
Environmental Development and Protection in the UAE

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Introduction

The United Arab Emirates is a predominantly arid land containing habitats and communities adapted to survive both small amounts of infrequent precipitation, and extremes of heat with consequent high evaporative losses. It is an exacting environment. Nonetheless, mankind has exploited the land now known as the UAE since the Late Stone Age, 7500 years Before Present (BP), although then the climate was wetter than it is today. Game would have been abundant on the Acacia savannah and neighbouring grasslands and even in the deep sands the basic necessities of life would have been available. Only the ingenuity and technology to exploit these resources would have been required to survive in relative affluence. Since those times there has been a trend toward increasing aridity, demanding a nomadic hunter-gathering lifestyle. It was solely in the relatively well-watered Hajar Mountains, with their permanent running supply, that cultivation would have been possible, a development which took place only in antiquity. Terraced fields there attest to such an agricultural economy (see Heard-Bey, this volume). Today this system has fallen into disuse, although the proximal cause was a shift in the socio-economic base rather than necessarily the increasing irregularity of winter rainfall.

The marine environment would, quite naturally, have proved the focus for human activity, assuming freshwater sources existed in the vicinity. That they did is known from the archaeological record (see Potts, this volume), with evidence from some island localities of continuous occupation over at least the past four or five millennia (Hellyer 1998, 1999). Even today, in perhaps the driest period the UAE has ever experienced, there are still potable supplies, including on some of the offshore islands where rain itself rarely falls. (The island of Dalma, as can be recalled by many still today, once provided drinking water to the fishing settlement which later grew to become the city of Abu Dhabi, capital of the UAE!) Recent anecdotal accounts provide confirmation of a long-suspected assertion that submarine freshwater springs would once have been utilized to sustain certain coastal and island communities.

In contrast to the past, when the human population was still small and natural resources were used sustainably without conscious effort, a burgeoning human population, increased longevity and commercial exploitation have served to put mounting pressure on the environment. Commercial fish catches in the Arabian Gulf continue to decline, for example, despite a general

awareness of basic ecological limitations. The increased effort, measured in an increasing size of the fishing fleet required to secure the same annual landings, has not gone unnoticed.

Much other wildlife is under threat. In the marine environment, dugongs, turtles and seabirds may be being driven close to extinction locally through a range of causes, singly or in combination, and including: insensitive development, habitat loss, illegal persecution and unsustainable harvesting. The scenario is apparently similar in terrestrial settings, with grazing pressure from domestic livestock at very high levels and the populations of indigenous ungulates, carnivorous mammals and several species of indigenous birds at a low ebb. Threats to the integrity of the natural world on a global scale are well documented and a lack of environmental impact assessment or study has allowed, hitherto, large scale and widespread losses of important habitats and wildlife resources. It is this situation which the UAE is now, institutionally speaking, in a position to address and redress, with enabling legislation firmly on the statute books.

The UAE has undergone something of an environmental renaissance in recent years. Environmental awareness is high on the agenda and reminders are constant of our obligation to the natural world, and none more so than in the particularly sensitive environment of the southern Gulf. There is now, in addition to the governmental structure, a plethora of non-governmental environmental groups and a clear conviction exists across the board amongst federal bodies, individual agencies and non-governmental organizations, together with their domestic and international alliances, of the need for environmental protectionism.

Sophisticated environmental legislation has been promulgated, involving several separate laws. Some apply at a federal level, others only at individual emirate level. There is a clear move toward consistency across the federation, although each emirate retains, constitutionally, a certain degree of overall autonomy. The task of putting into practice what is enshrined in such laws, backed up by monitoring and strict enforcement, is now being addressed. The UAE is endeavouring to restore the balance and ensure resources are used both sustainably and equitably, while at the same time maintaining a place for nature.

Before providing a description of the UAE environment and the organizations responsible for its upkeep, it is appropriate to provide a brief note of the relationship between Arab tradition and culture and the natural world.

The Holy Qur'an makes frequent reference to animals and plants and instructs all Muslims to study and appreciate living and non-living things around them. In such a harsh environment as exists in Arabia, where the vagaries of the weather make for additional uncertainty, the peoples of the desert lands have had to make their living frugally, even during times of plenty when a surplus may have been available. Plenty is a relative term, however, and meagre resources would have generally had to suffice.

A land management system evolved to ensure lean periods could be weathered. *Harim* and *hima* lands were set aside (by individuals, communities or the state) for grazing only during drought, something which could be the norm rather than the exception. Nomadism was typical in many areas, to avoid overexploitation of available resources. Coastal communities were somewhat better off for food, although water supplies remained similarly scarce. Close to the Hajar Mountains, part of the UAE's population once comprised transhumant pastoralists and farmers who retired to the hills in spring to cultivate terraced fields, but otherwise resided along the coast. Their lifestyle was not a choice, but a necessity, thrust upon the community by the severity of the environment (see Heard-Bey, this volume).

Modern times have brought inevitable changes, but many traditions survive. The tradition of falconry still continues, for example, possibly remaining as popular as ever. Today, however, the hunt is not necessary to provide fresh meat as was formerly the case, while the chase itself is certainly more efficient. Many falconers have moved with the times in recognition of this fact. Captive-bred falcons are particularly popular, serving to assist in the conservation of wild-raised birds, while high-tech scientific studies and ecological research aim to ensure that any harvesting of wild birds is sustainable. By a process of education and diffusion, rather than legislation, it is hoped that this lead will be generally adopted by all practitioners. This example is given deliberately to demonstrate a system, perhaps alien to outsiders, which can nonetheless succeed as well as, if not better than, any other.

The section immediately following briefly describes the climate, topography, biogeography and natural ecosystems of the UAE. This scene-setting is followed by an overview of the political and institutional framework relevant to the environment, and thereafter by a resumé of the relevant domestic legislation and international conventions relating to wildlife and the environment.

Climate, Topography and Biogeography

Straddling the Tropic of Cancer, the climate of the UAE is hot; on the coast, humidity reaches over 90 per cent in summer and autumn. Inland it is far less humid, although the temperature is higher, often exceeding 50°C before midday in July. The officially published temperatures are actually the precise air temperature. During the winter period daytime temperatures are generally in the mid-twenties, although, unlike in summer, nights can be relatively cool, down to 12–15°C, and less than 5°C in the depths of the desert or high in the mountains.

In most years it rains during the winter months, usually in February or March, but occasionally earlier. Squalls are the result of the subtropical jetstream re-routing depressions through the Mediterranean basin, these then tracking down the Gulf toward the Arabian Sea. Winter rains take the form of torrential frontal and orographic downpours, which, if occurring in the Hajar Mountains, runs off rapidly into wadis and thence onto the downwashed gravel plains, perhaps reaching the sea on the East Coast, but invariably braiding widely and soaking rapidly into the desert on the west side piedmont. Further west and along the coast, rainfall is often trapped on the *sabkha* (salt flat) surface until it evaporates or soaks away. Inland, surface water seldom remains for more than a day or two, except where artificially ponded or dammed.

Mainly localized thunderstorms occasionally reach the UAE in summer, their annual frequency varying widely. Generally appearing over the mountains of the south and east of the country, these rumbling convective cloudbursts, a break-away from the south-west monsoon affecting southern Arabia, give rise to severe flash floods. For the most part, the *shamal* (north-west wind) typical of summer, being drawn toward the low pressure associated with this monsoon, prevents rain reaching the plains to the north of the Dhofar Mountains and Arabia's central desert, the so-called Empty Quarter, or Rub al-Khali.

Even places with the highest average annual rainfall figures may experience lean years. At the Hajar Mountain town of Masafi, for example, 350 mm may fall in a 'wet' year, whereas as little as 30 mm may be recorded in a 'dry' year. As a rule of thumb, rainfall decreases westwards away from the mountains. Indeed, many inland localities in Abu Dhabi have had

no measurable rainfall for over three years (up to the end of 1999). Only through the regular formation of dew can vegetation and wildlife be sustained in such places.

Table 1. Mean monthly maximum temperature (Bateen airport, Abu Dhabi) and national mean monthly rainfall 1971/72–1988/89.

	J	F	M	A	M	J	J	A	S	O	N	D
°C	24	25	29	33	38	39	40	40	39	35	30	26
mm	11	38	34	10	3	1	2	3	1	2	4	10

Source: *The National Atlas of the United Arab Emirates* (UAE University, 1993)

The UAE is an arid land, but is, nonetheless, one of contrasting landscapes. The principal habitats, botanical communities and landscape associations of the UAE are described comprehensively in Western (1989) and, for Abu Dhabi alone, in Roshier et al. (1996) and Boer (1999).

The topography of the country is characterized by rapid changes between the sand and gravel desert which dominates most of the south and west of the country and the solid geology of the Hajar Mountain chain. At the furthest points inland the high crescentic dune systems of the waterless Empty Quarter of Arabia are reached. A dune belt with *ghaf*, *Prosopis cineraria*, adjacent to an extensive *Acacia*-clad gravel plain savannah of varying width, abuts the western side of the Hajar Mountains, with the arid, jagged and shattered mountains themselves, and their many associated wadis, rising rapidly to more than 1300 m. Once over the watershed there is an equally steep descent to the coast of the Gulf of Oman, part of the Arabian Sea. The corresponding alluvial gravel plain on the East Coast is patchy and small, and widest in the south, but, for the most part, separates the mountains from the sea. There are few cliffs, except where faulting has occurred, but numerous sandy beaches and coves. The elevated Musandam peninsula extending to the Straits of Hormuz is Omani territory.

By contrast to the north and east of the country, the Arabian Gulf littoral of the UAE is an exemplary development of active coastal *sabkha* (salt flats), recognized as the largest and geomorphologically most interesting of their type in the world. It is 300 km long and of variable width, but extends continuously 20 km or more inland in places. Isolated *sabkha* outliers, otherwise surrounded by dune and gravel desert, also exist inland (particularly in Abu Dhabi), more so in the west of the Western Region than elsewhere. The largest such area, the Sabkha Matti, a broad braided palaeo-river course covering several hundred sq. km, extends south well into Saudi Arabian territory.

The Arabian Gulf coast is extremely shallow and gently shelving. The numerous inshore and nearshore barrier islands in existence are simply part of a formerly more extensive and once almost continuous coastline invaded and dissected by post-Quaternary shamallic (north-westerly) storms, and thereafter inundated by a sea-level rise. The present-day *sabkha* coast itself only started to form some 4000 years ago. Many coastal and inshore areas have been affected by reclamation, dredging or other development or usage, while a number of islands are entirely man-made. Other than for oil-related activities, much of such development has been for recreational purposes.

Mangrove is represented in the Arabian Gulf, its most northerly occurrence in the world, by a single species, *Avicennia marina*, and covers extensive areas, although not continuously.

It is known to have been more extensive both historically and in the recent past, the reduction in area generally accepted as having been due to clearance (primarily for charcoal, as fodder or other uses) as well as to natural die-back or disease. In the last ten years, however, extensive planting of mangrove has been undertaken, often with considerable success. Natural colonization itself appears to be relatively slow in most areas. Mangrove plays a vital role in the life-cycle of many commercially valuable seafood species and provides a safe nesting, feeding and roosting site for many birds, waterfowl in particular.

The larger offshore islands, such as Dalma, Sir Abu Nu' air, Sir Bani Yas, Qarnein and Zirku, are mostly the higher parts of a diapiric salt-dome surface, the clearest evidence for which occurs where the migrating salt has erupted through to the surface to form distinctive and obtrusive looking hills. Other islands can be anything from tiny sandy and shelly shoals to larger ones of raised coral and outcropping limestone with or without a covering of drift deposits. In some instances there are deposits of guano, created by colonies of an important *endemic* Arabian species, the Socotra cormorant, *Phalacrocorax nigrogularis*. Many islands hold internationally important numbers of breeding seabirds.

Three biogeographic realms are represented in Arabia: Palearctic, Indo-Malayan (Oriental) and Afrotropical. A Palearctic flora and fauna predominates over most of the peninsula, with the Indo-Malayan element restricted to eastern UAE and northern Oman (with a relic in Dhofar, Oman) and the third, Afro-tropical, to most of south-west Saudi Arabia, Yemen and southern Oman. These realms possess overlap zones, in terrestrial settings at least, and are therefore of special environmental interest and concern.

From a marine perspective the Arabian Sea is part of the western Indian Ocean faunal province, of which the Arabian Gulf represents a blind arm. The Arabian Gulf possesses a fair degree of endemism, primarily amongst invertebrate groups such as coelenterates, but taxonomic studies are continuing and even amongst vertebrate groups new species, of, for example, elasmobranchs (sharks), continue to be described. Coral cover is high in the Gulf and Straits of Hormuz and off the Batina coast of Oman, but declines southwards due to sandiness, turbidity, cold-water upwelling and increasing water depth.

The Arabian Sea and Arabian Gulf possess a variety of habitats: patch and fringing coral reefs, seagrass beds (Gulf only), islands, mangroves, *khors* (tidal inlets), extensive intertidal flats and saltmarsh and *sabkha*. The Arabian Gulf is a relatively young sea, post-Quaternary in date (resulting from the Holocene transgression), being the drowned estuary of the Tigris/Euphrates delta. It is shallow, for the most part less than 10 m deep in the western (Arabian) sector, with an average overall depth of 31 m and experiences a small tidal range (*ca.* 0.5–1.5 m in eastern Arabia). Mangroves, as stated earlier, reach here their northernmost point in the world (being limited by winter temperature), while corals are limited by summer temperatures. A heat-induced die-off of around 90 per cent of all coral in the southern Gulf has taken place since 1995. Water temperatures in the Gulf exceed 33°C in summer, falling in winter to 16°C in the north and 22–24°C in the south (Chiffings 1994). A complete turnover (change) of waters in the Arabian Gulf is estimated to take five to seven years.

The Gulf of Oman and Arabian Sea is deep and is influenced by the rest of the Indian Ocean. Upwellings of cold or cool nutrient-rich waters and consequent high levels of productivity are a noteworthy feature, primarily in southern areas, and are responsible for substantial fisheries. Beach seine-netting operations along the UAE East Coast are especially productive.

International environmental organizations recognize two priority *ecoregions* in the Gulf region. Such ecoregions, which can be many thousands of sq km in extent, have been identified globally on the basis of their unique biological diversity and biogeographical functioning (Olson and Dinerstein 1997). The two ecoregions represented in the UAE – the Arabian Gulf and Arabian Sea and the Arabian fog and highland woodlands (both described below) – are considered of sufficient ecological and socio-economic importance to warrant concerted action at governmental and inter-governmental level to maintain sustainable levels of resource exploitation. Although the desert rangelands are not expressly singled out in the same way, they arguably represent a third ecoregion, a Nubo-Sindian province (part of a much larger Saharo-Arabian or Eremic phytogeographic zone stretching across tropical Africa to south-west Asia). The socio-economic value of the desert environment is not neglected, and its landuse management rests as a national prerogative (see below).

The conservation value of the first-named ecoregion, the Arabian Sea and Arabian Gulf, centres primarily on its commercial fisheries, coral reef and mangrove communities (themselves fish nurseries), internationally important island seabird colonies and numbers of visiting shorebirds, nesting and feeding grounds of turtles, cetaceans (including both whales and dolphins) and dugong herds, amongst others. The Gulf coast is highly significant for migratory waterbirds, lying on the west Asian-African flyway for intercontinental migrant waterfowl. Both coastal mudflats and marine waters, supporting resources independent of political borders, are, therefore, of common international interest. Hornby (1997) provides a useful summary of the environmental sensitivity of coastal habitats of the UAE.

The second ecoregion is that of Arabian ‘fog and highland woodlands and shrublands’. The south-east Arabian fog highlands, part of this ecoregion, reach to nearly 2000 m in the UAE and to nearly 3000 m in Oman, but are of restricted areal extent. The flora, of Nubo-Sindian affinity, is in part relict and unique both to and within Arabia and thus of high conservation value. At low altitude is *Acacia tortilis* savannah ‘parkland’. This changes higher up to similarly arid *Euphorbia larica* shrubland, with, on broken ground approaching 1000 m, an *Olea sp.* (wild olive) community. The associated higher vertebrate fauna is impressive, including Arabian leopard, Arabian tahr and ibex, as described below.

The climatic regime is all important in maintaining these high elevation communities, with the formation of fog and dew being absolutely critical. In the Hajar Mountains of the UAE, dewpoint can be approached closely without the formation of condensation and the mountain environment is teetering on the edge between survival and oblivion. Human use of such areas is now limited primarily to livestock grazing, quarrying and small amounts of tourism.

The desert environments of the UAE also require description, since four-fifths of the country’s land area is by definition desert. In Abu Dhabi, which represents around 80 per cent of the entire land area of the country, sandsheets, gravel desert and saline flats, each further subdivided, are recognized by Roshier et al. (1996) on the basis of their floral associations. To an untutored eye one piece of desert may look superficially similar to any other (not being helped by the ostensibly similar form of most xerophytic and halophytic vegetation), but this is far too simplistic an impression. The structure and function of even adjoining areas may differ appreciably from each other, as a result of, for example, varying soil characteristics, micro-climatic differences and grazing regime.

Although characterized by low ecological diversity and thus not always valued in the same way as a biologically more productive landscape, deserts are nonetheless of immense value to one primary industry – agriculture. Temporarily leaving aside desert greening and crop cultivation, itself sustained only by irrigation using supplies of desalinated seawater or non-replenishing fossil ground-water, traditional grazing by domestic animals (primarily camels, sheep and goats) is a major industry, producing meat, milk and related dairy products. Although in an altered format, with traditional nomadism essentially a thing of the past, the relatively static livestock herds (mostly tended by expatriate labour) are not regulated or subject to any formal control. Overgrazing is now widely accepted to be a major landuse issue.

Important Species Assemblages

i. Arabian Sea and Arabian Gulf ecoregion

Mangroves are vital nursery areas for commercially valuable fish and other species, and yet their incorporation in an integrated coastal zone management plan has still to be concluded. The areal loss of mangal woodland around the Indian Ocean, in its entirety, has been estimated at c. 50 per cent in the 20 years prior to 1985 (IUCN/UNEP 1985), this mostly resulting from human activity, although the picture in the UAE is different with a premium placed on mangrove conservation.

Reef fish populations have suffered from a natural die-off of corals in the Gulf during the last few years. Summer temperatures (and presumably a related rise in salinity) have exceeded that tolerable to corals which means the whole system is under stress. Any form of resource utilization needs therefore to be related to existing ecological limitations. The reefs of the Arabian Sea remain substantially intact, such losses as have been noted being from man-made causes.

Turtles in UAE waters are of international importance. Green turtle, *Chelonia mydas*, and hawksbill, *Eretmochelys imbricata*, nest on a limited number of islands, while important feeding and probably nursery areas, with high densities of non-breeding or immature animals, are known in the waters of both the Arabian Gulf and the Gulf of Oman. Loggerhead turtles, *Caretta caretta*, also occur, as do several species of seasnake (Brown 1987).

Thirteen *Important Bird Areas* (see glossary), have been identified in the UAE, almost all concerning island seabird colonies and intertidal feeding sites for shorebirds (Evans 1994). Among these only one internationally important intertidal wetland exists outside the Arabian Gulf, namely Khor Kalba on the UAE-Oman border. A *Directory of Wetlands in the Middle East* (Scott 1995) includes all of these sites, plus a few more recently identified significant areas. Using definitions derived from the *Ramsar Convention* (see glossary), the latter publication (being more habitat oriented) adopts criteria other than simply birds to assess whether sites are included. Many of the sites in Evans (1994) are merged here to form much larger units, thus amalgamating their overall values into cohesive, more readily ecologically sustainable blocks.

The Arabian Gulf is critical for internationally important numbers of long-distance migrant shorebirds and many sites would qualify as Ramsar sites. A minimum of 25 of over 100 species of regularly visiting waterfowl utilizing the West Asia-Arabia-Africa flyway (Scott 1995)

occur in regionally (internationally) important numbers in the UAE. In addition to these, there is the presence of internationally important breeding colonies of at least nine other species, all but one being seabirds (Aspinall 1996a) and all of which are national *Red Data species* (see glossary) (Hornby and Aspinall 1997).

Socotra cormorant, *Phalacrocorax nigrogularis*, is the sole regional endemic bird with only 14 known extant colonies worldwide, all but one or two of which are in the Gulf (though all fall within the single ecoregion). Some six or more of these colonies lie in UAE waters. Persecution is a problem, as is continuing development of islands supporting colonies. About 10 per cent of the world population of white-cheeked tern, *Sterna repressa*, breeds on the UAE's islands. An endemic race of white-collared kingfisher, *Halcyon (Todirhamphus) chloris kalbaensis*, is confined to the type locality, Khor Kalba, on the Gulf of Oman coast of the UAE and has a population of less than 50 pairs.

The continued survival of healthy populations of cetaceans and dugong are also dependent on a concerted international conservation effort. Large herds of dugong exist in UAE, Bahrain, Qatar and Saudi Arabian waters. The Gulf supports the second largest population of dugong, *Dugong dugon*, in the world, estimated in 1986 at 7310 plus or minus 1300 (Preen et al. 1989). A repeat survey of Abu Dhabi waters was completed in 1999 by the Commission for Environmental Research, part of the Emirates Heritage Club, Abu Dhabi, and found no statistically significant change in the number of dugong occupying Abu Dhabi waters, with an estimated 2000 to 3000 individuals present (Preen, pers.comm.).

Whales and dolphins have been studied to some degree in the Arabian Sea, primarily in Oman. There has been recent fieldwork in UAE waters too (Baldwin 1995), although much remains to be learnt about the population ecology and migrations of the country's cetaceans. Important populations of some species, for example Bryde's whale, *Balaenoptera edeni*, and humpback whale, *Megaptera novaeangliae*, certainly exist, and may do so for other species, for example the finless porpoise, *Neophocaena phocaenoides* (Aspinall and Baldwin 1999). Some such species, being isolated, possess behavioural and genetic differences compared with their nearest conspecifics, something which warrants further research and conservation attention.

The UAE's Exclusive Economic Zone, reaching to 200 nautical miles off the East Coast, is known to house many whales, some of which may be resident. Fujairah, which alone of the seven emirates fronts the Gulf of Oman (Arabian Sea) coast, has already designated three marine reserves closed to fishing in order to protect coral reef communities. These may be extended to cover the important cetacean populations present further offshore. The Arabian Sea and Arabian Gulf are both part of the International Whaling Commission's (IWC) Indian Ocean Whale (Cetacean) Sanctuary dating back to 1979.

Since the UAE is of such major importance for wildlife, it is surprising that formal protected areas (nature reserves) in the UAE's marine and coastal environment are rather few. There have been popular calls for the designation of a number of sites (see Aspinall 1996b; Aspinall and Hellyer 1997) and the whole issue is currently under review at the level of individual emirates. The coverage afforded is planned to extend, moreover, to important palaeontological and geological sites, landscapes (geomorphological features) and to archaeological sites.

The *keystone* marine communities of the Arabian Sea and Arabian Gulf – those essential to the continued successful functioning of the system – are the coral reefs, seagrass beds, mangrove woodlands, intertidal flats and predator-free islands. *Flagship species* are those

which, for a variety of objective or subjective reasons, are singled out to promote survival of the community in which they occur. Those dependent on keystone habitats (e.g. seagrass, coral reef or mangroves) and which are suitably rare or endangered are hawksbill and green turtles, dugong, and the endemic Socotra cormorant.

ii. Arabian fog and highland woodlands and shrublands ecoregion

The biogeographically unique fog woodland ecotype occurring in south-east Arabia is, as described earlier, primarily of Palearctic origin. Occurring only in northern Oman and the UAE, its ecological importance centres on its rare mammals, particularly ungulates (e.g. Arabian tahr, *Hemitragus jayakari*, and ibex, *Capra ibex*, the latter if still extant) and felids (Arabian leopard, *Panthera pardus nimr*, especially, and Gordon's wildcat, *Felis sylvestris gordonii*).

The flora and fauna is an uneven mixture of Palearctic and Indo-Malayan (Oriental), the latter forming a minor component, and contains relict populations of some taxonomic groups. Of special interest is the little studied limestone cave fauna of Jebel Hafit, an outlying mountain block immediately south of the inland city of Al Ain, which may harbour species as yet undescribed by the scientific community. Mammals (Stuart and Stuart 1998, 1999), butterflies (Gillett 1996, 1997, 1998), dragonflies and damselflies (Giles 1998, Feulner 1999), freshwater fish (Feulner 1998) and freshwater snails (Feulner and Green 1999) of the mountains and wadis have all been documented to some degree, but most taxa await thorough scientific study.

The Arabian leopard certainly, and possibly the Arabian tahr, are the flagship species in this ecoregion. As yet, no formally protected areas exist in the mountainous regions of the UAE, although a number have been proposed (Jongbloed, pers. comm.).

There is unanimous agreement on which higher taxa in these two ecoregions are at greatest risk in terms of threat to their survival. Many are keystone communities (cf. coral communities, seagrass beds, mangrove etc) or have been identified as flagship species. In marine environments, dugong and marine turtles are pre-eminent, whilst in the mountains, population levels of the Arabian leopard and endemic Arabian tahr are critically low, although the former, with an estimated Arabian Peninsula population of around just 100 individuals, is usually singled out as the sole flagship. The similarly endemic Gordon's wildcat found only in the mountains of Oman and the UAE is little known, and suffers hybridization with feral cats.

At a community level, commercial fishes, particularly the grouper, *Epinephelus coioides* (*hamour*), and sharks such as *Carcharinus* spp., are under threat from habitat degradation and overfishing, and the Gulf's commercial fisheries undoubtedly pose the threat of producing irreversible damage to commercial and non-commercial species alike, as well as to entire communities.

A gross data deficiency precludes assessment of the status of many other species and subspecies described from the region, particularly amongst lower taxa, but at a community level the longer term landuse issues and impacts are now well established. This applies in coastal and marine and mountain environments, as well as in desert areas as now described.

iii. Desert areas

As already stated, some four-fifths of the UAE land area is desert of one form or another. These terrestrial habitats and their geomorphological setting warrant brief description.

Sand desert is dominant, with high crescentic (mega-) dunes in the deep south of the emirate of Abu Dhabi, in the area known as the Liwa. A sandsheet of transverse and linear dunes with interdune plains occurs over most of the remaining such area west of the Hajar Mountains north to the Gulf coast of the northern emirates. Vegetation is sparse, dominated by the sedge, *Cyperus conglomeratus*, and various species of *Chenopodiaceae* (goosefoot family). A restricted belt of saxaul *Haloxylon persicum* shrubland exists some 20 km inland from the coast. The coast itself is characterized by halophytic scrub, again primarily involving goosefoots, with mangrove in mainly lagoonal settings.

Closer to the mountains is a zone supporting tall 'ghaf', *Prosopis cineraria*, trees. These are characteristically widely scattered, although occasionally clumped, in sandsheet terrain comprising low linear dunes. Nearer to the coast such sandsheets may be additionally cloaked with *Crotalaria*, *Calotropis procera* and other woody shrubs. Immediately adjacent to the western flank of the Hajar is an extensive gravel outwash plain of variable width. *Acacia tortilis* is dominant here, very often along with dogbane, *Rhazya stricta*, and the ecotype is one of savannah.

A number of general accounts exist of the mammal fauna of the UAE deserts (e.g. Duckworth 1996; Gross 1996; Harrison and Bates 1991). Hornby (1996b) provides a first 'Red Data' list which covers all UAE mammals. Arabian oryx, *Oryx leucoryx*, is extinct in the wild in the UAE, but individuals from the large captive herds (see below) will eventually be provided for a reintroduction programme. The size of the wild population of several species is now very small, particularly of sand gazelle, *Gazella subgutturosa* (considered critically endangered), and the Arabian or mountain gazelle, *Gazella gazella*. Rodents, excepting Cape hares, *Lepus capensis*, have been little studied, despite being numerically the most abundant of the desert mammals. Reptiles are perhaps no better known or documented (but see e.g. Brown 1984; Gross 1996; Hornby 1996a; Khan 1998), although reasonably thorough attention has been paid to birds (e.g. Aspinall 1996a; Osborne et al. 1996; Wardman et al. 1997).

Other lower taxa have been studied to varying degrees: e.g. insects (Gillett 1996, 1998); arthropods (excluding insects) (Tigar 1996); butterflies (Gillett 1997) and moths (Legrain and Wiltshire 1998).

Grazing management in desert areas is regulated by the graziers themselves, although many areas now show the characteristics of chronic overgrazing. The problem is not yet being addressed and now that the original socio-economic system has changed so radically, it is likely that rigid landuse management practices will eventually need to be introduced. In Abu Dhabi, seven sizable desert areas have recently been proposed by ERWDA as protected areas. Similar initiatives exist in Dubai and Sharjah emirates.

One further complexity, applicable in Abu Dhabi emirate, concerns the dissolution of nomadic practice. In part due to the establishment of political frontiers, the regular cross-country movement once enjoyed in and around the Empty Quarter has ceased to exist. Only within national borders is such movement now easily possible. The erection of fences also prevents wildlife moving freely, and such severance may, in disrupting necessary migratory movements, result in certain populations dwindling. The establishment of transfrontier reserves, primarily for ungulates (but valuable for the entire floral and faunal community), as have been mooted, may see a relaxation sufficient to allow wildlife to flourish.

As an adjunct, it should be mentioned that the ex-situ conservation (captive breeding) of rare breeds of ungulate (hoofed animal) and cats, is successfully in progress in UAE. A notable breakthrough has been recently achieved in breeding Arabian leopard and the notoriously difficult Arabian tahr, both, as already observed, highly endangered in their mountain retreats.

The success achieved with captive Arabian oryx since a few animals were taken from the last remaining wild herd at the instruction of UAE President, HH Sheikh Zayed, in the early 1960s has been remarkable. While once the species was on the brink of extinction, its future is now assured, although reintroduction programmes remain fraught with problems (none insurmountable). At the present time over one thousand individual oryx, comprising several separate herds, are held in UAE collections. Breeding loans of several different species are arranged with reputable overseas institutes and an international Secretariat, working on the conservation of Arabian oryx, is being established in Abu Dhabi under the aegis of Abu Dhabi's Environmental Research and Wildlife Development Agency (ERWDA).

Threats

Environmental protection relies on identification of threats to the integrity of the ecosystem involved, whether man-made or natural, thus permitting remedial or prescriptive action and appropriate long-term management. Threats to the Arabian Gulf and Arabian Sea mirror threats which occur on a global scale and include industrial and domestic pollution, eutrophication, reclamation, landfill and sedimentation, hunting, persecution, overfishing and unsustainable harvesting, alien introductions including predators on islands, disturbance, mismanagement and development. A lack of environmental impact assessment or study has permitted large scale and widespread loss of important habitats and indigenous wildlife resources. The introduction and enforcement of the most recent legislation should reduce or eliminate most of these threats.

Threats to the Arabian fog and highland woodland and shrubland communities are many. These include overgrazing, proliferation of invasive aliens, persecution and socio-economic changes, the latter apparent in the decline of traditional farming and landuse practices.

Most desert areas of the UAE are, as stated above, much degraded as a direct result of overgrazing, although mostly not beyond possible restoration. Large scale conversion of desert rangeland to irrigated grass and crop land has encroached considerably on the desert in the past 25 years, while the tradition of nomadism is now a thing of the past. Coupled with the unpredictability of the weather (a notable drought persisted in the UAE over the last three years of the old millennium), these factors have added to the problem of finite resources.

Mismanagement, often overlooked, is in fact an insidious and widespread threat to all ecosystems, but to coastal and desert areas in particular.

Agriculture

The main areas of agricultural development in the UAE are in Abu Dhabi, Ra's al-Khaimah and Sharjah. For many, UAE agriculture is inextricably associated with the production of dates. Indeed, the number of producing date palms has increased five-fold from under 5 million in 1986 to over 25 million in 1997 (Ministry of Agriculture and Fisheries statistics 1997).

This aside, there are now nearly 24,000 farms in operation throughout the country, 12,000 (50 per cent) of which have been established since 1993, and a wide diversity of crops are produced (Al Abed and Vine 1999, 2000). Presently, around 2000 sq. km of land is under the plough. Since the modernization of the industry as part of the process of economic diversification, traditional low-intensity but labour intensive farming practices survive only in some mountain districts, as the country strives for self-sufficiency in food production. The UAE is currently estimated to be 30 per cent self-sufficient in agricultural products. Surplus production of certain vegetables and fruits is now exported fresh, canned, dried, frozen or pickled.

Over ten million tonnes of agricultural produce is produced annually, with guaranteed prices assured by the Government to encourage the industry. Similar gains have been made in other sectors, including dairy produce, eggs, poultry and livestock. The number of camels (the meat of which is much prized) has more than doubled to around 200,000 animals in the last 20 years, while that of goats and sheep has increased four-fold to 800,000 in the same period. Production capacity of certain products, milk for example, approaches domestic demand, but as the human population continues to grow apace is likely to fall behind. Fodder production for the growing livestock industry similarly cannot match the demand and much has still to be imported.

Forestry plantations have become a widespread feature of the desert landscape. Afforestation, using a variety of native and exotic trees and shrubs, has transformed many areas of the desert. 'Green belts' and plots, some of considerable size, are often located to prevent sand movement smothering urban and rural developments. Such greening of the desert, as it is popularly described, serves the dual purpose of reducing airborne sand movement (drift) and of 'beautification' of towns and their outskirts. It does, however, require drip-fed irrigation to survive and uses significant quantities of water, some desalinated, but more of it increasingly drawn from recycled sources. The construction of dams, some 40 of which are now in existence in the mountains, may help reduce depletion of the aquifers at least in eastern regions. As a direct result of abstraction and lack of replenishment, the water table has dropped throughout the country, and at its most severe has allowed saltwater incursion to contaminate well-water supplies of some coastal communities.

Management of the natural woodlands of the UAE, including the Acacia savannahs (of, for example, the al-Madam and Kalba plains) and the zone of *ghaf* woodland or the saxaul belt, both in the sandsheets, as well as the zone within the Hajar Mountains is, however, still largely neglected. The Federal Environment Agency's (FEA) Biodiversity Committee has made a call for a concerted action in respect of these woodlands.

Commercial fisheries

According to recent statistics (1999), nearly 19,000 persons are employed as fishermen, some 15,000 (73 per cent) of whom are expatriates and 4000 nationals (27 per cent). Fish landings presently cover 100 per cent of domestic consumption.

Keen to protect the fishing industry, which in the UAE is second amongst the Arab Gulf Cooperation Council (AGCC) states in terms of the volume of its annual catch, the Ministry of Agriculture and Fisheries has introduced a suite of legal restraints (see Law No. 23 for 1999 below). The relevant new legislation requires any fishing boat going to sea to have an UAE national on board, although this is not always followed or enforced. The measure is as much to encourage nationals to take up the profession, as to prevent operators running small armadas

of vessels employing cheap labour which only serves to deplete fish stocks further. Fish may not now be caught during the spawning season and undersized fish must be returned to the sea, while trawling for shrimps has been banned since 1980 to safeguard spawning grounds.

Amongst management tools employed to some effect, artificial reefs have gained considerable favour. Although colonized by full-grown immigrant fish and vulnerable to abuse by fishermen, such reefs, quite apart from fostering coral growth, are now seen as a means of promoting ecotourism locally. Dubai and Fujairah are pioneering the process, which may lead to a shift in employment toward providing the range of services required by visitors.

Aquaculture is a growth industry with much potential. Plans to develop fish-farming have taken root under the offsets scheme, with a multi-million dirham public company, the International Fish Farming Company (Asmak), being incorporated in May 1999 (Al Abed and Vine 2000). The infrastructure will include hatcheries, cage-farms and shrimp ponds, and processing plants, with production targeted to approach an equivalent of 10 per cent of the present-day fish landings. Similar but smaller private initiatives also exist.

Institutional Framework

The institutional framework which exists in the UAE as a federation, as well as in each of the seven emirates, in relation to the environment is described below. As intimated in an earlier section, that institutional responsibility, still in its relative infancy, is in a process of evolution and development, and it is possible that changes will happen with such rapidity that some of the organizations described below may be overtaken by events even before this text appears in print.

Ruling families

Each emirate possesses a ruling family, whose head (or ruler) may make decrees which have the force of law. These occasionally concern environmental subjects such as the establishment of protected areas and the introduction of hunting bans in the relevant emirate.

Governmental bodies

Unless stated, the organizations listed below are governmental bodies. The responsibility allocated to the various bodies is described.

i. Federal Government

Federal Environment Agency (FEA)

The FEA is the federal governmental body charged with enforcement of environmental standards and pollution control as well as policy setting (see Federal Law No.(7) for 1993, below). The Minister of Health chairs the board of directors which oversees the agency's operation.

In 1998, the FEA, jointly with UNDP, published a draft National Environment Strategy and Environmental Action Plan which as yet remains of untested precision and efficacy. Federal Law No. (24) for 1999, concerning protection and development of the environment, as described later, was prepared by the FEA.

A national biodiversity committee set up under the aegis of the FEA (after the IUCN Riyadh Forum in 1995) is currently dormant.

ii. Ministry of Agriculture and Fisheries (includes Department of Fisheries)

The Ministry of Agriculture and Fisheries is occupied with both marine (see Law No. (23) for 1999 below) and terrestrial matters. Its fisheries department deals with coastal and marine commercial fisheries and aquacultural development, including a research programme into fishery stocks and recruitment. This Ministry houses the inspectorate for the Convention on International Trade in Endangered Species (CITES) in the UAE.

iii. Individual emirate agencies or other governmental bodies

Environmental Research and Wildlife Development Agency (ERWDA)

ERWDA is an Abu Dhabi government body with jurisdiction in Abu Dhabi but its services are on offer to other emirates. Terrestrial and marine research centres both operate under ERWDA along with a cross-sectoral Environmental Services Unit. The National Avian Research Centre, also part of ERWDA, with responsibility for all bird-related research, runs a captive-breeding facility and houses the Houbara Specialist Group of the Species Survival Commission of the World Conservation Union (IUCN).

Department of Environment and Protected Areas (DEPA), Sharjah

Active since 1998, DEPA runs the Desert Park (natural history museum) and Endangered Arabian Wildlife Centre, as well as having responsibility for designating nature reserves throughout the emirate, a process which has already commenced.

Department of Tourism and Commerce Marketing, Dubai

The remit of this body includes nature conservation and the establishment of protected areas in the emirate of Dubai.

In the other emirates, Ajman, Umm al-Qaiwain, Ra's al-Khaimah and Fujairah, environmental research and protection is developed to a much lesser extent, although Fujairah has designated marine reserves in the Gulf of Oman and is preparing a decree on cetacean conservation. Ra's al-Khaimah now possesses (since winter 1999/2000) an Environmental and Industrial Authority for regulation and enforcement of, for example, permissible levels of air pollution in the emirate related to local quarrying activities.

iv. Municipalities

All major towns, including the capitals of each emirate, possess a municipality or 'baladiya', essentially the local council. Municipalities are responsible for a multitude of activities, which can include everything from pest-control and refuse collection to managing parks and gardens and running zoos. In Abu Dhabi, the Food and Environment Control Centre (FECC) is part of the municipality. The FECC deals primarily with issues of public health. Other emirates have departments within their respective municipalities performing a similar function.

v. Academic research institutes

Emirates University, Al Ain.

The former Centre for Desert and Marine Studies, part of the Emirates University, had an affiliation with the Department of Fisheries offices and research laboratories in Umm al-Qaiwain,

itself part of the Ministry (as above). Recent re-organization at the former institute has meant this relationship now has an unclear future.

*vi. Non-environmental governmental bodies
Nationalized and other companies*

The Abu Dhabi National Oil Company (ADNOC) and all companies in its group, are bound by rigid Health, Safety and Environment standards. ADNOC, furthermore, is a driving force in environmental matters (policy, legislation and practices) in Abu Dhabi. Other companies in the group, including, in particular, the Abu Dhabi Company for Onshore Oil Operations (ADCO), also show a high level of corporate environmental responsibility. ADNOC and ADCO between them operate in exploration and production concessions covering over 75 per cent of the land surface of the emirate of Abu Dhabi. Amongst many environmental initiatives, the ADNOC group is committed to reducing or eliminating waste emissions, including working toward zero operational flaring in the near future.

Other companies, many from overseas, support environmental initiatives through, for example, sponsorship of research or awareness projects or by conducting their business activities applying environmental regulations from their own country, even when more stringent of those of the UAE itself. Examples include oil companies such as BP Amoco and Shell. It should be noted that Environmental Impact Assessments (EIA) are mandatory across all sectors.

Non-governmental organizations (NGOs)

A number of NGOs working in the environment sector exist in the UAE. Only the principal ones are named here: Arabian Leopard Trust (ALT); Environment Friends Society (EFS); Emirates Environmental Group (EEG); Emirates Natural History Group (ENHG); Dubai Natural History Group (DNHG) and Al Ain Natural History Group (Al Ain NHG). The mandate of each, excepting the three natural history groups, varies. Some have a lobbying and educational and awareness role, others may conduct research and survey, although the distinction may not always be immediately apparent.

The Abu Dhabi-based ENHG is a non-governmental member of the World Conservation Union (IUCN), the only current such member, governmental or otherwise, in the country. Certain other organizations, Dubai Zoo for example, are currently planning to submit their applications for membership.

Other organizations

A number of other organizations and departments are involved in environmental matters, two of which are described here on account of their importance in terms of governmental connections and scale of operation. The Environment and Wildlife Management section (EWM) of the Private Department of the UAE President is responsible for managing wildlife collections and farming enterprises on land owned by Abu Dhabi's ruling Al Nahyan family. This includes the island of Sir Bani Yas which houses captive breeding facilities for endangered Arabian and other ungulates (Anon 1999; Vine 1999).

The Emirates Heritage Club (EHC), under the chairmanship of Deputy Prime Minister HH Sheikh Sultan bin Zayed Al Nahyan, houses the Commission of Environmental Research

(CER), based on the island of al-Sammaliah 12 km from Abu Dhabi. The Commission undertakes applied research, retaining a particular interest in the protection of coastal and marine resources. In 1999 it completed the first phase of a fieldwork programme that will lead to the production of an atlas on which a coastal and marine management plan for Abu Dhabi emirate will be based.

Institutional relations

The many alliances of the different institutes are to some extent covered or inferred above, as is the national or international status of individual organizations. Some relevant high-level institutional relations are expanded on below.

In the UAE, the FEA and United Nations Development Programme (UNDP), enjoy close relations, often in conjunction with the World Conservation Union (IUCN) and there is increasing liaison between the Ministries and agencies internally, as is the case between the FEA and ERWDA and the FEA and the Abu Dhabi municipality's Food and Environment Control Centre (FECC). There remains, however, much duplication of effort, to different standards. This relatively commonplace institutional and political hazard is, through a restructuring process, close to being resolved in certain sectors with a routine exchange of dialogue now evident.

Intergovernmental activity

The Arab Gulf Cooperation Council (AGCC), created in 1981, is an intergovernmental body which tackles issues of mutual economic, political and military interest to member states (see e.g. Anon 1998). The secretariat is based in Riyadh, Saudi Arabia and all Arabian countries bordering the Arabian Gulf are members, namely: Kuwait, Saudi Arabia, Bahrain, Qatar, UAE and Oman. The GCC may give its patronage and support to regional meetings dealing with common environmental issues.

The Council of Environmental Affairs Ministers convenes annual meetings of the relevant AGCC ministers. At the sixth and most recent such meeting, which took place in Doha in 1999, issues such as ozone depletion, hazardous chemicals and international agreements were on the agenda, as was an AGCC Regional Strategy for Protection of the Environment in implementation of Agenda 21 (see below).

The World Health Organization (WHO), United Nations Food and Agriculture Organization (FAO), United Nations Environment Programme (UNEP) and United Nations Development Programme (UNDP), all maintain a presence in the region, advising governments and organizations as named above.

The role of the United Nations Educational Scientific and Cultural Organization (UNESCO) and Arab League Educational, Scientific and Cultural Organization (ALESCO) includes environmental matters of mutual concern. UNESCO's Man and Biosphere Programme (MAB) is relevant to the region, operating alongside and in tandem with the activities of UNEP/UNDP and other organizations. The Regional Organization for the Protection of the Marine Environment (ROPME), with a secretariat in Kuwait, is part of UNEP's Regional Seas Programme.

Kuwait Action Plan

Under the Kuwait Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution, the associated Kuwait Action Plan (KAP) is a regional initiative

for the Arabian Gulf (see MARPOL below). All AGCC countries are party to the convention which aims to reduce pollution, establish national standards and develop research and monitoring programmes relating to all types of pollution. KAP operates through ROPME, as well as with many national organizations and other institutions.

MARPOL

The Arabian Gulf and Gulf of Oman are declared Special Areas under Annex 1 and V of the MARPOL (Marine Pollution) treaty, Convention for Cooperation on the Protection of the Marine Environment from Pollution. This is as adopted by all AGCC countries, as well as Iraq and Iran, along with the Kuwait Action Plan (as above).

MEMAC/GAOCMAO

MEMAC, the Marine Emergency Mutual Aid Centre (run out of Bahrain), and the Gulf Area Oil Companies Mutual Aid Organization (GAOCMAO), are regional environmental management and pollution control initiatives, primarily linked to the oil industry.

UNESCO

Both the Man and Biosphere programme (MAB) and the World Heritage Convention operate under UNESCO. A World Heritage Site has been unofficially proposed for part of the Abu Dhabi coast and islands, UAE (see Aspinall and Hellyer 1997) and has recently been evaluated by an UNESCO team, although the UAE is not party to the relevant convention. The UAE has also yet to sign up to the MAB programme.

UNEP

UNEP's Regional Seas Programme includes within it the Kuwait Action Plan (above). Other UNEP initiatives include collaborative cross-sectoral alliances, for example, with the FEA.

Other national and international NGOs

IUCN

The World Conservation Union (IUCN) is also active in the region, independently and in collaborative efforts, for example with UNDP and the GCC, as well as, recently, with ERWDA.

A workshop on biological diversity in the Gulf Cooperation Countries was convened jointly by IUCN/GCC in Kuwait in September 1994 together with Kuwait's Environment Protection Council. In brief, the main purposes of this meeting were to review the implications of the Convention on Biological Diversity (CBD) for GCC countries and specify requirements for implementation; to assess the current status of biodiversity in member states and identify elements for inclusion in national strategies; to identify regional priorities, agree regional policies and to specify what support IUCN could give. Progress in these directions remains unclear.

At the IUCN North Africa/Middle East/West Asia regional conservation conference in Riyadh (Riyadh Conservation Forum) in October 1995, other than general sessions, three commissions convened. The Species Survival Commission (SSC) endorsed two objectives: the implementation of regional and national action plans that employ all appropriate conservation strategies and implementation of international conventions.

The then Commission for National Parks and Protected Areas (CNPPA) reviewed its draft strategic plan and discussed the draft regional action plan for North Africa and the Middle East. The Commission for Ecosystem Management (CEM), agreed on the assembly of task forces for integrated coastal zone and arid-lands management through seminars and the promotion of cross-sectoral collaboration. The Arabian Gulf has clearly to be a priority area for attention.

The IUCN West Asia, Central Asia and North Africa programme includes the Middle East. Recently, meetings have taken place to synthesize a project proposal towards 'An integrated protected areas strategy for biodiversity conservation in the Middle East'. This appears to be still on the drawing board. Training, protected area legislation, pilot protected areas, nature-based tourism and ecotourism are the four priority objectives proposed. IUCN operates closely with the GCC at a technical level.

The World Commission on Protected Areas (WCPA)

During 1998, the WCPA (formerly CNPPA) finalized a regional action plan for protected areas for North Africa and the Middle East. Funding is now being sought for its implementation (Sulayem, pers. comm.).

World Wide Fund for Nature

WWF-International anticipates establishing a permanent presence in the UAE capital in the near future. A memorandum of understanding has recently been signed with ERWDA, permitting WWF to operate independently, but in close association with UAE governmental and other non-governmental bodies.

BirdLife International

BirdLife International, which now has a Middle East office based in Jordan (as of 1997/98), first made inquiries about working in the UAE in the mid-1990s and may shortly establish some level of representation.

Wetlands International

Wetlands International, formerly the International Waterfowl Research Bureau (IWRB), completed an inventory of Middle Eastern freshwater and marine wetlands to 6 m below low water and published the findings as a directory (Scott 1995). The UAE was well represented. Wetlands International has no permanent presence in the country.

Environmental Legislation

Current legislation relevant to the natural environment and its resources is described below. Much has come into force only in the last decade, and the most recent, at least, has yet to be put to the test. The relevant organizational structure to institute, monitor or enforce such legislation is still in its infancy and individual roles and responsibilities may not yet be completely clarified.

UAE Hunting Law, Federal Law No. (9) for 1983

This, the earliest piece of federal legislation relevant to the environment, was issued nearly eight years after the creation of the first governmental environment body, the Higher Environmental Committee, although in 1976 a ban on hunting had been introduced by ruler's decree in Abu Dhabi. The 1983 law specifically regulated the hunting of birds and animals (mammals and reptiles) and was introduced on the basis of submissions by the Ministers of the Interior and of Agriculture and Fisheries. It was introduced in recognition of apparent declines being noticed in the populations of a number of desert and marine species. Regulations stipulated by Articles 1 and 2 are wholly unambiguous and read thus:

Article 1

Hunting, gathering or destruction of the eggs of wild and sea birds of various kinds including doves, orioles and small birds, with the exception of cormorants, are hereby banned in the UAE.

Article 2

It is not permitted to hunt the following animals:

- 1. Deer [antelope*] of various kinds [i.e. gazelle, oryx]*
- 2. Wild cows ['seacows' or dugong]*
- 3. Hares*
- 4. Mastigures ['dhubs' or spiny-tailed agamids (lizards)]*

*Note that square brackets are used where the translated animal names are given their common English names.

Article 3 details punishments that may be handed down, including imprisonment for a period of up to six months and confiscation of transport and tools used in committing an offence, while Article 4 revokes any prior provisions 'inconsistent' with those included in Articles 1, 2 and 3.

Since the UAE Hunting Law was introduced, the Ministry of Agriculture and Fisheries brought a successful case for a similar decree affording full protection to marine turtles and their eggs (see Law No. (23) for 1999). Implementation and enforcement of this legal protection, for birds and turtles in particular, remains a somewhat contentious and even openly challenged issue.

In addition to the above law, some individual emirates have introduced their own legislation relating to hunting or wildlife protection. The Ra's al-Khaimah government, for example, issued a decree in August 1998 banning the hunting of birds and hares, despite the existence of the 1983 Federal Hunting Law.

Legislation may even involve single species. A complete ban on the importation of houbara bustard, *Chlamydotis undulata macqueeni*, a species of particular significance to Arab falconers, was brought into effect by Cabinet Resolution in November 1993. Such a ban is pertinent to the Convention on International Trade in Endangered Species (CITES), to which the UAE is party, which bans any form of trade of species as listed on Appendix One of the convention, as the houbara bustard then was.

The Higher Environment Council, the first governmental body with any environmental protection mandate, was created in 1975 (Banoubi, pers. comm.). It was replaced by the Federal

Environment Authority (FEA) in March 1993. The latter became strictly the first UAE-wide institution with legal powers to protect and conserve the environment. Now overseen by the Minister of Health, in contrast to the earlier legislation concerning environmental matters which fell to the Minister of Agriculture and Fisheries, the FEA is itself entrusted to a board of directors, chaired by the Minister.

Federal Law No. (7) of 1993 for the establishment of the Federal Environment Agency

The FEA, established by Federal Law No. 7 of 1993, enjoys financial and administrative authority annexed to the Cabinet, with an independent budget attached to the state budget. Article 4 of the decree outlines the aims and objectives of the FEA and is reproduced below (translation compiled from two referenced sources, Anon 1993b and Anon 1993c):

Article 4

The objectives for establishing the Agency shall be: to protect and develop the environment within the State; to determine the necessary plans and policies to safeguard it from damaging activities, particularly those affecting human health, agricultural crops, wildlife, marine life, other natural resources and atmosphere; to implement such plans and policies; to take all suitable measures and actions to prevent deterioration of the environment, to combat environmental pollution of all kinds, and to minimize effects of pollution for the welfare of both present and future generations.

In order to achieve its aims and objectives, the Agency shall cooperate and coordinate action with concerned bodies to:–

- i. Prepare draft laws, legislation and regulations to ensure environmental safety, protection and development.*
- ii. Conduct research and studies and propose plans and general policies for environmental issues at the State level.*
- iii. Study and discuss plans and policies set by Ministries, agencies, institutions or companies practising activities that might affect the quality of the surrounding environment. Propose solutions to any environmental problems or obstacles impeding these programmes and projects.*
- iv. Examine, study, make necessary proposals and suggest suitable solutions for any environmental problems or matters that might be referred to the Agency by the Cabinet or any other official or non-official body within the State.*
- v. Conduct or supervise the conducting of extensive research and studies on pollution, monitoring its negative effects on health and environment, and take all necessary preventive measures and actions to minimize environmental pollution in all its forms.*
- vi. Establish the necessary basis and principles for incorporating environmental considerations into the process of planning and development in the State, by ensuring that environmental considerations become an integral part of policy-making, and by ensuring that environmental matters become part of planning, execution and follow-up of development projects initiated by Government or the private sector, applying the measures of environmental impact assessment.*
- vii. Monitor all public and private development activities that might have an adverse effect on the environment and has firstly to give approval to such developmental*

- activities before licensing them. Before approval, such projects shall be subject to Cabinet resolutions.*
- viii. *Collect and implement effective studies on air, water, sea, and soil pollution and devise ways of protecting the resources of the natural environment.*
 - ix. *Take an interest in the development of wildlife and protected areas (nature reserves).*
 - x. *Carry out studies on the nature of soil, water and energy and propose means by which they can be protected, and prepare guidelines to prevent the misuse or exhaustion of these resources, with a special focus on groundwater, desert areas and combating desertification.*
 - xi. *Carry out studies on the nature of the coastal zone and the marine environment and draw policies for protection, conservation and development of their resources.*
 - xii. *Determine and develop preventive measures to limit marine pollution, develop and train human resources and specialized personnel for implementation of schemes for the protection of the coastal zone (from pollution).*
 - xiii. *Establish a central environmental laboratory with the appropriate technical staff and equipment.*
 - xiv. *Specify permissible limits and carry out monitoring programmes for measuring radioactivity in water, air, soil and food.*
 - xv. *Endeavour to develop interest in education, information (media), sociological and cultural aspects with a view to increasing environmental awareness and promoting active public participation in protection and development of the environment.*
 - xvi. *Draw up and implement plans and programmes for the training of technical personnel in the field of environment.*
 - xvii. *Specify suitable methods for forecasting, anticipating and mitigating natural disasters.*
 - xviii. *Undertake a comprehensive review of problems of human settlement in cities, villages and rural areas. Follow up the effects of economic and social development on proposals for human settlement programmes, providing suitable solutions particularly for:*
 - a) *Achieving an ideal distribution of human settlements in cities and rural areas.*
 - b) *Ensuring the use of environmentally sound technology in design and construction of buildings.*
 - c) *Ensuring the most suitable living conditions for town and village planning.*
 - d) *Reduction of noise and air pollution through use of suitable means of transportation.*
 - xix. *Establish appropriate database systems for collecting, storing and exchanging information with research institutions and environmental organizations and making use of these regardless of whether they are inside the State or elsewhere.*

Federal Law No. (24) for 1999 for Protection and Development of the Environment

This is the most recent piece of federal environmental legislation, following hot on the heels of decrees establishing independent agency-level bodies such as ERWDA in Abu Dhabi and DEPA in Sharjah, empowered to undertake research and provide conservation advice. It came into force on 1 February 2000. Drafted by the FEA, this law, which carries 101 articles, is particularly strong in respect of the marine environment, with over 40 articles concerning

marine transportation and pollution and the respective penalties applicable to a vessel found in breach of any specified offence. Note that Federal Law No. (23) for 1999, which came into effect in mid-April 2000, after Law No. (24), also concerns, but exclusively so, the marine environment.

Article 2 of Federal Law No. (24) for 1999 for Protection and Development of the Environment outlines the objectives and general principles concerned:

1. *Protect the environment; preserve its diversity and natural equilibrium.*
2. *Fight all forms of pollution and avoid harmful immediate or long-term adverse effects resulting from planning for economical, agricultural or industrial or constructional development or any development programs aiming to upgrade the standard of living; Agency co-ordination with other concerned authorities and departments in order to preserve the environment, its diversity and the natural equilibrium, and consolidate concepts of environmental awareness and principles of pollution prevention.*
3. *Develop natural resources and preserve the various living species in the UAE and utilize them in an optimal way for the benefit of present and future generations.*
4. *Protect society, the health of human beings and other living creatures from any activities or acts which comprise a risk to the environment or which may impede the lawful use of the environmental milieu.*
5. *Protect the UAE environment from the adverse impact created by external activities.*
6. *Undertake the implementation of international and regional conventions ratified or signed by the State in respect of environment protection, pollution prevention and preservation of natural resources.*

Chapter 1, covering Development and Environment (Articles 3 to 16), introduces four sections: Environmental Impact (Section 1); Environment and Sustainable Development (Section 2); Environmental Monitoring (Section 3) and Plans for Emergencies and for Dealing with Environmental Disasters (Section 4).

Chapter 2 (Articles 17 to 41) covers the Protection of Water Environments from pollution in both marine and freshwater environments, including potable ground water, while Chapters 3, 4 and 5 deal with Protection of Soil, Protection of Air and Handling of Hazardous Substances and Wastes. Chapter 6 (Articles 63–68) defines the legal requirement for determining the location and boundary of nature reserves in the state.

Liabilities and compensation for environmental damages, Chapter 7 (Articles 71–72) and penalties, Chapter 8 (Articles 73–90), are explicit and apply, all importantly, both within and outwith the marine jurisdiction of the UAE, regardless of the nationality of any guilty party concerned. The penalties, involving fines and custodial sentence, extend, in the case of nuclear waste, to the possible imposition of the death penalty.

While the Federal Environmental Agency may be the ultimate authority in respect of the above law, the ‘competent authorities’ in each emirate will be responsible for activating its provisions.

In Abu Dhabi one such ‘competent authority’ would be the agency ERWDA, which itself carries a mandate (Law No. (4) for 1996 as amended by Law No. (1) for 1997) to:

. . . protect the natural environment, its wildlife and its biological diversity through monitoring and submitting of proposals and recommendations and by carrying out studies and research required for the protection of the environment and its wildlife.

Moreover, all Abu Dhabi government departments and agencies:

. . . are required to coordinate with the Agency [ERWDA] in relation to research, studies and programmes concerning environmental matters and wildlife.

Furthermore:

. . . The Agency's approval is required for the issuing of any regulations, policies and decrees related to environmental and wildlife affairs.

Together with a role to evaluate the use of agricultural chemicals, the effect of industrial projects, assess the impact of town planning amongst many others stated objectives, there is, in this particular instance, a complimentary but at least partially overlapping role between the Abu Dhabi agency and the federal body ultimately responsible for matters relating to the environment. It remains to be seen what relationship is developed here, as well as between those competent authorities as exist in emirates other than Abu Dhabi in relation to the above law and to the FEA.

Federal Law No. (23) for 1999 for Protection of the Marine Environment (see Anon 1999b)

UAE legislation covering the protection of the marine environment, Law No. (23) for 1999, as proposed by the Ministry of Agriculture and Fisheries, came into force on 17 April 2000. Compliance with the requirements of the new law allows for a transition period of one year (unless extended by Cabinet Resolution). Federal Law No. (23) governs the exploitation, protection and development of marine biological resources. Fishing, protection of restricted areas, processing and marketing of fish, the extension of grants and loans to fishermen and the export, re-export and transit of fish products are all covered. The new law sets forth procedures for registration of vessels (expressly limiting their number) and of fishermen and for licensing of their activities. Catch limits are to be set by the Ministry of Agriculture and Fisheries. There is provision to regulate minimum animal sizes caught, introduce close seasons and restriction of fishing activity in certain areas. Fishing methods are also considered, with bans on the use of certain equipment or particular methods – nylon nets, drift nets, bottom-trawling and the use of narcotics and explosives, for example. The construction of artificial reefs requires Ministry approval as well as that of the concerned authority in the specific emirate, while even fishfarms require permission to operate.

Concern at the number of vessels engaged in fishing (employing solely expatriate labour) has meant that an earlier restriction specifying that fishing boats are not allowed to sail without the owner or his national representative on board has been reiterated in the marine law. Nationals from any AGCC country are also accepted. Foreign vessels are not permitted to fish in UAE waters at any time.

Penalties for breach of any of the articles in law No. (23) include fines and/or imprisonment and confiscation of boats and fishing tools. Thus the catching of turtles or dugong will meet with a fine of between Dh 50,000 and Dh 100,000 (US \$13,500–\$27,000) and/or six months in prison, with a second offence attracting a minimum of three years in prison and a fine of Dh 100,000–Dh 200,000. Fishing in the close season or using forbidden methods will bring three months in prison and/or a Dh 25,000–Dh 50,000 fine while a second offence incurs a minimum one year in prison and a Dh 50,000–Dh 100,000 fine.

Some elements of earlier environment-related legislation are absorbed and reiterated and there is necessarily some overlap with Law No. (24) for 1999 (above), capture of dugong or turtles and collection of the eggs of the latter again being prohibited, for example, although the relevant applicable penalties are absent from the Federal Environment law (No. (24) for 1999).

What should be noted from the above text is that the legislation establishing and empowering the various bodies, whether federal or agencies at an emirate level, provides a mandate for them to draft and introduce new laws concerning environmental protection. This necessary process has already proved itself to be dynamic and further legislation is planned.

Other environmental legislation

Strict laws exist on pesticides. The import of many chemical insecticides is explicitly banned, prudently leaving permissible only those already licensed for use in agriculture by the EU, US, Canada and Japan, for example. Regulations are also under discussion to phase out leaded fuel.

Conventions and intergovernmental activity

To date the UAE Government has signed all, but has yet to ratify most, of the following wildlife and environment related conventions:

- Climate Change Convention.
- Convention on Biological Diversity (CBD).
- Convention on International Trade in Endangered Species of Flora and Fauna (CITES) (Ratified).
- United Nations Convention to Combat Desertification (UNCCD).
- Convention for Cooperation on the Protection of the Environment from Marine Pollution (see under MARPOL and Kuwait Action Plan, above). Also signed by all other GCC States bordering the Arabian Gulf.
- The Law of the Sea (UNCLOS). In the immediate region this has been ratified by Iraq, Kuwait, Bahrain and Oman and, as with the UAE, is also signed by Iran, Saudi Arabia, Qatar and Pakistan.

Eventual ratification of other of the above conventions, as well as the Bonn Convention (Convention on Migratory Species, CMS), the Ramsar Convention (Convention on Wetlands of International Importance especially as Waterfowl Habitat) and the Convention concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention) is currently under consideration.

Environmental Education and Awareness

The UAE celebrated its first National Environment Day on 4 February 1998, the fifth anniversary of the inception of the Federal Environment Agency itself. This annual event is celebrated amid much publicity, with many events held on the day itself and thereafter in the following days and weeks.

While much of the grass-roots effort to increase awareness is undertaken by such governmental agencies as ERWDA, a great deal of it is taken on by (non-profitmaking) non-governmental

bodies, such as the Environment Friends Society (EFS), the Emirates Environment Group (EEG) and the Arabian Leopard Trust (ALT) among others, or by enlightened school teachers devising their own extra-curricular programmes. An attentive press, in both English and Arabic, although perhaps more so the former, ensures more than adequate coverage of domestic and global environmental issues and events.

Several conferences on environmental or related issues are convened annually in the UAE, mostly in Abu Dhabi and Dubai. Often receiving high-level support and patronage, the range of subjects tackled in recent years has included desertification, protected areas, coastal zone management, conservation of Arabian oryx, and industry and environment.

Two of the most recent such meetings, both held in early 2000, were the 'Dubai International Conference on Desertification 2000', organized by the secretariat of the Zayed International Prize for the Environment in cooperation with UNDP and United Nations Convention to Combat Desertification (UNCCD), under the patronage of the UAE Defence Minister and Crown Prince of Dubai, General HH Sheikh Mohammed bin Rashid Al Maktoum and the '1st International Symposium and Workshop on Arid Zone Environments: Research and Management Options for Protected Areas', hosted by ERWDA under the patronage of the Deputy Chairman of the Agency itself, Minister of State for Foreign Affairs HH Sheikh Hamdan bin Zayed Al Nahyan.

A non-governmental initiative, under the private patronage of Deputy Prime Minister HH Sheikh Sultan bin Zayed Al Nahyan, Chairman of the Emirates Heritage Club and its associated commissions, was the '2nd Arab Envirotech Conference' held in Abu Dhabi in April 2000. This meet, which focused on protection of the UAE's marine and coastal zone (following up on the recommendations after survey and critical investigation by a multi-disciplinary team of international experts), demonstrated how, by bringing relevant environmental issues into sharp focus, not only governmental bodies may exert political influence.

A major conference, entitled the 'Environment 2001 Conference and Exhibition', took place in Abu Dhabi in February 2001, co-sponsored by the UAE Government, UNEP, UNDP and other international bodies.

Although the four conferences above have received specific mention, it would be unjust to suggest they are necessarily more important than many other similar events that have either already concluded or are due to take place. Conferences and symposia are seemingly perceived as an important socio-political exercise, and a quintessential part of the process without which further progress would not take place.

Conclusion

The UAE is a small rich country that has developed extremely rapidly. What the future may hold is not easy to judge. On the one hand there is a desire and the wherewithal to continue to develop the country, and on the other there are delicate life-sustaining ecosystems requiring careful custodianship. There will be losses, that much is sure, but the UAE has taken up the challenge with creditable foresight. The institutional structure, supported by clear legislation, is now in existence, even if further legislation is still required. However, the plethora of bodies working toward a common goal often duplicate each others' efforts. Coordination and cooperation would pave the way for greater collective achievement.

Environment and development are important to the people of the UAE, with a certain pragmatism existing about the whole issue. Dialogue and solution-finding rather than conflict and the risk of defeat are the norm, nonetheless compromises sometimes have to be found and accepted. A guarantee exists, however, that simple financial aspirations alone will not be allowed to destroy the fragile ecological balance.

Commenting on the award to him in 1999 of the *Gold Panda*, the WorldWide Fund for Nature's most coveted award, for services to the environment, UAE President, HH Sheikh Zayed bin Sultan Al Nahyan, has the final word:

'With God's will, . . . we shall continue to work to protect our environment and our wildlife, as did our forefathers before us. It is a duty – and, if we fail, our children, rightly, will reproach us for squandering an essential part of their inheritance and of our heritage.'

Extract from Sheikh Zayed's speech on the occasion of the UAE's first Environment Day, 4 February 1998.

Glossary

ecoregion: a biologically distinct biogeographical realm, based on the total number of species present, level of endemism and presence of unusual ecological or evolutionary phenomena. Ecoregions are the target adopted by *WWF-International* for the conservation of global biological diversity.

endemic: referring to a species or subspecies found only in a limited geographical area, generally a country, socio-political unit or, more properly, a biogeographical region.

flagship species: a species so-called due generally to its popular appearance or appeal, for whatever reason, and thus used to 'market' its own conservation, as well as, most often, that of other species sharing a similar environment.

Important Bird Area: an area of land or water the loss of which would jeopardize the survival of a particular bird species or assemblage of bird species, whether globally or regionally, and whether breeding, migrant or casual visitor.

keystone community: a plant and/or animal community, survival of which is vital to and underpins the survival of the overall ecosystem as a whole.

Ramsar Convention: the original name for the Convention of Wetlands of International Importance Especially as Waterfowl Habitat, drawn up at Ramsar, Iran in 1971. The UAE is not yet a signatory. Criteria used to select 'Ramsar sites' are a). those regularly supporting 20,000 or more waterfowl; or b). those supporting substantial numbers of individuals from particular groups of waterfowl, indicative of wetland values, productivity or diversity; or c). where the site regularly supports one per cent or more of the individuals in a population of one species or subspecies of waterfowl.

Red Data species: in no particular order of importance: a). an endemic subspecies confined to the UAE; b). any species that is adjudged to be regionally or globally threatened or near-threatened; c). any species with a national breeding population greater than one per cent of the biogeographical breeding population; or having an unfavourable conservation status; d). a species of 'restricted range' (<50,000 sq. km) living in a threatened habitat or habitat at risk from adverse man-made changes and e). any other native species with an estimated national breeding population of less than 50 pairs (excluding sporadic breeders and recent colonists) and considered to be under threat or known to be declining in numbers.

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