TRIBULUS

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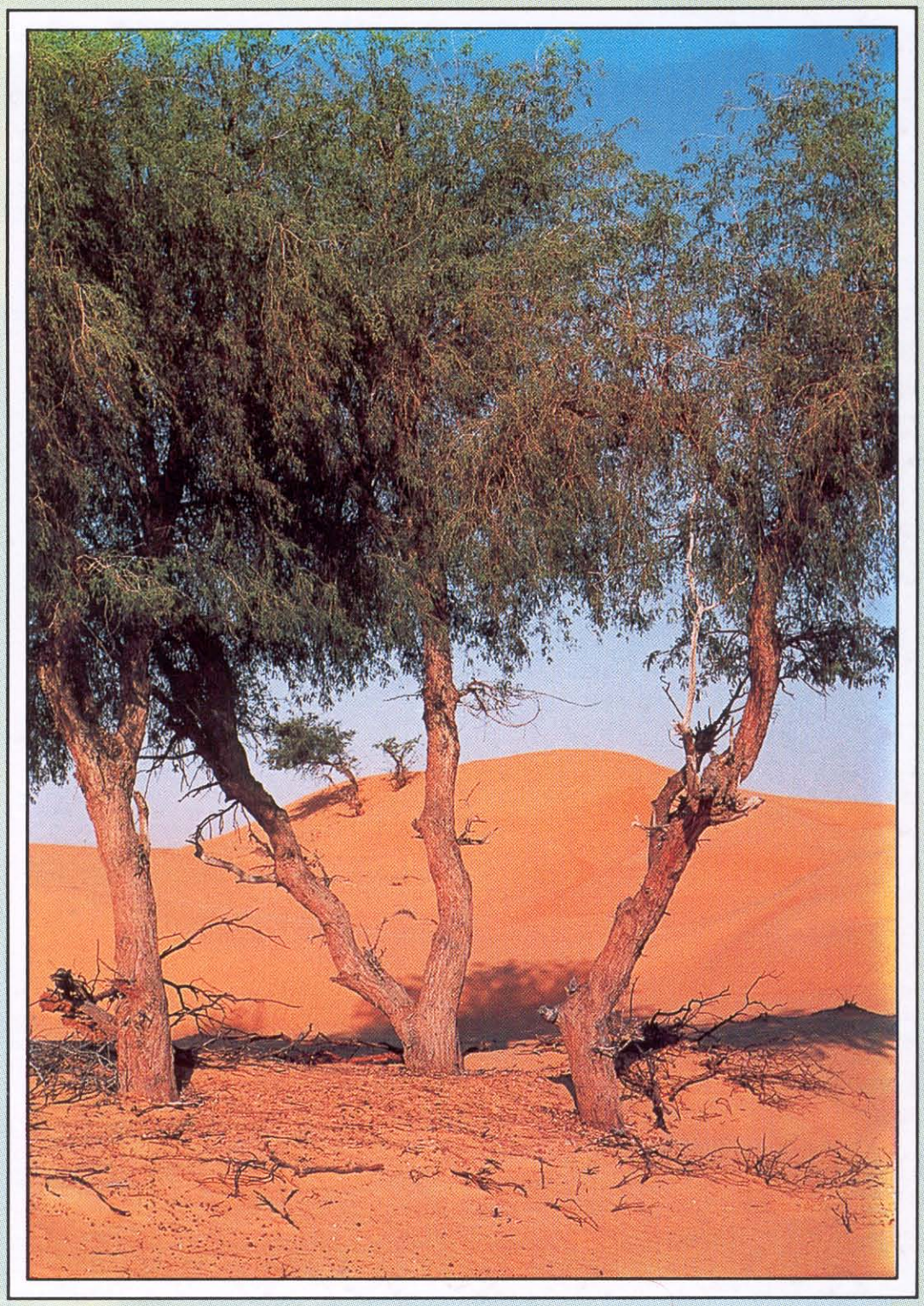
Vol. 7.2 WINTER 1997



NOTES FOR CONTRIBUTORS

TRIBULUS is the name of the Bulletin of the Emirates Natural History Group. The Group was founded in 1976, and over the next fourteen years, 42 issues of a duplicated Bulletin were published. The revised format of TRIBULUS, introduced in1991, permits the inclusion of black and white and colour photographs, not previously possible.

TRIBULUS is published twice a year, in April and October. The aim of the publication is to create and maintain in standard form a collection of recordings, articles and analysis on topics of regional archaeology and natural history, with the emphasis focussing on the United Arab Emirates and adjacent areas. Articles are welcomed from Group members and others, and guidelines are set out below. The information carried is as accurate as the Editorial Committee can determine, but opinions expressed are those of the authors alone.

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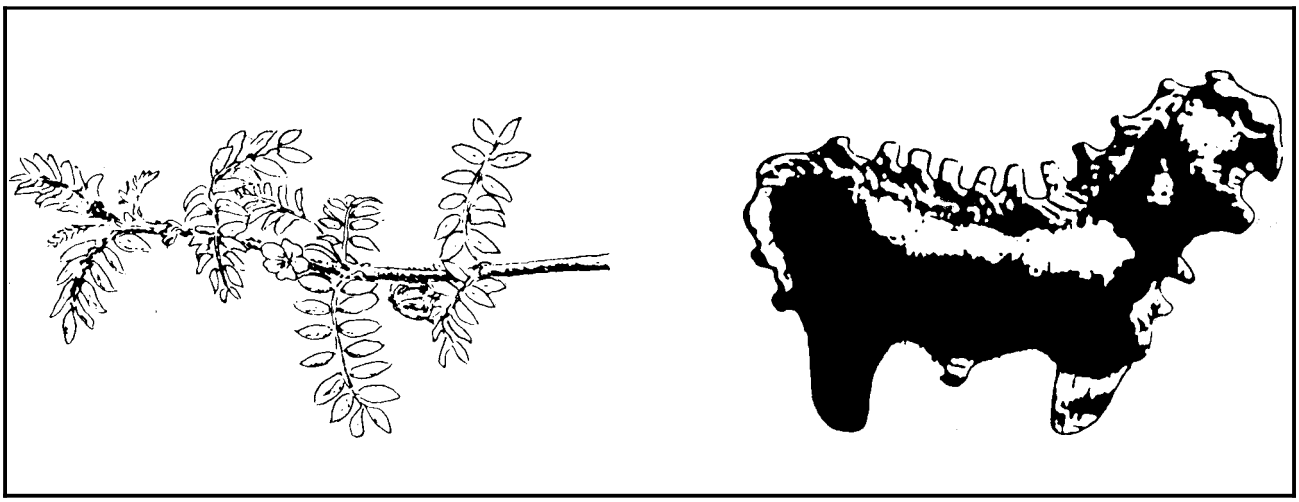

The plant motif above is of the genus Tribulus, of which there are six species in the UAE. They all have pinnate leaves, yellow flowers with free petals and distinctive five-segmented fruits. They are found throughout the country, except in coastal sabkha.

The animal motif above is of a tiny golden bull, excavated from the early Second Millennium grave at Qattarah, Al Ain. The original is on display in Al Ain Museum, and measures above 5 cm by 4 cm.

Manuscripts should be typed, on one side only, and double-spaced, and may be submitted in either English or Arabic. A short abstract should precede the article, with the address(es) of the author(s) at the end. For Arabic contributions, a short summary in English, of not more than 200 words, should also be supplied.

Photographs may be submitted and should be either glossy black-and-white prints or colour slides, which should be clearly captioned. Line drawings and maps should be in black ink on strong white or translucent paper.

References should give the author's name, with the year of publication in brackets, and with the list of articles, showing title and publisher, in date order.

Scientific names should follow customary nomenclature in Latin, while the English and, if appropriate, available Arabic names should also be supplied.

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Contents

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We also acknowledge the support and encouragement of our Patron, H.E. Sheikh Nahayan bin Mubarak Al Nahayan, the U.A.E. Minister of Higher Education and Scientific Research.

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Editorial

In **Tribulus 5.2,** October 1995, I referred to plans to reintroduce the African red-necked ostrich *Struthio camelus camelus* into the former range of the now extinct Arabian ostrich *S.c.* syriacus. Earlier this year ostriches bred in the wild in the Arabian peninsula for the first time in 40 years. These are free-ranging birds which inhabit the 2200 square kilometre Mahazat as-Sayd Protected Area in central Saudi Arabia. This successful breeding is a result of the introduction of 13 adults from Africa. In February this year four nests were found, two of which hatched, producing four and nine chicks from clutches of 13 and 33 respectively. After this success, new reserves are being prepared in the north and south of the country for future reintroductions of this nearest relative of the Arabian ostrich.

Meanwhile, the Bahraini Government has designated the 16 Hawar Islands a nature reserve, especially to protect the Gulf's largest breeding population of Socotra cormorants *Phalacrocorax nigrogularis,* dugongs Dugong *dugon* and Green turtles *Chelonia* mydas. The largest UAE colony of Socotras is on an island just offshore from Umm Al Qaiwain. The species has been vulnerable to industrial and pleasure developments on offshore islands and numbers have plummeted in recent years. Only 25 years ago the island of Zirku was home to tens of thousands and in 1980 I witnessed a breeding colony of an estimated 15,000 on Sir Abu Nuair island. Up to 15 years ago it was possible to watch a single flock of 100,000 + birds passing Das for hours on end. When they settled on the sea the surface was black to the horizon. Such days are gone except in the memory of old-timers offshore, but the speed at which a population can be drastically reduced is a poignant reminder of the fragility of habitats in and around the UAE.

The Government, of course, does, recognise the need for striking a balance between increasing material prosperity and protecting the environment in a finite area. In an interview with the Lebanese magazine "Environment and Development" in early October President H. H. Sheikh Zayed stressed the importance of preserving wildlife and wherever possible of reintroducing species that used to be part of the country's heritage. That the message is filtering down in illustrated by the recent example of a policeman at Medinat Zayed who held up traffic in both directions while he rescued a dhub which had strayed onto the main road. He then took it about a hundred metres off to one side before releasing it unharmed. The Arabian Leopard Trust is another instance of preserving a threatened species, while even the Arabian oryx is being considered for reintroduction. However, the relatively small size of the UAE compared to Oman, and the lack of suitable large wilderness areas may mitigate against the successful reintroduction of the oryx into a free-ranging habitat here. Furthermore, the designation of an area as a reserve is not necessarily a solution without problems. The recent forest fires in Indonesia are a reminder that catastrophes can and do occur. On a smaller scale, but with results that could be devastating for some species, is the case of the newly-designated Khor Kalba reserve which is extremely susceptible to oil slicks that continue to plague the East Coast. The problem continues despite the efforts of the Marine Pollution Control Committee, formed earlier this year to monitor East Coast waters.

In this issue Richard Hornby presents his findings of a survey of the habitats, invertebrate fauna and environmental sensitivity of the mainland coast of the UAE, including data on the distribution and status of crustaceans. We have had few records from the Group of crustaceans and this article goes some way towards redressing the balance away from the more popular topics. Two articles by Derek Gliddon (Head of the Geographic Information Systems mapping programme at ERWDA) and Simon Aspinall are concerned with desert conservation techniques. The first is an account of the use of GIS and its relevance to environmental recording, while the second gives a case study from the UAE desert. Qarnein, about 150 kilometres offshore between Zirku and Das, is the subject of a preliminary note on ceramic finds by Geoffrey King and Peter Hellyer.

The coastline, islands and sand desert are thus well represented in this issue, but not exclusively so. Birds get a look-in with an article on avian populations of the Al Madam plain, while geology is featured in Gary Feulner's article on hydrology and mountain wadis. Reptiles too make an appearance in Marijcke Jongbloed's observations of a dhub colony.

Finally it is good to see that ENHG members are receiving due recognition for their efforts in the natural history field. This year's Bish Brown Award goes to Steve James, while Simon Aspinall receives the Mubarak bin Mohammed Al Nahyan Prize. Congratulations are in order to both worthy recipients, and well done, too, to the ENHG.

A.R. WESTERN

The Application of GIS to Conservation

by Derek Gliddon & Simon Aspinall

Summary

The potential for the application of Geographic Information Systems (GIS) technology for wildlife resource management is described. This description is provided for a number of reasons. Firstly, GIS technology encourages the adoption of ecological principles in landuse policy and management plan formulation. Secondly, GIS and computing technology encourage collaboration, which is essential in establishing comprehensive environmental databases. Finally, to raise the awareness of the existence of resident expertise in Abu Dhabi working on the establishment of flora, fauna and habitat GIS-databases and to invite the participation of data collecting groups and individuals in the development of these facilities.

This account is written jointly by a GIS technical specialist and an ecologist 'end-user'. The two are joined by a common thread which is the application of data for environmental management.

GIS can be used to create a computer model of the natural environment. The natural environment is modeled in a GIS by the use of spatial databases, in which species, habitats and all other factors can be stored. Equipped with comprehensive databases and geographical query, analysis and presentation functions the GIS forms an environmental management support tool. A key feature provided by GIS is predictive analysis, by which the likely impact of developments can be assessed before any change to the real environment is made. This facility is powerful since it allows various scenarios to be played out and options evaluated.

A fundamental prerequisite for any information system is data, the greater the amount of data the greater the power of the information system. There is a paucity of environmental data in the UAE, and that information which is collected is largely uncoordinated and dispersed. The role of GIS in overcoming these difficulties is discussed.

Key Words: *GIS;* conservation; desert; *biodiversity; land*-use; environmental management; environmental *data*-bases.

تناقش الورقة أساليب تطبيق نظم المعلومات الجغرافية (جي آي إس) على المحمية.

Background and Rationale

The United Arab Emirates supports a predominantly desert landscape, receiving an average annual rainfall of less than 250mm. Abu Dhabi is the largest Emirate of the UAE, covering some 67,342 sq. km. Much of the Emirate is sand desert and it is this ecosystem which is the primary focus of this discussion.

The Abu Dhabi-based Environmental Research and Wildlife Development Agency (ERWDA) maintains several environmental databases holding data collected from within Abu Dhabi Emirate. Collection of data and its entry into computers is routine and ongoing; data arising from systematic surveys as well as opportunistic sightings. Amongst vertebrate groups the avifauna is the best recorded. Distribution information is 'reasonable' for larger herbivorous mammals. Floral communities of the entire country have recently been comprehensively surveyed, (Böer (in prep.).) The goal of such survey work within ERWDA is to have data, readily accessible, on which to base future landuse management decisions and as input to environmental impact studies.

The greater the amount of data held in any database the more meaningful will be any decisions derived from it. The natural environment is especially complex, with many inter-related mechanisms. If informed decisions are to be made about the environment then a great deal of data will be required to counteract its complexity. In the UAE, as in many parts of the world, there is a chronic data deficiency and that which there is often out-of-date*. A great deal of the known information has yet to be formally recorded, and what is recorded tends to be widely distributed and unavailable to others. A developer, for example, wanting to undertake a comprehensive (i.e. realistic) Environmental Impact Assessment (EIA) would be faced with a large data 'sourcing' task. Such obstacles tend to encourage token-gesture EIA's. The findings of an EIA usually restrict the activities of a developer; data deficiencies or accessibility problems can only support environmentally insensitive development. Effective environmental protection requires that these information difficulties be overcome. Providing a coordinated, collaborative environmental data repository is one of the primary aims of the ERWDA GIS programme.

*This does not however undermine the value of historical data as a basis for change detection.

Geographic Information Systems

GIS are computer database systems which facilitate the efficient storage, management, retrieval, analysis and display of location-referenced data and associated descriptive information. As a tool capable of manipulating complex, multi-theme datasets GIS have achieved a high level of refinement. Within the last decade GIS have achieved operational status; they are now considered an indispensable tool by a large and diverse range of organisations with a broad range of applications.

Properly applied GIS can lead to improvements in the completeness, objectivity and accuracy of analyses; this leads to greater confidence in their output and ultimately better-informed decision makers. Socio-economic is-

sues, for example, which are critically important in the success of landuse policy initiatives, but which are frequently complex in nature, can be incorporated into analyses by the use of GIS tools. Environmental analyses, prior to GIS, were: 'long-handed' (often to the point of being impractical), necessarily simplistic, error prone, and lacked objectivity and so lead to results of questionable validity.

In computing terms what comprises a GIS implementation varies tremendously. A GIS may be a single workstation running a single computer programme but equally it may comprise a heterogeneous mixture of wide-area networked computers running a diverse suite of software packages. GIS are differentiated from conventional database systems by their ability to operate upon geographically referenced data; their provision of spatial analysis tools and the use of map-based user interfaces. In short, they work on spatial data using geographical concepts and techniques.

Typically, organisations hold a great deal more spatial data than they realise. Spatial data may take the form of a map but this format is not mandatory. Any data that is related to a named place (area, or other feature) or coordinate can be readily incorporated into a GIS database.

Many GIS projects have failed because they did not live up to the unrealistic expectations of senior management who were initially over-sold on the technology (and under-sold on the timescales involved) by enthusiastic technical personnel who typically overlook the overriding issue - data, specifically the cost of its acquisition and conversion into computer format. Various studies have shown that typically (depending on the application) between fifty and eighty percent of the total cost of a GIS system (including labour costs) is spent in capturing data and making it usable.

Relational databases

Most modern database systems are of the relational type. This type of system stores data in tables where individual tables contain information about single concepts. Data about related concepts, held in separate tables, can be brought together on the basis of a common link. Where GIS bring benefit over other relational database systems is that in addition to linking tabular data through common columns GIS-enabled datasets can be related through their location. It is thus quite possible for two quite different datasets, collected at different times, for different purposes but which share a relevance to some conservation issue to be brought together on the basis of their geographic relationship; for example adjacency, separation or containment.

Shared databases - realising data synergy

One of the great benefits of GIS is its ability to integrate diverse datasets, from, for example, unrelated surveys. Data from different scales, coordinate systems and so on can all be incorporated and brought into a common display and analysis environment. For species distributions only the species name and its geographical location (and preferably observer and date of observation) are a minimum requirement, although clearly the more information the better the modeling potential.

A key factor in the concept of all relational databases, including GIS, is that the datasets do not have to be held in a single physical database. The database can be distributed, meaning that data can be physically held on different computers at entirely different (indeed remote) locations. The GIS thus becomes an interface to dispersed data. This is extremely important for a number of reasons. Possibly the most important factor in establishing a collective 'pool' of data, especially when there are multiple contributors, is to retain control of data with its 'owners'. If data collectors/recorders are required to handover data and relinquish control over it they are unlikely to cooperate. Modern computing technology readily facilitates on-line access to remote databases. Psychologically the collectors and recorders of data are likely to be much happier to share their data than to simply hand it, and thus control of it, to another body. In this kind of arrangement the 'owners' of data feel their data is contributing to a broader understanding of the environment without compromising the original purposes for its collection or their status as collector/coordinator.

The ability to access, display and analyse combinations of datasets which individually may pre-date the GIS and which primarily belong to another organisational function or indeed another organisation is one of the main advantages of this type of information system.

Remote Sensing - a partial solution to habitat data deficiencies

Remote Sensing is the name given to the technology of electronic imaging of the Earth, usually by satellite or aircraft. This technology offers many benefits to conservation, and is especially relevant to desert and marine studies. The high rate of change in the landscape (desert mobility) in regions like the Gulf states means that conventional maps are out of date almost as soon as they are produced. Management decisions are thus based on old information. Remote sensing data, especially from satellites, provides a cost effective way of obtaining regular updates on the state of the environment.

Conventional cartographic methods for representing the surface of the Earth have limitations in areas such as the Gulf countries. Traditional cartography requires that features of interest are delineated and represented by points, lines and areas. Themes of environmental interest, and desert landscapes in particular, can rarely be so clearly defined since one characteristic often merges into the next over some distance. The digital images provided by remote sensing instruments are matrices of reflectance measurements. Since these images are quantitative measurements of the Earth's surface they are not subject to the cartographic abstraction of conventional maps.

Satellite imagery combined with other habitat characterising datasets (e.g. topography, soil-type, distance from human activity) in a GIS provides a powerful tool for habitat characterisation, delineation, measurement and monitoring. The ERWDA GIS department employs sophisticated image processing software to delineate and map habitat units. This information will be combined with species distribution information to establish species-habitat associations.

Limitations in Ecological Data

In ecological surveys there are limitations of manpower, time, accessibility and so on which have, and which continue to, determine survey methodology, survey duration

and thoroughness. Rapid assessment faunal surveys, for example, have been undertaken using systematic methodologies but have also benefited from opportunistic observations. Geographical locations are now frequently determined using a Global Positioning System (GPS), but these have an instantaneous accuracy, in UAE, of only c.100 metres (Roshier unpub.). Furthermore, in Abu Dhabi data collection is only realistic in the cooler months, thus the data possesses certain temporal limitations. (See also below and following paper.)

Data Interpretation - Ecological considerations

Theoretical models may yield species distribution predictions which are at variance with observed patterns. This is not necessarily an error in the model but may be due to bias in observations, for example the arrival and presence of the observer is likely to effect sightings. Aerial photography, track, footprint and dropping observation and satellite and radio tagging may give improved information, but have their own financial and temporal constraints.

As stated above, in the Gulf states the climate certainly imposes a restriction on data completeness. For the seven or eight hot months of each year there is little or no field survey data so seasonal patterns may be difficult to determine with confidence.

Explanation of the distribution and density of different species or species assemblages may be correlated with habitat, for example a relationship between invertebrate diversity and plant biomass has already been established in Abu Dhabi deserts (Tigar in prep.). GIS with remote sensing data can be used to derive theoretical populations, carrying capacities or other non-directly measurable quantities by use of quantifiable parametric indicators. These estimates can then be calibrated against surveyed animal densities to predict actual population in unsurveyed areas i.e. by ground-truthing. Disturbance levels appear to be of major importance to wildlife, particularly in open landscapes and it is possible to derive objectively, with the aid of a GIS, where this is greatest, least and so on (see following papetj.

Fragmentation of plant or animal populations has long been recognised as a serious wildlife'management problem. With GIS it is a straightforward exercise to reveal habitat fragmentation and design remedial actions. For example, given the mobility of a species and the likelihood of natural recolonisation, whether, if other measures were put in place, re-introduction would be necessary. Such concerns are particularly relevant in UAE for species such as gazelle, oryx and leopard.

Complete areal coverage by ground survey is generally not feasible in any habitat - deserts being no exception. When full areal coverage is not available there is a possibility that maps of animal distribution may simply reflect observer distribution (& often do just that). A GIS is able to generate a potential or theoretical range map based on numerous, disparate environmental factors; for example vegetation, climate, soil, disturbance, complimentary and competing species. When the data available for analysis do not permit accurate density estimates for individual species, prime or core areas may still be identifiable. Alternatively the analysis may reveal data deficiencies, or unexplained gaps in distribution, which the ecologist is then obliged to explain and possibly instigate remedial actions (especially if man-made).

Of course ground truthing, i.e. field survey, is fundamentally important and will locate sites apparently of higher quality than others. During the course of survey work by ERWDA in Abu Dhabi, certain distributional patterns have emerged between species and habitat types, for example, mountain gazelles *Gazella gazella* cora with sand sheets; cream-coloured coursers *Cursorius* cursor with gravel plains; Ruppell's fox *Vulpes rueppellii* with high dunes and ***dhub*** lizard Urornastyx *microlepis* with sandstone/limestone outcrops. Unrelated taxonomic groups may also be associated, presumably by similar habitat preference, for example gazelle, eagle owl Bubo bubo acalaphus and long-legged buzzard Buteo *rufinus* have been found to co-occur in ***ghaf*** *Prosopis cinerea* stands. GIS is able to cross-check to show if these purported associations are valid and perhaps identify previously unknown associations.

Although much can be deduced from the output of the GIS itself, it is clear that a sound understanding of the ecological processes and the many inter-relationships in operation are required to define the models and apply appropriate management action (see following *paper*). Hence GIS, like all other information systems, must be firmly put in their place - they are information tools, albeit very powerful ones. GIS are a means to an end, not an end in their own right.

Conclusion

GIS technology offers tremendous potential as a conservation and environmental management support tool. The technology of GIS is well proven. The limiting factor is data. Environmental data for the UAE is geographically and temporally 'patchy'. Any data about the flora, fauna and habitats of the UAE have an important value in environmental conservation. The ERWDA GIS and database programme welcomes data contributions and on-line access in its attempt to provide a single point of focus for environmental information. No attempt to take ownership of data is intended, modern computing technology (including the Internet) facilitates on-line access of datasets held in computers spread across the country, indeed the globe. The primary issue of concern is collaboration and coordination in environmental data recording. Technology is no longer a limiting factor, only staff - a GIS technical specialist and one or more ecologists are required by any environmental research organisation.

Acknowledgments

Ron Loughland and Mrs. Theri Bailey read and commented on a draft of this paper and are thanked accordingly. Much of the data on ghaf distribution was supplied by Benno Boer while Ron Loughland was at all times a rumbustious and resourceful field companion. All are ever helpful colleagues and friends at NARC/ERWDA.

Reference

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GIS & the Conservation of Desert Areas: a case study from Abu Dhabi, United Arab Emirates

by **Simon Aspinall & Derek Gliddon**

تقدم الورقة دراسة عن استخدام نظم المعلومات الجغرافية على أكبر محمية في أبوظبي.

Introduction

This paper should, ideally, be read after the accompanying preceding paper by the same authors. The use of GIS as a 'decision-support' system is presented here by way of a case study from Abu Dhabi. Faunal examples are used to demonstrate some of the relevant capabilities and applications of GIS, while ecological information requirement and its interpretation is discussed, both with reference to conservation,

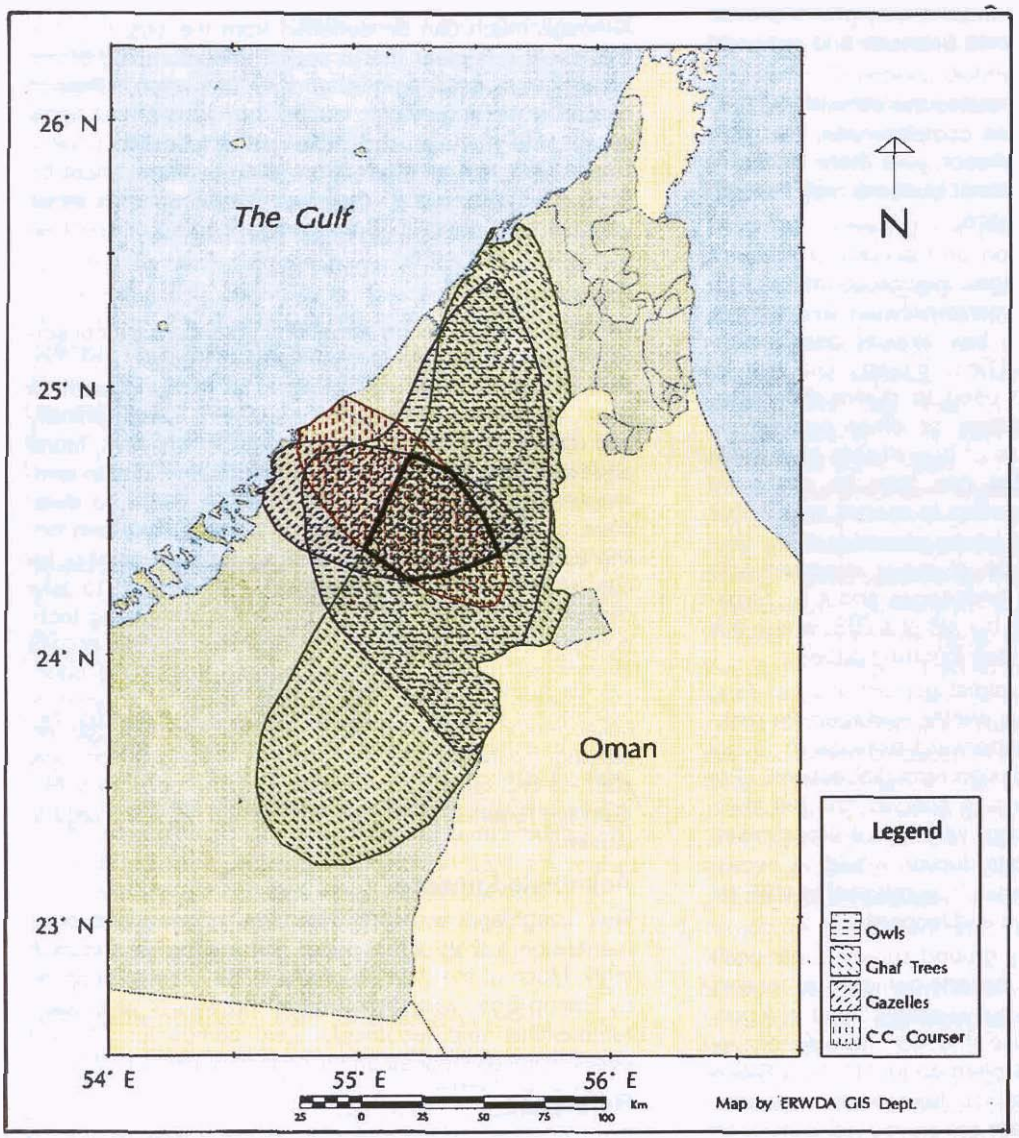

Figure I: Desert wildlife in eastern Abu Dhabi and Dubai

Background and Rationale

The Abu Dhabi-based Environmental Research and Wildlife Development Agency (ERWDA) maintains several wildlife databases holding data collected within Abu Dhabi emirate. It is the intention of the present paper to bring into focus the capabilities of GIS, particularly their predictive modelling capacity and its application in predicting the consequences of landuse practise and changes in desert areas, and the resulting effects on the indigenous wildlife. The ability to predict and not any predictions themselves is what is described. Some future research needs are also outlined, albeit briefly. The sand desert is the ecosystem under specific examination here.

The UAE desert is undergoing rapid development for agriculture, forestry and other uses; fields and plantations extensive already, are rapidly increasing m number. Apart from a network of desert protected areas, one important conservation goal is a reasoned and informed landuse policy for the Abu Dhabi deserts. These should reach an acceptable compromise between all parties but, as a minimum for conservation, ensure *in situ* maintenance of the country's biodiversity at viable levels without the need for excessive intervention in the future (see **Tribulus 6.1** pp. 5-9). There is no doubt that populations of some sensitive desert species are declining or are under threat and that habitats are being mis-managed to the point of serious. perhaps irreversible, damage.

GIS Application & Output

The applications of GIS for landuse assessment and wildlife resource management include: the targetting and specification of surveys; monitoring, 'gap analysis' (why is there a hiatus in a species' distribution?) and monitoring and measuring change through both location and time. It enables planning at a variety of scales but it is particularly useful at a landscape level c.f. 'landscape ecology'.

GIS has great flexibility in being able to accept and operate on data from unrelated surveys which use: different methodologies, differing scales or, more-or-less, anything else you care to mention. As a minimum only the species and its geographical location are required, although clearly the more information the better the modelling potential. Apart from graphic portrayal of presence and location, it is possible to show and quantify (subject to data availability) co-occurrence of species and nearest neighbours (see Figure 1). When density information is available, a map showing density distribution of any species can be produced to highlight the most or more important area or areas. For individual species the quality of an area can thus be assessed. One way a GIS offers greater value than the sum of the data it contains is its ablity to identify data deficiencies, or unexplained gaps in distribution, which the ecologist is then obliged to explain and thereafter possibly take remedial action to rectify i.e. restore lost ground.

GIS is able to assess landuse capability and trends therein, and also measure the suitability for differing uses. Measuring livestock carrying capacity (by measuring floral standing crop remotely) is an operational technique and the assessment of the suitability of current and former landuse systems are two further possibilities. It is possible that a 'hitec-bedouin' programme applicable to the UAE desert could be created which essentially dictates options as to when and where (and what size) herds should and could be at any given time related to the environmental carrying capacity, even if their movement between sites involves motorised transportation rather than passage on foot.

Fragmentation of plant or animal populations has long been recognised as a serious wildlife management problem. With GIS it is a straightforward exercise to reveal fragmentation and thence plan remedial actions. For example, depending on mobility of a species and the likelihood of natural recolonisation, whether reintroduction would be necessary. This is particularly relevant to conservation and the potential role of reintroduction, in UAE, for species such as gazelle, oryx and leopard. Severance is slightly different but produces the same net effect. This is, for example, when fences prevent free movement of (mainly terrestrial) animals cross-country. Camel fencing whilst obviously necessary also stops gazelles and could either exacerbate (or eliminate) livestock grazing pressure in a fragile ecosystem.

The impact of human activity is hard to measure absolutely and what is a deterrent for one species may actually be an attraction for another. Considering individual species or communities it is usually possible to forecast the impact of disturbance with a high degree of accuracy. Thus, for example, in a 'least' disturbed, high density *ghaf*/dune landscape habitat Gazelle, large numbers of rodents *Gerbillus/Meriones/Jerboa* spp., Eagle Owl and Long-legged Buzzard might all be expected to occur. Distance from major roads, tracks, forestry or agricultural activities, easily portrayed graphically by a GIS, may be a useful exercise to undertake to show remaining 'out of the way' parts of the UAE desert for just this reason.

Survey & Data Limitations

All the usual caveats regarding the difficulties of wildlife survey and the accuracy of the results required to show, meaningfully, distribution and abundance (relative or absolute) apply in deserts as in any other ecosystem. Specific illustrative examples include gazelles **Gazella** sp., **Houbara** Chlamydotis undulata and foxes **Vulpes** sp.

Gazelles are difficult to census in dune country and aerial reconnaissance may be the best survey method to employ; houbara are usually tracked, by professional trackers, with birds rarely, if ever, being sighted and foxes, for which trapping may provide an erroneous impression of abundance since animals appear to be less trap-shy in a resource deficient area (*pers.* obs.).

This subject has not been treated exhaustively here as this is not the purpose of the paper. Suffice to say that all data collected, in which there is reasonable confidence in the accuracy of the identification and the location, have been utilised in production of the accompanying maps. Nonetheless, survey methodology and inherent limitations need to be considered relative to the study objectives and results interpreted in the light of these shortcomings.

Specific Examples

Cream-coloured Courser *Cursorius* cursor

Cream-coloured Courser has proven to be a difficult species to census in Abu Dhabi. The population size is not known, but the species' affinity for flat interdune plains, mostly of gravel, during the breeding season is apparent. The easterly distribution observed reflects the disposition of such gravel plains within the country. Assuming this association has been accurately assessed, it is then a simple exercise to show the theoretical range within Abu Dhabi (or UAE) based on the availability of apparently suitable habitat. Discovery and introduction of other controlling variables into the model would improve the 'resolution' still further.

Mountain Gazelle Gazella gazella cora

The present range and relative abundance of gazelles within Abu Dhabi is reasonably well known. However, in many areas historical records show gazelle to have been very much more common. Hunting, disturbance and changed landuse presumably causing the declines witnessed. It is possible to identify, through GIS, optimum areas for gazelle, regardless of whether individuals (still) occur there, this could be a useful forerunner to successful reintroduction or restocking programmes. As stated above it is only the overall range which is shown by the map. A research/survey priority would be to collect the data to be able to produce a similar map showing gazelle density within this range. This is imperative to detect whether there is a core area or not. Fragmentation is a potential problem for remaining gazelle population~as may be fences preventing free movement cross-country.

Note that the map does not show abundance (animal numbers), range only is shown.

Ghaf *Prosopis cineraria*

Ghaf is important for wildlife, especially for birds, providing shade, food (invertebrates) and nest sites. In *ghaf* woodland, stand density may be, for certain species, of less importance than the level of disturbance, in particular avian predators such as Long-legged Buzzard *Buteo rufinus* and Eagle Owl *Bubo (bubo) ascalaphus*. Clearly to make the modelling more accurate some research is needed on species composition and population size relative to woodland area and structure. Mapping of top predators may be one of the best ways to measure habitat quality on the supposition that their presence indicates a 'healthy' ecosystem. Once again, this hypothesis may need independent objective evaluation.

Figure 1 shows the *ghaf* zone, without consideration for woodland density.

Eagle Owl *Bubo (bubo) ascalaphus*

Eagle Owl is considered resident in the UAE but there is certainly post-breeding dispersal of juveniles (which may then be sighted in improbable breeding sites) and possibly some wandering of adults outside of 'normal'

Ghaf-dwelling Eagle Owl pair.

Photo by Maarten Verhage

breeding areas. For these reasons, only breeding season observations are mapped. Although this may mean some actual sites are wrongly excluded, it also means that those sites that are included are of guaranteed quality. An association with undisturbed *ghaf* groves (see also above) seems evident. What may need examination is the strength of the association - would for example a single *ghaf* be sufficient for an Eagle Owl to nest under if there were next to no disturbance ? Similarly, for this species, individual foraging range and direction needs to be known for effective conservation action.

Desert Management & Planning

A call for the establishment of protected areas and for the development and adoption of wide-ranging landuse management policy and practise has been made repeatedly in recent years, (see for example Anon 1994; Aspinall 1996; Evans 1994 & Scott 1995). This is reiterated here. A prioritised rationale for the protection of single species and communities in the UAE and Arabian peninsula is in the process of being developed at GCC level. Red Data Lists of mammals and birds have recently been published (**Tribulus 6.1** & **6.2**, Hornby and Hornby & Aspinall respectively). Of the species mapped above, Mountain Gazelle is considered vulnerable and both Eagle Owl and Cream-coloured Courser threatened, all nationally so, hence their use as examples in this paper.

For sustainable usage, deserts, being especially vulnerable and sensitive habitats, require (resource) management. The traditional '*hema*' system adopted in the Arabian peninsula for the past 1000 or more years is just this, although in modern times the scale on which this system operates is proving to be insufficient. It is a fundamental tenet of the Holy Koran & sayings of the Hadith that man has dominion over nature but that he is ostensibly custodian and guardian. The concept of sustainability is not incompatible with Islamic beliefs in any way, it does, however, require legislative and other measures to ensure that resources are managed and utilised sustainably. It is important to realise that hunting and conservation are by no means mutually exclusive, although this may still be a common perception. Indeed modern thinking is that they are intricately and necessarily interlinked. Sustainable management of wildlife resources should allow traditional uses to continue and indeed foster them.

The composite map of Courser, Gazelle and Eagle Owl distributions shows clearly where these priority species occur 'in common'. Finding such an area may (ought?) then lead to their candidature as protected areas of some kind, as one of the many categories as proposed by IUCN for international acceptance viz. Strict Nature Reserve, National Park, National Monument, Habitat/Species Management Area, Protected Landscape, Managed Resource Area etc. (or zoned combination of these) whether for scenic/landscape, wildlife, resource use values, or at least for the adoption of a compromise sympathetic management practise - low or minimal development in this instance (see Aspinall 1996b).

Figure 1 showing a core area encapsulating viable measured populations of the example target priority species may also reasonably be expected to contain a sizeable proportion of the total desert biodiversity that it is sought to maintain. The area in this instance, by no small coincidence, includes an area popularly known as the 'public hunting triangle' shared between Abu Dhabi & Dubai. Obviously local knowledge did not require GIS to identify this area but what has been demonstrated by this exercise is that the area thus used as such might usefully be extended. At the same time as being used for hunting purposes, wildlife is also being effectively conserved. The two uses are completely compatible when appropriate management action is introduced. One final point, with fragmentation having been mentioned earlier, is that there are, all things held equal, sound ecological reasons for designating a single large area rather than two or more smaller units even if the latter total the same overall size (and still possibly so even if larger).

Conclusion

Priority species and communities for protection have already been worked out at national and regional scales, and on the basis of these lists a national protected area

plan can be formulated and presented in map form with documentation in support of the proposals contained in it (although surveys need to continue in many areas still). Wide-ranging landuse policies should also be drafted using GIS as a support system for the decisions reached. From both conservation and economic viewpoints it may be wise to bring in a moratorium on the commencement of new housing schemes and agricultural and forestry projects in desert areas and elsewhere to allow a critical stock-take to be undertaken.

Postscript

A dual carriageway is planned between Nahil new town, midway between Al Hayer and Sweihan, and Bida bint Saud near Al Ain, passing through the core area identified above as containing healthy populations of Courser, Eaale Owl and Gazelle The road is not in itself the main problem but the associated ribbon development (especially forestry and agricultural plots) and combined effects of severance and fragmentation will gravely deplete the value of this important near pristine desert area - one of few such areas remaining in the country.

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A Survey of the Habitats, Invertebrate Fauna and Environmental Sensitivity of the Mainland Coast of the UAE, with Information on Status and Distribution of Crustaceans

by Richard J. Hornby

Introduction

In July 1996 the UAE Federal Environmental Agency (FEA) commissioned from Southern Water McDowells a survey of the habitats and biodiversity of the intertidal zone of the UAE. Southern Water McDowells then commissioned the author to lead the project and carry out most of the fieldwork. A draft report on the survey was submitted to the FEA at the end of January 1997. The report covers the geomorphology, habitats, environmental sensitivity and invertebrate fauna of the mainland coast of the UAE. A copy of the report has been lodged in the Library of the Emirates Natural History Group, Abu Dhabi.

Fieldwork for the survey was carried out between 24 July and 2 December 1996, although data collection did not begin in earnest until early September. Fieldwork was therefore confined to a period of little over three months. In this period the whole of the mainland coastline of the UAE (nearly 800 kilometres) was visited in a four-wheel-drive vehicle. Data was collected on the physical characteristics of the coastline, the impact of man, the habitats, flora and fauna. At the request of the FEA, most attention was paid to the intertidal invertebrates. The data collected was entered onto tailor-made recording forms, from which it was entered into a computer. An Environmental Sensitivity Index was then created for the whole

تقدم الورقة نتائج دراسة عن الحياة البرية على سواحل دولة الإمارات، مع التركيز على أوضاع وتوزيع القشريات.

coastline. All this was combined with data from maps and satellite images and later transferred into a 'MapInfo' Geographic Information System (GIS) by the Geodata Unit of Southampton University, UK. The entire system was then given to the FEA, who now have the basis for a sophisticated environmental monitoring system for the UAE coastline.

Data was collected on marine invertebrates from a total of 185 intertidal sites, and comprised nearly 300 species from ten Phyla. Data was only collected on living specimens, and little attention was paid to the very large numbers and variety of dead shells of molluscs washed up on the shores. It is likely that most of the species represented by these shells would have been living in the intertidal or just into the subtidal, but if live specimens were not found, the species were not included. Wherever possible, identification was carried out in the field, but if this was not possible, specimens were collected and placed in 5% formalin for dispatch to Southern Science in Hampshire, UK. Most of the identifications were carried out by Ms. Juliet Thornton.

Some of the more useful publications used in identification are listed in the Bibliography.

The Invertebrates

The general state of knowledge of intertidal invertebrates in UAE is very poor, as it is for the Arabian Gulf in general. There is no up-to-date or comprehensive field guide, the best being that of Jones (1986), which is incomplete, out of print and very difficult to obtain. With the notable exception of molluscs, which have been well covered by Bosch et al. (1995), the amount of recent work on taxonomy, the availability of keys and guides and the number of people able to give useful advice is lamentably poor. Much of the taxonomic work on Arabian marine invertebrates has been carried out in the Red Sea or in Oman. It is possible that many species in the Arabian Gulf differ from those in the rest of Arabia, at least at the subspecific level, because of the degree of isolation and the very different ecological conditions, particularly on the sheltered, hot and hypersaline shores of most of Abu Dhabi Emirate. The form of some of the more common molluscs, which differ from illustrations in Bosch et al. supports this hypothesis, but confirmation will have to await much more detailed taxonomic studies.

The survey produced quite good information on polychaete worms (Phylum Annelida, Class Polychaeta), with a total of 63 different species being recognised, mostly to species level, from 24 different families. Some of the species which it was not possible to name to species level are likely to be either new subspecies or species new to science. As specimens could not be identified in the field, all the material collected had to be preserved and sent to the UK.

Molluscs were identified in the field using Bosch et al., and a total of 111 species were found. For most of the other Phyla, reliable identification was not always possible, other than by matching up specimens to the illustrations in Jones (1986) or other semi-popular publications. It was very difficult to find reliable names for many species within the Phyla Porifera, Cnidaria, Platyhelminthes, Echinodermata and Tunicata. It is not easy to preserve this kind of material without the animals losing their form and becoming difficult to identify.

The Crustacea, and the True Crabs (Brachyura) in particular, was the group which was easiest to preserve and dispatch to Britain for identification. Some of the specimens were returned to the UAE for use as a reference collection. It was not possible to find identification keys to all groups, and some specimens did not fit the descriptions in every detail (possibly because of the above-mentioned Arabian Gulf factor), but overall it was felt that the work was a very useful addition to knowledge on Crustacea of the UAE. No publications specifically on this subject have been found, so it was felt that it would be helpful to publish the following annotated checklist.

Annotated Checklist of Crustacea on the Mainland Coast of the UAE.

Class Maxillopoda

Subclass Cirripedia (Barnacles)

Balanus amphitrite. This was by far the commonest barnacle, being recorded at 104 sites, and effectively being ubiquitous.

Balanus tintinnabulum. This was only recorded at 7 sites but the species is believed to be much more common than this would suggest.

Cthamalus malayensis. Found at 4 rocky shore sites at Ras Al Khaimah and Khor Fakkan.

Euraphia sp. Found on mangroves near Abu Dhabi, on natural rock at Ma'rid (Ras al Khaimah) and near Jebel Ali, and on natural concretions in Khor Al Beidah.

Tetraclita squamosa. This very large and distinctive barnacle was found on virtually all the natural rocky shore sites on the Gulf of Oman coast, and at just one site on the Arabian Gulf side of Musandam, near the Omani border at Sha'am.

Lepas sp. (Goose barnacle). Only found once, on a fluorescent tube washed up on a rocky shore on the East Coast.

Class Malacostraca

Order Lepostraca

Nebalia sp. Only found once at Ras Kahaf on the Dabb'iya peninsula, west of Abu Dhabi.

Order Stomatopoda (Mantis Shrimps)

Gonodactylus demani. One impressive specimen, about 5cm long and believed to be of this species, was found in submerged crumbly rock at the mouth of the Ras Ghantoot channel.

Class Eumalacostraca

Rhopalopthalmus sp. Just one specimen of this small shrimp was found on a sheltered shore with natural rock between Shahama and Ras Sadr.

Order Isopoda

Ligia exotica. This large and fast moving isopod is very common on all natural rocky shores and some man-made breakwaters, generally at sites with high wave energy. It sits on bare rock in the splash zone and scuttles away when disturbed.

Occurs throughout, from Ras Ghumays in the west, to the Gulf of Oman coast.

Table 1. Distribution of Crustacea (Order Decapoda) according to habitat, on the mainland coast of the UAE.

	1. Exposed rock.	2. Exposed sand	3. Other rock/sand	4. Wide beaches	5. Sand flats	6. Lagoons
Penaeus sp.	■					
Alpheus euphrosyne			■			■
Emerita holthuisi		■				
Pacycheles natalensis			■			
Petrolisthes indicus	■					
Petrolisthes rufescens			■	■		■
Petrolisthes leptocheles	■					
Pisidia maequalis	■					
Diogenes avarus			■	■	■	■
Clibanarius signatus			■			■
Coenobita scaevola	■	■				
Grapsus spp.	■					
Ilyograpsus paludicola	■					■
Metopograpsus messor	■		■	■	■	■
Metopograpsus thukuhar	■		■			■
Metaplax indica						■
Uca annulipes						■
Uca inversa						■
Nasima dotilliformis			■	■	■	■
Ocypode rotundata		■	■	■		
Ocypode sp		■				
Scopimera crabricauda		■	■	■	■	■
Macrophthalmus depressus						■
Dotilla blandfordi						■
Iloplax frater						■
Portunus pelagicus			■	■	■	■
Charybdis sp.		■				
Thalamita poissoni						■
Pilumnus longicornis			■			
Pilumnus savignyi						■
Pilumnus vespertilio	■					
Pilumnus sp.			■			■
Leptodius exaratus	■		■			■
Eurycarcinus orientalis			■			■
Epixanthus frontalis	■					
Eriphia smithi	■		■			■
Lydia tenax			■			
Philyra scabriuscula		■		■		
Matuta sp.		■				
Menaethius monoceros	■					
Dromia sp.	■					
No. of species in each habitat	**15**	**8**	**17**	**8**	**5**	**22**

found on natural rock or concretions, in less exposed sites than L. exotica, including Khor Dubai.

Eurydice peratensis. Only found once, on the exposed rocky side of the dredged channel at the eastern end of Channel Street, east of Abu Dhabi.

Cymodoce sp. Found at two dissimilar sites - a rocky foreshore at Khor Fakkan and in the low shore at Khor Khuwayr, north of Rams, Ras Al Khaimah.

Tylos sp. This strongly rounded isopod is able to roll into a ball. It was found on the upper shore of three sandy sites in the Arabian Gulf from Ruwais to Zibara, and one rocky shore site in Fujairah.

Exosphaeroma reticulatum. Found once on an open sandy beach south of Jazirat Al Hamra, near the UAQ/ RAK border.

Exosphaeroma sp. Found once in faroush (concretions) on the west side of the Ras Ghumays peninsula.

Order Amphipoda

Ampelisca spp. The commonest genus of amphipod, widely distributed and found in a variety of habitats, but mostly sheltered, with some fine sand. Identification to species level was not possible.

Grandidierella exilis. Found at five sites, all very sheltered and not far from Abu Dhabi.

Cymadusa filosa. Found at two sheltered sites on concretions, at Yisrat Bu N'as near Shahama and in Khor Al Beidah, Umm Al Qaiwain.

Lembos sp. Found at only one site, which was fairly recently re-deposited fine sand near the eastern end of Channel Street, Abu Dhabi.

Urothoe sp. Found at only one site, on a hard-rock, exposed shore at Al Akkamia, near Dibba.

Amphipod A (Hyalidae). Found at six widely separated sites, all with some rock.

Order Tanaidacea

Leptochelia *?savignyi.* Found at six widely separated sites, all lagoons or very sheltered shores with fine sand.

Order Curnacea

Eocuma *affine.* This small shrimp-like species was found at only one site, in fine sand at the eastern end of Channel Street, east of Abu Dhabi.

Nannastacus sp. This small shrimp-like species was found at only one site, in fine sand in the Western Lagoon at Abu Dhabi.

Order Decapoda

Suborder Dendrobranchiata

Family Penaeidae

Penaeus sp. Found only amongst algae in the low intertidal of a rocky shore at Rul Dadnah, Fujairah.

Suborder Pleocyemata

Infraorder Caridea

Alpheus euphrosyne (Snapping Shrimp). A distinctive shrimp with an enlarged left chela with which it makes a loud snapping noise. There is probably more than one species of Snapping Shrimp in the UAE (Hogarth, pers. comm.), but they were not collected from every site where they were found. They occurred at many sites between Abu Dhabi and the East Coast. The species is likely to be present in all the larger stands of mangroves and most of the sites with natural rock or broken concretions, as long as they are not too exposed. The species was not found west of Abu Dhabi during 1996 but they were heard at a site on the eastern side of the Ras Ghumays peninsula in 1995.

Family Hippidae (Mole Crabs)

Emerita holthuisi. This very distinctive species was found on six sandy shores with high wave energy, all on the north-eastern part of the Arabian Gulf shore, between Jumeira and Ras Al Khaimah. They probably occur on all the sandy beaches along this stretch of coast but the technique for finding them, involving taking a sieve through shallow breaking surf, was not discovered until late in the survey. Mole Crabs are very adept at burrowing into wet sand but will 'play possum' on dry sand, looking very dead.

Family Porcellanidae [Porcelain Crabs)

Pachycheles natalensis. The species was found amongst broken dredged coral on a man-made shore at Khalidiyah, Abu Dhabi.

Petrolisthes *indicus.* Found at just one rocky shore site near Sharm, Fujairah.

Petrolisthes rufescens. The commonest of the Porcelain Crabs, occurring anywhere in the mid to low shore where they can find some shelter. They can be common in a variety of habitats along the whole length of the UAE coast. One can expect to find this species under nearly every boulder or lump of serpulid (calcareous tubeworm) colony that one picks up on any sheltered shore.

Petrolisthes leptocheles. Only found on four exposed rocky shore sites on the East Coast.

Pisidia maequalis. Only found on one exposed rocky shore site on the East Coast

Family Paguridae (Hermit Crabs)

Diogenes avarus. This is by far the commonest species of Hermit Crab in the UAE, being present in a variety of mollusc shells on all but the exposed rocky shores.

Clibanarius signatus. This is the commonest Hermit Crab of rocky shores, being very common on and amongst rock in Ras Al Khaimah and on the East Coast, but also present in the low shore amongst rocky faroush (broken concretions). The crab is distinctive as it has a dark body and legs but with golden tips to the legs. At one rocky shore site at Rul Dadnah, Fujairah, a little pile of hermits of this species were occupying the shells of no fewer than thirteen species of gastropod mollusc.

Coenobita scaevola. This is a large, strong Hermit Crab, associated with shores with high wave energy. It was only found in Ras Al Khaimah and Fujairah. The gastropod shells it was utilising were Hexaplex *kuesterianus, Nerita* sp. and Thais bufo. The crab is able to firmly seal the entrance of its shell, using its specially adapted front legs.

Infraorder Brachyura (True Crabs)

Grapsus spp. These are the conspicuous 'Sally Lightfoot' crabs which are common on exposed rocky shores and breakwaters from Dubai to Ras Al Khaimah and on the East Coast.

They are very nimble, moving rapidly on wet rocks and withstanding violent inundation by waves. Two or three very similar species are likely to be present (P. Hogarth, pers. comm.) and the commonest is Grapsus *albolineatus* (M. Apel pers. comm.). At least one species has colonized the Abu Dhabi breakwaters.

Ilyograpsus paludicola. This species was recorded from two very different sites – a rocky exposed shore at Khor Fakkan and within the fine sand of a lower intertidal part of the Khor Al Hamra lagoon, Ras Al Khaimah. This lagoon contains some broken concretions, but this is not where the specimen was collected.

Metopograpsus *messor.* This is one of the commonest and most widespread of all the UAE's crabs. It is fairly large (carapace up to 25mm) and distinctively coloured (olive and dark brown, with reddish legs), and can be found in all but the most exposed sites.

Metapograpsus thukuhar. This is much less common than the previous species, from which it differs in colour and having more parallel side to the carapace. It was found in a range of habitats – lagoons at Khor Qurayyah, Khor Khuwayr and Ma'rid, rocky shores at Dibba and Sharm, and faroush'near Jebel Dhana.

Metaplax indica. This was only found at one site, Khor Khuwayr, Ras al Khaimah, in the low shore in mud with concretions and rock oysters (Saccostrea cucullata).

Family Ocypodidae

Uca annulipes. This is much the commonest of the Fiddler Crabs. It occurs in relatively well compacted muddy sand. It was common, and in some places abundant, in the upper shore of some of the major lagoons, notably Khor Al Hamra, Khor Khuwayr, Khor Julfar, Ras Al Khaimah Khor, Khor Al Hamriyah, Khor Zawrah and Khor Kalba. Other species are clearly present and Khor Kalba is believed to have as many as five species of Fiddler Crab (G. Feulner, pers. comm.).

Uca *inversa.* This distinctive species of Fiddler Crab was

quite common in the mangroves at Khor Kalba.

Nasima dotilliformis (=*Cleistostoma dotilliforme*). This small crab is common on the upper shore of many sheltered sites in the Arabian Gulf. It was found in Khor Kalba and Khor Qurayyah and it probably occurs in all the major lagoons within the Gulf.

Ocypode *rotundata.* Previously widely misidentified as *Oxypode* saratan (Michael Apel *pers. comm.*). This is the large, sandy coloured Ghost Crab, which builds its distinctive pillars as a territorial signal near and usually just above the high tide mark. If is commonest on high wave energy beaches but can also occur in quite sheltered sites as long as the intertidal zone is not too wide. Thus it becomes more common from Al Taweelah eastwards. The species is said to be nocturnal but in cooler weather they were sometimes active in the middle of the day. About sixty were seen at 10 a.m. on 20 October. on a fine sand beach near Ras Ghanada, Indulging in some kind of territorial or sexual daplay. They can run very fast and also bury themselves very rapidly in wet sand.

Ocypode sp. A smaller and more delicate species than the above was only found on the Gulf of Oman coast, on sandy beaches, on which it can run with great speed.

Scopimera crabricauda. This is the very small sand-rolling crab which makes distinctive patterns with its 'pseudofaeces' in the upper shore of sandy beaches. It appears to be extremely common, or even super-anundant, but it is very easy to identify the signs, so other species may be relatively under-recorded.

Charybdis sp.

Photo by ***Richard Hornby***

Macrophthalmus depressus. This is a common and fairly large species found in muddy, sheltered sites, particularly those with mangroves. In which it may be the most conspicuous species.

Dotilla blandfordi. This was only found at one site. Khor Al Hamra, Ras Al Khaimah. Jones (1986) states that it is found around MHW on muddy/sandy shores; not common.

Iloplax frater. This very small crab was only found at one site, a sandy flat in the upper shore of Khor Al Beidah, Umm Al Qaiwain.

Family Portunidae

Portunus pelagicus. This is the distinctive and well-known Blue Swimming Crab, which has a carapace width of up to 16cm, and hind legs modified as paddles for swimming. It is believed to be common in all sheltered waters. It moves up and down the shore with the tide so it is rarely found at low water, but can be very common in the intertidal zone swimming with a rising tide. It is the most popular of the commercial species and is taken in very large numbers in Khor Al Beidah and Khor Al Hamra. Apart from netting, the most catching common method is to stab them with a small trident. In Khor Al Hamra two people were observed having success picking them out of the mud at low tide, with a heavy glove.

Eriphia smithi

Photo by ***Richard Hornby***

Charybdis *sp.* This is quite a large crab (carapace up to 6cm) with hind legs also modified as paddles for swimming. It was found on a few sandy beaches in both the Arabian Gulf and and on the East Coast, as well as in the big lagoons in Umm Al Qaiwain and Ras Al Khaimah. It is a different species from those illustrated in Jones (1986), being a different colour, and with a different pattern of spines on the carapace.

Thalamita poissoni. This medium-sized crab was only found in Khor Al Hamra, Ras Al Khaimah. Its habitat was quoted by Stephenson (1945) as being sandy mud and sand, and found to depths of 80cm. No doubt it is easily overlooked!

Family Xanthidae

Pilumnus longicornis. Only found on the rocky sides of the dredged channel near Shahama and at another site with rocky concretions a few kilometres to the north.

Pilumnus vespertilio. Only found on a rocky shore at Ru! Dadnah, Fujairah, but said to be a common and widespread species (P. Hogarth, *pers.* comm.).

Pilumnopeus vauquelinus. Only found in Khor Al Hamra, Ras Al Khaimah.

Pilumnopeus sp? Found at three sheltered locations, all with solid rocky concretions: Khor Dubai, Khor Al Beidah and near Jebei Dhanna.

Leptodius (Xantho) exaratus. A medium-sized, very slow-moving crab with distinctive black tips to the

chelae. Found on rocky shores and among concretions.

Common on the East Coast, in the lagoons in Umm Al Qaiwain and Ras Al Khaimah and around Abu Dhabi, but not found west of Dabb'iya.

Eurycarcinus orientalis. This is the very distinctive and locally abundant Violet Crab.

The carapace has a contrasting pattern of violet and cream, and is up to 4 cm in width. It inhabits the mid to low shore of very sheltered muddy sites, usually with mangroves. It was found at eleven sites, from Jebel Dhanna to Khor Kalba, and was the most conspicious/ abundant species in Khor Al Beidah and Khor Kalba.

On two occasions, both at dusk, the crabs were all out by their burrows offering a threat with their chelae.

Epixanthus frontalis. This rocky shore species was found at only three sites, all on the East Coast.

Xanthias sinensis. Found on two very different sites, in Khor Qurayyah and in a rocky shore site at Qidfa, near Khor Fakkan.

Eriphia smithi . Affectionately known as the Fat Crab, this large brown species can grow up to a carapace width of 10 cm. It is generally rather inactive, hiding under rocks, but it was found to be immensely strong. It was commonest on the rocky shores of the East Coast and occurs at a number of sites from Ras Al Khaimah westwards to Ras Ghanada.

Lydia (Ozius) tenax. The only place where this species was found was within ***faroush*** at Al Hadwaniyyah, near Jebel Dhanna.

Family Leucosiidae

Philyra scabriuscula. This very pale, long-legged little crab is found on exposed sandy beaches as well as in lagoons and other sheltered-Sites. It is probably much overlooked as it is thought to hide in the sand during the day and come out at night to feed on dead animal matter.

Family Calappidae

Matuta sp. (either ***M. lunaris*** or ***M. victor).*** This distinctive crab has a yellow carapace with purple mottling. It was only found at one site, the exposed sandy beach south of Jazirat Al Hamra.

Family Maiidae

Menaethius monoceros. This small Spider Crab was only found at one rocky shore site, at Rul Dibba, Fujairah.

Family Dromidae

Dromia sp. This was found at two rocky shore sites in Fujairah.

Habitats

The report of the 1996 survey, presented to the Federal Environmental Agency, divided the coastline of the UAE into six habitat types, based mainly on exposure to wave energy. These habitats and their respective lengths are as follows:

1. Exposed, high energy rocky shores at the base of cliffs, with boulders to provide shelter. 20km.
2. Exposed beaches of coarse sand and shell, with a steep beach profile. 120km.
3. Other shores with bare intertidal bedrock and sand. 150km.
4. Gently shelving beaches and flats of fine sand. 60km.
5. Very wide sand flats, usually with an underlying concretion of sand and shells. 200km.
6. Lagoons and other very sheltered wide intertidal zones of mud and fine sand often with a zone of blue-green algal mats in the upper shore and mangroves in the mid-shore zone. 250km.

The habitat preferences of the species of Decapoda have been related in Table 1 to the above six categories, which are in declining order of wave energy.

Conclusion

The main purpose of this paper is to try to rectify the dearth of published literature on the Crustacea of the UAE. It is by no means a definitive account as it is based on a short and very rushed period of fieldwork which started too early in the summer. It is hoped that the paper will assist and encourage other naturalists to observe and record marine Crustacea, and to publish their findings.

A provisional conclusion from the data on which this paper is based is that the Crustacean fauna is primarily associated either with rocky habitats or with sheltered sites with fine sand and mud. A lot of species are associated with Category 3 but this covers rather a broad range of shore types, the only common feature being the presence of both rock and sand. Few species were exclusively found in this habitat but several were found only on exposed rocky shores or in sheltered lagoons, or khors. The East Coast sites have the most diverse rocky shore fauna, and the richest of the sheltered sites are the big lagoons, in Ras Al Khaimah and Umm Al Qaiwain. The rocky shore sites are relatively unthreatened (though very limited in extent), but sadly this is not true of the lagoons. They are unique habitats with very high invertebrate diversity which in turn supports very large populations of wintering and passage birds.

The lagoons are very vulnerable as they can easily be infilled, and the habitats can be changed by altering flow in the channels. They were found to be the most environmentally sensitiye sites on the coast of the UAE because of their biodiversity and the difficulty of rectifying pollution- or other deleterious changes. The case for protection of these lagoons has been made many times, but the need is clearly reinforced by the new information on Crustacea, summarized in this paper.

Acknowledgements

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Thanks are also due to Dr. Peter Hogarth who was able to name some of the specimens for which identification

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ENHG Meetings - Sept. '96 to Sept. '97

1996

17 September : Leave no stone unturned, by John and Margaret Cooper
01 October : The mountains of UAE - people, culture and wild animals, by Moaz Sawaf
15 October : Birds and other delights of Central Asia, by Simon Aspinall
05 November : Marine Life of Papua New Guinea, by Robert Baldwin
26 November : Follow that Bird, by Bill Oddie
10 December : Releases of Falcons in Pakistan, by Fred Launay
17 December : The Holy Land, by Charles Turner

1997

07 January : Review of Archaeology in UAE, by Peter Hellyer
21 January : Jungle Odyssey - Wildlife of Northern India, by Geoff and Joan Gunson
04 February : Habitats and invertebrates of the Coastline of the UAE, by Dick Hornby
18 February : Sharjah Desert Park and Breeding Centre, by Christian Gross; AGM.
04 March : Ecosystems and flowers of the UAE, Benno Boer
18 March : Sabkhas and Sandspits, by Graham Evans
01 April : Wildlife of Australia, by Pat Slater
15 April : Recent archaeological discoveries in Ras Al Khaimah, by Derek Kennet
06 May : The World of Microbes, by Bill Dibb
20 May : Remote sensing of the UAE, by Mathew Evans
03 June : Specimens, GPS and Indian School, Members evening
17 June : Reptiles of the UAE, by Reza Khan
01 July : Wildlife conservation and community involvement in South Africa, by Peter Wright
02 September : Getting about in UAE, by Charles Laubach
16 September : Conservation and development in the Sahara, by John Newby, WWF

A Hydrological Oddity: Mountain Wadis that Fork Downstream

by Gary R. Feulner

For many years I have walked on weekends in the mountains of the U.A.E. and neighbouring Oman. I began by simply exploring, even before I had any maps of the area other than the standard road map. A question frequently asked of me was: "Don't you get lost?" The answer is no. But this is probably less a matter of talent than the application of some basic rules of solid geometry and natural phenomena.

Among the principles on which one can normally rely is that watercourses (including mountain wadis) fork or diverge significantly only in the upstream direction. In the downstream direction, they converge. Thus, for example, the Blue Nile and the White Nile converge at Khartoum to form the Nile, and not vice versa. A river does not diverge downstream, except around occasional islands that are small in relation to its overall scale and low in comparison to the surrounding relief. Accordingly, if you follow a wadi upstream you can easily return to your starting point by following the same wadi downstream (either by walking in the wadi bed or above it on an adjacent ridge), even if you have had to make occasional choices on the way up.

Recognized exceptions to the general rule are (1) the numerous shifting channels of delta environments (such as the Nile or Mississippi deltas) where flowing water meets a lake or sea, and (2) the so-called "braided streams" which typically flow from major glaciers, consisting of multiple sub-parallel interwoven channels interspersed with small islands of coarse sediment. Each of these exceptions exhibits the same underlying pattern: a stream with relatively high energy (either because it has a steep gradient or is constrained to a narrow channel), carrying a large volume of sediment, reaches a lower energy environment (a flatter and/or broader area) where it loses energy and therefore drops much of its sedimentary load and divides within and around that load.

تشرح الورقة التباين الجيولوجي لإثنين من الأودية الموجودة بجبال حجر واللذان ينفصلان بأتجاه المجرى.

A hybrid example of these two exceptions is seen where a watercourse experiences a major reduction in gradient at a discrete point along its length. In the U.A.E. this occurs at the point where wadis emerge from the Hajar Mountains onto the flat gravel plains. The best examples occur along the mountain front southeast of Dhaid. Here the typical steep-sided mountain wadis change character to form braided streams meandering across the coarse gravels, before regrouping against the desert sands to continue their journey to the sea. A sort of inland "delta" is formed as a result.

Downstream bifurcation may also be seen where a stream encounters an unexpected solid but malleable obstacle. In the UAE this can be seen at Rashidiya, west of Jebel Mileiha (Fossil Rock) and south of interchange no. 9 on the Sharjah-Dhaid road, where Wadi Fa'yah (which originates from the outflow of various streams that converge on the Madam plain) diverges in

Wadi Mayhah, looking towards a major bifurcation in the downstream direction. This phenomenon is very unusual in the mountain environment. The main wadi is on the left. ***Photo by Gary Feulner***

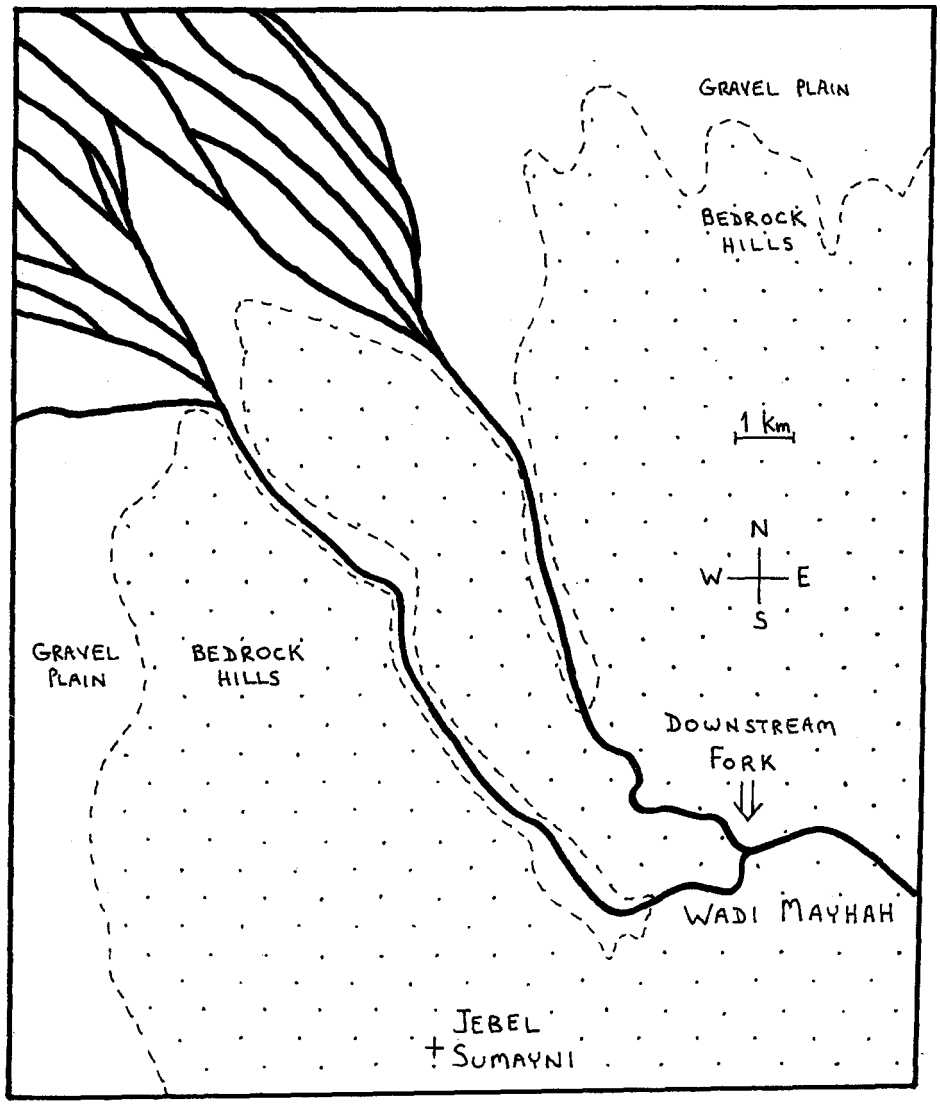

Fig. 1 :Sketch map of Wadi Mayhah, showing downstream bifurcation

the desert sands. One fork veers northwest to the desert north of Al-Awir, where it ends in a broad silty plain where sheep may graze after rains. The main fork continues north, then west, through the desert of Shariah and Umm al Qaiwain. In this case the phenomenon of bifurcation may be blamed on desert sands which now block a channel that once flowed freely but intermittently.

During heavy rains in 1987, augmented by water from the failed Shwayb Dam, the main fork of Wadi Fa'yah reached the coast at Ramtha in Ajman, and only the main coast road. prevented it from reaching the sea. Rolf Becker of MAPS (a Sharjah-based aerial surveying company) reports that the old channel was still discernible in aerial photographs, although no post-war maps recognize its extension in the coastal area.

In mountain areas the phenomenon of forking downstream is very rare indeed, and usually temporary. It results principally from what is called "stream capture," whereby erosion at the head or banks of one watercourse continues until it breaches the barrier separating one watershed from another. Once the barrier is substantially breached, the water entering each streambed above the breach has the choice of following either of the two watercourses. With time, one or the other will be favored (usually the one with the steeper gradient at the point of breach) and the other will be abandoned. Prior to abandonment, water will continue to flow in the less-favored channel only in times of extreme high water.

Two examples of wadis which fork downstream have recently been recognized in the nearby Hajar Mountains. One occurs in Wadi Mayhah, a major wadi which drains most of the area west of Jebel Hatta. Wadi Mayhah crosses the *gatch* track from Jebel Rawdhah to Mahdhah at a point about 16 kilometres south of the main road to Hatta. About 3 kilometres east of this crossing, the only two maps available to me (a 1:250,000 air map and a 1:100,000 relief map, both dating from the 1970s) indicate a fork to the northwest, which crosses the *gatch* road at a point about 13-11 2 kilometers south of the main road to Hatta. This appeared sufficiently unusual (and unlikely) that I investigated it with considerable skepticism, expecting to find that the maps were in error. As most such maps are made from aerial photographs (and the air map expressly cautions that it is not intended for ground navigation), thev mav occasionallv be in error in detail, as can be demonstrated in the field:

To my surprise, however, I was able to walk up the reported northwest fork exactly as shown, and into the main channel of Wadi Mayhah itself. The latter is clearly the dominant channel, and the bed of the unnamed northwest fork is slightly higher than the bed of Wadi Mayhah at their junction, but clearly flows away from, not towards, Wadi Mayhah at that point. Indeed, it contained flowing water less than a kilometer downstream when I visited. The two streams eventually rejoin, but only on the gravel plains at Madam, some 20 kilometres away as the crow flies, where both contribute to Wadi Yudayyah, itself a tributary of Wadi Fa'yah.

This example appears to be the result of continuing upstream erosion at the head of the northwest tributary until it breached the banks of the larger Wadi Mayhah. The area of the junction is a broad gravel terrace within the mountains, and the process of erosion may have been assisted by occasional flooding of Wadi Mayhah over its banks. Fig. 1 shows the geography of Wadi Mayhah and its northwest fork.

The second example of a mountain wadi that forks downstream is in Wadi Kub, and was brought to my

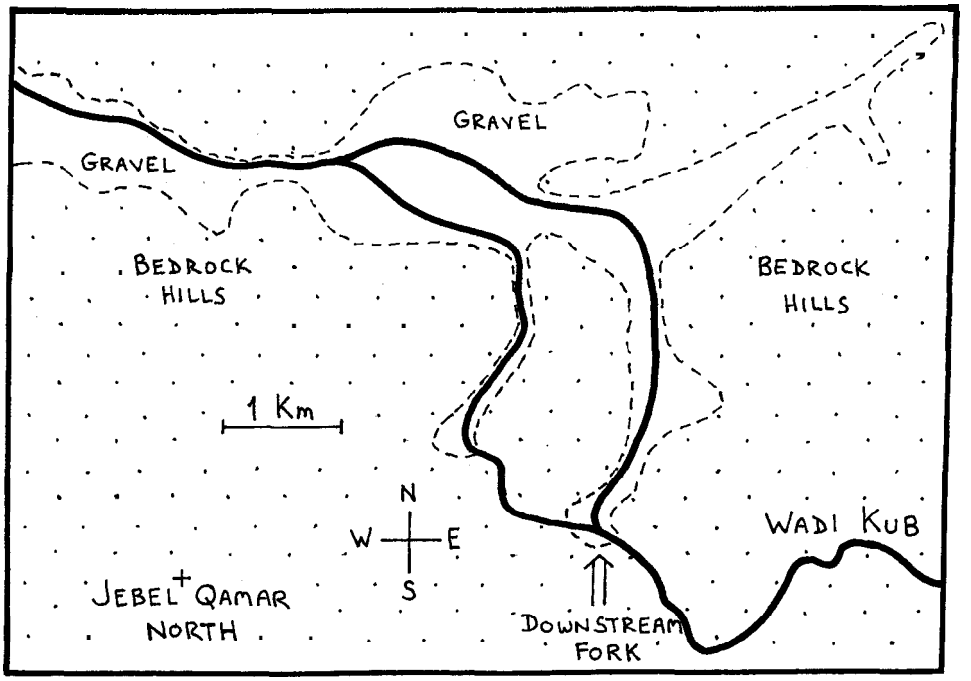

Fig. **2:** Sketch map of Wadi Kub, showing downsteam bifurcation

tention by Martin Parker, formerly of the Dubai Natural History Group, who takes very little for granted in the field. Wadi Kub is an attractive wadi east of Idhn that was first promoted as an off-road destination by the late Mr. B. Rajan of the Dubai Water & Electricity Department, known locally as the "Father of Maps," who featured it along with the off-road maps which he published annually in one of the U.A.E.'s English language newspapers in the early and mid-1980s.

I had visited Wadi Kub on a number of occasions, as it is of particular geological interest, but had never taken note of its unusual hydrology. Nevertheless, it is clear in the field that near the southernmost bend in Wadi Kub, east-northeast of Jebel Qamar North and approximately 9 kilometers east of the Ras Al-Khaimah-Manamah road, what at first appears to be a westerly tributary is in fact an outlet. Moreover it is an outlet which within a few hundred yards is seen to drop much more rapidly than the "main" gravel watercourse of Wadi Kub. The junction itself occurs in terraced gravels, and in this instance two smaller tributaries enter the combined watercourses just at the junction, while another larger tributary enters immediately upstream. From this it appears that the stream capture here may have occurred when a thin wall of gravels separating two adjacent watersheds was breached laterally near the head of the westerly channel.

Since the westerly outlet drops more steeply, it may be predicted that this will in time become the major watercourse, and it may even now carry the larger share of water when Wadi Kub is in flood. It should be possible to confirm this by observation shortly after rains. Ras Al Khaimah based observers are encouraged to take note.

The two channels rejoin approximately 5 kilometres downstream, each following an independent course through the Hajar Mountain foothills as shown in Fig. 2. The westerly channel, after cutting steeply through bedrock for more than a kilometer, joins a broader, flatter, northerly gravel wadi through which it returns to the "main" channel of Wadi Kub. It would be an interesting exercise to examine the westerly channel in detail, and the bedrock gorge in particular, for evidence of accelerated erosion following the apparent capture of Wadi Kub. This is suggested by the presence a couple of modest waterfalls within the gorge (they are otherwise uncommon in wadis in this area) and by the presence of at least one "hanging" waterfall that empties into the gorge, indicating possible disequilibrium between the channel and its own original tributaries.

It is worth noting that in this instance the mapmakers apparently shared the conventional bias of the geographer. Copies of three relatively recent topographic maps of Wadi Kub are available to me. On two of these, a 1:100,000 map dating from 1987 and a somewhat newer 1:50,000 map, both compiled and published in the United Kingdom, the westerly outlet is shown as a tributary of Wadi Kub and is not connected with its own downstream continuation. The third map, a 1:50,000 map published by the U.A.E. Armed Forces in 1991, arguably shows a continuous connection, but (perhaps not surprisingly) this is drawn so as to leave the proper interpretation open to question.

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Bird populations of the Al Madam plain, UAE

by Oliver L. Wardman, Benno Böer and Simon Aspinall

Abstract

This account provides information on breeding, wintering and migrant populations of twenty-six bird recorded on the Al Madam Plain in 1994. The plain is an area of Acacia savannah which contrasts markedly with the naturally treeless landscapes of most of the remainder of the country. Its importance as a major habitat type in eastern Arabia is outlined.

Key words

Bird survey, vegetation description, Acacia savannah. United Arab Emirates.

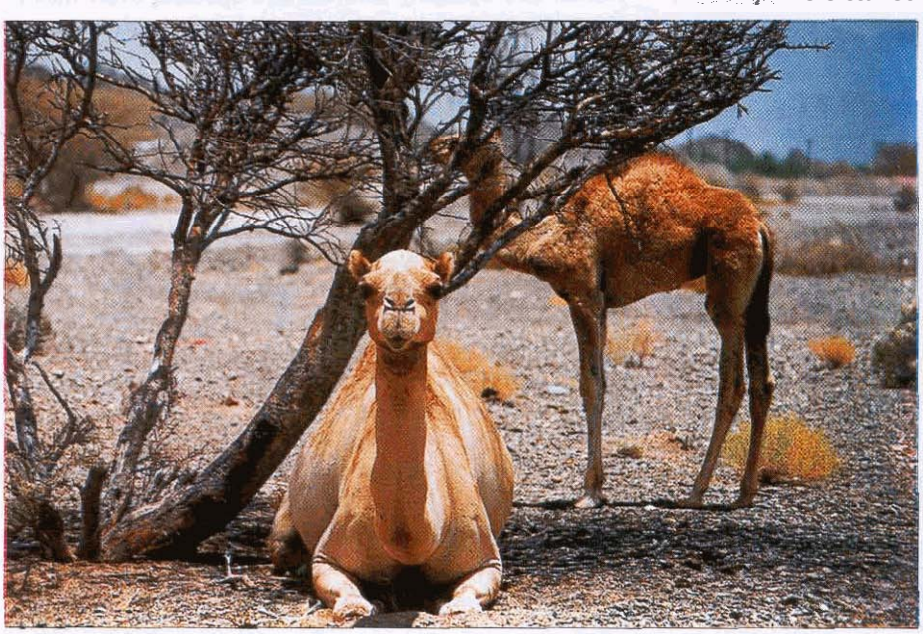
تقدم الورقة تحليلاً لعدد الطيور بسهل المدام الواقع بين منطقة الذيد والشويب، ويتضمن ذلك الطيور المهاجرة والمتزاوجة.

Introduction

A survey of breeding, wintering and migratory birds was carried out on the alluvial plain in the vicinity of the towns of Al Madam, Dhaid and Shwaib in the United Arab Emirates (UAE). The area was specifically selected for study as it represents a major biome of the UAE about which relatively little is known concerning birds or other wildlife. It is sited on the migration route of several species of bird. Acacia *tortilis* trees on the plain give it a 'savannah-like' appearance.

The alluvial plains run along the base of the Hajar Mountains starting in the north in Ras Al Khaimah and running almost due south into Oman south of Buraimi. Starting, as it does. near the Gulf coast in the north, this habitat provides a green 'corridor' along which birds on passage may travel and which presents an opportunity to feed and replenish fuel reserves. It is noted for its population of *Acacia tortilis* which forms the dominant woody vegetation at tree level. The Plain itself is an area of alluvial fans consisting of pebble and rock detritus overlaying gravelly alluvium close to the mountains, and Band and gravel further west where grain size decreases and winds have formed low dunes interspersed with fluvial deposits (Western, 1989). The survey area is sited adjacent to one of the main agricultural regions of the country, with the (fresh ground-) watertable occurring closer to Me surface than in most other parts of the country. Many shallow wadis run across the Plain and carry occasional flood water in winter, or more rarely, h other seasons.

The area has been put to a variety of uses by man and the consequent effects on the land have resulted in a v a n i of different habitats and mtcro-habitats. Much of the plain is still grazed in the traditional manner by goats and camels givhg the trees a familiar cropped look but probably not so intensively that vegetation density-has suffered: indeed the ground cover is quite rich in places offering a structured habitat suitable to many species including both residents and visitors.



The Acacia savannah is subject to heavy grazing pressure.
Photo by Simon Apinall

Method

Surveys were carried out using fixed radius point counts, a popular method for ease of operation and one that is suitable for studies of extensive areas (Bibby et *al*, 1982). Counts were taken at a chosen point for a period of ten minutes during which time all birds heard or seen within an estimated 100m radius were recorded. All counts were made in 1984, between January and May inclusive.

Ten points forming a rectangular grid were chosen. Five points were visited in a straight line each separated by one km, the next point lying two km from the last at 90 degrees and the remaining four running parallel to the outward points. Three of these' grids were visited twice (for replication) early in the season,. up until the beginning of March (the winter period), and then revisited twice between late

March and the end of May (spring) when the breeding season is at least part way through for most species. The first grid lay at the northern end of the chosen area some 20 km north of Al Madam, the second just outside Al Madam and the third near Shwaib. A Global Positioning System fitted to the vehicle allowed for an accurate return to each point. Grids were visited at the same time of day, starting around 4pm, to standardise the effects of time of day on bird activity.

The perennial vegetation was described at 20 different sites in the Madam Plain area. Dominant perennials, species composition and estimated vegetation cover were all recorded. This data is held at Sweihan Research Centre and is available for inspection by interested researchers.

Landscape description

The landscape of the Madam Plain is that of a savannah on a flat gravel plain interspersed with run-off systems and sandy hummocks. The majority of the plain is dominated by *Haloxylon salicornicum, Acacia tortilis* and *Pulicaria glutinosa.*

Results

Survey results are presented in Table 1.

Table 1. Winter and spring counts and relative abundance* of birds recorded on the Al Madam plain

Species	Relative abundance Winter	Spring (birds/km^2)	Status
Cream-coloured Courser *Cursorius cursor*	6.4	0	WV
Collared Dove *Streptopelia decaocto*	0	86.4	MB (Local)
Palm Dove *Streptopelia senegalensis*	38.4	41.6	RB
Pallid Swift *Apus pallidus*	6.4	0	WV
Little Green Bee-eater *Merops orientalis*	4.8	3.2	RB
European Roller *Coracias garrulus*	0	1.6	PM
Hoopoe *Upupa epops*	6.4	0	PM
Black-crwnd. Finch Lark *Ermptx. nigriceps*	115.2	76.8	RB
Desert Lark *Ammomanes deserti*	3.2	4.8	RB
Crested Lark *Galerida cristata*	6.4	1.6	RB
Pale Crag Martin *Hirundo obsoleta*	9.6	0	WV
Swallow *Hirundo rustica*	0	8.0	PM
Rufous Bush Chat *Cercotrichas galactotes*	0	1.6	PM
Isabelline Wheatear *Oenanthe isabellina*	12.8	0	WV
Desert Wheatear *Oenanthe deserti*	16.0	0	WV
Red-tailed Wheatear *O.xanthoprymna*	28.8	0	WV
Graceful Warbler *Prinia gracilis*	3.2	0	WV
Upcher's Warbler *Hippolais languida*	0	16.0	PM
Desert Warbler *Sylvia nana*	38.4	0	WV
Desert Lesser Whitethroat *Sylvia minula*	38.4	0	WV
Spotted Flycatcher *Muscicapa striata*	0	1.6	PM
Arabian Babbler *Turdoides squamiceps*	96.0	76.8	RB
Purple Sunbird *Nectarinia asiatica*	3.2	0	WV
Great Grey Shrike *Lanius excubitor*	83.2	73.6	RB/PM/WV
House Sparrow *Passer domesticus*	35.2	67.2	RB
Yellow-thrtd. Sparrow *Petronia xanthocollis*	0	6.4	MB

RB = resident breeder, WV = winter visitor, MB = migrant breeder, PM = passage migrant.

* The relative abundance for each season is calculated from the mean of replicate visits averaged for the three grids.

Discussion

Of the 26 bird species recorded on the Plain, eight were resident breeders, 11 were winter visitors, one a migrant breeder, five passage migrants, and one, a breeding species, Collared Dove, surprisingly proving to be a local migrant/wanderer. The population of one resident breeding species, namely Great Grey Shrike, was certainly supplemented by wintering individuals, and perhaps also by passage birds, from Asian populations (of the race *pallidirostris*) which is easily identifiable in the field. The local race *aucheri* breeds in southern Iran too and this population may also reach the UAE in winter.

It should be noted that the onset of breeding varies between species; for resident Great Grey Shrike it may commence in December whereas for Yellow-throated Sparrow, late April or May is typical. Conversely Palm Dove may have eggs in the nest in almost any month of the year.

The survey showed that the Plain attracted such common UAE breeding residents as Arabian Babbler and Great Grey Shrike as well as migrant visitors including three species of Wheatear (Desert; Isabelline and Red-tailed), Desert Lesser Whitethroat and Desert Warbler which remain for the winter. Passage birds of these same species probably also pass through the plain to/from alternative wintering sites further south. Such movements may occur in late winter (i.e. before late March) rather than in the 'official' spring. Spring passage visitors included Hoopoe, Swallow and Upcher's Warbler. Both Collared Dove and Palm Dove breed on the plain but, somewhat surprisingly, the former was only recorded in spring, whereas the latter was present throughout. Similarly, House Sparrow numbers increased in spring and may also have a regular seasonal pattern of movement. Purple Sunbird was found to visit only in winter, when the Sodom's Apple *Calotropis procera* is flowering. These observations prove there is much still to be learnt about seasonal movements and habitat use by many different bird species, even within the relatively well known UAE, and that much conventional wisdom may be incorrect. Late summer and autumn surveys are required to complete the picture.

The density estimates presented in Table 1 should be treated with caution and should not be used to compare densities of species in unrelated genera, since detectability varies between species (but is presumably constant within any given species and probably similar within any one genus). A correction factor certainly needs to be applied to the population density arrived at for mobile species, such as Arabian Babbler, which range widely and relatively rapidly. The survey method may need adjustment or results calibrating against figures achieved in an area in which absolute figures are known. At present this has not been completed. Since birds may leave a surveying area undetected, e.g. especially Great Grey Shrike, just as easily as they enter it undetected, and thence be 'logged' e.g. Arabian Babbler, during the recording period, under or overestimates respectively can arise. As such, however, the figures can still be used as indices of abundance and can certainly be used to compare the 'quality' of different areas surveyed, Aspinall (1996) having in fact proposed the use of Arabian

Babbler as a bio-indicator for this particular habitat (see also below).

At the most southerly survey grid near Shwaib, the Plain was at its narrowest, with only c.2 km between the sand dunes on one side and the mountains on the other. In many instances it appeared that birds recorded here were probably coming down from the mountains to feed over the plain, for example Pale Crag Martin, or conversely crossing the area to reach drinking water in the mountains. The same may be true in wider parts of the plain further north, but perhaps would not have been so easily identified.

The association between birds and different plant species and the vegetation structure has not been completely analysed to date, but it is clear that an association exists with constant specific preferences observed. The density and size of Arabian Babbler troops for example, for which the plain is clearly of national importance, is obviously regulated by the density of both A. *tortilis* and ground cover. Most feeding is at ground level. The Acacia canopy itself appears to be particularly valuable for a number of winter and passage visiting species to feed in (e.g. *Sylviidae*), quite apart from providing safety from avian predators and shelter (shade).

The importance of the plain for breeding, wintering and migrating birds is clearly a function of habitat. Systematic surveys throughout the UAE have shown that other than a zone dominated by ghaf *Prosopis cineraria*, most of the western, southern and central regions of the UAE are without trees as major vegetation elements (Western 1989; Boer in prep.). The Al Madam Plain is the largest example of acacia savannah in the UAE, and as such, every attempt should be made to maintain its wildlife interest through management of existing landuse practices on an ecologically sustainable basis.

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Observations in a Dhub colony

by Marijcke Jongbloed

Since the beginning of 1997, I have had the privilege of living in an area of sandy dunes separated by loamy plains. This areas is the home for the 'Dhub' or spiny-tailed lizard. From the very first day of moving into the new house, I have taken early morning walks on these sandy plains and observed the activities of the 'spinies.'

The Uromastyx uromastyx (formerly called Uromastyx microlepis) is a reptile of a length of about two feet, a fat body and a spine-studded tail of equal length. Recently someone told me he had seen a three-foot long dhub, but until I see one of those with my own eyes. I will stick to the two-foot size. They lay eggs that are about one inch long, which means that baby dhubs must be very small, but I have never seen a really tiny one. The smallest that I recorded was about 20 inch from the nose to the top of the tail.

Dhubs live in burrows with a entrance that is twice as wide as it is high, with a convex top and a straight bottom-half-moon shape. These burrows are quite difficult to spot from a distance and one needs to be on foot to find them. The tell-tale sign that one is approaching a

تقدم الورقة ملاحظات عن مجموعة من سحالي «الضب» في متحف الشارقة للتاريخ الطبيعي.

dhub burrow is seeing droppings. Dhubs are herbivorous as adults, though it is mentioned that very young dhubs will eat meat to provide them with protein for their growth. The plants that I have seen them eat so far are Zygophyllum sp., *Fagonia* sp. and Pennisetum *divisum* grass. The plains where they live have many other species of plants that are favourite ungulate fodder, like *Dipterygium glaucum,* Arnebia hispidissirna, *Tribulus terrestris,* Indigofera sp., Monsonia *nivea* and Stipagrostis grasses. When a dhub emerges from its burrow, it will sit at the entrance to become warm. Initially its colour is slate-grey all over, but when the sun's rays have heated up the cold-blooded reptile, the skin turns a mottled sulphurous yellow, with only the head remaining a dark grey colour. Its face is an ancient face that recalls dinosaurs and dragons, but there is nothing fierce about its gentle amber eyes. The skin is heavily folded on body

and neck. This allows the animal to puff itself up with air and make it seem much larger than it is whenever danger threatens. Since it cannot defend with its rather rasp-like teeth, it uses ifs spiny tail to lash out at a would-be predator. But it relies most on its speed to dive back into the burrow as a protection against predation. And this ploy probably works for most enemies except man. Local bedu used to catch dhubs for food in the days before supermarkets. They still savour a roasted dhub from time to time. The strong muscular tail is believed to be an aphrodisiac. To catch a dhub, they place a nail-studded plank near the entrance of a burrow and attach some nooses made of fine strong or plastic thread, which they place directly in front of the entrance. Any running full speed towards the burrow will hurt itself on the nails and diving for cover into the burrow will ensnare a leg in the strong noose. The plank prevents it from reaching the bottom of the burrow and enables the hunter to 'fish' it out easily. Sometimes a dhub will brace itself so tightly in the burrow, that the hunter will have to dig it out. These dug-up burrows are a regular feature on a plain that houses a dhub colony. I have heard reports of dhub burrows being up to 12 feet in depth, but I had never verified this myself. Recently some intruders into the dhub reserve were caught digging out one of the burrows. By the time they were stopped in their efforts their pit had reached a depth of 5 feet without having reached the animal. On the side of this pit the dhub burrow could be seen extending even further. Amazingly the size of the burrow at this point was 2 feet across and 1 foot high. What puzzles me is that there is never a large pile of dirt outside the burrow. Does the excavation take so much time that the sand brought to the surface is blown away by the winds...?

When the dhub has increased its body temperature it loses its reptile torpor and becomes active. It wanders a distance away from the hole and produces some droppings. A fresh dropping consists of one or two elongated black pellets of dry plant matter, followed by a drop of white urea (the bird and reptile equivalent of urine) and a little blob of orange jelly, which I have been told is a lubricant. The latter dries up very quickly and can only been seen in very fresh droppings. It takes several days for the white urea to disappear. The pellets stay for a very long time and it is the degree of blackness that can tell you how long it is been out in the open. By the time it has taken on the colour of the surrounding dry grasses, it is several weeks old.

Up until recently I have always thought that one burrow housed one dhub. But I had observed that whereas in most cases a burrow is surrounded by droppings of various ages, some burrows are surrounded by enormous masses of droppings, many of which seem to be of the same age, far more than one would be able to produce. One morning I came across two such burrows, and I noticed that the droppings were of various sizes. There were very large ones, each pellet being over 3 inches in length, others were medium sized at an inch or 2 and then there were tiny ones, less than an inch in length and very narrow. I wonder if these are family burrows. So I decided to do a little research. From one of the 'family-burrows' I removed all the droppings, and then did a daily count of the new droppings. During the first week there was a medium-sized and a very small scat every morning. The small scats were very close to the entrance of the burrow, the larger ones almost always around one particular stand of grass. In the second week I found only medium-sized droppings and for the last two days nothing, whatsoever. There was still activity at the burrow-foot and tail prints could be seen in the loose sand - so it was not deserted. An attack of constipation perhaps...? The research goes on!

Recently I discovered that there are two burrows which I can observe daily - one from the with binoculars and the other on my way to work, less than 10 metres from the road. Since I have started looking for the animals on a daily basis, I have seen that they do not emerge from their burrows early every day. I do not know yet whether they stay inside for two or three days at a time or whether on these days they emerge at a much later time of the day. I do not think they are out in the heat of midday, as they would become too hot, but they may be out again towards the evening.

Dhubs that are caught alive sometimes end up in the animal suqs. Whenever one comes across such an unfortunate animal, it would be best to release them again in the area of a colony, because they are extremely difficult to keep in captivity. Even though a variety of plants is offered as food, they seem to go on hunger strike, and finally die of starvation and stress.

The Natural History Museum of Sharjah is built on a plain which used to house a large colony of spinies. In the days before the development, I counted some 70 active burrows. Then one day in the late eighties I discovered 13 burrows with snares at the entrance and a half-dozen burrows dug up. It prompted me to try and get protection for these gentle dragons of the desert. Since the two square kilometres of the plains have been fenced off for the Desert Park, within the fences the dhubs are thriving. For every large burrow that houses an old adult, I have counted up to four small 'baby' ones. I have started a systematic count of the 1 sq. km that had less than 10 burrows left when it was fenced 2 years ago. In total I am now up to 40 living (pellet producing) animals. Taking into account the possible family burrows, there may well be more...

Postscript

Recently I heard from a specialist in North African arid regions that the dhub has been studied extensively there. He remarked that dhub populations explode after periods of heavy rain. The increased number of dhubs lasts for about three years, after which the numbers crash again. No one knows whether more eggs are laid during these periods, or whether eggs remain dormant for a long time until the rains bring about more food. So either the recent rains triggered the population increase at the SNHM & Desert Park or increased vegetation due to protection from grazing was a causative factor. For the dhubs it is '*kull wahdi*'.

A population cycle such as that described above is not entirely unexpected. It mirrors that observed of rodents such as northern populations of voles and lemmings, for example, there clearly being affinities between the vegetarian lizards (and presumably also rodents, such as gerbils) found in our hot deserts with rodents in the cold deserts of the world. These affinities are both structural and functional.

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A Preliminary Note on Ceramics from the island of Qarnein

by **Geoffrey** King and Peter Hellyer

تقدم الورقة تقريراً عن الفخاريات بجزيرة القرنين منذ القرن الأول بعد الميلاد.

Introduction

From 1989 onwards a number of visits have been paid to the island of Qarnein, approximately 130 km north west of Abu Dhabi. for the purpose of studying the history and natural history of the island, particularly its ornithology. The first of these study visits, in 1989, was undeitaken by a small party from the Emirates Natural History Group, among whom was PH, who subsequently ediied a preliminary report which appeared in the predecessor of Tribulus, the thrice-yearly Bulletin of the Emirates Natural History Group (1) During the course of this visit and a number of subsequent visits, undertaken primarily by Captain Maarten Verhage. Simon Aspinall and PH, a number of archaeological sites ware identified on the western side of the island, including an open mosque, a rectangular hearth and scatters of pottery. These were briefly commented upon in an earlier report to Sheikh Hamdan bin Zayed Al Nahyan (2), with the permission of whom all the visits to the island were undertaken.

In his capacity as Co-ordinator of the Abu Dhabi Islands Archaeological Survey, ADIAS (3), PH recognised upon re-examining photographs of some of the pottery located but not collected during previous visits that some might be of a date earlier than the Late Islamic period (ca. 16th Century AD onwards) to which much of the pottery had been provisionally ascribed.

On July 2-4 1997, following consultation with GRDK, then on a short visit to Abu Dhabi, Simon Aspinall and Captain Maarten Verhage made a further visit to the island at the invitation of Sheikh Hamdan. During this visit, a number of potsherds were collected and brought to Abu Dhabi for examination and preliminary identification by GRDK.

Methodology

In general, the methodology adopted by ADIAS is to leave artefacts, includina ceramics, in *situ.* prior to detailed surface survey aid, where appropriate, excavation. unless there is perceived to be a need for rescue archaeology to be undertaken. On this occasion, however, the approach was adopted of collecting ceramics from a number of distinct sites on the western coast of the island, bagging them separately. This was justified on the basis that any accidental destruction of the sites, or their covering by vegetation or wind-blown sand (whoh is already taking place) would have left us with no knowledge of the dating of these ceramics, which previous preliminary fieldwork, both on Qamein and elsewhere, had led us to suspect might be of particular interest.

As no archaeologist with appropriate ceramics experience has vet been able to visit Qarnein, it was, therefore, decided to undertake a selective collection of material for examination in Abu Dhabi.

Co-ordinates of the areas from where collections were made were taken with a Garmin Global Positioning System, GPS.

Pottery from Qamein, probably from the early centuries of the First Millennium AD.

Photo by *Nissar* Hoath

The total number of sherds retrieved was 57. The ceramics are currently in storage in the office of Sheikh Mohammed bin Zayed Al Nahyan, Patron of ADIAS. They were examined briefly by GRDK in Abu Dhabi between July 5-6 1997.

Description

The overwhelming majority (in excess of 85 per cent) of the ceramics are heavy, well-levigated reddish-brown ware, with ribbing. Most were body sherds. They are of a range familiar from other sites located by the Abu Dhabi Islands Archaeological Survey on the islands and coast of Abu Dhabi, and are dated to the early centuries of the First Millennium AD. They are probably to be assigned to c. 3rd/4th C. AD., although this dating may well be further refined in the future.

Ceramics of this period have previously been identified by ADIAS at Ghagha', al-Ufzai'iya and Yasat al-Ulya' and Yasat al-Sufla', all islands in the extreme west of the Emirate of Abu Dhabi (4) and also at Ra's Bilyaryar, on the mainland near Sheleala, north-east of Abu Dhabi (5). A limited number of ceramics have also been retrieved from a site at Abu Dhabi International Airport which are attributed to the early First Millennium AD (6).

No other sites from the same period have been published from anywhere on the coast or islands of the Emirate of Abu Dhabi, although there are known parallels in the northern United Arab Emirates, in particular at the coastal settlement of Ed-Dur (Ad Door) in Umm Al Qaiwain.

These sites identified by ADIAS vary in nature with those at Ghagha', al-Ufzai'iya and at Yasat al-Ulya' (North Yasat) in differing ways seeming to represent quite extensive settlements. By contrast, that at Abu Dhabi International Airport suggested a transit point or camping ground, rather than a settlement.

The c. 3rd/4th C. AD ceramics from Qarnein that are the subject of this note were recovered from amid scrub behind the beach along the western side of the island. Although in the general area of an Open Mosque (Site Q-2) and a Rectangular Hearth (Site Q-3) mentioned in an earlier report to Sheikh Hamdan (7) (both of possible Late Islamic date), the ceramic? did not seem to be associated with any structural remains.

However, without further examination of the locations from where they were collected, it is difficult to draw any firm conclusion about the nature of the sites to which they relate.

This group of ceramics from Qarnein belongs to a period which was until recently unknown in the archaeological chronology of Abu Dhabi. Since the formation of the Abu Dhabi Islands Archaeological Survey in 1992, however, ADIAS has identified ceramics and other finds of the period in at least six locations on the islands and coast of Abu Dhabi, of which Qarnein is the latest to be found.

Unlike all the other sites, Qarnein is well offshore. It should be noted, however, that three other offshore islands to the northwest of Abu Dhabi island, Arzanah, Das and Zirku, have been extensively developed as bases for the oil industry in recent years. No archaeological survey was undertaken on these islands prior to development, although a Late Islamic graveyard is known to exist on Das (8) and a Late Islamic shell midden still remained on Arzanah in 1995. No sites of any kind could be identified on Zirku (9). The loss of archaeological data from these islands, if it existed, adds to the importance of the Qarnein discovery.

Subject to the receipt of approval from Sheikh Hamdan, ADIAS plans more detailed work on Qarnein in a future season to attain a clearer idea of how this early First Millennium AD occupation relates to other contemporary sites on the coast and islands of Abu Dhabi.

Acknowledgement

The Abu Dhabi Islands Archaeological Survey acknowledges, with thanks, the permission granted by His Highness Sheikh Hamdan bin Zayed Al Nahyan for the July 1997 and earlier visits to Qarnein, during which the ceramics discussed in this note were noted and subsequently retrieved for examination. It further thanks Captain Maarten Verhage and Simon Aspinall for logistic support.

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NOTES AND QUERIES

Hyena sightings?

The status of the Striped Hyena Hyaena hyaena, still relatively common in south western Arabia, has been a matter of confusion in the United Arab Emirates, with some authorities believing it to be extinct, and others that it may survive, though without factual data to support their conclusions.

Thus the species was included in a 1996 Red List of Mammals for the UAE (1) among the group of animals extinct in the wild, along with Arabian Wolf *Canis lupis* arabs, Arabian Oryx, Oryx *leucoryx*, Wild Goat Capra aegagrus and Nubian Ibex Capra ibex.

Information relating to the species in a book published for the National Avian Research Centre, part of Abu Dhabi's Environmental Research and Wildlife Development Agency, ERWDA **(2),** suggests that the species "probably maintains a toe-hold in the Emirate (of Abu Dhabi), having been in the past much commoner", but cites no record more recent that "one dead by the Al Ain/ Dubai road about 13 km from Al Ain in the 1980s."

Another authority (3) says: "since the animal appears to be absent from northern Oman at the present time, the chances of the hyena reoccurring in the United Arab Emirates seem to be slim."

Evidence has now come to light, however, which, although not conclusive, suggests that the species may still exist in very small numbers.

In late November 1996, Al Ain resident Peter Rothfels spotted an animal near dusk running fast along a shallow wadi or sayh forming an inter-dunal plain between Sweihan and Al Ain. The location was close to a permanent encampment for camels.

He described the animal as being : "very hairy, blackish and brownish, about the size of a goat but hunched up closer to the ground... It wasn't a fox: I've seen lots of foxes. It didn't have a tail."

The animal was running fast but seemed "to be lower in the rear, kind of hunched up at the front, which suggests shorter back legs."

Striped hyenas do, in fact, have small tails, but tend to curl them between their hind legs when running, which would explain the failure by Rothfels to sight the tail.

The description is strongly indicative of a hyena, but, in the absence of a description of the striped pattern, or of the footprints, is not quite sufficient to be conclusive evidence.

Another report, albeit second hand, has been made available by Moaz Sawaf, of the Arabian Leopard Trust, who has advised that villagers in the Wadi Helou, in the Hajar Mountains, reported a sighting of a hyena in June 1996. Calling the animal by the local Arabic name for hyena, (*dhibba*, rather than dheeb, the word for wolf), the villagers described an animal of the right size to Sawaf, and also clearly described its striped pattern. They did not, however, describe the different lengths of the fore and rear legs, although since the animal was seen running up the mountainside, this might not immediately have been obvious.

The Wadi Helou report, again, is not conclusive, but is certainly indicative of the possible survival of hyenas in the mountains.

It is also possible, indeed perhaps probable, that the Sweihan report may refer to hyena. With the expansion of human activity in the desert, including the greater number of sheep and goats, there is certainly more food available for hyenas than there once would have been.

Hyenas can travel large distances, and it has been suggested by the Director of the Sharjah Natural History Museum and Desert Park, Dr. Marijcke Jongbloed, that the Rothfels sighting may indicate that animals that have become extinct locally can re-establish themselves by spreading from populations across the border in Oman.

"If wildlife reserves are created, such animals can find them themselves, without the need for a formal reintroduction programme," she says.

Over the last few years there has been substantially more research into the UAE's mammals than heretofore, with a number of significant discoveries being made, including the re-discovery of the Arabian Tahr Hemitragus jayakari, first in the mountains of Fujairah **(4),** and then on Jebel Hafit (5).

There have also been second-hand reports from mountain villagers that other large mammals such as the Arabian Wolf may survive (6).

The two reports of Striped Hyenas, although not confirmed, underline the necessity for further research to be undertaken.

Acknowledgements

I am grateful to Charles Turner, former Chairman of the Al Ain Emirates Natural History Group for first drawing the Rothfels' sighting to my attention, to Peter Rothfels for his data, and to Dr. Marijcke Jongbloed both for providing details of the Moaz Sawaf report and for commenting on a first draft of this note.

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Sheikh Mubarak Prize

Simon Aspinall has been chosen as winner of the Sheikh Mubarak bin Mohammed Al Nahyan Prize for Natural History for the year 1997. The Prize, the only award of its type in the United Arab Emirates, was established by Minister of Higher Education and Scientific Research (and ENHG Patron) Sheikh Nahayan bin Mubarak Al Nahyan, and is awarded to a person deemed to have made a major contribution to scientific knowledge of the country's natural history.

Aspinall was chosen as this year's prize winner for his ornithological work, in particular for his ground-breaking publication **Status and Conservation of the Breeding Birds of the United Arab Emirates,** reviewed in **Tribulus 6:1** (April 1996). Formerly a staff ornithologist with the Environmental Research and Wildlife Development Agency, ERWDA, he is currently Heritage and Environment Editor of the daily ***Emirates News,*** while he is also a member of the Emirates Bird Records Committee and an Assistant Editor of this journal.

The Bish Brown Award, created by the Emirates Natural History Group in memory of its founder member J.N.B. 'Bish' Brown, and awarded to an amateur naturalist who has made a significant contribution to the promotion of natural history in the Emirates, has been won for 1997 by another Assistant Editor of this journal, also an EBRC member, Steve James.

Currently Bird Recorder for Abu Dhabi and the ENHG Vice Chairman, James was chosen both for his ornithological work and for his effort in promoting natural history through lectures, school trips and the organisation of outings and excursions, which have introduced many people to the delights of the UAE's environment and wildlife.

RICHARD HORNBY,
Chairman, ENHG

WWF mission not impossible

During September of this year, Senior Conservation Adviser at WWF, John Newby, was in the UAE on a fact-finding mission at the invitation of, and hosted by, Abu Dhabi's Union National Bank (UNB).

This was a time for a frank exchange of views, especially between Newby and officials at governmental agencies charged with safeguarding the environment. The role of Abu Dhabi's new Environmental Research and Wildlife Development Agency (ERWDA) was the focus of much attention, but all Emirates were visited in order to see at first-hand some of the initiatives currently underway in the country. This included Sharjah's desert park and natural history museum; Fujairah's incipient marine reserves and the internationally important coastal wetlands in Umm Al Qaiwain and Ras Al Khaimah amongst many others.

Newby also found time to give an evening lecture to the ENHG entitled 'Conservation and Development in the Sahara', which primarily covered WWF's role in the Air-Tenere National Park of Niger, a reserve nearly the size of the UAE, and a place where Newby had himself spent many years working at grass-roots level. His experience there undoubtedly qualifies him in his advisory role, particularly in terms of arid zone ecology and socio-economics, and he was able to draw many parallels with environmental 'issues' of the UAE.

Development of a future role for the organisation here was also firmly on the agenda, with clear recognition amongst UAE authorities that the wealth of experience that WWF has to offer (particularly in terms of capacity-building) can be of great benefit to the conservation and sustainable utilisation of the country's ecosystems.

SIMON ASPINALL

ERWDA launches turtle study

Abu Dhabi's new Environmental Research and Wildlife Development Agency, ERWDA, has launched a major study of marine turtles in the Emirates.

Five of the world's seven species of turtles are known to occur in the waters of the United Arab Emirates, both inside the Arabian Gulf and the Gulf of Oman. The loggerhead, olive ridley and leatherback turtles are occasionally reported, while the green and hawksbill turtles are relatively common and breed on some of the UAE's more remote beaches and islands. All turtle species are considered under threat, while the hawksbill has been identified by the World Conservation Union, IUCN, as one of the ten most endangered species of animals in the world.

Announcing the study, the Secretary General of ERWDA, Dr. Saif Al Ghais, said that it would include a systematic survey by sea and air of turtles of areas where turtles are known to nest. Previous records indicate that both the green and hawksbill turtles can be found on beaches in the northern emirates, in particular at Jazirah Al Hamra, in Ras Al Khaimah, and also on some of the islands off the western coast of Abu Dhabi. One island, Qarnein, which is also an important nesting site for breeding seabirds,has already been provided with protection by its owner, Minister of State for Foreign Affairs Sheikh Hamdan bin Zayed Al Nahyan.

Other parts of the study will include the collection of biological samples, while ERWDA is also placing satellite tags on some turtles in order to follow their movements.

"We hope that through systematic research and monitoring, particularly of turtles' health status, nesting habitat and behaviour, feeding grounds and migration patterns, we will have a much clearer understanding of the biology of sea turtles,"according to Al Ghais.

"In particular," he said, "our aim is that our research will indicate very clearly what conservation measures need to be implemented in the United Arab Emirates to protect the turtles."

Legislation exists in the UAE making it illegal to catch turtles or to disturb their nests or to take their eggs, but the Ministry of Agriculture and Fisheries, responsible for implementing the legislation, lacks sufficient inspectors to enforce it, while there is also a need for a major educational programme among the UAE's fishermen, most of whom are Asian expatriates.

Part of the turtle study programme will involve the building of links with neighbouring countries that are also have important turtle populations. Although little study has yet been carried out, many are believed to migrate to nesting grounds in Oman.

Support for the programme has been provided by Shell Markets Middle East, based in Dubai, which has previously funded research into the UAE's mangrove eco-

PETER HELLYER

Swan Song of the Arabian Tahr in the UAE

Further to the article on Arabian Tahr ***Hemitragus jayakari*** in **Tribulus 7.1, Spring 1997,** studies on endangered populations in general indicate that there is little hope of our tiny herd surviving on Jebel Hafit much longer. In recent years, Minimum Viable Population, MVP, theories have become fashionable but the scientific evidence all points to the same depressing end. In the case of our Tahr, Sir Wilfred Thesiger commented that the species "was not uncommon" on Hafit in the late 1940s. Since then there have been just three or four sightings, the latest in 1997 of a single male. Given the amount of day trippers, weekend climbers and campers on the mountain over the past twenty years who have never seen any evidence of the species, it would appear that there has indeed been a significant population decrease since Thesiger's time.

The main threat to a small population comes from genetic constraints (genetic variance, inbreeding and genetic drift). In addition there are environmental constraints and in my view the comments in "Desert Ecology of Abu Dhabi" concerning the effects of development on Jebel Habit are essentially correct. Habitat loss, degradation and fragmentation are all now recognised as important factors in initiating a population decline and no small population is able to adjust and survive over an ecological time scale without outside intervention.

Observations elsewhere in the world suggest that a minimum size of 50 individuals is essential to avoid the genetic effects of inbreeding and a minimum population size of 500 to avoid genetic drift; and these figures assume optimum male/female breeding ratios. Admittedly, these estimates are based on experiments with fruit flies and figures may differ for mammals. However, a study of 122 bighorn sheep populations in the mountains of the southwest USA has shown that without exception every population under 50 became extinct within 50 years.

Jebel Hafit is an isolated outcrop and the area remaining totally undeveloped and undisturbed has shrunk considerably in recent years. Hence the concept of a Minimum Viable Area, MVA, also comes into play. The status of Tahr on the mountain is a precarious balance between numbers per area, birth and death ratios, and the structure of the herd. It seems to me that the Arabian Tahr on Hafit will inevitably become extinct without outside intervention. It is possible that we are already witnessing the end of the existing population, and that the recent recordings of individuals are all that remain.

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ROB WESTERN

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ROUND UP

Archaeology Review

The period under review, from late April, has covered the summer months, in which, as usual there has been relatively little archaeological field work to report. The bulk of it has been in the Emirate of Abu Dhabi, where the Abu Dhabi Islands Archaeological Survey, ADIAS, has managed to continue its work under conditions that, climatically at least, haven't always been ideal.

In the latter part of the ADIAS spring season, further study was taken of the Mantiqa al-Sirra site in the desert east of Medinat (Bida) Zayed, which was first published in an earlier issue of **Tribulus. (1).**

Field Director Salvatore Garfi, accompanied by field archaeologist Jakub Czastka, with support from the Diwan of the Ruler's Representative in the Western Region and from Abu Dhabi National Hotels, made a preliminary investigation of the site, showing it to comprise the remains of a fortified mud-brick structure. Further work is provisionally planned at the site during the 1997-1998 winter season. but a tentative dating. based upon potsherds, suggests that the structure is of Late Islamic date. Further sites of the same period were also identified in the vicinity, suggesting a pattern of more extensive use of the desert in the Late Islamic period than had heretofore been realised. A summary report will be published in a subsequent issue.

In July, another site from the early First Millennium AD was identified on the offshore island of Qarnein, helping to amplify the still scanty knowledge of this period in Abu Dhabi. The site was first noted during an ENHG field trip back in 1989, when surface scatters of pottery were seen, but sherds from the island were not examined by archaeologists until this summer. A preliminary note on the discovery appears elsewhere in this issue (see P. 25-26).

A number of raised circular mounds, of probable Late Islamic date, were identified by ADIAS in August near Ras Hanjurah, on the coast north east of Abu Dhabi, all of probable Late Islamic date, and similar to other mounds identified on nearby islands like Balghelam **(2).**

Finally, a potentially important Late Islamic site in the desert around 60 km south west of Abu Dhabi was drawn to the attention of ADIAS by the Chairman of the Abu Dhabi Municipality and Ruler's Representative in the Western Region Sheikh Mohammed bin Butti Al Hamed and Minister of Higher Education and Scientific Research (and ENHG Patron) Sheikh Nahyan bin Mubarak Al Nahyan at the beginning of September. The site has yielded a number of Late Islamic ceramic vessels, and extensive potsherds. Further study of the site, with assistance from the Municipality, is planned for the winter.

Elsewhere in the country, little archaeological activity has been reported, although a number of papers relating to UAE work were presented, as usual, at the annual Seminar for Arabian Studies in Oxford.

Plans for the winter 1997-1998 season include more work on the important early Islamic tell at Kush, in Ras Al Khaimah, to be directed by Derek Kennet, and a resumption of excavations at the Third to First Millennium BC site at Tell Abraq on the borders of Sharjah and Umm Al Qaiwain, which will be conducted by a University of Sydney team under the direction of Professor Dan Potts.

Elsewhere in Sharjah, more work is planned at the Jebel Buhays Late Stone Age cemetery and at the Muwailah Iron Age village.

ADIAS plans, besides Mantiqa al-Sirra, provisionally include further work on Merawah and Dalma, and the beginnings of trial excavations on some of the remoter islands in Abu Dhabi's Western Region.

Two of the finds reported over the summer months, those of the First Millennium AD site on Qarnein and the Late Islamic settlement in the desert south west of Abu Dhabi were first identified by non-archaeologists, underlining the important role that can still be played by the non-specialist. They join a long list of such sites, including the Al Sufouh Third Millennium BC tomb in Dubai and the First Millenium AD Christian settlement on Sir Bani Yas, both first discovered by ENHG member Carolyn Lehmann, (the second of them during another ENHG island expedition).

Further proof, if any is still needed, of the importance of drawing the attention of archaeologists to anything encountered while out and about in the Emirates. Despite the extensive development of recent years, there are likely to be many sites not yet discovered, and it is important for our knowledge of the country's heritage that they are recorded and examined before they are overtaken by the demands of development.

References:

1. Czastka, J. & Hellyer, P.[1994]. An archaeological-survey of the Mantakha As'sirra area in Abu Dhabi's Western Region. **Tribulus 4:1** (April 1994). p. 9-12.

2. Garfi, S. [1996]. Excavations on Balghelam Island - a preliminary report. **Tribulus 6:2** (October 1996]. p. 5-10.

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BIRD REPORT

April - September 1997

The six month period from April to September was this year very exciting. Two new species were discovered in late spring and many species were found which had occurred less than ten times before. As is the case with birds once found, they proved elusive thereafter; but that is the challenge of birdwatching. A lot of new information was added to our files, assisted by visiting Channel Islands' birdwatchers Mick Dryden (the Jersey Bird Recorder) and Max Allan. They arrived for a period of recreational birding in April and found a first ever **Blackstart** in Abu Dhabi, plus a number of interesting seabirds on the East Coast. Mike Jennings, a regular visitor to Arabia, combined business with pleasure in July, by bravely surveying parts of the Empty Quarter where, not to be put off by the searing heat (phew!), he discovered newly fledged **Namaqua Dove** young, confirming a new UAE breeding species. Meanwhile, in May, on Khalidiyah, Abu Dhabi, while tracking down a number of other elusive vagrants, Simon Aspinall found a **Pin-tailed Sandgrouse,** another new species for the UAE. A lesson for us all to keep our eyes open throughout the year.

APRIL

April was dominated by calm, clear weather throughout, except for a period of rain and unsettled weather on the 22nd and 23rd. The last of the early morning fogs were soon gone as night temperatures became milder and day time temperatures rose from an average of 24°C early in the month to a more seasonal 30°C during the last few days. Large numbers of birds passed through the country unhindered.

Early April had its highlights, including an **Olive-backed Pipit** (18th record) at Bateen Gardens on the 3rd and a **Forest Wagtail** (9th record) there on the 7th with a **Savi's Warbler** in Dubai on the same day. A **Spanish Sparrow** and a **White-crowned Black Wheatear** (5th record) were on Das Island on the 4th (with the latter remaining until the 15th). A **Black-headed Bunting** was at Ras Al Khaimah on the 8th. The first few days witnessed massive hirundine passage, with 650 **Sand Martins** counted at Al Ain camel track on the 2nd. As the month moved on, Das Island took the lead with a **Cinereous Bunting** (22nd record) on the 11th, plus another on the 21st, while two **Namaqua Doves** (only the 12th record, yet reportedly now breeding in the Western Desert!) were there on the 16th, with a **Scops Owl** from the 17th-18th (plus another in Bateen Gardens on the 14th). Up in Ras Al Khaimah an impressive **Lesser Kestrel** gathering was manifesting itself near the 'golf course' (has to be seen to be believed!), with 21 circling on the 7th, increasing to a peak of 150 on the 16th. Further breeding evidence was gathered in Ras Al Khaimah, with a **Short-toed Eagle** regularly over Jiri Plain from the 16th (and a pair in the nearby foothills on the 18th May), one or two **Quails** calling in Hamranivah fields from the 3rd-10th, a **Cuckoo** calling near the golf course on the 3rd and over 20 pairs of **European Bee-eaters** and 10 **European Rollers** at Khatt nest sites from the 10th. By mid-month, bird numbers reached a peak, with a dramatic 'fall' of passerines occurring throughout the country on the 14th. During just a few days 16 **White-throated Robins,** plus hundreds of **Redstarts** and **Pied Wheatears** were reported. Caught up in this movement were two **Knot** (4th record) at Al Jazeerah Khor on the 13th and a **Little Swift** (14th record) at Al Ain also on the 13th, an **Egyptian Nightjar** and a **Blackstart** (extraordinary 1st record) at Khalidiyah on the 14th, a **Barred Warbler** and a **'vittata'** (pale-throated) **Pied Wheatear** on the 17th, an **Alpine Swift** (13 record) at Jebel Hafit on the 18th and at least one **Blyth's Reed Warbler** in Bateen Gardens from the 19th-21st. More due to observer coverage, rather than by weather influence, a **Wedge-tailed Shearwater** was seen off Fujairah on the 11th plus a **Brown Booby** (3rd record) and a probable **Flesh-footed Shearwater** on the 12th. Further surprises were in store at the end of the month, with a **Merlin** (13th record) in Dubai on the 23rd, single **Golden Plovers** at Mafraq sewage works on the 25th (5th record) and at Khor Dubai on the 26th (5th record), an **Arctic Tern** (1st or 2nd record, if accepted) at Al Ghar on the 25th and a **Blyth's Pipit** at Al Wathba on the 24th. More mundane perhaps, but important for the breeding 'data-base' were **Short-toed Larks** and **Lesser Short-toed Larks** in song at Al Rifa'a (Umm Al Qaiwain) on the 30th.

MAY

Neither the weather nor the 'action' cooled down in May, with the temperature rising steadily from 30°C+ by the end. A few overcast days dominated the second week, bringing about an interesting fall of vagrants on the 8th.

Single **Barred Warblers** were at Bateen Gardens on the 1st and on Das Island on the 4th with a third **Namaqua Dove** (a female and 13th record) joining the two males there along with a single, late, **Lesser Kestrel** on the 4th. A **Masked Shrike** was at Al Wathba on the 6th and a **Blyth's Reed Warbler** was reported at Khalidiyah from the 7th-11th. On the 8th, all hell broke loose amongst the small birding community, when a **Pin-tailed Sandgrouse** (1st record), an **Olive-backed Pipit** (19th record), a **Thrush Nightingale,** a **Radde's Warbler** (3rd record) and a **Greenish Warbler** (4th record) were found by observers walking amongst the tree windbreaks on Khalidiyah spit, though virtually none of the birds showed well to subsequent observers. A **Scops Owl** was on Futaisi Island and a **Garden Warbler** was at Khalidiyah on the 9th. During the second week of May, **Willow Warblers** were ten a penny in Abu Dhabi parks and gardens, while **Marsh Warblers** were abundant in the Northern Emirates (150 at the Emirates

golf course on the 12th).

On the East Coast, three **Sooty Shearwaters** (3rd record) were seen on a pelagic boat trip off Fujairah, with 4,000 **Sooty Gulls** and 500+ **Common Terns** (the greatest numbers of both species on record) on the Fujairah-Kalba seafront on the 15th. 1,100 **Bridled Terns** were counted in the same area offshore on the 23rd. Further up the coast, 150 **Audubon's Shearwaters** were seen off Al Aqqah on the 22nd, one of the year's best counts.

A number of other good sightings were reported during the month, including 64 **Red-necked Phalaropes** at Al Ghar lake and several **Nightjar** reports, including four at Al Wathba on the 2nd, a **Hobby** on Das on the 5th, a **Great Reed Warbler** at Bateen Gardens from the 7th-10th, three **Little Bitterns** at Kalba, up to six **Little Terns** at Al Ghar lake, several **Whinchats** on Das Island, Ras Al Khaimah golf course and Al Wathba and an out-of-season **Robin** in Abu Dhabi from the 29th.

JUNE

A hot, dead month, respectively for weather and birds. Temperatures regularly reached 40°C with only one 'shamal' (on the 3rd) to break the calm.

52 **Crab Plovers** at Umm Al Qaiwain on the 6th was an unusually large summer flock and must raise further speculation that there may be a breeding colony on one of the inshore islands there. On nearby Siniyah Island, 13,000 **Socotra Cormorants** were lounging on the beach on the 13th, while four **Audubon's Shearwaters** passed Al Aqqah during a brief seawatch on the 14th. Four **Avocets** were at Al Ghar lake for most of the month, but showed no interest in nesting this year. Das Island observers reported the first breeding record of **Collared Dove** plus a late migrant **Common Rosefinch** on the 2nd, a **Whinchat** on the 6th, a juvenile **Cuckoo** and a **White-crowned Black Wheatear** (6th record) from the 25th-26th. A **Barn Owl** flew out of a well at Hamraniyah on 13th, adding a little more to our knowledge (or lack) of its UAE distribution.

JULY - AUGUST

Hot and hazy summer conditions prevailed, with occasional thundery conditions in the mountains to the east influenced by the build-up of the south-west monsoon over the Indian Ocean. Temperatures peaked at 43°C and a storm hit the Northern Emirates on the 8th August.

Mike Jennings discovered seven **Namaqua Doves** at Ghiyathi (including two recently fledged juveniles) on the 17th July plus a further two at Ruwais later in the day, then two more at Sila the next day. This is the first breeding record of Namaqua Dove in the UAE.

Evidence of early autumn migration started oddly with an **Egyptian Nightjar** on Qarnein Island on 3rd July, rather early for this rare migratory species. Otherwise, due to the paucity of birdwatchers, not much was found until a juvenile **Shikra** turned up in Safa Park on the 17th July, strongly suggesting a first breeding record; and yet there have been only a few previous sightings. An **Indian Koel** (5th record) in Abu Dhabi on the 25th July (seen again in early September) was a good adrenalin raiser, while Ras Al Khaimah, grabbing the spotlight in early August (a good place to be in summer?) produced two **Lanners** on the 8th August, with a juvenile **White-tailed Plover** at Khatt lake from the 8th-10th August and 16 **Cream-coloured Coursers** at Hulaylah Island on the 10th August. An exceptionally large flock of 250 **Red-necked Phalaropes** were at Wadi Bih dam on the 21st August with 14 **Pale Rock Sparrows** near the fast evaporating reservoir on the 29th August. Meanwhile, as migration showed further signs of life, Das Island produced three **Black-headed Buntings** on the 17th August and a **White-throated Robin** on the 19th.

SEPTEMBER

The low pressure summer conditions prevailed throughout the month, with very hot temperatures experienced inland, demonstrated by 46°C in Al Ain on the 5th. Regular cumulonimbus build-up over the mountains rarely affected the cloudless conditions over the Arabian Gulf coast.

Some interesting early autumn migrants pass through in early September, but few birders return from their summer leave until mid-month and many birds pass through unseen. This was not the case with single **Caspian Plovers,** seen well at the Emirates golf course on the 2nd and 5th-9th. There were at the Al Ain camel track fields on the 5th and one at Al Jazeerah Khor from the 12th-13th. Two early **Eastern Pied Wheatears** were found in Wadi Bih on the 5th.

A **Black Tern** (possible 4th record) was reported off Abu Dhabi's Eastern Lagoon on the 11th with 11 **Pintail Snipes** seen there on the 17th. An **Alpine Swift** (14th record) was seen over Bateen Gardens on the 16th while a few days later (while birders in the Northern Emirates waited patiently for something interesting to turn up), a **Rufous Turtle Dove** (3rd record) was found by Simon Aspinall at Khalidiyah on the 20th! While searching for it on the 24th, Steve James turned up a **Namaqua Dove** (17th record). Neither could be located on the morning of the 25th, although an obliging **Masked Shrike** was there instead. A **Long-toed Stint** (12th record) was at Dhayah on the 27th.

A **Bruce's Scops Owl** was (on migration?) at Jebel Dhanna port on 23rd while a migratory **Scops Owl** was seen at Ras Al Khaimah airport (typical Bruce's Scops Owl territory) on the 27th. How contrary birds can be.

Observers: Max Allan, Simon Aspinall, John Bannon, Dave Bradford, Phil Brett, Brian Curtis, Adrian Dalley, Mick Dryden, Gary Feulner, Darren Frost, Colin & Joy Glendenning, Jeff & Joan Gunson, Abdul Hakim, Peter Hellyer, Dick Hornby, Kevin Hyland, Steve James, Inger Larsson, Carolyn Lehmann, Naturetrek, Rob Quested, Len Reaney, Colin Richardson, Clive Saunders, Mika Selin, Andrew Twyman, Mike Wood and Andrew Ward.

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تريبيلوس

جمعية الإمارات للتاريخ الطبيعي

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