Biosphere Reserve Study, Sharjah, U.A.E.

Project Document - Rapid Assessment of Potential Biosphere Reserves at Khor Kalba

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with assistance from
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Prepared for
H.H. The Ruler's Office
Environment and Protected Areas Authority (EPAA)
Government of Sharjah

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UNESCO

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1. Acknowledgements

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Figure 1: Beach seine-netting off the open beach at Kalba
2. Summary

Khor Kalba and adjacent associated coastal (littoral) zone habitats of beach, halophytic scrubland and flats to the South of Kalba town and East of the Kalba to Oman highway, covers an area of approximately 12 km². The total water catchment area of Wadi Rumh, the principal wadi flowing into the khor, albeit intermittently, covers an area of over 100 km², much of it being mountainous in character (part of the northern Hajar Mountain range). A narrow alluvial plain dominated by *Acacia* woodland lies between the arid stony mountains and the littoral zone.

The vegetation zones comprise *Euphorbia larica* shrubs on the mountains, with *Acacia* woodland on the foothills and adjacent plain, an intertidal *Arthrocnemum* and *Halocnemum* salt marsh complex, and the mono-specific *Avicennia marina* mangal.

Khor Kalba itself is the only mangrove-lined khor present on the Gulf of Oman coast of the UAE and houses some of the oldest mangrove trees in the country. Judging from historical accounts, mangroves are presumed to have been far more substantial along the coast in the past, and those now found at Kalba can be regarded as the last, relict, stand.

The Kalba area, including its mountain backdrop, is scenically attractive and popular for recreational use. Nonetheless, the ecotourism and educational opportunity presented by the area remains, as yet, almost wholly undeveloped. Commercial seine-net fishing operations from the open beach are of some importance to the local economy, raising an estimated 6-8 millions dirhams annually.

A high level of biological diversity is known from the area, one subspecies of bird being endemic, with the populations of a number of other species of fauna being of national or regional significance. Biological productivity within the mangal is similarly high, with the area serving as a fish spawning ground and nursery for commercially valuable fish and shellfish (molluscs and crustaceans).

Khor Kalba is of global importance for two species of bird, namely white-collared kingfisher of the subspecies *kalbaensis*, which breeds only here in the world, and visiting sooty gulls. One other breeding bird, Sykes’s warbler, is found breeding nowhere else in the UAE, and at only one other site in Arabia.

Khor Kalba has been documented in the *Directory of Wetlands in the Middle East* this 1995 publication describing all sites that would qualify for designation as a
Ramsar Site under the 1971 Convention on Wetlands of International Importance\(^1\). The site also appears in *Important Bird Areas in the Middle East*, which details those sites of particular national and regional significance for their breeding or visiting bird populations, and is one of only 20 UAE sites, (and, moreover, one of just five nationally listed coastal wetlands).

New discoveries continue to be made at Khor Kalba. Two new crab species for the UAE were found in just one brief visit this year, for example. Certain groups are poorly studied but sufficient is known of others to warrant the immediate declaration of the site as a reserve area afforded complete protection.

The archaeology of the coastal hinterland includes a number of significant historical and prehistoric sites, some of the latter dating back to the 3\(^{st}\) Millennium BC, i.e. four to five thousand years before present, BP. A number of structures, such as forts, cairns and burial chambers, in differing states of preservation, are present, as is a remarkable assemblage of rock artwork or pictoglyphs. All of these are an important component of the local heritage, and fall within the Biosphere Reserve proposal as discussed in this document. The majority of archaeological sites within the preliminary survey area were located on the coastal plain, or within close proximity to the edge of the Hajar Mountains.

\(^1\)The UAE is not yet a signatory to the convention
The prehistorical and historical sites of the Kalba area are significant in terms of the history and management of the surrounding environment. The presence of settlements dating from the 3rd Millennium BC to the Iron Age are a reflection of the area’s ability to sustain a substantial prehistoric population for an extensive period of time. Portuguese, Arab and British written reference to the region also reflect the strategic and environmental importance of this stretch of coast in the more recent historical past.

The Khor Kalba area, assessed as part of this initial Biosphere Reserve assessment, is an area of considerable archaeological and cultural significance, not only for the prehistoric period but also to the local history of the region, and indeed to the Arabian Gulf. Coupled with its extraordinary ecological and landscape values, commercial assets and ecotourism potential, sustainable management practices must prevail. Biosphere Reserve designation would enhance the possibility of collective expertise being brought into play to ensure that the future of this area is secured for all parties concerned as well as for its wildlife.

3. Background

This study came about as a result of the adjudged need to manage sustainably the future development of those areas of national and international importance for cultural heritage and wildlife within the United Arab Emirates. The emirate of Sharjah was responsive to an initial UNESCO approach toward the possibility of Biosphere Reserve designation, and prompted this initial study of an internationally renowned site, namely Khor Kalba on the Gulf of Oman coast.

Designation as either a Ramsar Site or Biosphere Reserve, or both, has been proposed previously for Khor Kalba. The former is the highest form of recognition of the international importance of a wetland site, in particular for waterfowl. Biosphere Reserves are areas of land where sustainable development, without disruption to the local environment beyond its ecological carrying capacity, can be demonstrated, and where socio-economic factors do not result in non-sustainable resource utilisation.
4. Justification

Managed protected areas, such as Biosphere Reserves and World Heritage Sites, can play an important contribution in the conservation and development of the natural and cultural heritage wherever they are emplaced. Once established, they offer a valuable asset for the emergence of a tourism industry, in particular for outdoor recreation, education, and eco-tourism, but also raise environmental awareness.

The Sharjah government clearly comprehends the importance of Khor Kalba to the international conservation community, and also appreciates its sensitivity to man-induced changes. Formal designation of the area as a protected area has been promoted previously (since at least 1995) but has yet to take place. A number of suggested development proposals known of would certainly be acutely damaging to the area, and expert advice should be sought to ensure that development, for whatever purpose, does not lower the interest or integrity of the local physical or biological environment. This is where collaboration between EPAA and UNESCO, with their combined expertise, can be brought into play most effectively.

Submission of a proposal for designation of Khor Kalba as a Biosphere Reserve
Biosphere Reserve Study, Sharjah, United Arab Emirates

This map is not official and is not to be considered definitive with regard to the precise position of the national border.

Figure 4: Khor Kalba Biosphere Reserve Assessment
will be a clear demonstration of the commitment of the Sharjah government to the sustainable use of the area, balancing socio-economics with the ecological carrying capacity. The area stands to benefit from such a designation in attracting visitors and thus bringing increased, and certainly not decreased, revenue to the local economy.

5. Introduction

During May 2002 a survey team comprising the UNESCO regional science program specialist (also an accomplished plant ecologist), a consultant ecosystem and wildlife management specialist and an archaeologist visited the Khor Kalba area.

Those data collected during an earlier visit by a marine biologist specialising in mangrove ecology and marine invertebrates, were also provided and incorporated in this report, as were those significant findings generated over the past ten or so years by visiting and resident amateur and professional biologists and archaeologists/historians.

Kalba represents one of the most northerly mangrove habitats of the western Indian Ocean. From a biogeographical point of view, it lies in a particularly interesting position, in the transitional zone between the Arabian Gulf region and the Gulf of Oman / Arabian Sea. The mangrove vegetation is mature, dense, and flourishing, and supports an abundant and diverse fauna, some of restricted national or regional distribution. The *kalbaensis* subspecies of white-collared kingfisher, so named after this locality, is found breeding nowhere else in the world.

The UNESCO Biosphere Reserve concept is defined in popular terms as one that ‘weds conservation and sustainable development’. UNESCO, which has championed this approach since the 1968 Biosphere Conference, is responsible for Biosphere Reserve designation under its own Man and Biosphere Programme (MAB), all importantly, at the request of the State concerned. The State concerned thereafter takes those measures deemed necessary under its own national legislation.

Collectively, all Biosphere Reserves form a World Network, participation in which is entirely voluntary. At the present time nearly 100 different countries worldwide are involved in the management of a network of more than 400 such reserves. However, it should be noted that, hitherto, no Biosphere Reserve or reserves have been either proposed or designated by any country within the Arabian Peninsula.
There are three primary goals for Biosphere Reserves:

i. To conserve natural and cultural diversity

ii. To function as models of land management and of approaches to sustainable development

iii. To foster research, monitoring, education and training

It was within this definition and framework that the suitability of the Khor Kalba area was investigated. Designated Biosphere Reserves are invariably characterized by ‘zonation’; each possessing a core area devoted to long-term protection, a buffer zone, and an outermost ‘transition’ zone in which sustainable resource use is permitted. It is necessary to consider the functioning of the physical and biological systems on an appropriate scale. The freshwater catchment of the mountains to the west, being integral to the development and survival of the Khor Kalba area, is especially relevant and is thus given some degree of consideration in the current document. In the long-term, in Khor Kalba, the dimension of urban environment will play an important role, due to the human activities in and around the proposed core area.

6. Assessment

Khor Kalba and the surrounding area was visited during April and May 2002 to assess the current situation on the ground. A visit was also made to the EPAA offices where cordial discussions were held with the Director, H.E. Abdul Aziz al Midfa, and other staff. These discussions focused on the possibility of Biosphere Reserve designation for Khor Kalba, on proposed plans for development and management of the area, and also on future formal collaboration between EPAA and UNESCO over both this and other matters of mutual interest throughout Sharjah Emirate.

7. Survey Results

7.1 Flora and landscape

The flora in the area is relatively rich in species number compared with other areas of an equal size in the neighbouring areas in the UAE (Böer, 1999). Six major habitat types occur closely together in zonation, namely *Euphorbia larica* on the hills, *Acacia tortilis* in the foothills and plain, *Halocnemum* and *Arthrocnemum* saltmarshes in the
upper intertidal zone, *Avicennia marina* mangroves fringing the khorside, seagrasses also there and in the open water, and *Pennisetum divisum* grass dominating the beach vegetation.

The landscape consists mainly of open water, intertidal flats with mangrove and saltmarsh, flat gravel plains interspersed with rocky hills, and mountains in the hinterland, interspersed with surface water run-off systems (wadis). Furthermore, there are the urban landscapes of Kalba village, and smaller settlements in the area, as well as the anthropogenically changed landscapes in the intermediate area between the settlements and the natural ecosystems, which have been converted into semi-urban wastelands.

One of the potential core areas of the area is a coastal wetland complex formed of a large embayment system of ca. 6 km² in size. Extensive mangrove woodland, the only such area along the UAE coast with the Gulf of Oman, intertidal mudflat, saltmarsh and sabkha are present. An uninterrupted zonation from littoral zone, saltmarsh and mangrove to sabkha and coastal sand-sheet is exhibited.

Regarding the adjacent marine environment, no data were obtained, and a careful

![Figure 5: Petroglyphs at site 10](image)
survey needs to be conducted into marine ecosystems, and ecology, with special consideration of marine habitats, primary productivity, and fishing practices and efforts.


### 7.2 Anthropogenic impacts

The area undoubtedly has a significant role as an important spawning and nursery area for commercially valuable fish and shrimp stocks. Some artisanal and recreational fishing occurs locally, with other land and water-based recreational pursuits also taking place. Some mangrove areas are reportedly grazed intermittently by camels, but this is itself not considered detrimental to the ecology of the site, and may actually prove to be beneficial.

This desert area is utilized by numerous domesticated herbivores, with herds of goats and sheep commonplace. Agricultural development is underway in many areas, with freshwater irrigation being used. Urban and residential development is ongoing and already widespread. Hunting is popularly pursued, with ammunition shells being found in the *Acacia* woodland and further up in the mountains.

The anthropogenic impacts are relatively high around the mangrove core area. Changes in the intertidal hydrology are responsible for the partial dieback of ca. 3 ha of mangrove. The coastal road, build parallel to the coastline, forms an artificial dividing line perpendicular to the direction of surface run-off water – preventing the salt marsh, and the mangrove receiving freshwater input, which would otherwise accelerate growth. Fishing activities, agricultural experiments, as well as earth-moving along the beach and in the saltmarsh zone caused the total loss of large areas of beach vegetation and saltmarshes. Urban encroachment is taking place in each of the mentioned ecosystems, except for the marine part. The *Acacia* woodlands are being grazed by feral donkey, goat herds and smaller numbers of sheep.
There is a large area of date palm plantations in the area. Settlements, fences, roads, presence of tracks, droppings of camel, goat, and, sheep, oil pollution on beaches (tar balls), rubbish, car tracks, power-lines, radio towers, water pumps, earth-movement, spent munitions, tourist activities (picnicking/camping), livestock camps, and other activities, should all be quantified, and investigated for desirable/undesirable impacts.

Plans still at the conceptual planning stage have been prepared, including the establishment of an recreational area in the saltmarsh and mangrove zone of the wetland, which would involve large scale dredging, and the construction of an additional road. Changes to the surface hydrology especially have to be handled with the utmost care, and only under consultation of professional hydrologists, in order to avoid adverse impacts to the mangrove and saltmarsh habitats.

7.3 Fauna

Invertebrates

A single visit in April 2002 produced a total of 17 crab and 2 hermit crab species. Of these, two (Clibanarius longitarsus, Perisesarma guttatum) had not previously been recorded from the UAE, and one (Parasesarma plicatum) had been recorded from the UAE but not from the East Coast. The discovery of abundant \( P. \) guttatum represents a significant extension of its known range, the nearest location previously known being...
in East Africa. In addition, it has not been possible to identify two species of leucosiid crabs, probably *Ebalia* spp. Whatever their identity, these are certainly new records for the area, and may conceivably represent previously unknown species.

The Khor Kalba mangroves are also the primary location in the UAE for the giant mudcreeper (*Terebralia palustris*), a large gastropod. This species typically inhabits mud amongst mangroves during its adult stage, although juveniles and some adults can also venture into tidal channels.

*Terebralia* was once common in the southern Arabian Gulf, as witnessed by its dominance in shell middens associated with many prehistoric coastal settlements in the Northern Emirates. It was clearly a favoured food resource in past times. Destruction of the mangrove habitat and various environmental factors probably accounted for its decline and, ultimately, its local extinction.

**Fish**

The fish community of the khor has not been thoroughly investigated to date. Feulner apparently found eight species, including the Arabian Killifish (*Aphanius dispar*), which is tolerant of both fresh and saline water and occurs in wadi systems. Other species doubtless occur, even if only as larval or juvenile stages.

Commercial species harvested by beach seine–netting operations are primarily sardines (*Sardinella* spp.), anchovies (*Engraulis* spp.) and *Stolephorus* spp. (see also current landuse). The annual revenue from this industry is estimated to be 6-8million AED. Little is known of other marine fishes present or of their populations and seasonal movements.

**Turtles**

Green turtles (*Chelonia mydas*) formerly nested on the open beach east of the khor, although no nests have been knowingly reported from here in recent years. It is reported that such nests were previously dug up and the eggs taken for human consumption. The regular traffic of 4WD along the beach, and other human disturbance, also probably precludes successful breeding here at the present time.

Large numbers of green turtles do, however, still feed close inshore off the open beach. Individuals occasionally enter the khor itself. Those present off the open beach are frequently caught during the deployment of seine-nets. Some individuals drown, but most are apparently returned to the sea unharmed. The endangered Hawksbill turtle (*Eretmochelys imbricata*) has also been recorded locally.
**Mammals**

There is little data on mammals from the Kalba area and none of those species known to be present locally is rare or threatened. One possible exception to this could be with regard to certain species perhaps still present within the mountains (catchment). At least two, currently unidentified, species of bat have been recorded near Khor Kalba, one of these previously roosting in some numbers in the khorside quay feedstore. Egyptian fruit bats (*Rousettus aegyptiacus*) are also frequently recorded in spring, at least. Further survey needs to be completed on mammals and terrestrial reptiles in the area.

A number of marine mammals are known to occur offshore, primarily species of dolphin, but whales are present in deeper waters further from land. The possibility of whale-based ecotourism being developed here is not beyond question.

**Birds**

Khor Kalba and the surrounding area are relatively well-surveyed ornithologically.

The mangroves and mudflats of Khor Kalba are critical to the survival of the endemic white-collared kingfisher (*Halcyon chloris*). The subspecies present, *kalbaensis*, so named after Kalba itself, breeds nowhere else in the world (one pair may have colonised Khor Liwa near Sohar, Oman since 2000 or have bred there intermittently.

![Figure 7: The endemic *kalbaensis* subspecies of the endangered white-collared kingfisher](image)
The Khor Kalba population is estimated at 44 pairs. This kingfisher nests in holes in the oldest mangroves, and feeds primarily on crabs picked up off the mudflats and from among the mangrove’s pneumatophores at low water.

**Sykes’s warbler** (*Hippolais rama*) breeds only here within the UAE and at just one other site in Arabia (Khor Liwa, Oman), although it is not otherwise restricted or rare in world terms. At Khor Kalba, nesting and feeding takes place in the mangroves, particularly where camels have grazed the lower branches to result in a thicket of foliage at or near ground level, and where their manure encourages those flies that the warblers prey on.

The beach at Khor Kalba is frequented by large numbers of gulls (*Larus* spp.) and terns (*Sterna* spp.), both on migration and during the winter months. The concentration of sooty gulls (*Larus hemprichii*) present is of international importance, with up to 5% of the estimated world population present at times, as may be the populations of certain of the tern species. A wide variety of shorebirds and herons frequent the beach and mudflats of the khor, although the numbers of no one of those species present is regarded as being nationally or regionally significant.

A number of characteristically Middle Eastern breeding species is present in the area of *Acacia* savannah on the alluvial plain west of the Kalba-Oman highway. These include yellow-throated sparrow (*Petronia xanthocollis*), blue-cheeked bee-eater (*Merops persicus*), Arabian babbler (*Turdoides squamiceps*) and striated scops owl (*Otus brucei*). All occur here at densities higher than in almost any other location in the UAE (nor does any other single site nationally support all four of these species at once). The large populations of each species is at least in part due to the quality of the *Acacia* savannah. The significance of previous survey findings, including many by the same authors, is incorporated into the discussion section.

**7.4 Archaeology, history and local heritage**

A 3rd Millennium BC *tell* site at Kalba is situated within the date palm gardens between the mountains and the modern town. This *tell* consists of a large defensive tower from the Umm an-Nar period (2500-2000BC), an extensive mudbrick platform of the Wadi Suq period (2000-1300BC), and Iron Age remains (1300-300BC). The site is significant as prehistoric settlements are relatively rare in Southeastern Arabia. However, it is comparable to the site of Tell Abraq on the border between the emirates of Sharjah and Umm al-Qawain.
Situated nearby the Kalba tell in the village of al-Taraif, are the remains of a large, earth filled, circular tower base. The tower was constructed from mountain and wadi rocks, gravel, and saruj (mortar and plaster). Similar structures are to be found along the east coast of the UAE and Oman, e.g. at Rul Dibba, Rul Dadnah, and Khor Fakkan. Architectural and historical sources would suggest that these solid tower bases date from the middle of the 17th Century.

The restored fort at Sur Kalba is located close to the coast, within the modern town of Kalba. It has been suggested that this fort post-dates the Portuguese period in the Arabian Gulf, i.e. post mid 17th Century, based on the supposition that the Portuguese would not have permitted the survival of a local Arabian fort so near to their own at Kalba. Based on architectural parallels, it is likely that the fort of Kalba dates from the late Islamic period, i.e. circa early 19th Century.

The location of the Portuguese fort of Kalba has yet to be determined. During the early 17th Century, the Portuguese established a fort and watchtower at Kalba (Quelba). The existence of these buildings were recorded by Antonio Bocarro in the Portuguese chronicle, Livro do Estado da India Oriental, dated 1646 (Sloane Manuscript 197, British Library). These strongholds, strategically positioned throughout the Indian Ocean, were designed to advance Portuguese control of the trade routes.

Located on the coastal plain of Kalba, close to the edge of the mountains, is an

Figure 8: Date farms surrounding a new housing development on the plains
extensive Wadi Suq period burial site (2000-1300BC), which was excavated by Sharjah Department of Antiquities & Heritage. The site consists of a long, low lying stone built wall with interlocking individual burial cairns, aligned north-west to south-east. A single Wadi Suq burial cairn is also present at the northwest corner of the site. In addition, a number of smaller stone built burials of Samad type dating from the late Iron Age period, are located within close proximity to the Wadi Suq burials.

On the coastal plain midway between Kalba and Khor Kalba is a group of defensive structures located on three peaks of an isolated jebel. The site is located within an area of modern agricultural activity close to the edge of the mountains. The eastern peak of the jebel houses the Fujairah/Sharjah border marker. These stone built structures, probably dating to the late Islamic period, are likely to have served as lookouts and/or military living quarters. Such a site may be related to historical references concerning border disputes and skirmishes that took place along the Fujairah-Kalba border. Many of these recorded incidents are reflective of the period during which Fujairah was attempting to establish its independence under the Sharqiyyin chief, Abdullah bin Khamis, circa 1866. Incidents relating to territorial issues along the East Coast of the UAE were recorded throughout the 19th and 20th Centuries (Zahlan, R.S. 1978, The Origins of the United Arab Emirates).

A late Islamic period hillfort located on an isolated jebel on the coastal plain of Khor Kalba, close to the mountainous zone, may also reflect this period of instability, which lasted in the early decades of the 20th Century. Associated khaimah type houses are also present on the slopes of the jebel. These houses were rectangular in shape, semi-subterranean, with stone lined walls, and pitched roofs constructed with tree branches and bound woven date palm leaves. Located on an adjacent jebel to the west of the hillfort are further stone-built settlement structures. Situated to the west of this jebel, on the edge of the Hajar Mountains is an extensive late Islamic period settlement. Late Islamic pottery including red coarse wares (cooking pots) and Fine Wares (water jugs and containers) were noted at the site. Extensive shell scatters are also present.

An impressive corpus of rock art has been noted on the southeast face of an isolated jebel located on the coastal plain of Khor Kalba, close to the UAE/Sultanate of Oman border checkpoint (56°20′53.9N 24°59′21.4E). These ‘petroglyphs’ were manufactured via a subtractive process (rather than by the application of ‘paint’) using either indirect
or direct methods of percussion. This method of production is common throughout rock art sites in Southeastern Arabia. The motifs depicted on the rocks at Khor Kalba are comparable to material recorded at various sites in the UAE, including Wadis al-Hayl, Saham, Ashwani, Bidyah Mosque, Wadis Thayb, Ramth, ah-Shanah, Hassat al-Risoom (Fujairah), Khor Fakkan, area between Husn Awhala and Wadi Ramth (Sharjah), and Wadi Ash Sha’m (Ras al-Khaimah). The motifs and compositions found at Khor Kalba may also be compared with material from sites in the Sultanate of Oman. A further rock art site located at the border checkpoint of Khatmat Milahah was found by the noted British explorer Bertram Thomas in the early 20th Century.

Situated on the highest peak of the *jebel* containing the petroglyphs is a group of stone built structures preserved to heights of 1 to 1.5 metres. Their exact function and date has yet to be determined.

Adjacent to the rock art site is a single Wadi Suq period burial cairn dating from the 2nd Millennium BC. This above ground tomb was built with locally available mountain rocks and is oval in shape. The walls are corbelled and slope inwards to form a chamber which was presumably capped with large flat stone slabs, noted at the site. Two similar Wadi Suq burial cairns were also noted on the eastern slope of the mountains close to the border checkpoint. Comparable burials have been recorded in the Wadi Ghalilah, Ras al-Khaimah, (de Cardi, B. 1971.’Archaeological Survey in the Northern Trucial States’ *East & West*).

The rock art site also contains substantial shell deposits, sherds of late Islamic pottery, and a worked piece of flint. The fragment of worked flint may date from the 5th to 3rd Millennia BC (Arabian Bifacial tradition). Dating of the rock art is more problematic to determine with any certainty. There is a possibility that the earliest depictions date from the Iron Age (1300-300BC), with more recent additions continuing up until the early Islamic period or even more recently.

### 8. Current Landuse

Khor Kalba is widely regarded to be a protected area, although this is not backed up by formal decree and neither is the area yet managed as a reserve. Intermittent patrols do, however, prevent persons from harvesting crabs or removing other animals, although some such activities still take place, particularly by Arab and Asian expatriates.
The most conspicuous commercial activity surrounds fishing and fish-processing. Small fish are spread out on the ground to dry in the sun, thereafter being used for human consumption, animal feed and as fertiliser. Recreation in the area is also immensely popular, although at the present time little revenue is raised from this activity.

The potential landuse options available are sustainable agriculture with improved water management techniques, sustainable fisheries (in tandem with improved fisheries assessments and management plans), as well as the development of a Biosphere Reserve. Development of the reserve boundaries will progressively expand to encompass the entire town of Kalba, and convert this coastal village into a model for sustainable coastal development.

9. Discussion

Mangroves are of crucial physical and economic importance. They perform a valuable role in stabilising soil, buffering against storms and preventing coastal erosion, while mangrove trees themselves are a highly important source of primary production that supports commercial fisheries.

Mangrove vegetation and mangrove fauna are mutually interdependent. The complex structures of mangrove roots and pneumatophores provide protected nursery habitats for juvenile fish and shrimps, often of commercial species. Crabs are of great importance and have been described as ‘keystone species’ in the mangrove ecosystem. Crab burrows help to aerate the soil, which stimulates growth of the mangrove trees themselves, while grapsid crabs such as *Perisesarma guttatum* also play a key role in digesting leaf material from the mangrove trees. They also drag fallen leaves below the surface of the soil. These are either subsequently eaten, or decompose. The leaf-burying behaviour of the crabs retains mangrove productivity within the mangrove area. Ocypodid crabs extract organic particles from the mangrove soil, while the predatory portunid swimming crabs, being highly mobile, link mangroves to adjacent ecosystems. All small crabs are an important food source for vertebrates in and around the mangroves, including fish and birds such as the endemic, resident white-collared kingfishers and localised, winter visiting Indian pond herons.
The Kalba mangroves represent the last major foothold of the occurrence of the giant mudcreeper (*Terebralia palustris*) in the UAE, and the area should be protected to ensure that this valuable species survives.

The endemic *kalbaensis* subspecies of white-collared kingfisher mentioned above breeds only at Khor Kalba and nowhere else in the world (those mangals present at Khors Shinas and Liwa south of Khor Kalba in Oman are apparently unsuitable for nesting by this species. (One pair may be present and have attempted to breed at Khor Liwa in 2000-2002 (pers. obs.)). Sykes’s booted warbler (*Hippolais rama*) is also found breeding at Khor Kalba and Khor Liwa, Oman. The respective populations are 8-10 pairs and c16 pairs (own obs.). These are the only two known nesting localities for this species in Arabia.

Previous survey data, from different seasons of the year, show that up to 5% of the estimated world population of sooty gulls gather on the beach and offshore from Kalba during spring and early summer. Significant numbers of terns are also found in spring, summer and autumn.

The health of mangrove ecosystems depends on the maintenance of a suitable hydrological regime. The dredging of mangrove lagoons, and the deliberate clearance of mangroves, are often followed by coastal erosion and severe reductions
in fish catches, quite apart from the more obvious direct effects on the mangrove habitat. The overall contribution of mangrove ecosystems to the human economy is becoming recognised. One recent study assessed the inclusive annual economic value of mangroves as being of the order of $US 100,000 per hectare.

The area of Khor Kalba itself and adjacent associated habitats (beach, halophytic scrubland and flats) to the south of Kalba town and east of the Kalba to Oman highway is approximately 12 km² extending westward beyond the Kalba – Oman highway to the foot of the mountains, the entire area, including the beach-front north towards Fujairah, is of about 75 km². The total water catchment area of Wadi Rumh, the principal wadi flowing into the khor, albeit intermittently, covers an area (much of it mountainous) of over 100 km². All of the latter area would ideally be included in any Biosphere Reserve.

Biosphere Reserves are characterised by zonation to permit different activities in different zones, and a marine extension, out to sea for a minimum distance of 500m perpendicular from the shore (and preferably even further still), should also be given serious consideration.

The prehistoric and historical sites of the Kalba-Khor Kalba zone are significant in terms of the history and management of the surrounding environs. The presence of settlements dating from the 3rd Millennium BC to the Iron Age are a reflection of the area’s ability to sustain a substantial prehistoric population for an extensive period of time. Historical references (Portuguese, Arab and British) to the region also reflect the strategic and environmental importance of this stretch of coast subsequently.

The mangroves still present in the region today are presumed to have been far more substantial judging from historical accounts. References to the Qasimi (the confederacy of tribes located in Sharjah and Ras al-Khaimah territory) ships retreating into the numerous khors (inlets) and lagoons of the shallow coasts along the UAE are common (Heard-Bey, 1996, From Trucial States to United Arab Emirates). The Kalba-Khor Kalba area, assessed as part of this initial Biosphere Reserve assessment, is an area of considerable archaeological significance, not only for the prehistoric period but also for the local history of the region and indeed the Arabian Gulf.

There is also scope and sound ecological and political reason for making Khor Kalba a transfrontier reserve with neighbouring Oman. The integrity of the area would be greatly improved by doing this and it is therefore also recommended for
serious consideration. Designation of Khor Kalba as a Biosphere Reserve would not be, however, dependent on agreement being reached with Oman regarding this possibility. Mention was made above of the need for a marine extension to the ultimately designated area.

All of the following are existing threats to the integrity of the Khor Kalba area. Note that they are NOT listed in any particular order of significance. Some of the most important, actually or potentially damaging to the local environment and socio-economic situation, are discussed further later.

- Overexploitation. Over-fishing and excessive harvesting of other edible species e.g. swimming crabs (*Portunus pelagicus*)
- Grazing pressure (overstocking with sheep and goats in particular)
- Cutting of live wood
- Development of agricultural land (loss of land, input of pesticides/nutrients)
- Fly-tipping and dumping of rubbish (unsightly, with health concerns and pest problems)
- Encroachment by new residential development, housing projects (loss of land, hydrological disruption)
- Road-building (loss of land, disruption to local hydrology)
- Off-road driving (damage to the beach vegetation leading to erosion)
- Ghost-fishing by abandoned and lost nets (depleting stocks)
- Risk of waterborne pollution such as oil and other pollutants (with potentially devastating results to the habitat and associated faunal communities)
- Persecution (shooting) and trapping birds and turtles (the latter with low reproductive rates and long period until maturity being especially vulnerable)
- Disruption to the local hydrological regime (absolutely critical to avoid disturbing or stressing the system which is as yet not understood)
- Mismanagement or inappropriate land management (exacerbated by the lack of a management plan).
- Disturbance (not quantified or examined in detail as yet, but levels should be managed to prevent damage)
Khor Kalba has been subject to a number of commissioned and independent studies, all of which have called for designation of the area as a formal protected area. An area such as this, being of international importance and, rightly so, considerable world renown, but remaining without adequate safeguard is of some concern. It is a geographically small area and sensitive to perturbation and human intrusion. The hydrology in particular could be seriously jeopardised by development both nearby and at distant localities (some over ten kilometres away) within the ‘feeding’ mountain catchment. Any development plans within the catchment should only be approved after consultation with acknowledged experts. Activities that are damaging or potentially damaging, short-term and long-term, should be prevented. A full hydrological assessment must be made at the earliest opportunity. UNESCO can advise on the best and most cost-effective approach to the above and views this as of the highest priority in this locality.

It should be noted that just as certain threats may become a reality, there is conversely the ready opportunity to extend and expand the most valuable ecological asset, mangrove itself. This can be achieved by the carefully planned excavation of new channels through the saltflats west of the existing area and planting up of seedlings. In this way the scenic attraction can be increased while the populations
of a number of species, some rare or threatened, can be helped to increase. The increased productivity and concomitant increase in fertility of the system will also benefit existing fisheries.

UNESCO is willing to assist in the expert production of a management plan to ensure the integrity of the site remains undiminished. Any development as should be permitted locally should of course offer the guarantee of sustainability.

10. Justification for Biosphere Reserve candidacy

The following criteria are used to identify potential Biosphere Reserves:

1. Encompassing a mosaic of ecological systems representative of the biogeographic region and showing a gradation of human interaction.

2. Significant for the conservation of biological diversity.

3. Providing the opportunity to demonstrate sustainable development on a regional scale.

4. Be of appropriate size to foster landscape conservation, sustainable economic and human development and be suitable for demonstration projects, education and training, research and monitoring related to criterion 3 above.

5. Provide appropriate tripartite zonation, with a legally constituted core area or areas.

6. Possess organizational arrangements for the participation of all interested and concerned bodies and individuals, public and private, in guaranteeing the efficacy of the reserve

7. Notwithstanding provision being made for:
   a) mechanisms for management of human use and activities in the buffer zone or zones
   b) production of a management policy or plan compatible with its status as a Biosphere Reserve
   c) a designated authority or mechanism to implement such a policy or plan
   d) development of research, monitoring, education and training programmes
11. Biosphere Reserve designation

There is no question that the biophysical situation found at Khor Kalba, and within its catchment, lends itself to Biosphere Reserve designation. The biodiversity of this area, being of international significance, certainly merits robust safeguards being emplaced by the Sharjah government. UNESCO recommends putting forward the area for Biosphere Reserve designation and is willing to assist EPAA as and when required in preparation of materials for submission (see below).

The procedure leading to adjudication and designation of Biosphere Reserves, should the government of Sharjah wish to pursue the matter, would be as follows:

The EPAA, with advice and assistance, if required, from the UNESCO Office Doha, would complete a nomination form. This would then be submitted to the Advisory Committee for Biosphere Reserves for recommendation to the International Coordinating Council (ICC) of the MAB Programme.

Once formally notified of acceptance as a Biosphere Reserve a management authority

Figure 11: An archaeological excavation in progress at the Kalba tell
would have to be established. All reserves are assessed again after a period of ten (10) years to ensure appropriate measures in the spirit of the Biosphere Reserve network are being employed effectively. The ICC will once again adjudicate on the basis of the Advisory Committee’s recommendation, and, if remedial measures are required to ensure conformity, time will be given to permit these to take effect. If, after a reasonable time these are still not implemented, the area will be removed from the global network. The Director General of UNESCO will advise the State concerned of the decision of ICC. Conversely, a State wishing to remove a Biosphere Reserve from the network is at liberty to do so by informing the secretariat in writing. The process is notable for the lack of ‘red tape’ or bureaucracy.

It is strongly recommended that the above designation process be expedited (fast-tracked) with respect to Khor Kalba and its hinterland, including a marine component. The current study in Sharjah was a forerunner to other possible Biosphere Reserve nominations, both in Shajrah and in other emirates within the UAE.

12. Immediate objectives

The immediate objectives are threefold:

1. The foremost requirement is for the initiation of the process for the establishment of a Biosphere Reserve in the area of Khor Kalba, as suggested in this document. This can be done under permanent cooperation and in coordination with the UNESCO Office in Doha.

2. Additional studies into the marine ecosystems in particular, and into the coastal and terrestrial ecosystems in detail, are required in order to obtain a more comprehensive picture than that which is already in existence. Socio-economic impact studies should also be carried out.

3. A management plan for Khor Kalba and its catchment area should be produced in consultation with relevant specialists. Again UNESCO is available and willing to assist and to take the lead role should it be invited to do so.
13. Longterm objectives

1. To establish and manage, in demonstration of environmental sustainability, Khor Kalba as a Biosphere Reserve, with the long-term view to include terrestrial, marine, and urban areas located close by the Khor Kalba wetlands.

2. To carry out detailed studies into ecosystem functioning of areas, which are candidates for Biosphere Reserves. Studies of particular importance are those concerning primary productivity. This comprises, in the terrestrial arena, studies into rangeland grazing, and vegetation (cover, density, biological diversity, and palatable species) aiming at habitat restoration. In marine aquatic areas, studies into the marine/coastal vegetation - salt marshes, mangroves, seagrass beds, macro-algae, micro-algae - and coral reef communities) should be carried out.

Figure 12: An unsightly dumping ground adjacent to the main area of rock art
3. Special view towards the conservation and management of “flagship” species, including any highly endangered species and, where appropriate, commencing re-introduction and restocking programmes.

4. To survey the entire territory of Sharjah Emirate, in order to advance towards the establishment of additional Biosphere Reserves and/or World Heritage Sites, and thus improve the conservation of the emirate’s natural and cultural heritage. These designated areas will lend the opportunity to develop employment opportunities and generate income sources based on educational and recreational tourism.

14. Monitoring

Monitoring of the situation and actions taken is an essential process. Clear goals should be defined and worked toward, with a timetable for these improvements. UNESCO is willing to act as an independent assessor and coordinator at all times, if wished.

15. Further work

UNESCO is able and willing to offer its expertise in the following recommended projects:


2. Completion of a Coastal, Marine, and Terrestrial Resources Mapping project, aimed at the establishment of a comprehensive Sharjah national environmental database, and identification of other areas requiring conservation management - Project

3. To conduct detailed ecosystem studies, and socio-economic impact studies regarding the establishment of Biosphere Reserves and/or World Heritage Sites in Sharjah – Project
16. Budgets

1. To compile a Management Plan for Khor Kalba - Project.


Contract for four expert consultants (three months) 54,384 US $
Per Diem four expert consultants (three months) 48,048 US $
Travel 8,000 US $
Printing costs 5,000 US $
Sub-total 115,432 US $
Administrative support (13 %) 15,006 US $
Total 130,438 US $

2. To conduct detailed ecosystem studies, and socio-economic impact studies regarding the establishment and enhancement of Biosphere Reserves and/or World Heritage Sites in Sharjah, together with the production of an illustrated guide to the habitats of Sharjah – Project

Products: environmental baseline data; Book: illustrated guide to habitats in Sharjah

Contract for eight expert consultants (three months) 108,768 US $
Per Diem eight expert consultants (three months) 96,096 US $
Travel 16,000 US $
Report Printing costs 5,000 US $
Book Production cost 30,000 US $
Vehicle leasing costs 10,000 US $
Boat renting costs 10,000 US $
Equipment 5,000 US $
Sub-total 280,864 US $
Administrative support (13 %) 36,513 US $
Total 317,377 US $
17. Selected Bibliography


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