitation for short-term profit.

In January 2001 oil spilled from the tanker *Jessica*, which ran aground offshore from the capital, Puerto Baquerizo Moreno on San Cristobal Island. Despite desperate attempts by the Ecuadorian Navy, the United States Coast Guard and other agencies, within three weeks, most of the 900,000 litres of oil escaped and dispersed, killing some 10-25,000 marine iguanas on Santa Fé; elsewhere the contamination was widespread but light. Environmental organisations were quick to point out the involvement from the start of local fishermen, the tourism sector and the local population in mitigating the disaster. Mitigation included collecting the fuel on the water; rescuing wildlife like boobies, pelicans and sea lions, which were evacuated, and building corrals to keep the animals in during the emergency (World Heritage News, 2001). And in October 2002, US\$10 million compensation was awarded to the National Park against the insurers. Meanwhile however, in 2000, 12 sea-lions and in June 2001, 35 more were destroyed for parts considered aphrodisiac in the Far East.

In February 2004, the Park Service buildings and the Research Station were again seized by militant fishermen, with no apparent response from the civil authorities (WWF, 2004). In June the local police were restrained by Presidential order which allowed fishermen to occupy the National Park Headquarters, two other offices and a tourist centre (Forest Conservation Portal 2004). In September that year, on Presidential direction, the Minister of the Environment dismissed the Director of the Marine Reserve and suspended the contracts of 123 out of 229 rangers (Campbell, 2005). A past advisor to the fishing industry was appointed as the eighth Park Director in twenty months, replacing a committed conservationist. Fishermen, led by the Islands' deputy congressman, supported his forcible installation, again threatening to destroy valuable animals kept for breeding programs. The Park's rangers struck against political interference in the direction of the Park, against not receiving their work contracts and salaries and for adequate funding for the Park (IUCN, 2004). They returned to work within three weeks after many of their demands were met and a senior ranger was appointed interim Director. However, following a reduction in government funding that year, 115 staff were let go, many being experienced and of long standing (UNESCO.2005).

In 2005, political conflict continued to undermine the Park's integrity. Since January 2003, there have been 12 Park Directors and 4 Ministers of the Environment. By 2007 little progress on the 1988 Special Regulations had been made, creating uncertainty about the future. The quarantine system was not yet fully operational: there was an increase in the number of entry points and in movement between islands, with inadequate inspection, quarantine measures and phytosanitary practices (UNESCO/IUCN,2007). On behalf of the fishing industry, the Minister supported proposals for international sport fishing and legal long-line fishing within the Reserve, with the demand that the Navy be made responsible for

patrolling the Marine Reserve instead of the Park Service. The International Galapagos Tour Operators Association pointed out that the local fishermen, including the *peperinos*, total 1,000 out of a population of 25,000; and that their industry brings in only \$6 million compared with the \$150,000 million from tourism - most of which however, accrues to interests outside the islands (IGTOA, 2005). Tourism flourishes but, without adequate funding and consistent government support, the institutions which have so far preserved the integrity of these unique islands may no longer be able to control the problems caused by the unplanned growth of the population, by overfishing and by increased tourism in the face of a lack of governmental will to regulate it.

In April 2007 the situation worsened: the Park Director was assaulted by soldiers, a new airport on Isabela Island and doubling of commercial flights heightened the risk of invasion by alien species, and mangroves on Isabela were again cut down, with municipal connivance. At a multi-stakeholder meeting in April, the pro-conservationist government was accused of being deaf to commercial interests wanting a greater share of the benefits from the fast increasing tourism, and solutions to the islands' social and environmental problems. A lack of effective governance by the National Institute for the Galapagos (INGALA) and of interagency cooperation was emphasised. Simultaneously a Presidential decree declared the conservation and management of the archipelago's ecosystem a national priority and requested the Governor of the Galapagos to coordinate policies with the local people to deal with the problems, especially the eradication of introduced species. A detailed corrective action plan has resulted. But in the opinion of IGTOA, they were "slowly but surely losing the fight to preserve the Galapagos Islands.... With neither government understanding nor support, and corruption from top to bottom, the future is bleak." (IGTOA, 2005). In 2007 the site was finally listed as endangered because of invasive species, illegal immigration and the uncontrolled growth of tourism: a figure of 173,000 visitors for 2008 was quoted by the Director of the Research Station, G.Lopez, who attributed this to the increasing popularity of mass tourism (BBC, Feb. 2009). That year the Galapagos Invasive Species Fund was established by the United Nations Development Fund, a Conservation International fund and the Galápagos Conservancy to deal with part of the problem (WHC, 2008). However, in response to political pressures, the site was declared out of danger in 2010.

## **STAFF**

In 1995 this comprised a Director, a sub-director, a technical coordinator, a chief on each inhabited island, two accountants, a protection officer for each technical office, 41 rangers, and four assistant secretaries (INEFAN, pers.comm., 1995). Approximately 25 people are dedicated to the GMRR (Carrasco, 2000). The total staff numbered 296 until 2004 when budget cuts reduced the staff to 181. There is adequate equipment in good condition including several fast patrol vessels, and one light aircraft, but since 2004 too few staff to use them; only one boat was in use in 2005 (IGTOA, 2005). But the staff lack job security, tenure and law enforcement powers and are targeted by violence. By 2008 there had been 12 Park Directors during the past 3 years (IUCN, 2008).

## **BUDGET**

In 1994, the budget was US\$860,000.. In 1998 the WHB granted US\$92,500 for training and technical cooperation (UNESCO, 1999). The National Park receives 40% of the revenues paid by the visitors to the islands; the GMRR receives 5% and the Ecuadorian Naval Army 5%. These three items totalled US\$3.6 million in 1999 (Carrasco, 2000). From 1999-2004 the GEF funded a study of invasive species. The Park receives additional income from the tourism operating permits, as well as funds from the national budget. However, in 2004 this was severely reduced. In 2003 JICA (Japan) launched a 5-year plan to fund education, conservation and development projects. US\$10 million was provided by the Inter-American Development Bank. In 2005 the Italian government gave US\$3 million towards the migratory control agency. Funds to maintain and operate the Park remain inadequate, though by 2008 a US\$3.19 million Galapagos Invasive Species Fund had been created by the UNDP, Conservation International's Global Conservation Fund and the Galápagos Conservancy (WHC, 2008). By 2008 US\$506,250 had been provided from international sources for emergency training and technical support (IUCN, 2008).

## LOCAL ADDRESSES

The Minister of the Environment, Ministerio de Agricultura 7mo. Piso, Ave .Eloy Alfaro y Amazonas, Quito, Ecuador.

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