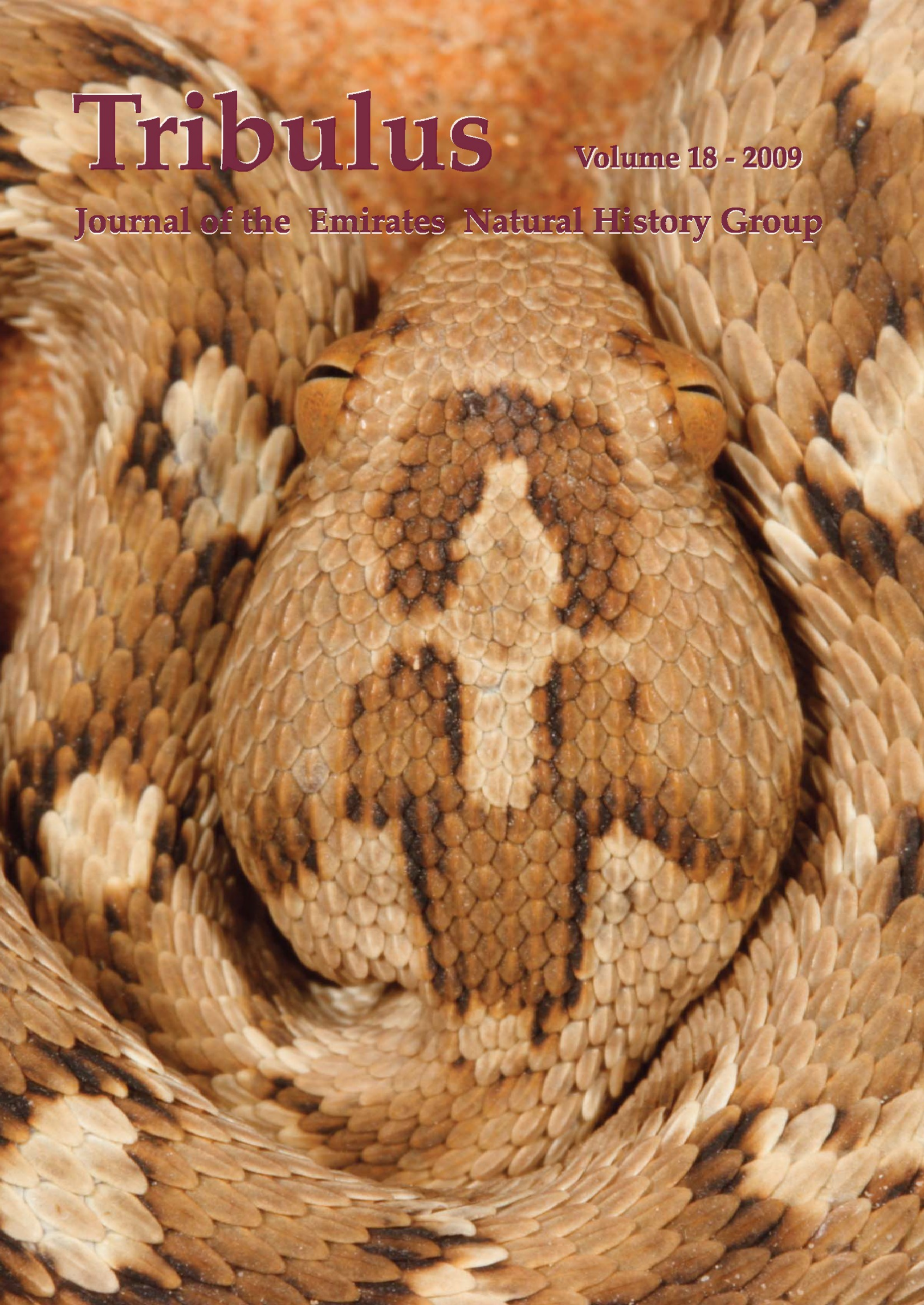

Tribulus

Volume 18 - 2009

Journal of the Emirates Natural History Group

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Contents

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Cover Illustrations

Front: **A juvenile Sind Saw-scaled Viper, *Echis carinatus sochureki*, photographed at Qarn Nazwa, Sharjah on 18 April 2009. Picture: Drew Gardner.**

Back: **A Naked-bellied Tomb Bat, *Taphozous nudiventris*, photographed at Qarn Nazwa, Sharjah on 18 April 2009. Picture: Drew Gardner.**

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Editorial

One perennial feature of research into the natural history and environment of any country is that there are always new discoveries to be made – the identification of species not previously recorded in a country, or the extension of known range or even if one is especially dedicated and fortunate, the discovery of a species that is not just new for a country, but new for science. That is part of the fascination and challenge. In a country like the United Arab Emirates, where research only really got under way less than fifty years ago, this is particularly true. Several of the papers in this issue of *Tribulus* document discoveries of new species for the Emirates, including two geckoes, a snake, a damselfly, a grass and a moth – sufficient evidence, if any was needed, that there is still scope for new finds. Another paper documents a previously-unrecorded feature of animal behaviour – the attraction of caterpillars to mercury vapour lights at night, something that is of international scientific significance. It's worth pointing out, too, that while some of the discoveries were made by professional scientists, others have been made by dedicated and well-informed amateurs, even if they have been helped in the process of identification by professionals.

It is always the case, moreover, that the current state of knowledge is open to amendment, as a result of such new discoveries and that it is possible to supplement previously-published data. It is a pleasure, therefore, to be able to include an updated checklist of the country's damselflies, not merely adding a new species but also other new information.

Since it was launched in 1991, nearly twenty years ago, *Tribulus* has sought to become a place where such discoveries may be reported and it is pleasing to note the presence of so many papers of this type in the current issue.

While the papers mentioned above deal with individual species or groups of species of flora and fauna, it is also important, of course, to study the habitats in which they are found, not simply as a backdrop, but in themselves. While there is now a considerable amount of information about the UAE's habitats in general, little has been published, as far as we are aware, on specific locations. This issue attempts to make a start on that process with studies of the geology of two of our important, but privately-owned, offshore islands. Further studies will follow as well as, we hope, broader papers or groups of papers looking at particular habitats and at the flora and fauna to be found within them. There is much available only in 'grey', unpublished reports produced as a result of commissioned consultancy surveys devoted to particular areas that is worthy of publication. As the picture of the country's natural and biological diversity as a whole becomes better known, there is, increasingly, a need for such locally-based studies to appear.

When *Tribulus* commenced publication, the UAE appeared only rarely in international scientific journals and there was little being done in terms of original research into natural history, at least, even if topics such as archaeology were being extensively examined. As is evident from the lengthy bibliography in this issue of recently-published books and papers, there is now a wide variety of research being undertaken, both by professionals and by enthusiastic and informed amateurs. As is also evident, much of this is now being undertaken by official organisations that simply did not exist a couple of decades ago.

It is disappointing that, in some cases at least – as is clear from some of the book reviews in this issue – that insufficient recognition is given to the previous and current work of those researchers outside the official or officially-sponsored bodies. Nor are publications from official bodies automatically subjected to a peer review process, as a result of which the academic quality of published material is not always as high as it might be. For these problems to be addressed effectively, there is a need for greater collaboration and exchange of information between the official bodies, other professional scientists, in the local academic community for example, as well as for short-term visitors from academic institutions overseas, and the informed and dedicated amateur researcher. We are pleased to note that this failing is now being addressed, the Memorandum of Understanding between the voluntary Emirates Bird Records Committee and the official Environment Agency – Abu Dhabi, EAD, being one particularly good example, but there is scope for much more collaboration of this kind. The creation of some kind of national scientific research council, perhaps under the sponsorship of the federal Ministry of Higher Education and Scientific Research or the Ministry of Environment and Water, with which the whole range of researchers could be involved, might be one way of proceeding at a national level.

Finally, an apology is due for the late appearance of this issue, both to our readers and to those contributors who have been waiting many months for their papers to be published. Work on the next issue is already well under way!

Peter Hellyer

A Geological Description of Belghelam Island, North-East Abu Dhabi, UAE

by Graham Evans and Anthony Kirkham

Fig 1. General location map for Belghelam. (Courtesy: Google Earth)

Fig 2. Detailed map of Belghelam. (Courtesy: Google Earth)

The island of Belghelam, north-east of Abu Dhabi Island, is approximately five kilometres long and one kilometre wide with a WNW-ESE orientation (***Figs. 1 & 2***). The island has a core of Pleistocene rocks and is fringed by Quaternary sediments.

The core of the island is formed of Pleistocene carbonate aeolianites (wind-blown carbonate sands locally known as 'miliolite') displaying large scale, high-angled cross-bedding (***Figs. 3 and 4***). This forms a series of low ridges orientated parallel to the main trend of the island. The highest occur along its western and northern flanks and forms the substrate on which the main residence of H.H. Sheikh Surour bin Mohammed Al Nahyan is built. A wave-cut platform along the northern shoreline, generally about 20m wide, is cut into these aeolianites and this widens to well over 100m at the western seawards-facing extremity of the island (***Fig. 5***). The seaward edge of the wave-cut platform displays a resistant raised rim due to a thin crust of calcium carbonate precipitated from evaporation of water which splashes over it at most high tides (***Fig. 6***). The wave-cut platform is thought to have developed about 4000-5000 years ago at about the climax of the Flandrian transgression when sea level was approximately one metre higher than it is today.

The cross-bedded sets of the aeolianite originated in a barchanoid dune field formed by an earlier (palaeo) Shamal that blew from a general north-westerly direction. However, as a result of increased wind strength during climatic variations in the Pleistocene glacial periods, the barchans were remodelled to long, linear, *seif* dunes. In fact, it seems likely that the entire island represents the westernmost erosional relict of a palaeo-*seif* dune that formed a peninsula extending seawards from the immediately adjacent mainland shoreline. This same pattern of *seifs* can be traced for about 100kms towards the Hajar Mountains across the UAE (***Fig. 7***). The sands of the *seifs* become more quartzose in composition and redder in colour as the carbonate constituents decreases to leeward along the palaeowind direction.

The remnants of similar fossil *seif* dunes, remodelled from barchans, have been described from the Al Dabb'iya Peninsula but there they are capped by Pleistocene marine sediments which accumulated when sea level was about 7-8m higher than that of today (about 125 Ka). It is likely that similar sediments once partially covered the Belghelam aeolianites but have since been removed by deflation.

Lithified fossil mangrove trunks and rhizoliths (fossilised roots) are abundantly exposed along the outer parts of the wave-cut platform all along the northern coast (***Fig. 8***). These former mangrove stands appear to have developed in the intertidal zone, just as they are today in the area, around the time of the Flandrian transgressive climax (ca 4 Ka). Any Holocene sediment that once covered the rhizoliths has been largely removed by wind and wave erosion, except for one or two remnants. Burrows of *Ophiomorpha* also occur on the wave-cut platform and can be recognised by their sub-vertical orientations and their sediment linings created by the burrowing organisms (possibly crabs). A small patch of a coquina of disarticulated oyster shells can be seen plastered against part of the wave cut platform near the western extremity of the island and gave a carbon dating of ca 650 years BP ***(Fig. 9***). However, the cutting of the platform is thought to have occurred earlier at ca 4 Ka.

Much of the southern half of the island is formed by a carbonate platform with an elevation of about two metres above mean sea level. The underlying bedrock is in places either deflated aeolianites or, along the extreme south coast, Pleistocene marine carbonates which unconformably overlie the truncated aeolianite.

The platform is covered by a thin, mobile sand veneer fashioned into highly deflated *nebkha* (coppice dunes). The halophytic plants that stabilised these were dead in 2004, when fieldwork was undertaken, probably due to lack of significant rainfall during recent years. All that remained were the woody stems of the dead halophytes which are no longer able to baffle the wind-blown sands and so the *nebkha* was slowly being deflated to leave behind a lag of marine mollusc shells including abundant cerithid gastropods. These suggest that the platform was flooded during the Holocene and probably is still occasionally flooded by marine waters during severe Shamal storms. Living halophytes occured in 2004 only along the back of the present intertidal zone, especially along the southern shore, where it appears moisture is more readily available for sustained growth (***Fig. 10***).

At two localities (GPS N24.56061 E 54.56568) along the southern edge of the two metre platform Holocene(?) beachrocks displaying fenestral pores and containing mollusc shells are exposed (***Fig. 11***). Broken slabs of the beachrock show up to three caliche crusts. Along the same southern shoreline, small gullies cut a scarp in which the aeolianite and overlying Holocene(?) marine carbonate are exposed suggesting there is, or has been, periods of substantial run-off during or after heavy rains (***Fig. 12***).

Whereas most of the northern shoreline is rocky, the eroded edges of the platform along the south coast and parts of the northeast are flanked by a narrow beach of skeletal pelletal sands and by a belt of low modern dunes (1-2m high). In the northwest a thick stand of mangroves has also developed. Generally the entire island is flanked by broad intertidal flats of carbonate sand which are exposed at low water (***Fig. 13***).

Offshore to the south-west of the main island is a small islet composed of aeolianite but with a capping of marine limestone (***Fig. 2***). A narrow wavecut platform similar to that of the main island surrounds the feature.

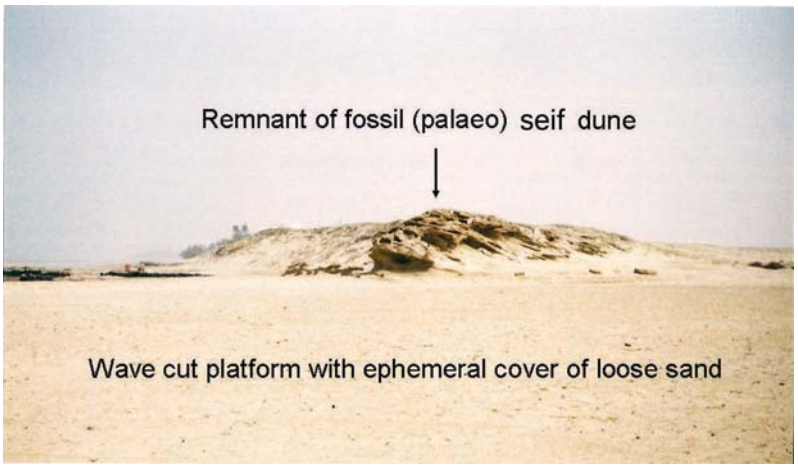

Fig 3. Remnant of a palaeo-seif dune trending WNW-ESE along the northern coast. Current dune height is approximately 15m on average. A wave cut platform is seen to the left of the dune. View to the east from the western extremity of Belghelam.

Fig 4. Exposure of cross-stratified aeolianite at the paleo-seif shown in *Figure 3*.

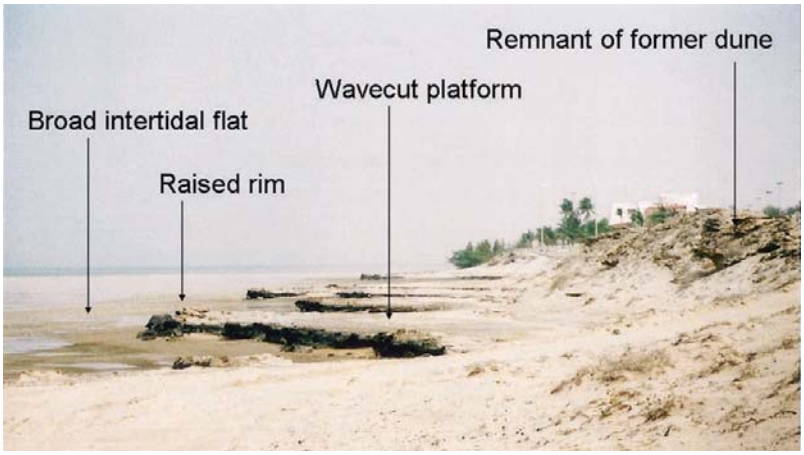

Fig 5. The wave cut platform along the northern coast of Belghelam. Palaeo-seif dune to the right. View to the east.

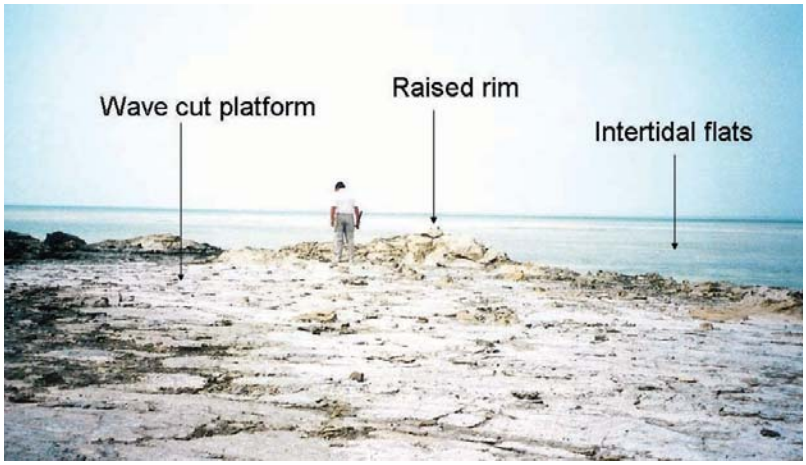

Fig 6. Wavecut platform with raised rim along its western seaward edge. The platform is about a metre above present day mean sea level and cut into aeolianite. Northern coast of Belghelam.

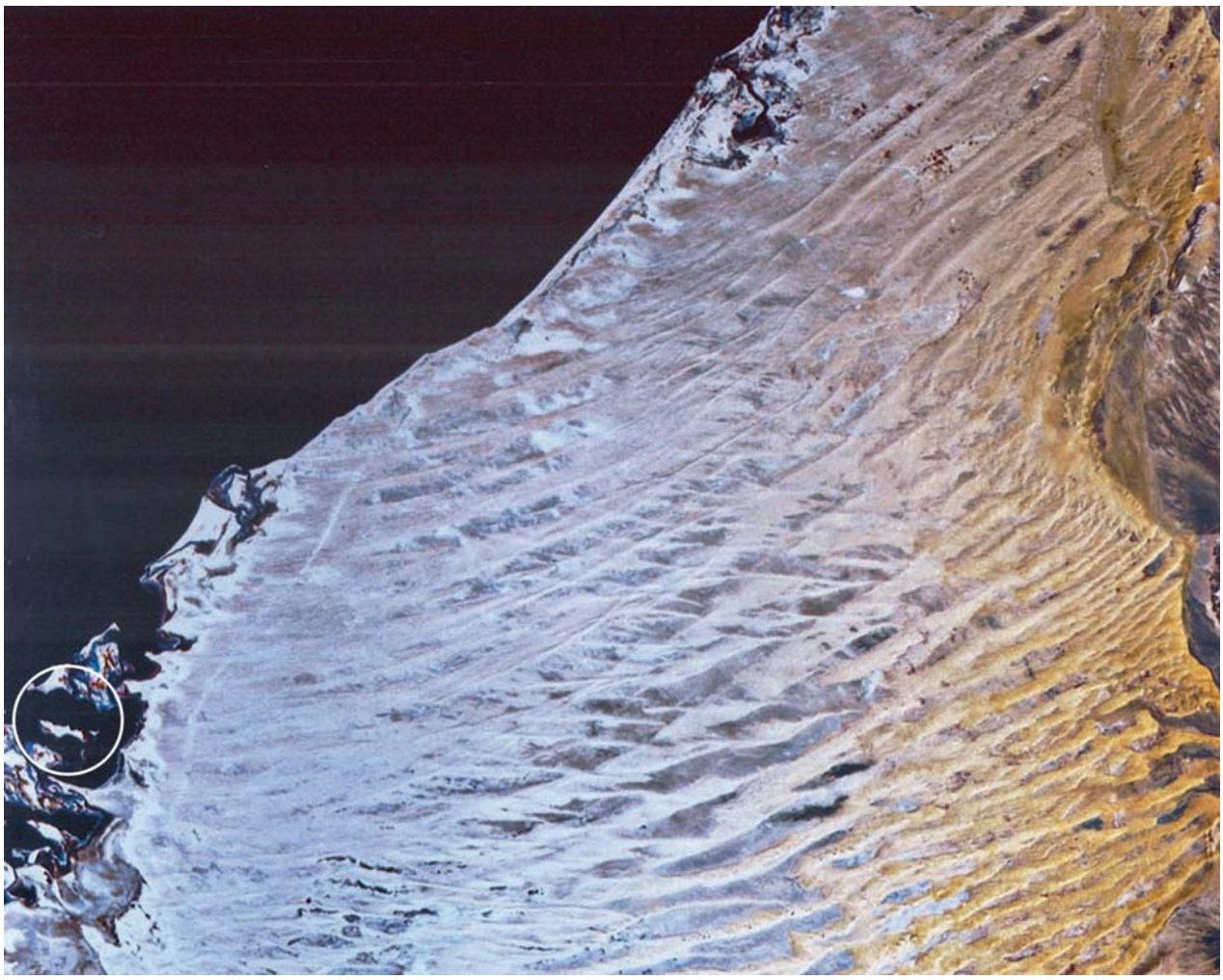

Fig 7. Satellite image of the mainland between Abu Dhabi and Jebel Ali. Alluvial fans outwashing from the Hajar Mountains are to the right. Most of the area is traversed by sweeping palaeo-seif dunes which formed during the Pleistocene. They are now largely cemented and form promontories or peninsulas that extend into the lagoon (lower left). Belghelam (circled) is as an offshore remnant of one of these palaeo-seifs. Courtesy of *GeoArabia*.

Fig 8. Mangrove rhizoliths exposed on the wave-cut platform.

Fig 9. An oyster coquina plastered against the wave-cut platform, northwest end of Belghelam, The oysters have been dated as about approximately 650 years of age.

Fig 10. Southwest coast of Belghelam with a narrow cordon of halophytes along the back of the beach. The low scarp is poorly developed here. Inland, the platform is sparsely covered by dead halophytes.

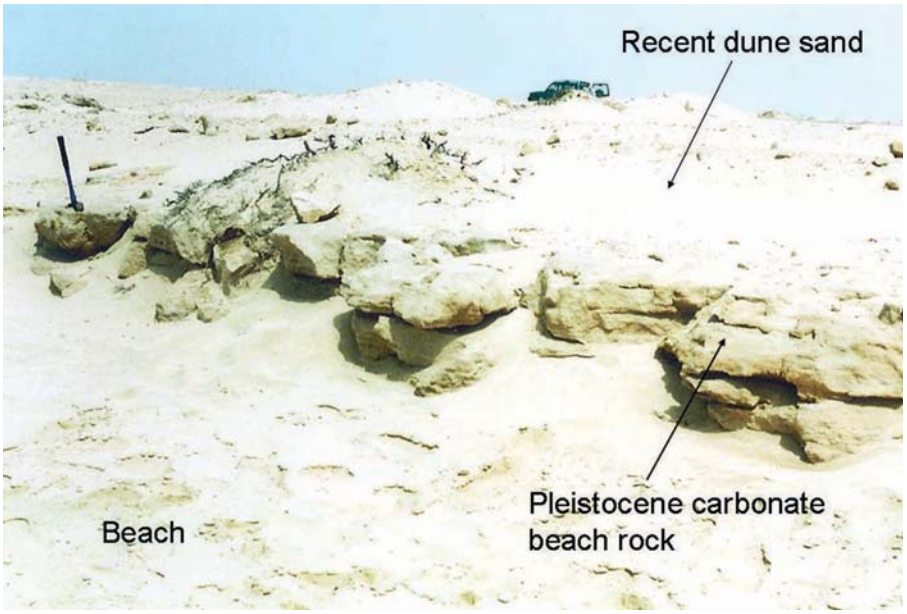

Fig 11. Holocene(?) beachrock scarp along the southern coast of the island. Hammer (left) for scale.

Fig 12. An erosional gully transecting the low beachrock scarp, southern coast of Belghelam.

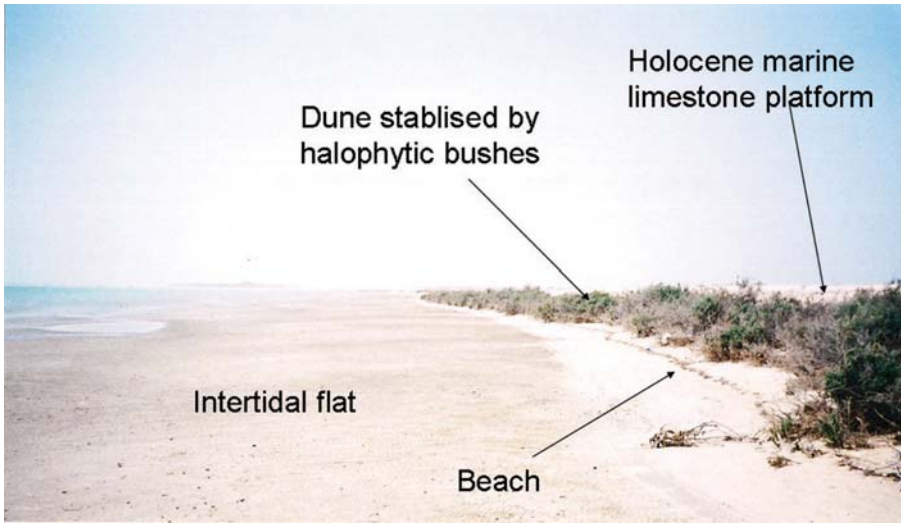

Fig 13. Sandy beach with halophytic plants stabilising aeolian dunes along the back of the beach. The low Holocene(?) platform is visible behind. Southern coast of Belghelam.

Acknowledgements

The authors very much appreciate the logistical support give them by Peter Hellyer whilst they conducted their field work. Special thanks go to H.H. Sheikh Surour bin Mohammed Al Nahyan for giving permission to visit Belghelam and for his warm hospitality.

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* Further details of the whole coastline of Abu Dhabi can be seen in: The Emirates: A Natural History. *Eds.* P. Hellyer and S. Aspinall, 2005, Trident Press Ltd., London. See especially articles therein by 1) G.Feulner, A Geological Review, p.41-63, 2) G.Evans and A.Kirkham, The Quaternary Deposits, p.65-78. These articles have a reasonably complete general bibliography of the Quaternary and sedimentology of the coast of Abu Dhabi.

A Report on a Geological Reconnaissance of Al Aryam Island, March, 2004

by Graham Evans and Anthony Kirkham

Fig 1. General location map of Al Aryam Island. (Courtesy: Google Earth)

Al Aryam Island is part of the Abu Dhabi barrier island complex. It is located at the western end of Khor Qirqishan (***Figs. 1 & 2***). It is bounded to the south-west by a tidal channel which separates it from Al Dabb'iya and divides into smaller channels which flow around the southern side of Al Aryam and ultimately link with Khor Qirqishan. Another tidal channel on Al Aryam's north-east flank separates it from Al Bahrani Island and also passes southwards, via an area populated by mangrove stands, into Khor Qirqishan. Both these main tidal channels lead seawards (north-westwards) to a broad shoal area of merged tidal deltas where precipitation of $CaCO_3$ from the warm highly saline agitated water leads to the production of ooliths (sand grains with a core surrounded by concentric layers of calcium carbonate). Skeletal carbonate sands and some reefs dominate the offshore region today.

Both Al Aryam Island and the mainland coastal sabkha are believed to be underlain by a Pleistocene unconsolidated brown quartzose sand, although on Al Aryam it is only visible around its southern parts as elsewhere it is covered by marine Pleistocene and Holocene carbonate. This brown sand is wind-blown (aeolian) and is at least six metres thick in the region as was seen in a temporary pit near the junction of the Al Aryam road with the main Abu Dhabi–Jebel Dhanna road (***Fig. 3***).

Outcrops of Pleistocene limestones composed mainly of aeolianites (cemented wind blown carbonate sands locally known as 'miliolite') occur at the northwestern and northeastern extremities of the island *(**Fig. 4***). A wind-deflated platform exposing aeolianite covers part of the southwestern part of the island. As in Al Dabb'iya, these upstanding patches of aeolianite probably represent erosional remnants of long, curved palaeo-*seif* dunes which were at one time continuous with the prominent palaeo-*seif* dunes that extend across the mainland from the coastline to Al Ain and the Hajar Mountains. They formed about 125,000 years ago (125Ka) and became cemented before being partly drowned by the rising sea of a Pleistocene marine transgression that deposited marine sediment on their crests and around their flanks.

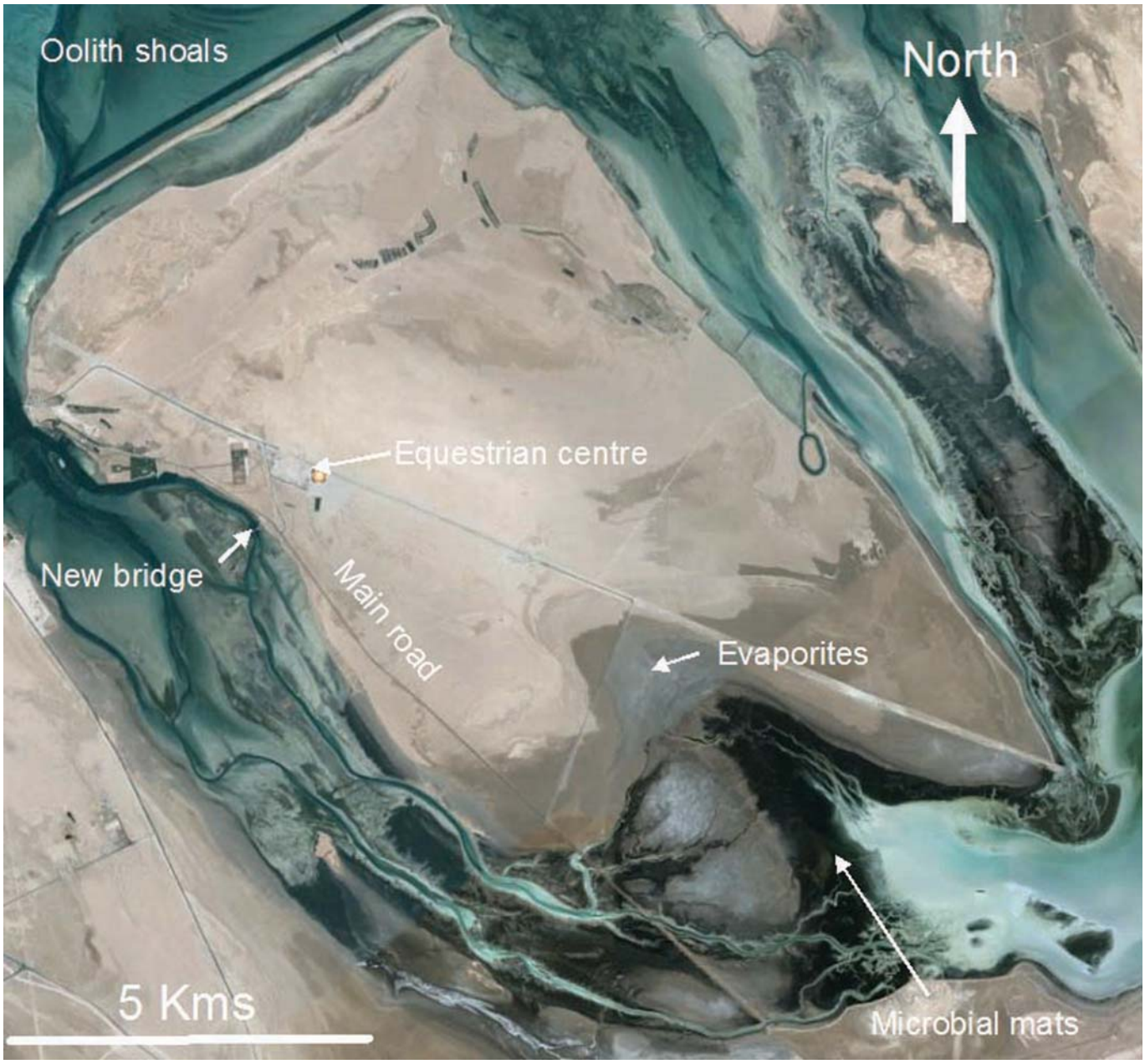


Fig 2. Detailed satellite image of Al Aryam. (Courtesy: Google Earth)

In some locations, as near the equestrian centre on the island, the Pleistocene marine sediments which dip off the flanks of the *seif* dunes are cross-bedded and probably formed under high energy (tidal) current conditions (***Fig. 5***). Lower down the flanks of the palaeo-*seif* dunes the marine sediment is intensively burrowed. Elsewhere, the marine sediments are horizontally bedded and highly bioturbated and commonly contain fossil red algal fragments and barnacles. On the north central area of the island (*e.g.* east of the equestrian centre) are large areas where marine Pleistocene carbonate accumulated in a lower energy tidal embayment. Similar sediments are also observed immediately south of the new bridge near the north-west corner of the island and both sides of the main island road.

In some places, during the marine transgression, the sea eroded the partially cemented sediments of the flanks of the *seif* dunes to create cliffs. Large angular blocks of the aeolianite accumulated as a scree at the bases of the cliffs. These blocks were eventually buried by the later marine sediments (***Fig. 6***).

A later sea level fall exposed the area to deflation (***Fig. 7***). The latest sea level rise (the Flandrian transgression) commenced about 18,000 years ago and drowned most of the deflated remnants of the earlier dunes and marine sediments to deposit the modern (Holocene and Recent) carbonate muds, sands and, in places, coral reefs developed offshore.

Fig 3. A temporary pit near the junction of the Aryam road with the main Abu Dhabi-Jebel Dhanna coast road. At least six metres of brown sand are exposed. It probably extends beneath the whole of Al Aryam. (The apparent cross-beds are actually digger markings).

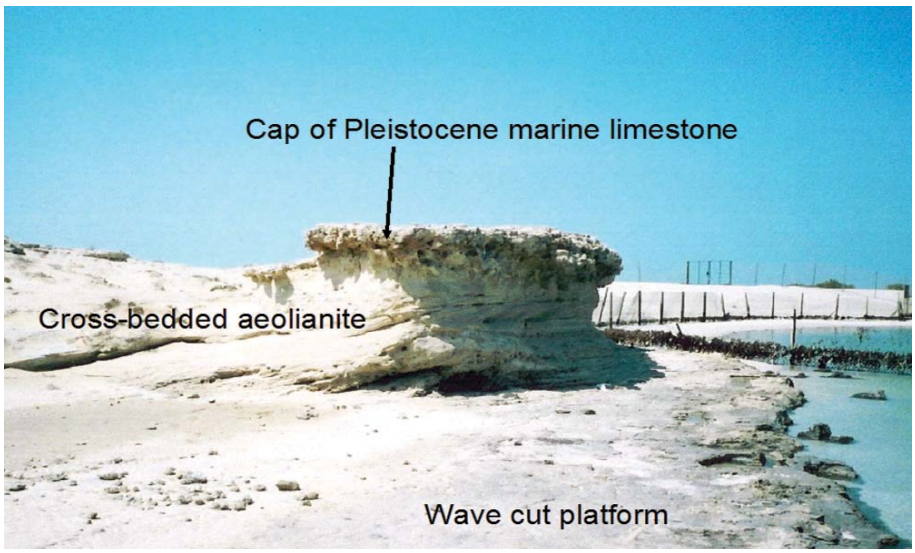
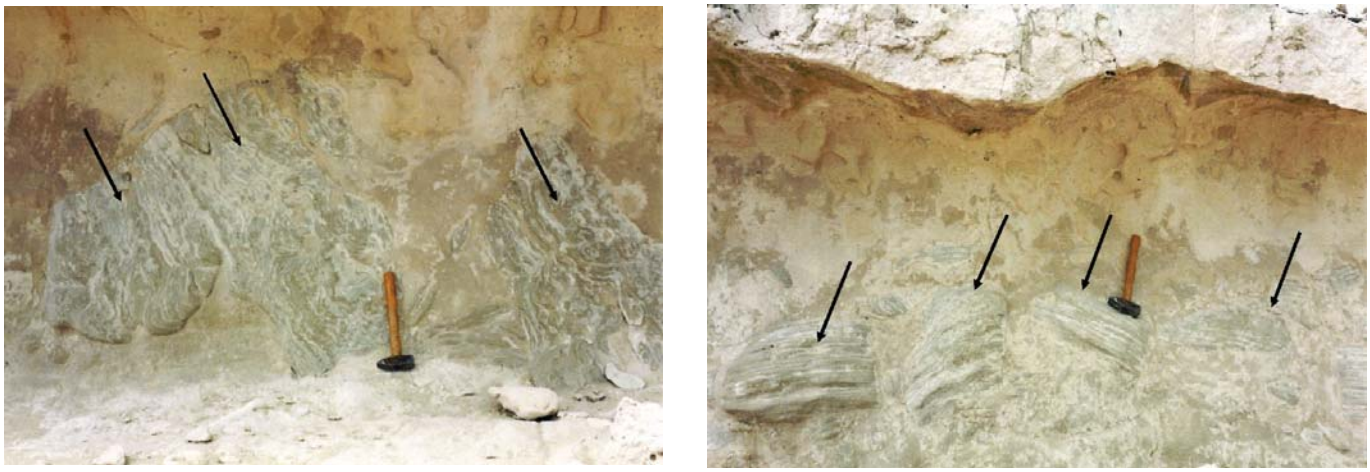


Fig 4. Pleistocene aeolianite with large-scale cross-bedding capped by intensely burrowed Pleistocene marine strata. NE corner of Al Aryam.

Fig 5. Pleistocene cross-bedded marine carbonate overlying aeolianite. Top of hammer coincides with the contact. Top of marine transgressed palaeo-seif dune near the equestrian centre.



a b

Fig 6. Pleistocene cliff scree deposits comprising boulders (arrowed) of carbonate aeolianite surrounded and encased by Pleistocene marine sediments. The upper overhanging hard crust in b) is calcrete (this is a hard crust formed by contemporary conditions on exposed carbonate rocks).

Isolated rock outcrops (zeugen) forming islands composed of aeolianite with marine caprock are very well preserved offshore to the east of Al Aryam, (***Fig. 8***). As on the main island, they are surrounded by wave–cut platforms with their surfaces about a metre above present day mean sea level. These platforms probably formed about 4,000 years ago when mean sea level was about a metre higher than today. Mangrove stands developed on these platforms where their fossilised root systems (rhizoliths) are abundantly exposed. These ancient mangrove stands developed in similar intertidal environments to those of the present day mangrove stands around Al Aryam (***Fig. 9***).

Modern marine sedimentation has extended (prograded) the northern shore of Al Aryam slightly seawards over approximately the last 4,000 years. More importantly, as on the other barrier islands of Abu Dhabi Emirate (*e.g.* Marawah, Al Dabb'iya and Abu Dhabi Island), Al Aryam has clearly also been extended southwards by leeward accretion towards the mainland as Shamal-driven waves have driven sand southeast along the margins of the old seif dune remnants and beyond.

Most of the southern half of Al Aryam comprises what appears at first sight to be a monotonous deflated sabkha plain with halite crust (***Fig. 10***). However, traces of accretionary lobes extending landwards to the south-east are evident along the southern shores of Al Aryam and suggest that the island is a composite of two former islands that probably nucleated on the vestiges of two(?) former *seif* dunes, eventually being linked by marine deposition in the form of beach bar sands. The accretionary 'growth lines' on the south-eastern leeward part of the island are clearly visible on satellite images and probably represent successive spits or strand lines (***Fig. 11***).

Fig 7. Deflation surface of Pleistocene cross-bedded aeolian dune sand. NW Al Aryam.

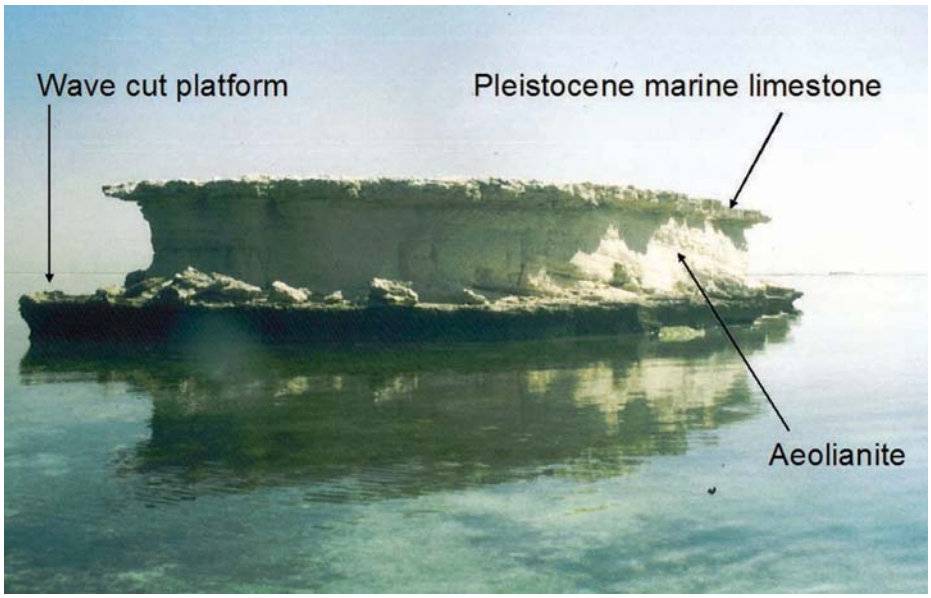


Fig 8. A zeuge off the east coast of Al Aryam. It comprises large scale, Pleistocene carbonate aeolianite capped by Pleistocene marine carbonate. The island is bordered by a wave-cut platform cut about 4,000 years ago when sea level was about a metre higher than today. Numerous lithified mangrove roots (rhizoliths) are exposed on the platform.

Fig 9. A mangrove stand *(Avicennia marina).*

Fig 10. Partly wind-eroded salt (halite) crust on the sabkha of southern Al Aryam. (View is about 1.5 m across).

Fig 11. Satellite image showing Al Aryam (left). Ancient beach ridges extend along the mainland coast and are traversed by old tidal channels. Note the growth lines around the southern coast of Al Aryam and the two lobes of Pleistocene sediments which extend to the southeast from the front of the island.

Fig 12. A major tidal channel with halophytic plants (*Arthrocnemum* sp.) growing along the crest of its levee. Looking north, east Al Aryam tidal channel. Extensive microbial mats (left background) cover the muddy intertidal flats behind the levee.

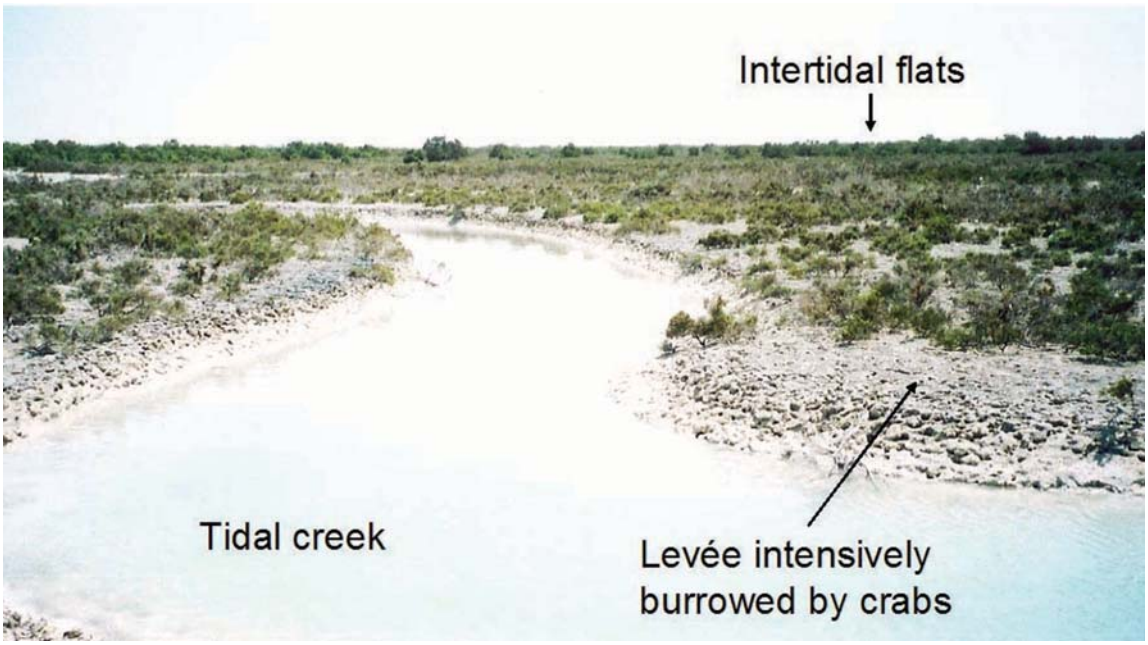


Fig 13. A two-metre wide tidal creek which branches off the main tidal channel, east side of Al Aryam. The sediment of its banks is intensively burrowed by crabs and the adjacent intertidal flats are populated by halophytic shrubs.

Fig 14. A close-up of intertidal crab burrows with excavated pseudo-faecal pellets of mud deposited by the crab in a 20 cm area around the burrow entrances. Many other crab burrows and 'middens' surround the prominent burrows.

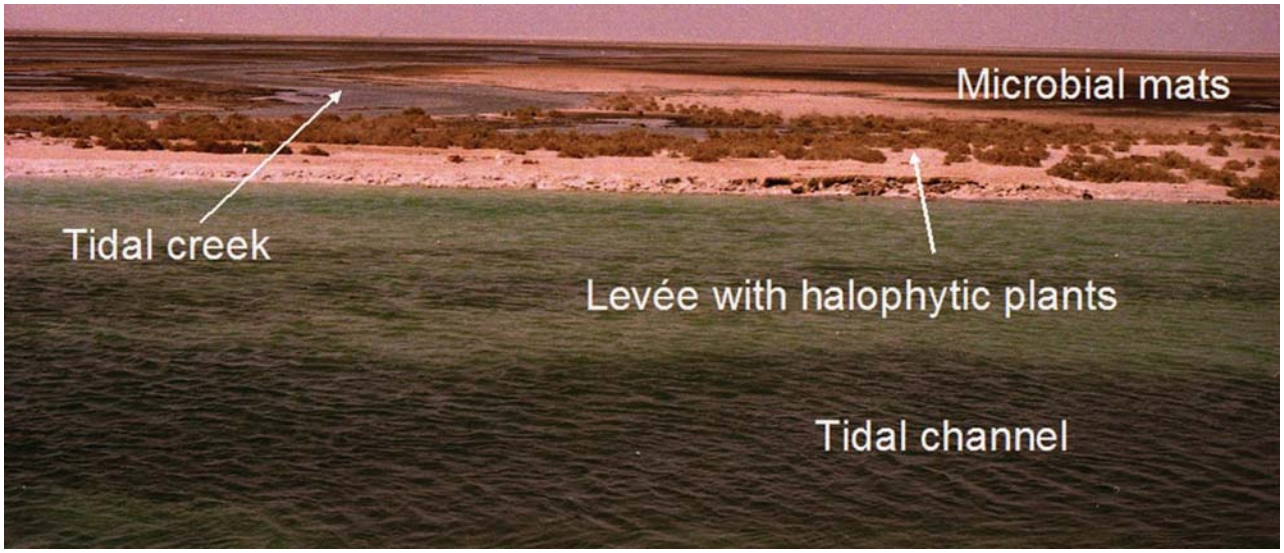


Fig 15. View northwards from the mainland across a major tidal channel to a halophyte colonised levée beyond which are extensive intertidal microbial mats. Southern coast of Al Aryam.

As the leeward accretionary wedge developed, the subsequent surface was only drowned at exceptional high tides and became converted to sabkha as the accretion proceeded. Both the beaches and the sabkhas were subsequently severely deflated as indicated by the exposure of large gypsum crystals which originally grew beneath the surface and are now exposed on the present day sabkha surface. Immediately beneath the evaporitic crust is the brown quartzose aeolian sand. Extensive gypsum 'mush' or minor anhydrite occurs along the southern flank of Al Aryam. This is believed to be the first recording of anhydrite on any of the Abu Dhabi barrier islands.

Along the south-eastern flank of the island, and between the southern flank and the mainland, are wide areas of intertidal flats cut by numerous tidal channels and creeks in which carbonate sands and muds are accumulating. The tidal channels are bordered by slightly raised banks (levées) produced by sediment deposition on the channel flanks during floods. Salt-tolerant halophytic plants populate these near-channel environments whereas mangroves flourish in the lower, more frequently flooded areas (***Fig. 12***). Narrow (1-2 m wide) tidal creeks that pass through the levées act as distributaries and carry sediment onto the adjacent intertidal flats during extreme high water. The sediments of these levées and their adjacent tidal flats are very extensively burrowed by crabs that sometimes deposit their pseudo-faecal pellets as low sub-circular mounds on the surface around the entrances to their burrows (***Figs. 13 & 14***). These channels and their associated intertidal flats are very similar to those of the Bahamas' intertidal zones.

Beyond the levées are wide intertidal flats colonised by microbial mats where carbonate muds accumulate (***Fig. 12 & 15***). Especially on the mainland side of the main channel, above the limits of normal tides, they pass into the flat, salt encrusted surface of the mainland sabkha which fringes much of the Abu Dhabi coastline. Approximately two kilometres into the mainland coastal sabkha, the salt-encrusted surface is replaced by some slightly higher (now deflated) storm ridges composed of shelly sand which marks the position of the mainland shoreline approximately 4,000 years ago (***Fig. 11***). Inland of these, beyond the Abu Dhabi-Jebel Dhanna coast road, the deflated flat sabkha surface extends into the rocky escarpment composed of Miocene rocks.

Al Aryam is well-preserved and relatively unspoiled. There is only limited building, mainly around its north-west corner and there is a limited network of dirt tracks that facilitate easy access to many parts of the island. The only obtrusive, non-natural feature is a long, 50 m wide road that extends for many kilometres on a NW-SE trend across the island and effectively splits it into two parts. Otherwise, Al Aryam is one of the best preserved of the barrier islands of the Abu Dhabi coast in terms of its natural state and it will hopefully continue to be preserved as part of the natural heritage of Abu Dhabi. The island and its immediate surrounding terrain also has the potential to be a very important natural laboratory for scientific teaching, research and conservation. It is valuable because it is one of the very few undisturbed and unspoiled extensive areas of natural beauty in the Abu Dhabi coastal region, an area already renowned globally in the geological community as a model for the deposition of carbonate and evaporitic sediment although unfortunately the entire coastal region is rapidly losing its natural identity because of ever-increasing civil engineering projects.

It is strongly recommended that a more rigorous geological and sedimentological study of Al Aryam and its surrounding marine fringe involving pre-defined transects and with the aid of satellite images should be made. The area is possibly the last chance to truly conserve a relatively unspoiled landscape and provides excellent potential to protect part of Abu Dhabi's natural environment for future generations of both the Emirates and the world at large.

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* Further details of the whole coastline of Abu Dhabi can be seen in: The Emirates: A Natural History. *Eds*. P. Hellyer and S. Aspinall, 2005, Trident Press Ltd., London. See especially articles therein by 1) G.Feulner, A Geological Review, p.41-63, 2) G.Evans and A.Kirkham, The Quaternary Deposits, p.65-78. These articles have a reasonably complete general bibliography of the Quaternary and sedimentology of the coast of Abu Dhabi.

Two new gecko species records for the United Arab Emirates: *Pristurus carteri* (Gray, 1863) and *Hemidactylus persicus* Anderson, 1872

by Andrew S. Gardner

Introduction

The most recent listing of the UAE reptile fauna includes 17 species of geckos recorded within the United Arab Emirates (Gardner 2008). Here I present the discovery of two further gecko species from the UAE. Both appear to have extremely limited distributions within the national borders and hence are vulnerable to local extinction.

Carter's Semaphore Gecko *Pristurus carteri* (Gray, 1863)

Carter's semaphore gecko was first collected by Surgeon-Major Henry John Carter in 1846 from Masirah Island, Oman, during a survey of the southern Arabian coastline on the surveying brig Palinurus of the Honourable East India Company. The two dried specimens he collected were described by Gray (1863) as *Spatalura carteri*, and described in life by Carter himself (1864). These were the first scientific reptile specimens to be collected in Oman (Gardner 1999). The species was placed in *Pristurus Rüppell* 1835 by Boulenger (1885). Further specimens were collected by Bertram Thomas on his travels in southern Arabia between 1926 and 1931, and by several later collectors, so that by 1986, Arnold (1986) described the distribution as 'Coastal regions of central Oman from around Ra's al-Hadd westwards to North Jol, South Yemen'.

Given this purported southern distribution, I was surprised to find *Pristurus carteri* living on rocky plateau outcrops on the Sultan Qaboos University campus west of Muscat in October 1987. The known range was given a further major extension in November 2006 when Angela Manthorpe and the Dubai Natural History Group found *P. carteri* on a Cretaceous ridge 50 km south of Ibri, extending the known range 160 km to the north west. This discovery raised the possibility that the species extends further north and westwards on the gravel outwash fans and outcrops to the south of the Hajar mountains, and might approach the UAE. Then, on 18 May 2007, *Pristurus carteri* was found on wadi gravels and outwash in Wadi Agram, adjacent to the UAE border fence, during a baseline ecology survey by Brigitte Howarth, Brien Holmes and myself (Gardner, Howarth and Holmes 2007). This site is 150 km NNW of the Ibri locality. Four individuals were observed during a two day field survey; two adult males and two adult females, suggesting that *Pristurus carteri* was not uncommon in this habitat and area. The closest record was just 600 metres from the UAE border fence, and hence probably within an individual's normal lifetime range of movement. As similar habitat continued across the border fence to the north, it seemed reasonable to assume that the species must also occur on the UAE side of the border.

In September 2007, a search was made by members of the Emirates Natural History Group in the UAE border area adjacent to the Oman Wadi Agram records, but no specimens of *Pristurus carteri* were found. A further search was made on 23 February 2009 by Brigitte Howarth, Heather Mikhail, Brien Holmes and myself, at several sites within the bulge of land extending east of Jebel Hafit to the Oman border. It was noted that the stony plain habitat suitable for *Pristurus carteri* is extremely limited in extent due to gravel extraction, construction, over-grazing and farms. Most habitats retaining natural surface in this area are sandy plains, rather than stony. Two small limestone ridges centred on 24.1484°N / 55.9468°E and 24.1227°N / 55.9585°E were searched, without finding *P. carteri*. However, a search adjacent to the border fence was successful this time, and 2 sub-adult specimens of *Pristurus carteri* were observed and photographed between 1400 and 1500 hrs. One was 310 metres from the border fence and the other was 550 m from the fence. Both were apparently active, and were first seen when they ran from an approaching observer. ***Fig 1*** shows the Oman and UAE distribution as presently recorded.

The habitat in the Wadi Agram site is a barren-looking alluvial outwash plain, containing cobbles and gravels mainly from the Semail nappe of the Hajar mountains. These are rocks of the upper mantle and ocean crust which were emplaced in the late Cretaceous. In the Wadi Agram area these cobbles are mainly gabbros of the lower ocean crust, which have been silicified to some extent. In higher areas above the present wadi channels, the cobbles have a desert varnish. The general vegetation of the area falls into the *Acacia tortilis – Rhazya stricta – Fagonia indica* zone typical of the foothills of the northern Oman and UAE mountains (Ghazanfar 1991a, Ghazanfar 1991b, Ghazanfar 1999). The UAE area has numerous camel farms and is severely overgrazed. This is particularly obvious when the relatively luxuriant vegetation on the Oman side of the border is compared. There are a few widely scattered trees of *Acacia tortilis*. Other typical plants observed in this habitat are *Gaillonia aucheri*, *Lycium shaw*i, *Blepharis ciliaris*, *Arnebia hispidissima*, *Crotalaria aegyptiaca*, *Indigofera intricata*, *Tribulus* sp, *Aizoon canariense*, *Euphorbia granulata*, *Glossonema varian*s, *Schweinfurthia imbricata*, *Paronychia arabic*a, *Polycarpaea repens*, *Boerhavia elegans* and *Stipagrostis plumosa*. Other lizard species seen in the area are *Mesalina adramitana*, *Uromastyx* sp. and *Bunopus tuberculatus*. On the Oman side, we also observed *Stenodactylus leptocosymbotes*, *Bunopus spatalurus hajarensis*, and *Ptyodactylus hasselquistii*, the last on outcropping limestone ridges.

The extent of this habitat on the UAE side of the

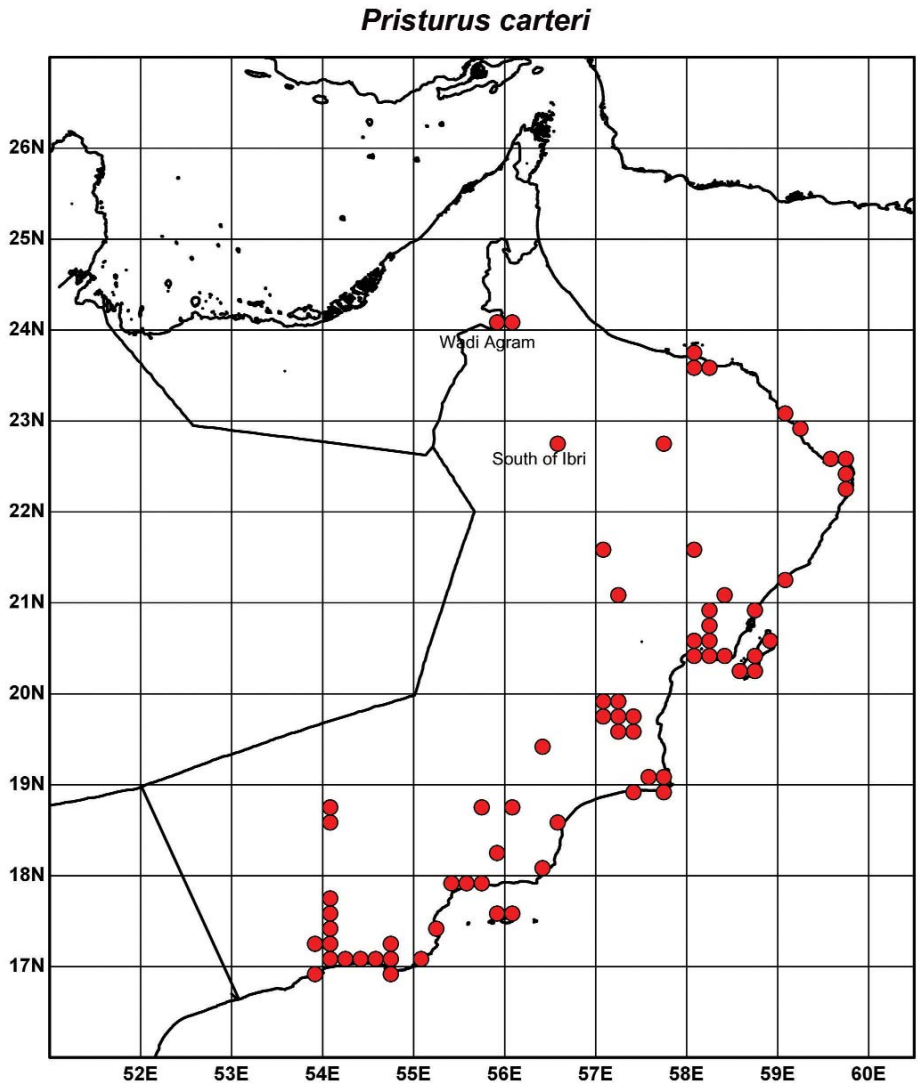

Fig 1. The distribution of *Pristurus carteri* in Oman and the UAE. The new records from Wadi Agram and the Cretaceous ridge south of Ibri represent a major extension of the known range for the species.

border is very limited as much of the area has been degraded by gravel extraction. Indeed on the Oman side of the border, the land will also be quarried in the next few years. The exact limits to the *P. carteri* distribution in the UAE are not known but the area suitable is unlikely to exceed 10 sq. km, and is most likely to be less than 4 sq. km. Given the sparse surviving vegetation and apparent low gecko population density, the total population may well be less than a thousand individuals. Any further gravel extraction or expansion of the farms is likely to result in the extinction of this species in the UAE.

Persian Gecko *Hemidactylus persicus* Anderson, 1872

Hemidactylus Gray, 1845 is one of the most species–rich genera of the family Gekkonidae with at least 80 species. These are generally recognised as being difficult taxonomically due to intraspecific variation and the plasticity of their external feature. *Hemidactylus persicus* is a widespread species, which falls within the 'arid clade' of species from north eastern Africa, south western Asia and Socotra (Carranza and Arnold 2006). According to Arnold (1986), the distribution of *H. persicus* is 'North-eastern Arabia south to Hofuf and Bahrain, northern Oman (Jabal Akhdar), Iraq, southern Iran, Pakistan'. The population on the Jebel Akhdar massif is characterised by large body size, growing to nearly 90 mm in snout to vent length (SVL) compared to about 67 mm elsewhere (Arnold 1977,Arnold 1986). Arnold (1977) noted that 'No *Hemidactylus persicus* has been taken between Hofuf and Jebel Akhdar, in spite of considerable collecting in the United Arab Emirates'. This remained true until Bob Reimer of the Al Ain chapter of the Emirates Natural History Group sent me a photograph of a gecko in an underground falaj (water channel) near Al Dhahr village in the Buraimi district of Oman. The photograph clearly showed an *Hemidactylus* different from the widespread *H. robustus*, in that it had a long tail with 27 dark bands. Further observations at this location in May 2008 confirmed the species as *H. persicus*. At this time a gravid female was seen, and the falaj walls and roof have numerous traces of gecko eggs. The falaj also contains fan-footed geckos *Ptyodactylus hasselquistii*. This represents a range extension of some 150 km to the NW of Jebel Akhdar.

On 29 August 2008 Tommy Pedersen and I visited Qarn Nazwa, a limestone outcrop in the sand sea 45 km south east of Dubai and 90 km NWN of Al Dhahr. Surprisingly, *H. persicus* were abundant on the outcrop, with 13 individuals being located in an hour between

Plate 1: Female sub-adult *Pristurus carteri* on the UAE side of the border fence in the Wadi Agram area.

Plate 2: Male adult *Pristurus carteri* in the Wadi Agram area on the Oman side of the border.

Plate 3. *Hemidactylus persicus* at Qarn Nazwa.

Plate 4: Gravid female *Hemidactylus persicus* in an underground *falaj* at Al Dhahr, Oman. She has extensive scarring on the upper body and a partially regenerated tail.

Table 1. Length and meristic data for three specimens of *Hemidactylus persicus* from Qarn Nazwa

Sex	Snout to vent lenght (mm)	Original tail length (mm)	Divided and undivided scansors on 1st and 4th toe	Pre-anal pores
Male	57	70.5	9 13	8
Male	58	65	9 13	8
Female	57	68	9 13	none

2200 and 2300. The geckos were seen on cliffs, boulders and in *Acacia tortilis* shrubs. They were very active, jumping and running at speed when pursued. On this and on a subsequent night visit in September 2009, no fan-footed geckos (*Ptyodactylus hasselquistii*) were seen. Other geckos species observed were *Stenodactylus leptocosymbotes* on the stony plain at the base of the outcrop and *Bunopus tuberculatus*, also at the base of the outcrop. Two juvenile Sind saw-scaled vipers *Echis carinatus sochureki* were also seen on the rock.

The Persian leaf-toed geckos of Qarn Nazwa were relatively small. Three individuals (2 males , 1 female) were collected and preserved. Table 1 gives some length and meristic data. Other than a slightly lower number of pre-anal pores (8 rather than 9-11), they fit well with other *H. persicus* populations (Arnold 1986). There are 16 longitudinal rows of moderately sized and striated dorsal tubercles, some of which have conspicuous white pigmentation, the adhesive pads are strongly expanded and much broader than the toes, and 23 to 27 dark bands on the tail. The skin appears to be fragile in these geckos. It breaks very easily on handling animals and several individuals were seen with extensive scarring.

A further record of *Hemidactylus persicus* comes from Dalma Island, where, during an ecological survey on 4 April 2008, a single individual was found active on the ground amongst rocks in the central hills. Although not caught and examined in detail, a photograph shows that it has the *persicus*-like features of small tubercles arranged in regular longitudinal rows, more expanded adhesive pads and colouration unlike *H. robustus*. On 23 September 2009, during an ecological survey on Sir Bani Yas, a single male individual of *H. persicus* was observed and photographed on rocky ground in the mountainous centre. It had 7 pre-anal pores and similar colour and tuberculation to the Dalma individual.

I have also recorded *H. persicus* in three coastal localities to the east of Jebel Akhdar in Oman, at Sifah, Dibab and on a rocky escarpment between Ad Daffah and Khubah, and at an inland locality at Mukhtari village near Sanaw (***Fig. 2***). All these populations are composed of individuals markedly smaller than those in Jebel Akhdar.

Arnold (1977, 1977) suggested that the population of *H. persicus* in Jebel Akhdar might be isolated due to competition with *Ptyodactylus hasselquistii* in the intervening lowland areas. *H. persicus* is widespread even at sea level on Bahrain which does not have *P. hasselquistii*. The subsequent records of *H. persicus* in lowland areas of the UAE and northern Oman provide further evidence for this, albeit equivocally. In the northern UAE, Qarn Nazwa is an isolated rocky outcrop which apparently does not have *P. hasselquistii*. The nearby and ecologically very similar outcrop known as 'Pink Rock' sited 7.5 km to the north east was searched at night on 8 March 2009. *P. hasselquistii* is abundant here, but no *H. persicus* were seen. On Jebel Faiyah, a higher and more extensive limestone ridge 20 km NE of Qarn Nazwa, there have been several records of *P. hasselquistii* but no *H. persicus*. The same is true of the well recorded limestone massif of Jebel Hafit (Gardner 2004). Dalma Island also has no *Ptyodactylus*. However, both species have been recorded in the underground falaj at Al Dhahr. Relict populations of *H. persicus* apparently also survive on at least the two rocky offshore islands of Dalma and Sir Bani Yas, also in the absence of *Ptyodactylus*.

Further east In Oman, the sites at Sifah, Dibab and Mukhtari have both *P. hasselquistii* and *H. persicus*. However at the most easterly record on the coastal escarpment, between Ad Daffah and Khubah, *H. persicus* is common, but *P hasselquistii* appears to be absent. Within the Jebel Akhdar massif, lower crags and caves below 800 m tend to have both species (such as in Wadi Halfayn, Bimmah in Wadi Bani Auf, Al Hijir in Wadi Bani Kharus) while higher sites up to 2000 m have only *H. persicus* (such as the Saiq plateau, Qayut, Jebel Shams). Whether the very large Jebel Akhdar form of *H. persicus* should be recognised as a separate taxon requires further study.

The UAE population of *Hemidactylus persicus* on Qarn Nazwa occupies a series of limestone outcrops totaling about 20 ha. The outcrops rise almost 50 metres above the sand sea which itself is approximately 150 metres above sea level. Much of this area is fenced and protected as part of the Dubai Desert Conservation Reserve. The unfenced site is close to the settlement at Qarn Nazwa and a major highway, and is a popular spot for picnics. It is already quite disturbed and littered with broken glass, plastic and cans. The crevices in the rocks are important roosts for naked-bellied tomb bats (*Taphozous nudiventris*), and the site is a well-known nesting site for the Pharaoh Eagle Owl (*Bubo ascalaphus*) and a haven for other wildlife, As such, it would be an ideal site for also receiving protection as a small nature reserve.

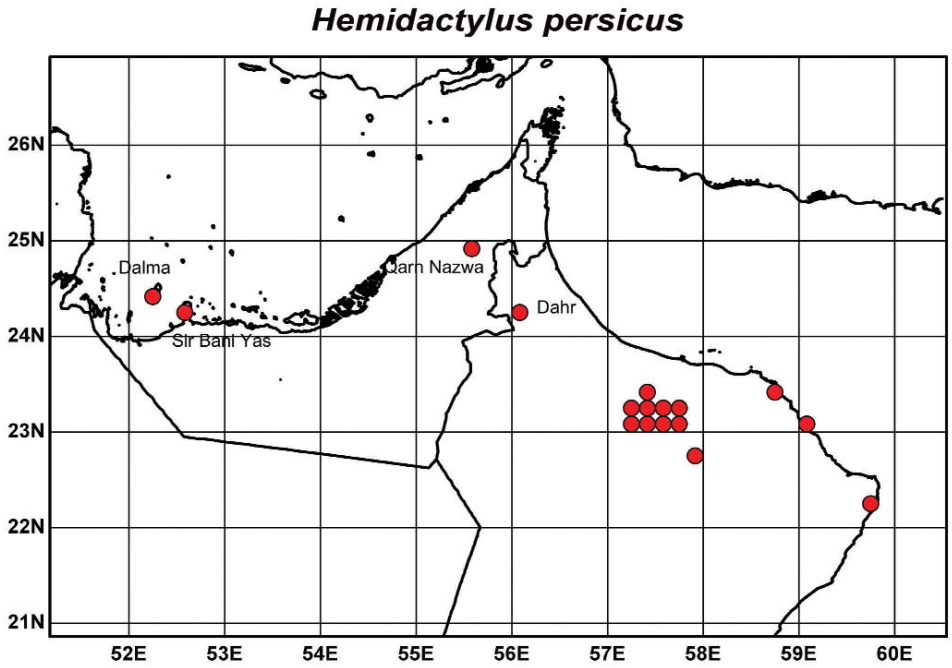

Fig 2. The distribution of *Hemidactylus persicus* in Oman and the UAE.

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The Arabian cat snake (*Telescopus dhara* (Forskål, 1775)): a new species record for the United Arab Emirates, with notes on the species in Oman

Andrew S. Gardner, Neil Tovey and Johannes Els

Plate 1. Road-killed specimen of *Telescopus dhara* photographed near Ain Al Ghamour, UAE. The coin is a UAE dirham, 23 mm in diameter. Picture by Neil Tovey.

Plate 2. Unpatterned morph of *Telescopus dhara* at Ras Aban Khaluf in central Oman. Photo Andrew Gardner.

The Arabian cat snake *Telescopus dhara* (Forskål, 1775) is a rear-fanged colubrid snake found in the peripheral mountains of Arabia, from the Gulf of Aqaba, southwards through the Hijaz to the Yemen mountains, to the mountainous and rocky areas of Oman. It is also reported from northern central Arabia including the Riyadh area (Gasperetti 1988). A closely-related species *Telescopus obtusus* is found across north and north eastern Africa, and is often included classified as a subspecies of *T. dhara*. While the species is well known in Oman, the only published record from the UAE is of an orange individual reported by Egan (2007) as being caught in Sharjah, but probably transported in date palms from northern Oman. Since then, three UAE records of Arabian cat snakes have been made. The first two were recorded by Damien Egan and Johannes Els of the Sharjah Breeding Centre for Endangered Arabian Wildlife (BCEAW). First, a cat snake was killed and photographed on 10 September 2006 at the Meridien Hotel at Al Aqah, 17 km north of Khor Fakkan. However the specimen was not preserved. On the night of 3 June 2008, a cat snake was caught in Wadi Helo and taken live to the BCEAW. The third record is of a road-killed Arabian cat snake from near Kalba and this is described in more detail here.

The recently killed snake was observed by Clive Temple and one of the authors, Neil Tovey, on the tarmac road near the Ain Al Ghamour picnic site (24.959° E 56.315° E), on the morning of September 20th 2008. The road here runs parallel to the Omani border and is within the lower areas of the Hajar Mountains. The snake appeared to have been recently run over while crossing the road from a group of low-lying hills to the south east of the road. It was approximately 80cms in total length, very thin but with a relatively wide head, narrow neck and large eyes. The dorsal colouration was pinkish brown with scattered lighter buffy markings, while the ventral side was unpatterned and white. After taking a series of digital photographs (***Plate 1***), the snake carcass was discarded.

Table 1 gives details of unpublished Arabian cat snake records from Oman since 1989. Most adult Arabian cat snakes are between 60 and 70 cm in total length (Egan 2007), though an individual collected near Nizwa on 15 July 1998 and measured by Drew Gardner had a total length of 113.2 cm (of which 16.5 cm was tail). This appears to be the longest specimen of the species on record. The localities of all records known to the authors are plotted in ***Figure 1***. Cat snakes are nocturnal and most of the records are of snakes active at night. The 40 cm total length cat snake on Jiddat al Sahasa at 1450 m was active at 21.45 hrs on a February night, when the air temperature was 10.5° C. This snake was rather slow, but still adept at climbing vertical rock faces.

The colour and pattern of these snakes vary enormously. ***Plate 2*** illustrates an almost unpatterned pinkish orange juvenile photographed near Khaluf, central Oman on 18 January 1999 and similar individuals occur on the Jiddat al Harasis. A heavily patterned individual, also juvenile, was observed climbing in a bush at night in Wadi Ayun, Dhofar, on 27 March 1989 and is shown in ***Plate 3***. ***Plate 4*** shows a living individual, similar in colour and pattern to the Ain Al Ghamour individual, photographed on the Jiddat al Sahasa in the Ru'us al Jibal of the Musandam peninsula. Another Musandam individual, photographed as a road kill by Dr Gary Brown on 6 May 2005 in Wadi Sal al Ala, also appears to be of a similar colour and pattern (***Plate 5***). The photo of the Al Aqah specimen is poor, but this individual appears also to be pinkish brown with buffy

markings. The Wadi Helo specimen (***Plate 6***) is similar in pattern but a darker brown. The individual from Qayut in the Jebel al Akhdar, observed at 2230 hrs, was a 60 cm individual in very poor condition, being thin and with lumps under the skin suggesting it was heavily parasitised. Its colour was similar to the Jiddat al Sahasa, one, as was the road-killed one from NE of Ibra photographed by Chris Hillman in September 2009. With rather few records, one cannot draw firm conclusions, but perhaps the northern Hajar Arabian cat snakes are mainly of this colour morph.

Given that Arabian cat snakes have previously been recorded in Jebel Akhdar and also in the Ru'us al Jibal, and that they have been recorded from sea level to 2150 metres, it is to be expected that this species would also occur in the Hajar mountains of the UAE. Indeed, it is somewhat surprising that the Arabian cat snake has not been recorded until now (Gardner 2005,Gardner 2008). This suggests that Arabian cat snakes are uncommon in the UAE, and deserving of listing on the UAE Red Data List of species of conservation concern.

Table 1: Unpublished Arabian cat snake records from Oman and the UAE. Unless otherwise indicated, these are by Andrew Gardner.

Date	Location	North	East	Altitude (m)	Notes
27.03.1989	Wadi Ayun, Dhofar	17.245°	53.888°	675	In bush at night, on rocky wadi side (***Plate 3***)
05.01.1992	Ja'aluni, Jiddat al Harasis	19.950	57.100	155	3 juveniles found by S. M. Farook.
30.03.1993	Manttakat Sukaykira, Sur	22.550°	59.517°	200	Wadi in mountains. No collection data.
11.05.1995	Above Qayut	23.150°	57.467°	2150	Observed at night in rocky wadi.
15.07.1998	Nizwa	22.933°	57.533°	550	Collected by Fahad Hamad Al-Kalbani, Sultan Qaboos University.
18.01.1999	Ra's Abana, Khaluf	20.450°	58.050°	15	A juvenile (total length about 30 cm) active at night on rocky outcrops and white sand, 1.0 km from sea. (***Plate 2***)
17.02.1999	Jiddat al Sahasa	25.967°	56.217°	1450	Observed at night in rocky wadi. (***Plate 4***)
04.12.2002	2.5 km SWS Ad Daffah	22.271°	59.807°	20	Active at night on rocky escarpment 0.75 km from sea.
06.05.2005	Wadi Sal al Ala	26.078°	56.327°	250	Road-killed specimen photographed by Dr Gary Brown. (***Plate 5***)
10.09.2006	Al Aqah Le Meridien resort	25.507°	56.363°	Sea level	Killed and photographed by Hotel staff.
3.06.2008	Wadi Helo	25.049°	56.203°	880 m	A male of total length 530 mm (SVL 450mm). BCEAW. (***Plate 6***)
20.09.2008	Ain al Ghamour	24.959°	56.315°	50	Road–killed specimen photographed by Neil Tovey. (***Plate 1***)
18.09.2009	NE of Ibra	22.716°	58.764°	440	Road-killed specimen photographed by Chris Hillman.

Plate 3. Well patterned morph at Wadi Ayun in southern Oman. Picture: Andrew Gardner.

Plate 4. Individual from Jiddat al Sahasa at 1450 m in the Musandam mountains with similar pattern to the Ain Al Ghamour specimen. Picture: Andrew Gardner

Plate 5. Road-killed specimen from Wadi Sal al Ala, Musandam, Oman close to the UAE border. Picture: Gary Brown

Plate 6. Cat snake from Wadi Helo, UAE, kept in the Breeding Centre for Endangered Arabian Wildlife, Sharjah.

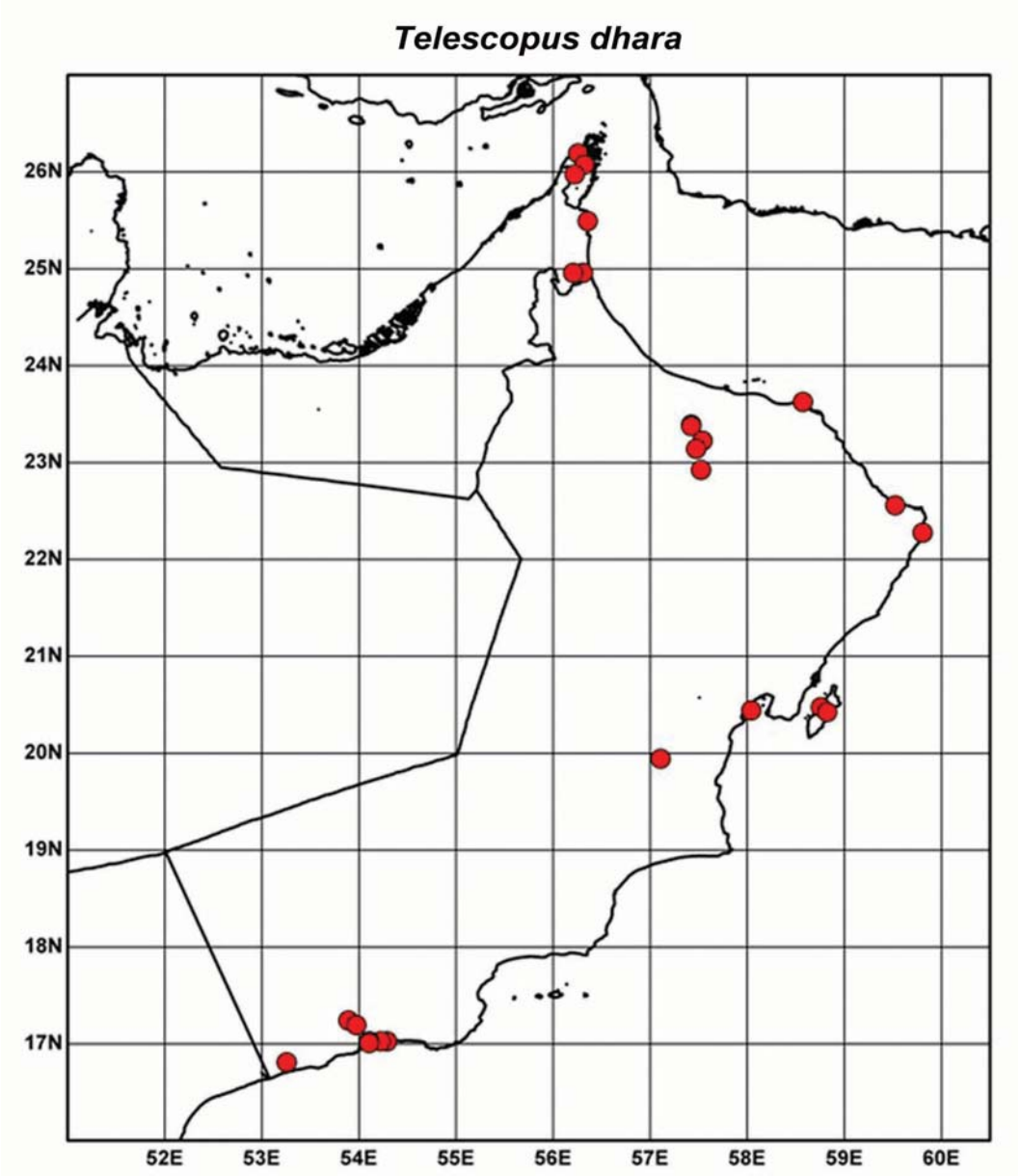

Fig 1. Localities of all records of *Telescopus dhara* known to the authors in Oman and the UAE.

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Errata and Addenda: Updated Illustrated Checklist of Dragonflies of the UAE – including a third species of *Ischnura* damselfly

by Robert W. Reimer, Gary R. Feulner and Richard J. Hornby

Our paper titled "An Updated Illustrated Checklist of Dragonflies of the UAE" (Feulner et al. 2007), published in ***Tribulus*** Vol. 17, stimulated valuable comment and inquiry as well as further investigations by the authors themselves. These confirmed errors in the identifications attributed to several photographs, which are corrected below.

In addition, continuing research and field studies by Reimer have revealed the presence of a third species of *Ischnura* damselfly, as well as the possible presence of a further dragonfly species observed in the coastal environment in neighbouring Oman. These developments are reported below, along with certain additional information likely to be of interest to those studying the Odonata of the UAE and northern Oman, including tips for field discrimination between *Ischnura* damselfly species.

Errata

Among the photographs which illustrated the checklist, we made the decision to include images of a number of atypical forms seen over the years, which were not always readily identifiable. Subsequent comment by international experts has confirmed the value of that decision from a heuristic standpoint, but also emphasises that we should have been more circumspect in assigning even tentative identifications.

Three of our photographs, all of immature individuals, have now been more authoritatively identified and a note is made here of the corrections. K-D.B. Dijkstra, Wolfgang Schneider and Laurent Juillerat have all written to indicate their views as follows (all Figures referenced are reproduced here):

Fig. 15b is an immature male *Diplacodes lefebvrei*, not an adult female of that species. Among the distinguishing features are the relatively long pair of white claspers at the tip of the abdomen and the pruinescence (dark colouration) on the face (frons). A bona fide female *D. lefebvrei* is shown here as ***Fig. 15c***.

Fig 15b. Immature male *Diplacodes lefebvrei* [RWR] (corrected).

Fig 15c. *Diplacodes lefebvrei* female [GRF].

Fig. 24d is an immature male *Sympetrum fonscolombii*, not an immature male *Trithemis arteriosa*.

Fig. 25c is an immature male *Crocothemis sanguinolenta*, not an immature male *Trithemis kirbyi*.

Fig 24d. Immature male *Sympetrum fonscolombii* [GRF] (corrected).

Fig 25c. Immature male *Crocothemis sanguinolenta* [GRF] (corrected).

In addition, further study of the *Ischnura* species in the UAE leads us to believe that ***Fig. 4d*** captioned "*Ischnura evansi* female in a brighter gynomorph colouration" is actually a female *Ischnura senegalensis*, based on the shape of the pterostigma and the ovipositor, which can be seen better in the original photograph. ***Fig. 4d*** is a more vivid example of the colouration shown in ***Fig. 5b***.

Fig 4d. *Ischnura senegalensis* female [GRF] (corrected).

Fig 5b. *Ischnura senegalensis* female [RWR] (original).

Addenda

Photo of *Ceriagrion glabrum* (female). At the time of publication we lacked an image of the cryptically coloured female of *Ceriagrion glabrum*, which has only rarely been observed in the UAE and northern Oman. We have since seen females at 'Ubul (Abool), in the Mahdhah area of northern Oman. One image is shown here as ***Fig. 3b***.

Fig 3b. *Ceriagrion glabrum* female [RWR].

Photo of *Crocothemis sanguinolenta* (female). We also lacked photographs of the female *Crocothemis sanguinolenta*. We were able to obtain some at Wadi Wurayah which has recently been given protected status by the Emirate of Fujairah. One is shown as ***Fig. 14b***.

Fig 14b. *Crocothemis sanguinolenta* female [RWR].

A third *Ischnura* species, *I. fountaineae*, confirmed for UAE and Oman. During April 2009, Reimer was privileged to be able to spend two days with Dr. Wolfgang Schneider at the Senckenberg Institute in Frankfurt, Germany, going over specimens of the various species present or expected in Arabia. As part of that process, Schneider kindly reviewed photographs taken in the Mahdhah area of northern Oman of *Ischnura* that could not confidently be assigned to either *Ischnura evansi* or *I. senegalensis*, the only two *Ischnura* species previously recognised in the UAE and Oman. Keying out the photographs led to the conclusion that these anomalous individuals were in fact *Ischnura fountaineae* Morton, 1905, representing a new species for Oman. Literature for the UAE and Oman in Schneider's library, much of which is not available in the UAE, was also reviewed. Kappes & Kappes (2001) published photographs of female *Ischnura* from Ramtha Lagoons in Sharjah which was identified as *Ischnura senegalensis* (***Fig. 27***). With the review of *Ischnura* keys fresh in mind, it was suspected that the photograph was not of *I. senegalensis*. The keying process again led to the judgment that the female was *Ischnura fountaineae*, adding this third *Ischnura* species to the UAE list as well. *I. fountaineae* had previously been recorded in the Arabian Peninsula from Saudi Arabia (Waterston 1980) and Qatar (Waterston & Pittaway 1991).

Fig 27. *Ischnura fountaineae* female [Wulf Kappes].

The three species are known to occur sympatrically in other localities (Dumont 1991). Sage (1960) reports that *Ischnura evansi* and *I. fountaineae* (*I. bukharensis* in his paper, since synonymised with *I. fountaineae*) occur together in the marshes in the south of Iraq. Borisov (2006) describes the ecology of five species of *Ischnura* that occur together in the oases of the Pamir-Alia Mountains of Tajikstan. *Ischnura fountaineae*, *I. evansi*, *I. elegans*, *I. forcipata* and *I. pumilio* were found to use the same habitat during different time intervals, apparently driven by temperature and humidity.

We posited in our earlier article that *I. evansi* was the dominant species at mountain sites, which seems to hold true for most of the year. *I. senegalensis* appears to be dominant at anthropogenic sites such as the ponds at the Palm Sports Resort (formerly Al Maqam) and the sewage treatment plant in Al Ain. A recent survey of an artificial watering hole at the Dubai Desert Conservation Reserve showed an even split between the two species. Reimer's observations of *I. fountaineae* in the Mahdhah area of Oman have occurred at locations where the other two species were also seen, but they have tended to occur in well shaded areas. Photographs by Feulner of *Ischnura* males and females along irrigation channels among cultivation on the Saiq Plateau, at ca. 2000 metres elevation in the Jebel Akhdar region of Oman, also appear to show *I. fountaineae*.

Heidari and Dumont (2002) list seven species of *Ischnura* from Iran. With that information and the fact that Borisov observed assemblages of up to five *Ischnura* species, it is possible that additional species will be recognised in the UAE as more attention is paid to this fascinating genus.

Distinguishing males of the three *Ischnura* species in the field. As evidenced by the confusion in recognising the three species of *Ischnura* now known from the UAE, it is difficult to distinguish the various species with the naked eye in the field. Even binoculars or the view through a long telephoto lens may be insufficient. However, digital photography is a real aid and the latest digital SLR cameras have LCDs that allow zooming in sufficiently to recognize several diagnostic characteristics.

The three species are closely related, with *I. evansi* and *I. fountaineae* belonging to the *elegans* group and *I. senegalensis*, not too distant phylogenetically, being closely related to the Australian species *I. heterosticta* (Morgan 2002). Hybrids are known to occur in *Ischnura* as well. Identification of *Ischnura* females is complicated by the fact that they exhibit multiple colour forms (occasionally including male, or androchrome, colouration) that change as the individual matures. Males of the three species are compared in ***Fig. 28***.

We do not know of any field guide that includes all three *Ischnura* species now recognised for the UAE and Oman. The only place all three are treated in detail in the English language is in Dumont's (1991) monograph, *Odonata of the Levant*. While this publication is excellent, it concentrates on features that are distinguished microscopically or with a 10x or better hand lens, such as the pronotum (part of the thorax behind the head) and the terminal appendages of the male which form the lock and key system for mating in damselflies. It is well illustrated with line drawings and SEM images, but lacks photographs or drawings of the entire insect. There is a good species account of *Ischnura fountaineae* in Dijkstra and Lewington's *Field Guide to the Dragonflies of Britain and Europe* (2006). Wolfgang Schneider's Ph.D. thesis also treats all three species but is in German.

Ischnura senegalensis males are most easily identified in the field by three characters mentioned by Samways (2008): (i) the colour of the second abdominal segment ("The most distinguishing feature in the field is the blue patch on the side at the base of the abdomen."); (ii) the pterostigma ("blackish on the inner half, bright blue in outer half, the blue of which fades on death"); and (iii) the terminal appendages ("the peaked end of S10 and the horn-like inferior appendages are also distinctive."). Clear photographs taken from the side or above will show the longer, pointed terminal appendages.

In contrast, both *I. evansi* and *I. fountaineae* have blunt terminal appendages. Also, in both *I. evansi* and *I. fountaineae* the black on the second abdominal segment does not extend all the way around the segment, but is limited to the top half of the segment only. The pterostigma of these two *elegans* group species is dark with a whitish edge surrounded by dark veins. In *I. fountaineae*, the apical (outer) half of the pterostigma can be clear (Kalkman 2006) but may turn black in older specimens (Dumont 1991).

I. evansi and *I. fountaineae* can be most easily distinguished in the field by the colouration of the thorax and first few segments of the abdomen and the antehumeral stripes on the thorax. In *I. evansi*, the colour is greenish-blue and there are always clearly visible stripes of the same colour on the shoulders (Dumont 1991). *I. fountaineae* is coloured sky-blue without a hint of green, the same colour as the blue that occurs on the eighth abdominal segment (Dijkstra and Lewington 2006). The antehumeral stripe may be missing, interrupted or very narrow (Dumont 1991).

Records from the Ru'us al-Jibal (the mountains of the Musandam peninsula). We noted that dragonflies are uncommon in the Musandam region due to the extreme scarcity of surface water. In fact, apart from *Anax ephippiger* and *Pantala flavescens*, both of which are often found far from water, the only known records of Odonata from within the mountain areas of the Musandam are associated with a small number of permanent or ephemeral springs and with the permanent bedrock pools of the precipitous Wadi Zibat, a tributary of Wadi Bih. The species that have been observed at such sites are *Arabineura khalidi*, *Crocothemis erythraea*, *Orthetrum chrysostigma*, *O. ransonnetii* and *Trithemis arteriosa*. Access to most of these sites is physically challenging and has been made politically so as well, following the closure of the UAE/Oman border in Wadi Bih a few years ago.

Fig 28a. *Ischnura evansi.*

Fig 28b. *Ischnura fountaineae.*

Fig 28c. *Ischnura senegalensis.*

A possible additional species: *Macrodiplax cora* (Kaup in Brauer, 1867). We wrote of *Pantala flavescens* that it is "[o]ccasional in mangroves, where it is the most commonly observed dragonfly." While this is supported by numerous observations and by positive identifications (see Feulner *et al*. 2007, ***Fig. 20b***), Reimer has subsequently suggested, based on recent observations in Oman, that a similar species, *Macrodiplax cora*, may also be present in UAE coastal environments, at least at Khor Kalba on the East Coast.

In Dhofar in January 2008, Barbara Reimer photographed male and female dragonflies (***Figs. 29a and b***) resting in a coastal khor. Based on Reimer's experience and available references, the only reasonable identification that appeared to be close was *P. flavescens*. Reimer himself took in-flight pictures of a swarm of reddish dragonflies that was foraging at sunset at about 50 -100cm off the ground on the beach near Al Mughsayl, which he could not identify. Subsequently, van der Weide and Kalkman (2008) published several new records for Oman that included a picture of *Macrodiplax cora*. That picture matched up well with Barbara Reimer's resting male "*P. flavescens*".

On a second trip in 2008, Reimer was able to obtain additional records from along the Dhofar coast, including pictures of pairs copulating in flight and ovipositing in flight (***Figs. 29c and d***). Then, in November 2008, he was at the Al Sawadi Resort at Ras Sawadi on the Gulf of Oman and observed several dragonflies behaving like the ones in Al Mughsayl. Because the individuals were foraging around the swimming pool, no photographs were obtained but they flew close enough to identify them as *M. cora*.

A species account of *M. cora* is included in *Dragonflies and Damselflies of South Africa* (Samways, 2008). It is just a bit smaller than *P. flavescens* and the male is redder. The pterostigmae of the two are similar in size and colour. *P. flavescens* has a distal amber patch on the rear wing while *M. cora* has a basal amber patch on the rear wing. The markings on the abdomen are similar although *M. cora* has a more pronounced hourglass shape to the black marks on each segment. *M. cora* perches horizontally rather than hanging vertically as *P. flavescens* does.

Keith Wilson, now resident in the UAE, commented from Hong Kong on *M. cora* as follows:

"*Macrodiplax cora*, a dragonfly newly recorded for Hong Kong in May 1997 (see Porcupine! 16:5), is a widespread species found in three zoogeographical areas – the Ethiopian, Oriental and Australasian regions. It is highly migratory with populations established on islands in the Indian and Pacific Oceans. The larvae are salt tolerant with populations occurring in lagoons and estuaries. The genus *Macrodiplax* is both tropical and neotropical and closely allied to *Pantala* which is also found throughout the tropics. *Macrodiplax cora* and *Pantala flavescens* are perhaps today's most successful dragonflies in terms of numbers and distribution."

M. cora was recorded in Socotra in 1903 and Salalah and Yemen in 1990 (Schneider & Dumont 1997). Hedari and Dumont (2002) expect that *M. cora* could occur as an Oriental faunal element in south-eastern Iran, since it occurs in southern Arabia. Sakagami *et al*. (1974) provide detailed behavioural descriptions of several species in the Bonin Islands, including *P. flavescens*, and they note generally that the behaviour of *M. cora* is similar to *P. flavescens*.

The Sawadi beach area is approximately 200 km from the UAE border at Khor Kalba. The intervening Batinah coast does not present any barriers to dispersal, especially to a dragonfly that is so successful in migrating to new sites. Feulner's records from Khor Kalba include observations of reddish dragonflies that were not positively identified but were presumed to be male *Pantala flavescens*. At least one of these, however, was seen to perch (not hang) on a mangrove branch, behaviour which would be unusual for *P. flavescens*, suggesting it could have been *M. cora*. More concerted efforts to observe dragonflies on the east coast of UAE could be rewarded with the discovery of another species.

Fig 20b. *Pantala flavescens* female [RJH].

Fig 29a. *Macrodiplax cora* male, from Dhofar [Barbara Reimer].

Fig 29b. *Macrodiplax cora* female, from Dhofar [Barbara Reimer].

Fig 29c. *Macrodiplax cora* copulating in flight, from Dhofar [RWR].

Fig 29d. *Macrodiplax cora* ovipositing in tandem flight, from Dhofar [RWR].

Acknowledgements

The authors extend their thanks to K-D Dijkstra, Laurent Juillerat and Wolfgang Schneider for their corrections of misidentified photographs. Thanks to Wulf Kappes for the use of his picture of *Ischnura fountaineae* from Sharjah. Reimer would particularly like to thank Dr. Schneider for generously sharing his time and knowledge of Arabian Odonata.

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The biology of *Pyrrhiades anchises jucunda* (Butler) in northern Oman (Lepidoptera: Hesperiidae, Coeliadinae)

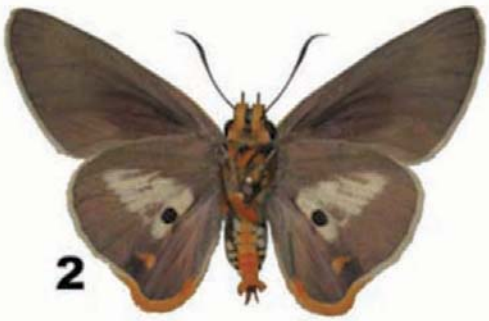
by Matthew J.W. Cock

Summary

The giant skipper, *Pyrrhiades anchises jucunda* (Butler) (= *Coeliades anchises jucunda*), was reared from *Acridocarpus orientalis* A.Juss (Malpighiaceae) in Oman. All stages are described and illustrated. Three adult forms are illustrated and compared with previous observations and illustrations published by T.B. Larsen; one form has not been previously reported.

Figs. 1-4: Undersides of *Pyrrhiades anchises*.

1: *P. a. anchises* male, Kenya.



2: *P. a. jucunda* male, form 1, Oman.

3: *P. a. jucunda* male, form 2, Oman.

4: *P. a. jucunda* male, form 3, Oman.

Introduction

The giant skipper, *Pyrrhiades anchises jucunda* (Butler), is the largest skipper butterfly found in Arabia. Until recently, it was known as *Coeliades anchises jucunda*, but Chiba (2009) transferred it and three others species from *Coeliades to Pyrrhiades*, based on clear differences in the male genitalia. Its distribution includes the island of Socotra (type locality), Dhofar and northern Oman (Evans 1937; Larsen 1984; Ackery *et al*. 1995; Gillett 1995), with one record from Jebel Hafit, UAE (Khan 1999). The biology of ssp. *jucunda* in Oman is known (Larsen & Larsen 1980; Larsen 1984), but not recorded in any detail. A second subspecies, *P. anchises anchises* (Gerstaeker) (***Fig. 1***) is found from South Africa, where it is probably not resident (Henning *et al.* 1997), throughout eastern Africa to Arabia (Yemen). This paper describes the biology of ssp. *jucunda* from Oman, and makes limited comparisons with the author's unpublished observations of ssp. *anchises* in Kenya.

Food plants

The only confirmed food plant of ssp. *jucunda* is a small tree in the Malpighiaceae: *Acridocarpus orientalis* A.Juss (Larsen & Larsen 1980), known locally as *qafaf* or *qafas* (Khan 1999). Larsen (1983) quotes an early report that *Ficus* sp. (Moraceae) is a food plant of ssp. *jucunda* on Socotra, but he considers this likely to be an error, and I agree.

In contrast, reported food plants of ssp. *anchises* include Asclepiadaceae: *Marsdenia* sp. in Kenya (Sevastopulo 1974), *Marsdenia angolensis* N.E.Br. in East Africa (van Someren, 1974), and Malpighiaceae: *Tristellateia australis* A.Rich. in Kenya (Sevastopulo 1974) *Triaspis leendertziae* Burtt Davy in South Africa (Gifford, 1965), and *T. glaucophylla* Engl. also in South Africa (Henning *et al.* 1997), although the last two records may actually refer to the same host plant species. In Kenya, I have found caterpillars on two other Malpighiaceae: once on *Acridocarpus zanzibaricus* A.Juss. (a sprawler rather than a tree), and frequently on *Caucanthus auriculatus* Nied. (M.J.W. Cock unpublished).

Locality and habitat

The observations reported here were made on 28 January 1995, in Oman, close to the border with Abu Dhabi, UAE, and subsequently from material collected on this occasion. The locality is Hajah al Gharbi; it lies South-East of Al Buraymi Oasis (also spelt Buraimi), about 5 km south of Daqiq (also spelt A'Daqeeq), following the route described in Zandi (1993). This is an area of dry hills and wadis (***Fig. 5***), and was located on the basis of advice from M. Jongbloed (*pers. comm.* 1995) that the food plant, *Acridocarpus orientalis*, could be found in this area. South of Daqiq, *A. orientalis* grew as scattered bushes or small trees along the sides and edges of the wadis. Ova and caterpillars were easy to find on the food plant. Final instar caterpillars were particularly common on *A. orientalis* growing along a wadi running from West to East, and many could have been collected. By collecting large caterpillars, I subsequently reared six male and three female adults.

Fig 5. Habitat of *Pyrrhiades anchises jucunda*, Oman (Hajah al Gharbi, about 5 km South of Daqiq, Southeast of Al Buraymi Oasis), 28 January 1995. The small tree in the middle foreground is the food plant, *Acridocarpus orientalis* (*qafaf* or *qafas*).

Adult behaviour

Adults of ssp. *jucunda* (***Fig. 6***) were quite common and at least 10 were seen. They were noted to fly around the food plants, settling briefly, but were very restless. They were also observed to fly slowly around low vegetation, perhaps looking for nectar sources, but to fly rapidly around hillsides with little vegetation

Life History

Ovum. Ova (***Fig. 7***) are laid on both the leaf upper surface and under surface, usually singly, or two close together, but one small group of six was also found. The ova are white when newly laid, and turn cream in colour as they mature. Ova are typical of *Coeliades* and *Pyrrhiades* spp., almost hemispherical, 1.3mm (± 0.03, n=8) diameter and 0.9 mm (± 0.00, n=3) height, with 23-27 (mean 24.8 ± 1.4, n=9) fine ribs from the base to short of the micropyle, leaving a smooth area around the micropyle of about 0.7mm diameter . They are similar to the ovum of ssp. *anchises* which I have found in Kenya (M.J.W. Cock unpublished), but are larger and have more ribs.

Caterpillar behaviour. The smallest caterpillars hide between two leaves, one on top of the other, held in position with silk threads. They do not make the typical first stage shelter of *Coeliades* and *Pyrrhiades* spp., perhaps because the leaves of *A. orientalis* are so tough. Small caterpillars skeletonise the leaf upper surface, rather than perforate the lamina. The medium grown caterpillars either continue to shelter between two leaves, or may make a second stage shelter. Two forms of second stage shelter were observed. Typical of *Coeliades* and *Pyrrhiades* spp., one was made at the leaf apex by eating a cut from the edge of each side of the lamina about 25 mm from the tip to close to the mid-rib, and folding both flaps upwards to form a pocket (***Fig. 8***). Alternatively, just one cut was made and the resultant flap folded over onto the other half of the leaf apex. The third stage shelters occurred in three forms. Some caterpillars simply roll a whole leaf (***Fig. 9***). Other caterpillars made a cut from the edge of the lamina near the base of the leaf, and rolled the resultant distal flap. Finally, some drew together two or three leaves and held them with silk to form a tube between them (***Fig. 10***) - this was the least common type.

Final, Sixth Instar Caterpillar. Larsen & Larsen (1980) illustrate the mature caterpillar on *Acridocarpus orientalis* at Wadi-al-Asi near Nakhl, Oman. Henning *et al*. (1997) reproduce this photo in their account of *P. a. anchises* in South Africa. Larsen (1984, p.23) also illustrates the caterpillar in lateral view.

The following is based on an individual caterpillar of 45 mm (***Fig. 13***). Head 5 mm across; red; shiny rugose; a row of five black spots across the lower part of the face, the outer spots surrounding the stemmata, and the central one on the clypeus; mouthparts brown; scattered long, pale, setae, especially ventrally.

Thoracic segment 1 black, posterior margin white.

Thoracic segments 2 and 3 black; double, narrow white line across posterior margin, narrowly interrupted on dorsum; the two lines fuse laterally and each to the legs; dark red ventrally.

Abdominal segments 1-4 black; quadruple white line across posterior margin, narrowly interrupted at dorsum apart from the second line; the four lines join together laterally and extend to just below the spiracles; red ventrally. Abdominal segments 5-9 brown-red ventrally.

Abdominal segments 5-6 similar to abdominal segments 1-4, but anterior two transverse lines brown-red at dorsum.

Abdominal segment 7 black; a long brown-red transverse bar; separated by narrow black line from double white line on posterior margin (interrupted at dorsum).

Abdominal segment 8 black; a long brown-red transverse bar on posterior margin.

Abdominal segment 9 black; a curved line runs from laterally on the anterior margin of the segment, to the posterior margin on the dorsum; this line brown-red apart from the lateral extremities which are white. Anal plate brown-red, with yellow anterior margin and dark lateral spot.

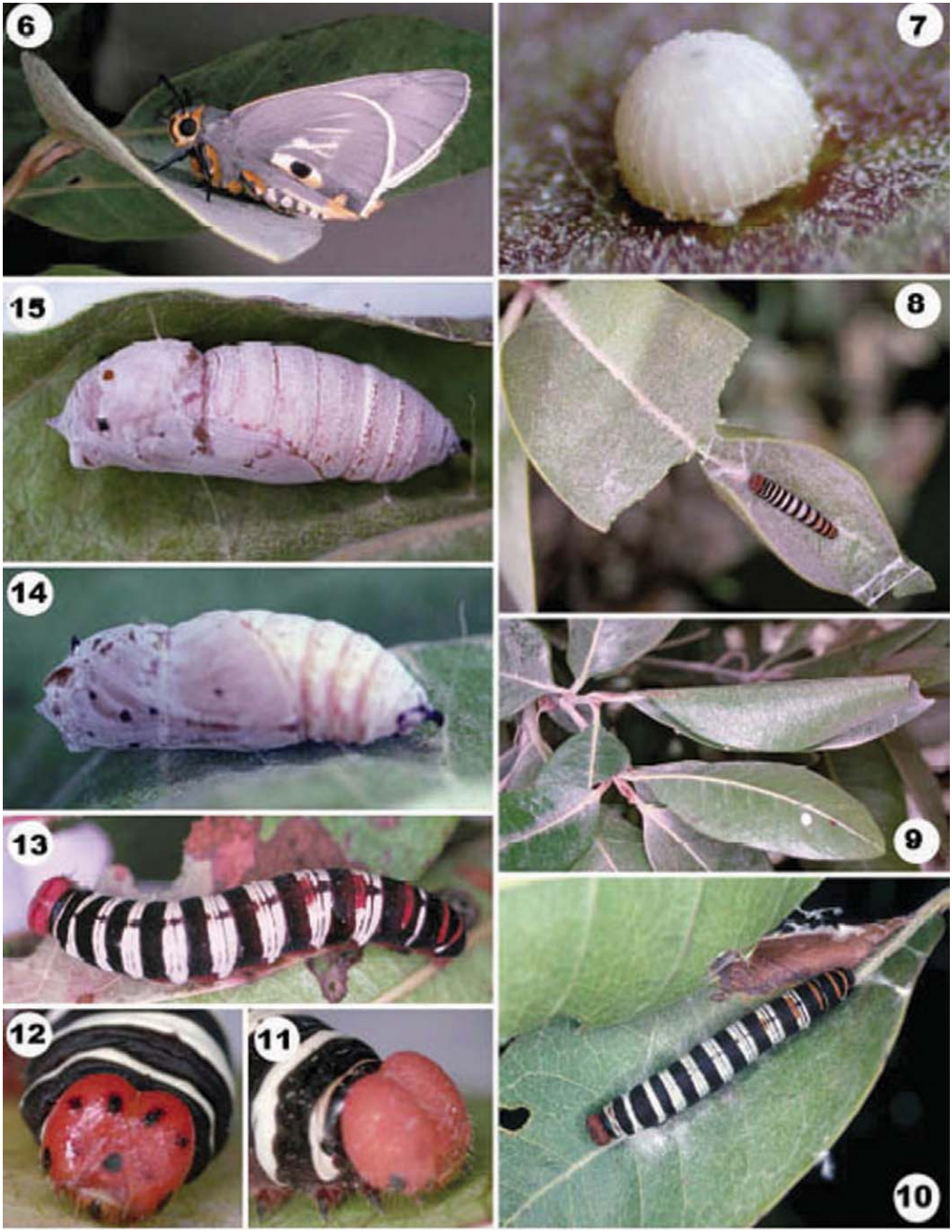
Spiracles dark; legs black; prolegs red-brown.

The markings of the head are variable, ranging from specimens with a plain red head, apart from a black spot around the stemmata (***Fig. 11***), to those with an upper row of four spots as well (***Fig. 12***), all heavily marked. Similarly, the extent to which the white transverse bands are interrupted at the dorsum is also variable, some caterpillars having more heavily marked white bands that continue across the dorsum. One caterpillar had lateral red-brown patches anterior to the white stripes on abdominal segments 3-6.

The caterpillars of ssp. *jucunda* are superficially similar to one of three forms of caterpillars of ssp. *anchises* which I have found in Kenya (M.J.W. Cock unpublished), which will be reported elsewhere.

Earlier Instars. In the first instar caterpillar, the head measures 0.7 x 0.7mm (n=1) wide x high and is orange-brown, with a black spot covering the stemmata; body orange-brown. The caterpillars of instars 2 to 5 are all basically similar in markings to the final, sixth instar caterpillars (***Figs. 8 and 10***). The head capsules of the penultimate instar measures 3.8 x 3.8mm (n=2), width x height.

Pupa. Pupation is in the stage 3 caterpillar shelters. Larsen (1983) refers to pupation taking place in a particularly elaborate shelter, but this does not seem to be the case. The pupa is smoothly contoured, with a short pointed frontal spike (***Figs. 14, 15***). When newly moulted, the pupa retains the colouring of the caterpillar, but over 1-2 days it turns pale brown and acquires a patina of white waxy powder so that it appears white. Cremaster, projecting spiracles on thoracic segment 1, two spots on the leg of thoracic segment 2, one spot on the leg of thoracic segment 3, spot at end cell forewing, and heart shaped outline ventrally just anterior to cremaster all black (***Fig. 14***). A spot dorso-laterally on thoracic segment 1 is bare of the white waxy powder and shows the light brown ground colour of the pupa (***Fig. 15***). The pupa is similar to that of ssp. *anchises* (M.J.W. Cock unpublished), but with reduced spotting.



Figs 6-15. Life cycle of *Pyrrhiades anchises jucunda*, Oman. 6: Adult male, form 2; 7: Ovum; 8: Second stage caterpillar shelter; 9: Third stage caterpillar shelter, made by rolling an individual leaf; 10: Instar 4 caterpillar in third stage caterpillar shelter made from two leaves, one on top of the other; the shelter has been opened and the upper leaf displaced towards the top of the picture; 11: Head of instar 5 caterpillar, form with no spots on head; 12: Head of instar 5 caterpillar, form with full complement of spots, although the spots between the clypeus and stemmata are weak and diffuse; 13: Instar 5 caterpillar, dorsal view; 14: Pupa, ventro-lateral view; 15: Pupa, dorso-lateral view. All food plant leaves are *Acridocarpus orientalis*.

Natural enemies

One ovum was parasitised by a *Trichogramma* sp. egg parasitoid, and more than 20 adult wasps were reared from this one ovum. They have not been identified to species. Other ova found in the field showed similar exit holes. No caterpillar parasitism was recorded.

Adult variability

T.B. Larsen comments on the variability of adults of this species, and indicates that the type "has no trace of white markings and well developed red markings on the underside of the hind wings" (Larsen 1983, p. 443). The specimen illustrated by Larsen & Larsen (1980, p. 71) and Larsen (1984, plate 22, 416) closely resembles the type according to Larsen (1983), but it does have traces of white markings along the veins on the disc of the hind wing underside. Larsen (1983) states that most Oman specimens have feeble traces of white markings and less intense orange markings, but that very occasionally specimens are encountered in Dhofar (Larsen, plate 22, 418) with a white band almost as well developed as in ssp. *anchises*.

The reared adults from Oman were all collected as mature caterpillars, all collected at the same time, and within a few metres of each other, yet they are surprisingly variable. They seem to fall into three distinct groups, referred to here as forms 1-3.

In form 1, consisting of one male, the underside hind wing band is almost white, comparable with Larsen's Dhofar specimen (***Fig. 2***). In form 2, comprising four males and two females, the band is heavily sullied with grey, and there is a variable orange border to the dorsal margin of the white band in space 2 (***Fig. 3***); these are comparable with the intermediate male illustrated in Larsen (1983, Plate 22, 417). Finally in form 3, comprising one male and one female, the band is almost completely grey with just the veins paler, and the black spot in space 2 surrounded by grey instead of orange, and resembling a greasy blemish (***Fig. 4***). Nothing comparable to this third group seems to have been previously reported. No specimens matched that which Larsen compares to the type, in which the white in the underside hind wing band is replaced with orange. More material is needed to clarify whether these are relatively discrete forms, or whether the variation is continuous.

Although, both caterpillars and adults are variable, I cannot detect any correlation between the two. The adult of form 1 was reared from a caterpillar with all spots present on the head, although the outer spots in the upper row and the spots between the clypeus and the stemmata in the lower row were weak. Of the caterpillars which produced form 2 adult males, one had the upper row and the central spot of the lower row both missing, another had only the lower row of spots, and two had all spots present. One female of form 2 was reared from a caterpillar with only the spot over the stemmata, while the other had only the lower row of spots, the middle three being weak. The male of form 3 was reared from the caterpillar described in detail above, having only the lower row of spots on the head, while the female was reared from a caterpillar that had the lower spots and just a trace of the two inner spots from the upper row.

Acknowledgements

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Observations on the biology of *Pelopidas thrax* (Hübner) (Lepidoptera: Hesperiidae: Hesperiinae) in the Hajar Mountains, Oman

by Matthew J.W. Cock

Summary

Pelopidas thrax (Hübner) - the Millet Skipper- is a widespread skipper butterfly found throughout sub-Saharan Africa, Cyprus, Egypt and the Middle East to Pakistan. The published information on the food plants and early stages is critically reviewed. Caterpillars and pupae collected on *Saccharum kajkaiense* (Melderis) Melderis (Poaceae) in the Hajar Mountains, Oman, are described and illustrated. Differences from the published accounts are discussed. A specimen captured in Dubai may be the first record of this species from the United Arab Emirates.

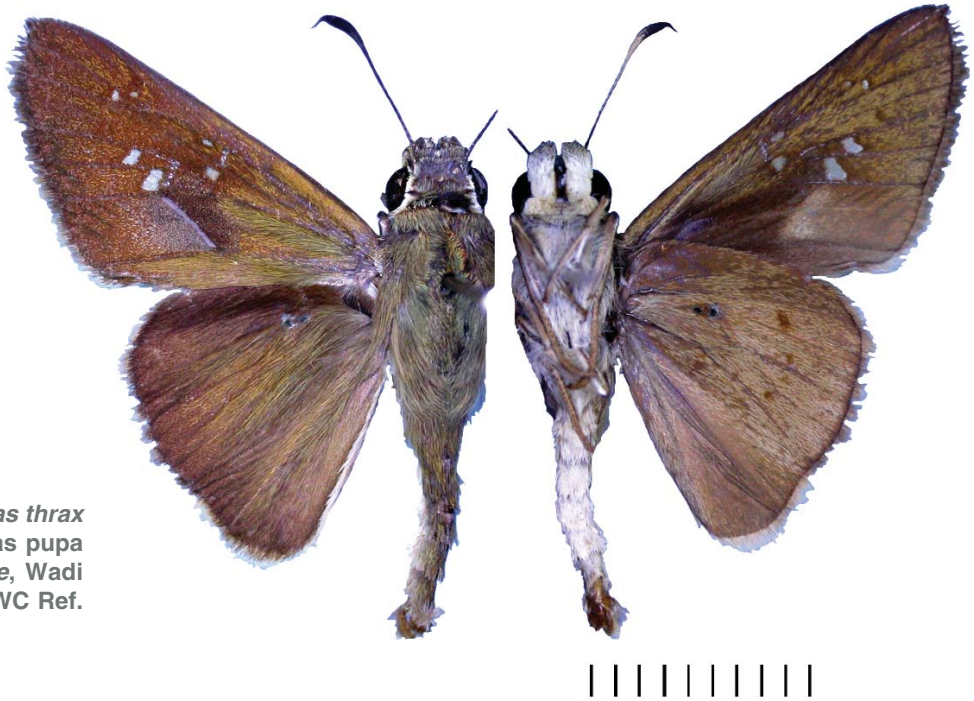

Fig 1. Adult male *Pelopidas thrax* (scale in mm), collected as pupa on *Saccharum kajkaiense*, Wadi Khamees, 17.iv.1994 (MJWC Ref. 94/200B).

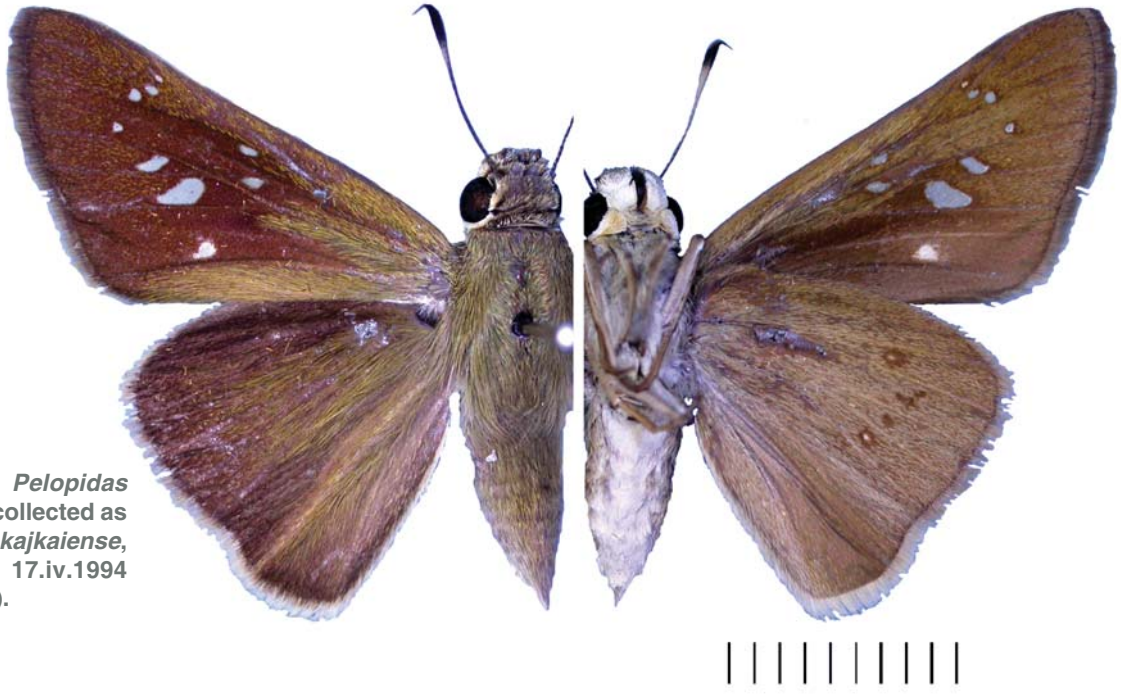

Fig 2. Adult female *Pelopidas thrax* (scale in mm), collected as pupa on *Saccharum kajkaiense*, Wadi Khamees, 17.iv.1994 (MJWC Ref. 94/200A).

Introduction

Pelopidas thrax (Hübner) (***Figs. 1-2***) is a widespread skipper butterfly found throughout sub-Saharan Africa, Cyprus, Egypt and the Middle East to Pakistan and North-west India (Evans 1937, 1949; Larsen 2002, 2005). Until recently, it was treated as two separate subspecies: the nominate *thrax*, described from Syria, and found in Cyprus and from Egypt to North-west India (Evans 1937, 1949; Larsen 2002); and subspecies *inconspicua* (Bertolini), described from Mozambique and found throughout sub-Saharan Africa (Evans 1949; Dickson and Kroon 1978; Larsen 2005). However, Larsen (2005) examined adult material from throughout this range and concluded that Evans (1937, 1949) incorrectly treated *thrax* as an extreme dry season form, exemplified by specimens from Iraq. He concluded that *P. thrax* is a single subspecies throughout its range and accordingly, he synonymised *inconspicua* under *thra*x.

There are no supporting observations for or against this conclusion based on early stages, so observations and comparison of material of the two former sub-species would be useful.

Pelopidas thrax is similar to the even more widespread *P. mathias* (Fabricius). The two species are quite easily distinguished as adult males: *P. thrax* (***Fig. 1***) having a grey-white brand on the upper forewing, whereas *P. mathias* has a black brand. The females are rather similar and separation may cause difficulty. The early stages have not been compared hitherto.

Both these *Pelopidas* species are found in the Arabian Peninsula (Larsen 1984). *Pelopidas thrax* is known from northern Oman (Rostaq, Wadi Sahtan), but probably also occurs in Dhofar and Musandam (Larsen & Larsen 1980). Similarly, *P. mathias* occurs in Dhofar, Rostaq and Musandam (Khasab) (Larsen & Larsen 1980). Brown (1992) includes only *P. mathias* in his interim list "Butterflies of the United Arab Emirates". Gillett (1995) includes both species in his annotated list of butterflies recorded from the UAE and the Buraimi – Al Mahdah region of Oman, noting that *P. thrax* is regularly found in the plantations around Mahdah, but not yet observed in the Al Ain area.

In sub-Saharan Africa, *P. thrax* is a species more associated with forests than grassy areas. Thus, Henning *et al.* (1997) state that it is "an inhabitant of woodland and forest margins ... only occasionally in grass-, thorn-, or bushveld .... More often found in dense rain forests" in southern Africa. However, also writing about southern Africa, Dickson & Kroon (1978) only associated it with grassy areas. Larsen (1991), writing about the situation in Kenya, found that *P. thrax* "tends to be less well adapted to the more arid parts of the country" than *P. mathias.* Writing about West Africa, he states that *P. thrax* is "more frequently found in the forest zone than *P. mathias*, occasionally even in actual forest" (Larsen 2005). I have personally collected this species in Uganda (Mabira Forest) and Côte d'Ivoire (Adiopodoumé) in forested areas, supporting the observations above. I have also found it common in Pakistan at Rawalpindi in a suburban situation, where the original vegetation was probably light forest. In the Arabian Peninsula, *P. thrax* is reported as a species of oases and plantations (Larsen 1984; Gillett 1995).

The reported food plants of *P. thrax* are all grasses, but almost all published records seem to be secondary sources, and I have failed to track down many original food plant records. For example, it has been reported several times as a pest of rice, yet Heinrichs & Barrion (2004) do not mention this species in their comprehensive review of rice pests in West Africa, although they do include *P. mathias*, which is well recognised as a minor pest of rice (e.g. IRRI 1983).

The food plant records from the Arabian Peninsula are limited. Larsen & Larsen (1980) give "grasses, including rice, wheat and millet", but this is probably based on sources from outside the region. Larsen's (1984) illustration of a caterpillar on a millet leaf is misidentified (see discussion below).

Dickson & Kroon (1978), presumably based on the notes of G.C. Clark from South Africa, give the food plant as *Imperata cylindrica* (L.) Raeusch. (as *I. arundinacea*), and add that it was reared on *Ehrharta erecta* Lam. and other grasses. Pringle *et al*. (1994) in the revision of Dickson & Kroon (1978) imply that *E. erecta* is a food plant, but this is probably based on the rearing food plant record from the earlier edition. Larsen (1991) reports that the caterpillars feed on grasses (*Ehrata*, *Oryza*, *Imperata*) and it may be a minor pest of rice. Larsen (2005) expands this to a "wide array of Poaceae, including *Oryza*, *Ehrhata* and *Imperata*".

The possibility of confusion between the two *Pelopidas* spp. suggests that all records not based on reared voucher specimens are open to question.

As far as I can tell, of those mentioned above, the only unequivocal field record of a food plant for *P. thrax* is G.C. Clark's South African record on *I. cylindrica*.

Clark (1978) provides excellent paintings of the life history on "grass" (Dickson & Kroon 1978, Plate 32). The egg, all caterpillar instars and pupa are shown in dorsal and lateral view. The final instar caterpillar is pale yellow-brown, with a darker dorsal line and a brown lateral line. The head is pale brown, the posterior margin and lateral areas dark, as are the epicranial and clypeal sutures. The earlier instars are similar, but the head is dark. The pupa is slender, pale yellow-brown, with a slightly downturned, dark, frontal spike, and the proboscis sheath projecting about one segment beyond the wing cases.

Makris (2003) illustrates a caterpillar of *P. thrax* from Cyprus, which is very similar to that illustrated by Clark (1978). The head is shown almost in lateral view, but with a slight anterior perspective. It is light brown with a very strong lateral stripe, which extends at least partly to the posterior margin; the epicranial suture and some or all of the adfrontals and clypeus are black, and there is a trace of a black streak extending dorsally on the epicranium from the adfrontals.

The main purpose of this paper is to document the life history and a food plant of *P. thrax* in the Hajar Mountains, Oman, in order to contribute to understanding the biology of this species and the better understanding of the fauna of the region. However, it also provides an opportunity to record the capture of a male specimen at Dubai (Jumeirah) on 9th April 1992. Larsen (1984), Brown (1992) and Gillett (1995) do not include the UAE in the distribution of this species, but it is not unexpected.

Fig 3. Wadi Khamees with a large tuft of *Saccharum* sp. in the foreground.

Fig 4. Edge of wadi with two plants of *Saccharum kajkaiense.*

Localities

Two wadis were visited in the area South-east of Hatta in November 1992 and April 1994. To reach them, take the road south past the Hatta Pools and past a sign for Wadi Khamees. The road follows Wadi Qilifi south-south-west for several kilometres, and Site 1 is Wadi Dainah, the only large wadi to the left with high walls and a lot of green vegetation. Following the road for several more kilometres, it goes over a small pass and comes to a village; Site 2 is the next wadi on the left after the village. For my specimen data labels, both areas are referred to as Wadi Khamees, for lack of more authoritative information at the time. Both localities are on the Oman side of the border with the UAE, based on road signs and maps.

Observations

What I assumed to be a single species of tussock forming grass was present, in the wadi bed of both sites, both as large plants (***Fig. 3***) and small plants, the latter particularly along the edge of the wadis at the foot of the side wall (***Fig. 4***). My herbarium specimen was identified as *Saccharum kajkaiense* (Melderis) Melderis (Poaceae) by T. Cope of the Royal Botanic Gardens, Kew, who commented that it is very local in Oman and also known from Iran and Afghanistan. However, there may have been two species of grass present as the large tussock grass found in wadis is locally known only as *S. ravennae* (L.) L. (Jongbloed 2003). In the following, I refer to all food plants as *S. kajkaiense*, while recognising that I cannot say now whether my observations were only from *S. kajkaiense*, or from both *Saccharum* spp.

Eight caterpillars of several different instars were found 23rd November 1992 at Site 1 (MJWC Ref. 92/210), on *S. kajkaiense*, and I was able to rear one through to an adult female. I was not successful in rearing the remaining caterpillars, as I ran out of fresh food plant material, and, although the caterpillars accepted another grass, *Rottboellia cochinchinensis* (Lour.) Clayton, they all died before pupating. On 17th April 1994, two caterpillars and two pupae were collected from Site 1 and Site 2 (MJWC Ref. 94/200). At this time, many (10-20) empty pupae were also found. From the April 1994 collections, I successfully reared a male and female. The following account includes details from both collections, the description of earlier instars based on the first, and the description of the final instar and pupa mostly based on the second.

The caterpillars seemed to be found on the more isolated small plants of *S. kajkaiense*, and in April 1994 I noted that they seemed to be particularly associated with the north or north-east side of the wadi.

The caterpillars rest in shelters formed from the leaves of the food plant. Small caterpillars make a shelter from a single leaf, by rolling the edges upwards until they meet, and holding the edges together with strands of silk. They then feed from the edge of the leaf lamina distally or basally to the shelter, or both. Larger caterpillars draw together several leaves and hold the edges together with silk strands to form a tube.

No ova were found. Detailed observations on and photographs of the early stages were not made, but the head capsules were preserved (***Fig. 5***), and the following account of the early stages is based on these. Head capsules were measured using a binocular microscope with an eyepiece graticule, accurate to ±0.05mm for instars 1-4, and ±0.07 for instars 5-6. There seem to be consistently six larval instars with variable intensity of markings (Fig. 5, Table 1), although more material and sequential observation would be useful to confirm this.

Fig 5. Head capsules of *Pelopidas thrax*, instars 1-6, collected on *Saccharum kajkaiense*, Wadi Khamees, 23.xi.1992 and 17.iv.1994. The instar 6 head capsule contains the dried remains of the dead caterpillar, and so is darker than in life (cf. Figs. 6-8). For dimensions see Table 1.

Table 1. Dimensions and colouring of head capsules of caterpillars of *Pelopidas thrax* collected on *Saccharum kajkaiense*, Wadi Khamees, 23.xi.1992 and 17.iv.1994.

Instar	n	Width (mm)	Height (mm)	Colour
1	2	1.0-1.1	1.1-1.2	Uniformly dark.
2	4	1.5-1.6	1.6-1.7	Three are light brown with narrow dark lateral lines, epicranial suture and adfrontal sutures, but one is darker brown, with strong dark lateral line and epicranial suture, adfrontals and clypeus dark.
3	2	1.8-2.0	2.0-2.1	One light, with thin dark lateral line and epicranial suture, and adfrontals and clypeus dark; the other dark brown with thick dark lateral line and epicranial suture, and adfrontals and clypeus dark.
4	3	2.1-2.4	2.3-2.5	Two light brown with narrow lateral dark line, epicranial suture and adfrontal sutures; one dark brown, with thick dark lateral line and epicranial suture, and adfrontals and clypeus dark.
5	4	2.4-2.7	2.7-3.1	All light brown, with dark lateral line varying from (1) very narrow not extending as far as the vertex, (2) very narrow extending to vertex, (3) medium strong, (4) strong; narrowly dark epicranial suture and adfrontal sutures.
6	4	3.3-3.6	3.4-4.1	Pale brown, two with only a trace of the dark lateral line above the ocelli, one with no dark lateral line at all, and one with strong line stopping well short of apex; epicranial suture may or may not be dark, adfrontal sutures not dark. Other caterpillars (e.g. Figs. 6 & 8) show a strong lateral line extending to vertex, or the epicranial suture almost unmarked (*Fig. 7*).

The sixth instar caterpillars (***Figs 6-8***) grow up to 35mm long. Body dull pale green; dorsal line darker; sub-dorsal and lateral pale stripes. Spiracles pale, inconspicuous; all legs concolorous. Wax glands formed ventro-laterally on the anterior margin of abdominal segments 7 and 8 when caterpillar mature.

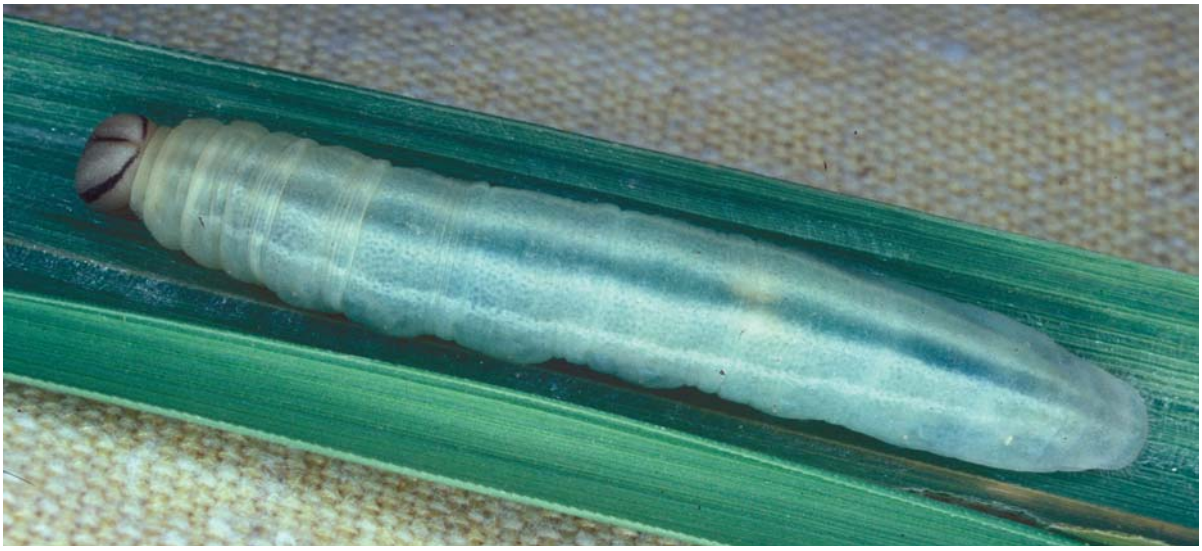

Fig 6. Sixth instar caterpillar of *Pelopidas thrax*, approx. 35 mm, collected on *Saccharum kajkaiense*, Wadi Khamees,17.iv.1994 (MJWC Ref. 94/200C).

Fig 7. Head of sixth instar caterpillar of *Pelopidas thrax* with reduced dark markings (about 3.5mm wide), collected on *Saccharum kajkaiense*, Wadi Khamees, 17.iv.1994 (MJWC Ref. 94/200D).

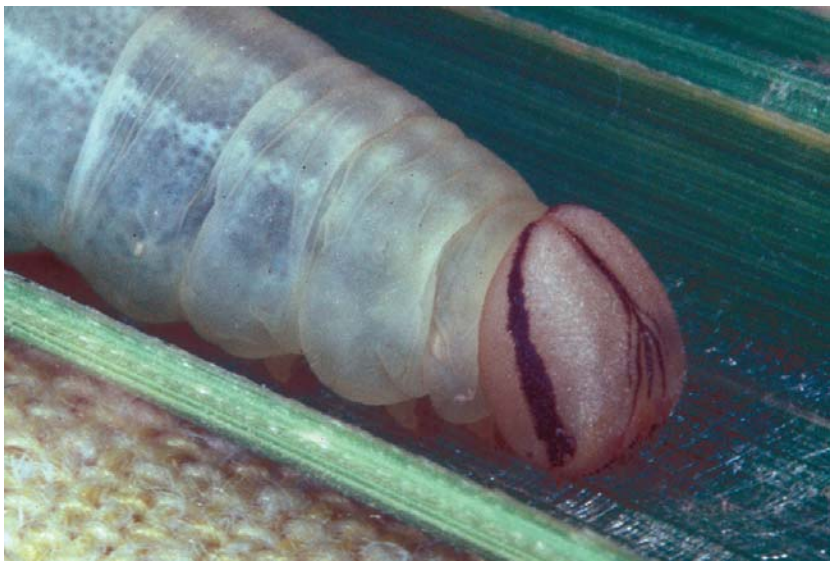

Fig 8. Head of sixth instar caterpillar of *Pelopidas thrax* with strong markings (about 3.5mm wide), collected on *Saccharum kajkaiense*, Wadi Khamees, 17.iv.1994 (MJWC Ref. 94/200C).

Pupa (***Fig. 9***) 32 mm long; elongate, with a frontal spike of about 3 mm, pointed slightly upwards; yellowish white; slightly paler sub-dorsal line. The pupa is formed in the shelter of the mature caterpillar, which is lined with silk. The inside of the shelter is covered with a thin deposit of white waxy powder, which is not found on the pupa itself.

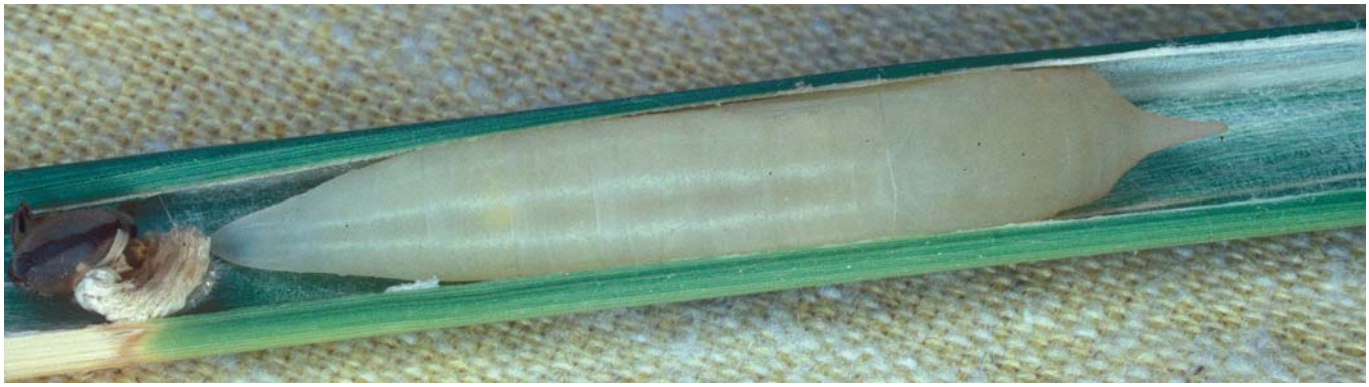

Fig 9. Pupa of *Pelopidas thrax* (approx 32mm long) collected as pupa on *Saccharum kajkaiense*, Wadi Khamees, 17.iv.1994 (MJWC Ref. 94/200B).

In captivity, adults (***Figs. 10-11***) emerged after 6-13 days from pupae collected in the field.

Fig 10. Newly emerged male *Pelopidas thrax*, collected as pupa on *Saccharum kajkaiense*, Wadi Khamees, 17.iv.1994 (MJWC Ref. 94/200B).

Fig 11. Newly emerged female *Pelopidas thrax*, collected as pupa on *Saccharum kajkaiense*, Wadi Khamees, 17.iv.1994 (MJWC Ref. 94/200A).

One caterpillar in the fifth instar, collected in November 1992, had been parasitised by a gregarious eulophid parasitoid. Seven female and three male adult wasps were reared from the associated black pupae, but have not been identified. Another caterpillar collected in the fifth instar produced a tachinid larva in the sixth instar which formed a puparium 3.4 x 7.2 mm diameter x length, which failed to emerge.

In view of the presence of *P. thrax* at Sites 1 and 2, in Oman but only a few kilometres from the UAE border, it seems reasonable to expect that the butterfly and its food plant are also present in suitable habitat within that part of the Hajar Mountains lying within the UAE, at least in the Hatta / Huwaylat area.

The separate capture of a specimen in coastal Dubai at Jumeirah (Jumeirah Villas) on 9th April 1992 was in typical garden habitat with mostly exotic plant species, including flowering plants. It was at rest when found, and so I cannot report any observations of adult feeding or early stages.

Discussion

Although the available reports from sub-Saharan Africa indicate this is mostly a species associated with forests, and generally not associated with arid areas, these observations from wadis of the Hajar Mountains show that *P. thrax* is able to live and breed on a specialised grass in the generally dry wadi habitat as well as plantations and oases, as noted by Gillett (1995) and Larsen (1984) in Oman. The single record from coastal Dubai is difficult to interpret in isolation; it probably represents a specimen that had dispersed from its normal habitat and breeding area, but the possibility of a breeding population cannot be ruled out.

Comparing my pictures and descriptions with those of Clark (1978) from southern Africa and Makris (2003) from Cyprus, in the final instar the Oman material has a very much less strongly marked head capsule. Moreover, whereas the head capsules of all the early instars illustrated by Clark (1978) are black, those of the Oman material are variably pale with more or less pronounced black markings.

The pupa from Oman clearly differs from that illustrated by Clark (1978) in that the frontal spike of the former is concolorous with the rest of the pupa and slightly upturned, whereas in the latter it is dark and slightly down turned.

However, the caterpillar illustrated as *P. thrax* by Larsen (1984) is obviously different, having a green head, with a red-brown line running from the epicranial suture at the dorsum, laterally to the ocelli, and an adjacent white stripe anterior to this. It is actually the final instar caterpillar of *P. mathias*. I have reared *P. mathias* in Kenya and Zimbabwe but have not yet published these observations. I have found very little published on the life history and very few published pictures of the early stages, which is surprising since it is a recognised pest. IRRI (1983) illustrate a caterpillar comparable with my rearing, but the pupa illustrated is incorrectly associated as it has no frontal spike, whereas the pupa of *P. mathias*, like that of *P. thrax*, has a frontal spike. It seems likely that the pupa illustrated is that of *Parnara guttata* (Bremer & Grey), another hesperiid pest of rice in Asia.

The *Pelopidas mathias* caterpillars that I have reared and the one illustrated by IRRI (1983) both match the caterpillar illustrated as *P. thrax* by Larsen (1984). T.B. Larsen (*pers. comm*. 2008) did not rear that caterpillar, which he found in Dhofar and assumed to be *P. thrax*, because of the food plant, and, as far as he knew at that time, *P. mathias* did not occur in the area. Thus, it seems safe to conclude that Larsen's (1984) illustration is of *P. mathias*, and the specific food plant association of millet relates to that species and not *P. thrax*.

My adult specimens from the UAE and Oman are certainly larger and more fulvous than those I have seen from elsewhere, but I have not examined enough material from different localities and different seasons to suggest that Larsen's (2005) monotypic treatment of *P. thrax* is incorrect. However, the differences noted in the caterpillars and pupae suggest that the Oman population, at least with regards to the early stages, may not fit into the concept of *P. thrax* as a monotypic species; the possibility of subspecies or a complex of similar species cannot be ruled out. Several recent studies have shown that cryptic species pairs or groups exist which can be separated by their caterpillars and food plants and by bar-coding, but are very similar as adults, both in appearance and in genitalia (Hebert *et a*l. 2004; Burns *et al*. 2007, 2008). *Pelopidas thrax* would seem a worthwhile subject for similar study, based on life history information and the use of DNA techniques.

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Hidden in plain view: First UAE record of the wadi grass *Saccharum kajkaiense* and notes on its distribution in the UAE and neighbouring Oman

by Gary R. Feulner and Narayan Karki

The genus *Saccharum* (SAK-er-um) consists of some 200 species, subspecies, varieties and/or cultivars including the cultivated sugar cane, *S. officinarum* (eFloras 2009; ZipcodeZoo.com 2009). In the UAE and northern Oman the genus is represented principally by the conspicuous *S. ravennae*, which grows in large clumps in and alongside gravel wadi beds. The clumps can be more than 2 metres tall, with the plumed inflorescence on spikes up to another metre taller.

S. ravennae has an Old World temperate and tropical distribution ranging from the circum-Mediterranean region through the Caucasus and Arabia to Central Asia, China, India and Indo-China (Clayton *et al.* 2006 onwards). It has also been introduced as an ornamental in the United States, where, under names such as "Ravenna Grass", "Hardy Pampas Grass" and "Plume Grass", it is advertised for its large size, distinctive appearance and large plumose inflorescence as one of the most attractive decorative grasses, although it is considered moderately invasive.

Two other sugar cane congeners have been mentioned in earlier literature for the UAE and northern Oman. *S. griffithii*, which has a primarily South Asian distribution (Clayton *et al.* 2006 onwards), has been recorded in the UAE from anthropogenic sites in Abu Dhabi and at Al-Wigan, in the south-eastern desert (Jongbloed 2003). *S. spontaneum*, sometimes called "Kans Grass" or "Wild Sugar Cane", is an invasive species which is considered to have a South Asian origin but is now widely distributed in the Old World (Clayton *et al.* 2006 onwards). It was recorded from northern Oman (Ghazanfar 1992) and from an unspecified wadi site in the UAE or neighbouring Oman (Jongbloed 2003).

Both *S. griffithii* and *S. spontaneum* are, like *S. ravennae*, potentially very large plants, and both are typically associated with relatively damp conditions, whether natural or irrigated. *S. spontaneum*, for example, forms thick stands on alluvial plains along South Asian rivers which flood seasonally (Wikipedia 2009). It also grows, spontaneously, in damp fields and is considered excellent fodder for most South Asian livestock.

The UAE and northern Oman records of *S. spontaneum* have subsequently been revised, as discussed below, but in any case the prior records other than *S. ravennae* were generally treated as exceptional and there is no evidence that the significant presence of any other *Saccharum* species in Hajar Mountain wadis was recognised or suspected by most of the many field investigators in the UAE and northernmost Oman (see, e.g., Western 1989, Boer & Chaudhary 1999, Curtis 1999, Karim 2002, Jongbloed 2003, and Karim & Fawzi 2007).

Nevertheless, another regional congener, *Saccharum kajkaiense* (Meld.) Meld., had in fact been recorded by the mid-1990s, when lepidopterist Matthew Cock obtained an identification from Thomas Cope at the Royal Botanical Gardens, Kew, for the grass species on which Cock had collected larvae of the Millet Skipper butterfly *Pelopidas thrax* (Cock 2008/2009, in this volume) at several locations in Wadi Qahfi (the locally popular "Hatta Pools" wadi), situated in the middle of the Hajar Mountains in northernmost Oman. Cope was able to comment at that time that *S. kajkaiense* was found in Iran and Afghanistan and had a localised distribution in northern Oman (the type specimen is from Iran and the species is also found in the North West Frontier Provinces of Pakistan (eFloras 2009)). Cock himself had not distinguished between *S. ravennae* and *S. kajkaiense*, considering that only a single species was present (which he understood to be *S. kajkaiense*), but he did observe that *P. thrax* larvae were more common on smaller plants near the wadi walls.

It appears that the occurrence of *S. kajkaiense* in northern Oman was not actually published until the appearance of Flora of the Arabian Peninsula and Socotra, Vol. 5, Part 1 (Cope 2007). In that volume, Cope rejects the earlier determinations of *S. spontaneum* from Oman and considers them to be in part *S. griffithii* and in part *S. kajkaiense*.

Cope plotted the Arabian distribution of *S. kajkaiense* on the basis of professionally determined specimens, which are limited to two sites in the Western Hajar Mountains of northern Oman and several along the coast of the Eastern Hajar, including the Sur area (Cope 2007, Map 421). Its habitat is described as "Wadis; 50-650m" and its known range outside Arabia is given as Iran, Afghanistan and Pakistan. However, this information remains to be widely disseminated locally and *S. kajkaiense* first came to the authors' attention in late 2008 through a communication from Cock, who wrote to request a review of the local geographical nomenclature used in a draft of Cock (2008/2009).

Distribution

Armed with the information provided by Cock, the authors were able to distinguish *S. kajkaiense* and, in the course of investigations during the summer of 2009, to recognise it at a number of sites along Wadi Qahfi and also in many of the wadis along the west flank of the Western Hajar Mountains in northernmost Oman, from Wadi Jizzi in the south to the Hatta road in the north. Those areas remain relatively remote from Muscat but are well known to many UAE-based naturalists. It also proved to be a relatively straightforward matter to locate a few clumps of *S. kajkaiense*, but only a few, in Wadi Shawkah, UAE, some 30 km north of the Hatta road, a first record for the UAE.

S. kajkaiense was not found in all wadis, however, and in some wadis only a few specimens were observed. In terms of distribution it can be considered the wadi equivalent of a riparian species, localised in the "wettest" wadis, and almost always in or adjacent to the lowest

areas of the wadi bed (***Fig. 1***), where permanent water is nearest the surface and where the soil remains somewhat damp, even in summer. It can occupy slightly higher ground near seeps or where thicker accumulations of silt preserve moisture. Closely associated species include *S. ravennae*, the large rush *Juncus socotranus* and (in the relatively 'wet' wadis of the Mahdhah area of Oman, north of Wadi Jizzi) the smaller, rush-like sedge *Schoenus nigricans*. ***Fig. 2*** shows the observed distribution of *S. kajkaiense* in the UAE and neighbouring Oman.

S. ravennae is a wadi bed species like *S. kajkaiense* but it is evidently less dependent on regular access to near surface water. It is present in most gravel wadis in the Hajar Mountains and common in many. Compared to *S. kajkaiense*, it extends to higher ground at a greater distance from the axis of the watercourse, especially where silt has accumulated either in the wadi bed or in niches in the rocky wadi walls. *S. ravennae* is much more common overall than *S. kajkaiense*, but their relative abundance at any given site depends upon the amount of surface water present, and *S. kajkaiense* may be locally abundant, e.g., in parts of Wadi Musah (***Fig.3***).

To the south of the area of initial investigations, *S. kajkaiense* is almost certain to occur in the area immediately south of Wadi Jizzi, e.g. in Wadi Sarfanah and Wadi Daqiq, which have relatively abundant surface water. To what extent it can be found still further south, e.g. in Wadi Ajran, Wadi Qumayrah and beyond, remains to be investigated, but Cope's data suggest that it may prove to be present at least intermittently. The northernmost site plotted in Map 421 seems to be in the vicinity of Wadi Jizzi.

To the north, the search for *S. kajkaiense* at additional likely sites within the UAE has been unsuccessful. For example, the authors failed to find *S. kajkaiense* in areas of permanent surface water in mid-Wadi Asfani, just c.10 km north of Shawkah, where *Juncus socotranus* dominates the wadi bed assemblage, accompanied by *S. ravennae* and *Tamarix* sp. The result was the same for the relatively wet Yas Fork of Wadi Mowrid, east of Al-Ghail, some 35 km north of Shawkah, despite dutifully marching past perhaps a thousand clumps of *S. ravennae*; and for tributaries of Wadi al-Fay, on the southern edge of the Musandam region, a further 15 km to the north, where *S. ravennae*, *J. socotranus* and *Nerium oleander* are abundant in association with permanent surface water.

Likewise, although it seemed reasonable to expect *S. kajkaiense* in wadis in the Hatta area, several of which feature permanent water at travertine springs, investigation at several sites has failed to reveal it there, although *S. ravennae* can be abundant (***Fig. 4***).

On the East Coast of the UAE, permanent water is relatively scarce except in Wadi Wurayah, which features the UAE's only year-round waterfall. There a single *S. kajkaiense* plant was found within the forest of *Arundo donax* reeds and *S. ravennae* above the falls. A by-product of that particular visit was the discovery of the tall, reed-like sedge *Cladium mariscus*, apparently a first record for the UAE. Other potential East Coast sites in Wadi Safad and Wadi Hayl did not reveal *S. kajkaiense*. However, it is not unreasonable to expect it to occur to the south, in some of the larger, wetter wadis of the Batinah coast of Oman.

Fig 1. *Saccharum kajkaiense* along Wadi Khadra, showing its affinity for low ground. A clump of *S. ravennae* is visible at top, left of centre.

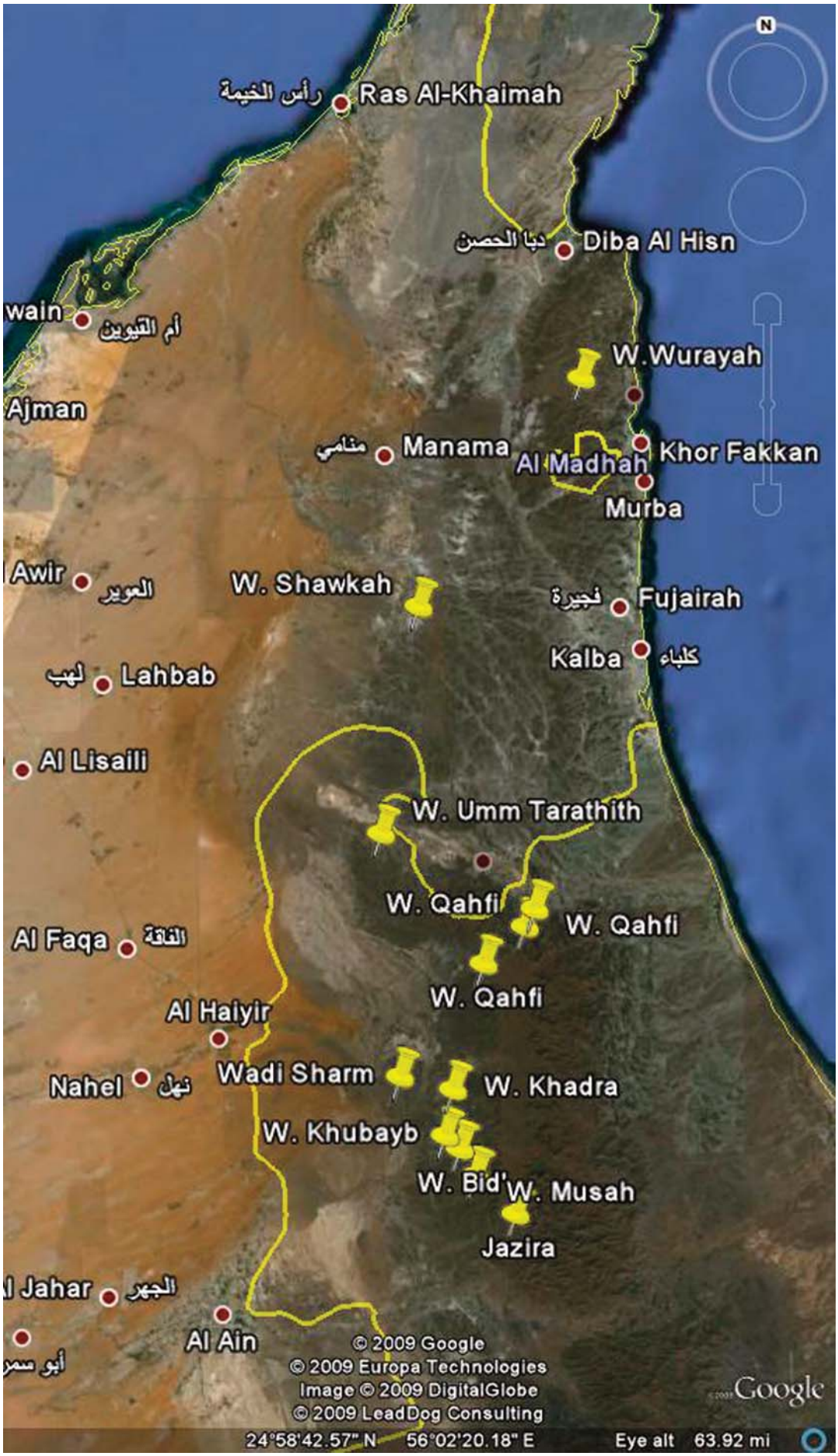

Fig 2. Observed distribution of *Saccharum kajkaiense* in the UAE and neighbouring Oman.

Fig 3. Abundant *Saccharum kajkaiense* (right) in Wadi Musah.

Identification

Despite the gross similarity between clumps of the two *Saccharum* species (***Fig. 5***), the authors found that *S. kajkaiense* can be confidently distinguished from *S. ravennae* by a number of characteristics that are easy to observe in the field, even if the plants are not in flower:

1 **Size:** *S. ravennae* grows to be a much larger plant and is more robust overall, with heavier culms (stems) and peduncles (the spike of the inflorescence). *S. kajkaiense* does not exceed c.1.5 metres in height.

2 **Colour:** *S. ravennae* is relatively bright green and drying leaves become a contrasting, slightly orange colour. *S. kajkaiense* is paler, somewhat grayish-green, and dried leaves turn a pale straw colour (***Fig 6***).

3 **Leaf form:** *S. ravennae* leaves are normally flat (but may curl when dry or after collection). *S. kajkaiense* leaves are always rolled, usually to full a "U" shape or more.

4 **Leaf surface:** The underside (abaxial surface) of the leaves is smooth in *S. kajkaiense* (except sometimes distally) and normally slightly rough in *S. ravennae* (although many specimens in the Mahdhah area were also relatively smooth, except distally).

5 **Denticles on leaf margins**: *S. ravennae* leaves have a continuous whitish border of fine asymmetric teeth like the blade of a crosscut saw. The leaf margins of *S. kajkaiense* have intermittent single, slightly curved, whitish spines, sub-parallel to the leaf edge; these may be somewhat more closely spaced distally. The denticles can be seen with the naked eye under optimal conditions, but are best observed with a hand lens.

6 **Branching:** In *S. ravennae* the leaves separate at or very near the base of the plant. In *S. kajkaiense*, the lowest leaves separate c.20-30 cm above the ground.

7 **Ligule:** The ligule is the interior of the area where the leaf separates from the culm (stem). In *S. ravennae* the ligule is always somewhat hairy and normally has a distinct brush of soft, light brown hairs. The ligule is not hairy in *S. kajkaiense*.

8 **Base of stem:** The base of the culm (stem) is relatively thin in *S. kajkaiense* and has a round cross-section. In *S. ravennae* the base is thicker and is flattened into an elliptical cross-section; it may also be finely hairy.

9 **Palatability:** *S. ravennae* often shows evidence of browsing. *S. kajkaiense* does not.

10 **Inflorescence:** *S. ravennae* has a large, elliptical inflorescence, more than 20 cm long. The inflorescence in *S. kajkaiense* is smaller (20 cm or less) and narrower (more spike-like). The spikelets of both species are hirsute, but the hairs of *S. kajkaiense* spikelets are finer and are more clearly confined to discrete whorls emanating from the base of the spikelet.

Fig 4. A monospecific stand of small *Saccharum ravennae* in a wadi near Hatta.

Fig 5. Confusingly similar: The two grass clumps on the left of co-author Karki are *Saccharum kajkaiense*; the two on the right are *S. ravennae*.

Fig 6. A large stand of dry *S. kajkaiense*, a somewhat unusual sight.

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An unusual observation – attraction of caterpillars to mercury vapour light in the Abu Dhabi desert (Lepidoptera: Pyralidae)

by Michael P.T. Gillett and Andrew S. Gardner

Fig 1. Pyralid caterpillar attracted to a white sheet placed on the ground below a mercury vapour bulb in sand desert at Al Faya in Abu Dhabi emirate. The caterpillar has been putatively identified as that of the moth *Arsenaria hypercanalis*, the early stage and biology of which have hitherto been unknown to science (DG).

A great number of adult nocturnal moth species belonging to many different families are attracted to artificial light, particularly ultraviolet light. The phenomenon is so well known that light trapping has, for more than a hundred years, been one of the most productive collecting techniques employed by lepidopterists. Even diurnal species of Lepidoptera such as butterflies, if disturbed from their roosts at night, are also drawn to light. Bright lights also attract many other types of adult insects, including, but not restricted to, true flies (Diptera), beetles (Coleoptera), wasps (Hymenoptera), nerve-winged insects such as antlions and lacewings (Neuroptera), earwigs (Dermaptera), bugs (Hemiptera and Homoptera), mantids (Mantodea) and grasshoppers, katydids, crickets and mole crickets (Orthoptera).

Based on many personal observations made with mercury vapour lamps set up in desert areas in the UAE, the species attracted to light are, almost without exception, insects with functional wings. Just very occasionally, non-flying insect species such as the ground beetle *Anthia duodecimguttata* Bonelli, 1813 are attracted towards the light, as too are other types of arthropods such as spiders, camel spiders and scorpions – these terrestrial visitors usually do not remain motionless and wander around the lighted area and often may subsequently move away altogether.

The cause of attraction of insects to light, especially with regard to moths, has long been debated, but has no unique explanation (Frank, 1988). The commonest suggestion involves the concept that moths (and other insects) use a form of celestial navigation called transverse orientation in order to navigate at night, using the moon as a fixed beacon (Sottibandhu and Baker, 1979). In this process, by keeping the moon at a constant angle, moths are able to fly in a straight line, but by supplanting the moon with a close-up bright light source, they are tricked into flying in an ever-tightening spiral around the light.

However, this simply does not fit the observed flight-to-light behaviour of most insects, which generally fly straight towards the light and then either settle directly

Fig 2. Saltbush, *Tetraena qatarense*, at Al Faya showing silken tubes and feeding damage caused by a pyralid caterpillar putatively identified as that of the moth *Arsenaria hypercanalis* (MPTG).

some distance from it or else circle the light a few times at a more or less constant distance before settling. Moreover, it is well known that light traps catch many more insects on moonless nights and fewer at the time of the full moon (Bowden and Church, 1973), apparently contradicting any suggestion that the moon is essential for moth navigation.

However, the orientation/navigation of moths at night may involve not just the moon or other celestial light sources, but many other phenomena such as geomagnetism, gravity or barometric, acoustic, olfactory and terrestrial visual cues (Riley and Reynolds, 1986; Frank, 1988) and the presence of a strong source of artificial light may confuse the insects into ignoring such factors.

Another theory suggests that moths are attracted to the infra-red (IR) component of the artificial radiation because the males of at least some species have IR-sensors on their antennae and react to IR in a similar way as in their response to female pheromones (Callahan, 1977). In support of this, males of some species of insects tend to be attracted to light in greater numbers than females, but on the other hand, ultraviolet (UV) light sources radiate very little IR, but attract larger numbers of insects than hotter light sources (Frank, 1988).

Other suggestions are that it is the UV component of artificial light that attracts the moths because it mimics moonlight reflected from the petals of nocturnally blooming flowers (Stevensen, 2008). However, a majority of insects attracted to artificial light are not known to visit or feed from such flowers.

Equally diverse are the theories as to why insects, having reached the vicinity of the light source, then eventually settle down. These range from simple suggestions that the insects tire themselves out after their fluttering, to the idea that having reached the illuminated area, the insects are tricked into thinking that it is daytime and, therefore, time to settle. It is also been shown by Hsiao (1973) that moths are at first attracted towards the light, but as they approach the source, they actually then try to avoid its effects and end up flying around the lamp at a fixed distance (usually 20-30 cm) within a perceived dark area known as the Mach band. Eventually, the insects either manage to escape from the lighted area or else settle down. This fits the behaviour of some insects, especially some moths, but not of others. Indeed given the huge number of different insects of many different orders that are attracted to artificial light, it is apparent that more than one mechanism may be involved, but the end result is the same in that the insects are confused or distracted by the light into exerting abnormal behavior.

Hitherto, only the attraction of adult insects to light has been considered, but recently an instance of the attraction of immature insects to artificial light was recorded by the authors. The insects in question were small caterpillars, which appeared in numbers within an area of desert illuminated by a mercury vapour lamp. As far as can be ascertained, no other case of this type has been recorded, prompting a full description of the event here.

Fig 3. Adult pyralid moth, *Arsenaria hypercanalis*, attracted to mercury vapour light in the desert at Al Faya (DG).

The observation in question took place at night on 24 March 2009 in a sand dune area on the site of the proposed Al Faya Industrial City about 50 km east of Abu Dhabi Island, Abu Dhabi emirate (GPS co-ordinates: 24.37339 N 54.96026 E). Plant diversity in this area was very poor with an abundance of the saltbush *Tetraena qatarense* (Zygophyllaceae) and just occasional plants of *Cyperus conglomeratus* (Cyperaceae) and *Dipterygium glaucum* (Capparaceae). At this site, a 250 W mercury vapour lamp was run continuously from 19:00 until 01:00 the following morning. The lamp was positioned about 75 cm above two white king-sized bed sheets spread on the ground and these sheets were monitored at intervals for insects. Probably because of the poor makeup of the local vegetation, the diversity of insects that were collected from the sheet was low – not many more than 20 different species, including moths, grasshoppers, antlions, bugs and beetles. However, at about 20:00, several small green caterpillars were noticed on the sheets (***Fig. 1***) apparently circling the light source. Over the course of the light's operation, the number of caterpillars increased and as many as 13 individuals were counted on the sheets at about 22:00, with others present on the nearby sandy ground. The size of the caterpillars was within a range of about 5-10 mm and in appearance, they resembled micromoth larvae such as those of the Indian Grain and Greater Wax Moths – *Plodia interpunctella* (Hubbner, 1813) and *Galleria mellonella* (Linnaeus, 1758) respectively. A couple of caterpillars were collected and were subsequently shown to belong to the micromoth superfamily Pyraloidea using the key given by Solis (2006).

The source of the caterpillars was nearby saltbushes, *Tetraena qatarense*, the only vegetation present in the immediate vicinity of the mercury vapour lamp and, indeed over most of the Al Faya site. Almost every single one of these plants showed damage due to larval feeding and around the damaged areas, a web of silken tubes leading down from the branches to the soil ***(Fig. 2***). Inspection of damaged areas at night revealed many small green larvae like those attracted to the light. Protective strategies of this type are used by the caterpillars of several families of moths, including Pyralidae. The larvae remain hidden in the soil during the day and, at night, climb up the silken tubes to renew their feeding. The identity of the larvae is not conclusively known, but it is most likely to be the species *Arsenaria hypercanalis* (Amsel, 1951), three or four adult moths of which were attracted to the lamp at the same time as the caterpillars. Only single examples of other micromoths were recorded, for example *Agdistis* spp. (Pterophoridae), *Ethmia alba* (Amsel, 1949) and *E. quadrinotella quinquenotella* (Chrétien, 1915) (Ethmiidae) and *Ceutholopha isidis* Zeller, 1867 (Pyralidae). The early stages and biology of *A.*

hypercanalis are quite unknown, but a related species *A. caidalis* (Hampson, 1900) is also found in the UAE as well as N. Africa. In Tunisia, its larvae are known to fashion silken tubes on a different saltbush, *Halocnemum strobilaceum* (Chenopodiaceae), which are similar to those observed on *Tetraena*.

Although the larvae that are here recorded as being attracted to mercury vapour light can only putatively be identified as *A. hypercanalis*, there is no doubt that they originated from the infested *Tetraena* bushes on which they normally inhabit the silken tubes leading from the soil. The most likely explanation for a proportion of these larvae being attracted to the light may be disorientation brought about by the sudden illumination of the bright lamp at dusk at a time when the larvae would normally be preparing to leave the soil and ascend the silken tubes in order to resume feeding on the branches. Their behaviour in response to light is strikingly similar to that of adult moths that are attracted towards light, only then to be repelled and induced into circling the light source within the Mach band.

Could the attraction of caterpillars to light be brought about by the same or by a similar mechanism to that of adult moths and if so, does it have any bearing on adult behaviour with regard to their response to light? Clearly, as juvenile insects and without conspicuous antennae, the caterpillars in question could not be reacting to light in an analogous way to that of sexually mature moths attracted to pheromones. Moreover, caterpillars of various sizes were attracted to the light, suggesting that they were not involved in any dispersal prior to pupation and, furthermore, the probably related species *A. caidalis* does not disperse, but pupates directly within the silken tubes (Asselbergs, 2007).

Therefore, it seems unnecessary to suggest any need for the caterpillars to use a celestial point source of light for navigation; after all, in order to go about their nocturnal business, all that these particular caterpillars need to do is to follow the silken tube upwards from the soil to the feeding site amongst the branches.

However, it is not inconceivable that such behaviour might be aided either by gravitational cues or by diffuse celestial light in a fashion analogous to plant phototropism. Indeed positive heliotropism in caterpillars has been known since the pioneering work of Jaques Loeb (1918). Amongst the diverse theories proposed to account for the apparent attraction of insects to artificial light that of confusion induced by the artificial light would seem to be the one that best fits the circumstances for the caterpillars highlighted in this report. The sudden appearance at close proximity of a powerful light source may confuse the caterpillars making them unable to react to cues such as celestial light or gravity that would normally guide them to their feeding station.

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Records of the phytophagous ladybird *Henosepilachna elaterii orientalis* (Zimmerman, 1936) from the Al Ain/Buraimi area of the UAE and Oman (Coleoptera: Coccinellidae)

by Michael P. T. Gillett

Fig 1. Two examples of *Henosepilachna elaterii orientalis* from Al Ain. The ladybird on the left (7 mm) displays typical markings; that on the right (6 mm) shows four much reduced spots on the basal section of the elytra.

Ladybird beetles belong to the family Coccinellidae and of all the hundreds of thousands of different beetles, they are perhaps the best loved group. Their popular names in many European languages, not just in English, reflect this. There are probably several reasons that account for such fondness. Undoubtedly, one is the gay colouration of the more conspicuous ladybird species, although their bright and contrasting colour schemes of red, orange or yellow and black actually advertise the fact that these insects are poisonous.

Another major reason for the endearment of ladybirds is that they have long been recognised as friends of the gardener and the farmer, as both the adult and immature insects feed upon plant pests including scale insects, whiteflies and aphids (all insects of the order Homoptera). Not all ladybirds are brightly coloured and not all of them feed on homopterans. Some feed on spider mites and others on mildews and moulds and some, amongst the larger species of the family, are plant feeders and may be important agricultural pests themselves. The subfamily Epilachninae contains several phytophagous ladybird species, including the species *Henosepilachna elaterii orientalis* that is known from across Arabia (Fürsch, 1979; Raimundo and van Harten, 2000; Al-Houty, 2004).

This species is not mentioned in Volume 1 of the **Arthropod Fauna of the UAE**, which deals with the family Coccinellidae (Raimundo *et al*., 2007), even though it has previously been recorded from the United Arab Emirates on a number of occasions (Gassouma, 2003; Gillett and Gillett, 2005) and is even given an entry in the synopsis of the insect records of the UAE published by Van Harten (2005). This apparent lack of acceptance of *Henosepilachna elaterii orientalis* as a *bone fide* UAE species may be because earlier records have been published without exact data. In order to establish the fact that the species really does occur in the UAE, and also in Oman, where it has apparently not previously been recorded, the following records are presented and the beetle is illustrated (***Fig. 1***). Several other ladybird species found in the UAE, but not covered by Raimundo *et al*. (2007) will be the subject of future notes.

UAE – Jazirat al Harah sand dunes, Ra's al-Khaimah emirate, 1 ex., IV. 1993; Towayya (24o15.051'N 55o40.445'E), Al Ain, Abu Dhabi emirate, 25.III.2000, 1 ex., leg. MPT Gillett; Al Maqam camel race track (24°08.554'N 55°34.724'E), Al Ain, Abu Dhabi emirate, 11.IV.2000, 3 ex., on wild cucurbits, leg. MPT Gillett; Towayya (24°15.145'N 55°40.289'E), Al Ain, Abu Dhabi emirate, 19.V.2000, 1 ex., leg. MPT Gillett.

Oman – Buraimi, Fossil Valley (= Jebel Huwayya) (24°18.419'N 55°50.224'E), 17.III.2000, 1 ex., on desert squash, leg. MPT Gillett.

Henosepilachna elaterii has an enormous range from S. Europe and W. and N. Africa (nomotypical ssp.) to the Middle East, Iran, Afghanistan and the Indian Sub-continent (ssp. *orientalis*). It appears not to be common in Arabia with only about a dozen specimens previously recorded from Saudi Arabia, Yemen and Kuwait (Fürsch, 1979; Raimumdo and van Harten, 2000; Al-Houty, 2004). The records given here significantly extend the species' range towards the south-east of the peninsula (***Fig. 2***). Across its global range, a variety of plants are associated with the beetle. The wild foodplants for ssp. *orientalis* in the UAE and neighbouring Oman include three local species of the family Cucurbitaceae (Jongbloed, 2003), but of these only two are common. They are the bitter gourd *Citrullus colocynthis*, which is widespread on both

sandy ground and on gravel and the wild cucumber *Cucumis prophetarum* found throughout the Hajar Mountains. Thus the beetle is likely to be found over most of the UAE's territory, except in the waterless sand dune wastes in western Abu Dhabi. Furthermore, Cucurbitaceae are widely cultivated in the UAE and plants such as cucumber, marrow and water melon could potentially be attacked. Indeed in some parts of its range, the beetle is considered a pest of these crops (Ali, 2009).

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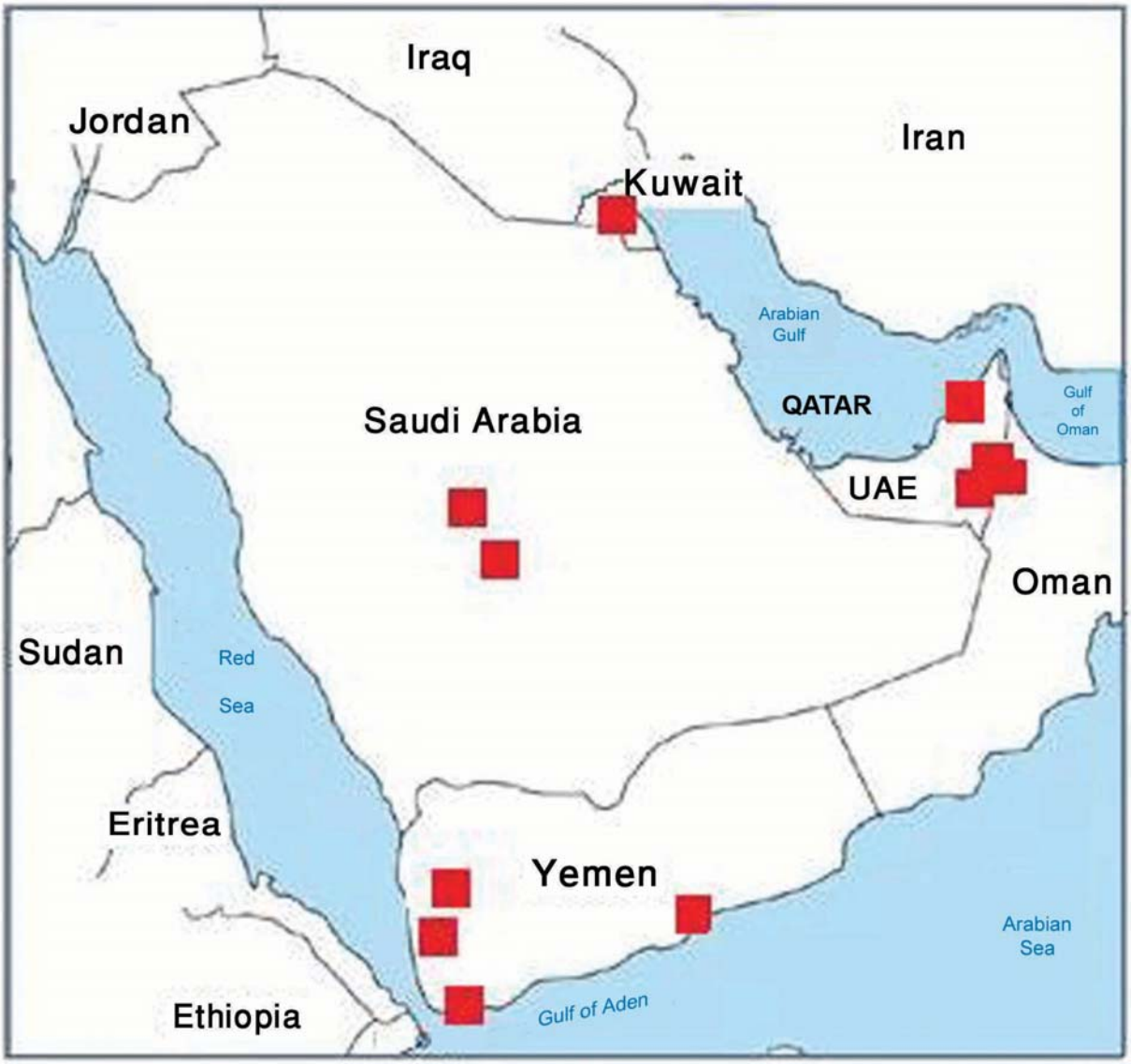

Fig 2. Map of the Arabian peninsula showing the approximate locations where *Henosepilachna elaterii orientalis* has so far been recorded.

Unknown or little-known large ground beetles from the United Arab Emirates (Coleoptera: Carabidae: Scaritinae, Harpalinae, Platyninae)

by Michael P. T. Gillett

In a recent paper, Felix (2009) illustrated and recorded the occurrence of 70 species of ground beetles (family Carabidae) in the United Arab Emirates, UAE. As the author states, this list is necessarily incomplete, not only because the specimens were mainly collected by light, malaise or water traps, but also because much of the collecting took place in the northern emirates rather than in the larger expanses of Abu Dhabi. There are certainly several tiger beetles (subfamily Cicindelinae) in the UAE that are not included in Felix's work (Weisner, 1993; Gillett, 1995; Weisner, 1996; Weisner, 1998; Cassola *et al*., 2010). Also missing are three large species of ground beetles that have previously either not been recorded from the UAE or, at least, are but poorly known for the country. These three beetles form the basis of the present note; they belong to three different subfamilies (Lorenz, 2005), two of which are not mentioned in Felix (2009).

Scarites (Scallophorites) guineensis Dejean, 1831 (Subfamily Scaritinae)(*Figure 1*)

Scarites guineensis Dejean, 1831
Scarites asphaltinus Klug, 1832
Scarites nitidus Chaudoir, 1843
Scarites boysi Chaudoir, 1855
Scarites rocheti Chaudoir, 1855
Scarites striatus guineensis Bänniger, 1938

Material: UAE: 2 ex. Dubai, Jebel Ali, 10m, IV. 1993, Running on beach at night, J.E.D.T. Gillett; 1 ex. Abu Dhabi, near Sweihan, IV.1997, under board, M.P.T.Gillett.
Geographical range: Senegal to Sudan, Ethiopia, Egypt and Arabia

Fig 1. *Scarites guineensis*, UAE: Dubai, Jebel Ali, 34 mm.

Fig 2. *Heteracantha depress*, UAE: Abu Dhabi, Al Ain, Al Masoudi, Al Ain, 17 mm.

Fig. 3 *Sphodrus leucophthalmus*, UAE: Abu Dhabi, Ain Al Faydah, 27 mm.

This is a much larger species than the two mentioned by Felix (2009), *S.* (*Parallelomorphus*) *subcylindricus* Chaudoir, 1843 and S. (*P.*) *terricola aethiopicus* Bänninger, 1933, and it belongs to a different subgenus. In the UAE, the species is typically found in tunnels or under debris on sandy beaches; it is sometimes present in numbers at the Jebel Ali locality. However, it also occurs inland in the UAE and it has been recorded elsewhere at altitudes up to 2000 m. Overall, it appears to be relatively rare or at least very local in the UAE, at least in comparison with the two smaller species. However, across its large range, *S. guineensis* has been described as common (Balkenohl, 1994). Nevertheless, only a single specimen from Saudi Arabia was available for his examination and only very few Saudi examples were studied earlier by Basilewsky (1979). Although not indicated above, *S. guineensis* along with about 50 other *Scarites* spp., was also recorded by Andrewes (1929) from several localities in 'British India', but some of these records for *guineensis* are doubtful, especially those from Assam and Poona. This species has been previously recorded from the Abu Dhabi desert by Tigar and Osborne (1999) and without specific details by Gillett and Gillett (2005).

Heteracantha depressa Brulle, 1834 (Subfamily Harpalinae)(*Figure 2*)

Heteracantha depressa Brulle, 1834

Material: UAE: 6 ex. Abu Dhabi, Al Ain, Al Masoudi, 03.III.1995, running in woodland at dusk, M.P.T. Gillett; 2 ex. Dubai, al Lisaili, IV.1998, at lights in service station, M.P.T. Gillett; 1 ex. Abu Dhabi, Sheikh Tahnoon Farm, Sweihan, 17.V. 2003, light trap, M.P.T. Gillett and B. Howarth.
Geographical range: North Africa, Morocco to Egypt, Israel, Syria and Saudi Arabia.

This is a typical ground beetle of desert areas in N. Africa and Arabia. It is spring-active and spends the daytime hidden below ground to emerge at dusk and actively seek its prey such as grasshoppers and other invertebrates. Although far smaller than *Anthia duodecimguttata* Bonelli, 1831 or *Scarites guineensis*, this species unlike these others, will bite viciously if molested. *H. depressa* has previously recorded from the UAE, but without details (Gillett and Gillett, 2005).

Sphodrus leucophthalmus (Linnaeus, 1758) (Subfamily Platyninae)(*Figure 3*)

Carabus leucophthalmus Linnaeus, 1758
Carabus spiniger Paykull, 1790
Carabus obsoletus P. Rossi, 1790
Carabus planus Fabricius, 1792
Sphodrus armeniacus Oseulati, 1844
Sphodrus indus Chaudoir, 1852
Sphodrus siculus Motschulsky, 1865

Material: UAE: Abu Dhabi: 1 ex. Ain al Faydah 05.XI.1993, pitfall trap in saline soil, M.P.T.Gillett; 1 ex. Near Mirfa, 29.XII.1998, M.P.T. Gillett; 1 ex. Al Ain, Towayya, 19.V.2000 pitfall trap, M.P.T.Gillett
Geographical range: Virtually all of Europe except extreme north, Canary Islands, Morocco to Egypt, Turkey, Iraq, Syria, Caucasus, Yemen, Saudi Arabia, Afghanistan and India (Uttar Pradesh)

This is a very interesting species with a predominantly Mediterranean distribution and its occurrence in northern Europe, including the British Isles, is considered to have resulted from accidental introductions. Under these circumstances, the beetle is only found indoors in dark and damp situations such as cellars, bake-houses and the like, where it has been recorded as preying on *Blaps* sp. (Coleoptera: Tenebrionidae), but in recent times, it has become extinct or very scarce right across this northern range (Luff, 1998). In its natural range, including the UAE, the beetle is found outdoors and because it is fully winged, it is capable of effective dispersal. Within this natural range, tenebrionid beetles are a major component of the soil fauna and are almost certainly a main prey for *S. leucophthalmus*. Two of the UAE records are from *sabkha*-like soils, where *Prochoma bucculenta* C. Koch, 1940 is a dominant tenebrionid and a possible prey. The single record of *S. leucophthalmus* from Libya is also from *sabkha* (Le-Quellec and Ringenbach, 2009), suggesting that this is a preferred habitat across the natural range. The beetle has also been recorded from saltpans in the Mediterranean region, but it also occurs on agricultural land in Iran (Ghahari *et a*l., 2009). Besides the above records, a further specimen probably representing this species was seen, but not captured, at an electric light on Marawah Island, Abu Dhabi during 27-29.XII.1998. *S. leucophthalmus* belongs to the tribe Sphodrini within the Platyninae and it is relevant to note that two other species from this tribe, both endemic to Arabia, could also occur in the UAE; these are *Sphodrus trochanteribus* Mateu, 1990 and *Laemostenus* (*Arabosphodrus*) *balkenohli* Sciaky, 1996; the latter from Jebel Akhdar in N. Oman (Sciaky, 1996). *S. leucophthalmus* is a new record for the UAE.

The three large species of carabid ground beetles recorded here for the UAE represent an increase in the total number of species known for the country (Felix, 2009). There are several other carabid species that have been collected in the UAE that are awaiting proper determination before they can be formally recorded. All three beetles dealt with here are already known from Saudi Arabia. They are also likely to be present in other neighbouring countries. However, they are apparently not yet known for the Sultanate of Oman (Janikova, undated).

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New status for the tiger beetle *Grammognatha euphratica* (Latreille & Dejean, 1822), formerly included in the genus *Megacephala* Latreille, 1802 (Coleoptera: Cicindelidae: sub-tribe Megacephalina)

by Michael P. T. Gillett

The tiger beetles are usually recognised within the Coleoptera as constituting a separate family of the suborder Adephaga (*e.g.* Cassola and Schneider, 1997), although some authors continue to treat them as either a subfamily, Cicindelinae (Felix *et al.*, 2009) or as a super-tribe, Cicindelitae (Erwin and Sims, 1984) within the ground beetle family Carabidae. Tiger beetles are found on all continents except Antarctica, but most species are found in warmer temperate and tropical regions.

In the United Arab Emirates (UAE), less than a dozen species and subspecies of tiger beetles have been noted (Wiesner, 1993; Gillett, 1995; Wiesner, 1996; Cassola and Schneider, 1997), but not all known species have yet been formally recorded (Howarth, B., *pers. comm.*). All UAE species so far known are diurnal tiger beetles belonging to various genera of the nominal tribe Cicindelini, except for a single nocturnal species in the sub-tribe Megacephalina, which was formerly known as *Megacephala* (*Grammognatha*) *euphratica euphratica* Latreille & Dejean, 1822. This former name denoted that the beetle found in the UAE belonged to sub-genus *Grammognatha* Motschoulsky, 1850 and to the nominal sub-species, *euphratica,* and differentiated from the blue, rather than green, sub-species, *euphratica armeniaca* Castelnau, 1834, which is known from Armenia and western parts of Central Asia.

Until recently, *Megacephala* was considered to include seven sub-genera, including *Grammognatha*, but each of these has now been recognised by Naviauxi (2007) as a valid genus as follows:

Megacephala Latreille, 1802 – species found in open habitats in Africa;

Metriocheila Thomson, 1857 – a single Neotropical species;

Phaeoxyantha Chaudoir, 1850 – South American species;

Pseudotetracha Fleutiaux, 1894 – central Australian species;

Australicapitona Sumlin, 1992 – coastal Australian species;

Tetracha Westwood, 1838 – many species in the New World;

Grammognatha, Motschoulsky, 1850 – one Palaearctic (Mediterranean) species.

The sub-tribe Megacephalina now includes these seven genera together with *Aniara* Hope, 1838, *Oxycheila* Dejean, 1825, *Pseudoxycheila* Guérin, 1839 and *Cheiloxia* Guérin, 1855. This change in the status of these groups formalises a situation already followed *de facto* by tiger beetle workers. Within the sub-tribe, *Grammognatha euphratica* (***Fig. 1***) is most closely related to members of the genus *Tetracha*, such as *T. bilunata bilunata* (Klug, 1834) (***Fig. 2***).

Fig 1. *Grammognatha euphratica euphratica* from Ain al-Faydah near Al Ain (Eastern Region, Abu Dhabi emirate); 18 mm.

Fig 2. *Tetracha bilunata bilunata* from Fortaleza (Ceará state, Brazil); 20 mm.

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Migration of Blue-spotted Arabs *Colitis phisadia* and associated insects at Sila'a, Western Abu Dhabi in November 2008

by Oscar Campbell

Further to the note in ***Tribulus*** by Gardner and Howarth (2007), a comparable migration of butterflies and certain other insects was noted at Sila'a, Western Abu Dhabi on 7th November 2008. Whilst bird-watching in two small, sheltered plantations that lie approximately 3km north of the town of Sila'a, I encountered very large numbers of Blue-spotted Arabs (*Colotis phisadia*), mostly sheltering and basking on any and every piece of vegetation available close to the ground. Given the large numbers of individuals, their ceaseless movement and two-dimensional distribution, counting them did not prove practical but they probably numbered many thousands since it seemed that every shrub, however small, was covered in them. There was no marked directional flight observed and many of the butterflies were clearly using the plantations for rest, presumably having recently arrived.

Clearly associated with this movement were many tens of Lime Butterflies *Papilio demoleus* (like Blue-spotted Arab, classified as a 'moderate migrant' by Larsen 1984), and hundreds of the dragonflies *Anax ephippiger* and, especially, *Pantala flavescens*. Both of these Odonata species are well-known as strongly migratory opportunists (Dijkstra, 2006).

A return visit to the area one month later (9th – 10th December) produced negligible numbers of Blue-spotted Arabs and both dragonfly species, whilst no Lime Butterflies were recorded.

Regular observations throughout the autumn on Abu Dhabi Island revealed small numbers of migrant *Pantala flavescens* on many dates in October and November, but no evidence for inflated numbers of any of the other species noted at Sila'a, nor the presence of Caper White *Anaphaeis aurota* or the Crimson Speckled moth *Utetheisa pulchella*, two species sometimes temporarily abundant in the area.

On the original date at a nearby freshwater pool and small marsh bordering a date palm plantation, I observed both dragonfly species again, albeit in smaller numbers, and also present were small numbers (less than 10 each) of *Crocothemis erythraea*, *Diplacodes lefebvrei* and *Orthetrum sabina*, all holding territory on small pools. None of the latter three species appeared to be behaving as transients. However, on a return visit on 9th – 10th December, none were in evidence despite several hours being spent in the general area.

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Blue-spotted Arab

Blue-spotted Arab

Crocothemis erythraea

Diplacodes lefebvrei

News, Reviews and Bibliography

ENHG Conservation Fund grants

For several years, the Emirates Natural History Group has run a Conservation and Research Fund, which makes small grants for projects considered to be of value in terms of promoting the Group's objectives of studying various aspects of natural history and archaeology, with particular reference to the United Arab Emirates. The Fund is funded from membership subscriptions and from donations by the Group's Corporate Sponsors.Three such grants were made in 2008 and 2009.

During 2008, a grant of 500 pounds sterling was made towards the cost of a pilot study into late pre-Islamic / early Islamic 'torpedo jars', manufactured in Mesopotamia and exported widely to sites in the Arabian Gulf, including the United Arab Emirates, and further beyond, along the coasts of Oman, India, Sir Lanka, Yemen and East Africa. The 'torpedo jars' are thought originally to have been used for the storage and transport of wine, and are lined with bitumen.

The pilot study will involve petrographic analysis of thin sections taken from some fragments of 'torpedo jars' and will seek to determine where the jars were manufactured. It will also involve the carrying out of provenance analysis of the associated bitumen.

The objective is to identify patterns of production, consumption and maritime trade in the years preceding and following the coming of Islam.

The study is being undertaken under the direction of Dr. Robert Carter of Oxford Brookes University.

Subject to the results of the pilot study, Dr. Carter and his colleagues plan to seek further funding for a major study covering 'torpedo jars' from throughout the region, including the Emirates.

During 2009, a grant of US$3000 was made to the Yemeni Leopard Recovery Programme. Yemen is believed to be one of only two countries, along with Oman, in Arabia where a viable population of leopards may still exist in the wild. The species has not been seen in Jordan since 1967 or in the UAE since 2001, and probably only survives in very small numbers in Saudi Arabia.

The project involves the training at the Jebel Samhan Nature Reserve in Dhofar, Oman of the YLRP co-ordinator and five Yemeni staff in specific leopard field research methodologies, with other objectives including a preliminary assessment of suitable areas in Yemen for further survey work and to demonstrate Yemen's continued interest in the development of the Al Hawf – Dhofar Transboundary Conservation Area (TBCA) in Eastern Yemen/Western Oman and advance the process of TBCA formation.

The second grant for 2009, for an amount of 500 pounds sterling, was made to an archaeological PhD student from France, Sabrina Righetti, to enable her to visit the National Museum of Ra's al-Khaimah to study its collection of Wadi Suq period (middle Bronze Age) pottery and stone vessels in the museum's collection. Her PhD is focussed on the Wadi Suq period in both the UAE and Oman, and will, for the first time, compare the material from both countries. She is expected to take up her grant in late 2010.

This grant was made in association with the Society for Arabian Studies, to whom the original grant application was made.

As part of plans to increase the number of applications received, the ENHG has also entered into a partnership with the Orntihological Society of the Middle East, the Caucasus and Central Asia, OSME, to supplement its own grant programme.

Previous grants from the Conservation Fund have included support for archaeological work at Abu Dhabi International Airport, at Muwailah, in Sharjah, and at the Portuguese-period fort at Bidiya, in Fujairah.

Winners of ENHG Awards

Since the early 1990s, the Emirates Natural History Group has presented two annual awards, The Sheikh Mubarak bin Mohammed Prize for Natural History, named after the father of the Group Patron, Sheikh Nahyan bin Mubarak Al Nahyan, and the Bish Brown Award, named after J.N.B. 'Bish' Brown, the founder of the Group. The Sheikh Mubarak Prize is given to a person considered to have made a substantial contribution, through original research, publication or other achievement, to study and conservation of the UAE's archaeology, history or natural history. The 'Bish' Brown Award is presented to a person who is considered to have made a major contribution, through lectures, organisation of field trips or other means to the promotion of public awareness about the UAE's archaeology or natural history.

Winners of recent awards were as follows:

Sheikh Mubarak Prize

2007: Gary Feulner, for contributions to knowledge of the UAE's geology and natural history

2008: Dr. Mark Beech, for contributions to knowledge of the UAE's archaeology

'Bish' Brown Award

2007: Robert W. (Bob) Reimer, for digitising and making available on the Al Ain ENHG website (www.enhg.org) all back copies of ***Tribulus*** and for popularising the study of the UAE's dragonflies.

2008: Major Ali Al Suwaidi, founder of the Emirates Marine Environment Group.

The UAE's 'dhubs' – now a single species again

To sort out taxonomic confusion (or maybe to add to it!), Leptien's dhub *Uromastyx leptieni* has now been downgraded from full species status to a subspecies of *U. aegyptia* in a paper by Wilms *et. al*. (2009) UAE dhubs are therefore two sub-species, rather than being two separate species.

Uromastyx aegyptia microlepis is found in western Abu Dhabi, south and west of a line from approximately Abu Dhabi island to Al Wigan.

U. aegyptia leptieni is the dhub in the north and east of the UAE. While it remains a regional Oman and UAE endemic form, it is now at subspecies rather than species level.

Wilms, T., Böhme, W., Wagner, P., Lutzmann, N. & Schmitz, A. (2009). 'On the phylogeny of the genus Uromastyx Merrem, 1820 (Reptilia: Squamata: Agamidae: Uromastycinae) – Resurrection of the genus Saara Gray, 1845.' **Bonner zoologische Beiträge, Bonn 56(1/2)**:55-99.

Drew Gardner

Soldier's Orchid (*Zeuxine strateumatica*) takes the high ground

On 3 March 2009, while looking for migrant birds in the grounds of the Mercure Hotel on Jebel Hafit, the author spotted a familiar-looking sight in the well-watered lower lawn: Soldier's Orchids. This species, which originates from Asia, was first noted in the UAE on the outskirts of Al Ain at Al Maqam in February 2006. (**Tribulus 16.1**:19). Although still to be found at the original location, this is the first report away from that site. The altitude at the Mercure Hotel is c1200m.

Up to 50 clumps of the orchid were seen in the lawn, in bloom, but by the next visit a couple of weeks later they had all disappeared. Obviously they were imported here, most likely unknowingly in soil or fertiliser.

Close-up they are quite striking short-lived miniature beauties, welcome in any lawn.

Dave Clark

Dead Bryde's whale

A dead whale, identified as *Balaenoptera edeni*, (Bryde's whale) was recovered by a combined team of Environment Agency- Abu Dhabi, EAD, and Critical National Infrastructure Authority, CNIA, personnel about four nautical miles west of the Umm Al Dalkh oil field on 16 April 2009.

The whale, which measured about 9 metres in length, was partially decomposed when found indicating that it may have been dead for at least 4 to 5 weeks. The fluke (or tail) was found to be lacerated, probably by a large boat propeller and may have been the cause of death.

Some taxonomists believe that there may be 3-4 distinctive forms of Bryde's whale populations. In the waters of the Arabian Gulf, Gulf of Oman and Northern Arabian Sea, two forms or subspecies - an offshore and a coastal form - are thought to exist. The coastal, inshore type is perhaps entirely resident.

Belonging to the family Balaenopteridae together with Humpback whale and Blue whale, the species, which is also commonly known as Tropical whale reflecting its preference for tropical waters and warm temperate waters was given its common name, Bryde's whale, in honor of Norwegian consul Johan Bryde, who built the first whaling factory in Durban, South Africa.

More killer whales in the Gulf

Photograph by Khaled Mohammed Saleh Al Rumaithi. (Courtesy: EAD)

Following on from the late December 2007 sighting of killer whales *Orcinus orca* near Ra's al-Khaimah (**Tribulus 17**: 103) a further sighting was made close to Abu Dhabi on 30th May 2008.

The sighting was made by a group of young Emiratis, one of whom, Khaled Al Rumaithi, reported it to the Environment Agency – Abu Dhabi, EAD, noting: "There were about seven whales swimming in two groups. One of the whales was almost 10 m in length and had its calf close by. We didn't feel any danger from them and they were a beautiful sight that we will never forget."

Although first recorded in the UAE only recently, this sighting and that in Ra's al-Khaimah suggest that there may be a family group may have taken up residence in the UAE's Gulf waters, or, at least, has become frequent visitors.

Source: EAD press release

Agreement on UAE bird records

The Environment Agency – Abu Dhabi (EAD) and the Emirates Bird Records Committee (EBRC) have signed a Memorandum of Understanding that will give EAD access to nearly a quarter of a million reports of wild birds seen in the United Arab Emirates since the late 1960s.

The MoU, which was signed by EAD Secretary General Majid Al Mansouri, Simon Aspinall, Chairman of the EBRC, and Tommy Pedersen, Secretary of the EBRC, provides for the entire EBRC database of records to be integrated into the EAD environmental database, covering both Abu Dhabi and the other Emirates.

The EBRC, founded over 15 years ago, collects data from both visiting and resident birdwatchers throughout the country, and also researches historical data going back to before the formation of the UAE federation in 1971. It also assesses reports of rare birds seen in the country, in accordance with prevailing international standards, and maintains the UAE's Bird Species List, now standing at over 440 species.

Under the agreement, EAD'S records of wild birds will be integrated into the EBRC database, providing EAD

with one of the most extensive national databases of wild bird records in the Arabian Peninsula.

"The Agency has a policy of building effective partnerships with all those bodies that share its vision for the conservation and protection of the UAE's environment and wildlife," says Al Mansouri. "The EBRC and its members and contributors have worked over many years to collect and maintain this important database, which will provide us with valuable information to assess the changing patterns of wild bird populations throughout the country.

Al Mansouri noted that EBRC members and supporters have also provided valuable help to EAD in the monitoring of wild birds as part of the National Avian Flu monitoring campaign.

EBRC Chairman Simon Aspinall said, "We have wanted for many years to have our database housed effectively for the long-term by an appropriate Government agency. EAD is the ideal partner for the EBRC, and I am delighted that we have now been able to conclude this agreement."

Sources: EAD press release, EBRC

Plans to extend Al Yasat reserve

The Environment Agency – Abu Dhabi, EAD, is planning to expand the area of the Al Yasat Marine Protected Area. The preserve, currently measuring 428 square kilometres, is focused on the Yasat archipelago, a group of four islands in western Abu Dhabi, and their surrounding waters. Endangered marine turtles live, breed and forage in the area, as do dugongs, also endangered, with around 20 per cent of the UAE's 3,000 strong dugong population using the area.

The law, if enacted in full, will expand the area to nearly 3,000 sq. km., including seven more islands and several smaller islets. Several of the islands have been subject to changed land use and increased human activities that have affected the nesting of turtles as well as breeding by endangered bird species, including the Socotra cormorant and the sooty falcon.

The EAD plan to set aside two core areas in the expanded reserve, with access restricted except for EAD staff and other scientists. Other zones may allow traditional fishing or other recreational activities.

Source: The National

http://www.thenational.ae/apps/pbcs.dll/article?AID=/20090326/NATIONAL/679204911

http://www.thenational.ae/apps/pbcs.dll/article?AID=/20090721/NATIONAL/707209848

Flamingos breed near Musaffah

A major new breeding colony of Greater Flamingos *Phoenicopterus roseus* was found just west of Musaffah in spring 2009 by staff of the Environment Agency – Abu Dhabi, EAD. The colony, which included two parts, one on a sand-bank and the other on the nearby shoreline, is within the Bu Syayif Marine Protected Area, managed by EAD and was found during a routine monitoring programme of the coastal zone.

224 active nests were counted on the sand-bank, with the total nest count for the colony being 1,954, many of which had already been used by the time the discovery was made, although the majority appeared to have been abandoned after storm high tides. More than 800 chicks were counted, as well as a total of over 18,000 adult birds, a record count for the UAE. Flamingo numbers at the colony remained high during the summer, with over 10,000 being counted, according to an EAD press release.

The colony is the largest ever recorded in the Arabian Gulf. Apart from a 1922 record of breeding in Kuwait, the only other records of greater flamingo breeding in the Gulf are from the Emirate of Abu Dhabi, with breeding having taken place twice, in 1993 and 1998/1999, at the Al Wathba Wetland Reserve, inland from Musaffah, and once at a privately-owned man-made lake near Shahama, in 2007, where breeding may also have taken place in previous years. There have also been reports of successful nesting in 2006 at Qarn al-Aysh, on the coast between Abu Dhabi and Jebel Dhanna.

Sources:

EAD Press Release,

Aspinall, S. (in press). Breeding Birds of the United Arab Emirates. EAD, Abu Dhabi

Caracals shot

Photograph by Dr. Richard Hornby.

Despite the existence of legislation on wildlife protection, the continued hunting of the threatened caracal (*Caracal caracal*) in the mountains of the northern emirates was proven in February 2009 by the discovery near Tawiyeen, on the border between Fujairah and Ra's al-Khaimah, of a tree with the bodies of nine dead animals hanging from it. The discovery was made by former ENHG Chairman Dr. Richard Hornby. Some of the animals may have been killed up to two years previously, judging by the state of the bodies, with others as recently as January 2009. A further report of two caracal carcases being seen near the village of Silhi, was noted in an early 2009 issue of ***The Gazelle***, newsletter of the Dubai Natural History Group (Vol. 24, no.2, February 2009).

While the discovery is an indication that caracals still survive in the UAE mountains, it also shows that local residents are still breaking the law, presumably to protect their livestock.

"People think there is no value in these animals," according to Dr Saif al Ghais, executive director of the Environment Protection and Development Authority of Ra's al-Khaimah. "They do not understand biodiversity ... They must feel these animals are their asset."

Source: The National

http://www.thenational.ae/apps/pbcs.dll/article?AID=/20090318/NATIONAL/855511822

Wadi Wurrayah protected

Wadi Wurrayah, in Fujairah, was accorded formal protection as a wildlife reserve in a decree issued by the Ruler of Fujairah, HH Sheikh Hamad bin Mohammed Al Sharqi, in early 2009.

The move follows a detailed , three year, study of the Wadi by the Emirates Wildlife Society – WWF (EWS-WWF) and the environmental team of Fujairah Municipality.

Covering an area of 169 sq.km. between the towns of Masafi, Khor Fakkan and Bidiyah, Wadi Wurrayah is home to more than 100 species of mammals, birds, reptiles and amphibians as well as more than 300 species of plants. Key mammal species include the caracal (*Caracal caracal*) and the Arabian tahr (*Arabitragus jayakari*), both endangered, while it is believed possible that Arabian leopard (*Panthera pardus nimr*) may also survive in the vicinity, although this is unproven. It also has the UAE's only year-round waterfall.

A management plan prepared by EWS-WWF has been submitted to the Fujairah Municipality while extensive consultations are being held with local residents, who are to be represented on a management board for the reserve. The plan also calls for local residents to be employed as rangers. The long-term objective is to ensure that international standards established by WWF as well as by the International Union for Conservation of Nature, IUCN, and the United Nations Scientific and Cultural Organisation, UNESCO, are implemented. While all hunting will be illegal, traditional activities such as the collection of honey and medicinal plants will be permitted.

The EWS-WWF work in Wadi Wurrayah was primarily funded by HSBC Middle East.

Sources: EWS-WWF press release

http://uae.panda.org/news/?163161/Arabian-Tahr-gets-royal-protection

The National

http://www.thenational.ae/apps/pbcs.dll/article?AID=/20090428/PAGETHREE/704279804

UAE, UK take lead in new raptor protection agreement

In late October 2008, the Environment Agency – Abu Dhabi, EAD, and Britain's Department of Food, Rural Affairs and Agriculture, DEFRA,, along with the Convention on Migratory Species, CMS, part of the UN Environment Programme, organised a major international conference in Abu Dhabi to finalise a new agreement to conserve and protect migratory birds of prey in Africa, Europe and Asia. 77 species are involved, including eagles, falcons, harriers, kites and buzzards.

The meeting followed one in 2007 at Loch Lomond in Scotland, also jointly sponsored by EAD, DEFRA and the CMS.

In 2005, an independent study commissioned by DEFRA found that more than fifty percent of the species likely to be covered by the agreement were threatened either at the global or regional level, with some showing signs of rapid or long-term population decline. Many of the threats to the survival of these species are well-known, such as habitat loss and illegal hunting and shooting, but there are other factors, too, which the planned agreement will address, such as the impact of climate change. Migratory birds of prey include some of the most threatened species worldwide and their populations are excellent indicators of the state of the wider environment.

Over 20 countries, including the UAE and Britain, were among initial signatories to the agreement. A secretariat for the new MoU is to be housed at EAD offices in Abu Dhabi.

Sources: EAD press release, news reports.

Golden jackal in Qatar

A report in the Newsletter No.1 for 2008-2009 of the Qatar Natural History Group (October 2008) noted the re-discovery of Golden jackal *Canis aureus*, also known as common jackal, in Qatar. The last reported sighting had been in the 1950s (Gillespie 2008).

The sighting was made in April 2008 by Bo Madsen, director of a team of Danish archaeologists working at the Ra's Abrouq peninsula, who said that "he got a good view of the animal and was quite certain it was a jackal and not a 'wild' dog. A Sudanese attendant living at the Ra's Abrouq oasis also reported that he had seen jackals on three previous occasions. A survey of the whole peninsula by the Danes found no further animals but did identify "burrows in the limestone jebel which were too large to be those of foxes."

The species has a wide range, stretching from East Africa and North Africa to south-eastern Europe, the Middle East, Iran, the Indian sub-continent, Myanmar and Thailand, and is present in Saudi Arabia, including the Eastern province, north of Qatar.

The Qatar animal is presumed to have been of the Arabian sub-species, Arabian Golden Jackal (*Canis aureus hadramauticus* Noack, 1896). There are three other sub-species recognised from the region, Syrian Golden Jackal (*Canis aureus syriacus* Hemprich and Ehrenberg, 1833), Egyptian Golden Jackal (*Canis aureus lupaster* Hemprich and Ehrenberg, 1833) and Palestine Golden Jackal (*Canis aureus palaestina* Khalaf, 2008)

There are no records from the UAE, although one was claimed to have been caught "in the Abu Dhabi/Qatar border area" (presumably well to the west of the UAE's current land borders (Gross 1987), and it is not known ever to have been present in the Emirates.

However, the ratel or honey badger *Mellivora capensis* was only first formally recorded in the UAE in 2005, near Ruwais, and there remains the possibility that this large, but shy, canid may be present in the far west of the UAE.

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http://www.canids.org/species/Canis_aureus.htm

Peter Hellyer

Obituaries

J.A.D. (Adrian) Chapman

Adrian Chapman, one of the founders of birdwatching in the Emirates, died in Manila, Philippines, on 14th September 2009. He was 67.

A seaman for 16 years before joining Lloyds Register of Shipping as a surveyor (Ship's Inspector), Adrian first came to live in the UAE in 1981, when posted to its Dubai office. He already knew the country's offshore waters well, having joined and left ships offshore between 1968 and 1974. He quickly linked up with the small number of other birdwatchers in Dubai, including Mike West, Gerry Ricks and Colin Richardson, and in 1985 became, with them, one of the founders of the Dubai Natural History Group. Adrian was the first keeper of regular birding records in Dubai, but gave up the task in 1986, due to pressure of work, his place being taken by Colin Richardson.

From Dubai, Adrian moved in November 1988 to Abu Dhabi, where he stayed until 1992. He was then posted by Lloyds to Hong Kong for two years, and then to Gdansk in Poland until October 1997 when he returned to work again in the UAE, based until Dubai, until he retired in May 2000.

Throughout his period in the UAE, Adrian's extensive experience proved to be of enormous value. Colin, later UAE Bird Recorder and one of the founders of the Emirates Bird Records Committee, recalls "Adrian was great company, and very understanding, especially during my inexperienced early birding years. He guided me through several identification minefields, such as separating ducks in non-breeding plumage and identifying warblers on call and by shape."

His job permitted him to gain access to the harbour-master's boat at Dubai's Port Rashid, allowing trips with birdwatching colleagues that often involved a few scrapes with authority, including one occasion when they approached a bit too closely to an American navy ship in the dry dock. He was also able to visit far-flung areas like the oil terminal at Jebel Dhanna, in Western Abu Dhabi, and some of the offshore oil-terminal islands, these visits always producing useful new records for the expanding national database.

A 'no nonsense' Yorkshireman, Adrian was always confident in his identification skills, this leading on occasion to lively discussions with those assessing his records. His Pied Flycatcher, seen in Dubai's Safa Park in March 1985, was the first record for the UAE, as well as for Arabia, and was questioned by experts in the United Kingdom, but Adrian would have none of it. A Pied Flycatcher it was, and it was eventually accepted as such.

Two other species, a Wedge-tailed Shearwater, seen in 1986 off Khor Fakkan and a Pechora Pipit, seen with his friend and colleague Dave Robinson in 1988 west of Abu Dhabi, no longer appear on the UAE list, since his descriptions have subsequently been deemed to be insufficient to rule out other species, but, like most good birders, Adrian was prepared to accept the Committee's decision. He simply noted, in an e-mail in 2006 to the Emirates Bird Records Committee about the shearwater: "My description may not have been brilliant but I was certain of this record. No-one seems to have considered that I was a seaman for 16 years before I joined Lloyds Register … and have a wealth of seabird watching experience." No-one else has yet seen either species in the Emirates.

A review of the 440+ species on the UAE's database, however, still turns up his name at frequent intervals. Besides Pied Flycatcher, he was, for example, the first person to see Hen Harrier, Golden Eagle, Black-winged Pratincole, Icterine Warbler and Tree Sparrow. The Temminck's Lark he saw in Jumeirah beach in 1982 remains, 28 years later, the only record of the species in the country. He was the first UAE birdwatcher to reach, in 1990, a total of 300 species on his country list. His last addition, bringing him to 333, was a Lesser White-fronted Goose seen in Al Ain in 2007, on one of his regular trips back to the country to visit his two daughters, who have taken up employment in Dubai and Abu Dhabi.

Adrian was a disciplined note-taker, providing a monthly list of records for many years which are now of great historic and scientific value. In 1988, he collaborated with Colin Richardson on a paper entitled Bird Migration Patterns through Dubai 1984 - 1988. Published in the journal *Sandgrouse* it was compiled from data collected from over 500 visits to Safa Park and Khor Dubai and broke new ground for bird study in the Emirates. In 1991, he wrote two short papers for *Tribulus* on the birds of Dalma and other offshore islands.

This was followed in 1992 by the best-selling *Birds of the Southern Gulf*, co-authored with Dave Robinson (and later entitled *Birds of Southern Arabia* – the publisher

changed the title in the hope of attracting a wider audience!).

Shortly before he retired, Adrian was diagnosed with advanced kidney cancer, but bravely fought through the operations and treatment that followed, then retiring to the Philippines with his second wife, Edie. There he continued to watch birds, proving to be a magnificent host for those of his birding friends from the Emirates who made the long journey to see him before the onset of his last illness.

Great company and an inspired and patient teacher for all those who sought his help, Adrian Chapman helped to lay the groundwork for today's knowledge of the birds of the Emirates.

Peter Hellyer and Colin Richardson

Alexander 'Sandy' Fowler

(*The following note is taken from the December 2009 issue of 'The Gazelle', monthly newsletter of the Dubai Natural History Group*).

Dr. Alexander P. "Sandy" Fowler died in Dubai in late November, from complications associated with the treatment of an aggressive lung tumour. Sandy and his wife Beryl Comar discovered and joined the DNHG soon after they came to Dubai some 20 years ago. Both served on the DNHG Committee during the 1990s, when Sandy was Treasurer.

Although he was always modest and self-effacing, we quickly learned that Sandy would never say no to a request to help out. For many years he also served as the DNHG's Seashell Recorder and he earned the ENHG's 'Bish' Brown Award in 2005 for his *Rough Sheller's Guide to the UAE*. He donated attractive and diverse collections of UAE seashells to both ERWDA (now EAD) and the Jumairah English Speaking School, our former lecture venue.

Sandy's activities took him beachcombing at many UAE localities, and also into the desert at Sweihan, Liwa and in the Western Region, still quite remote in the 1990s.

Sandy retired from his medical practice in late 2004 and celebrated by climbing Mount Kinabalu (on Borneo) and Mount Kilimanjaro (a trip he shared with us at Members Night in 2005) before settling down to somewhat more sedate touring and trekking in, inter alia, Mexico, Spain and Cyprus. Sandy and Beryl were trekking in the mountains in Spain as recently as this summer and it is difficult not to feel that his death was one of those that came too soon.

Gary Feulner

Michael Kyrle-Pope

Rear-Admiral Michael Kyrle-Pope, formerly Senior (British) Naval Officer – Persian Gulf, (1962-1965) and general manager, Middle East Navigation Aids Service, MENAS (1971-1977), died on 14 September 2008. He was born on 1 October 1916. While his jobs in the Gulf and his extensive career in the British Royal Navy from 1934-1969, including several unsuccessful attempts to escape while a World War Two prisoner-of-war in Italy, are of little relevance to *Tribulus*, Kyrle-Pope deserves mention here because of his contributions to the study of birds in the Arabian Gulf.

His tasks as the general manager of MENAS, which managed buoys and beacons for shipping in the Gulf, included the erection of Decca radio-fixing chains, one of which was located on the UAE island of Qarnein. An avid birdwatcher, Kyrle-Pope was one of the first to recognise the importance of the UAE's offshore islands for nesting seabirds, and, as noted in his Obituary in '*The Times*' of London, "his name could be found footnoted twenty years later in such scholarly papers as a study of the conservation of the white-cheeked tern and bridled tern populations of Qarnein island, north of Abu Dhabi (now an important World Wide Fund for Nature site."

Sadly, his field records and notebooks have not so far been traced – they would provide valuable data on the bird population of Abu Dhabi's islands prior to recent development.

Source: Obituary in 'The Times'
http://www.timesonline.co.uk/tol/comment/obituaries/article4811555.ece?token=null&offset=12&page=2

Peter Hellyer

Book Reviews

Building on Desert Tides. Ronald Hawker. WIT Press, Southampton, UK & Billerica, MA, USA. 2008. ISBN: 978-1-84564-135-1. www.witpress.com 236 pp.

For the visitor to the modern Arabian Gulf and the casual observer alike, it is far too easy to dismiss the region as devoid of a notable history before the discovery of oil. In the contemporary population centres like Abu Dhabi, Dubai, Doha, and Riyadh, buildings and artefacts from even the first half of the twentieth century are scarce, and design references to regional traditions are startlingly rare. The natural assumption is that there is no tradition to speak of — but, like most natural assumptions, this one is egregiously wrong. Indeed, in the last decade, after the massive physical and commercial development of the modern Gulf states, numerous scholars have begun to uncover and display the richness of the archaeological, sociological, artistic, and humanistic traditions indigenous to the Arabian Gulf. While these diverse academic disciplines approach the subject from different angles and with different techniques, all reach the same conclusion: the Gulf has always been a vital participant in the major trends of history and has evolved its own unique and sophisticated traditions.

Ronald Hawker's ambitious new book, *Building on Desert Tides* (WIT Press, 2008), mostly succeeds in explaining this history by clearly demonstrating the evidence upon which his argument is based, and by elucidating the contexts that have driven the development of traditional architecture — and the domestic crafts associated with buildings — in the

Arabian Gulf. His argument rests comfortably upon a brief but satisfying historical survey of the region from the Bronze Age to the Twentieth Century. Upon this foundation, Hawker charts the combined influences of trade, tribal politics, and geography on the patterns of indigenous architecture and craftwork in the Gulf. This alone is an interesting study, particularly as it is charmingly illustrated with hundreds of more-or-less relevant photographs and diagrams, and peppered with personal as well as archival anecdotes. But Hawker goes beyond historical summary to posit a larger narrative: that native constructions in the Gulf are integral to the larger story of Near Eastern architectural history, and that the trajectory of Gulf history is a tidy arc from the prehistoric to the present. This is an intriguing proposal, but it may risk conflating the relative diversity within the regional traditions, and it feels slightly too teleological, as if the Gulf has always deserved the respect, influence, and finely-parsed national identities it presently has. Nonetheless, the book carefully and convincingly describes and interprets the region's architecture anthropologically, archeologically, and sociologically. What emerges is the conclusion that the Arabian Gulf has always been — as it is today - part of a broad, trade-based exchange of people, ideas, techniques, and influences.

The real strength of *Building on Desert Tides* derives from its careful scholarship and its balance between broad generalisations and precise examples. Hawker's compendious knowledge of the region and its history makes for fascinating reading: on nearly every page there are both references to established scholarly works on the region and original insights. Consistently, Hawker's broad inclusiveness is apparent and he rigorously avoids the common fracture between Arabian and Persian/Iranian cultural history. Instead, his examples are drawn liberally from both sides of the Gulf and convincingly display the similarities and shared influences. Furthermore, both vernacular and highbrow architectures peaceably coexist within his argumentative framework, and examples from everyday life and ordinary folk are given the same accord as colonial, religious, and political histories. In so doing, the book is able to celebrate popular culture alongside more monumental cultural production.

The title of the volume deftly suggests one of the volume's major themes: historically, the peoples of the region were equally defined by the desert sands and the waters (tides) of the Gulf. Dates in the interior and pearls on the coast were fundamental products that spurred an integration of land and sea trading routes. The Gulf's strategic geographic location both facilitated trade and allowed access by an array of foreign influences, from Europeans to Ottomans, from Persians to South Asians. In many ways, this long history of outside intervention and influence encouraged a wide array of small architectural and artistic variations. Yet Hawker is careful not to discount the most fundamental element of Gulf identity: inclusion in the Islamic tradition. He notes that "[w]hile stylistic variety existed, there was a limited set of building types and the Gulf can be characterised generally by one of the great features of Islamic design: unity and variation." (p. 101) Again, the multiple registers in which Hawker examines his artefacts make great sense and do offer a fresh way of interpreting the art and architecture of the region.

Another highly successful element of the book is Hawker's ability to write for specialists and non-specialists simultaneously. He strikes a fine balance between erudite academic shorthand and carefully explained concepts in accessible prose. Indeed, Hawker provides his readers with a primer to the language of architecture and then applies the concepts to an fulsome array of historical examples up and down (and across) the Arabian Gulf. Through careful organisation and patient explication, Hawker advances his argument steadily, persuasively, and in a way that encourages application to the current realities of the region.

Instead of positing a single engine to drive the history of the Gulf, Hawker seeks to tell a more complete and complex tale: trade, politics, and geography shaped the socio-cultural environment, which in turn was expressed in architecture and its related crafts. Of course all three of these factors intersect variously, but by untangling them and pursuing each line independently, Hawker is able to reveal some original and powerfully convincing trends. At the root of his argument is an intuitively obvious idea that nonetheless bears repeating: human production — be it buildings, boats, crafts, or gardens — in the region always needed to account for climate and for the severely limited range of material available. Thus palm fronds, mud bricks, and local stone were utilised to respond to the unforgiving climate, the scarcity of fresh water, and the nomadic traditions of the region. As he states in Chapter Three, "The specific language of space, mass, decoration and function followed these rhythms of trade and tribe. The buildings thus demonstrate the Gulf's critical role in bridging the peoples and traditions of the interior Arabian Peninsula and its ports, the mountains, deserts and coastlines of Oman, and the nearby shores of Persia, Pakistan and India." (p. 75). Then as now, the Gulf was a site of diversity, but also of strong, independent traditions.

For anyone wishing an accessible and sound source of history about the region, this book is invaluable. As the region continues to wrestle with how to balance its traditions with modern globalism, Hawker's work implicitly suggests that new artistic production and architectural development might acknowledge the past and perhaps even celebrate the very real, beautiful, and efficient traditions that have emerged over the past two millennia. Contemporary nation-states of the Arabian Gulf are quick to stake their claims of individuated identities, but a careful reading of *Building on Desert Tides* suggests that there is much history that is deeply shared in the Arabian Gulf; could this not be developed into a new manifestation of regional style that carries the traditions forward by anchoring the contemporary in the richness of history?

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Marine Environment and Resources of Abu Dhabi. Edited by Thabit Zahran Al Abdessalaam, with contributions by Thabit Zahran Al Abdessalaam, Himansu Das, Edwin Grandcourt and Anbiah Rajan. **2007. Environment Agency - Abu Dhabi. 255 pages. ISBN 978 1 86063 240 2. Price: UAE dirhams 150.**

As it says on the inner front dust jacket of this publication… "*The sea has always had a special place in the lives of the people of Abu Dhabi and the United Arab Emirates, yet there have been few publications about the marine environment of the area*". This book provides a description of the marine environment of the Emirate of Abu Dhabi, bringing together the latest research findings and information about the marine resources and environment of the Emirate. Following the introduction, there is a description of the geography, geology, climate and oceanography, and phytoplankton of the Emirate's waters. The next section describes the coastal and marine habitats covering intertidal habitats, coastal wetlands and marine flora. The section on marine invertebrates covers sponges, jellyfishes and echinoderms, molluscs and corals and coral reefs, while the part on marine vertebrates describes marine reptiles and mammals (mainly dugongs) and fish and fisheries. The final part discusses the ongoing efforts for the conservation and management of the coastal and marine environment.

This publication provides one of the first comprehensive compilations of the major aspects of the marine environment of the Emirate of Abu Dhabi, and was compiled by the staff of the Marine Research Centre of the Environment Agency – Abu Dhabi, EAD. It mostly represents the product of research and studies undertaken by staff at the Agency over the course of the past seven years.

In his foreword, Sheikh Hamdan bin Zayed Al Nahyan, Chairman of EAD, stresses that the importance of the marine environment cannot and should not be underestimated. The passing of new federal laws to protect the marine environment and fisheries highlights the importance attached to this valuable natural resource.

This book makes a valuable contribution towards increasing the general public's awareness and knowledge of their local marine environment. It is only currently available directly from EAD, which is a pity. Such books need to be made more widely available throughout the UAE to inform the general public. Perhaps, also, EAD could make electronic versions of some of its publications available online.

On a more academic note, I would make the following comments.

No mention is made of the archaeological and historical evidence for the presence of *Rhizophora*-type mangroves within the Gulf. Research by a Swedish archaeobotanist, Dr Margareta Tengberg, has confirmed their presence at a number of locations throughout the Gulf. Its presence in the past may have been as a result of the fact that water temperatures and salinity levels were not so high as they are today, enabling it to survive. The sole surviving mangrove species, *Avicennia marina*, is highly tolerant to high temperatures and salinity. Today's marine environment may therefore not have precisely the same conditions as during the past.

Chapter 7 was for me the most disappointing chapter in the book. Marine molluscs are only given a total of 8 pages, which does not allow justice to be done to this important category of marine organisms. Only a total of 14 species (7 gastropods and 7 bivalves) are discussed in the chapter, whereas earlier a total of 15 species (9 gastropods and 6 bivalves) are mentioned in Table 5.2 as being common fauna found in mangrove habitats off Abu Dhabi. The most comprehensive so far published book on marine molluscs in the region '*Seashells of Eastern Arabia*' by Donald T. Bosch, S. Peter Dance, Robert G. Moolenbeek and P. Graham Oliver (1995, Motivate Publishing: Dubai) document 1,273 species in Eastern Arabia, of which many occur within the Gulf.

The 14 types of marine mollusc which are discussed in the chapter were "... *collected randomly from the shoreline off Abu Dhabi*". It is a pity that no systematic survey was carried out at different sampling points throughout the Emirate. It is just not true to say that published information on the topic is non-existent. I know of at least five publications on Gulf molluscs, published between 1973 and 1989, besides the large Bosch *et al.* 1995 volume already mentioned, along with the results of the intertidal survey done by ENHG member Richard Hornby (**Tribulus 7:2**, 1997; pp. 12-17).

There is no mention in the section on 'Man and Molluscs' of the fact that marine molluscs have provided an invaluable food source for Man since earliest prehistoric times, as shown by the shell middens, waste piles of shells, found along the coastline of Abu Dhabi.

On the island of Abu al-Abyadh, for example, a shell midden almost 4km in length was discovered. Pearl oysters provided food as well as the valuable pearls within them.

Although the shell chapter mentions that many people ".. *derive great enjoyment from shell collecting*" and that "…*in some instances, the aesthetic and recreational values of marine molluscs also translates into huge economic value*" no warning is given of the dire consequences of the shell collecting market. From the marine conservation point of view all efforts should be made to discourage the sale of such material which is leading directly to the destruction of coral reefs and other habitats. People should only collect dead and not living shells, otherwise they may seriously harm the survival and habitat of some species.

The chapter on corals and coral reefs provides an excellent summary of our current state of knowledge, although it is a pity that no more detailed mapping of the distribution of coral types specifically for Abu Dhabi was included from the recent coral reef mapping project undertaken by EAD, with support from Dolphin Energy, which has been separately published. There is also no mention of artificial reefs and their benefits and/or disadvantages.

The chapters on sea turtles and dugong provide valuable new data on their distribution and biology within Abu Dhabi Emirate and points out the dangers from future coastal development and its likely impact on these species. These animals were both exploited by the early prehistoric populations inhabiting the coast and islands

of Abu Dhabi as long ago as 7,500 years ago, as shown by the presence of their bones within the excavations carried out by the author at Site MR11 on Marawah Island.

The excellent fish and fisheries chapter provides really for the first time a detailed overview of the status of the Abu Dhabi fisheries. It makes depressing reading to hear that the Arabian Gulf waters of the UAE have shown major declines in fish abundance with current biomass estimates at around 19% of the 1978 levels. The research presented also demonstrates how many of the common fish species are being heavily over-exploited, fish being caught which are small and haven't yet reached sexual maturity. In the case of the orange-spotted grouper (*Epinephelus coioides*), known locally as '*hamoor*', this is being fished at six times the sustainable level!

The book concludes with a chapter by the main editor concerning coastal and marine conservation. This summarises the main threats to the coastal region which include tourism and industrial development. It is suggested that the way forward is Integrated Coastal Zone Management (ICZM). This is a multi-disciplinary process that combines levels of government, science and management and sectoral and public interests in preparing and implementing programmes for the conservation and sustainable development of coastal and marine resources and habitats.

Minor gripes are as follows: Tables with species names should generally be arranged in taxonomic and not alphabetical order (see e.g. Table 4.1). Some of the photographs have incorrect captions, e.g. Figure 2.5… "*An example of a volcanic salt dome island off Abu Dhabi*." It is not strictly speaking correct to call this a volcanic island. Salt domes simply push up to the surface material originating from deep under the earth.

Although the book has an extensive bibliography it is littered with errors such as incomplete and missing references. Thus Bramwell 1987 and Satyamurty 1956 are quoted in the text but do not appear in the bibliography. No page numbers are given in some of the references, e.g. Shepherd-Popescu 2003. There are also a number of irritating typographical errors.

Overall the book is an excellent contribution and will provide many readers with an excellent introduction to marine issues in Abu Dhabi emirate.

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Terrestrial Environment of Abu Dhabi Emirate. Edited by Richard Perry. 2007. ISBN 978-9948-408-33-8. 464 pp. Published by Environment Agency – Abu Dhabi. Price: UAE dirhams 250.

Any work which covers the terrestrial environment of Abu Dhabi must be compared to what has gone before. In particular, *The Emirates - A Natural History* (Hellyer & Aspinall [*eds.*] 2005), which although wider in scope (covering both the marine and terrestrial environments) and also wider in geographical area (covering the entire UAE, not just Abu Dhabi Emirate) is a serious body of work and any subsequent publications must add to our knowledge of the natural environment and be compared to this scholarly body of work.

So, how does this present work match up? First impressions are very good. This is a large coffee-table type publication, with a stunning cover design, depicting both habitats and examples of the fauna and flora found in them. The back cover contains a brief summary of each of the book's chapters. These range from an introductory chapter, which sets the terrestrial scene, to specialised chapters on geology; soils; climate; water; flora; birds; reptiles; mammals and arthropods to be found in the terrestrial environment of Abu Dhabi Emirate. Each chapter is authored by a subject specialist and the overall publication is edited by Dr. Richard J. Perry. However, each of these very short summaries are written in a far from objective manner! Any informed reader, (rather than a casual one), will find this as irritating as I did.

The layout is large format. On a superficial level, this at first is quite attractive, but as the reader progresses from page to page and chapter by chapter, one realises that the book design is not as good as it should be. I found the text to be slightly too large and the choice of font does not compare well with previous publications. There are also large areas of white space present on each page, around the edges, as well as the top and bottom of many pages. The photographs used in this volume are on the whole very good: indeed, some are stunning. I particularly enjoyed photographs depicting certain types of typical behaviour and animals in their natural habitats. The quality of photographs in the bird and reptile chapters was especially high.

Each chapter opens with a virtual double page spread photograph of the subject being discussed. Most are very pleasing indeed, but a few reveal the imperfections of the photograph, when enlarged to such a scale. Some lack captions, leaving the reader to wonder which species is shown.

Modern publishing technology has been used in this work, but not always to the best effect. I found some of the montages to be clumsy. For example, the full page picture found on page 231 (full page photographs do not have page numbers on them) depicts two bird species found in mountain habitats. Both pictures are quite good, but have been greatly over-enlarged and the scale of the two species, as depicted here, is very misleading. The layout of this and other pictures could also have been improved.

Not all the chapters conform to a set standard. I refer in particular to the chapter on mammals, which for the most part, is set out in a Field Guide-like manner. Although informative, it seems out of place in a work of this sort. Photographers are briefly acknowledged at the beginning, but there is no acknowledgement for individual photographs found in the book. Some of the photographs are also taken of animals in captivity, or in a nearly captive state. Most publications clearly state when a photograph is of a captive animal.

The Environmental Agency - Abu Dhabi, EAD, the publisher, which also commissioned the work, looms large, and, although not explicitly stated, there is a strong implication that the book is the entire work of the Agency's staff. This is far from the case. The editor

himself receives little acknowledgement of his efforts.

Other irritations, perhaps minor in themselves, but with a substantial cumulative effect, include the following: the layout of the figures, tables and pictures, could have been greatly improved; placing of some appendices at the end of individual chapters is an unusual choice; some pages lack numbering.

What of the individual chapters themselves? They vary enormously in standard, from the excellent chapters on flora, reptiles and arthropods to the far less satisfactory chapter on UAE's birds. Figure 6.3 on page 221 depicting flyways of migratory birds through the UAE is not based upon any scientific foundation and bears little relationship to the true migratory paths that these bird species undertake twice each year. Figure 6.4 on page 225 shows the landforms and bird habitats in the UAE. It does not help that this map has been shrunk to fit the page, ensuring that meaningful detail is, at best, hard to ascertain from the map. The colours used for the map legend could have been improved upon and do not in all cases match what is shown on the map.

There are also inaccuracies in the text. For example, the Great Reed Warbler is a scarce passage migrant and is not commonly seen round the reed beds found in the Al Wathba Wetland Reserve. The species mentioned here should be the Clamorous Reed Warbler, a closely-related but totally different species. The Black-crowned Finch Lark (now renamed Black-crowned Sparrow-Lark) does not nest on sabkha. There is no distinct sub-species of Clamorous Reed Warbler found in Khor Kalba – Sykes's (Booted) Warbler is the warbler in question. The Peregrine Falcon does not possibly breed in the mountains (though the Barbary Falcon does). Spanish Sparrow is not under normal circumstances a bird of acacia plains. The whole paragraph at the top of page 236 is inaccurate and should be removed. White-capped Buntings do not occur in the mountains of the UAE (I only wish they did)! Statements made on the checklist of birds at the end of this chapter are in some instances inaccurate or misleading and occasionally contradict what is written in the main body of the text. And more. These inaccuracies should not occur in a work of this kind.

This is a useful book, some of the chapters being very good indeed, but the body of work as a whole leaves one feeling disappointed. Moreover, where chapters depend heavily on earlier work undertaken by different authors, this should be more clearly stated.

So, does this volume add to our knowledge of the terrestrial environment of Abu Dhabi? In some cases it certainly does. The chapter on arthropods is based upon recent field work and study and goes well beyond what has been previously published on the subject. It is a pity that not all chapters are of this quality. Should you buy this book? It depends entirely on what you want from it. It is certainly not the definitive work on the subject and the quality of the work is very uneven. For serious students, *The Emirates: A Natural History* is a far more scholarly publication and gives a more complete picture both of the environment and of the entire country. Works such as this one, which are narrower in scope and coverage, should be more detailed than what has gone before, but this is true of only a few of the chapters. This is a pity, but also an opportunity for others to contribute to the fascinating environment which we live.

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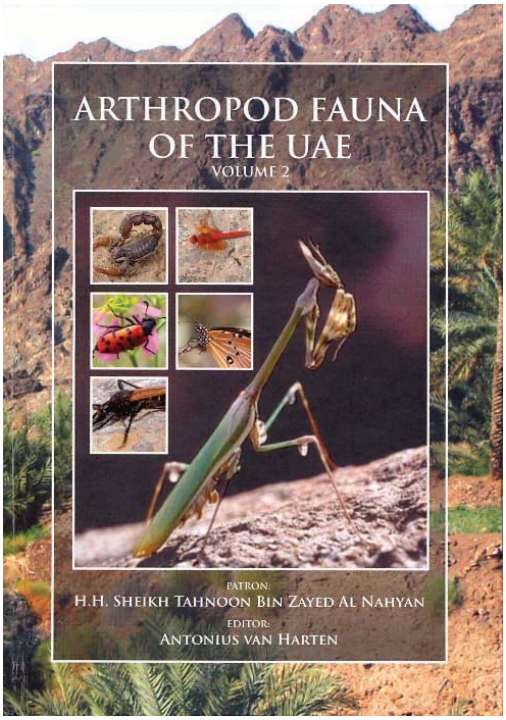
Arthropod fauna of the UAE – Volume 2. Edited by A. Van Harten. 2009. Dar Al Ummah Printing, Publishing, Distribution and Advertising, Abu Dhabi. ISBN 978-9948-15-090-9. 786 pp.



The UAE Insect Project was set up in 2004 following a remarkable and far-sighted initiative of H.H. Sheikh Tahnoun bin Zayed Al Nahyan as an endeavour to study and record the total arthropod biodiversity of the United Arab Emirates. Dr. A. Van Harten was appointed to run the project and to collect specimens from around the country, sort and send them out to an impressive team of specialist experts from around the world to carry out scientific work on the collected material and finally to coordinate and edit the published results. Prior to the setting up of the Project, almost the only significant entomological work undertaken in the UAE was made by enthusiastic amateurs, many of whom were members of, or associated with, one of the three chapters of the ENHG. These individuals all held responsible and demanding full-time professional occupations and were able only to devote a little of their spare time to the country's entomological biodiversity. A majority of their studies were made in an era before the full blooming of information technology and, when published, information relevant to Arabian arthropods was very scarce indeed. Nevertheless, they achieved a lot and were able to set the study of UAE insects on track. Lamentably, their contributions do not always receive the recognition that they deserve.

From the onset, the UAE Insect Project encompassed a number of goals, two of the most obvious being the establishment of a reference collection of UAE

arthropods to be housed and curated in-country (the UAE Insect Collection) and the publication of the scientific results of the Project. Both such objectives are already being realised successfully, especially the publication of the accounts of the different insects and other arthropods found in the UAE. These findings have now generated the first two hard-bound volumes of a series intended to cover all of the scientific results of the Project.

Following closely on the heels of the first volume published in 2008, ***Arthropod Fauna of the UAE – Volume 2*** is of a similar size and format. It also mirrors the type of content seen in the earlier volume by providing an introduction and a series of contributions of varying length devoted either to whole orders, superfamilies or to families of arthropods. The introduction is concise since much of the material dealing with general collecting techniques and with the specific localities at which arthropods were captured is dealt with at length in the earlier volume. Nevertheless, the introduction does include a tabulated list of the orders and classes of arthropods so far collected in the UAE and an indication of those that have been published to date as well as a gazetteer of collecting localities and acknowledgements to all of the many contributors to the book. Sadly, two of the world-renowned specialists collaborating with the UAE Insect Project, the neuropterist Professor Herbert Hoelzel and the arachnidologist Dr. Michael Saaristo, passed away in 2008 before their studies were completed. Fittingly, the publication of ***Arthropod Fauna of the UAE – Volume 2*** is dedicated to their memory.

The main part of this work is given over to accounts of two different orders within the Arachnida, a contribution on the Collembola (class Entognatha) and no less than 38 articles on different groups of insects. Some of the contributions are only modest in size and cover just a few or even a single species, such as the account of the fly family Oestridae. Others are extensive and cover such larger and important insect groups as the ground beetles (family Carabidae) and the owlet moths (superfamily Noctuoidea). In terms of numbers, a total of 390 species are added to the list of species known to occur in the UAE, of which 83 species and two sub-species are new to science.

Whatever the size of each individual contribution, careful attention has been made to give accurate collection records for every specimen of each species and in most cases to provide appropriate illustrations.These include detailed line drawings, paintings and, of course, black and white and coloured photographs/photomicrographs of individual structures and of habitus. In general, the quality of the images is first class, better even than that achieved in the first volume. Some, like the tinted drawings used to illustrate structures of midges (family Chironomidae) are simply superb. Whilst some contributions contain keys to enable identification of individual UAE species, this is not so for all taxa and, therefore, the illustrations are particularly important adjuncts to identification.

The different groups that are dealt with in detail include mites from the family Cunaxidae, pseudoscorpions (Pseudoscorpionides), springtails (Collembola), booklice (Psocoptera), earwigs (Dermaptera), beetles (Coleoptera) belonging to some 17 different families, including such important ones as the ground beetles (Carabidae), hide and carpet beetles (Dermestidae), blister beetles (Meloidae) and weevils (Curculionoidea). Several families of wasps (Hymenoptera) are covered as well as the paramountly important bee superfamily (Apoidea). This is followed by nine families of moths (Lepidoptera), including the species-rich owlet moths or Noctuidae (now considered to include the once separate families of tiger and tussock moths) and finally, but by no means least, some 12 families of true flies or Diptera. In some cases, the contributions in the present book are continuations of work already reported in the first volume and this is clearly indicated in their titles, as for example for the earth-measurer moths Geometridae.

As for the first volume, the detailed, accurate and well-illustrated taxonomical accounts found in the present volume make it a must-have book, not just for the professional entomologist, but also for many others including ecologists, naturalists, pest-control officers, environmentalists etc., both within the UAE and throughout Arabia and the Middle East. Nevertheless, this volume is not without its faults, some of which have already been raised with regard to the first volume (Howarth, 2007). Firstly there are a few small mistakes that come to light. For example, on pages 566 and 567, the same photograph is shown with captions for two different moths *Utetheisa lotrix lepida* (Rambur) and *U. amhara* (Jordan). Since the two species in question are so similar, it is hard for the non-specialist to be sure as to which moth is actually depicted. This is a shame, but it by no means undermines a simply wonderful and beautifully illustrated account of the noctuoid moths of the UAE. Another mistake, this time on page 187, deals with the chemical nature of the secretion of the beetles belonging to the family Meloidae and which gives rise to their common name of “oil” or “blister“ beetles. It is quite wrong to call the chemical agent in question, cantharidin, an alkaloid; for alkaloids are nitrogen-containing plant chemicals not made by beetles or other animals. Cantharidin is actually a toxic sesquiterpenoid and does deserve accurate attention, as it is of fundamental biological importance for meloid beetles, their reproduction and their defence against predators. Cantharidin has also played a variety of dubious roles in human medicine.

These and other minor faults aside, however, there are several broader concerns, which in this reviewer’s opinion detract a little not just from the practical usefulness of the volume, but which also raise questions about the completeness of the coverage implicit in the book’s title and perhaps even about the style in which the work has been edited, particularly in relation to previous studies on the entomofauna of the UAE.

Firstly, it is customary practise in a work of this sort to list the synonyms for each species immediately below the currently recognised species name. This is lacking although it would make the book easier to use. This is particularly important where there have recently been wholesale changes in nomenclature affecting Arabian species. In the mylabrine oil beetles of the family Meloidae, there has long been confusion at the generic

level surrounding many species found in Arabia. Some that were dealt with under the generic name *Mylabris* by Kasab (1983) and Schneider (1991) are now assigned to other genera such as *Croscherichia* and *Hycleus*. In the latter case the feminine generic name *Mylabris* has been replaced by a masculine one, thus also precipitating changes in the ending of the specific name. All of this is difficult to follow without the inclusion of a formal synonomy. There are other similar cases both within the Meloidae and in several of the other insect families.

The second concern has to do with the inclusivity of a work, the title of which implies that it covers all species of each arthropod group known from the UAE. Clearly there is no consistency here. For the noctuoid moths, Fibiger and Legrain treat all recorded species from the UAE, including some like *Hypena obsitalis* that were neither collected by Van Harten nor seen by themselves. On the other hand, Batelka and Geisthardt mention records of 26 species of Meloidae from the UAE as published by Bologna and Turco (2007), but in the current book, they deal only with the 21 species collected by Van Harten and themselves. Well-known UAE species such as *Rhampholyssodes pitcheri* Kaszab,1983 are ignored. Similar omissions occur within the ground beetles, where, for example, species such as the tiger beetles *Hypaetha copulata emiratensis* and *Salpingofera helferi*, known to belong to the UAE fauna, are missed out. This, in turn, raises further questions. If recently published records by well-known scientists can be ignored, then this is likely to be the case also for other sources of information that are pertinent to the entomofauna of the UAE. These include collections in well-known museums in London, Muscat, Oxford and Manchester, amongst others known to have important eastern Arabian material, as well as collections that are still in private hands and also the published records of the first amateur individuals to take an interest in the insects and arthropods of the UAE.

Another question might then be to ask exactly what is meant by the UAE. Is it just the small number of localities listed in the gazetteer that represents mainly Dubai, Sharjah and the Northern Emirates? Or does it not also include the extensive sandy deserts that make up so much, not just of Abu Dhabi, but also of the whole UAE? In the light of these limitations on often not using outside records and not covering all of the UAE territory, it might be more informative to give this book (and others in the series) the subtitle "Insects and Other Arthropods Collected by the UAE Insect Project 2004 – 2009".

There is inaccuracy and inconsistency too in the attribution of the label "First record for the UAE." I read through Volume 1 silently and merely noted that many locally-published first records both of Coleoptera, Lepidoptera and other orders had been usurped by contributions in the new work without explanation or justification. This time with Volume 2, I have tried, not always successfully, to steer clear of that path. I did see one such – lack of recognition of one of my own first UAE records, that of the moth *Autographa gamma* (Gillett, 1998). Presumably this was an oversight since my record of *Ctenoplusia limbirena* in the same publication was recognised. Other locally published records that are firsts for the UAE have, however, quietly been ignored and attributed to others as for the tiger beetles *Megacephala* (*Grammognatha*) *euphratica* and *Lophyro histrio* (Gillett, 1995, not Weisner, 1996). In many other cases, valid records are quietly submerged by referring not to any original work, but instead to Van Harten (2005), a publication which is merely a checklist of published records of species recorded for the UAE by others, together with the original references.

In summary, ***Arthropod Fauna of the UAE – Volume 2*** contains some truly excellent contributions and overall, it will make a very useful addition to the literature on Arabian arthropods and is well worth getting. Nevertheless, it does suffer from a number of shortcomings including, in some cases, inadequate recognition of previous work, lack of a synonomy for each species, failure often to have studied UAE specimens in museums and other collections and an explanation as to why the geographical coverage does not include the whole national territory of the UAE, although the title would suggest that it does so.

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Arabian Wildlife. Arabia's Wildlife Centre – Sharjah. Osama S. Abdulla. 2008. Environmental and Protected Areas Authority, Sharjah, UAE. 158 pp.

This handsome hardback coffee-table volume illustrates the work of the Arabian Wildlife Centre, the Breeding Centre for Endangered Arabian Wildlife, and the Desert Park, all situated in Sharjah. It is produced by the Sharjah Environmental and Protected Areas Authority, and is in both Arabic and English. The 158

page volume, which is undated and has no ISBN number, is abundantly illustrated with photographs. These photos are not credited, but appear to be mainly taken in captivity within the Sharjah facilities.

The production of a book highlighting Arabia's wildlife, much of which is disappearing rapidly, is to be applauded. This is particularly true where the book includes Arabic text, and hence is a valuable information tool and resource for a wider audience, including local schools. This review is of the English text only. The book covers mammals, reptiles , amphibians, freshwater fish and a variety of invertebrates. Surprisingly, the only bird mentioned is the now extinct (in Arabia) ostrich. In species accounts, there is some mention of data collected at the Sharjah facilities, such as clutch and litter sizes, which is valuable information.

The introduction discusses the role of the excellent Sharjah facilities, including "a comprehensive source of environmental information for the publishers and researchers alike" and "providing support, information and expertise on this field". For a book to play a part in these roles, the information needs to be accurate and up to date. Unfortunately this is where this volume falls down. The text is riddled with errors, photographs are attributed incorrectly, the distribution maps are frequently wrong and do not discriminate between former range and present range, and poor editing has resulted in the retention of many typographical errors. These greatly detract from the value of the book. There is no room in this review to mention all these errors but some of the more important are indicated below.

The map of the ecological regions (p. 10) has no text in the key, and so cannot be used. The base map for the species distributions has Yemen and Oman indicated as cities, and Salalah is incorrectly sited well down the Yemen coast. The two photographs illustrating Brandt's hedgehogs (p. 35) are incorrectly identified, and are of Ethiopian hedgehogs. The photo illustrating the ocellated skink *Chalcides ocellatus* (p. 101) is apparently of a Mabuya species. The photo illustrating the 'Large-headed ground gecko' *Stenodactylus doriae* (p. 103) is of the eastern sand gecko *Stenodactylus leptocosymbotes*, whose `burrows do not extend several metres under the sand'. The photo illustrating a 'house gecko' *Hemidactylus turcicus* (p. 104) is of the Rough-tailed bowfoot gecko *Cyrtpodion scabrum*.

The Nile Rat *Arvicanthis niloticus* (p. 41) is also known from Dhofar. The rock hyrax is not found in north western Oman (p. 67). The discovery of the Oman saw-scaled viper *Echis omanensis* Babocsay 2004 is not mentioned and hence the northern Oman and UAE populations are still described erroneously as *Echis coloratus* (p. 75). The 'blue-headed agama' *Pseudotrapelus sinaitus* is named as *Agama pseudotrapelus sinaitus* and *Pseudotrapelus siniata* (sic), both incorrect and the distribution map is duplicated (p. 90-91). Leptien's dhub (*Uromastyx aegyptia leptieni*) is not included, and the northern Oman and UAE populations are therefore not attributed to subspecific status (p. 96-97). The Yellow-bellied house gecko (*Hemidactylus flaviviridis*) is exclusively a house gecko in Arabia and certainly not found in rocky desert, cliffs and caves (p. 98). The distribution map of *Pristurus rupestris* is incorrect and there is no evidence that males try to bite the tails of other males to prevent them from signalling (p. 99). Similarly the map of *Pristurus carteri* (p. 105) is completely wrong, indicating the species is restricted to Yemen. This species is widespread in desert areas of Oman and has recently been discovered in the UAE. The Fan-footed gecko (*Ptyodactylus hasselquistii*) (p. 106) does not have tiny hooks on its toe pads, but has adhesive scansors with microscopic setae, as do other climbing geckos. The 'Steppe agama' (p. 112) illustrated is *Trapelus flavimaculatus* and the distribution map is badly inaccurate . The name *Trapelus jayakari* has long been added to the synonymy. The map of the distribution of the Arabian toad (p. 117) is wrong. This species is not found in southern Oman. *Garra barreimae* is misspelt as 'Carra' (p. 122) and both common and scientific names given for *Garra dunsirei* (p.128) are wrong. The species was named after the collector, Andy Dunsire and so should be 'Dunsire's cave fish' rather than 'Dunser's' and its specific epithet is not '*dunseri*'.

There are three families of scorpions in Arabia, not two (p. 133). The third is the Diplocentridae which includes *Nebo hierichonticus*, the species used to illustrate the page! The information that black widow spiders are not native Arabian species (p. 136) is incorrect, as there are several native species, and they may be found deep in the mountains away from human habitation.

It is unfortunate that the book has retained so many unnecessary errors. Most of these could have been caught before publication if the manuscript had been reviewed by scientists and natural historians with the relevant expertise. Such expertise is available locally in the UAE. Although the book is still an attractive and interesting volume, and will be of considerable use in spreading the conservation message, the quality of the information it contains limits its use for researchers, natural historians and conservation professionals.

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The Native Plants of Oman: An Introduction with Notes for Gardeners. C. Winbow. 2008. Environment Society of Oman, Muscat. 127 pp. ISBN 978-9948-03-775-0

The author's enthusiasm and passion for these plants and their cultivation is palpable throughout this sturdy, extensively illustrated guide. What sets it apart from a typical wildflower book is information on cultivating native species.

The introduction is a plea for conserving and cultivating native plants, drawing upon the author's gardening experience in Oman and other arid regions of the world. Following this — actually a continuation — is very practical, hands-on horticultural advice on how to grow these plants in Oman. I imagine much of this data has not previously been presented, at least not his observations for lesser known plants. In the acknowledgements, Winbow writes ". . . the present book contains many observations and a little guesswork on semi-arid gardening, grafted onto botanical fact from

sometimes scanty sources."

It is the "botanical fact" that will concern some botanists. For example, *Ephedra foliata* is noted as one of three monocotyledonous plants in the book (it is a gymnosperm, not a flowering plant). *Aerva javanica* hardly has "male and female flowers on separate species", rather it is a dioecious species. Other examples could be noted. There are also some errors in nomenclature and use of author names. While distracting and irritating, in my opinion these errors do not distract from the overall utility of the work.

The main part of the book is divided into two sections, plants from Dhofar and those from northern and coastal Oman for good reason — the environments are entirely different as Dhofar is strongly influenced by tropical monsoons and includes numerous plants with African origins. The other parts of Oman are more arid.

The length and detail of entries varies but for each there are ample images. I found these useful in identifying some of the species I encountered in the Hajar Mountains of northern Oman. The author has included much interesting information on these plants, largely from personally experience. Each entry has the scientific name (consistent use of scientific names of families would increase the reference value), the transliterated Arabic name(s), distribution, and a wonderful potpourri of information including uses, legend, and cultivation — although, curiously, several plants are included with no information on how to grow them.

No doubt it is a sign of the times that various web sites are included for many of the species descriptions as well as horticultural and conservation aspects. I have not checked out most of these but I am concerned about the reliability of the information that is often posted on such sites. Several are dependable and these sites can certainly lead the interested reader to further information.

I wish books like this were marketed outside their country of publication as it has a great deal of information, lore, and enjoyment for anyone who is interested in the flora of the Arabian peninsula. Productions like this can do much to avoid over-collecting of plants for gardens, many of which are already in danger from habitat destruction and over-grazing.

Lytton Musselman

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Guide to Common Marine Phytoplankton in Abu Dhabi Waters. A. Rajan and T.Z. Al Abesssalaam. 2008. Environment Agency – Abu Dhabi, EAD. ISBN 1-100122-18910. 127 pp. Price: UAE Dirhams 100

For most people, the only time they are likely to notice phytoplankton in the waters of the UAE is when there is an algal bloom or 'red tide' off the shoreline. As EAD's Managing Director notes in his Foreword, though, 'these microscopic plants are probably the most important group of organisms on Earth', being responsible not only for generating much of the oxygen we breathe, and fixing carbon dioxide from the atmosphere, but being important components of most marine food chains. They are also important indicators of the health of the marine environment, and much else besides.

Rajan and Al Abdessalaam, both of EAD, provide here a preliminary list of species, describing 65 diatom species and 35 dinoflagellate species identified from the waters of Abu Dhabi. There are, perhaps, many more species from these groups, not just inside the Arabian Gulf but along the UAE's East Coast as well, and the book does not deal with cyanobacteria, or blue-green algae, another important group. Many species of phytoplankton have not yet been formally described.

Research, though, has to start somewhere, and the real importance of this book is that it is the first publication to deal with the phytoplankton not just of the Emirates, but of the entire region. The microscopic size of the organisms means that many of the photographs leave something to be desired, though the intricacy and beauty of their varied structures is easily apparent. An introductory section explaining what phytoplankton are, and what they do, adds value, though in language that the layman will struggle to understand. This is, then, very much a book for the specialist but one which, nevertheless, it is good to see. EAD deserve credit for first funding the research and then, secondly, the publication. It's not going to sell many copies, but will be an invaluable work of reference for those involved in the field.

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Pre-Islamic Archaeology of Kuwait, Northeastern Arabia, Bahrain, Qatar, United Arab Emirates and Oman: A Bibliography. Second Supplement (1996-2006). K.G. Stevens and E. Haerinck. 2008. ISBN 978-90-429-2005-7. Peeters, Bondgenotenlaan 153, B-3000 Leuven, Belgium. www.peeters-leuven.be email: order@peeters-leuven.be 84 pp. Price 30 Euros.

The third in an important series of bibliographies from the University of Ghent on the pre-Islamic archaeology of the Arabian side of the Gulf.. A total of 2,255 books and papers are in the list, and many of the paper cited, we are pleased to note, are from previous issues of ***Tribulus***. The list is divided into periods, and then by country/region, rather than by country/region alone, and there is also a useful index of paper and book authors at the back. The resulting listing is easy to peruse. Compilation of such bibliographies is, at best, a chore, but this really is an invaluable piece of work, essential for all serious students of Gulf archaeology. The compilers deserve heartfelt thanks from anyone involved in the field.

Peter Hellyer

Other Books received

(*Mention here does not preclude a review in a subsequent issue*)

Coral Reefs in the southeastern Arabian Gulf (2008). Prepared by Dolphin Energy and Emirates Wildlife Society – Worldwide Fund for Nature,EWS-WWF. (No editor given). ISBN 978-9948-03-844-3. Published by Dolphin Energy, Abu Dhabi.

New Perspectives on Recording UAE History (2009). Proceedings of the International History Conference, New Perspectives on Recording UAE History, National Center for Documentation and Research 40th Anniversary Conference (23-25 November 2008). (No editor given). National Center for Documentation and Research, Abu Dhabi, UAE. ISBN 978-9948-05-071-1. For contents, see **Conferences** (Page: 87).

Abuzinada, A.H., H-G. Barth, F. Krupp, B. Boer and T. Abdessalaam (2008). **Protecting the Gulf's Ecosystems from Pollution**. Birkhauser, Berlin. 285 pp. ISBN 978-3-7643-7946-9.

Agius, D. A. (2009). **Seafaring in the Arabian Gulf and Oman – The People of the Dhow**. (Digital Print version). First printed 2005.
ISBN 0-7103-0939-2. Routledge, Oxon and New York. Price: 25 GBP. New paperback version.

Al-Tamimi, Faris (2008). **Falcon and Hunting in Arabia**. 320 pp. ISBN 9780973885309. Hancock House Publishers, Surrey, BC, Canada. http://www.hancockhouse.com 320 pp.

Bailey, T. (2008). **Diseases and Medical Management of Houbara Bustards and Other Otididae**. Emirates Printing Press LLC, Dubai.
ISBN 978-9948-03-562-6. 494 pp.

Cleuziou, S. and Tosi, M. (2007). **In the Shadow of the Ancestors – The Prehistoric Foundations of the Early Arabian Civilization in Oman**.Ministry of Heritage and Culture, Sultanate of Oman.
Publication no. 135/2007. Available from http://www.mhc.gov.om 334 pp.

Cordoba, J., Molist, M., Perez, C., Rubio, I. & Matinex, M. (2008). **Proceedings of the 5th International Congress on the Archaeology of the Ancient Near East (Madrid April 3-8, 2006)**. Published by UA Ediciones, Madrid. Three Volumes (Vol. 1 ISBN: 978-84-8344-41-1. 820 pp; Vol. 2 ISBN 978-84-8344-142-8. 814 pp. Vol. 3 ISBN: 978-84-8344-147-3. 814 pp.
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Proceedings of the 2nd Annual Symposium on Recent Archaeological Discoveries in the Emirates and of the Symposium on the History of the Emirates, Al Ain, 2004. ISBN 978-9949-06-078-9. Zayed Center for Heritage and History, Al Ain. Available from: www.zayedcenter.org.ae 190 pp.

King, Geoffrey (2009). **Old Mosques of the Coasts of Abu Dhabi**. National Center for Documentation and Research, Abu Dhabi.
(*The focus of this book is the group of three Late Islamic mosques on Dalma, already published in a previous edition of Tribulus, with other notes on smaller mosques found on the islands of Abu Dhabi and on the old 'Grand Mosque' of Abu Dhabi, the 'al-Otaiba mosque'*).

Mouton, M. (2008). **Peninsule d'Oman de la fin de l'Age du Fer au debut de la periode sassanide (250 av.-350 ap. JC)**. ISBN-13: 978-1-4073-0264-5. ISBN-10: 1-4073-0264-7. Archaeopress, Society for Arabian Studies Monograph 6, British Archaeological Reports International Series 1776. 355 pp text, 162 pp illustrations. Price: 55 GBP.
Available from:
http://www.oxbowbooks.com/bookinfo.cfm/ID/85751
(*This thesis was written fifteen years ago and is now published, unchanged but with a supplementary bibliography*).

Muller, M.G (2009). **Practical Handbook of Falcon Husbandry and Medicine**. ISBN 978-1-60741-608-1. Nova Science Publishers, Hauppauge NY11788-3619, USA. email: Main@novapublishers.com
(*The author is director of the Abu Dhabi Falcon Hospital*).

Petraglia, M.B. & Rose, J.I. [eds.] (2009). **The Evolution of Human Populations in Arabia: Paleoenvironments, Prehistory and Genetics**
Vertebrate Paleobiology and Paleoanthropology. Springer Academic Publishers. Hardcover: 300 pages. Publisher: Springer; 1 edition (August 1, 2009). Language: English. ISBN-10: 9048127181 - ISBN-13: 978-9048127184.
This book includes several papers on the archaeology from the United Arab Emirates, including: chapter 3: 3. Pleistocene Climate Change in Arabia: Developing a Framework for Hominin Dispersal over the Last 350 ka, by Adrian G. Parker; chapter 9: A Middle Paleolithic Assemblage from Jebel Barakah, Coastal Abu Dhabi Emirate, by Ghanim Wahida, Walid Yasin Al-Tikriti, Mark J. Beech, and Ali Al Meqbali; chapter 10: Paleolithic stone tool assemblages from Sharjah and Ras al Khaimah in the United Arab Emirates, by Julie Scott-Jackson, William Scott-Jackson, and Jeffrey I. Rose; and chapter 15: The Holocene (Re-)Occupation of Eastern Arabia, by Hans-Peter Uerpmann, Daniel T. Potts, and Margarethe Uerpmann.
Order from: http://www.amazon.co.uk/Evolution-Populations-Vertebrate-Paleobiology-Paleoanthropology/dp/9048127181/ref=sr_1_1?ie=UTF8&s=books&qid=1247571146&sr=1-1

Pickering, H. & Patzelt, A. (2008 & 2009 reprint). **Field Guide to the Wild Plants of Oman**. ISBN-13: 978-1844-617-78. Royal Botanic Gardens, Kew.UK. 281 pp. Price: 38.99 GBP.
Available from:
http://www.nhbs.com/title.php?tefno=158791

Taha, M.Y. (2009). **The Discovery of the Iron Age in the United Arab Emirates**. ISBN 978-9948-15-017-6. Ministry of Culture, Youth and Community Development, Abu Dhabi. Available from: http://www.mcycd.ae
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Uerpmann, H-P., Uerpmann, M. 7 Jasim, S.A. [eds.] (2008). **The Natural History of Jebel al-Buhais: past and Present. The Archaeology of Jebel al-Buhais, Sharjah, United Arab Emirates, Volume 2**. Department of Culture and Information, Government of Sharjah, UAE, University of Tuebingen, Germany. 148 pp. ISBN: 978-3-935751-05-06

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Conferences

The following conferences dealing, at least in part, with the archaeology of the United Arab Emirates took place during 2008 and 2009. Papers, where not already published, are expected to be published in due course.

5th Annual Symposium on Recent Archaeological Discoveries in the United Arab Emirates, Al Ain.
3rd – 4th April 2008
Zayed Centre for Heritage and History.

Seminar for Arabian Studies. The British Museum, London. 24th-26th July 2008

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2008 Archaeozoology of Southwest Asia (ASWA) Working Group meeting: November 15-20, 2008, Al Ain.

UAE-related papers:

Sophie Mery, Mark Beech and Vincent Charpentier. New evidence for deep sea fishing: the Neolithic settlement at Akab, Umm al-Qaiwain.

Mark Beech, Tatsuo and Hanae Sasaki, Mohammed Amer Al Neyadi,, Jaber AL Merri, Ahmed El-Haj, Dia'eddin Tawalbeh, Mohammed Mater Al Dhaheri, Hamdan Al Rashidi and Ali Al Meqbali. Fish in the Desert - Late Islamic period Bedouin camp sites in Abu Dhabi.

Margarethe Uerpmann and Hans-Peter Uerpmann. Muweilah and the problems of dromedary domestication. Mark Beech, Marjan Mashkour, Matthias Huels and Antoine Zazzo. Prehistoric camels in Abu Dhabi's Western Region.

New Perspectives on Recording UAE History. 23-25 November 2008
National Center for Documentation and Research, Ministry of Presidential Affairs, Abu Dhabi.
(Page numbers refer to the Conference Proceedings, published in 2009
ISBN 978-9948-05-071-1. Order from:
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Part 1 – Prehistoric roots of the UAE: From the Stone Age to the Pre-Islamic Period.
Globalization, 'big history' and multi-scalar analysis: Conceptualizing 8000 years of the UAE's cultural development, by D.T. Potts (Pages 13-22);
Middle Palaeolithic Assemblage in Abu Dhabi Emirate: The view from Jebel Barakah, by G. Wahida, W.Y. al-Tikriti, M. Beech and A. al-Meqbali (Pages 23-36);
Early Fishers and Herders: The Neolithic period in the UAE, by H-P. Uerpmann and M. Uerpmann (Pages 37-50);
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Britain and State Formation in the Gulf: The case of Abu Dhabi and Shaikh Zayid bin Khalifa, by J.E. Peterson (Pages 207-214);
The British contribution to development in the Trucial States, by T. Clark (Pages 215-226);
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تريبيلوس

مجلة جمعية الإمارات للتاريخ الطبيعي

مجلد ١٨ - ٢٠٠٩