Socotra: Discovering biodiversity on the island that time forgot.

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Socotra

Discovering Biodiversity on the Island that Time Forgot

by Giuseppe Orlando** & Arnoldo Santos*

"..... and opposite this cape, well out at sea, there is an island, lying between it and the Cape of Spices opposite, but nearer Syagrus: it is called Dioscorida, and is very large but desert and marshy, having rivers in it and crocodiles and many snakes and great lizards, of which the flesh is eaten and the fat melted and used instead of olive oil. The island yields no fruit, neither vine nor grain. The inhabitants are few and they live on the coast toward the north, which from this side faces the continent. They are foreigners, a mixture of Arabs and Indians and Greeks, who have emigrated to carry on trade there. The island produces the true sea-tortoise, and the land-tortoise, and the white tortoise which is very numerous and preferred for its large shells; and the mountain-tortoise, which is largest of all and has the thickest shell; of which the worthless specimens cannot be cut apart on the under side, because they are even too hard; but those of value are cut apart and the shells made whole into caskets and small plates and cake-dishes and that sort of ware. There is also produced in this island cinnabar, that called Indian, which is collected in drops from the trees."

This is how an anonymous Greek sailor described the island of Socotra, "*Dioscorida*", the *Insula Dioscoridis* of the Romans, in its famous manuscript, the *Periplus Maris Erithraei*, probably written about 100 A. D.

Known from the early antiquity for its products, aloe, incense, myrrh, turtle shells, and dragon's blood, Socotra, in the Indian Ocean, has been until very recently one of the most isolated places on earth.

The Archipelago

Located at the eastern entrance of the Gulf of Aden, the Socotra archipelago lies between latitudes 12º06' N and 12º42' N and longitudes 52º04'E and 54º32'E. It consists of the main island Socotra (3,549 Km^2), three smaller islands, Abd al-Kuri (162 Km^2) and "The Brothers", Samhah (45 Km^2) and Darsa (10 Km^2) and two rocks, Cal Farun and Hertha. Abd al-Kuri, the westernmost of the archipelago, lies at only 100 Km from Cape Guardafui, in Somalia. Socotra itself lies at about 240 Km East off the Horn of Africa and at some 300 km from Ras Fartak, on the Arabian mainland. The whole archipelago politically belongs to the Republic of Yemen. Like the Seychelles and Madagascar, they are continental islands, which formed part of the southern continent Gondwana until the late Cretaceous. Since then, as a result of the long isolation, a high degree of endemism characterises the flora and fauna of the whole archipelago, and particularly of the largest island, Socotra, a "hot spot" of the world biodiversity.

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The island of Socotra is about 135 Km long and 40 Km wide at its widest point. It can be divided into three main zones: the coastal plains, a limestone plateau extending over most of the island with an altitude of 300-700 m and dissected by several deep valleys and, in the centre, the granitic Haghier mountains with peaks that reach a height of 1519 m. There are two annual rainy seasons. The main one is from August to October, when the South-West monsoon brings with it occasional heavy rains. The second, smaller rainy season takes place from April to May. The mountains are often shrouded in clouds and heavy dews are common. Average temperatures range from 23.5ºC to 35ºC between the hottest and the coolest month, and vary greatly with altitude (minimum temperatures of 13.5ºC have been registered on the Haghier mountains). The mean annual rainfall varies between 130-170 mm per year, being much greater in the central highlands

Floristic diversity

The flora of the island includes about 850 species (Miller & Bazara´a, 1998), of which 273 (32%) species and 8 infraspecific taxa are believed to be endemic. There are 10 endemic genera, being 8 of them monotypic and thus don't represent significant examples of insular evolution, which has probably taken place within the genera *Heliotropium* (11 endemic species), *Boswellia* (at least 7 endemic species), and *Helichrysum* (9 endemic species).

Among the families richest in endemics are *Compositae* (26), *Acanthaceae* (24), *Leguminosae* (24), *Euphorbiaceae* (21), *Labiatae* (20), *Boraginaceae* (16) and *Asclepiadaceae* (11). Nevertheless the worldwide famous plants that are the symbols of the archipelago are not included in any of the above families. We are talking of the common local species of "Dragon tree" *Dracaena cinnabari* (*Dracaenaceae*), of the rare living fossil *Dirachma socotranum* (*Dirachmaceae*), and of the giants *Dorstenia gigas* (*Moraceae*), *Dendrosicyos socotrana* (*Cucurbitaceae*) and *Adenium obesum* ssp. *socotranum* (*Apocynaceae*). The first clings to ledges and sheer cliffs while the grotesque trunks and huge dimensions of the last two give a prehistoric aspect to the island's lowland landscape.

Frankincense extracted from endemic species of Boswellia (Boswellia elongata, *bottom left), dragon's blood from* Dracaena cinnabari *(right) and the sap extracted from A* loe perryi *(up left) have been very priced since ancient times for their medicinal properties.*

The grotesque trunks and huge dimensions of Adenium obesum *ssp.* socotranum *(left) and* Dendrosicyos socotrana.*(up) give a prehistoric aspect to the island's lowland landscape.*

Other Socotran endemics have a great scientific and economic interest, such as *Punica protopunica* (*Punicaceae*), the only wild relative of the pomegranate (*Punica granatum*), or *Begonia socotrana* (*Begoniaceae*) and *Exacum affine* (*Gentianaceae*), two high-value species in the world of

Dracaena cinnabari *dominates the northern slopes of the Diksam plateau.*

Punica protopunica, *the only wild relative of the pomegranate.*

ornamental plants. We can't fail to mention all those plants whose products have been very priced since ancient times for their medicinal properties, such as the resins extracted from the endemic species of *Boswellia* (frankincense) and *Commiphora* (myrrh), both belonging to the *Burseraceae* family, the dragon's blood from *Dracaena cinnabari* and the sap extracted from *Aloe perryi* (*Aloaceae*). Legend suggests that Aristotle persuaded Alexander the Great to capture the island of Socotra to get its rich supply of aloe to help his wounded soldiers.

Due to the difficult inland communications, caused by the complex orography and the poor trail network (the first asphalt road has just been built, linking the airport to the capital), the island flora is still partially unknown, and new discoveries are expected in the next years.

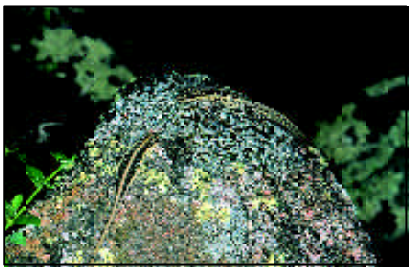
Although the strongest links of the Socotran flora are with adjacent parts of East Africa and Arabia, its geographic position east of Northern Africa allows us to make interesting comparisons with the Macaronesian archipelagos located off the western African coast, and in particular with another island biodiversity centre: the Canary Islands, whose native flora includes some 1300 species, 570 (40%) of which are endemics (Santos, 2001 in press). The higher richness in species is directly related with the number of islands that make up the archipelago, and therefore its total area and ecological diversity. Several floristic and faunistic similarities can be found between the two islands groups. Both have been centres of refuge and evolution for floras that are nowadays extinct or almost extinct in the neighbouring mainland, and in several cases we can find a very close relationship between them. These Socotra-Macaronesia relationships have been in part discussed by Mies (1995, 1998), who listed among others, some striking examples of homologous species and genera, such as *Campylanthus*, *Dracaena* (*D. cinnabari* - *D. draco*), *Euphorbia*, *Habenaria*, *Hypericum*, *Polycarpaea* and *Pulicaria*. The relationship existing between the two *Dracaena* species has been confirmed with molecular data, while the others are still waiting for further studies. In both territories the genus *Euphorbia* has evolved with several endemic species, 9 in the Canary Islands and 12 in the Socotra archipelago. *Euphorbia balsamifera* is represented in both archipelagos with two subspecies: ssp. *balsamifera* (Canary Islands) and ssp. *adenensis* (Abd al-Kuri and Arabian peninsula).

The strange flowers of the endemic Duvaliandra dioscoridis *are pollinated by flies. This plant is restricted to a very small area of the granitic Haghier mountains.*

The strange Dorstenia gigas *clings to ledges and sheer cliffs.*

Like a sentinel, an Egyptian vulture looks around from the top of a dead dragon tree

The Jewel beetle Julodis clouei.



The diurnal geckoes Pristurus *have evolved with 7 endemic species*

*A new endemic crab species (*Socotra pseudocardisoma*) was discovered in 1997.*

Faunistic diversity

In recent years, zoological research in the archipelago has produced a wealth of results which underline the global importance of the biodiversity of these islands and their surrounding coastal and marine areas.

About 13 species of terrestrial mammals have been recorded so far, and all of them have been introduced by man or can have occasionally come from the mainland, as it is supposedly the case of the three species of bats. One hundred and twelve bird species have been recorded, of which 31 are known or thought to breed, 6 species and 11 subspecies are endemic (Al Saghier & Porter, 1996), such as the Socotra sunbird (*Nectarina balfourii*), the Socotra starling (*Onychognathus frater*), the Socotra bunting (*Emberiza socotrana*), etc. The island hosts the highest concentration of Egyptian vulture (*Neophron percnopterus*) in the Middle East, with around 1,000 breeding pairs (Porter & Stone, 1996).

No rests of the crocodiles, great lizards and land tortoises mentioned by the author of the *Periplus* have been found so far, but this does not mean that they did not exist. Of the 24 species of reptiles, 21 are considered endemic. More than half are geckoes. Among them, the diurnal *Pristurus* genus has evolved with 7 endemic species and the nocturnal *Haemodracon riebeckii*, with its 30 cm, is the largest known species of leaf-toed gecko. An endemic chameleon (*Chamaeleo monachus*) is not uncommon in the areas with good vegetation cover.

The invertebrates of the archipelago are still imperfectly known, and data are available only for certain groups (*Mollusca*, *Aracnida*, *Crustacea*, *Chilopodia* and *Insecta*) while others have not been mentioned, although they are frequent in some habitats and material has already been collected for its study. A very high rate of endemicity is recorded among land snails (56 species, 80% endemics), a spectacular process of speciation and adaptive radiation at the Archipelago (Wranik, 1998) showing a spectacular diversity in sizes, colours, and shapes. Insects also show high rates of endemism, specially within *Himenoptera* (74 species, 66% of which endemic) and *Coleoptera* (72 species, about 35% endemics).

Chamaeleo monachus *is not uncommon in the areas with good vegetation cover.*

Very common in the water courses is an endemic freshwater crab (*Potamon socotranus*) Despite its big dimensions (about 9 cm of carapace breadth) a second endemic crab species (*Socotra pseudocardisoma*) was discovered only in 1997. It appears to be restricted to those parts of the limestone plateau rich in small karstic cavities.

Socotran Archipelago's coastal environment is as yet pristine; the virtual absence of land-based pollution sources, minimal coastal development and a high energy wave climate has meant little or no impact to date. The archipelago forms the boundary between the major Somali upwelling and the Gulf of Aden. Beside the biological productivity due to upwelling, the coastal waters play a role as a haven for cetaceans, sea turtles and a great variety of fishes and marine invertebrates.

Four, possibly five species of sea turtle are found in the Socotran waters: the green turtle *Chelonia mydas*, loggerhead turtle *Caretta caretta*, hawksbill turtle *Eretmochelys imbricata*, Olive Ridley

Lepidochelys olivacea and possibly the Leatherback turtle *Dermochelys coriacea*, all of which are considered endangered species by the IUCN. The common dolphins (*Delphinus delphis*) are very abundant and many other cetaceans inhabit these waters, including the sperm whale, *Physeter macrocephalus*, that was probably a frequent visitors of the Socotra waters, judging the amounts of *ambergris* traded from the archipelago in historical times (Forbes, 1903).

People

The total population of the Socotra archipelago is estimated from 50,000-80,000, with the vast majority on Socotra Island where the two main towns Hadibo the capital and Qalansiya are located. The livelihood of the people living in the mountains and in the interior of the island is dependent on livestock, while the coastal populations rely more on fishing and date cultivation, or are involved in trade in the two main towns. The harvesting of incense, myrrh, aloe sap and dragon's blood, which made Socotra a vital maritime crossroads, are still common practices in rural areas. Medicinal plants are also known and used by population. The strong monsoon winds don't allow any type of agriculture but seasonal crops and date palms. Fruit trees are seldom grown in the highlands, less affected by wind.

The traditions of the Socotran natives differ from those of other Yemenis in that they are influenced by all three of the nearby major regions: the Arabian Peninsula, the Horn of Africa and India.

The Socotran people have their own native language, which is a hold-over from the ancient Himyaritic language. They share this language, or variations of it with the people of the Al-Mahra region in Yemen and Dhofar in Oman.

Their lifestyle has probably changed very little since people first colonised the islands.

Nevertheless, medical services are still very basic, and tuberculosis, intestinal illness, malaria and other diseases are widespread. Infant mortality rate is one of the highest in the world.

Conservation and Management

Kossmat (1907) described Socotra as one of the most isolated places on earth, and this was true until a few years ago, as the island was accessible only by boat or little aeroplanes, and the strong monsoon winds cut the communication with the mainland for many months every year. The opening of the island to the world, thanks to the new airport inaugurated in 1999, marked a crucial turning point for the fragile ecosystem of the archipelago. Any inappropriate development may lead to an irreversible environmental damage.

The first scientific expeditions to the archipelago date of the end of last century, and were led by the Scottish botanist Isaac Bayley Balfour (1880) and the British W. R. Ogilvie-Grant and H. O. Forbes. After that period, not many surveys were made by western scientists. The most important of them was the Middle East Command Expedition in the spring 1967. The collections of plants were made by the two botanists Alan Radcliffe-Smith from the Royal Botanic Garden Kew and John Lavranos, while the zoological records were done by the British entomologist Kenneth Guichard.

After the withdrawal of the British from Yemen in 1967 Socotra remained virtually closed to foreigners and further scientific exploration.

Research started again in 1982, when the geographical and biological departments of the University of Aden sent a scientific mission to the Archipelago.

In 1985 the island botanist Quentin Cronk visited Socotra and found that although there were still large herds o livestock and extensive wood-cutting, the environment was largely unspoilt. He said: "Having seen the degradation overgrazing can cause, I was staggered to come across a place which was in all probability substantially the same now as 1000 years ago."

The low population density and the subsistence economy of the inhabitants caused little impact on the environment. Thanks to this, many areas are still well

The only energy available on the island is from firewood. Only the capital, Hadibo has a few hours of electric supply in the evenings.

Fishing is the main activity of coastal populations.

Typical architecture in the western town of Qalansiya

The high granitic peacks of the Haghier

conserved. The central granitic peacks, valleys such as Wadi Ayhaft, and several coastal areas are all interesting biotopes characterised by a high floristic and faunistic diversity.

Traditionally the people practise rotational grazing. Live trees and shrubs are rarely felled and camels are periodically banned from the hyper-arid west of the island, preserving the island's fragile equilibrium. A network of tribal councils strictly enforce these rules.

In 1997 the UNDP started the project "Conservation and Sustainable Use of the Biodiversity of Socotra archipelago" to be financed by GEF, the British Government, UNDP, UNICEF, WHO and others for five years. The long-term objective of this project is to conserve the endemic and globally significant biodiversity of Socotra archipelago. Other objectives include a zoning system for the Master Plan for Development, sustainable plant and marine resource management, ecotourism development, environmental awareness and education and institutional strengthening and capacity building.

Any management plan for the Archipelago should anyway seek to attain harmony between development and protection, with active participation and involvement of the local communities. An interesting comparison can be made if we think that present-day Socotra archipelago is similar to what the Canary archipelago was 2000 years ago. At that time the island of Tenerife maintained a population of 30,000 inhabitants on an area of more than 2,000 km^2. Today residents are more than 670,000 and foreign visitors are little less than 5,000,000 every year. In spite of the strong impact suffered by the environment in the last 500 years, the very rich endemic terrestrial flora has not yet lost any species, although many of them are nowadays endangered for different reasons. All this involvesof course a great effort for the conservation and management of this rich biodiversity, and can be a good reference to be taken into account when it is the moment to draw the future development and management plans of the Socotra archipelago.

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