
Paper originally presented at:
Commonwealth Science Council Conference on
*Identifying and Monitoring Biodiversity and its Utilization in Commonwealth Small
Island Developing States*
Valletta, Malta - 30 October - 3 November 1995

BIODIVERSITY CONSERVATION AND UTILISATION IN THE MALTESE ISLANDS

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ABSTRACT

The Maltese archipelago which occupies an area of c.316km² consists of the inhabited islands of Malta, Gozo and Comino and several other uninhabited islets and rocks. In spite of their restricted area, the limited number of habitats, and the intense human pressure, the Maltese Islands support a very diverse terrestrial and freshwater biota, with some 2000 species of plants and fungi known, more than 4000 species of insects, several hundred species of other invertebrates, and more than 200 terrestrial or freshwater vertebrates; of these c.80 taxa are considered as endemic. The most characteristic terrestrial ecosystems are those represented by the Mediterranean scrubland, of which the maquis, garigue and steppe are the main types present - evergreen woodlands are all but extinct and only four relict patches occur. Minor terrestrial ecosystems include rupestral, freshwater and coastal communities including sand dunes, saline marshlands and rocky coasts. Marine communities include those characteristic of both hard and mobile substrata.

Human impact is significant, and human influence is a key feature of the islands' ecology. In fact, the population density is the highest in Europe and built-up areas have increased from 5 to 16% in the past 30 years. Some 38% is agricultural land and 46% of the area is undeveloped, but even so, no wilderness areas remain in the Maltese Islands. The management practices of the islands include mainly those concerned with agriculture, animal husbandry and herding, and the use of fire, which all proved to be detrimental to the local biota, mainly through habitat destruction, the removal of competing species and the introduction of alien ones, particularly goats, rabbits and sheep. All these human activities have put great stress on the Maltese biodiversity, with a consequent impoverishment of the flora and fauna.

Flora and fauna which are directly or indirectly exploited in the Maltese Islands are reviewed. Work on biodiversity carried out by national institutions, government departments, agencies and non-governmental organisations is also outlined.

Legislation safeguarding biodiversity is relatively new to Malta. Prior to the Environment Protection Act [EPA] (1991), and the Development Planning Act [DPA] (1992), legislation mainly protected species due to their associated economic importance. Both the EPA and DPA have permitted the creation of protected areas. The EPA also protects some of the flora and fauna, including some 10% of the endemics. The DPA, on the other hand incorporates the Structure Plan for the Maltese Islands which is a strategic plan meant to harmonise development with conservation. On the international level, Malta is party to the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) which is implemented locally by means of regulations controlling trade in species of flora and fauna (1992). Malta is also party to the Ramsar Convention, the Berne Convention, the Barcelona Convention, the Convention on Biological Diversity, and the Law of the Sea Convention.

Introduction

The Maltese archipelago consists of a group of small, low islands, located in the central Mediterranean at a distance of 96km from Sicily and about 290km from the Tunisian coast. The archipelago is made up of three main inhabited islands: Malta (245.7km²), Gozo (67.1km²) and Comino (2.8km²), together with several uninhabited islets of which the main ones, in order of decreasing size, are St. Paul's Island (10.1ha), Cominotto (9.9ha), Filfla (2.0ha) and Fungus Rock (0.7ha). Geologically, the islands are composed almost entirely of marine sedimentary rocks, mainly limestones of Oligo-Miocene age, capped by minor Quaternary deposits of terrestrial or lacustrine origin. The highest point is 253m above sea level. The annual precipitation normally ranges between 500-599mm (Chetcuti *et al.*, 1992) with 85% occurring between October and March; however, rainfall is very variable and extremes of 191.3mm and 1031.3mm have been recorded (Chetcuti *et al.*, 1992).

Table One: *Data concerning the main islands of the Maltese Islands.*

	MAX LENGTH (km)	AREA (km ²)	COASTLINE (km)	POPULATION (1985 CENSUS)	POP. DENSITY (km ⁻²)
MALTA	27	245.7	136.8	319,736	1,301
GOZO	14	67.1	42.6	25,670	302
COMINO	2.7	2.8	10.2	12	4.3

Table Two: *Climatic Parameters (Source: Chetcuti et al., 1992).*
 (*) *Pot. ETP is the Potential Evapotranspiration.*

Month	Rainfall (mm)	Max. Temp. (°C)	Min. Temp. (°C)	Sea Temp. (°C)	Sunshine (hours)	Pot. ETP* (mm)
Jan	86.4	14.9	10.0	14.5	5.3	25
Feb	57.7	15.2	10.0	14.5	6.3	26
Mar	41.8	16.6	10.7	14.5	7.3	37
Apr	23.2	18.5	12.5	16.1	8.3	50
May	10.4	22.7	15.6	18.4	10.0	84
Jun	2.0	27.0	19.2	21.1	11.2	124
Jul	1.8	29.9	21.9	24.5	12.1	160
Aug	4.8	30.1	22.5	25.6	11.3	156
Sep	29.5	27.7	20.9	25.0	8.9	119
Oct	87.8	23.9	17.7	22.2	7.3	81
Nov	91.4	20.0	14.4	19.5	6.3	48
Dec	104.3	16.7	11.4	16.7	5.2	31

Maltese Flora and Fauna

In spite of their restricted area, the limited number of habitats and the intense human pressure, the Maltese Islands support a very diverse terrestrial and freshwater biota, with some 2000 species of plants and fungi known, more than 4000 species of insects, several hundred species of other invertebrates, and more than 200 vertebrates (Schembri, 1990; 1994). Of these, some 23 tracheophytes, 2 bryophytes and 55 animal taxa are considered endemic (Schembri, 1994). Such endemics, besides their great cultural importance, are also of scientific interest, particularly because of the valuable phylogenetic, biogeographic and evolutionary information they provide.

Table Three: *The number of species of representative groups of plants and animals in the Maltese Islands. Only terrestrial and freshwater species are considered. In some cases the numbers given are only estimates as the groups concerned have not been adequately studied. Adapted from Schembri (1994).*

PLANTS

Algae	c. 200+
Large Fungi	c. 200+
Lichenes (lichens)	c. 300
Bryophyta (mosses and relatives)	c. 130
Pteridophyta (ferns and relatives)	11 species
Gymnospermae (conifers)	2 indigenous
Angiospermae (flowering plants)	c. 1000

ANIMALS

Hydrozoa (hydras)	1 species recorded
Turbellaria (flatworms)	at least 10 species
Annelida (earthworms and leeches)	at least 15 species
Mollusca (snails and slugs)	c. 67
Arachnida (spiders and relatives)	at least 200+ species
Branchiopoda (fairy-shrimps, water-fleas and relatives)	at least 10 species
Ostracoda (seed shrimps)	at least 7 species
Amphipoda (sand-hoppers and beach-hoppers)	c. 9 recorded
Isopoda (woodlice)	c. 49
Decapoda (crabs)	1 freshwater species
Odonata (dragonflies and damselflies)	c. 10 recorded
Dictyoptera (mantises and cockroaches)	c. 11
Orthoptera (grasshoppers and relatives)	c. 48
Coleoptera (beetles)	c. 600 recorded; probably 2000+ occur
Heteroptera (true bugs)	209 recorded; more occur
Lepidoptera (butterflies and moths)	c. 590
Neuroptera (lacewings)	c. 12 recorded
Diptera (flies)	c. 200 recorded; probably 500+ occur
Hymenoptera (bees, wasps and ants)	c. 150 recorded; probably 500+ occur
Diplopoda (millepedes)	c. 14
Chilopoda (centipedes)	c. 15
Pisces (fish)	1 brackish-water sp.
Amphibia (frogs)	1 species
Reptilia (reptiles)	9 species
Aves (birds)	c. 13 resident; c. 57 regular visitors; c. 112 regular migrants
Mammalia (mammals)	23 species

Table Four: *The number of endemic taxa occurring in the Maltese Islands. Only those groups which have been adequately studied taxonomically are included and only freshwater and terrestrial species are considered. Adapted from Schembri (1994).*

GROUP	NUMBER OF ENDEMICS
Bryophyta (mosses and relatives)	2
Tracheophytes (higher plants)	23
Mollusca (snails and slugs)	8
Pseudoscorpiones (false scorpions)	3
Palpigradi (micro-whipscorpions)	1
Isopoda (woodlice)	5
Decapoda (crabs)	1
Thysanura (silverfish)	1
Orthoptera (grasshoppers and relatives)	1
Heteroptera (true bugs)	1
Coleoptera: Staphylinidae (rove beetles)	4
Coleoptera: Elateridae (click beetles)	1
Coleoptera: Tenebrionidae (darkling beetles)	5
Coleoptera: Curculionidae (weevils)	2
Lepidoptera (butterflies and moths)	17
Hymenoptera: Formicidae (ants)	2
Hymenoptera: Mutillidae (velvet ants)	1
Pisces (fish)	1
Reptilia (reptiles)	1
Mammalia (mammals)	1

One effect of the intense human pressure on the natural environment has been that, over the years, a number of indigenous species of wildlife have become extinct, while others are threatened in various ways: for example, some 12% of the native vascular flora is now extinct. Endemic species are no exception and, unfortunately, some are also probably extinct, as for example three presumably endemic vascular plants [the Maltese Venus looking-glass *Legousia hybrida* var. *foliosa*; the Maltese bulbous buttercup *Ranunculus macrophyllus* forma *macranthus* (Lanfranco, 1989b), and a probably new species or subspecies of *Limonium* (Lanfranco, 1989b; 1990)].

Table Five: *The number of extinct and threatened species of the Maltese Islands. Only those groups which have been adequately studied taxonomically are included and only freshwater and terrestrial species are considered.*

Key: X: Extinct; E: Endangered; V: Vulnerable; R: Rare; I: Indeterminate. Adapted from Schembri & Sultana (1989).

<i>Group</i>	X	E	V	R	I
Macrofungi ("higher " fungi)	0	1	0	16	0
Bryophyta (mosses and relatives)	0	1	0	33	3
Tracheophyta (higher plants)	136	59	23	195	14
Crustacea (crustaceans)	0	2	2	8	2
Mollusca (snails and relatives)	2	11	7	5	2
Odonata (dragonflies and rel.)	0	0	1	1	0
Dictyoptera (mantises and rel.)	0	0	0	2	0
Orthoptera (grasshoppers and rel.)	1	0	2	5	0
Dermaptera (earwigs)	0	0	1	0	0
Hemiptera (bugs)	0	0	0	1	4
Trichoptera (caddisflies)	0	0	0	2	0
Hymenoptera (bees, wasps and ants)	0	1	6	5	0
Lepidoptera (butterflies and moths)	7	1	11	9	4
Coleoptera (beetles)	11	0	37	64	48
Pisces (fish)	0	1	0	0	0
Amphibia (ampibians)	0	0	1	0	0
Reptilia (reptiles)	0	0	11	0	0
Aves (birds)	0	10	9	2	0
Mammalia (mammals)	0	0	12	8	3

Threatened Terrestrial Ecosystems of the Maltese Islands

The terrestrial ecosystems of the Maltese Islands may be grouped into two main categories:

- i. Major communities that are part of the successional sequence towards the climatic climax; and
- ii. Minor communities which are either specialized to occupy particular habitats, or occupy habitats that are rare in the islands, or are relicts from a former ecological regime, now surviving in a few refugia.

The major communities are classified on the basis of the vegetation and are: evergreen woodland, maquis, garigue and steppe communities, the latter three being seres of the former.

1. **Evergreen Woodlands**, which probably occupied large areas of the Maltese Islands before human colonization, are now

almost inexistent (Schembri, 1991b; Grech, 1994; Stevens, 1995). They are mainly dominated by the holm oak *Quercus ilex* and the Aleppo pine *Pinus halepensis* (Lanfranco, 1993a, 1995 a,c; Stevens, 1995). Only remnants of the original native forests remain in four localities, although there are a few semi-natural woodlands, where trees originally planted by man are now self-regenerating. Some of the trees present in the woodland remnants are estimated to be between 500 to 900 years old, probably the oldest trees on the islands.

2. **Maquis** is still widespread especially on the sides and bottoms of dry valleys or *widien* (Lanfranco, 1993a; Stevens, 1995). The Maltese maquis is predominantly of secondary origin, being mainly dominated by trees such as carob *Ceratonia siliqua* and olive *Olea europaea*, which were introduced in the antiquity because of their economic importance. Other characteristic maquis species include the mastic tree *Pistacia lentiscus* and Mediterranean buckthorn *Rhamnus alaternus* (Lanfranco, 1993a).
3. **Garigue** and **steppe** are the most common natural vegetation types present. Some are natural, but others result from the degradation of forest and maquis. The most important garigue shrubs include the Mediterranean thyme *Thymus capitatus*, the Mediterranean heath *Erica multiflora*, the endemic Maltese spurge *Euphorbia melitensis*, the olive-leaved germander *Teucrium fruticans* and the shrubby kidney-vetch *Anthyllis hermanniae*. Various grasses, thistles and geophytes also occur in such communities (Lanfranco, 1993a; 1995c; Stevens, 1995). These communities are particularly vulnerable to quarrying, dumping and flower/plant collection.

Of the "minor communities", **coastal communities** are amongst the most vulnerable due to land reclamation and development.

1. **Saline marshlands** constitute only 0.5% of the Maltese coastline, and are now very scarce (Schembri *et al.*, 1987; Anderson & Schembri, 1989). Some have been completely obliterated (most recently, five sites in Malta and two in Gozo) whilst others are much degraded (eight sites in Malta, three in Gozo and one in Comino) by human activities. Some five saline marshlands only are still extant.
2. Only 2.4% of the Maltese coastline consists of sandy beaches (Schembri, 1991a; Schembri & Lanfranco, 1993), but few of these now support **sand dunes** and those which still exist are extremely degraded mainly due to human activities connected with beach development for touristic purposes and recreational use. The important sand-binding Mediterranean marram-grass *Ammophila littoralis* was eradicated from all known sites during the last ten years, and the sand bindweed *Calystegia soldanella* disappeared within the last 50-60 years (Lanfranco 1989b; Schembri & Lanfranco, 1993). Other sand dune plants are actively threatened; for example, the spiny echinophore *Echinophora spinosa* and the sea holly *Eryngium maritimum*,

both very rare, are being regularly weeded out to make room for beach users (Schembri & Lanfranco, 1993);

3. **Low-lying rocky coasts** are still quite widespread. These coastlines support a characteristic maritime vegetation which includes a number of scientifically important plants, such as three endemic sea-lavenders, *Limonium* spp., and the endemic Maltese sea-chamomille *Anthemis urvilleana*, as well as Pignatti's fern-grass *Desmazeria pignatii* and pygmy groundsel *Senecio pygmaeus*, both Hybleo-Maltese endemics, and the Maltese hymenolobus *Hymenolobus revelieri* ssp. *sommieri*, a Pelago-Maltese endemic (Schembri, 1991b).

Other 'minor' communities include the **rupestral habitats**, which, due to their relative inaccessibility and shelter, provide important refuges for many species of the Maltese flora and fauna, including many endemics. Such species include two rare endemics, the Maltese cliff-orache *Cremnophyton lanfrancoi* and Maltese rock-centuary *Palaeocyanus crassifolius*, both belonging to monotypic (and hence endemic) genera, of great evolutionary and biogeographic significance due to these being ancestral to important genera like *Atriplex* and *Centaurea*, respectively (Lanfranco, 1989a); also, the rarest of the Maltese endemic animals, the door-snail *Lampedusa melitensis*, occupies a very precarious habitat of a few tens of square metres only on the southwest cliffs of mainland Malta (Thake & Schembri, 1989).

Freshwater communities are represented in the islands by those of temporary rainwater pools on karstlands, permanent pools, watercourses (wet only in winter) and permanent springs. The latter are very rare and are also endangered due to pollution from pesticides and eutrophication from dumping of organic waste.

However, due to the aridity of the islands, all freshwater biota are rare. Also, these are largely exploited (refer to section on Human Influence) resulting in habitat loss (Lanfranco & Schembri, 1986; Schembri & Lanfranco, 1993).

Threatened Marine Ecosystems of the Maltese Islands

The marine coastal ecosystems of the Maltese Islands are similar to those of other parts of the Mediterranean and may be classified as follows:

1. **Supralittoral Communities:**
 - i. **Rocky Substrata** - the commonest given that most of the islands' coastline is rocky. Some of the more accessible rocky shores are highly disturbed due to recreational activities and tourist-related developments.
 - ii. **Soft Substrata** - few sandy beaches occur and the most important, and actively threatened, ecosystems here are the

banquette communities, which are specialized communities developing within masses of drying and decaying plant debris deposited on the shore by waves. These are regularly cleared since they are unattractive to local and tourist sunbathers !

2. Mediolittoral Communities:

The most notable are the bioconstructions known as vermetid/coralline algae trottoirs and the very rare *Lithophyllum lichenoides* rims, both of which are threatened on a Mediterranean scale. Little information on local trottoirs is available.

3. Shallow Water Infralittoral Communities:

- i. Rocky substrata - the main communities developing here are those dominated by attached macroalgae mainly by *Cystoseira* forests, *Dictyopteris* forests and coralline algae.
- ii. Sea-grass Meadows - these are mainly based on the neptune sea-grass *Posidonia oceanica*, which is endemic to the Mediterranean. These meadows constitute the most important infralittoral community type and, due to various human influences, are regressing throughout the Mediterranean.

Both types of infralittoral communities are highly sensitive to pollution, and hence are decreasing in the Maltese Islands.

Exploitation of Biological Resources

The main biological resources which are exploited are the various cultivated plants and farmed/domesticated animals. These will be dealt with in brief, the main emphasis of this section being on the exploitation of wild plants and animals.

The principal cultivated crop is perhaps the potato, *Solanum tuberosum*, which is also exported. Other Solanaceae which are commonly grown include tomatoes, *Lycopersicon esculentum*, usually greenhouse grown; bell peppers, *Capsicum annum*, and aubergines, *Solanum melongena*. Paprika (*Capsicum baccatum* and *Capsicum frutescens*) are grown mainly for home consumption.

Cruciferous crops are particularly common especially cauliflower; *Brassica cretica* subsp. *botrytis*; cabbage, *Brassica oleracea* subsp. *capitata*; and kohlrabi, *Brassica rupestris* subsp. *gongyloides*. Radishes, *Raphanus sativus*, are grown on a smaller scale. Cucurbits, especially a type of dwarf marrow, *Cucurbita pepo*; pumpkin, *Cucurbita maxima*; watermelon, *Citrullus lanatus*; melon, *Cucumis melo*; cucumber, *Cucumis sativus*; and trumpet gourd, *Lagenaria siceraria* are commonly cultivated, while Chayotte, *Sechium edule*, is rather less frequently grown.

A variety of pulses are grown, particularly broad beans, *Vicia faba*, but also peas, *Pisum sativum*, and French beans, *Phaseolus vulgaris*, while chick-peas, *Cicer arietinum* are eaten mainly by children.

The main cereals are wheat, *Triticum durum*, and barley, *Hordeum vulgare*, which are grown mainly as fodder. A few other cereals such as maize, *Zea mays*, and durrah, *Sorghum vulgare*, the latter mainly as bird-seed, are less frequently grown.

The main umbelliferous crop is carrot, *Daucus carota* var. *sativa*, while parsley, *Petroselinum crispum*, and celery, *Apium graveolens*, are grown on a smaller scale. Malta used to be famous for the cultivation and export of cumin, *Cuminum cyminum*, which is no longer cultivated commercially.

Other herbaceous crops include onions, *Allium cepa*; leeks, *Allium porrum*; lettuce, *Lactuca sativa*; endives, *Cichorium endivia*; globe artichoke, *Cynara scolymus*; Jerusalem artichoke, *Helianthus tuberosus*; beetroots, *Beta vulgaris*; spinach, *Spinacia oleracea*; and strawberry, mainly *Fragraria moschata*, although in the past *Fragraria vesca* used to be the main species. Safflower, *Carthamus tinctorius*, known chiefly for its dye and oil, is cultivated locally mainly to provide bird-seed while chamomille, *Matricaria recutita*, which also grows wild, is cultivated on a limited scale. The main fodder crop is *Hedysarum coronarium* which has also run wild. A type of banana, the St. Michael's banana (a cultivar of *Musa paradisiaca*), actually a plantain, with fruits that can be eaten raw, is still frequently seen near farmhouses and in old gardens but it is not marketed and its cultivation is on the decline.

Woody crops include grapevines, *Vitis vinifera*, grown for both fruit and wine, and a variety of fruit trees. The main citrus trees include oranges, *Citrus sinensis*, including the well-known Maltese Blood-Orange; lemons, *Citrus limon*; and tangerines, *Citrus nobilis*, all in several varieties, some of which are of local origin. The Seville orange, *Citrus aurantium* is used as a stock, but also for making orange-flower water, jams and sweetmeats. Rosaceous trees include peaches and nectarines, *Prunus persica*; apricots, *Prunus armeniaca*; plums of various sorts, *Prunus domestica*; cherry-plums, *Prunus cerasifera*; apples, *Malus domestica*; pears, *Pyrus communis*, including a distinctive local cultivar "Bambinella" (Small Malta June Pear); and loquat, *Eriobotrya japonica*. Several of these are grafted on quince, *Cydonia oblonga*, which is also used for its medicinal properties. White mulberries, *Morus alba*, were introduced during the nineteenth century to support a short-lived silk industry but their fruits and those of the black mulberry, *Morus nigra*, are picked to be eaten. Jujube, *Ziziphus zizyphus*, is going out of use, although several trees still exist in the countryside, while azarole, *Crataegus azarolus*, has practically disappeared as a fruit tree. Pecan nuts, produced by *Carya illinoensis*, are often picked though not marketed. Palm leaves, particularly those of the Canary Island palm, *Phoenix canariensis*, are harvested to be used in

connection with Coryphene fishing, for which they are especially grown, and to a lesser extent for decoration. In addition, many species are cultivated as ornamentals and as culinary herbs. Hemp, *Cannabis sativa*, used to be grown on a small scale to provide bird-seed, but, due to its use as a narcotic, its cultivation is now illegal. Nevertheless, its cultivation is still carried out clandestinely.

Until relatively recently the most important domestic animals were goats, *Capra hircus*, and sheep, *Ovis aries*, of which distinct Maltese varieties also occur. Their numbers have gone down drastically, having been replaced by cattle, *Bos taurus* (Busuttill, 1993; Schembri and Lanfranco, 1993); a local breed of cattle was also raised but this has all but disappeared. Pigs, *Sus domesticus*; chickens, *Gallus domesticus*; Guinea fowls, *Numida meleagris*; ducks, *Anas platyrhynchos*; geese, *Anser anser*; and rabbits, *Oryctolagus cuniculus* are also bred, the latter also in a distinct Maltese race. Horses, *Equus caballus* and donkeys, *Equus asinus*, the latter including a valuable Maltese breed, are important adjuncts to rural life; but donkey breeding has greatly declined. A recent development is aquaculture of marine fish, the most important subjects being gilt-head sea bream, *Sparus aurata*, and sea bass, *Dicentrarchus labrax*, as well as red tilapia, *Oreochromis mossambicus* x *O. niloticus*. Aquaculture of oysters, *Crassostrea gigas* and *Ostrea edulis*, and mussels, *Mytilus galloprovincialis*, was attempted during the 1960s and 70s, but is now largely discontinued. In addition several other animals are bred as pets including a local breed of dog, *Canis familiaris*, the "Pharaoh Hound" which was originally used for rabbit hunting, while pigeons, *Columba palumba*, are bred by hobbyists as well as to decorate public squares.

The main natural biological resources which are exploited commercially on a large scale are marine fish and, to a lesser extent, cephalopods, especially squid and octopus, crustaceans such as lobsters, prawns, scampi and crawfish, and marine molluscs such as the date mussel, *Lithophaga lithophaga* and Venus shell, *Venus verrucosa*. Among the most important fish which are commercially exploited on a large scale by registered fishermen are coryphene, *Coryphaena hippuris*; swordfish, *Xiphias gladius*; pilot fish, *Naucrates ductor*; tunny, *Thunnus thynnus*; and bogue, *Boops boops*. Some fish caught by SCUBA divers, such as groupers, *Epinephelus guaza*, are often sold to restaurants.

Bird hunting and trapping are still widespread activities in the Maltese islands - but in this case the main aim is not commercial; rather, these activities are indulged in as a pastime and many of the birds hunted are stuffed (in spite of the fact that taxidermists require a license to operate and no licenses have been issued!). In fact relatively few birds are hunted for food. Notable exceptions are turtle dove, *Streptopelia turtur* and quail, *Coturnix coturnix*. Birds are trapped mainly for their song and, in this case, there is also considerable commercial exploitation since good song-birds may fetch very elevated prices. These activities are

subject to regulation by legislation, nonetheless numerous infringements of regulations still occur. Rabbits are also hunted on a considerable scale, mainly for food, sometimes by employing ferrets, *Mustela furo*.

Production of honey has been one of Malta's most important industries since at least Punic times. Apart from bees, this is of course also dependent on the availability of suitable wild plants which determine the flavour of the honey. Much Maltese honey is based on the Mediterranean thyme, *Thymus capitatus*.

Other animals are collected for food, mainly to be eaten *in situ* as in the case of many seafoods particularly limpets, *Patella* spp., sea urchins, particularly *Paracentrotus lividus*, and some types of shore crabs. Common garden snails, *Cantareus aspersum*, are collected in large quantities for consumption at home and, sometimes, sold to restaurants. Some animals are captured to be kept as pets, particularly the Mediterranean chamaeleon *Chamaeleo chamaeleon*; the Algerian hedgehog *Erinaceus algirus*; the Maltese freshwater crab *Potamon fluviatile lanfrancoi*; the painted frog *Discoglossus pictus pictus* and occasionally snakes. In the past both the frog and the freshwater crab were used as food and it is recorded that a broth made from frogs used to be given to sickly children. It was also a common practice for children to catch skinks, *Chalcides ocellatus*, which were then sold to apothecaries who used them for the preparation of pharmaceuticals. In spite of it being covered by protective legislation, the loggerhead turtle *Caretta caretta*, is still caught for food.

Over the centuries a large variety of wild plants have been exploited on a considerable scale. Many species have been, and some are still, used medicinally (see Lanfranco [G.], 1993); examples are Maltese savory, *Micromeria microphylla* and rue, *Ruta chalepensis*. Of special note is the inappropriately named "Malta Fungus", *Cynomorium coccineum*, a parasitic flowering plant to which were attributed a variety of medicinal and magical properties and which was once a valued product, the distribution of which was entirely under the control of the Order of the Knights of St. John. There have been sporadic attempts to grow some medicinal plants commercially, examples being squirting cucumber, *Ecballium elaterium* and seaside squill, *Urginea pancracion*, and it seems that renewed attempts in this direction are under way. Medicinal plants are often prescribed by traditional herbalists, whose knowledge has been transmitted by word of mouth over the generations. This breed of herbalists is dying out to be replaced by a new breed of more sophisticated (but not necessarily any more efficacious) practitioners.

Several species are used for food or fodder. The carob, olive, fig and pomegranate trees (*Ceratonia siliqua*, *Olea europaea*, *Ficus carica* and *Punica granatum*) were probably introduced in antiquity. The carob is still used, mainly for animal fodder, but also for human consumption as a syrup and for sweetmeats. The olive used to be grown for its oil, but is now no longer commer-

cially used for this purpose, although the fruit is occasionally harvested and marketed. The pomegranate and fig are common orchard trees, but have also run wild, probably since antiquity. Their fruit is still often sold to shops and markets. The prickly pear, *Opuntia ficus-indica*, and the almond tree, *Prunus dulcis*, were introduced for their fruit but have now run wild. The prickly-pear is also often utilized as fodder and as a very effective hedge, but has the habit of overgrowing and can pose a danger to the native flora; its fruits are still regularly marketed. Perhaps the most important are the capers, *Capparis orientalis* and *C. spinosa*, the flower-buds of which are collected on a large scale to be prepared as a condiment, supporting a flourishing cottage industry.

Several plants are collected sporadically because of their edibility. A few examples are the edible birdsfoot trefoil, *Lotus edulis*, which is collected for its pods; the wall-rockets, *Diplotaxis* spp.; purslane, *Portulaca oleracea*; spiny asparagus, *Asparagus aphyllus*; and fennel, *Foeniculum vulgare*. The fruits (blackberries) of bramble, *Rubus ulmifolius*, are often picked while bay leaves from *Laurus nobilis*, and rosemary, *Rosmarinus officinalis*, are used as culinary herbs. Children sometimes eat the blanched underground stems, known locally as "Hanxul", of the Cape sorrel, *Oxalis pes-caprae*, an invasive alien, and the unripe fruits of mallows, *Malva* and *Lavatera* species. The sea lettuce, *Ulva laetevirens*, is also sometimes eaten. In Malta there is little use of wild mushrooms as a source of food. Sommier and Caruana Gatto (1915) state that a species of oyster mushroom, *Pleurotus eryngii* var. *ferulae*, which grows on the stumps of dead *Ferula communis*, used to be collected and sold at the markets. It is now too rare to make its sale profitable but it is still occasionally collected and sometimes crops up in the odd restaurant. A few other edible mushrooms are sporadically collected for food, particularly the wood blewits *Lepista nuda*, and pine boletus *Suillus collinitus*. The milk-vetch *Astragalus baeticus* used to be grown on a limited scale and used like coffee, either on its own or mixed with real coffee (Borg, 1918).

In the case of traditional fodders, it is often difficult to establish whether they are wild plants which were taken into cultivation, or cultivated fodders which have run wild. Apart from the most commonly grown species, *Hedysarum coronarium*, which was almost certainly imported, one may mention the white vetch, *Lathyrus ochrus*, and the common vetch, *Vicia sativa*. This last is also sown around Christmastime and grown in the dark for blanching. It is then used for decorating Christmas cribs.

The great reed, *Arundo donax*, was probably introduced in antiquity and has become widely naturalized. It is still harvested to be used for fencing, basketry and curtain making. The narrow springy twigs of the chaste-tree, *Vitex agnus-castus*, were used (and are still, to a very limited extent, owing to its rarity) as supports for basketwork, in much the same manner as willow twigs are used elsewhere. Rushes, *Juncus* spp., were, and to a limited extent still are, used for basketry as were the leaves of

the dwarf fan-palm, *Chamaerops humilis*, now extinct in the wild. The Neptune sea-grass, *Posidonia oceanica*, sheds its leaves which accumulate as thick masses, known as 'banquettes', on the seashore. This material is sometimes used as a fertilizer.

Wild plants have also been widely used as firewood. Whenever there were wars (including the Second World War) and invasions, trees were cut down for burning - a practice which must have contributed greatly to the loss of Malta's tree cover. Other plants have also been regularly used as kindling, notably the yellow restharrow, *Ononis natrix*, while the phagnalons, *Phagnalon* spp. and some bracket fungi, mainly *Phellinus* spp., have been used as tinder. The Mediterranean thyme, *Thymus capitatus*, is frequently collected around Christmastime to decorate cribs, notwithstanding the fact that it enjoys legal protection, while leafy olive twigs, mainly of cultivated origin, are used during Eastertide particularly for Palm Sunday celebrations.

Many species of indigenous plants are also cultivated as ornamentals. This includes a number of indigenous trees including holm oak, *Quercus ilex*; African tamarisk, *Tamarix africana*, sandarac tree, *Tetraclinis articulata*; Aleppo pine, *Pinus halepensis* and dwarf fan-palm, *Chamaerops humilis*. The last two are virtually extinct as wild plants, but the pine has been reintroduced in afforestation schemes and is regenerating, and there is no reason why the palm cannot also be reintroduced. In public gardens one may see the Mediterranean heath, *Erica multiflora*, Egyptian St. John's-wort, *Hypericum aegypticum* and the endemic Maltese rock-centaury, *Palaeocyanus crassifolius*, which has become popular as an ornamental plant since, in 1971, it was declared the National Plant of Malta. The seaside shrub, *Atriplex halimus* is widely cultivated as a hedge. Attractive wild flowers, particularly French daffodil, *Narcissus tazetta*, are often picked in large quantities to be sold. Others include branched asphodel, *Asphodelus aestivus*; common pyramidal orchid, *Anacamptis pyramidalis*; Mediterranean heath, *Erica multiflora*; corn-flags, *Gladiolus* spp.; southern iris, *Iris pseudopumila* and star-of-Bethlehem, *Ornithogalum arabicum*. Pheasant's eye, *Adonis microcarpa*, has been driven to near extinction as a result of this practice. Also, leaves of the giant fennel, *Ferula communis*, are often used as greenery by florists.

Human Influence on local Biodiversity

The Maltese Islands were settled around 7000 BP by an agricultural/pastoral society (Schembri, 1993; Lanfranco, 1995b). The islands have been experiencing considerable, and at times intense, anthropic pressure ever since. The present population is of about 367,000 (as at December 1993) with a population density of 1157km⁻², as the highest in Europe (Lanfranco, 1995b) and is projected to reach 380,000 by the year 2000 (Schembri, 1991b). Such a high population density is augmented further by tourist arrivals, which are currently about one million annually. Such a high population density creates a considerable stress on natural

habitats and their biota, and the islands' biodiversity is under threat and ever decreasing.

In fact, human influence is a key feature of the islands' ecology. Human activities have created a variety of habitats such as cultivated and abandoned fields, private and public gardens, road verges, and land cleared of the natural vegetation cover for a variety of purposes. Much of the land area is given either to agriculture (c.38%) or is built over (c.16%) and only some 46% of the land area can be described as undeveloped, although even this is greatly influenced by human activities; no wilderness areas remain in the Maltese Islands (Schembri, 1991b; Schembri & Baldacchino, 1992).

The main human activities which have an impact on biodiversity include:

1. The **disposal of waste** generated by the permanent and transient population, and by industry, which is posing a serious environmental problem: there are only four official dumping sites in the Maltese Islands, but there are many other unofficial ones and fly-tipping in rural areas has degraded a large number of natural habitats. These unofficial sites are cleared periodically by the authority concerned, however rubbish soon accumulates, sometimes overnight.
2. Another serious cause of biodiversity reduction is the increase in **quarrying activity**. Limestone is one of the most important natural resources of the islands, with Globigerina Limestone being used as a building stone and Coralline Limestone as spalls. Many of the old quarries have been worked out and abandoned without any restoration, while new quarries are being established in ecologically sensitive areas. Several plant and animal species have become extinct from the islands due to the destruction of their habitat by quarries or due to habitat disturbance related to this, and many more are threatened by quarrying activities.
3. **Deforestation and clearing of land** started with the earliest inhabitants of the islands and have continued to the present. Since trees are not adequately protected in the islands, many trees are felled; for example, a small evergreen oak forest remnant at Wied Hazrun (one of only four such remnants remaining) was recently sprayed with herbicide, burnt and cut down by a single farmer. Also, birds, which are important in seed dispersal, are intensively hunted, and in some cases, what germinates is eaten up by goats, sheep or rabbits. Bird trapping, which is practiced on a considerable scale, also has a large impact since trappers clear large rectangular tracts of land (each approximately 35m²) in front of their hides in order to spread their nets and cages. This usually leads to soil erosion (Schembri & Lanfranco, 1993). Some trappers also employ herbicide to clear the vegetation, or plant unsuitable alien trees like acacias or eucalypts to attract birds (Lanfranco, 1991a; 1995b).

4. Local wildlife has also been exploited since time immemorial, and in most cases the rate at which individuals are removed from the population is well below the rate at which they are replaced. Many species are **overexploited** and are hence declining. Contributing factors include the use of indiscriminate methods of collection, such as fine mesh nets which capture target and non-target species alike, collection for commercial purposes as is the case of several species of wild flowers and reptiles, and collection for private use, as is the case of birds which are shot to be stuffed, and species bearing decorative shells.
5. Due to the islands' aridity, **freshwater communities are also overexploited**. Water sources have been diverted for human use, mainly irrigation and commercial exploitation (as bottling of spring water). This has led to a reduction in number and rate of flow of high level springs resulting in a loss of the habitat they provided (Lanfranco & Schembri, 1986; Schembri & Lanfranco, 1993).
6. The **abandonment of agriculture and changing agricultural practices** are also resulting in a severe habitat loss as dry stone walls and field verges provide important habitats, the former also prevent soil erosion. Some species associated with agricultural uses are threatened, if not extinct (for example, corn cockle *Agrostemma githago*, Mediterranean hibiscus *Hibiscus trionum*, and the endemic Maltese Venus looking-glass *Legousia hybrida* var. *foliosa* are already extinct) (Lanfranco, 1989b), while on the positive side, this has permitted the regeneration of maquis associations.
7. **Development away from the traditional urban centres**, especially on the coast or along valley beds, as well as urban sprawl, radiating from formerly small isolated villages, is also posing serious problems, resulting in habitat loss and the eventual extinction of species.
8. Besides these, **ignorance and persistent persecution** is also a cause of loss of biodiversity. Many invertebrates such as insects and spiders, as well as reptiles, birds, and some mammals like shrews, hedgehogs, bats and cetaceans are aimlessly persecuted (Lanfranco [G], 1969b; Lanfranco [G] & Schembri, 1989; Sultana, 1989).
9. Disturbance due to human activities has resulted in a continuously changing environment which favours the **spread of alien weeds** often at the expense of indigenous plants. Thus, the Cape sorrel, *Oxalis pes-caprae*, introduced at the beginning of the 19th century, and the narrow-leaved aster, *Aster squamatus*, probably introduced as late as the 1930s have overrun the islands and also insinuate themselves in natural habitats, displacing native species. The castor oil tree, *Ricinus communis*, probably naturalised since the late 19th century has spread prodigiously and grows in several valleys.

The once uncommon tree mallow, *Lavatera arborea*, has now become common in disturbed coastal localities, while the glaucous tobacco, *Nicotiana glauca*, which was introduced in the 19th century, mainly grows on rubble and old derelict walls (Lanfranco, 1996).

All these factors banalise to a substantial degree the vegetation and its related fauna, while many rare species are seriously threatened due to such human-induced stress.

Traditional Management Practices

The traditional management practices of the Maltese Islands are mainly agriculture, apiculture, animal husbandry and herding, afforestation and deforestation, and the use of fire.

Agriculture, now on the decline (Busuttil, 1993), was one of the most important means of land management, and, due to the erection of dry stone walls, it protected, to some extent, soil from being lost. The traditional modes of land management in agriculture involved primarily:

- i. terracing of slopes and the construction of dry stone walls which reduced soil erosion;
- ii. collection and transport of soil;
- iii. planting of hedges and windbreaks;
- iv. construction of reservoirs, boreholes and the diversion of springs to use water for irrigation;
- v. land reclamation for agriculture;
- vi. the elimination of competing species such as the native willow species (*Salix alba*; *S.pedicellata*) and woods.

Agriculture has in fact also destroyed part of the flora and fauna, particularly in fertile alluvial plains and valley-beds. The introduction of the great reed, *Arundo donax*, as a windbreak species in very ancient times, has eradicated the natural deciduous forests with the native willows (*Salix* spp.) and narrow-leaved ashes (*Fraxinus angustifolia*) in many areas, and what remained was cut down by farmers as these competed with their crops since they used to grow on very fertile land. No deciduous forests now remain in the Maltese Islands. Another plant, the prickly pear, *Opuntia ficus-indica*, introduced for its edible fruit at the beginning of the 16th century, has naturalized and colonized large stretches of land, sometimes becoming the only species present in a particular area since it hardly allows any undergrowth species to grow.

Animal husbandry and herding, which was once very diffuse, is now much reduced: some 45,000 goats were recorded in 1952; 35,000 in 1960 (Central Office of Statistics, 1962); 14,000 in 1972 (Central Office of Statistics, 1973); and only some 1,850 in 1990 (Ministry of Agriculture and Fisheries, 1991). Cattle are today preferred (Busuttil, 1993), and these are kept in closed managed areas and fed hay and forage, as opposed to goats and sheep

which browsed and grazed in the wild and could utilize rough pasture. This also had an impact on biodiversity since grazing pressure by sheep and goats favoured grazing-resistant species and low garigue and steppe, while with the decline in herding, maquis and woodland are regenerating in appropriate habitats.

Firing is also a major management practice in the Maltese Islands. In the past, since overbrowsing of palatable species resulted into a 'grazer-resistant' vegetation, particularly goat-resistant maquis, this became impenetrable to livestock, hence shepherds and farmers used to burn the thickets. Such shepherd-induced fires ultimately removed grazing-resistant shrubs and this explains the rarity of species like the Spanish broom (*Spartium junceum*), the bean trefoil tree (*Anagyris foetida*) and the possibly extinct Christ's thorn tree (*Paliurus spina-christi*). Nowadays, fires are primarily used to eradicate competing trees and weeds, or else to obtain nutrient-rich ash.

Apiculture is another traditional activity "relished with a certain amount of local folklore" (Ministry of Agriculture and Fisheries, 1991). At the time of the Roman Empire, Maltese honey was one of the few export items and was accredited as one of the specialities of the islands. The industry is based primarily upon the Mediterranean thyme *Thymus capitatus*, a garigue shrub, which is an important 'food' for bees (and for this reason protected by law). Nowadays, this industry, although still important, is very small, with some 250 bee-keepers and 5000 colonies (Ministry of Agriculture and Fisheries, 1991).

Afforestation, as deforestation, was also a kind of land management. During the colonization of the islands by the Romans and Arabs, trees like carobs and olives were planted all over the country. During the reign of the Knights of St. John, silviculture thrived and many trees were planted for agricultural, commercial, recreational and decorative purposes. The semi-natural woodland at Buskett originates from this period, when the natural woodland present there was heavily augmented with other trees to turn the area into gardens and a hunting park (Borg, 1990; Schembri & Lanfranco, 1993). A drive to afforest the islands also started in the early 1950's and has continued to the present time. Afforestation projects have often been attempted in unsuitable areas, and even worse, alien species were more commonly utilized in afforestation projects than were indigenous and archeophytic trees and shrubs. Until recently, *Acacia* spp., particularly *A. cyanophylla* and *A. cyclops*, were indiscriminately planted in many localities, including in ecologically sensitive areas where they tend to displace native species. *Eucalyptus* spp., notably *E. camaldulensis* and *E. gomphocephala*, have also been extensively used. These trees prevent most other plants from growing in their vicinity due to allelopathic effects (Schembri, 1991b; Schembri & Lanfranco, 1993; Stevens, 1995). Hunters and trappers also have a very important role in afforestation, since they plant trees to attract birds, in the main exotic, fast-growing trees such as those mentioned above.

MANAGING BIODIVERSITY

Existing Knowledge on Biodiversity

The Maltese vascular flora is relatively well-known, and accounts have been published since the 17th century by various authors, notably Boccone (1673); Zerapha (1827; 1831); Grech Delicata (1853); Gulia (1872a,b; 1873a,b); Duthie (1874; 1875a,b); Donaldson in Gulia (1877); Armitage (1889); Sommier & Caruana Gatto (1915); Borg (1927); Lanfranco [G] (1969a); Haslam (1969); Haslam *et al.* (1977); and Lanfranco (1995a; and a new flora in preparation). In addition to these, Lanfranco (1988; 1989b) lists the rare, threatened and/or scientifically important species, whilst Lanfranco (1993b) gives a short account on some extinct and endangered plant species. However, although well-known, unrecorded species are still being discovered (for example, Briffa, 1986; Lanfranco, 1991b; Tabone, 1995).

On the other hand fungi and lichens have received much less attention. Relatively little is known about the mycoflora of the Maltese Islands and almost all knowledge is due to the compilations of Saccardo (1912; 1914; 1915), Sommier & Caruana Gatto (1915) and Briffa & Lanfranco (1986). The only compilation on Maltese lichens is that of Sommier & Caruana Gatto (1915).

More is known about bryophytes and algae. Works concerned with bryophytes are those by Sommier & Caruana Gatto (1915); Gradstein (1972); Dia *et al.* (1985; 1987) and Borg (1993); those concerned with algae include Ardissonne (1883; 1886; 1893); Piccone (1883); Möbius (1892); Sommier and Caruana Gatto (1915); Lanfranco (1969); Rizzi-Longo & Giaccone (1974); as well as unpublished works such as those by Calleja (1991); Mallia (1991); Azzopardi (1992); Mifsud Bonnici (1992); Buttigieg (1993); Mallia [R] (1993) and Mifsud (1995).

Similarly, some groups of Maltese fauna are relatively well-studied, but others are poorly known. Reviews of Maltese fauna have been provided by Gulia (1914) and Schembri (1992). Schembri (1988; 1991b) also lists the major faunal taxa occurring in terrestrial and freshwater habitats in the Maltese Islands and gives the number of species known for each, or, in the case of groups which have not been studied, an estimate of the number of species expected to occur on the islands. An annotated list of a selection of fauna is given in Sultana (1995) and compilations of rare, threatened, endemic and/or scientifically interesting species are given in Schembri & Sultana (1989).

National Initiatives concerning the Study and Preservation of Biodiversity

A number of local institutions are concerned with the study and monitoring of local biota and ecosystems. Various habitats such as saline marshlands, sand dunes and *widien* (dry valleys), and the ecology of the organisms living therein, are being studied by

the Department of Biology of the University of Malta (Axiak, 1993; 1994; 1995), the Department for the Protection of the Environment, the National Museum of Natural History, and local NGOs. Others like the Department of Agriculture and the Department of Fisheries and Aquaculture carry out research on animals and plants of economic importance.

Herbaria housed at the Argotti Botanic Gardens and the University of Malta Botanic Gardens, provide records of the nation's plant biodiversity. Botanic gardens play another important role since some plants, in particular indigenous species like the horsetail joint pine, *Ephedra fragilis*, and the dwarf fan-palm, *Chamaerops humulis*, survive only as planted individuals in such gardens following their eradication from the wild. Others, like the dragon arum, *Dracunculus vulgaris*, and the Maltese squill, *Scilla clusii*, were saved from extinction by some local NGO's and single individuals who planted them in private gardens .

Besides these, Arbor, a local NGO, has set up a seed bank and a silvicultural group responsible for the growing of rare and endangered plants and trees, to be later re-introduced into the wild. The Society for the Study and Conservation of Nature, another NGO, has just started a similar project.

The Agriculture Department and the Environment Protection Department have created nurseries, in which some indigenous trees and climbers are grown. The Agriculture Department also runs a micropropagation centre where attempts are being made to save certain indigenous species (like *Ephedra fragilis*) from extinction, since these cannot be propagated by other means.

Work in progress includes a National Database on Biodiversity, a joint project of the Malta Council for Science and Technology (MCST) and the Department of Biology of the University of Malta (Mallia & Schembri, 1992). The objective is to collect all the available data on indigenous species in a computerised database. Its scope and aims include:

1. Conservation and Sustainable Use and Development:
The NDB enables the identification of areas containing species requiring conservation, as well as of species of economic, cultural and/or scientific importance.
2. Centralisation of the data:
The database provides easy access to data on flora and fauna of the Maltese Islands and up-to-date annotated synonymic checklists of Maltese biota. Such data centralisation also highlights deficiencies in the knowledge of particular groups and thus identifies areas for future research and/or monographic revision.
3. Legislation:
The database provides information on the status of biological resources and the trends shown by wild populations. This can

form the basis for the enactment of legislation for the protection of endangered species.

4. Documentation:

Data from this database form the basis of national compilations of the flora and fauna, in addition to providing information useful in the assessment of forestry, fish and mineral resources;

Departments and Agencies responsible for the Environment

At present the Government agency specifically designated as being responsible for the environment is the Department for the Protection of the Environment within the Ministry for the Environment. In practice, however, responsibility for the environment is shared between a number of Government departments and agencies. These include:

a. Environmental Management Unit (EMU) within the Planning Directorate in the Planning Authority (PA)

This is the section of the Planning Directorate primarily concerned with biodiversity conservation and is responsible for:

- Countryside and nature conservation;
- The scheduling of areas or sites of ecological and/or scientific importance;
- The issuing of Conservation Orders;
- The issuing of Tree Preservation Orders;
- Formulation of management plans;
- Producing strategic countryside policies and guidelines;
- Providing expert advice on conservation issues;
- Processing applications related to development in rural areas;
- Managing the restoration and re-use of quarries;
- Environmental education;
- Co-ordinating the environment impact assessment process associated with development applications.

b. Department for the Protection of the Environment

- Environmental legislation and its enforcement;
- Production of environmental education material;
- Waste management.

c. Departments of Agriculture and Fisheries

- Agriculture, fisheries and aquaculture;
- Soil conservation, afforestation and landscaping;
- Issuing of phytosanitary, veterinary and other certificates in connection with importation and exportation of flora and fauna.

d. Department of Health

In the context of biodiversity, the main concerns of this Department are waste disposal and public hygiene, ecotoxicology and occupational health, and the control of the importation of toxic substances.

- e. Department of Works
Cleaning of valleys, building sites and other sites of heavy rubble.
- f. Water Works Department:
Water resources and their conservation.
- g. Department of Tourism:
Tourist amenities and beach cleaning.
- h. Police:
Enforcement of legislation relating to the environment.
- i. Customs Department:
Control of importation of flora and fauna and enforcement of trade regulations.
- j. Armed Forces of Malta - Maritime Section:
Prevention and combating oil pollution at sea.
- k. Local Councils:
Each local council has its own jurisdiction. There are presently 67 Local Councils. Some areas of national importance (for example, the island of Comino and the Ta' Qali National Park) are not within the jurisdiction of any Local Council and are managed by the central Government.
- l. Ministry for Gozo:
The Island of Gozo, including environmental affairs.

Besides these, nature conservation groups also play an important role. Many of these exist, but all work for the same aim: to safeguard local biodiversity. The history of local environmental NGOs started with the industrialization and urbanization of the Maltese Islands (in the 1960s), when most Maltese were not particularly concerned about the destruction of natural habitats and their rich biodiversity. This period in fact saw the start of the modern environmental movement in the Maltese Islands. The first Maltese NGOs were established in 1962: the Natural History Society of Malta, now the Society for the Study and Conservation of Nature (SSCN) and the Malta Ornithological Society, now Birdlife-MOS, and eventually others followed like Men of the Trees (founded in 1969), now International Tree Foundation, and Movement għall-Ambjent (founded 1985), now Friends of the Earth-Malta. During the late 1980s, as interest in nature and the need for its conservation increased, new, specialized NGOs were formed, including Arbor (the society for the protection of trees and the natural environment) in 1989 and the Marine Life Care Group (MLCG) in 1993, specialized in the conservation of trees and woodlands and their biodiversity, and of marine biodiversity,

respectively. Other NGOs exist but space does not permit a full compilation. All such groups played, and still play, a leading role in the protection of Maltese biodiversity.

Legislation

Legislation aimed specifically at safeguarding biodiversity for its own sake is a novel development in the Maltese Islands. Until very recently, governments were very slow to appreciate the need to protect biodiversity, apart from economically important species, and it is mainly due to the lobbying and pressure exerted by several environmental NGOs that the authorities have been persuaded to act.

Some legislation already existed during the rule of the Knights of St. John, however, this only protected species because of their commercial importance. For example, during the 18th century, the collection of *Cynomorium coccineum*, the so-called "Malta Fungus", which in those days was highly valued because of its presumed medicinal properties, was strictly prohibited: unauthorized collection could lead one to the galleys (Lanfranco G, 1961)! In the same century, the collection of *Ononis natrix*, a shrub extensively used as kindling, was prohibited before the lapse of eight days following the feast of St. John the Baptist, at the beginning of July (Lanfranco, 1995b).

More recent legislation protecting nature and natural resources includes that concerning the Mediterranean Thyme *Thymus capitatus* which is protected due to its importance for the honey industry (Government Notice 85, 1932); that protecting conifers (Government Notice 328, 1949); and the Antiquities (Protection) Act (Act XI of 1925) which protects certain trees older than 200 years, including some stands of *Quercus ilex*, *Olea europaea* and *Fraxinus angustifolia*. Other legislation controls the removal and transport of sand (Act XVI of 1949) and soil (Act XXIX of 1973), and the introduction of agricultural pests and diseases from overseas (Act XXIX of 1966).

The most important current environmental legislation is the Environment Protection Act (Act V of 1991) and the Development Planning Act (Act I of 1992), the latter incorporating the Structure Plan for the Maltese Islands, which has as its basic objective "the optimal physical use and development of land which respects the environment and at the same time ensures that the basic social needs of the community are, as far as is practical, satisfied" (Ministry for Development of Infrastructure, 1988).

The Environment Protection Act (EPA) empowers the Minister responsible for the environment to make regulations related to the conservation of the island's biodiversity, including the declaration of nature reserves. Under the provisions of this act, three of the minor islets of the Maltese Islands have been declared as nature reserves. These are Filfla, Fungus Rock, and St. Paul's Island. Furthermore, Legal Notice 146 of 1993 upgraded the previous

legislation regulating the hunting and trapping of birds and the wild rabbit *Oryctolagus cuniculus*. This Legal Notice also identified 22 sites in which no hunting or trapping could take place. These sites are also termed 'Nature Reserves' as defined by the EPA, however, they are not nature reserves as the term is usually used (e.g. by the World Conservation Union, IUCN), but effectively bird sanctuaries since it is only the avifauna that is afforded protection.

In 1992, following representations by the Society for the Study and Conservation of Nature, a local NGO, some flora and fauna started being protected by means of regulations issued in terms of the EPA. All the reptiles (including the endemic Maltese wall-lizard, *Podarcis filfolensis*) and the marine mammals of the Maltese Islands and surrounding waters were protected (Legal Notices 76 and 77 of 1992, respectively). Subsequently, in 1993, the endemic Maltese freshwater crab, *Potamon fluviatile lanfrancoi*; the painted frog *Discoglossus pictus pictus*; all bats and the other non-domestic mammals (except rats and mice, but including the endemic Gozo white-toothed shrew, *Crocidura sicula calypso*), and some vascular plants (including four endemics) were protected (Legal Notice 49 of 1993). However, to date only seven endemics out of some 80 (a mere 9%) are directly protected by law; a number of others (for example the presumably endemic giant leek, *Allium* sp. nov., of Filfla and Fungus Rock) are indirectly protected since they occur in nature reserves where all biota are protected.

In 1992, the Maltese Parliament approved the Development Planning Act (DPA) whose main objective is the planning and management of development. This piece of legislation effectively gave legal status to the first Structure Plan of the Maltese Islands, which was prepared a year before, and also set up the Planning Authority, whose function is to implement the DPA and the Structure Plan. Amongst the numerous policies in the Structure Plan are a number concerning the conservation of areas and sites of ecological or scientific importance.

Unlike the EPA, the Structure Plan recognizes several types of protected areas, including Sites of Scientific Importance, Areas of Ecological Importance, National Parks and Marine Conservation Areas. The Structure Plan also recognizes the protected area management categories of the World Conservation Union (IUCN). It is a requirement of the Structure Plan that the several types of protected areas be delimited and scheduled. For Areas of Ecological Importance and Sites of Scientific Importance, scheduling involves giving each site a protection rating from Level 1 (the most important) to Level 4, and the Structure Plan further specifies the development and activities permitted or prohibited for each level.

The DPA empowers the Planning Authority to issue emergency conservation orders in cases where a valuable habitat or site is under immediate threat of damage or destruction. This gives the

Authority time to study the case and schedule the site as necessary.

On the international level, Malta is party to the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) which is implemented locally by means of regulations controlling trade in species of flora and fauna (1992). Malta is also party to the Ramsar Convention, the Barcelona Convention, the Berne Convention, the Convention on Biological Diversity, and to the Law of the Sea Convention.

It is the declared intent of the Maltese Government to seek membership in the European Union. If Malta's application is accepted, Malta will automatically have to become party to a number of other treaties, including the Convention on the Conservation of Migratory Species of Wild Animals (Bonn - 1979), besides becoming subject to EC directives and decisions on wildlife and habitat conservation, such as Directive 85/337/EEC (Environment Impact Assessment), Directive 82/72/EEC (Convention on the Conservation of European Wildlife and Natural Habitats), and Directive 79/409/EEC (Conservation of Wild Birds).

In the field of information on biodiversity, the Maltese Government has also published the *Localities with Conservation Value in the Maltese Islands* (Schembri *et al.*, 1987) and the *Red Data Book for the Maltese Islands* (Schembri & Sultana, 1989), both of which are currently being revised. The first gives a list of localities requiring urgent protection due to their scientific, ecological and/or cultural importance, whilst the second is a list of rare, threatened, endemic and/or otherwise scientifically important species occurring in the Maltese Islands and their territorial waters.

Priorities for Action

Since the biodiversity of the Maltese Islands is particularly vulnerable, there are a number of priorities for action. Of the more urgent is the protection of those c.90% of the endemic biota not yet legally protected, and the enforcement of existing legislation.

There is also urgent need to preserve certain natural habitats by declaring them protected areas of various types, particularly those habitats which are overall rare on the islands and hence support a unique flora and fauna, as well as those areas which are under threat from a variety of human activities. These top priority habitats include forest remnants, woodlands, permanent springs, freshwater pools and wetlands, sand dunes, saline marshlands, coastal cliffs and screes, deep caves and the minor islands of the archipelago.

Management plans and a wardening system to control present and future protected areas should be actively considered. The restoration of old disused quarries, and of degraded areas should also be encouraged, and this is particularly important for sand

dunes, which are on the verge of extinction from the Maltese Islands. Also, of prime importance, is education at all levels.

Acknowledgements

We are particularly indebted to Mr. Alfred E. Baldacchino of the Department for the Protection of the Environment, and Mr. Charles F. Grech of the Environment Management Unit at the Planning Authority, for their help, particularly on the matter of legislation. Patrick J. Schembri and Edwin Lanfranco are grateful to the University of Malta for supporting their research on the biodiversity of the Maltese Islands through an award of research grants. All authors are grateful to the Malta Council for Science and Technology, to the Secretariat for the Environment, and to the Planning Directorate of the Planning Authority for their financial and other support.

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Figure One:

Vegetation Map of the Maltese Islands.

Source: Schembri (1991b).

Figure Two:

Underwater Habitat Map of the Maltese Islands.

Source: Role (1991).