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Cover illustrations:

Front: A Common Swallowtail *Papilio machaon*, nectaring at Wadi Wurayah National Park, Fujairah, during winter.
Photo by Binish Roobas

Back: Arabian Red Fox *Vulpes vulpes*, Wadi Mai, Fujairah.
Photo by Binish Roobas

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Editorial

In the years since ***Tribulus*** first began to be published, at the beginning of the 1990s, there have been major changes in the environmental scene in the United Arab Emirates. Up to that date, much of the original research into the country's biodiversity, both of flora and fauna, had been undertaken by the National Avian Research Centre, NARC, and, to a great extent, by independent enthusiasts, some of whom were qualified scientists while others were dedicated, self-taught amateurs. We still draw on their work today to provide early baseline information.

In the early days, Law No. 9 of 1983, covering hunting, was the principal regulation. However, the seeds of subsequent conservation work were sown by the UAE's Founding Father, the Late Shaikh Zayed bin Sultan Al Nahyan. He was instrumental in setting up conservation breeding programmes for Arabian Oryx and Houbara Bustard in Al Ain Zoo as far back as 1977. This was followed by the establishment of NARC in 1989 and the creation of the Federal Environment Agency, FEA, in 1993. The establishment of the Environmental Research and Wildlife Development Agency, ERWDA, now known as the Environment Agency – Abu Dhabi, EAD, followed in 1996.

Much has changed since those early days, and in this issue we are pleased to carry some papers that reflect that change.

The Environmental Agency – Abu Dhabi, EAD, now publishers of ***Tribulus*** along with the Emirates Natural History Group – Abu Dhabi, recently completed its first 25 years and has been at the forefront of that change. Its role as a regulator continues to become more effective while, at the same time, its continued focus on research is producing new insights both about our flora and fauna and about the threats to it.

One paper, by Rashed Al Zaabi, Robert Gubiani and Pritpal Soorae, looks at the results of important survey work undertaken by EAD into the distribution of the endangered Arabian Sand Cat in the deserts of Abu Dhabi. Another EAD contribution, by Nessrine Alzahlawi, Rajeyah Binkulaib, Yasser Al Kharusi and Salim Javed, reports on the results of a survey to gather the views of camel-owners on the impact of overgrazing by camels on the natural environment. The obvious conclusion, although it is not overtly stated as such, is that numbers need to be reduced and camel farms and grazing regimes to be more effectively managed to tackle the issue.

Another clutch of papers reflect the continued research being undertaken in one of the UAE's most important protected areas, the Wadi Wurayah National Park, WWNP, in Fujairah. Sami Ullah Majeed, a park ranger, in his first contributions, one alone and the other in collaboration with Gary Feulner and Ali Al Hmoudi, offers important information on one of our rarest breeding birds, the Arabian Spotted Eagle Owl, and on the behaviour of one of our freshwater fish, *Garra barreimiae*. In a third paper, Johannes Els, of Sharjah's Breeding Centre for Endangered Arabian Wildlife, BCEAW, revisits the identification of a gecko species from the WWNP first discussed in the previous issue of this journal, while Binish Roobas reports on the discovery in the WWNP of a new butterfly species for the Emirates. Roobas and Feulner are lead authors of a new book on UAE butterflies, due to be published later this year with the support of EAD.

The Wadi Wurayah area is now one of the best-studied parts of the UAE in terms of its flora and fauna, but these contributions indicate that, even so, there is still much to be learned.

A selection of other papers further underline the fact that continued research can identify new data about the UAE's biodiversity. Mohammed Shahid examines landraces of the strains of barley and wheat cultivated in the mountains. Reza Khan's report on the discovery of a new alien arthropod, the first millipede to be found in the Emirates, underlines the need for more attention to be paid to the issue of deliberate or unintentional introduction of exotic species. A specially-designed EAD database includes information on around 150 alien species of flora and fauna in the Emirates.

The value of historic data is emphasised by Oscar Campbell's review of the status of Egyptian Vulture.

With locust swarms affecting much of Africa and Arabia in late 2019 and early 2020, the study by Athol Yates of anti-locust campaigns over 70 years ago provides a historical perspective.

Finally, three contributions from neighbouring Oman, two by the late Peter Cowan and Elaine Cowan, on the butterflies of Dhofar and a giant waterbug, and on a new dragonfly for the country, by Vicky Dobson and Andrew Childs, complete this volume.

In accordance with our long-established editorial policy, the content is diverse both in terms of geography and of the orders of plants and animals, with contributions from scientists, professional naturalists, historians and by highly-experienced independent researchers. The variety will, we hope, prove to be of interest.

Peter Hellyer

An overview of the recent status of Egyptian Vulture *Neophron percnopterus* in the United Arab Emirates

by Oscar Campbell

Introduction

Despite an extensive global distribution, from Iberia and western African, south across the Sahel zone to parts of East Africa, Arabia and India and north to southern Kazakhstan (Orta *et al.* 2019), Egyptian Vulture *Neophrom percnopterus* is classified as Endangered (BirdLife 2017) due to a general decline across much of this range. The current world population is estimated at 12,000 to 38,000 mature individuals, with declines of 50-79% in Europe over three generations and over 90% in India in the last decade (BirdLife 2019). The species is adaptable and, in some areas, is commensal with humans, attending and moving between locations such as municipal refuse tips where food may be temporarily super-abundant (Buechley *et al.* 2018, McGrady *et al.* 2018). However, reasons for a marked decline across its range as a whole include disturbance, direct and secondary poisoning, electrocution, collisions with wind turbines, reduced food availability and habitat change (BirdLife 2019).

In Arabia, the species has undergone a long term decline (estimated as up to 90% over 50 years) and has gradually withdrawn to more remote areas; records up to around 1960 imply the species was a common scavenger in towns and villages, including Riyadh and Dubai (Jennings 2010). The current Arabian population is estimated, very approximately, to be 2,000 pairs, although a very large proportion of these are concentrated on Socotra Island, Yemen where a population of 1900 (c. 800 pairs) has been estimated (Jennings 2010, Porter & Suleiman 2012). This represents the highest population density of the species in the world. Away from Socotra, Arabian breeders are widely scattered but primarily distributed across both central and western Saudi Arabia and northern and eastern Oman (Jennings 2010). The species has been generally believed to be decreasing in Oman (Jennings 2010, Eriksen & Victor 2013) although large numbers still utilise municipal waste dumps (for example a maximum of 458 counted near Muscat, November 2013; Al Fazari & McGrady 2016). Further, a recent study on Masirah Island established 65–80 breeding pairs, over five times the previous estimate (Angelov *et al.* 2013). In addition, Meyburg *et al.* (2019) used tracking data to infer that the majority of birds in winter in Oman are resident (not migrants) and thus the Omani breeding population is likely to be much larger than previously expected and certainly multiple times greater than the 100 pairs tentatively suggested by Jennings (2010; M. McGrady pers. comm.).

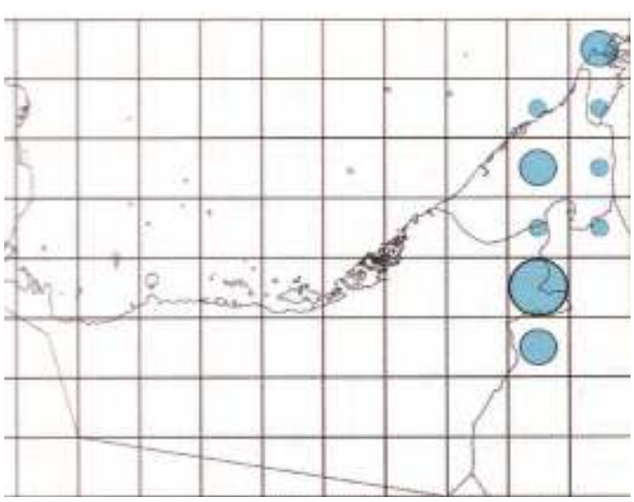

Figure 1. Distribution of possible, probable and confirmed breeding records of Egyptian Vulture *Neophron percnopterus* from the UAE. Source: Aspinall (2010). The largest circle lies directly over Jebel Hafit.

Distribution of Egyptian Vulture records from the United Arab Emirates

In the United Arab Emirates, almost all recent records of the species come from the Al Ain area, in particular on and in the vicinity of Jebel Hafit (see Figure 1). This is a barren, spectacularly rocky inselberg of tertiary sedimentary rock (mainly limestones) approximately 17 km long and reaching a maximum elevation of 1240 m, straddling the border between the UAE and Oman just south of the city of Al Ain (Aspinall & Hellyer 2004). The species has been present there long-term, their presence being noted by Thesiger (1949). There are only 13 records (1.4% of all records) of Egyptian Vulture from 2006–2018 away from this site or the immediate surrounding area (UAE Bird Database). Records remote from the greater Al Ain area may concern wandering birds from Jebel Hafit or northern Oman, or perhaps less likely (see below), migrants from southern or central Asia.

Almost all UAE records away from the greater Al Ain area are from sites in or adjacent to the main Hajar mountain chain, bar three records from the greater Dubai/ Sharjah area. There is also a record from Abu Dhabi Island in March 1992 (Richardson 1993) and one from nearby Al Wathba (March 1995).

Egyptian Vulture has been recorded migrating into and out of Arabia in quite large numbers at Bab el Mandeb, Yemen (Welch & Welch 1988, 1991, McGrady *et al.* 2014) although there is no evidence that Arabian breeders are involved (Jennings 2010). Sixteen Egyptian Vultures (trapped mainly in Turkey but also north east Africa) were satellite tracked between Turkey and Kenya (Buechley *et al.* 2018). All moved in or out of the Arabian peninsula via Bab al Mandeb or (to a lesser extent) Sinai, Egypt and entirely avoided eastern Arabia.

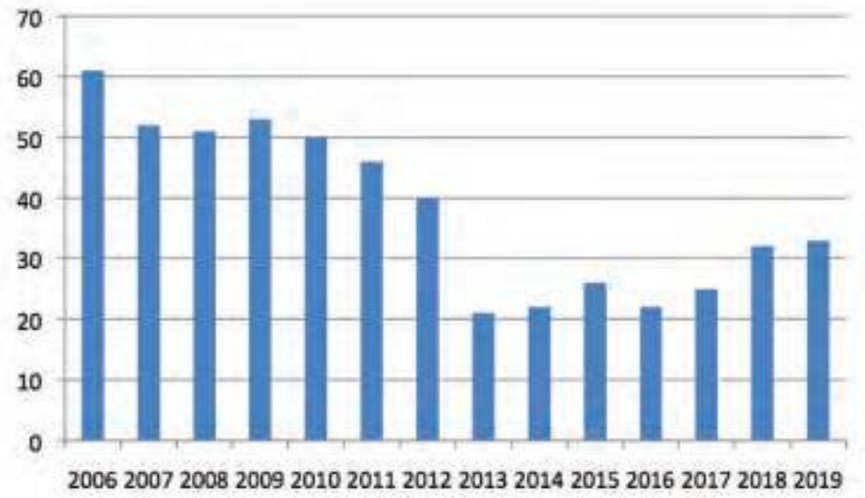

Figure 2. Number of Egyptian Vultures *Neophron percnopterus* 2006–19, Jebel Hafit.
Data taken from the UAE Bird Database and obtained by averaging the three highest counts in each year.
Source: UAE Bird Database. Note that data for 2019 was only available up to 30 August.

Despite migratory populations breeding in central Asia north and north east of the UAE, there is no evidence that birds from such sources migrating to or through the UAE are anything other than exceptional (contra BirdLife, in prep). Supporting this contention, a recent study, involving twelve birds trapped in winter near Muscat and subsequently satellite tracked, indicated that, somewhat contrary to expectations, those birds were resident and only one individual crossed the Straits of Hormuz via Musandam, Oman in April 2018 and settled in southern Iran (Meyburg *et al.* 2019, M. McGrady pers. comm.).

Numerical analysis records of Egyptian Vulture from Jebel Hafit

BirdLife (in prep.) categorises Egyptian Vulture as Critically Endangered in the UAE, on account of its rapid decline and current tiny resident population. An analysis of records 2006–19 from Jebel Hafit and the immediate vicinity (see Figure 2; data from UAE Bird Database) reveals a general decline over this period, with numbers from 2013–19 inclusive less than 50% of those during 2006–10, although the same dataset implies that numbers have stabilised, and perhaps even increased slightly, since a low point in 2013. Data presented in Figure 2 are based on means of the three highest counts in any given year, and should be regarded as an index rather than an estimate of absolute population size.

Over the longer term, the actual decline may be more severe than this, as database records from as far back as 1985, although sparse, include counts of up to 122 (November 1994), 111 (October 1994) and approximately 100 (December 1992), all from Jebel Hafit or its immediate environs. There have been no triple figure counts since 1994 and, since 2006, only 12 records exceeding 50 individuals, all of which were prior to August 2011. Given very limited evidence for regular passage of the species through the UAE (see above) it may be reasonable to regard these counts as representing a resident, or at least wintering, population. However, although admittedly speculative, it is at least conceivable that some of the earlier high counts refer to influxes of birds from Oman, moving into the area temporarily in response to, for example, food availability. Such a phenomenon seems to occur erratically with Lappet-faced Vulture *Torgos tracheliotos* in the UAE, perhaps in response to the temporary availability of animal carcasses at sites that are well-stocked with

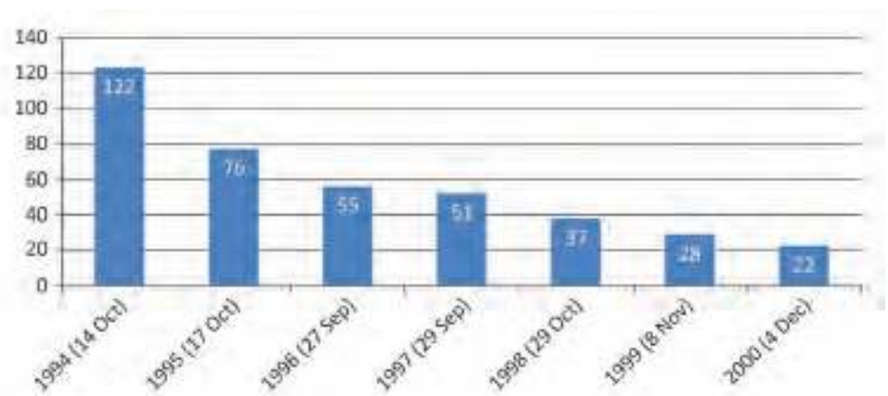

Figure 3. Numbers of Egyptian Vulture *Neophron percnopterus* 1994– 2000, Jebel Hafit.
Data taken from Richardson (2003), based on the highest count reported each annually.

game such as Dubai Desert Conservation Reserve and Al Marmoom (UAE Bird Database). Indeed, some of these highest counts in the early 1990s come from birds congregating at the nearby Al Ain Zoo where food was presumably easy to obtain. A simple change to food provision practice (for example, from outdoor to indoor feeding) could account for a marked decline in numbers of Egyptian Vultures using this site.

There are insufficient data in the UAE Bird Database to permit rigorous analysis of records prior to 2006 but Richardson (1990) regarded the species as a local resident of the mountains as far north as Masafi, with Jebel Hafit being a traditional nesting area. One record from Wadi Bih, Ra's al-Khaimah (May 1995) was regarded as noteworthy, as the species was 'formerly common' there (Richardson 2003) prior to the 1970s (Aspinall 2010). However, no confirmed breeding records are explicitly mapped from that area either by Jennings (2010) or Aspinall (2010). This implies that the species has contracted in range as well as numbers in (formerly?) suitable montane habitat across the UAE. Richardson (2003) documented a decline in the species at Jebel Hafit, based on annual peak counts reported 1994–2000 (see Figure 3). It is apparent that the numbers presented therein are not quite in accord with those in Figure 2 and it is not possible to determine if the species underwent a temporary increase in the Jebel Hafit area during the intervening years or, perhaps more likely, that this aberration is simply due to non-systematic collation of data.

Discussion

Although Jebel Hafit may represent predominately a roosting or nursery area for birds from a population that breed further east (Aspinall 2010), adults are regularly observed (OC pers. obs.). Given that at least small numbers are present throughout the year, breeding may occur annually, at least in the less accessible Omani sector of the mountain or on nearby spurs of the main Hajar mountain chain in Oman. However, hard evidence of breeding from the UAE sector of the mountain has very rarely been obtained. A newly-fledged bird was observed in June 2000 and is quite likely to have been locally bred, although it could theoretically have come from a site 30 km away in Oman where an active nest was located in April (Aspinall & Hellyer 2004, Aspinall 2010). There were no further strong suspicions of breeding until 2017 when a bird was seen carrying nesting material in March and a large chick seen on a nest with an attendant adult in May (UAE Bird Database; N.P. Williams *in litt.*). In January 2018, a pair was observed mating and up to two juveniles, seemingly recently fledged, were observed at a nearby private site in June (UAE Bird Database). There was no evidence suggestive of breeding reported in 2019. Interestingly, the first successful rearing of an Egyptian Vulture chick in captivity on the Arabian Peninsula, at the Kalba Birds of Prey Centre, on the UAE East Coast, has recently been reported (Whitehouse-Tedd & Whitehouse-Tedd 2017) and it is therein proposed to use such birds, upon maturity, as part of a regional captive breeding programme.

Given that the status of Egyptian Vulture in Oman is rather more favourable than has been assumed until very recently, then there exists the possibility that Oman may act as a source population that can, in theory, exert a rescue effect for the species on Jebel Hafit. However, Jebel Hafit lies on the edge of the species' range in eastern Arabia and, in consequence, is likely to be subject to fluctuations in the species' fortune. Long mooted as a prime candidate for 'national park' status (with plans being drawn up at least as long ago as the early 2000s; Aspinall & Hellyer 2004), 81 km^2 of Jebel Hafit is now formally protected (EAD 2018), although it is not clear what this means in terms of habitat protection and conservation monitoring. Despite the site's exceptional biodiversity and archaeological value at a national level, there has been extensive development for housing in its immediate environs and, apparently, further development on the actual slopes, including stocking the area with grazing animals, may follow. Egyptian Vulture has long been protected in the UAE by Article 1 of Federal Decree Law No. 9 (1983). Direct persecution is most likely very unusual, at least currently (although there have been unconfirmed reports of shooting in the past; P. Hellyer pers. comm.), but habitat modification, reduction in food supplies and, potentially, incidental poisoning remain threats.

In light of this, as a minimum, systematic monitoring of the Egyptian Vulture population is urgently required, ideally including analysis of relative proportions of different ages and phenological variation. For a conspicuous species that, at least formerly, roosted communally (for example, on a large radio mast on the mountain's summit), such basic data at least should not be hard to attain. A systematic survey of Jebel Hafit to locate any regular nesting areas would also help, although issues related to natural topography and access would likely thwart anything attempted by enthusiastic amateurs. Further, with much of the mountain being in Oman, a genuinely systematic survey would require international co-operation to a degree not previously demonstrated with regard to nature conservation regionally. Ultimately, it is even possible that, with a targeted and sustained approach (and at relatively low cost) that includes supplementary feeding and associated viewing facilities, perhaps with a sympathetic waste management company and Al Ain Zoo as critical local partners, Egyptian Vulture could become a conspicuous and spectacular flagship species for conservation efforts on Jebel Hafit. Whilst potentially far-fetched at this stage, such an idea was first mooted long ago (Aspinall 1996) and, since then, similar efforts have been very successful showcasing Greater Flamingos at Al Wathba Wetland Reserve, with resultant positive knock-on effects for a multitude of other species (Campbell *et al.* 2017, EAD 2019). Such 'vulture restaurant' projects have been successful elsewhere with larger vultures *Gyps* (for example Cambodia; WCS Cambodia 2018) and to a lesser extent, with Egyptian Vulture (for example, BSPB 2018).

Acknowledgements

I am grateful to all birdwatchers who have contributed records to the UAE Bird Database and in particular to Tommy Pedersen for maintaining it, this paper being largely based on that Database. Prior to TP, Colin Richardson fulfilled a similar role and compiled various Emirates Bird Reports, which are an extremely valuable mine of data for the period up to 2000. Peter Arras made a particularly important contribution to the Database with many records made in recent years. Mike McGrady was extremely helpful in providing references and made many useful comments that significantly improved this paper, as did Richard Porter. Ian Burfield (Bird Life International) and Rob Sheldon (Ornithological Society of the Middle East) discussed and made available the draft assessments of the IUCN Red List project, carried out in July 2019.

References

Al Fazari, W.A. & M.J. McGrady 2016. Counts of Egyptian Vultures *Neophron percnopterus* and other avian scavengers at Muscat's municipal landfill, Oman, November 2013–March 2015. **Sandgrouse 38:** 99–105.

Angelov, I., T. Yotsova, M. Sarrouf & M.J. McGrady 2013. Large increase of the Egyptian Vulture *Neophron percnopterus* population on Masirah Island, Oman. **Sandgrouse 35(2):** 140–152.

Aspinall, S. 1996. Status and conservation of the breeding birds of the United Arab Emirates. Hobby Publications, Dubai.

Aspinall, S. 2010. Breeding birds of the United Arab Emirates. Environment Agency – Abu Dhabi.

Aspinall, S. & P. Hellyer (eds.) 2004. Jebel Hafit, a natural history. ENHG, Abu Dhabi.

BirdLife International 2019. Species factsheet: *Neophron percnopterus*. Retrieved from *http://www.birdlife.org* on 3 November 2019.

BirdLife International. In prep. Red List assessment – *Neophron percnopterus*.

BSPB 2018. Congregation of Egyptian Vulture floaters observed at Studen Kladenets feeding station this year. Retrieved from *http://old.lifeneophron.eu/en/news-view/522.html* on 8 January 2018.

Buechley, E.R., M.J. McGrady, E. Çoban, Ç.H. Şekercioğlu 2018. Satellite tracking a wide-ranging endangered vulture species to target conservation actions in the Middle East and East Africa. **Biodiversity and Conservation 27(9):** 2293–2310.

Campbell, O., S. Javed, S. Al Dhaheri, K.A. Al Omari, P. Soorae & A. Al Dhaheri 2018. Al Wathba Wetland Reserve, Abu Dhabi emirate: Successful mixing of bird and people. **Sandgrouse Supplement 4:** 73–84.

EAD 2018. Terrestrial protected areas. Retrieved from *https://www.ead.ae/Pages/Green%20Business/Terrestrial-Protected-Areas.aspx* on 27 November 2019.

EAD 2019. Al Wathba Wetland Reserve. Retrieved from *https://www.ead.gov.ae/Pages/al-wathba-wetland-2.aspx.* on 12 November 2019.

Eriksen, J. & R. Victor 2013. Oman bird list. Edition 7. Centre for Environmental Studies and Research, Sultan Qaboos University.

Jennings, M. 2010. Atlas of the breeding birds of Arabia. **Fauna of Arabia 25:** 1–751.

McGrady, M.J., D.L. Karelus, H.A. Rayaleh, M. Sarrouf Willson, B.-U. Meyburg, M.K. Oli & K. Bildstein 2018. Home ranges and movements of Egyptian Vultures *Neophron percnopterus* in relation to rubbish dumps in Oman and the Horn of Africa. **Bird Study 65 (4):** 544–556.

McGrady, M.J., H.A. Rayaleh, A.M. Dara & E. Abdillahi 2014. Migration of raptors across the Bab el Mandeb Straits during 2–10 March 2013. **Bulletin of the African Bird Club 21:** 65–72.

Meyberg B., M. McGrady, M. Sarrouf Willson & A. Al Bulushi 2019. Tracking data suggest that Oman's Egyptian Vulture population is much larger than expected. **British Birds 112:** 535–540.

Orta, J., G.M. Kirwan, D.A. Christie, E.F.J. Garcia & J.S. Marks 2019. Egyptian Vulture (*Neophron percnopterus*). *In:* del Hoyo, J., Elliott, A., Sargatal, J., Christie, D.A. & E. de Juana (eds.) Handbook of the birds of the world alive. Lynx Edicions, Barcelona. Retrieved from *https:// www.hbw.com/node/52993* on 31 October 2019.

Porter, R.F. & A.S. Suleiman 2012. The Egyptian Vulture *Neophron percnopterus* on Socotra, Yemen: population, ecology, conservation and ethno-ornithology. **Sandgrouse 34(1):** 44–62.

Richardson, C. 1990. The birds of the United Arab Emirates. Hobby Publications, Dubai and Warrington.

Richardson, C. (comp.) 1993. Emirates Bird Report 17. Dubai.

Richardson, C. (comp.) 2003. Emirates Bird Report 2003.

Thesiger, W. 1949. A further journey across the Empty Quarter. **The Geographical Journal 113:** 21–46.

Welch, G. & H. Welch 1988. The autumn migration of raptors and other soaring birds across the Bab el Mandeb Straits. **Sandgrouse 10:** 26–50.

Welch, G. & H. Welch 1991. Spring raptor observations from Djibouti. **Ornithological Society of the Middle East Bulletin 26:** 25–27.

WCS Cambodia 2020. Wildlife – Vultures. Retrieved from *https://cambodia.wcs.org/Saving-Wildlife/Vultures.aspx* on 8 January 2020.

Whitehouse-Tedd, G. & K. Whitehouse-Tedd 2017. Successful captive rearing of an Egyptian Vulture at Kalba Bird of Prey Centre, UAE. **Tribulus 25:** 62–66.

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Current distribution of Arabian Sand Cat *Felis margarita harrisoni* in Abu Dhabi, United Arab Emirates, via camera trapping

by Rashed Al Zaabi, Robert Gubiani & Pritpal Soorae

Introduction

The Arabian Sand Cat (*Felis margarita*) is a small cat that is highly adapted to the extreme desert environment. This felid has a head–body length ranging from 40–57 cm, with weight range from 1.4–3.4 kg, and possesses significantly large ears, a common feature amongst desert predators. The low-set ears have been a suggested adaptation to stalking in areas with little vegetative cover and high distance visibility. The palms and soles of the Arabian Sand Cat (henceforth referred to as Sand Cat) are distinctive in that they are covered in a dense mat of fine, long wavy hair ultimately concealing the pads. This fur results in almost no tracks being produced. Its fur is soft and pale sandy with a silvery-grey colouration on the upper legs. The distinct barring on the thighs and flanks, along with the tail tipped with black bars, make it easily identifiable. Although distinct barring is evident on all individuals, sexual dimorphism is not evident, making positive identification of individuals difficult to achieve.

It is an extremely elusive species that is almost wholly nocturnal in nature. It survives without the need for access to permanent water sources as it obtains sufficient water from its prey. The lack of tracks produced when foraging and the secretive behaviour results in very limited knowledge of the basic biology and ecology of the species. Currently the IUCN has deemed it to be Least Concern (LC). However, the highly elusive nature of Sand Cats makes it difficult to accurately determine population numbers and trends. As information regarding the ecology of the species increases, as well as the magnitude of the influence of threats, it is likely that the IUCN classification will need to be revised.

Historical records for Sand Cat within the Emirate of Abu Dhabi do occur although they are limited in number. Aspinall *et al.* (2005) noted: “There are very few confirmed sightings of sand cat from the UAE, records being both infrequent and geographically widely dispersed.”

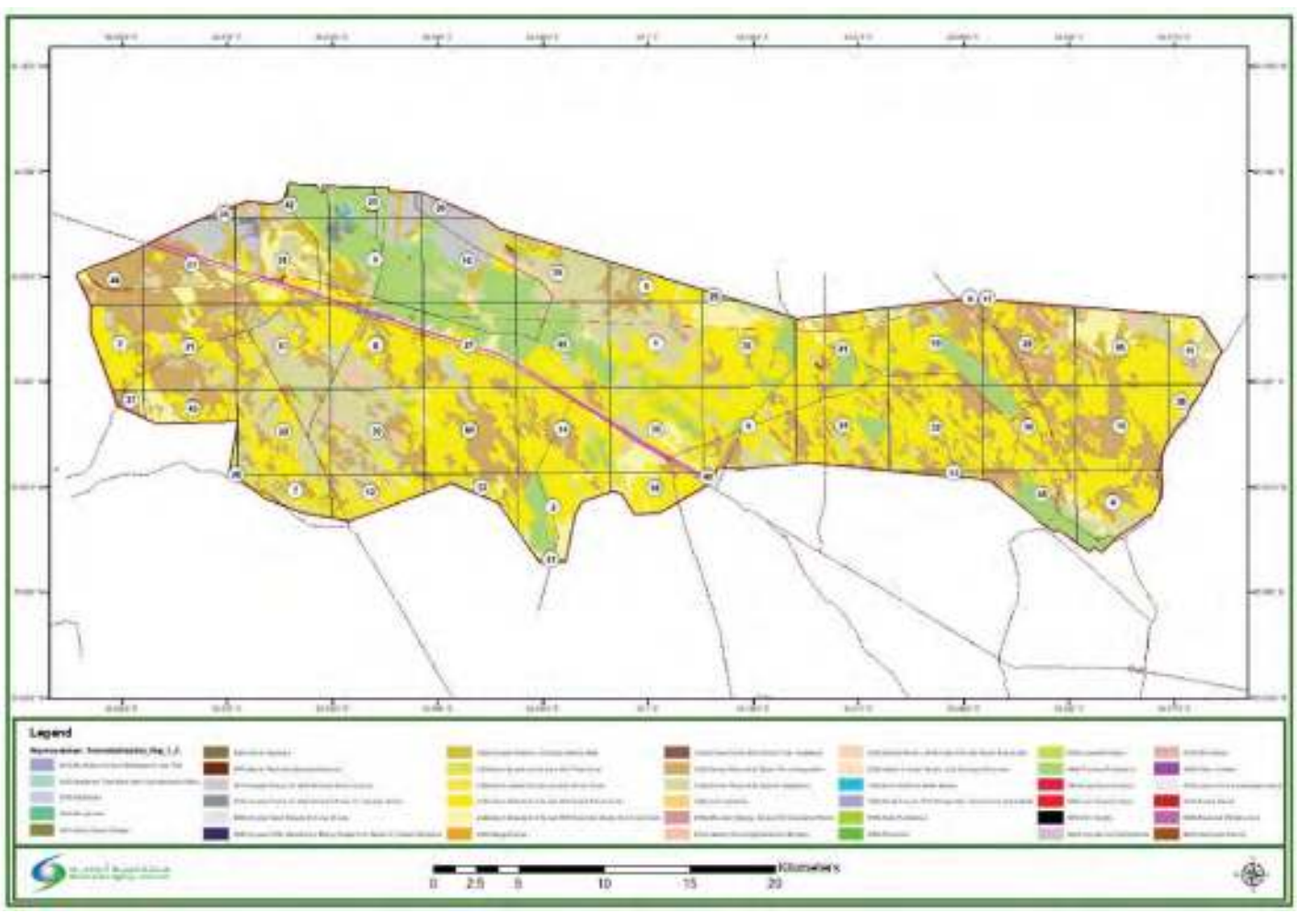

Figure 1. Baynouna Protected Area, indicating grid based survey layout.

Some historical locations have changed considerably. However, habitat quality within some of these historical locations is considered still to be high. The formation of dedicated protected areas within Abu Dhabi Emirate and reduced grazing pressure from livestock has enabled large areas of suitable habitat to be retained that are suitable for Sand Cat. Similarly, militarised areas inadvertently provide protected status, with no grazing allowed and habitat preservation to continue. Camera trapping by EAD has resulted in some of the first sightings after an absence of about 10 years (Ahmed *et al.* 2016).

Major threats to this species include the development within important habitat areas outside of the protected zones. Similarly, the introduction of domestic cats is leading to hybridisation with the Arabian Sand Cat, with some populations harbouring domestic diseases such as Toxoplasmosis. This hybridisation, in addition to continued hunting and persecution, further reduces the rigidity of the population genetics for this species. The continued increase in feral cat populations also results in significant competition between already limited food sources and pressure on den sites needed for reproduction.

As a means to curb the impact on this relatively unknown species, an international collaboration project to unite global experts was developed to design a way forward for the conservation of the Sand Cat. In November 2013 both the *in-situ* and *ex-situ* conservation communities, from the UAE, Saudi Arabia, Qatar, Oman, Jordan, Europe and the USA, came together to share knowledge, experience, problems and ideas. The ultimate aim was to establish coordinated conservation, research and monitoring programmes in all range states and an *ex-situ* regional Population Management Plan. This plan was subsequently finalised and agreed activities were initiated (Banfield 2014).

Initial surveys

Based on species richness maps and a baseline survey of Abu Dhabi Emirate during 2013–2014, the Al Houbara Protected Area, also known as the Baynuna Protected Area, was chosen as a potential site for camera trapping and attempting to locate elusive species, such as the Sand Cat, during 2015. A total of nine camera traps were deployed during March–December 2015, covering an area of 1,990 km^2. A total of 278 trapping nights occurred and, from this, 46 photographs of Sand Cat were recorded with three individuals being identified, including a single confirmed male. Given these initial results, an additional species-specific programme was initiated within the Al Houbara Protected Area in 2016. The site was divided into 5×5 km grids (see Figure 1) to explore for undetected populations and a more thorough survey was conducted, using grid-based methodology. From this survey, an additional 45 records were obtained, providing additional important information. Camera traps baited with canned fish and cat-food proved to be the most frequented by Sand Cat. These have subsequently become the standardised bait choice.

Figure 2. Sand Cat records from Al Houbara Protected Area.

Current information

Additional records of this species made in Al Ghada Protected Area (December 2017), Barqa Al Soqour (July 2017), Al Tawi Protected Area (2018) and recently Yaw Al Debsa and Al Beda'a Protected Areas (2019) provide

Figure 3. Sand Cat records from Barqa Al Soqour Protected Area (*above*) and Yaw Al Debsa Protected Area (*below*).

Table 1. Sand Cat sightings.

Location	Total records	2015	2016	2017	2018	2019
Al Houbara PA	91	X	X	X	X	X
Yaw Al Debsa PA	7					X
Al Tawi PA	4				X	X
Al Ghada PA	2			X		
Barqa Al Soqour PA	1				X	
Al Beda'a PA	1					X

valuable insight into the distribution of this species within the emirate. The preferred habitat choice appears to be vegetated sand sheets and dunes with dwarf shrubs and areas identified to have high densities of insects, reptiles and rodents species. So far, a total of 106 sightings have been recorded with a breakdown of locations provided in Table 1.

Future work

Further investigation into wild populations is required to provide appropriate protection, monitoring and management plans for this ecologically important species.

Important biometric information for the species is currently lacking, both locally and internationally. Biometrics relating to physical condition provide valuable insight into the current health of the population but also help to identify unknown threats. This information will also provide baseline information for future research and surveys. In addition to this, genetics testing of individuals could also provide information as to whether the population within Abu Dhabi can be considered as a separate subspecies and whether any form of localised migration may occur in light of resource change throughout the year. If it does, this can provide information on vitally important movement patterns that can help guide future conservation programmes or management plans.

References

Ahmed, S., R. Al Zaabi, P. Soorae, J.N. Shah, E. Al Hammadi, R. Pusey & S. Al Dhaheri 2016. Rediscovering the Arabian Sand Cat (*Felis margarita harrisoni*) after a gap of 10 years using camera traps in the Western Region of Abu Dhabi, United Arab Emirates. **European Journal of Wildlife Research 62:** 627–631.

Aspinall, S., P. Hellyer & C. Drew 2005. Terrestrial mammals – Cats (Felidae). *In:* The Emirates – a natural history. Trident Press, London, and EAD, 315 pp.

Banfield, L.M., H. Al Qahtani & D. Mallon 2014. Arabian Sand Cat *Felis margarita harrisoni*: status review and conservation strategy. Al Ain Zoo, Abu Dhabi, United Arab Emirates.

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The contribution of oral history interviews in ecological conservation – a case study in grazing practices and perspectives from Abu Dhabi, United Arab Emirates

by Nessrine Alzahlawi, Rajeyah Binkulaib, Yasser Al Kharusi & Salim Javed

Abstract

The integration of local and traditional ecological knowledge and community perspectives has been widely recognised by international conventions and frameworks as a key element in biodiversity conservation and sustainable land management. In particular, the use of oral history in ecological research has been recognised as a useful approach in addressing historical data gaps and gaining an in-depth understanding of past and current natural resource use. This case study is believed to be the first in the United Arab Emirates to gather traditional knowledge and community perspectives on grazing, camel herding and uses of desert flora, through individual semi-directed interviews with experienced and respected community elders in Abu Dhabi Emirate.

It aimed to assess perceived trends in vegetation cover, as well as seeking out and listening to voices from the community on the factors behind these trends. Twenty-four interviews were conducted between April 2017 and October 2019, in partnership with the National Archives Department, in the areas of Al Wathba, Al Ain, Sweihan, Ghiyathi and Madinat Zayed. Overall, 92% of the interviewed community members perceived a significant decline in plant cover across their areas, with 96% attributing this difference to the increase in number of livestock and lack of rain. All interviewees agreed that plant diversity had been reduced, mentioning specific species that have become rare or are no longer occurring in their areas.

Possible solutions for addressing unsustainable grazing across open areas of the desert were proposed by the interviewees, including reductions in the number of camels owned, rehabilitation of habitats, and seasonal closure of grazing in certain areas, to allow natural regeneration and reseeding. These perspectives are considered useful when developing and justifying policy and regulatory proposals for achieving sustainable land management. The interviews have helped to highlight the utility of seeking out community views and perspectives early on, as a form of improving our understanding of stakeholder opinions, societal issues and proposing locally tailored ecological conservation measures that fit within the socio-cultural context in question.

Introduction

Grazing pressure on desert ecosystems: a local and regional challenge

Desert ecosystems in the Emirate of Abu Dhabi are threatened by groundwater depletion, habitat fragmentation, introductions of exotic species and overgrazing (EAD 2017). Grazing has been frequently described as the greatest threat to desert ecosystems in the UAE, reducing species diversity and affecting ecosystem function and productivity (Aspinall 2001). This type of pressure occurs mainly due to grazing by camels of wild palatable plant species at intensities and frequencies that surpass the natural productivity of desert habitats. It is considered a key threat to plant biodiversity across the Arabian Peninsula and is estimated to affect approximately 3,500 plant species.

In 1998, it was estimated that 44% of all land in the region was severely or very severely degraded, and 90% was affected in some way (ICARDA 2002 Ghazanfar & Fisher 1998, Ferguson *et al.* 1998). In 1996, vegetation surveys across Abu Dhabi Emirate had already found indications of high grazing pressure across much of the emirate, influencing the structure and distribution of plant associations (Oatham 1996). More recent studies conducted in and around the Dubai Desert Conservation Reserve (DDCR) and one study looking at vegetation richness and diversity in Abu Dhabi's Western (Al Dhafra) region in 2012 have found vegetation to be significantly reduced due to overgrazing by camels with the highest impact seen in gravel substrata habitats (Gallacher & Hill 2006a, Sakkir *et al.* 2012).

The UAE camel herd increased from 39,500 in 1976, to approximately 250,000 in 2004 and 436,800 in 2016 (FAOSTAT 2018). In Abu Dhabi Emirate, a 42% increase in the number of camels has been reported between 2005 and 2018, with the most recent number standing at 405,160 camels (SCAD 2018). This represents a camel population density of 2.99 camels/km^2 for the UAE in 2004, increasing to 5.22 camels/km^2 in 2016 and 6 camels/km^2 for Abu Dhabi Emirate as of 2018, compared to 0.12 camels/km^2 in Saudi Arabia and 0.79 camels/km^2 in Oman (FAOSTAT 2018).

Studies that have investigated this type of environmental pressure have determined that overgrazing in Arabia occurs for social, cultural and political reasons (Al-Rowaily 1999). A shift in cultural, social and economic perceptions may be needed to reassert an environmentally balanced approach to rangeland management. In Abu Dhabi, a rapid assessment of grazing impact carried out in 2017–2018 identified an average difference in vegetation abundance by 85% in Al Dhafra region (grazed areas had 85% less) and 65% less vegetation in the Abu Dhabi region when comparing grazed habitats to protected habitats (Figures 1 & 2). In terms of impact on fauna and the biodiversity associated with wild desert vegetation,

Figure 1. A stark contrast in vegetation cover is observable across the same habitat and soil type in fenced (protected) vs grazed areas. This site in Al Dhafra region had camel and livestock farms at less than 2 km nearby, grazing frequently in the area just outside the fence (photo by Nessrine Alzahlawi).

Figure 2. Well-vegetated coastal sand sheet habitat near Ruwais, in an area protected from grazing pressure (photo by Nessrine Alzahlawi).

the rapid assessment found significant differences in the abundance of mammals, reptiles and invertebrates with an average 54% less reptiles 51% less mammals and 59% less invertebrates in grazed sites versus protected sites in the three areas surveyed (EAD 2018).

Although these results are preliminary and further studies are needed, they indicate that the significant reduction of vegetation due to overgrazing may be having a negative impact on natural ecosystems (Figure 3), affecting all levels of the food chain, reducing reptile, mammal and invertebrate diversity and abundance.

In addition, the physical properties of the ecosystem, including water retention, soil stability, permeability and erosion, may be affected by the reduction in plant biomass. In hyper-arid desert ecosystems such as the ones in Abu Dhabi Emirate, all the associated animal life is entirely dependent on the plants, either directly as food, or indirectly through a food web in which the rule is mutual co-existence of species. If grazing pressure is not managed, the physical and biological identity of the emirate's natural desert ecosystems and its critical function as a food source and shelter for native threatened species is at risk of being irreversibly lost.

In order to develop and propose management measures that would be both evidence-based and effective as well as socio-culturally adapted, key community stakeholders have been involved in the development of recommendations to better organise grazing activities in the emirate. This has involved the gathering of perspectives, opinions and proposed solutions from experienced camel owners in the form of oral history interviews, to document their traditional knowledge of grazing practices and to include their suggestions in any proposed environmental policies.

Traditional ecological knowledge and its role in biodiversity conservation

Traditional ecological knowledge refers to people's knowledge, practices, and beliefs about the relationships between organisms and their biophysical environment. This form of knowledge has been recognised by conservationists and organisations globally as an important tool to strengthen ecological research and foster shared responsibility with local communities. The purpose of the stakeholder interviews was to gather people's views on the state of rangelands in the emirate and how this has changed in their lifetime. Traditionally, finding grazing and water were the main concerns of the Bedouin. Life has changed dramatically for the people of the UAE in the past 50 years, and so have the practices associated with caring for and providing nutrition to camel and livestock.

Farm owners, farmers' associations and camel '*ezba*' (livestock farm) owners are key components and stakeholders for achieving sustainable grazing. Their perception of the issue and their buy-in is key to achieving successful management measures. Their knowledge of the land, and of the traditional grazing practices applied by their ancestors in the past, can provide a clear demonstration that the sustainable use of natural resources and preservation of cultural heritage are interdependent.

Figure 3. Overgrazed Ghada (White Saxaul, *Haloxylon persicum*) in Abu Dhabi, just outside a protected area, in an area with regular camel grazing (photo by Nessrine Alzahlawi).

The key objectives of the community member interviews were:

1. To gather traditional ecological knowledge on the state of desert rangelands, in the past and present, and on changes in species occurrence and availability.
2. To identify and collect supporting evidence for the linkages between Emirati identity, heritage and the natural desert environment.
3. To understand stakeholders' perspectives on the reasons and causes behind any observed changes.
4. To obtain community perspectives on future policy measures for preserving desert flora.
5. To better understand current practices and dependencies of modern day camel and livestock farms in key areas of Abu Dhabi Emirate (time spent by camels outside the farm, distance covered, dependence on fodder, etc.).

Method

The project team members, in cooperation with the National Archives Department of the Ministry of Presidential Affairs, interviewed 24 members of the community between April 2017 and October 2019. The team asked questions relating to past and present grazing and camel herding practices, to try to gauge the types of interactions that people had with the natural terrestrial environment. The questionnaire, developed in Arabic, also included questions on the role of women, the type of plants that were most favoured, their seasonality, uses in the past, how the distribution and presence of these plants has changed according to their observations and impressions, and the reasons behind these changes.

Interviews were carried out using the semi-directive oral history interview method. This involves asking guiding questions and allowing the interviewee to respond at length and provide additional information, akin to 'storytelling'. All interviews were completed after receiving in-depth training in oral history data gathering and recording from the National Archives Department who run an ongoing programme on Documenting Oral History of the UAE. This training took place in 2015 and a refresher training took place in early 2017. Oral history interviewers from the National Archives accompanied EAD staff and led the interviews with all narrators, bar one. Interviews were mostly one on one, although in some cases interviews took places in duos (husband/wife pair in one case, father/son pair) based on interviewee preference.

Interviewees were identified by looking for and selecting community leaders or experienced camel herders and owners, who were generally the family or tribe elder in the area and owner/manager of the camel and livestock farms owned by the family, and widely respected or recognised by their peers and local community as an experienced *Bedou* and '*Raii*' (camel herder), based on their years of practicing this activity (Figure 4.) All interviewees were

Figure 4. Narrator Saif Al Mazrouie, during an interview near his farm in Sweihan (photo by Nessrine Alzahlawi).

Figure 5. Recording of an interview in Ghiyathi, with narrator Ali Ahmed Shaheen Al Mansoori (photo by Nessrine Alzahlawi).

above 50 years of age with the eldest being around 78–80 and the youngest 50.

The survey sample size was not pre-determined. The aim was to gather the contacts of as many relevant oral history narrators and farm owners as possible from the Abu Dhabi, Al Ain and Al Dhafra regions and meet with them individually to gather their views and knowledge. The authors arranged interviews with the contacts identified through EAD partners, the National Archives Department, the Emirates Heritage Club and the Abu Dhabi Department of Culture and Tourism (DCT).

Previous studies have warned that often a researcher may not know who is in possession of the required knowledge (Huntington 2000, Davis & Wagner 2003). Only one out of the twenty-four interviews conducted was found to be less informative than expected. The team prompted the interviewees for suggestions of additional community members to meet, helping to obtain additional contacts and arrange future interviews with those that were perceived by their communities as the most experienced and knowledgeable on camels and grazing.

The semi-directive interview method was chosen for this study taking into account the UAE context, cultural considerations and the objectives of the interviews. Consistent with 'story telling' being a key part of Emirati culture, this method of interviewing was chosen as it involves more of a conversation than a question and answer session. The interviewer guided participants into the discussion, following an introduction to the purpose of the survey and the requests for permission to take an audio or a video record of the session. This method allowed the participant to speak freely and be at ease but with guidance from the interviewer if the discussion steered away from the key purpose. Rather than a fixed questionnaire template to be filled out, the interviewer had as a guide a list of questions, with the flexibility to move between questions rather than to ask them in a predetermined order (Huntington 2000, 2005). It was the lead interviewer's responsibility to ensure the conversation stayed on track once he or she noted that the interviewee was veering away from the main topics.

The interviews were captured on film whenever permitted (Figure 5). If permission to record video was not obtained from the interviewee, then the interview was recorded using audio only. The team members were the same for all interviews, ensuring the implementation of a consistent method and style for all interviewed narrators.

During the pre-arranged meetings, the survey team lead or National Archives representative welcomed and thanked the interviewees for attending, requesting that one interviewee be interviewed one at a time or in duos, determining the best location for carrying out the interview, explaining the purpose of the survey and gaining permission to film or record audio. All data sheets, audio and video equipment were prepared by team members before commencing the interview. All questions were asked in Arabic and answers were recorded on paper, video and audio following the receipt of permission from the interviewee.

Results

Twenty-four interviews were conducted between April 2017 and October 2019 in partnership with the National Archives Department, in the areas of Al Ain, Al Wathba, Sweihan, Ghiyathi and Madinat Zayed. Each interview lasted between an hour and two and a half hours. Overall, 22 out of the 24 (92%) interviewed community members noted a significant decline in plant density and diversity across their areas, with 8 (33%) attributing this difference to the increase in number of livestock and most (96%) associating it with both the increase in livestock and a reduction in rainfall. Some of the other causes for a decline in the diversity and abundance of plant species were identified by interviewees as development and off-road driving.

All interviewees agreed that plant diversity had been reduced, mentioning specific species that have become rare or no longer occur in their areas, such as '*rimth*', *Haloxylon salicornicum*, '*nossi*', *Stipagrostis ciliate*, '*helta*', *Saccharum ravennae*, '*ghada*', *Haloxylon persicum* and '*saadan*', *Neurada procumbens*. When asked about the purpose behind owning camels, almost all expressed an emotional connection to this practice, saying that it allows them to preserve traditions and heritage. The farm is perceived as a place of rest and recreation, a place to reconnect with the outdoors environment and to keep up with traditions, occasionally offering camel meat and milk to friends and family.

A small number of interviewees mentioned that they enter some of their camels in racing competitions, incentivised by the prizes offered. Many mentioned, however, that the number of camels owned today could sometimes constitute a burden, requiring them to spend from their income and salary. Indeed, most (81%) farm owners who were interviewed confirmed that they spend a variable portion of their salary/pension on farm expenses and feed each month (reportedly from AED 3,000 to Dh 12,000). They also lamented the general lack of interest of the younger generation in the upkeep of the farm and their declining or completely absent knowledge of camel husbandry and wild desert plants (54% of respondents). When asked to compare the numbers of camels owned in the past (50–60 years ago) and the present, many (46% of interviews) confirmed that in the past families rarely owned more than 30, while today numbers often exceed 100 (37% of interviews). When asked what would be the ideal or most sustainable number of camels for a single family, both for reducing the pressure on wild desert plants and reducing the financial burden on the owners, 50% said that the number should not exceed 20 while the other half recommended up to 40 or up to 60 camels. None of the interviewed narrators recommended exceeding 60 camels per family (Figure 6).

Many community members were of the view that there is very limited adequate "rangeland" left in the emirate (communicated in 96% of the interviews with livestock owners). Interestingly, all interviewees (100%) confirmed that, for the past few years, their livestock and camels have relied entirely on imported feed either personally

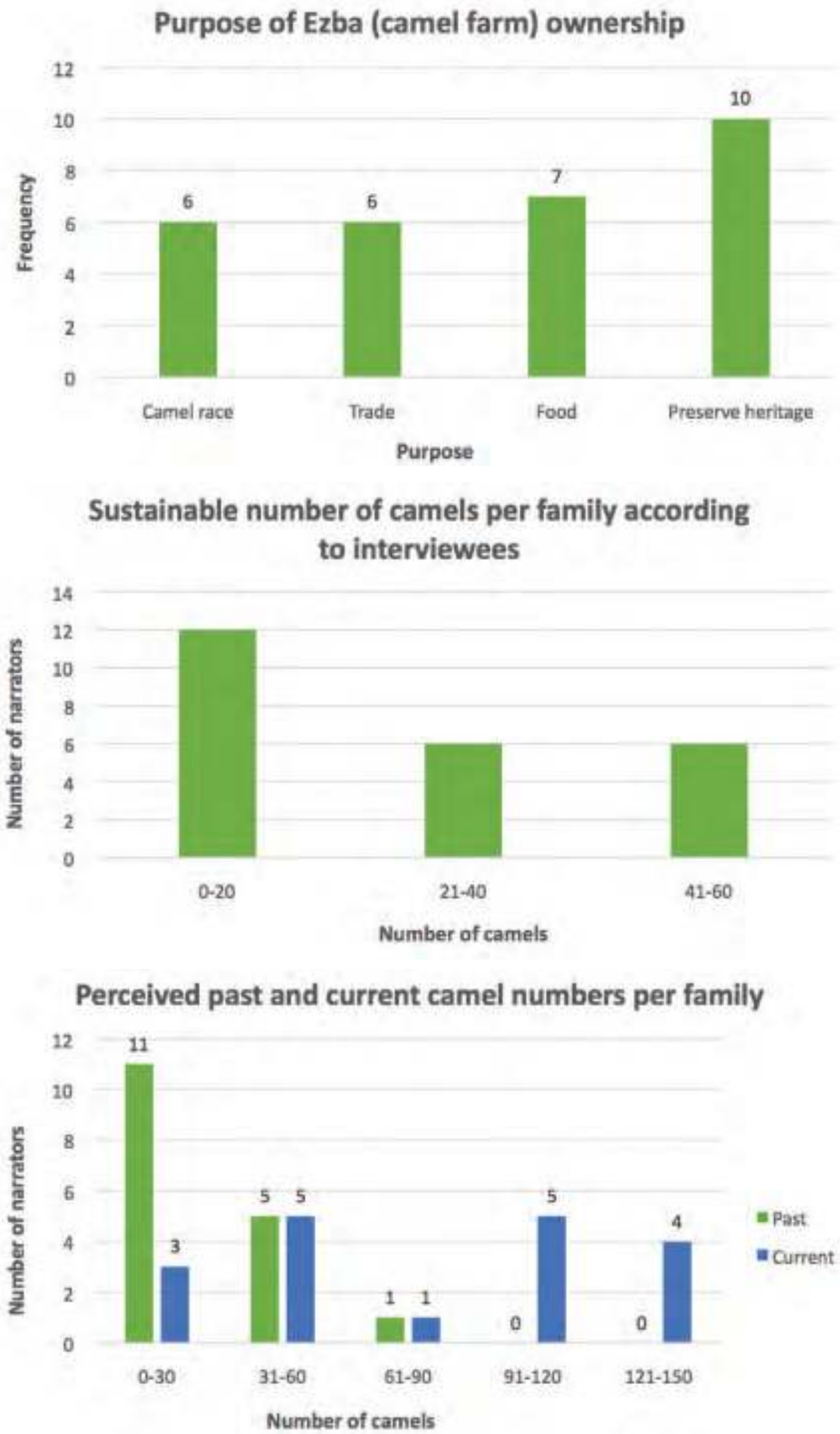

Figure 6. Key results of oral history narrator interviews.

purchased by them or subsidised by the Abu Dhabi government. Camel grazing in open areas has occurred only around their '*ezbas*' (farms) when the herds are taken out by the hired farm employee for their daily 'exercise' for a few hours each day. This means that current camel stocks in Abu Dhabi have long exceeded the natural carrying capacity of Abu Dhabi's terrestrial habitats, with wild desert flora no longer sufficient or necessary for sustaining animal wealth in the emirate.

In Al Ain, camels are very rarely left out to graze in open areas for a full day due to the limited space restricted by development, forestry areas and roads, whereas in Al Dhafra region, narrators stated that this practice is more common, especially in the winter months probably grazing opportunistically on any annual or perennial plants. Daily exercise and movement is seen as beneficial and wild desert plants are perceived by some owners as healthier for their stock than the purchased feed.

In some countries in the region, community-managed areas known as "*Hima*" were maintained in the past and the concept is being revived for modern day conservation initiatives. A *Hima* is defined by the Holy Qur'an as "a private pasture", an "inviolate zone", referring to an area set aside for the conservation of nature. *Hima*s also protected the agricultural community from overexploitation by nomadic herders and allowed regeneration to occur, to encourage resilience and sustainability. There are commonly five types of *Hima* areas: areas where grazing of domestic animals is prohibited, areas where grazing is restricted to certain seasons, beekeeping reserves where grazing is restricted during flowering, forest areas where cutting of trees is forbidden, and reserves managed for the welfare of a particular village, town or tribe.

Although there is no record of *Hima* systems being applied in the UAE in the past, the interviews carried out confirmed that community management and cooperation were a key feature of past historical grazing and groundwater use in the UAE. An adapted model of community management and stewardship could be revived in the region for nature conservation, through the local *Majlis*, championed by identified community elders. When the narrators were asked whether they believed that some form of community-led management could help with rangeland recovery, a limited number agreed and most were unsure. Indeed, studies have observed that wealth can reduce the likelihood of a community to self-organise shared resource management through the reduced economic incentive and a greater adoption of technology (Agrawal 2001).

Some of the options proposed by interviewees for managing rangelands in Abu Dhabi include reduction in number of camels per family (75%), creation of more protected areas (45%), seasonal closure of areas to grazing (40%) and replanting or reseeding activities by the government (60%). Many interviewees said they would reduce the number of camels they own if the government provided buy-back options or opportunities to sell or market their stock (67%). However, some believed that, even with a reduction in total camel numbers in the emirate, rangelands are unlikely to sufficiently recover due to the lack of rain (33%).

Discussion

Global case studies in rangeland management suggest that arid rangelands could be efficiently managed with planning and cooperation, matching grazing levels to vegetation growth and a more focused use of fodder. In Abu Dhabi, achieving the ideal carrying capacity of the natural desert would only be practical if there was a drastic reduction in the number of camels and a strongly imposed higher-level control over ownership, movement and sale of camels. Furthermore, determining the carrying capacity of Abu Dhabi's open access rangelands would require long-term investment in research (a minimum of 5–10 years covering all representative habitats of the emirate) while enforcement of the concept of carrying capacity would need a significant degree of centralised control and monitoring.

Studies on carrying capacity in desert habitats with similar levels of precipitation (e.g. Sudan) suggest that the stocking density for camels should not exceed 0.2 km^2 (Abusuwar & Yahia 2010). This would mean that for all the land area (including cities) of the Emirate of Abu Dhabi, the total number of grazing camels should not exceed 13,468. The current number of camels in Abu Dhabi is almost 30 times this number, with 405,160 camels recorded as of 2018 (ADSC 2018). Currently, there is no accurate or documented information on how many of these camels are grazing in the open desert and for how long. It has been observed, however, that camels from all categories of livestock farms (racing, breeding, grazing and seasonal farms) graze whenever given the opportunity to roam in open-access areas outside the farms for several hours daily. This has been confirmed by the community interviews conducted during this project.

The community interviews have helped to identify the fact that excessive camel numbers are seen as an issue by the main stakeholders that contributes to the decline and degradation of natural desert rangelands in the emirate. Livestock farms do not seem to be contributing to local livelihoods or income, and are, instead, a form of hobby and a way to maintain traditions. As shown by this case study, many believe that owning less than half the current numbers would be sufficient to satisfy this social need, and, in many cases, would be more financially viable for the owners as government subsidies change or become reduced.

Possible bias (an inherent aspect of community interviews) and limited sample size are the main limitations of this study, although these two elements can be considered partially mitigated by the honesty and openness often seen in older generations of Emiratis, the lack of association of the interviewers with any government body offering subsidies (an environmental body, rather than an agricultural entity) and the selective process by which only knowledgeable and experienced narrators were interviewed.

Some of the options proposed by community stakeholders could be further examined and integrated into a future proposed Abu Dhabi Sustainable Grazing Strategy. The results of the conducted interviews confirmed observations on the impact of grazing and the decline in native

species of desert flora as well as indicating that ownership of camels has become entirely reliant on subsidies and imported feed, as expected.

Achieving sustainable grazing in Abu Dhabi Emirate requires investment in long-term ecological research, targeted awareness, incentives, enforcement programmes and consistent stakeholder engagement, to better identify and implement actions that would be both environmentally effective and socio-economically beneficial. The key policy measures that could be further developed include:

- Integrated Land Use Planning: Managing grazing through better zoning and pro-active planning of livestock farms of all types (seasonal/heritage farms, racing farms, breeding farms and grazing farms).
- Placing of Quotas on Licences: Develop a long-term strategy with key government partners including and determining yearly quotas for the number of *ezba* licences in each category and in each area, setting a limit on the number of new *ezba*s permitted, their size and how many animals they can hold.
- Optimising benefits for farm owners: Through better financial planning and improved animal management, the benefits for owners can be optimised and the burden of expense reduced. This could include, for example: greater access to the market and assistance with a breeding management strategy for controlling numbers of animals, maximising the benefits and lowering the expenses of the farm.
- A socio-economic study would be able to assess accurately the cost-effectiveness of farms and their contribution to local livelihoods and the economy, to ensure that subsidy programmes provide a social benefit without resulting in environmental decline and biodiversity loss. Animal wealth is seen as a form of capital and a key element for ensuring food security. However, as animal wealth currently relies almost entirely on imported feed, food security could be better guaranteed with alternative strategies that take into consideration the long-term sustainability of local natural resources, including native flora, water and soil preservation. The best way to ensure food security is to use resources sustainably and to protect the productivity of natural habitats and their ability to regenerate.

Conclusion

The interviews provided a useful direction for conservation planning and policy development, demonstrating the need to study further the socio-economic and cultural drivers of overgrazing in the emirate in order to form a solution that would be both ecologically sound and socio-politically acceptable. The project highlighted the benefit of continued targeted community engagement. This provides a way of identifying 'community champions' or respected community elders who would help advocate for more sustainable use of desert ecosystems, and a return to simpler, less intensive and more respectful use of land resources. This would allow younger generations to continue practicing cultural traditions while experiencing the natural desert as it should be: diverse, rich and blooming after the rains.

References

Al-Rowaily, S.L.R. 1999. Rangeland of Saudi Arabia and the "Tragedy of Commons". **Rangelands 21:** 27–29.

Abusuwar, A.O. & E.O. Yahia 2010. Pastoralist and seasonality: their effects on range productivity and carrying capacity in a semi-arid rangeland of Sudan (Southeast Darfur State). **Agriculture and Biology Journal of North America 1(2):** 80–88.

Agrawal, A. 2001.Common property institutions and sustainable governance of resources. **World Development 29(10):** 1649–1672.

Aspinall, S. 2001. Environmental development and protection in the UAE. Pp. 277–304 *in:* Al-Abed, I. & P. Hellyer (eds.). United Arab Emirates: A new perspective. Trident Press, London.

Davis, A. & J.R. Wagner 2003. Who knows? On the importance of identifying experts when researching local ecological knowledge. **Human Ecology 31:** 463–489.

EAD 2017. State of the environment report. Environment Agency – Abu Dhabi, UAE.

EAD 2018. Grazing pressure assessment in Abu Dhabi: Situational analysis final report, Phase 2. Environment Agency – Abu Dhabi.

Ferguson, M., I. McCann & G. Manners 1998. Less water, more grazing. **ICARDA Caravan 8:** 9–11.

Gallacher, D.J. & J.P. Hill 2006a. Effects of camel grazing on the ecology of small perennial plants in the Dubai (UAE) inland desert. **Journal of Arid Environments 66:** 738–750.

Gallacher, D.J. & J.P. Hill 2006b Effects of camel vs oryx and gazelle grazing on the plant ecology of the Dubai Desert Conservation Reserve. Pp. 85–95 *in:* Mohamed, A.M.O. (ed.). Reclaiming the desert: towards a sustainable environment in arid lands. Proceedings of the Third Joint UAE–Japan Symposium on Sustainable GCC Environment and Water Resources. Taylor & Francis, Abu Dhabi.

Ghazanfar, S.A. & M. Fisher 1998. Vegetation of the Arabian Peninsula. Kluwer Academic, Dordrecht.

Huntington, H.P. 2000. Using traditional ecological knowledge in science: methods and applications. **Ecological Applications 10(5):** 1270–1274.

Huntington, H.P. 2005. "We dance around in a ring and suppose": academic engagement with traditional knowledge. **Arctic Anthropology 42(1):** 29–32.

ICARDA 2002. Strengthening agricultural research and human resource development in the Arabian Peninsula. International Center for Agricultural Research in the Dry Areas (ICARDA), Arabian Peninsula Regional Program, Aleppo.

Oatham, M. 1996. Restoring habitats for the Houbara Bustard in Abu Dhabi. Pp. 67–85 *in:* Osborne, P.E. (ed.). Desert ecology of Abu Dhabi – a review and recent studies. Pisces Publications, Newbury.

SCAD 2018. 2018 Livestock statistics. Statistics Centre Abu Dhabi – *www.scad.ae*.

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The British military and the anti-locust campaign across the Arabian Peninsula, including the Emirates, 1942–1945

by Athol Yates

Abstract

Crop-destroying plagues of desert locusts have been recorded since time immemorial. In the face of millions of the flying insects, there was little a farmer could do. This changed in the 20th Century when a systematic effort got under way to understand locusts. Driven by Britain, a series of international anti-locust conferences were organised in the 1930s to coordinate the collection of information and research on locusts, and to develop methods to destroy them.

However, progress towards a multi-national, collaborative approach to preventing locust plagues stopped with the outbreak of World War Two in 1939. This coincided with the start of another multi-year locust plague which threatened food and fodder production in the Middle East and North Africa. By 1943, locusts had become a military concern because a famine in the region would result in the need to import large volumes of food. This would divert shipping essential for military operations, thus delaying Allied counter-offensives.

Consequently, in 1943 Britain established a locust control group within an Allied para-military organisation that supplied both military and civilian needs to and within the Middle East. This group planned a large combined military and civilian anti-locust operation in the Arabian Peninsula over the locust season from late 1943 to mid-1944. It involved over 800 British Army personnel and 329 vehicles plus 105 civilian locust personnel and 29 vehicles. The Trucial States and Oman were important in this operation because this area was frequented by locust swarms and was a known breeding site.

This paper describes this little-known, large scale 1943–1944 anti-locust campaign in the Arabian Peninsula, with a focus on activities in the Trucial States. It concludes with a summary of British military involvement in Trucial State anti-locust operations in subsequent years, with the last recorded instance being in 1962.

The locust

The Desert Locust, *Schistocerca gregaria*, is one of the most damaging pests for agriculture due to its ability to form huge, mobile swarms which devour everything in their paths. Locust swarms have long caused devastation in the Trucial States, for example in 1958–9 they destroyed about 85% of crops in the region.[1] The resulting food loss often led populations to move in search of food or work, as occurred in 1950–1 in Liwa. In 1950, 45 *jirab*s of dates were collected from the Al Manasir date palms in the Liwa area, but, after locust swarms the following year, production fell to only 15 *jirab*s. As a result, many Al Manasir men sought work on the pearl boats over that summer rather than tending their date palms.[2]

Plagues of locusts occur periodically with most lasting for several years. In the 20th century, Desert Locust plagues have occurred in the Middle East on seven different occasions (1901–1908, 1912–1917, 1926–1933, 1941–1947, 1949–1962, 1968 and 1987–1989).[3]

Locusts are not a species in their own right but a name given to a number of grasshoppers which can change colour, behaviour and physiology.[4] The Desert Locust is one of about a dozen species of short-horned grasshoppers (Acridoidea; Figure 1).[5]

The Desert Locust has three phases – solitary, transitional and gregarious. In the solitary phase, it lives on its own, flies at night only for a few hours and travels short distances. While solitary individuals can survive on the limited green matter in semi-arid or arid areas, they are more often found in areas where rainfall has occurred, creating a source of moisture and food.[6]

The gregarious phase is characterised by large numbers of locusts forming dense groups (known as *bands* for the non-winged, immature 'hoppers' and *swarms* for the winged immature and mature insects). For both bands and swarms, the locusts act cohesively. Bands of hoppers contain hundreds of hoppers per square metre,[7] and can be several hundred metres long and deep. Swarms can consist of millions and even billions of locusts. After warming up in the morning sun, they can fly continuously for 13–20 hours, always downwind, meaning they can travel 5 to 200 km a day.[8] Swarms regularly cross the Red Sea and the Arabian Gulf.

The transition phase occurs when the insects move between the two other phases. This can be in either direction, that is from solitary to gregarious, and vice versa. The transition from solitary to gregarious starts with the insects crowding together which typically occurs because of food availability and wind. The physical contact triggers the transition and it can occur over a few hours.[9]

The United Arab Emirates is not only on the path of locust swarms but is also a breeding site for the locusts. Swarms commonly come from and go to the Horn of Africa and the interior of Yemen across the Emirates to Iran and Pakistan. Breeding sites before modern agriculture spread across the Emirates were mainly in the areas rich with vegetation, notably the coastal areas of Ra's al-Khaimah and in the Buraimi/Al Ain area and Liwa. However, breeding does also occur in deserts, typically after rains when sands are moist and there is plenty of greenery.

Controlling the Desert Locust required an understanding of its life cycle (Figure 2). The insect lives from three to five months and its life cycle development varies signifi-

cantly with micro-environmental conditions, with optimal conditions being lush vegetation, temperatures of 30°C or more, and light winds.

The life cycle has three stages: egg, hopper and adult. The female lays egg pods of up to 158 eggs in the bare earth. Emerging from the ground is the hopper (a wingless nymph). Hoppers undergo a series of instars (periods between two moults) before gaining their wings, after which their bodies and wings harden which allows them to fly.

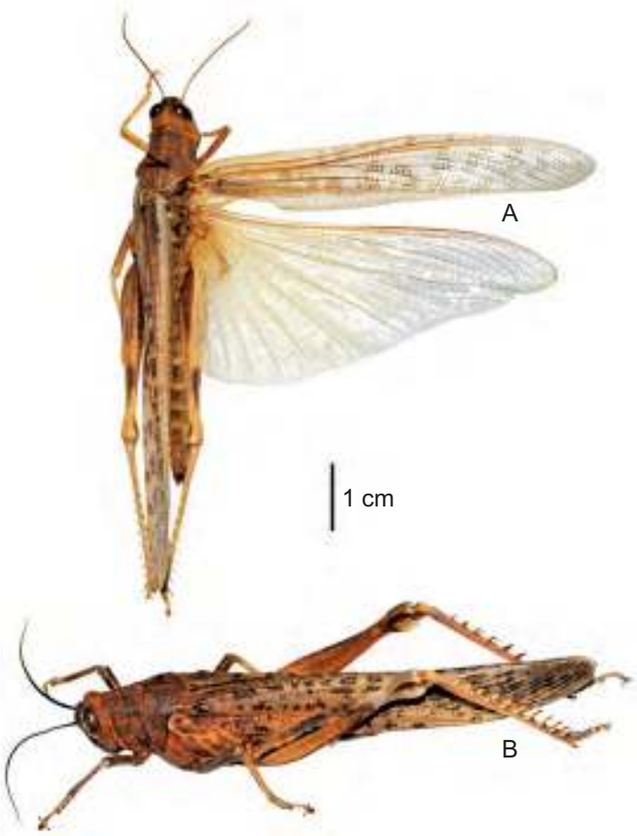


Figure 1. Two locust species causing significant economic losses to agricultural crops: *Schistocerca gregaria* (A), *Anacridium melanorhodon arabafrum* (B).

Combatting the locust

While efforts started in the 1800s to combat locust plagues, lack of knowledge about the insect made it difficult. So little was known about the Desert Locust that until 1921 it was thought that the locust and the large solitary grasshopper found in the desert were different species – a reasonable assumption as they differed in habits, colour and structure. A great leap forward was made in 1921 when the Russian-British entomologist, Sir Boris P. Uvarov (1889–1970) published a paper identifying the locusts' phase changes.[11]

In 1926–1933, a Desert Locust plague was having a severe impact on British colonial interests in the Middle East and North Africa. A research centre to combat the locusts was established in London in the middle of this period. It was headed by Dr. Uvarov,[12] who identified two key problems with countering the threat. Firstly, as the locust swarms do not occur annually but in cycles of multiple years separated by an absence of locusts, countries only took action when locusts appeared. This meant that not only was the response too late but also, between cycles, little action was taken as it was hoped that invasions would not reoccur. Secondly, response in one country was done in isolation from its neighbours despite the fact that locusts crossed borders. Countering locusts required coordinated action across countries.[13]

During the 1930s, great efforts were made to collect reliable information across the region, which allowed both the seasonal breeding areas and the paths of migrating swarms to be identified. A series of international conferences were also organised, to foster the sharing of information, research and anti-locust methods. The conference attendees agreed to establish a central repository of locust information and research – that being in the United Kingdom.

Until chemical poison was introduced in the early 1940s, the main large-scale method used to control locust plagues was 'trenching'. This involved digging trenches into which the insects would crawl or be driven and then burying them, sometimes after burning them. A variation

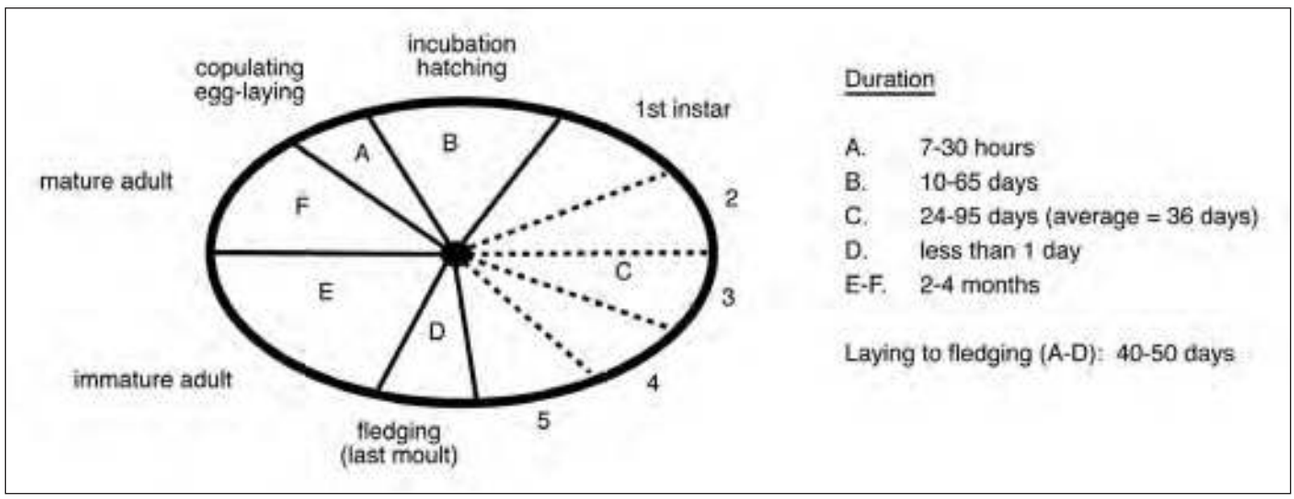
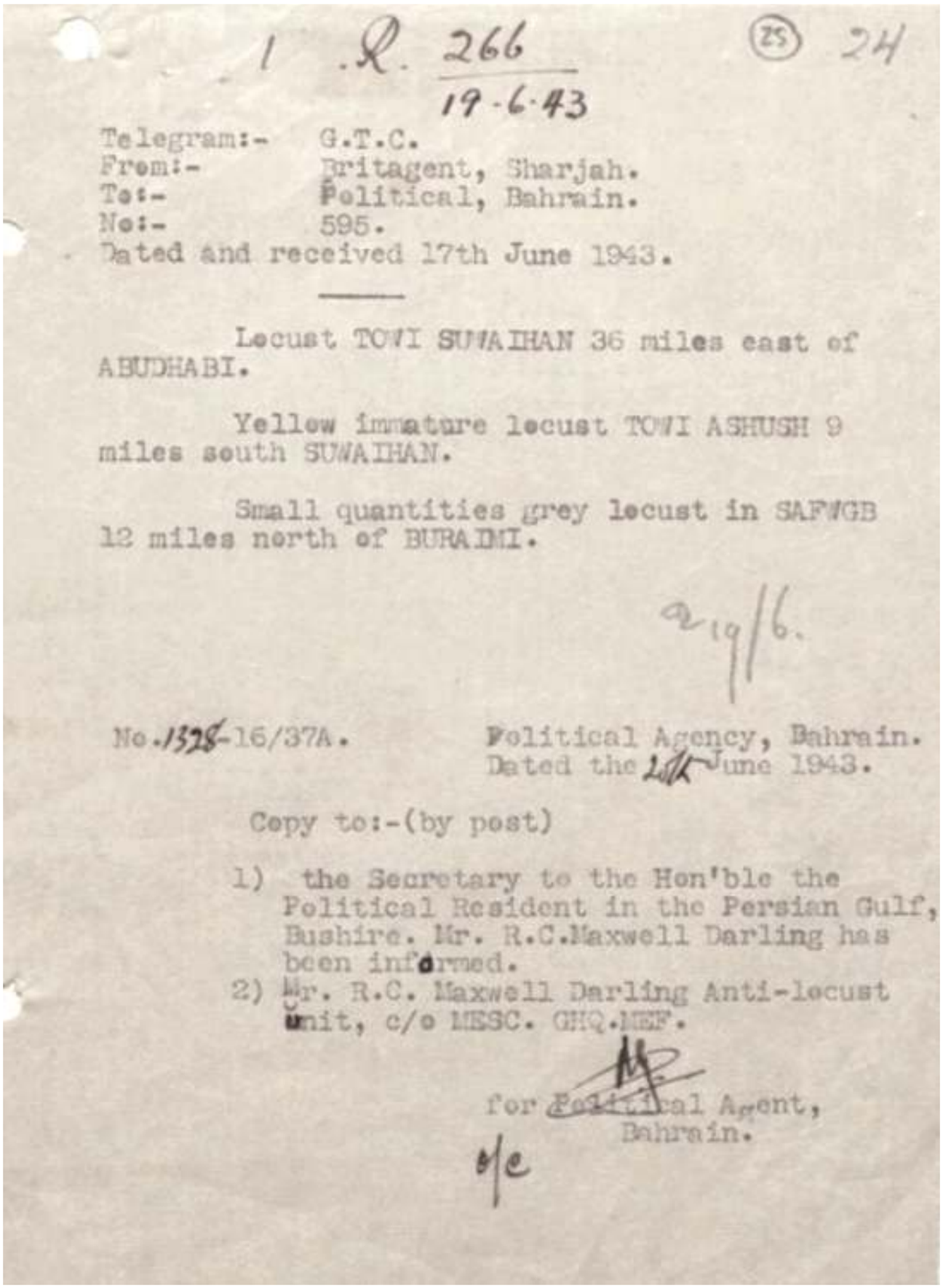


Figure 2. The life cycle of the Desert Locust.[10]



1 .R. 266
19-6-43

(25) 24

Telegram:- G.T.C.
From:- Britagent, Sharjah.
To:- Political, Bahrain.
No:- 595.
Dated and received 17th June 1943.

Locust TOWI SUWAIHAN 36 miles east of ABUDHABI.

Yellow immature locust TOWI ASHUSH 9 miles south SUWAIHAN.

Small quantities grey locust in SAFWGB 12 miles north of BURAIMI.

a 19/6.

No.1328-16/37A. Political Agency, Bahrain.
Dated the 21st June 1943.

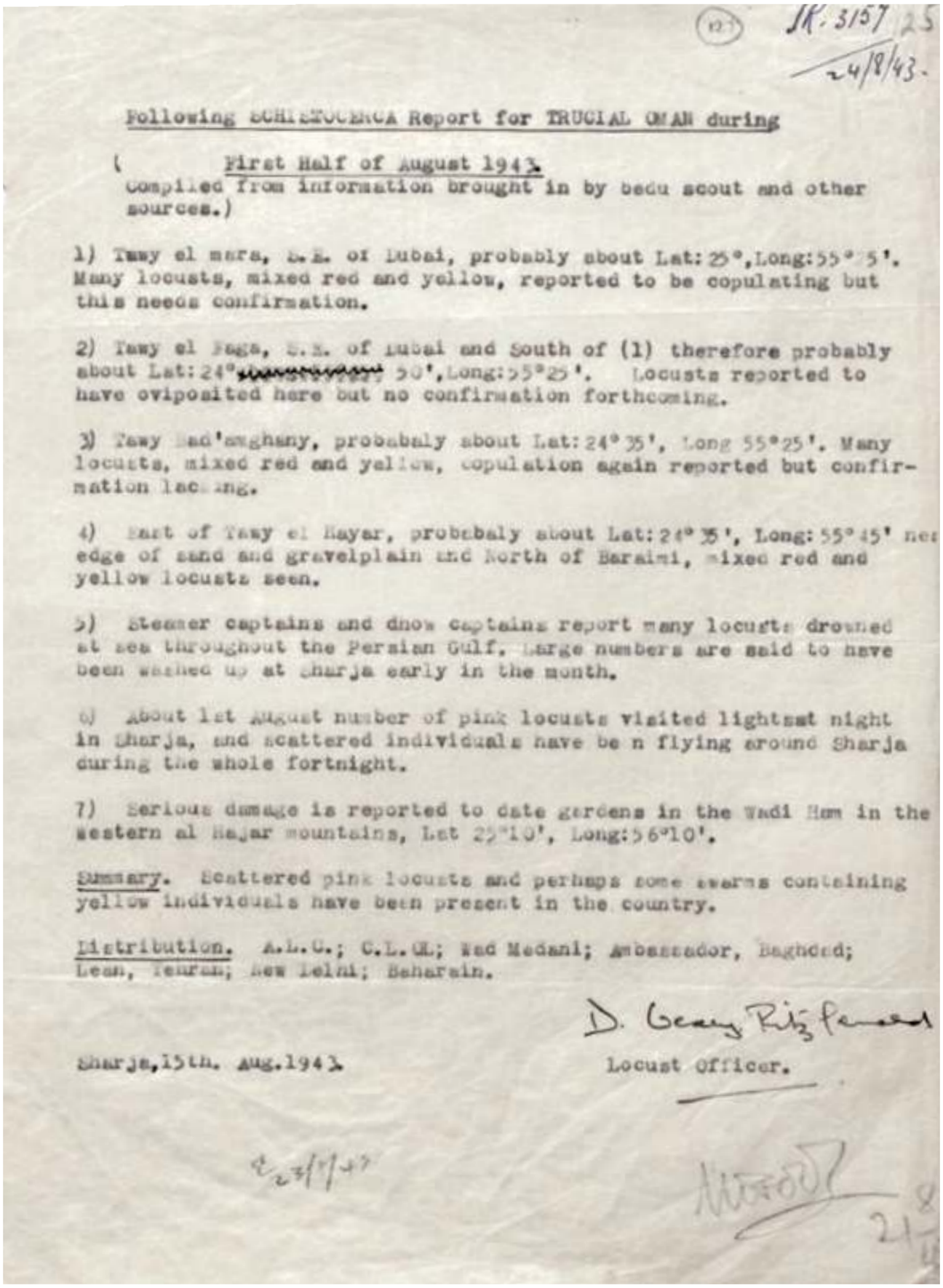
Copy to:-(by post)

1) the Secretary to the Hon'ble the Political Resident in the Persian Gulf, Bushire. Mr. R.C.Maxwell Darling has been informed.
2) Mr. R.C. Maxwell Darling Anti-locust Unit, c/o MESC. GHQ.MEF.

for Political Agent,
Bahrain.

h/c

Figure 3. A locust report from the Political Agent in Sharjah, 1943.[21]



(123) JK. 3157 25
24/8/43.

Following SCHISTOCERCA Report for TRUCIAL OMAN during

(First Half of August 1943.
Compiled from information brought in by bedu scout and other sources.)

1) Tawy el mara, S.E. of Dubai, probably about Lat: 25°, Long: 55° 5'. Many locusts, mixed red and yellow, reported to be copulating but this needs confirmation.

2) Tawy el Raga, S.E. of Dubai and South of (1) therefore probably about Lat: 24° [redacted] 50', Long: 55° 25'. Locusts reported to have oviposited here but no confirmation forthcoming.

3) Tawy Bad'aughany, probably about Lat: 24° 35', Long 55° 25'. Many locusts, mixed red and yellow, copulation again reported but confirmation lacking.

4) Part of Tawy el Mayar, probably about Lat: 24° 35', Long: 55° 45' near edge of sand and gravelplain and North of Barami, mixed red and yellow locusts seen.

5) Steamer captains and dhow captains report many locusts drowned at sea throughout the Persian Gulf. Large numbers are said to have been washed up at Sharja early in the month.

6) About 1st August number of pink locusts visited lightsat night in Sharja, and scattered individuals have been flying around Sharja during the whole fortnight.

7) Serious damage is reported to date gardens in the Wadi Ham in the western al Hajar mountains, Lat 25°10', Long: 56°10'.

Summary. Scattered pink locusts and perhaps some swarms containing yellow individuals have been present in the country.

Distribution. A.L.O.; C.L.O.; Wad Medani; Ambassador, Baghdad; Legation, Tehran; New Delhi; Bahrain.

D. Vesey Fitzgerald

Sharja, 15th. Aug. 1943.

Locust Officer.

E/23/7/43

21/8

Figure 4. A locust report made by D. Vesey-Fitzgerald, a locust expert.[22]

on trenching was to use barriers of sheets of zinc or tin. These were buried vertically to create a barrier in the path of migrating hopper bands. Breaks in the barriers led into pits, with the locusts that fell into them being buried. Sheeting appears to have been mostly used in grazing areas where Bedu objected to the use of poison bait as they believed it would kill their cattle. In Syria and Iraq in 1942, some 145 kilometres of sheeting was used.[14]

In areas where crude oil was available, a common control method was contact spraying, which involved spraying oil directly onto the hoppers. Burning was also used. This could involve setting fire to scrub around which the hoppers clustered or grass through which they were moving. Flamethrowers were also tried but an international conference on anti-locust activities, unsurprisingly, advised that "the use of flame throwers except by specially trained personnel cannot be recommended owing to the danger of accidents."[15]

A final mechanical method was to plough the land in which eggs had been laid. A range of improvised methods were also used to keep locusts away from crops. In the Trucial States, these included setting fires which produced thick smoke and banging metal cans in the hope of driving away the locusts.[16]

In 1942[17] the first effective chemical poison was used to control hopper bands – sodium arsenate.[18] A 1–2% sodium arsenate solution was mixed with wheat bran and laid out in the path of the hopper bands. Locusts which ate this preparation died, with the vast majority dying within 90 hours. Sometimes, molasses was added as there was an (incorrect) belief that sweetened bran would be more attractive and lead to more deaths.[19] Another form of the poison was a 3–4% sodium arsenate solution which was sprayed on the insects. This, however, does not appear to have been used in the Trucial States, probably because of the lack of water.

To destroy the hoppers, it was necessary to locate them before they could become airborne. This required timely information on environmental conditions, signs of the early stage gregarious behaviour of grasshoppers, and knowledge of breeding sites and swarm movements. Such information had been collected since 1933 when the Government of India, which managed British interests in the Gulf, had required British diplomatic representatives in the Gulf region to regularly report on locust sightings.[20] British diplomatic representation in the region was managed by the Political Resident in the Gulf (whose headquarters was located in Bushire, Iran until 1946 when it moved to Bahrain), and subordinate Political Agents who, on the Arabian Peninsula, were located in Bahrain, Kuwait, Muscat and Sharjah. The Political Agent in Sharjah was responsible for the Trucial States. Figure 3 is an example of a locust report which contains information on the locusts' colour, life cycle state, location and number. Environmental conditions were frequently also reported.

These reports were more detailed when made by locust experts. This can be seen in Figure 4 which is a report made by Desmond Vesey-Fitzgerald, the Locust Control Officer, who was responsible for the Trucial States and Oman during 1943–4.

The military campaign

World War Two started in 1939 and in the early years of the war the Middle East was a significant theatre of operations. This was because it controlled access to Africa and the oil of the Gulf, as well as allowing operations to be launched against the Axis powers in the Mediterranean.

In 1941, locust swarms were reported in the Arabian Peninsula region and this was to mark the start of seven years of locust plagues (1941–1947). This was on top of agricultural problems, as noted by the Trucial States' historian, Mark Hayman:

> "Middle East grain crops in 1941 were affected by drought and scorching winds, with yields down 18 per cent on 1939. The large regional grain producers, instead of having more than 100,000 tons of wheat available for export within the region, found it necessary themselves to import wheat. In addition, Allied forces now in the region required nearly 200,000 tons of wheat."[23]

The agricultural problems, and in particular the threat of locusts, presented the British with unpalatable choices between allowing the local population to starve or importing and distributing large amounts of food. The latter would have had significant military consequences as it would divert ships and manpower essential for prosecuting military operations in the region and beyond. The former would likely to lead to civil disturbances which would undermine British prestige, which again might affect military operations.[24]

The threat of a locust plague was of the gravest concern in the Middle East as seen in its comparison to Hitler by Walter Guinness, 1st Baron Moyne and Britain's Deputy Resident Minister of State for the Middle East, at his address to the 1942 anti-locust international conference in Cairo. He stated that "in the locust we have an enemy as ruthless as Genghis Khan or Hitler with the same indifference to human rights, equally willing to bring the horrors of famine to men, women and children. Like Hitler, the locust respects no rules of warfare and observes no national frontier."[25]

In military terms, combating locusts was "regarded as second only in importance to operations against the enemy", according to a Royal Air Force planning document.[26]

To avert this situation, in 1943 Britain formed the Middle East Anti-Locust Unit (MEALU) and tasked it with destroying locust swarms at the source. While the headquarters of the MEALU was in Cairo, decision-making power rested with Dr. Uvarov in London.[27] MEALU was established within the Middle East Supply Centre (MESC), a para-military logistics organisation charged with operating supply lines to the Middle East and within the region. MESC serviced both military and civilian needs.[28]

In the knowledge that success in combating locusts across the vast area of the Arabian Peninsula required coordination and input from other countries, a conference was held in Cairo in June 1943. It was attended by Uvarov, MEALU personnel and locust experts from India, Egypt, Syria, Lebanon, Palestine, Eritrea and Cyrenaica and Tripolitania, now Libya, amongst others.[29] This conference

and one held shortly afterwards in Tehran led to the development of a plan for the largest-ever coordinated operation against locusts in the Middle East. The success of this plan depended on direct and large-scale logistics assistance from the British military.

The 1943–1944 plan built on small-scale and generally uncoordinated work undertaken by civilian teams from several countries over the 1942–3 locust season. These teams operated in various parts of the Arabian Peninsula, north-east Africa, Persia, and Baluchistan in that season. In the north-east of the Arabian Peninsula, an Indian control party arrived in Muscat in January 1943. The Indian team subsequently split in two. One group joined the British Locust Officer, Desmond Vesey-Fitzgerald, who had his base in Sharjah and was undertaking control activities in the Trucial States. The combined Vesey-Fitzgerald and Indian team subsequently moved to Hasa in Saudi Arabia, with other teams responsible for other parts of Saudi Arabia.[30]

The 1942–3 anti-locust campaign was described as an experiment in that it trialled offensive techniques to deal with the locusts. Until the very early 1940s, anti-locust measures concentrated on protecting crops. This defensive strategy meant waiting until the locusts arrived near the crops and then attempting to destroy them. In contrast, the new approach involved sending scouting parties out into the desert, and, when locusts were located, sending gangs of workers out to destroy them. The critical components in this approach involved getting timely information, creating highly mobile scouting and extermination parties, and ensuring the parties were adequately supplied with transport, water, bait and other supplies. It also required considerable planning and coordination so that the work was continuous, efficient and effective.[31] The greater success of anti-locust operations in the Trucial States and Oman, compared to the Saudi Arabian operations, in 1942–3 also revealed how essential political support by the Rulers was, because it allowed the locust teams to move around freely. Another lesson was that it was important to have large, pre-positioned stocks of bait in country because bait could not be shipped in quickly.[32]

The 1943–4 plan involved a large, coordinated anti-locust campaign focused on Arabia, which was the principal breeding site and transit route for locusts that crossed between Arabia and Persia, Baluchistan and India, before moving to Russia and beyond, and between Arabia and the Levant and Egypt. The plan required mobile units to be deployed across Arabia, with British locust officers in east and central Saudi Arabia and Oman and the Trucial States, Palestinian officers in the Nefud region, and Egyptian officers for the Hejaz. The units all needed to be motorised which would require a massive increase in vehicles. Only 30 vehicles were used for the 1942–3 operations while over 200 were used in the 1943–4 campaign.[33]

Such an operation was only feasible if it was a combined operation involved locust experts, MESC, and the British military.[34] The locust experts, who included the Locust Officers of the MEALU and international locust delegations, were responsible for the overall anti-locust strategy. This was developed via the two international conferences in 1943 in Cairo and Tehran. Operational planning was done via the MEALU's Locust Control Officers under the Chief Locust Officer.[35] MEALU was also responsible for the conduct of anti-locust operations. As MEALU was a part of MESC, it was able to coordinate the transport of bait, food supply, and anti-locust equipment and stores for both MEALU and other anti-locust teams, as well as recruitment of local personnel who made up the vast majority of the extermination gangs. The civilian MEALU/MESC operational contingent consisted of 105 personnel[36] and 29 vehicles, made up of 3-ton trucks and 15-cwt cars.

The British Army was the main British military service involved in the campaign, although the Royal Air Force also contributed through air transport.[37] The British Army's role was to provide the transport necessary for locust destruction, which involved responsibility for vehicles, transport personnel, maintenance of the vehicles, and anti-locust operations under the aegis of MESC.[38] This logistical support was absolutely critical to the operation, as noted by Britain's Deputy Resident Minister of State for the Middle East when he stated during the planning of the operation "it was as essential to have transport and Q [Quartermaster] Officers…as it was to have poison bait."[39]

The British Army contingent for the operation consisted of (1) a large number of vehicles with drivers, mechanics and workshop facilities, (2) signallers for coordination, (3) quartermasters for logistic supply; (4) staff officers for planning and control, and (5) medical personnel to prevent illness and injury and to treat people if they did become unwell.

The British Army contingent consisted of 25 officers and 803 Other Ranks (i.e. enlisted personnel) made up of 443 Britons and 360 Palestinians.[40,41] The Army provided 329 vehicles, mostly 3-ton trucks plus ten 10-ton Mack trucks for vehicle maintenance.[42] The 3-ton trucks were supplied by two Palestinian-based General Transport Companies (No. 446[43] and No. 38[44,45]), each of which was made up of transport platoons consisting of around 30 3-ton vehicles.[46] The 10-ton trucks were supplied by two platoons from No. 335 Tank Transport Company.[47,48] Other components in the contingent were a wireless section and a medical section.[49]

Each of the 1943–4 campaign's operational areas (i.e. Saudi Arabia, Oman and the Trucial States, Nefud and Hejaz) was supported by a British Army detachment, which included a number of vehicles, along with medical, signals and MESC locust personnel. As of 1 January 1944, there were detachments in Sharjah, Bahrain, Riyadh, Hail and Buraida (Qasim).[50]

These detachments were under the control of two British military commands – Middle East Command and Persia and Iraq Command (PAIForce). The division of command was not based on geography *per se* but rather on who supplied each locust control detachment. If a detachment was supplied via the Red Sea ports, it was the responsibility of Middle East Command, while those supplied via the Arabian Gulf were under the command of PAIForce.[51] Middle East Command was the long-standing and dominant military command for the region and had overall command of the anti-locust campaign.[52,53] PAIForce was formed in 1942 to protect oil fields in the region and

to facilitate the transport of supplies from Gulf ports to the Soviet Union.[54]

PAIForce was responsible for support of the locust campaign detachments with headquarters at Sharjah, Bahrain and Riyadh.[55] The Sharjah headquarters was based at RAF Sharjah, and it supported operations across both the Trucial Coast and the Batinah Coast. Like all the detachments, the Sharjah one had British Army transport, quartermaster, signal and medical personnel. Transport was provided by a part of No. 38 General Transport Company, consisting of one British officer, 11 British non-commissioned officers, and 60 Palestinian Arabs.[56] Their vehicles were transported to Sharjah or Oman by sea from Basra.

British Army personnel supporting the locust control teams in the Trucial States and Oman wore standard British uniforms and carried arms.[57] This was not possible for British Army personnel supporting these teams in Saudi Arabia, who wore army uniforms but were not allowed to wear insignia of rank or army headwear. Instead all British and Palestinian personnel in the Saudi Arabian teams wore Arab head-dress. To signify ranks, officers wore a white *kuffiya* (i.e. *shemagh*) with a gold *agal*, and Other Ranks (i.e. enlisted personnel) a red and white *kuffiya* and black *agal*. Warrant Officers and Non-Commissioned Officers wore *lanyards* to distinguish them from other ranks. The only weapons allowed were revolvers which could be carried by Officers, Warrant Officers and Non-Commissioned Officers.[58]

The logistical requirements to support the detachments across the Arabian Peninsula were significant. Not only were supply lines to the region long, but the difficult nature of the landscape and its large area meant that careful planning and coordination were required. Vehicles travelled an average of 40 miles per day,[59] and suffered severe wear and tear. Thus preventative maintenance and rapid field repairs were necessary to keep the operation on the move.

The Sharjah detachment had a monthly requirement for six tons of food, 35 tons of petrol, oil and lubricants, 36 tons of water, and 20 tons of other materials such as clothing and spare parts.[60] In addition, to cover the campaign in the Trucial States and Oman, 50 tons of bait had to be delivered to Sharjah before the start of the campaign (the pre-campaign estimate for the entire Arabian Peninsula campaign was 1,190 tons).[61,62] While transporting to the detachments was generally well managed, this was not always the case. For example, the Chief Locust Officer wrote in June 1943 that he had requested that the 'track grip' tyres fitted to the Army-supplied trucks be replaced with tyres suitable for the desert. Subsequently, a batch of 50 tyres were received but these turned out to be of the 'track grip' type, and were returned.[63]

The time line for the operation was driven by the 1943–4 locust cycle described below:

> "Swarms will probably begin to appear from a general southerly direction in December, and these may mature/oviposit [laying of eggs] in January–February, the earlier oviposition taking place in the south may continue longer, but the above months will probably see the bulk of the egg-laying. Eggs may hatch in 4–6 weeks according to the temperature, so that hoppers may first appear in February or March. In the event of a warm winter, it might even occur earlier."[64]

Based on these assumptions, both personnel and equipment needed to arrive on site in November, scouting parties needed to be recording the environmental conditions and the appearance of eggs from December to February, and from February to March gangs of labourers needed to be trained and dispatched to breeding sites to destroy the locusts. The destruction of locusts could continue to June.

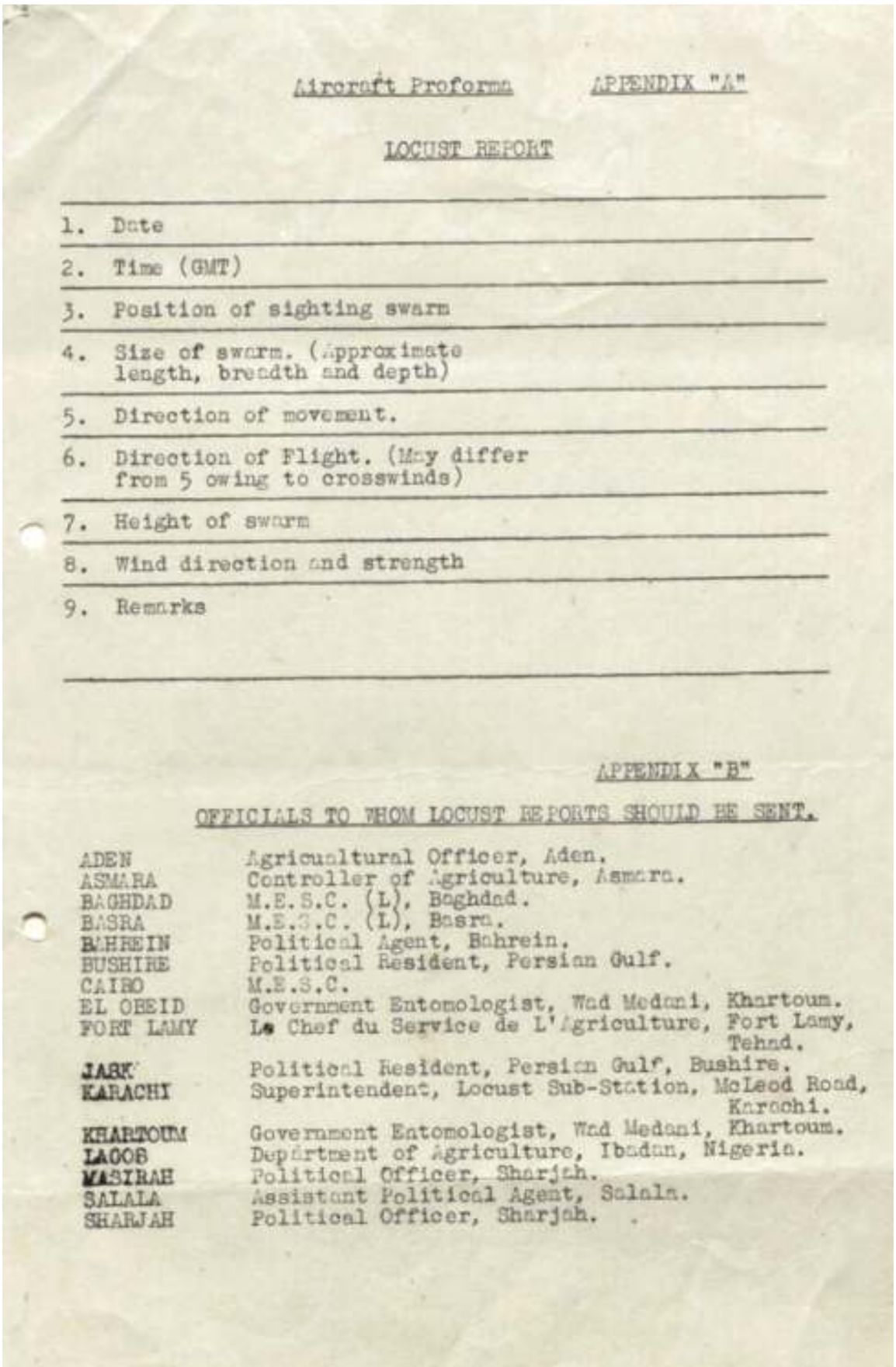
A key challenge to the campaign's effectiveness was a lack of local knowledge, because there had been little detailed exploration of the natural history of the affected areas. Consequently, scouting parties needed to travel widely and continuously, and extermination teams needed to be rapidly moved in as soon as breeding sites were identified. Thus motorised transport was essential. As seen in Figure 2, the period of time from egg laying through the hopper phase to fledging is only between 40 and 50 days. This meant that there was a narrow window of opportunity for the location and destruction of insects. If this window was missed, the swarm would move, eat and breed, something that could happen four or five times during their lifetime.

The MEALU/MESC anti-locust field structure consisted of a Chief Locust Officer for the Arabian Peninsula and subordinate Locust Officers each responsible for an area of operations. The Chief Locust Officer at the start of the campaign was R.C. Maxwell-Darling, and after February 1944, D. Vesey-FitzGerald.[65] Locust Officers included O.B. Lean who set up operations initially at Dhahran,[66] Major McGough, Major Hedder, and Mr. Wateraton,[67] and Mohamed Hussein, an entomologist from the Egyptian Ministry of Agriculture, who was sent to survey the Hejaz and northern Arabia.[68] In the Trucial States and Oman, the Locust Officer was Vesey-FitzGerald.

Under the Locust Officers were technical supervisors and, in the case of the Trucial States and Oman, this included Sudanese personnel from MEALU/MESC plus an Indian locust control delegation. This delegation consisted of around 10 locust officers under the leadership of Mr. Shabhire.[69] They arrived in Sharjah at the end of January 1944,[70] were stationed in Muscat in February 1944, and returned to Sharjah at the end of March that year, remaining there until the disappearance of locusts for the season.[71] Under the supervisors were locally-engaged labourers. Guidance on the employment of local labourers stated "it is advisable to fix their wages with the local Amir on the basis of a ration of rice and dates plus so much money."[72] Locally engaged personnel could subsequently travel with the team even when it moved. In the case of locally-engaged Trucial States citizens, some moved with the detachment to Saudi Arabia late in the 1943–4 campaign.[73] Labourers worked in gangs.

Below is a description of the roles involved in locust operations in the Trucial States/Oman:

> "A Locust Officer may have 8–15 gangs working under him. He is responsible for general supervision and large-scale movements. He will have trucks allocated to him for transport of petrol, water, poison bait, etc, and must ensure that supplies from the nearest dump or port are kept up.



Aircraft Proforma APPENDIX "A"

LOCUST REPORT

1. Date
2. Time (GMT)
3. Position of sighting swarm
4. Size of swarm. (Approximate length, breadth and depth)
5. Direction of movement.
6. Direction of Flight. (May differ from 5 owing to crosswinds)
7. Height of swarm
8. Wind direction and strength
9. Remarks

APPENDIX "B"

OFFICIALS TO WHOM LOCUST REPORTS SHOULD BE SENT.

ADEN	Agricultural Officer, Aden.
ASMARA	Controller of Agriculture, Asmara.
BAGHDAD	M.E.S.C. (L), Baghdad.
BASRA	M.E.S.C. (L), Basra.
BAHREIN	Political Agent, Bahrein.
BUSHIRE	Political Resident, Persian Gulf.
CAIRO	M.E.S.C.
EL OBEID	Government Entomologist, Wad Medani, Khartoum.
FORT LAMY	Le Chef du Service de L'Agriculture, Fort Lamy, Tchad.
JASK	Political Resident, Persian Gulf, Bushire.
KARACHI	Superintendent, Locust Sub-Station, McLeod Road, Karachi.
KHARTOUM	Government Entomologist, Wad Medani, Khartoum.
LAGOS	Department of Agriculture, Ibadan, Nigeria.
MASIRAH	Political Officer, Sharjah.
SALALA	Assistant Political Agent, Salala.
SHARJAH	Political Officer, Sharjah.

Figure 5. Air crew reporting form for locust swarms.[78]

The Locust Officer should either make tours himself or send scouting parties throughout his area outside the zone of operations, so as to determine where to shift his forces next.

The control unit will be a lorry with about 10 labourers in charge of a technical supervisor. Having been allocated an area, he should make his own plan of campaign. An Area Commander may be in charge of about 5 gangs, and will be responsible for keeping them supplied with water and poison bait and for supervising the work of the gang supervisors. He will instruct gangs when to move to a new area. He should have a 15cwt truck if possible.

The Area Commander should personally ascertain the areas of infestation not yet dealt with.

The Gang Supervisor can usually make scouting tours over his smaller area during the time of day when it is too hot or too cold for poisoning operations."[74]

The principal control method used in the campaign was poison baiting, but other methods such as trenching could be employed if there was a lack of bait.[75]

In addition to scouting parties, around mid-1944, an additional approach for collecting locust information was tried. Starting in May 1944, officers at control points along the main flying routes in the Middle East were asked to brief Royal Air Force and British Overseas Airways Corporation (BOAC) flying crews so that they could observe and then report locust swarms seen from the air. They were also asked to brief the crews of the US Army Air Force which flew through the area and had a base in Sharjah.[76] A proforma for reporting locust swarms was produced along with information about who it should be sent to (see Figure 5).

However, by June 1944, it was reported that identification of swarms from the air had "largely failed." According to the Chief Locust Officer, "the failure was due to the appeal being too general, the system too dispersed and above all, to the lack of direct contact between the appropriate local air representatives and the local locust authorities." To rectify these problems, the Chief Locust Officer requested local British Government and locust representatives to be more active locally. In the case of the Trucial States, this meant that the Political Officer in Sharjah had to establish contact with the military and civilian air station in Sharjah.[77] There is no subsequent record of the effectiveness of air crew reporting.

In February 1944, it was reported that there was no "great number of locusts" in the Trucial States and Oman area.[79] Consequently the anti-locust campaign closed on 4 March 1944. All parties assembled at Sharjah and their equipment was stored for next year. This included some 6,000 sacks of left-over poison bait.[80, 81] The Indian delegation returned to India. The British military transport unit (B Platoon of No. 38 General Transport Company) left for Saudi Arabia on 14 March 1944 together with the MEALU/MESC personnel.[82] One locally-recruited supervisor remained stationed in Sharjah to report any locust news and handle administrative work.[83] The only identified post-departure locust information for that season for the Trucial States noted that a "loose immature swarm are reported to have covered the Trucial Coast from 25th March 1944 … [but the] … country is said to be too dry for breeding."[84]

The 1943/4 anti-locust operation in the Trucial States and Oman was a success according to the British Political Resident. He reported that "Intensive anti-locust measures were undertaken during the year under the supervision of Mr. D. Vesey Fitzgerald and a serious outbreak was probably averted by timely action."[85]

The military support for the Arabian Peninsula campaign was absolutely critical; an assessment noted that without the help "received from the Services in the provision of personnel, transport and essential stores, it is safe to say that the campaign could never have become an accomplished fact."[86] However, military support did occasionally hinder anti-locust work. For example, in at least one case, locals were unwilling to cooperate because the anti-locust team looked more like a military force. This can be seen in the following report by a Political Agent reporting on the Trucial States and Oman:

"A recent visit by a small party of the anti-locust expedition to a part of the Al bu Shamis property at Buraimi met with a rebuff. There are no locusts anywhere in the area and the arrival of men in khaki in army lorries with the stated object of being there to kill locusts which obviously do not exist is treated with a very justifiable suspicion. They are in fact not wel-comed."[87]

British military involvement in anti-locust operations in subsequent years

While the locust menace of 1943–4 had been reduced, the threat remained. Despite the Allies gaining momentum during 1943 and into 1944, the Middle East still needed to produce its own food. Consequently, combating locusts remained a high priority. However, the military need for British Army personnel and vehicles in other theatres meant that it could not make a similar contribution to the 1944–5 anti-locust campaign.[88] The lack of military support meant that the 1944–5 campaign was much reduced in scale and was far more defensive. Specifically, it focused more on protecting local crops rather than seeking out hoppers in open country, and restricted its activities to the limited area on the west coast of Saudi Arabia and the Trucial States and Oman. The campaign ran from December 1944 to June 1945.[89]

The combined military and civilian personnel for the 1944–5 Arabian Peninsula campaign was just 197, and only 110 vehicles were provided.[90, 91] Rather than the British Army providing drivers and first line maintenance and repairs, this became the responsibility of personnel hired locally by MESC. In 1944–5, the total military and civilian detachment consisted of just Captain R. J. V. Joyce (a Locust Officer), around seven Indian supervisory staff,[92] a workshop group made of five military personnel (a Sergeant, two fitters, an electrician and driver), plus 11 locally recruited drivers.[93] This was a substantial reduction from over 70 British Army personnel involved in the previous year. Signal support was also reduced, with the mobile radio set not being supplied.[94] Like the previous year, the HQ for the detachment was in Sharjah and was supported by PAIForce. The detachment had 12 vehicles,

eight 3-ton Chevrolet C60L trucks, three 8-cwt Morris trucks, and one breakdown truck.[95]

In the Trucial States, the priority area was the triangle bounded by the townships of Abu Dhabi, Ra's al-Khaimah and Buraimi/Al Ain, for two reasons. Firstly, it was predicted that rainfall south and west of Abu Dhabi would probably be too light for much breeding to take place. Secondly while there was a possible area of breeding at the edge of the mountains north of Buraimi, "political difficulties would probably make a campaign [here] impractical", according to the Chief Locust Officer. However, he noted that "if breeding took place there, and these difficulties could be overcome, the campaign would of course be extended to these areas.[96]

Following the end of World War Two, Britain wanted arrangements for controlling locusts in the Middle East changed. Suffering from massive debts and needing to rebuild at home, Britain argued for the Arab states to take over financial and administrative responsibility of the MEALU, with the British providing technical support including locust control officers. This was not supported by the Arab states which feared that Britain would use its technical role to collect intelligence as its personnel moved around the countries where anti-locust operations were under way. The subsequent deadlock ensured that locust control once again became *ad hoc*.[97]

Despite the political deadlock, locust research in the region continued under the auspices of British locust experts, including Dr. Uvarov. He believed that there were outbreak centres where solitary grasshoppers would find the environmental conditions that would turn them into desert locust swarms. He thought some of these might be in southern Arabia and the only way to know for certain was to explore the area.[98] The MEALU entomologist O.B. Lean mentioned the need for someone to go to this region and gather information to the English explorer and travel writer, Wilfred Thesiger.[99] He accepted the opportunity due to his desire to explore the region.

In preparation in the second half of 1945, Thesiger went to Saudi Arabia for two months to learn about locusts from Vesey-Fitzgerald who was then running the Saudi anti-locust campaign and had previously done the same in the Trucial States and Oman. Thesiger commenced his first journey in October 1945, starting in Salalah in Oman. He explored the south-eastern edge of the Empty Quarter and region around the intersection of modern-day Oman, Yemen and Saudi Arabia, with the exploration finishing in February 1946. Along the route, he recorded information on locust breeding, seasonal rainfall and vegetation.[100] Thesiger dearly wanted to cross the Empty Quarter, and, although there was no justification to do so from a locust research perspective as its lack of rainfall meant it was not a breeding site of note, the trip was approved as it would allow him to explore Oman's hinterland on his return journey.[101] He left Salalah in October 1946 on the first of two now-famous treks across the Empty Quarter. The trip saw him reach Liwa in mid-December, and he subsequently visited Abu Dhabi town and Al Ain/Buraimi and travelled back through Oman via Dhofar before arriving back in Salalah in February 1947. (The second trip was after he left the employment of MEALU and started in December 1947 at Manwakh well in Yemen, with him crossing the Empty Quarter before arriving in Liwa and then Abu Dhabi town, arriving in March 1948.)

Direct British control over locust control operations in the Trucial States ended in May 1948 when a representative of the MEALU visited Sharjah, disposed of all the saleable stores from the Locust Control Unit and destroyed the locust poison bait stored there.[102]

Locust control in the Trucial States subsequently became a Pakistani responsibility with that country's government sending delegations when required. Up until 1954, the arrangements were *ad hoc* and support was also given by Indian, and occasionally British, personnel. Although anti-locust operations were no longer a British responsibility in the Trucial States, this was not the end of British military support for these operations. British forces continued to provide support when available. Thus, for example, the Royal Air Force provided the Pakistani Anti-locust delegation with two vehicles from its base in Sharjah for at least three months in 1949.[103]

In 1951, the British established a permanent army unit in the Trucial States – the Trucial Oman Levies. This British-officered, Arab-manned force was renamed the Trucial Oman Scouts in 1956.[104] This force provided support to anti-locust operations, and the need to do so was written into the Directive which specified the roles and responsibilities of the Commander, TOS. A 1961 Directive specifies "locust plagues" as a type of disaster in which the Commander TOS is expected to "render such assistance to the civil authority as your resources allow."[105] This year was the last identified one in which the British military provided assistance to anti-locust operations in the Trucial States.[106]

Below is a report by a British Warrant Officer in the TOS, J.H. Coleman, of the 1961 operation. The background to it was that in late 1961, the TOS had received a request for aid from the locust control advisor, Mr. Tillen, and six Land Rovers of both British and Arab troops were sent to Digdagga, the home to the Agricultural Trials Station and centre of Ra's al-Khaimah's agricultural area.

> "After staying the night, we moved to the field camp where we had our first view of the enemy; disappointed by their size (1/2in. long) but awed by their numbers (they appeared endless), we set about destroying them. This is done by dusting the whole of the area with a mixture of Gamaxine and sand; the effect of this is immediate; and had we collected the carcasses of the first lot they would have filled a three-tonner.
>
> Flushed with the first victory, we returned to camp, reloaded with Gamaxine and moved off north, east and west, finding and destroying these hopper bands as they are called. At last light we were still finding them, but had to call a halt until next morning.
>
> We had a tremendous area to cover, approximately 120 square miles, and even in that first day we had seen more than we thought could possibly exist, in the solitary square mile or so that we had covered.
>
> The next day we went back to Sharjah for more vehicles and bodies. When they arrived, we went into the same routine, out of camp, into the dunes, see, stop, spray, remount and on again.

The female locust which laid the eggs from which these hoppers were hatching, always seem to choose the top of the highest sand dunes, where one could only take the Rover to the base, clamber up, sliding back six inches at each pace, only to find, having dusted all the way up, there were hoppers on that side too."

We moved camp on the fourth day to a new area about forty miles away; there we were joined by a further five Land Rovers and ten British Other Ranks for Signal Squadron.

The operation now continued at a much faster rate, with ten Land Rovers dashing in and out of camp, up the dunes, exterminating locusts for miles around."[107]

The British military's support for the anti-locust campaign from the Second World War to the early 1960s rarely rates a footnote in the histories of the Middle East. This is unfortunate, for it overlooks important contributions made by the military in these years – not only to the health and livelihoods of the people of the Middle East, but also to winning World War Two.

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Bibliography

1944. Middle East Anti-Locust Campaign. **Middle East Economic and Statistical Bulletin.**

Abdulla Abdul Rahman 1988. A swarm of tasty morsels. **Emirates News.**

Administrative Officer, Middle East Anti-Locust Units 1944. Reporting of locust swarms. IOR/R/15/2/1545.

Agricultural Officer 1942. Ref 88/142/E. FO 922/179. TNA.

Britagent Sharjah 1943. No 1328. IOR/R/15/2/1545. Qatar Digital Library.

Burdett, A. (ed.) 1997. Records of the Emirates 1961–1965: 1961. Archive Editions.

Chief Locust Officer, Middle East Anti-Locust Units 1944. Reporting of locust swarms by air crews. IOR/R/15/2/1545.

Coleman, J.H. 1962. Locust Control. **The Wire: The Royal Signals Magazine 16(6):** 209.

Cressman, K. 1998. Monitoring Desert Locusts in the Middle East: An Overview. Pp. 123–140 *in:* Albert, J., M. Bernhardsson & R. Kenna (eds.). Transformations of Middle Eastern Natural Environments – Legacies and Lessons. Yale School of Forestry and Environmental Studies.

GHQ Middle East Forces 1943. ME Anti-Locust Campaign Saudi-Arabia. IOR/R/15/2/1545. Qatar Digital Library.

Government of India, New Delhi 1944. No 179. IOR/R/15/2/1545. Qatar Digital Library.

Hayhurst, J. n.d. The Forgotten War against Locusts that Helped Win the War [Online]. Available: *https://www.qdl.qa/en/forgotten-war-against-locusts-helped-win-war*

Hayman, M. 2018. Economic Protectorate in Britain's Informal Empire: The Trucial Coast during the Second World War. **The Journal of Imperial and Commonwealth History 46:** 323–344.

Heard-Bey, F. 1982. From Trucial States to United Arab Emirates: a society in transition. Longman, London, New York,

Hellyer, P. & L. Garey 2004. World War Two plane crashes in the UAE. **Tribulus 14(1):** 9–11.

Information, Great Britain. Central Office of & Office, Great Britain. War 1948. Paiforce: The Official Story of the Persia and Iraq Command, 1941–1946. H.M. Stationery Office.

Inter-Departmental Committee on Locust Control 1944. Meeting of Members of the Inter-Departmental Committee on Locust Control and Locust Officers from the Middle East in London, June 26th, 27th, 29th and 30th. IOR/R/15/2/1545.

Jackson, A. 2006. The British Empire and the Second World War. Bloomsbury Academic, London, etc.

Jaman, E.L. (ed.) 1998a. Political Diaries of the Arab World: Persian Gulf: 1947–1958: 1958. Archive Editions.

Jaman, E.L. (ed.) 1998b. Political Diaries of the Arab World: Persian Gulf: 1961–1962. Archive Editions.

Kingston, P.W.T. 2002. Britain and the Politics of Modernization in the Middle East, 1945–1958. Cambridge University Press, Cambridge.

Lord, C. 13 November 2018. RE: Trucks in locust patrol (email).

Matthews, W.H.E., Administrative Officer MEALU 1944. The following reports of incidence of Locusts have been received. IOR/R/15/2/1545. Qatar Digital Library.

Maxwell-Darling, R.C., Chief Locust Officer 1943a. 16/37-A. IOR/R/15/2/1545. Qatar Digital Library.

Maxwell-Darling, R.C., Chief Locust Officer 1943b. Letter of 20 August 1943. IOR/R/15/2/1545. Qatar Digital Library.

Middle East Anti-Locust Unit 1944. Saudi Arabia and Oman Campaign 1944/1945. AIR 23/1098. TNA.

Middle East Command? 1943. Arabian Locust Campaign – Winter-Spring 1943–1944. IOR/R/15/2/1545.

Middle East Supply Centre 1943. Proceedings of the Conference on Locust Control held in Cairo July 2nd–3rd, 1943. CO 852/400/6. Cairo: TNA.

Morton, M.Q. 2013. Thesiger and the Oilmen. **Journal of the Petroleum History Institute 14:** 125–139.

Pantenius, C. & M. Butrous 2017. A Celebration of 50 Years of Service 1967–2017: The FAO Commission for Controlling the Desert Locust in the Central Region. Food and Agriculture Organization of the United Nations.

Political Agent Bahrain 1944. Anti-Locust measures on the Trucial Coast. IOR/R/15/2/1545. Qatar Digital Library.

Political Residency, Persian Gulf 1944. Administration Report of the Bahrain Agency and the Trucial Coast for the year 1943: Trucial Coast. IOR/R/15/1/719. Qatar Digital Library.

Political Resident at Shiraz 1943. T1047. IOR/R/15/2/1545. Qatar Digital Library.

Saunders, F/Lt, Air Plans, RAF 1944. Review of Situation. AIR 23/1097: TNA.

Stobart, P.D., Political Agent Bahrain 1949. Bahrain Intelligence Summary for the Period 1st to 31st May 1949. IOR/R/15/2/320. Qatar Digital Library.

Taylor, K. 2008. Wildlife at the Workplace: Locusts! **Focus** (Bulletin of the Emirates Natural History Group) **32:** 5.

Thesiger, W.P. 1946. A New Journey in Southern Arabia. **The Geographical Journal 108:** 129–145.

Thesiger, W.P. 2008. Arabian Sands. Penguin Books, London.

Uvarov, B.P. 1943. The Locust Plague. **Journal of the Royal Society of Arts 91(4631)**: 109–118.

Vesey-Fitzgerald, D., Locust Officer Oman 1943. Following *Schistocerca* report for Trucial Oman during. IOR/R/15/2/1545.

Vesey-Fitzgerald, D., Locust Officer Oman 1944. Report of D. Vesey Fitzgerald, Locust Officer for March 1944. IOR/R/15/2/1545. Qatar Digital Library.

Yates, A. 2020. The Evolution of the Armed Forces of the United Arab Emirates 1951–2020. Helion & Co., Warwick.

Yates, A. & C. Lord 2019. The Military and Police Forces of the Gulf States: Trucial States & United Arab Emirates, 1951–1980. Helion & Co., Warwick.

Footnotes

[1] Jaman, E.L. (ed.) 1998b. Political Diaries of the Arab World: Persian Gulf: 1961–1962. Archive Editions.
[2] Heard-Bey, F. 1982. From Trucial States to United Arab Emirates: a society in transition. Longman, London, New York.
[3] Cressman, K. 1998. Monitoring Desert Locusts in the Middle East: An Overview. Pp. 123–140 *in:* Albert, J., M. Bernhardsson & R. Kenna (eds.). Transformations of Middle Eastern Natural Environments – Legacies and Lessons. Yale School of Forestry and Environmental Studies.
[4] Taylor, K. 2008. Wildlife at the Workplace: Locusts! **Focus 32:** 5.
[5] Cressman, K. 1998. Monitoring Desert Locusts in the Middle East: An Overview. Pp. 123–140 *in:* Albert, J., M. Bernhardsson & R. Kenna (eds.). Transformations of Middle Eastern Natural Environments – Legacies and Lessons. Yale School of Forestry and Environmental Studies.
[6] Pantenius, C. & M. Butrous 2017. A Celebration of 50 Years of Service 1967–2017: The FAO Commission for Controlling the Desert Locust in the Central Region. Food and Agriculture Organization of the United Nations.
[7] *Ibid.*
[8] Cressman, K. 1998. Monitoring Desert Locusts in the Middle East: An Overview. Pp. 123–140 *in:* Albert, J., M. Bernhardsson & R. Kenna (eds.). Transformations of Middle Eastern Natural Environments – Legacies and Lessons. Yale School of Forestry and Environmental Studies.
[9] *Ibid.*
[10] *Ibid.*
[11] Pantenius, C. & M. Butrous 2017. A Celebration of 50 Years of Service 1967–2017: The FAO Commission for Controlling the Desert Locust in the Central Region. Food and Agriculture Organization of the United Nations.
[12] *Ibid.*
[13] Uvarov, B.P. 1943. The Locust Plague. **Journal of the Royal Society of Arts 91(4631):** 109–118.
[14] Middle East Supply Centre 1943. Proceedings of the Conference on Locust Control held in Cairo July 2nd–3rd, 1943. CO 852/400/6. Cairo: TNA.
[15] *Ibid.*
[16] Abdulla Abdul Rahman 1988. A swarm of tasty morsels. **Emirates News**.
[17] Pantenius, C. & M. Butrous 2017. A Celebration of 50 Years of Service 1967–2017: The FAO Commission for Controlling the Desert Locust in the Central Region. Food and Agriculture Organization of the United Nations.
[18] A less effective substitute was for sodium arsenate was sodium fluosilicate.
[19] Agricultural Officer 1942. Ref 88/142/E. FO 922/179. TNA.
[20] Hayhurst, J. n.d. The Forgotten War against Locusts that Helped Win the War [Online]. Available: *https://www.qdl.qa/en/forgotten-war-against-locusts-helped-win-war* [Accessed].
[21] Britagent Sharjah 1943. No 1328. IOR/R/15/2/1545. Qatar Digital Library.
[22] Vesey-Fitzgerald, D., Locust Officer Oman *ibid.* Following *Schistocerca* report for Trucial Oman during.
[23] Hayman, M. 2018. Economic Protectorate in Britain's Informal Empire: The Trucial Coast during the Second World War. **The Journal of Imperial and Commonwealth History 46:** 323–344.
[24] *Ibid.*
[25] Middle East Supply Centre 1943. Proceedings of the Conference on Locust Control held in Cairo July 2nd–3rd, 1943. CO 852/400/6. Cairo: TNA.
[26] Saunders, F/Lt, Air Plans, RAF 1944. Review of Situation. AIR 23/1097: TNA.
[27] Pantenius, C. & M. Butrous 2017. A Celebration of 50 Years of Service 1967–2017: The FAO Commission for Controlling the Desert Locust in the Central Region. Food and Agriculture Organization of the United Nations.
[28] For details on MESC's activities in the Trucial States, see Hayman, Mark 2018. Economic Protectorate in Britain's Informal Empire: The Trucial Coast during the Second World War. **The Journal of Imperial and Commonwealth History 46:** 323–344.
[29] Pantenius, C. & M. Butrous 2017. A Celebration of 50 Years of Service 1967–2017: The FAO Commission for Controlling the Desert Locust in the Central Region. Food and Agriculture Organization of the United Nations.
[30] Middle East Supply Centre 1943. Proceedings of the Conference on Locust Control held in Cairo July 2nd–3rd, 1943. CO 852/400/6. Cairo: TNA.
[31] *Ibid.*
[32] *Ibid.*
[33] In terms of British entomologists, their number doubled to four. *Ibid.*

[34] Other groups also contributed such as the US and USSR militaries, although their contribution was peripheral rather than central.
[35] Middle East Supply Centre 1943. Proceedings of the Conference on Locust Control held in Cairo July 2nd–3rd, 1943. CO 852/400/6. Cairo: TNA.
[36] GHQ Middle East Forces 1943. ME Anti-Locust Campaign Saudi-Arabia. IOR/R/15/2/1545. Qatar Digital Library.
[37] For example, two aircraft transporting MEALU/MESC personnel crash-landed on Sir Bani Yas en route from Sharjah to Bahrain on 22 April 1944. Hellyer, P. & L. Garey 2004. World War Two plane crashes in the UAE. **Tribulus 14(1):** 9–11.
[38] GHQ Middle East Forces 1943. ME Anti-Locust Campaign Saudi-Arabia. IOR/R/15/2/1545. Qatar Digital Library.
[39] Middle East Supply Centre 1943. Proceedings of the Conference on Locust Control held in Cairo July 2nd–3rd, 1943. CO 852/400/6. Cairo: TNA.
[40] GHQ Middle East Forces 1943. ME Anti-Locust Campaign Saudi-Arabia. IOR/R/15/2/1545. Qatar Digital Library.
[41] 1944. Middle East Anti-Locust Campaign. **Middle East Economic and Statistical Bulletin.**
[42] GHQ Middle East Forces 1943. ME Anti-Locust Campaign Saudi-Arabia. IOR/R/15/2/1545. Qatar Digital Library.
[43] 446 Gen Tpt Company consisted of 9 Officers, 258 ORs and 102 vehicles. *Ibid.*
[44] The initial headquarters of No. 446 Gen Tpt Company with at Yenbo, and No. 38 Gen Tpt Company at Bahrain. *Ibid.*
[45] The Officer Commanding of 38 Gen Tpt Comp was Major Pickavance and later Major Leney, and 446 Gen Tpt Comp was Major Horsfall. 1944. Middle East Anti-Locust Campaign. **Middle East Economic and Statistical Bulletin.**
[46] GHQ Middle East Forces 1943. ME Anti-Locust Campaign Saudi-Arabia. IOR/R/15/2/1545. Qatar Digital Library.
[47] Jackson, A. 2006. The British Empire and the Second World War, Bloomsbury Academic, London, etc.
[48] GHQ Middle East Forces 1943. ME Anti-Locust Campaign Saudi-Arabia. IOR/R/15/2/1545. Qatar Digital Library.
[49] 1944. Middle East Anti-Locust Campaign. **Middle East Economic and Statistical Bulletin.**
[50] GHQ Middle East Forces 1943. ME Anti-Locust Campaign Saudi-Arabia. IOR/R/15/2/1545. Qatar Digital Library.
[51] *Ibid.*
[52] Information, Great Britain. Central Office of & Office, Great Britain. War 1948. PAIForce: The Official Story of the Persia and Iraq Command, 1941–1946. H.M. Stationery Office.
[53] The overall military command for the detachments were Major Pickavance, Officer Commander No. 38 Gen Transport Company. GHQ Middle East Forces 1943. ME Anti-Locust Campaign Saudi-Arabia. IOR/R/15/2/1545. Qatar Digital Library.
[54] Information, Great Britain. Central Office of & Office, Great Britain. War 1948. PAIForce: The Official Story of the Persia and Iraq Command, 1941–1946. H.M. Stationery Office.
[55] GHQ Middle East Forces 1943. ME Anti-Locust Campaign Saudi-Arabia. IOR/R/15/2/1545. Qatar Digital Library.
[56] The No. 38 General Transport Company group consisted of B Platoon, which arrived in Muscat in February 1944.
[57] Political Resident at Shiraz 1943. T1047. IOR/R/15/2/1545. Qatar Digital Library.
[58] GHQ Middle East Forces *ibid*. ME Anti-Locust Campaign Saudi-Arabia.
[59] Middle East Anti-Locust Unit 1944. Saudi Arabia and Oman Campaign 1944/1945. AIR 23/1098. TNA.
[60] GHQ Middle East Forces 1943. ME Anti-Locust Campaign Saudi-Arabia. IOR/R/15/2/1545. Qatar Digital Library.
[61] *Ibid.*
[62] The movement of poisoned bait to the detachments was via the Movement/Transport Branch of GHQ MEF, and subsequently its local movement by the Officers Commanding the General Transport Companies in conjunction with the MESC technical advisors. *Ibid.*
[63] Maxwell-Darling, R.C., Chief Locust Officer. *Ibid.*16/37-A.
[64] Middle East Command? *Ibid.* Arabian Locust Campaign – Winter-Spring 1943–1944.
[65] 1944. Middle East Anti-Locust Campaign. **Middle East Economic and Statistical Bulletin**.
[66] Pantenius, C. & M. Butrous 2017. A Celebration of 50 Years of Service 1967–2017: The FAO Commission for Controlling the Desert Locust in the Central Region. Food and Agriculture Organization of the United Nations.
[67] Middle East Command? 1943. Arabian Locust Campaign – Winter-Spring 1943–1944. IOR/R/15/2/1545.
[68] Pantenius, C. & M. Butrous 2017. A Celebration of 50 Years of Service 1967–2017: The FAO Commission for Controlling the Desert Locust in the Central Region. Food and Agriculture Organization of the United Nations.
[69] Matthews, W.H.E., Administrative Officer MEALU 1944. The following reports of incidence of Locusts have been received. IOR/R/15/2/1545. Qatar Digital Library.
[70] Government of India, New Delhi. *Ibid.* No. 179.
[71] Vesey-Fitzgerald, D., Locust Officer Oman ibid.Report of D. Vesey Fitzgerald, Locust Officer for March 1944.
[72] Middle East Command? 1943. Arabian Locust Campaign – Winter-Spring 1943–1944. *Ibid.*
[73] For example, the following Trucial States' citizens appear to have worked in Saudi Arabia for they arrived in Bahrain at the end of the locust season having worked in the Anti-Locust Unit: Mohammed Hassan, Syed Mohammed Syed Yusef, Abd el Jalil Mohammed, Mohammed Saleh, Syed Abdalla Syed Yusef, Amir Abd el Rahim, Ali Abd el Rahim, Salim Ali, Abud Ibrahim and Syed Ahmed Ismail.
[74] Middle East Command? 1943. Arabian Locust Campaign – Winter-Spring 1943–1944. IOR/R/15/2/1545.
[75] *Ibid.*
[76] Administrative Officer, Middle East Anti-Locust Units 1944. Reporting of locust swarms. *Ibid.*
[77] Chief Locust Officer, Middle East Anti-Locust Units *ibid.* Reporting of locust swarms by air crews.
[78] *Ibid.*
[79] Political Agent Bahrain *ibid.* Anti-Locust measures on the Trucial Coast. Qatar Digital Library.
[80] In general, 34 sacks of bait equals one ton.
[81] Maxwell-Darling, R.C., Chief Locust Officer 1943a. 16/37-A. IOR/R/15/2/1545. Qatar Digital Library.
[82] Vesey-Fitzgerald, D., Locust Officer Oman 1944. Report of D. Vesey Fitzgerald, Locust Officer for March 1944. *Ibid.*
[83] *Ibid.*
[84] *Ibid.*
[85] Political Residency, Persian Gulf 1944. Administration Report of the Bahrain Agency and the Trucial Coast for the year 1943: Trucial Coast. IOR/R/15/1/719. Qatar Digital Library.

[86] GHQ Middle East Forces 1943. ME Anti-Locust Campaign Saudi-Arabia. IOR/R/15/2/1545. Qatar Digital Library.
[87] Political Agent Bahrain 1944. Anti-Locust measures on the Trucial Coast. *Ibid.*
[88] Middle East Anti-Locust Unit 1944. Saudi Arabia and Oman Campaign 1944/1945. AIR 23/1098. TNA.
[89] Inter-Departmental Committee on Locust Control 1944. Meeting of Members of the Inter-Departmental Committee on Locust Control and Locust Officers from the Middleas East in London, June 26th, 27th, 29th and 30th. IOR/R/15/2/1545.
[90] Middle East Anti-Locust Unit 1944. Saudi Arabia and Oman Campaign 1944/1945. AIR 23/1098. TNA.
[91] Overall military command for the Arabian Peninsula anti-locust mission was Major Leney, RASC.
[92] Another report notes there were nine Indians in the delegation – four Junior Locust Officers and five assistants. Chief Locust Officer, Middle East Anti-Locust Units 1944. Reporting of locust swarms by air crews. IOR/R/15/2/1545.
[93] Middle East Anti-Locust Unit 1944. Saudi Arabia and Oman Campaign 1944/1945. AIR 23/1098. TNA.
[94] *Ibid.*
[95] *Ibid.* Examples of the 3-ton trucks can be seen in one of the photographs in the article by Abdulla Abdul Rahman. These are most likely 15 Cwt Chevrolet C8 CMP trucks with Type 11 cab or similar, and would be a 4×4 as the 2×4 variants did not last long in ground conditions extant in that region. Lord, C. 13 November 2018. RE: Trucks in locust patrol (*email*).
[96] Maxwell-Darling, R.C., Chief Locust Officer 1943b. Letter of 20 August 1943. IOR/R/15/2/1545. Qatar Digital Library.
[97] Quoted in Kingston, P.W.T. 2002. Britain and the Politics of Modernization in the Middle East, 1945–1958, Cambridge University Press, Cambridge.
[98] Thesiger, W.P. 2008. Arabian Sands, Penguin Books, London.
[99] Morton, M.Q. 2013. Thesiger and the Oilmen. **Journal of the Petroleum History Institute 14:** 125–139.
[100] Thesiger, W.P. 1946. A New Journey in Southern Arabia. **The Geographical Journal 108:** 129–145.
[101] Thesiger, W.P. 2008. Arabian Sands. Penguin Books, London.
[102] Jaman, E.L. (ed.) 1998b. Political Diaries of the Arab World: Persian Gulf: 1961–1962. Archive Editions.
[103] Stobart, P.D., Political Agent Bahrain 1949. Bahrain Intelligence Summary for the Period 1st to 31st May 1949. IOR/R/15/2/320. Qatar Digital Library.
[104] Yates, A. & C. Lord 2019 (forthcoming). The Military and Police Forces of the Gulf States: Trucial States & United Arab Emirates, 1951–1980. Helion & Co., Warwick.
[105] Burdett, A. (ed.) 1997. Records of the Emirates 1961–1965: 1961. Archive Editions.
[106] The force had been involved in anti-locust operations periodically, such as in 1958. Jaman, E.L. (ed.). 1998a. Political Diaries of the Arab World: Persian Gulf: 1947–1958: 1958. Archive Editions.
[107] Coleman, J.H. 1962. Locust Control. **The Wire: The Royal Signals Magazine 16(6):** 209.

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Barley and wheat landraces of the United Arab Emirates

by Mohammad Shahid

Abstract

During botanical explorations of several wadis in the mountainous region of Ra's al-Khaimah emirate, United Arab Emirates (UAE), the cultivation of one local barley and three wheat landraces were studied. The native wheat in the region is primarily grown for making traditional food, but some farmers also use it as a fodder crop. The seeds of the four local cereal landraces were collected from Wadi Baih, Wadi Ghalilah and Wadi Sha'am. After raising of the plants, they were added to the genebank of the International Centre for Biosaline Agriculture, Dubai. The barley accession was of 2-row type, while the three wheat landraces included two species: *Triticum aestivum* and *T. durum*. This is the first known study of the cultivation of the native barley and wheat landraces of the UAE.

Introduction

The emirate of Ra's al-Khaimah (RAK) is divided into two parts, the northernmost of which is also the northernmost part of the UAE, where it shares the international border with the Musandam exclave of the Sultanate of Oman. Much is made up of part of the Hajar Mountain range, within which is Jebel Jais, the highest peak in the UAE. Within the mountains are a number of major wadis (valleys), the majority of which have extensive agricultural farms, many of which are abandoned (Shahid 2017). Archaeological excavations and research have shown that RAK has been continuously inhabited for more than 7,000 years.

Excavation and archaeobotanical studies at Tell Abraq (Figure 1), on the border between the Emirates of Sharjah and Umm al-Qaiwain, close to the Arabian Gulf coast, indicate that more than 4,000 years ago, both barley and wheat were probably being grown as food crops (Willcox & Tengberg 1995). Studies of the chaff and grains in mud-bricks at the site have shown that bread wheat (*Triticum aestivum*) and 6-row barley (*Hordeum vulgare*) were grown. (Willcox & Tengberg 1995). It has been suggested that the crops were introduced into the area from ancient Mesopotamia (Iraq) through trade (Gebauer *et al.* 2010).

Studies at the later archaeological site of Kush, RAK, have indicated the presence of two wheat species (*Triticum aestivum*, *T. durum*) and both 2-row and 6-row barley (*H. vulgare*) around 12–15,000 years ago in the region (Kennet 1997, Potts 2000). The Kush site is close to Wadi Baih where the local wheat landrace is still cultivated by the farmers.

Most local farmers use only rainwater for local wheat and barley planting in their farms. Seed is sown when there is good rain during the month of November, otherwise no planting takes place. The locally-produced wheat is used to make traditional food like Harees, Khabees and bread. A few farmers sometime use green wheat plants as fodder. Though barley grain generally is used for animal feed, it is also used in the preparation of some local traditional dishes.

The progenitor of cultivated barley (*H. vulgare*) is considered to be *H. vulgare* subsp. *spontaneum* (Badr *et al.* 2000), also called wild barley. The natural range of this wild subspecies is in parts of North Africa (Libya, Egypt), Southeast Europe (Cyprus and the Greek island of Crete) and Southwest Asia, where it is found from the eastern Mediterranean to the western parts of Pakistan (Harlan & Zohary 1966). The distribution of wild barley is more extensive in the Fertile Crescent of the Middle East than any other region.

Wild barley has fragile rachis, a slight spike and smaller grains, which make it less attractive for cultivation as a crop. At the time of maturity, its rachis breaks and hulled seeds get scattered. Cultivated barley, however, has a large spike with many sizeable seeds and its rachis does not shatter at the time of maturity. Studies by Avni *et al.* (2017), identified the mutations in Brittle Rachis 1 (TtBtr1) genes that led to a stronger rachis, a key factor in domestication of the wild grass.

Barley was first domesticated about 10,000 years ago in West Asia. In the beginning, it was used primarily for food, although it was later also used for animal feed and in brewing. Barley is the fourth major cereal crop after wheat, rice and maize. Based on number of grain rows on the spike, barley has been classified into 2-row and 6-row types.

Wild emmer (*T. turgidum* ssp. *dicoccoides*), a tetraploid, is the primogenitor of modern wheat (Dubcovsky & Dvorak 2007). Wild emmer grows naturally in modern-day Iraq, Israel, Jordan, Lebanon and Syria, part of the Fertile Crescent, as well as in Iran and Turkey. Later bread wheat (*T. aestivum*) evolved due to the hybridisation of domesticated emmer and Tausch's goatgrass (*Aegilops tauschii*), a diploid (McFadden & Sears 1946). The cultivation of wheat began more than 11,500 years ago, also in West Asia, and was a staple food of major civilisations in West and South Asia, Europe and North Africa. In terms of global trade, it is today the most important crop in the world. There are two types of wheats, one used for bread (*T. aestivum*) and the other for durum/pasta (*T. durum*). Bread wheat comprises about 95% and durum 5% of the worldwide grain production of this important cereal crop.

A crop landrace is a domesticated population of a plant species that has an ancient origin, a separate identity and

Figure 1. The locations of the three wadis, Baih, Ghalilah and Sha'am in the mountainous region of Ra's al-Khaimah (RAK) and the archaeological sites of Kush (RAK) and Tell Abraq (Umm al-Qaiwain).

Figure 2. Local wheat growing in a farmer's field in Wadi Baih, Ra's al-Khaimah (photo by Mohammad Shahid).

Figure 3. A native wheat landrace cultivation in Wadi Ghalilah, Ra's al-Khaimah (photo by Mohammad Shahid).

Table 1. GPS coordinates of the locations where the barley and wheat landraces were studied in the emirate of Ra's al-Khaimah.

S. N.	Crop	Name of landrace	Location	Coordinates	
				N	E
1	Wheat	Baih	Wadi Baih	25°88.2541	56°10.3298
2	Wheat	Ghalilah	Wadi Ghalilah	25°98.3818	56°15.1933
3	Wheat	Sha'am	Wadi Sha'am	26°03.8659	56°12.5460
4	Barley	Shaeer Sha'am	Wadi Sha'am	26°02.5952	56°12.8391

no history of refinement. A landrace is usually genetically varied, adapted to local conditions and related to conventional agricultural practices. Crop landraces that have been evolved through a consolidation of natural selection and collections made by farmers (Belay *et al.* 1995) generally have a wider genetic base. This is of use in any breeding programmes to develop a better variety (Keller *et al.* 1991). The wheat landraces are mostly tolerant to local stresses (Li *et al.* 1997), which make them a valued part of the gene pool.

Breeding success mainly depends on having access to suitable genetic diversity in crop gene pools. Genebanks are the sources of unique and valuable genetic variation exists in the gene pool of a crop. There are more than 850,000 accessions of wheat preserved worldwide. The CIMMYT (International Maize and Wheat Improvement Centre) genebank has more than 13% of these collections, the largest in the world, followed by NSGC (National Small Grain Collection) of the USA with around 7%. The ICBA genebank in Dubai contains more than 60 accessions of wheat.

Around 450,000 cultivars of barley have been reported from around the world. PGRS (Plant Gene Resources of Canada) genebank has about 45,000, the largest collection of its kind, while the NSGC genebanks with about 30,000 accessions are the second largest collection. ICARDA (International Centre for Agricultural Research in the Dry Areas) genebanks hold more than 28,000 barley landraces. The ICBA genebank has close to 5,000 barley cultivars, from over 100 countries.

Materials and Methods

Between 2015 and 2019, several botanical excursions were undertaken in Wadi Baih, Wadi Ghalilah and Wadi Sha'am, in the mountainous areas of northern Ra's al-Khaimah (Figure 1, Table 1). The barley and wheat farms were visited at different stages of the cropping season. Information on the cultivation of the two crops were collected from the farmers and agricultural workers. After the plants' maturity, the seeds of each barley and wheat landrace were then collected from the farms.

The following year, the collected seeds of the four landraces were planted in the field research facilities of the International Centre for Biosaline Agriculture (ICBA), Dubai for multiplication. Different traits of plants of the landraces were studied for identification. After threshing and cleaning, seeds of the four landraces were deposited at the ICBA genebank for conservation.

Results and Discussion

In Wadi Baih (Figure 2), sowing of wheat landrace was observed in around ten farms during the 2015–16, 2016–17 and 2018–19 cropping seasons. In Wadi Ghalilah (Figure 3), five farms with plots for wheat were observed. In 2015–16, barley and wheat landraces planting was noted in one and two plots respectively in Wadi Sha'am (Figure 4). In subsequent years, no cultivation of either crop was found anywhere in Wadi Sha'am, even during seasons of good rainfall. The plot where barley was grown has since remained fallow.

The sowing of the landraces in the wadi farms varies from year to year but is mainly dependent on sufficient rainfall at the right time. During 2017–18, as a result of insufficient rainfall in November 2017, no planting of wheat landraces was done in the plots used before and after that cropping season. Instead, the plots were left to lie fallow.

Local farmers do not buy seeds of the two crops from the market for planting. Instead, they save some seeds of the barley and wheat landraces after harvesting and use them for cultivation in the next season. This practice is said to have been passed down through generations. It cannot, however, be determined whether the same landraces are being cultivated that would have been used in the distant past.

It should be noted that many farms are no longer cultivated, with plots remaining fallow throughout the season, an indication of declining interest in farming.

The preliminary study of the three wheat landraces indicates that they are mixtures of, at least, two species, i.e., *Triticum aestivum* and *T. durum*. This heterogeneity within the wheat landraces was found in plots in all three of the wadis studied. The diversification within wheat landraces has also been reported from different parts of neighbouring Oman (Al Maskri *et al.* 2003, Jaradat & Shahid 2014). The barley landrace from Wadi Sha'am, a 2-row type, looks homogenous.

The seeds of all four landraces were collected directly from the farmers' fields. In the case of wheat, the seeds collected from different farms within the same wadi were put together and were designated as a single landrace. The following year, the seeds were multiplied at the International Centre for Biosaline Agriculture (ICBA), Dubai. After cleaning, the germplasm was deposited in the ICBA genebank for long-term conservation and future use in research and breeding programmes in the UAE and elsewhere. The conserved seeds of the four landraces may be of use in genetic improvement of the two crops for yield, nutritional composition and resistance against biotic and abiotic stresses.

Figure 4. Barley landrace growing in Ra's al-Khaimah's Wadi Sha'am (photo by Mohammad Shahid).

The conservation of the seeds of the local crop landraces before they disappear is of scientific importance, in terms of maintaining agricultural biodiversity. Landraces play an important role because of their adaptability to particular ecological environments and the repository of genetic variability they possess. The research into the local crop landraces is part of the efforts by the ICBA to explore, record, conserve, use and restore the botanical heritage of the United Arab Emirates.

Though archaeological studies indicate the existence of barley and wheat within the region thousands of years ago, definitive evidence of their past cultivation is lacking. It is suggested that the sowing of local wheat and barley landraces, reported here for the first time from the UAE, may represent a link to the agricultural practices of the past.

Conclusion

The landraces of barley, wheat and other crops in the UAE, as elsewhere, are at risk. With their adaptation to the local environments, they are a rich source of genetic biodiversity, important for local traditional agriculture as well as for research, which make them precious material for the local agriculture, as well as, for research and breeding. It is important that they are conserved.

References

Al-Maskri, A., M. Nagieb, K. Hammer, A. A. Filatenko, I. Khan & A. Buerkert 2003. A note about *Triticum* in Oman. **Genetic Resources and Crop Evolution 50:** 83–87.

Avni, R. *et al.* 2017. Wild emmer genome architecture and diversity elucidate wheat evolution and domestication. **Science 357:** 93–97.

Badr, A., K. Müller, R. Schäfer-Pregl, H. El Rabey, S. Effgen, H. Ibrahim, C. Pozzi, W. Rohde & F. Salamini 2000. On the origin and domestication history of Barley (*Hordeum vulgare*). **Molecular Biology and Evolution 17(4):** 499–510.

Belay G., T. Tesemma, E. Bechere & D. Mitiku 1995. Natural and human selection for purple-grain tetraploid wheats in the Ethiopian highlands. **Genetic Resources and Crop Evolution 42:** 387–391.

Dubcovsky, J. & J. Dvorak 2007. Genome plasticity a key factor in the success of polyploid wheat under domestication. **Science 316:** 1862–1866.

Gebauer, J., S. Al Khanjari, I. A. Khan, A. Buerkert & K. Hammer 2010. Plant genetic resources in Oman – Evidence of millennia of cultural exchange in the Middle East. Pp. 28–33 *in:* Buerkert, A. & E. Schlecht (eds.). Oases of Oman. Al Roya Press and Publishing House, Muscat, Oman.

Harlan J. R. & D. Zohary 1966. Distribution of wild wheats and barley. **Science 153:** 1074–1080.

Jaradat, A.A. & M. Shahid 2014. How diverse a farmer-managed wheat landrace can be? **Emirates Journal of Food and Agriculture 26(1):** 93–118.

Keller L., J.E. Schmid & E.R. Keller 1991. Are cereal landraces a source for breeding? **Landwirtschaft Schweiz 4:** 197–202.

Kennet, D. 1997. Kush: a Sasanian and Islamic-period archaeological tell in Ras al-Khaimah (U.A.E.). **Arabian Archaeology and Epigraphy 8:** 284–302.

Li, S., F. Sun, B. Guo, L. Liu & C. Pang 1997. Evaluation of abiotic stress resistance in Hebei winter wheat genetic resources. **Wheat Information Service 85:** 1–6.

McFadden, E.S. & E.R. Sears 1946. The origin of *Triticum spelta* and its free-threshing hexaploid relatives. **Journal of Heredity 37:** 81–89, 107.

Potts, D.T. 2000. Ancient Magan: The secrets of Tell Abraq. Trident Press Limited, London.

Shahid, M. 2017. Goats: a threat to biodiversity in the United Arab Emirates. **Tribulus 25:** 4–12.

Willcox, G. & M. Tengberg 1995. Preliminary report on the archaeobotanical investigations at Tell Abraq with special attention to the chaff impressions in mud brick. **Arabian Archaeology and Epigraphy 6:** 129–138.

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Gecko species from Wadi Wurayah in the UAE

by Johannes Els

Volume 26 (2018) of ***Tribulus*** published a paper *Additions to the herpetofauna of the Wadi Wurayah National Park, Fujairah* (Farkas *et al.* 2018) reporting results of investigations undertaken in Wadi Wurayah National Park, WWNP, Fujairah, adding one colubrid snake, Arabian cat snake, *Telescopus dhara dhara* (Forskål, 1775), to the reptile records from the park and also reporting the presence of two gecko species.

One of the gecko species was identified by Farkas *et al.* (2018), on the basis of photographs, as Musandam leaf-toed gecko, *Asaccus caudivolvulus* Arnold and Gardner, 1994, citing Gardner (2013) to distinguish it from *A. gallagheri* (Arnold, 1972).

Asaccus caudivolvulus was originally described based on collections from two different localities: the type locality in Khor Fakkan, UAE, and Khasab, a locality 100 km to the north, in the Musandam Peninsula, Oman. In the original description, Arnold & Gardner (1994) observed that the specimens from Khasab and Khor Fakkan differed in some characteristics. Nevertheless, given the lack of material from intermediate localities, the specimens from Khasab were not described as a new species.

Figure 1. Distribution of *Asaccus caudivolvulus* in the UAE.

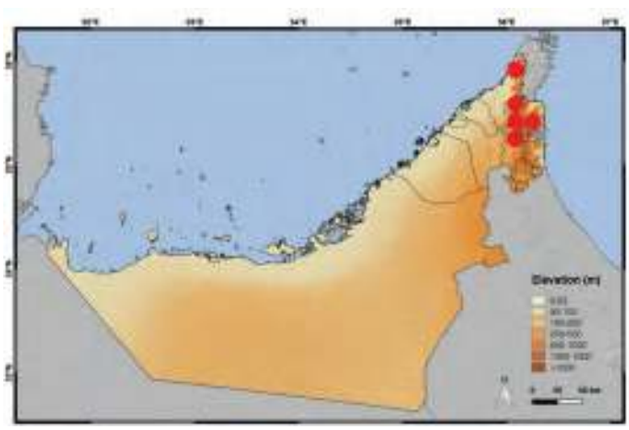

Figure 2. Distribution of *Asaccus gardneri* in the UAE.

Subsequently, Carranza *et al.* (2016) split A. *caudivolvulus* into three distinct microendemic species: *A. margaritae* Carranza, Simó-Riudalbas, Jayasinghe, Wilms and Els, 2016 from the Wadi al Helo area (Sharjah Emirate) in the UAE, *A. gardneri* Carranza, Simó-Riudalbas, Jayasinghe, Wilms and Els, 2016 which is widely distributed in the northern Hajar mountains of the UAE and Musandam Peninsula of Oman (which includes Khasab), and *A. caudivolvulus*.

Thus, the decision by Farkas *et al.* (2018) to rely on Gardner (2013), derived from Arnold & Gardner (1994), to identify their records from Wadi Wurayah as *A. caudivolvulus* was no longer well-founded, since the species had already been split by Carranza *et al.* (2016).

From the photographic evidence presented, it appears that the species shown should instead be considered as being *A. gardneri*. A. S. Gardner, co-author of the paper that originally described *A. caudivolvulus* (Arnold & Gardner 1994) (*pers. comm.*), and G. R. Feulner (*pers. comm.*) concur with this view.

The third of the three microendemic species described by Carranza *et al.* (2016), for which the name *A. caudivolvulus* was retained, has a known range of approximately 8 km^2, centred on Khor Fakkan, being restricted to coastal hills and some adjacent inland areas, within which elevation ranges from sea level to around 20 m. The species is considered to be the only endemic vertebrate of the UAE. The species is not protected and is not currently known from any protected areas. Due to its restricted distribution and threats, the species conservation priority is categorised as Critically Endangered.

The two specimens identified by Farkas *et al.* (2018) as *A. caudivolvulus* were encountered at approximately 195 m and 190 m within WWNP, several kilometres from and at considerably higher elevations than the currently-known range of that species. However, *A. gardneri* has been frequently recorded at those elevations.

Moreover, through a comprehensive sampling effort, Carranza *et al.* (2016) and Burriel-Carranza *et al.* (2019) have confirmed the presence of *A. gardneri* in Wadi Wurayah and surrounding areas. For all of these reasons, it is recommended that the species from Wadi Wurayah identified as *A. caudivolvulus* by Farkas *et al.* (2018), and depicted therein, is best treated for the moment as *Asaccus gardneri*. It is understood that genetic analysis is currently being undertaken by B. Farkas (*pers. comm.*) to confirm the earlier photographic identification.

The second gecko species, with “non-contrasting head patterns”, recorded by Farkas *et al.* (2018) was tentatively assigned by them to the taxon, Orlov’s fan-footed gecko, *Ptyodactylus orlovi* Nazarov, Melnikov and Melnikova,

2013 although they noted that "the low resolution of our digital pictures makes a detailed comparison with the two species consistent with this feature—*P. orlovi* and *P. ruusaljibalicus*—impossible."

The presence of *P. orlovi* in the WWNP is attested by Simó-Riudalbas *et al.* (2017) and Burriel-Carranza *et al.* (2019), thereby supporting the identification of *P. orlovi* by Farkas *et al.* (2018).

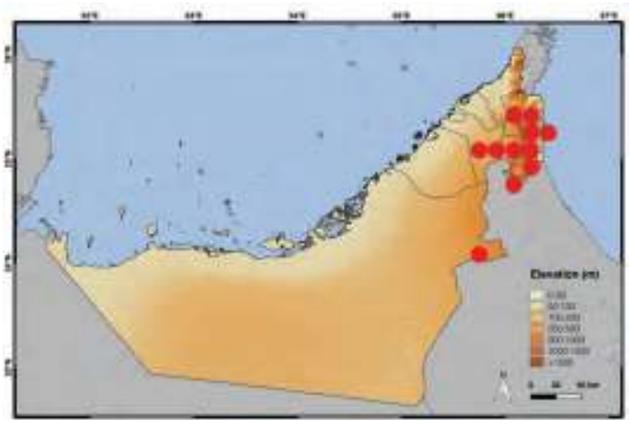

Figure 3. Distribution of *Ptyodactylus orlovi* in the UAE.

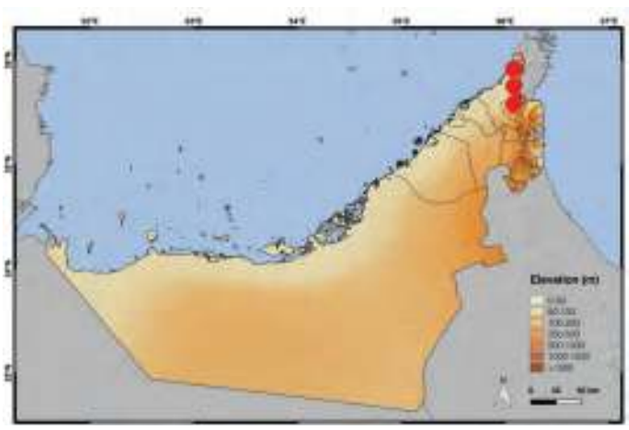

Figure 4. Distribution of *Ptyodactylus ruusaljibalicus* in the UAE.

References

Arnold, E.N. & A.S. Gardner 1994. A review of the Middle Eastern leaf-toed geckoes (Gekkonidae: *Asaccus*) with descriptions of two new species from Oman. **Fauna of Saudi Arabia 14:** 424–441.

Burriel-Carranza, B., Tarroso, P., Els, J., Gardner, A., Soorae, P., Mohammed, A.A., *et al.* 2019. An integrative assessment of the diversity, phylogeny, distribution, and conservation of the terrestrial reptiles (Sauropsida, Squamata) of the United Arab Emirates. **PLoS ONE 14(5):** e0216273.

Carranza, S., Simó-Riudalbas, M., Jayasinghe, S., Wilms, T. & J. Els 2016. Microendemicity in the northern Hajar Mountains of Oman and the United Arab Emirates with the description of two new species of geckos of the genus *Asaccus* (Squamata: Phyllodactylidae). **PeerJ 4:** e2371.

Farkas, B., Buzás, B. & V. Farkas. 2018. Additions to the herpetofauna of the Wadi Wurayah National Park, Fujairah. **Tribulus 26:** 24–45.

Gardner, A.S. 2013. The amphibians and reptiles of Oman and the UAE. Frankfurt Contributions to Natural History 58. Edition Chimaira, Frankfurt am Main.

Simó-Riudalbas, M., Metallinou, M., de Pous, P., Els, J., Jayasinghe, S., Péntek-Zakar, E., Wilms, T., Al-Saadi, S. & S. Carranza 2017. Cryptic diversity in *Ptyodactylus* (Reptilia: Gekkonidae) from the northern Hajar Mountains of Oman and the United Arab Emirates uncovered by an integrative taxonomic approach. **PLoS ONE 12(8):** e0180397.

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Garra barreimiae Fowler & Steinitz, 1956 (Cyprinidae: Labeoninae): A video record of individuals scaling the main waterfall in Wadi Wurayah National Park, Fujairah

by Sami Ullah Majeed, Gary R. Feulner & Ali Hassan Al Hmoudi

Garra barreimiae deserves our respect. One of only two native freshwater fish still found in the UAE, it is widespread but localised in the dry, rocky wadis of the Hajar Mountains of the UAE and northernmost Oman. There it must cope with a nutrient-poor environment, extreme surface water temperatures, and extremes of drought and flash flooding. Increasingly, too, water extraction and infrastructure construction (roads, powerlines and dams) are destroying native freshwater habitats, even in formerly remote areas (Figure 1).

Garra barreimiae is a small, streamlined bottom feeder that eats primarily algae and other small organisms that live on rock surfaces, as well as organic detritus (Freyhof *et al.*, in press). Individuals resemble catfish as they nuzzle their way along the bottom and sides of rocky pools. Their movement is generally leisurely but they can dart about frantically when approached in shallow water bodies where they are vulnerable to predators. Their normal colour is mottled brown, typically dark but varying somewhat with the surroundings. Larger adults may show more colourful orange, red, white and blue markings (Feulner 1998, 2005).

Garra is a large genus belonging to the carp family (Cyprinidae). Approximately 150 species of *Garra* are known today from fresh waters in the Middle East, South and Southeast Asia, and tropical Africa. These include the so-called “doctor fish” used in spas for pedicures. Almost all *Garra* species (and all *Garra* in the Middle East) are distinguished by a kind of natural suction cup, called the “mental disc,” formed from the skin of the lower jaw and located immediately behind the downward pointing mouth (Freyhof *et al.*, in press). This makes them relatively easy to distinguish.

The mental disc is generally regarded as an adaptation to living in flowing water, enabling the fish to maintain their position while resting or feeding in a current. However, in at least a few species of *Garra* found in Arabia, including *G. barreimiae*, the mental disc is also used for a less ob-

Figure 1. Adult *Garra barreimiae* from Wadi Farfar, Fujairah (photo by Gary R. Feulner).

vious and more surprising purpose – to climb rock faces and waterfalls during periods of rain or increased flow (Feulner 1998, 2005, Freyhof *et al.,* in press). This facilitates the dispersal of the fish population and its re-colonisation of newly refreshed upstream habitats which may have been completely desiccated by drought.

It seems almost impossible that these little fish can ascend rock faces more than 100 times their own body lengths, but this behaviour has been observed and photographed (Feulner 1998, also reporting film footage by UAE photographer Mike Shepley). Adult *G. barreimiae* can reach a maximum of ca. 7–8 cm in length, but the normal size range is ca. 3.5–6.0 cm, and it appears that most climbers are medium-sized fish, probably adolescents or young adults.

A recent observation of this climbing phenomenon is a particularly dramatic one, and can now be viewed online. In April 2019, Wadi Wurayah National Park (WWNP) rangers on patrol in the waterfall area spied a group of some 12 to 15 individuals of *G. barreimiae* attempting to scale the 8-metre main waterfall – the only permanent waterfall in the UAE. The fish were observed on the wet surface beside the main flow of water, wriggling, pausing, shooting forward, and in some instances making small leaps (not always successfully) to span gaps in the ascent. Climbing activity was observed and filmed twice during the same afternoon, for an hour or more each time, at 13:00 and 17:00 hours, and is believed to have continued

Figure 2. Screenshot from the video showing a group of *Garra barreimiae* climbing the waterfall (photo by Sami Ullah Majeed).

Figure 3. Screenshot (close-up) from the video showing a single *Garra barreimiae* climbing the waterfall (photo by Sami Ullah Majeed).

Figure 4. Overview of the main waterfall area, Wadi Wurayah (photo by Sami Ullah Majeed).

Figure 5. The main waterfall at Wadi Wurayah, the UAE's only year-round waterfall (photo by Sami Ullah Majeed).

throughout that period. A video record is available at the YouTube account of WWNP: *https://youtu.be/pqY-dUBP-pUE* (Figures 2 and 3).

A park ranger (SUM) was in the plunge pool when the climbing fish were first noticed, but climbing was already under way when the pool was re-entered for further observation several hours later. The total number of fish that may have been involved was not determined. The bedrock pools below the falls are estimated to contain several hundred *G. barreimiae*, although not all would be of suitable size to make the climb. Multiple fish were always seen ascending, but the success rate was difficult to ascertain. Several fish were observed just below the uppermost lip of the falls, but at that point they each entered the current and their success or failure could not be confirmed. However, those observations suggest a consistent strategy and hint that there may be an advantage for the fish to make their final surge within the current itself, before the water is in free fall.

The WWNP video is consistent with Feulner's (1998) account of *G. barreimiae* attempting "to climb a 4-meter waterfall consisting of several steep chutes. They ascended on the wet surface of the splash zone immediately adjacent to the main flow of water, sometimes wriggling, sometimes jetting forward, resting periodically with pectorals spread, the mental disc apparently engaged for suction, and the tail twisted and pressed flat against the rock." The WWNP video also appears to be consistent with the earlier generalisation that the fish seem to embark on their ascent in small groups (Feulner 1998). However, it remains to be determined just when and why they embark, and how often they are successful in overcoming the most difficult obstacles.

Wadi Wurayah, located in the Emirate of Fujairah, is one of the UAE's largest mountain watersheds and has the most extensive surface freshwater resources in the form of pools, streams and springs. Wadi Wurayah National Park, the UAE's first mountain protected area, encompasses an area of 220 km^2. It is also a RAMSAR site and UNESCO Biosphere Reserve. Its montane and freshwater ecosystems are home to more than 800 species of flora and fauna, including numerous plants and animals endemic to the Hajar Mountains (Figures 4 and 5).

References

Feulner, G.R. 1998. Wadi fish of the UAE. **Tribulus 8(2):** 16–22.

Feulner, G.R. 2005. Freshwater fishes. Pp. 257–259 *in:* Hellyer, P. & S. Aspinall (eds.). The Emirates – a natural history. Trident Press.

Fowler, H.W. & H. Steinitz 1956. Fishes from Cyprus, Iran, Iraq, Israel and Oman. **Bulletin of the Research Council of Israel 5B(3/4):** 260–292.

Freyhof, J., Els, J., Feulner, G.R., Hamidan, N.A. & F. Krupp (in press). Freshwater fishes of the Arabian Peninsula. Motivate Publishing, Dubai.

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A daytime record of Arabian Spotted Eagle Owl (*Bubo milesi* Sharpe, 1886) on the periphery of Wadi Wurayah National Park, Fujairah, UAE, and notes on its behaviour

by Sami Ullah Majeed

On the afternoon of 27th October 2019, I was informed by a member of the local community about a 'strange bird' found roosting in the mountains on the periphery of Wadi Wurayah National Park (WWNP), Fujairah, on a *Ziziphus spina-christi* tree, locally known as *sidr*. After a mountain hike of about 1.2 km, I reached an area at an elevation of ca. 158 metres that had at least eight *sidr* trees and some acacias (*Vachellia tortilis*) (Figure 1). The bird was perched on a branch of a large *sidr* and I took a few photographs (Figures 1 and 2). It appeared to be an eagle owl. The owl stayed there for at least seven minutes and then flew to a nearby rocky perch. Quickly visiting the tree, I found many droppings and pellets under it and, to my surprise (Figure 3), another smaller owl among the rocks nearby. The second owl started calling and trying to fly but without any success. It seemed stressed by my presence (Figure 4) and I moved quickly away after taking a few photographs.

I initially identified the larger owl as an Arabian Spotted Eagle Owl (*Bubo milesi* Sharpe, 1886). To confirm this, I contacted Jacky Judas, of Emirates Nature – WWF, and Tommy Pedersen, the Bird Recorder for the Emirates Bird Records Committee, who also manages the UAE Birding website (*www.uaebirding.com*) which maintains a complete database of birds recorded in the country. They confirmed the identification as Arabian Spotted Eagle Owl, with Pedersen noting that the photographs taken were the first-ever daytime pictures of the species to be taken in the Emirates. Pedersen identified the small owl as an adult European Scops Owl (*Otus scops*), also known as Eurasian Scops Owl.

I made a subsequent visit to the location on the morning of 30th October and found the eagle owl at the same tree and on exactly the same branch. I was able to approach to a distance of around 20 metres from the tree and set up my camera on a tripod to take clearer pictures of the owl. It was awake and actively scanning the surrounding area by rotating its head. After a few minutes, it flew to a nearby rocky area, then moved quickly over the rocks and jumped up to reach a boulder. From there, it continued upwards to a position at least 10 metres from where it first landed. At that point, it looked around and then moved out of view behind other boulders, possibly into a small cave. I did not investigate further, suspecting there could be a nest with eggs or chicks. However, Jennings (2010) states that the limited evidence available for the breeding season suggests that this is from spring to early summer, with young being seen in the UAE in May 2018 and May 2019 (O. J. Campbell, pers. comm.).

I then returned to the *sidr* tree at which I had first seen the two owls. There was no sign of the European Scops Owl seen on my first visit. I collected one Eagle Owl pellet for identification of the prey species consumed by the owl, to be determined from the remains of bones, hairs and feathers, and other body parts present in the pellet.

The Arabian Spotted Eagle Owl (*Bubo milesi* Sharpe, 1886), formerly believed to be a subspecies of Spotted Eagle Owl, *Bubo africanus*, is now considered a separate species (Robb & The Sound Approach 2015) and is found in Saudi Arabia, Oman, Yemen and the UAE. According to the Emirates Bird Records Committee (EBRC) Annotated

Figure 1. Wide angle view of the Arabian Spotted Eagle Owl roosting site on 27 October 2019 (photo by Sami Ullah Majeed).

Figure 2. Closeup view of the Arabian Spotted Eagle Owl, 27 October 2019 (photo by Sami Ullah Majeed).

Figure 3. Arabian Spotted Eagle Owl perched on the hillside, 27 October 2019 (photo by Sami Ullah Majeed).

Figure 4. European Scops Owl under the *sidr* tree, 27 October 2019 (photo by Sami Ullah Majeed).

Figure 5. Eagle Owl droppings (above) and pellet collected from the site (below) (photos by Sami Ullah Majeed).

Checklist of the Birds of United Arab Emirates, the first confirmed records of the species in the UAE were made in November 2017 and April 2018 at two undisclosed sites in the Hajar Mountains. Subsequent fieldwork established the species as a scarce and inconspicuous resident of the UAE's Hajar Mountains, with approximately 10 territories being located by May 2018 (Robb *et al.* 2018).

A juvenile Arabian Spotted Eagle Owl given to Dubai Zoo in 2003 was said to have come from mountains near Dibba. At that time, it was considered to be from a subspecies of Desert Eagle Owl (*Bubo ascalaphus*), its identity becoming apparent as it matured. It remained at Dubai Zoo for more than 11 years (M. A. Reza Khan, pers. comm., November 2019). However, it was not possible to determine whether this bird had been collected within the United Arab Emirates or from the adjacent Musandam exclave of Oman and whether, therefore, it represented a first record of the species for the UAE.

The presence of the disabled Eurasian Scops Owl at the Arabian Spotted Eagle Owl roost reported here is intriguing for the insight that it may suggest into the habits and diet of *B. milesi*. As suggested by T. Pedersen (pers. comm.), the most reasonable explanation for the presence of the scops owl at the roost site is that it had been hunted by the eagle owl and had somehow managed to escape, although perhaps not for long. The diet of *B. milesi* is known to be opportunistic, including diverse avian prey such as sunbirds, doves, falcons, hornbills and francolins (Holt *et al.* 2020). If the foregoing interpretation is correct,

it would represent a first known record of Arabian Spotted Eagle Owl predation on European Scops Owl.

Acknowledgements

I would like to thank Mr. Haitham Abdullah Al Hmoudi from the local community who was kind enough to guide me to the location. Mr. Jacky Judas of Emirates Nature – WWF and Mr. Tommy Pedersen from the Emirates Bird Records Committee confirmed the identification of the Arabian Spotted Eagle Owl. Mr. Pedersen also identified the European Scops Owl and encouraged the inclusion of that record, and its possible significance, in this account. I express my profound thanks to Dr. Ali Hassan Al Hmoudi (Wadi Wurayah National Park Manager) for his continuous support and guidance as our team leader. My appreciation is also extended to H.E. Eng. Mohamad Saif Al Afkham, Director General, Fujairah Municipality, and Eng. Fatma Al Sharary, Director of its Public Services and Environment Department, for their personal support. I am extremely thankful to Dr. Reza Khan, a wildlife specialist who has been resident in the UAE for the past 37 years, for reviewing a draft of this report and providing the information about the owl taken to Dubai Zoo. I am also grateful to Mr. Maral Khaled Chreiki, for reviewing this report and providing valuable input, and to Mr. Gary Feulner for helpful edits to the draft.

References

Holt, D.W., Berkley, R., Deppe, C., Enríquez Rocha, P., Petersen, J.L., Rangel Salazar, J.L., Segars, K.P., Wood, K.L. & J.S. Marks 2020. Spotted Eagle-owl (*Bubo africanus*). *In:* del Hoyo, J., Elliott, A., Sargatal, J., Christie, D.A. & E. de Juana (eds.). Handbook of the birds of the world alive. Lynx Edicions, Barcelona. Retrieved from *https://www.hbw.com/node/55012* on 25 February 2020.

Jennings, M.C. 2010. Atlas of the breeding birds of Arabia. **Fauna of Saudi Arabia 25:** 1–751.

Robb, M.S., Judas, J. & A.Q. Stoquert 2018. Arabian Eagle-owls in United Arab Emirates and northern Oman. **Dutch Birding 40(5):** 326–327.

Robb, M. & The Sound Approach 2015. Undiscovered owls: a Sound Approach guide. Poole, UK.

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First UAE record of the Indian Fritillary butterfly *Argynnis hyperbius* (Lepidoptera: Nymphalidae: Heliconiinae) from the Hajar Mountains, Fujairah

by Binish Roobas

Introduction

The Indian Fritillary *Argynnis hyperbius* has been identified from three individuals (a male and two females) observed and photographed in February 2020 at two open, well-vegetated sites about a kilometre apart in the lower reaches of the Wadi Wurayah watershed in Wadi Wurayah National Park (WWNP). The park is located in the Hajar Mountains of Fujairah Emirate on the Indian Ocean coast of the UAE (Figure 2). Those observations constitute the first record of *A. hyperbius* for the UAE. They may also constitute the first confirmed record for the Arabian Peninsula.

Biogeography

Argynnis hyperbius belongs to a group of butterflies that is Palaearctic in origin, and is primarily a species of cooler areas. It is common in the Himalayan region from Afghanistan and Pakistan to Northern India and Nepal, but its range extends east to China and Japan and southeast to mountain regions of Southeast Asia, the Indonesian archipelago and New Guinea (Larsen 1987a-b) and even Australia (Savela online).

To the west, *A. hyperbius* is found in Iran but is apparently rare (it is listed in Mohammadian [2006] but not in Nazari [2003a, 2003b]), and in Ethiopia (Larsen 1987a-b) where it is also rare (D. Benyamini pers. comm., 2020). The distribution map in Tuzov & Bozano (2017) shows its West Asian range as Baluchistan and the Makran region of southern Iran, and extends the previously reported range to much of the UAE and northern Oman, where the map is truncated. There is, however, no information on whether the map is based on actual records or educated surmise, based on the Oman–Makran distribution of numerous plant and animal species (including several butterflies).

Observations

During a mid-February 2020 midday reconnaissance of plants and animals in a well-vegetated wadi in lower Wadi Wurayah, following relatively heavy rains in October

Figure 1. A basking male of the Indian Fritillary *Argynnis hyperbius*, seen in Wadi Wurayah, Fujairah, UAE in mid-February 2020 (photo by Binish Roobas).

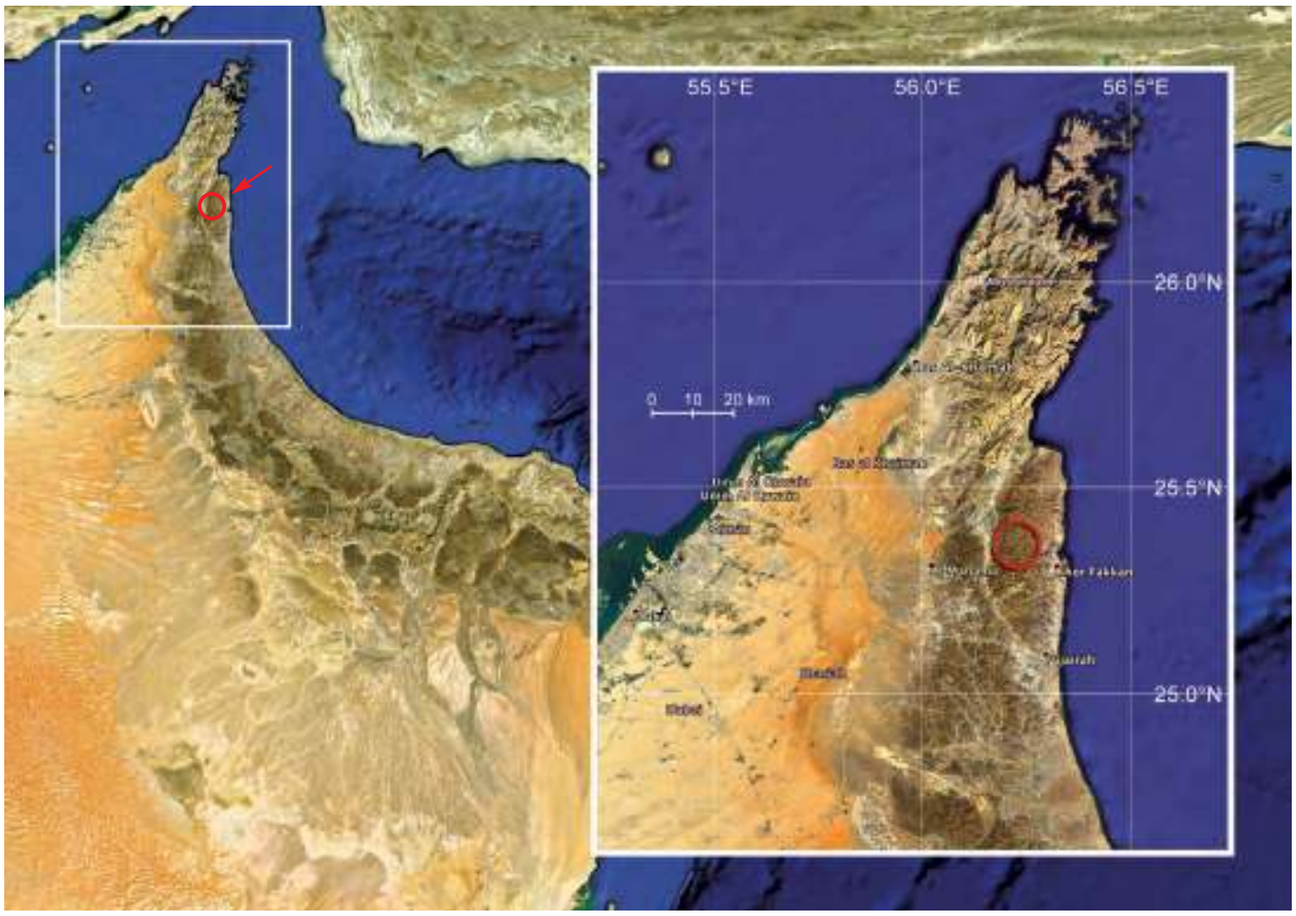

Figure 2. Regional map showing the UAE and the location of Wadi Wurayah National Park (red circle).

2019 through mid-January, my attention was attracted to an orange butterfly flying with several Plain Tigers *Danaus chrysippus*. It was slightly smaller, slightly different in colour and with a much more hurried, erratic, less stately flight. When it alighted and basked on a patch of barren gravel (Figure 1) I recognised immediately that it was a butterfly new to the UAE (Feulner *et al.*, in press). It was spotted like the Common Leopard butterfly *Phalanta phalantha* but the hindwing margins resembled those of Lacewing butterflies (*Cethosia* spp.) that I know well from India.

From experience, I suspected the new butterfly was a male. That suspicion was confirmed. I later had sightings of two females in late afternoon, trying to roost in an area of low shrubs and grasses not more than 1km from the male sighting, where many Plain Tigers had already roosted. Each of the females was initially flushed by human observers. Thereafter, they proved to be easily disturbed, each flying first ten metres or so in an arc, and then high and fast and over low ridges. I was able take a few photographs of one female before it disappeared (Figure 3).

Identification

It was a relatively simple effort to identify the new butterfly from online and paper references as the Indian Fritillary *Argynnis hyperbius* (Linnaeus, 1763) and to rule out competing possibilities such as the Queen of Spain Fritillary (*Issoria lathonia*) and the Large Silverstripe (*Argynnis childreni)*.

Figure 3. Profile of a female *Argynnis hyperbius* in flight, showing the markings at the angle of the forewing, which resemble those of the Plain Tiger *Danaus chrysippus* and Painted Lady *Vanessa cardui* (photo by Binish Roobas).

Figure 4. The well-vegetated tributary of Wadi Wurayah in which the male *A. hyperbius* shown in Fig. 2 was found (photo by Gary R. Feulner).

Argynnis hyperbius has sometimes been classified in a separate genus as *Argyreus hyperbius* (e.g., Kunte 2000, Kehimkar 2008), but most recent authors assign it to *Argynnis*. Two south Indian butterflies formerly recognised as separate species, *Argynnis costetsi* and *A. hybrida*, are now generally treated as subspecies of *A. hyperbius* (Kunte 2000, Kehimkar 2008).

The Indian Fritillary is a relatively large butterfly, the female being larger than the male, but the observed UAE specimens appeared to be smaller than the 65–85 mm wingspans recorded for India. The male appeared smaller than the local Plain Tigers with which it flew; I estimated the female to be about the same size as local Plain Tigers (ca. 61–77 mm).

The upperside of the male is unmistakable in the UAE – bright tawny orange with more or less evenly distributed black spots, becoming smaller rearward. The rear edge of the hindwings has a black margin decorated with two rows of thin blue-white chevrons. The male underside, featuring a tessellated hindwing and black-spotted orange forewing, could possibly be mistaken in haste for the Painted Lady *Vanessa cardui*.

The female upperside has a similar orange ground colour with black spots, the hindwing uppersides have a black rear margin decorated with chevrons, and the hindwing underside is tessellated – all like the male. The apex of the female forewings, however, is dramatically marked on both upperside and underside with black colour, highlighted towards its interior by a thick, jagged, diagonal band of white. The female colouration is said to mimic that of the toxic Plain Tiger *Danaus chrysippus*, and Larsen's (1987a-b) anecdotal data suggests that this mimicry is effective in reducing avian predation on female *A. hyperbius* versus males.

Presence in the UAE

It was a surprise, after many years of investigating butterflies in the UAE, to find a previously unrecorded species in the wild, but the presence of the Indian Fritillary in the Hajar Mountains may not be as surprising as it might seem at first. Larsen (1987a-b) speaks admiringly of *A. hyperbius*, as follows:

> "The INDIAN FRITILLARY is a Palaearctic butterfly that has managed to colonise the montane zones of Ethiopia, South India, Sri Lanka, Malaysia, Sumatra, Sulawesi (Vane-Wright, pers. comm.), and New Guinea. This feat is quite unique in the butterfly world but it is reminiscent of several genera of plants (e.g., *Impatiens*). Possibly the wide range is due to the migratory capacity of the species which may breed on the plains of India during winter. I have seen large numbers on the Chambal river south of Agra in December 1986, several hundred kilometres from any permanent foothold."

Argynnis hyperbius in the UAE is almost certainly a temporary migrant, probably from more northerly populations in neighbouring Iran, visiting to take advantage of favourable conditions arising from repeated substantial rainfall in the Hajar Mountains during the period from October 2019 through January 2020. The larval foodplants of *A. hyperbius* throughout its range are said to be species of *Viola* (Violaceae). In the Hajar Mountains, that genus is represented only by *V. cinerea*, a diminutive, delicate perennial that is also found in southern Iran, the Makran and Baluchistan (eFloras online, Open Herbarium online), where Tuzov & Bozano (2017) map the distribution of *A. hyperbius*. *Viola cinerea* can be found at all elevations; it is seldom common but is more abundant after rain, and a few plants were found near the site in Wadi Wurayah where the male *A. hyperbius* was observed, so local breeding is a possibility. A biogeographic range encompassing the Hajar Mountains, the Makran and Baluchistan is common to many regional plants and animals, e.g., *Euphorbia larica*, Hume's Wheatear *Oenanthe alboniger*, and the Persian Horned Viper *Pseudocerastes persicus*.

Intermittent or occasional opportunistic migration is a well-established pattern in the Arabian environment. Other rare or uncommon UAE butterflies that are intermittent winter visitors include the White Desert Black Tip *Euchloe amseli* and Small Cabbage White *Pieris rapae*. The number of more regular winter visitors also varies considerably from year to year as well, e.g., African Emigrant *Catopsilia florella* and Painted Lady *Vanessa cardui*. However, few, if any, of these species are seen in the UAE in high summer.

Likewise, *A. hyperbius*, although it is active and breeds throughout the year in most of its range (Larsen 1987a-b), is unlikely to be able to survive the high temperatures of the Arabian summer. The chances that it can establish a permanent presence are probably very low. More likely, future occurrences, if any, will rely on inward migration in "wet" winters, or on other serendipitous events. It is nevertheless a pleasure to welcome this beautiful butterfly to the UAE.

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I am grateful to the management and staff of Wadi Wurayah National Park, and in particular to Dr. Ali Hassan Al Hmoudi, Sami Ullah Majeed and Nuri Asmita, for their invitation to visit and update earlier investigations of the biodiversity of WWNP, and for assistance in the field. Dubi Benyamini and Ofir Tomer alerted me to the information and map presented in Tuzov (2017) and provided access to that information. I am also grateful to Gary Feulner for his continuing encouragement and support of my UAE fieldwork, for thoughtful discussion of many aspects of UAE natural history, and for conscientious review of a draft of this paper.

References

eFloras online. Flora of Pakistan. *http://www.efloras.org/flora_page.aspx?flora_id=5* (accessed 25 February 2020).

Feulner, G.R., Roobas, B., Hitchings, V.H., Otto, H.H.H., Roberts, H.G.B., Campbell, O., Hornby, R.J. & B. Howarth (in press). Butterflies of the United Arab Emirates. Motivate Publishing, UAE.

Kehimkar, I. 2008. The book of Indian butterflies. Bombay Natural History Society, Mumbai and Oxford University Press, Oxford, 497 pp.

Kunte, K. 2000. Butterflies of Peninsular India. Universities Press (India), Hyderabad, 254 pp. + 31 plates.

Larsen, T.B. 1987a. The butterflies of the Nilgiri Mountains of Southern India (Lepidoptera: Rhopalocera). **Journal of the Bombay Natural History Society 84(1):** 26–54.

Larsen, T.B. 1987b. The butterflies of the Nilgiri Mountains of Southern India (Lepidoptera: Rhopalocera). **Journal of the Bombay Natural History Society 84(2):** 291–316.

Mohammadian, H. 2006. Biological diversity of Lepidoptera in Iran. Shabpareh Publications, Tehran, 385 pp. (checklist available online at: *https://en.wikipedia.org/wiki/List_of_butterflies_of_Iran*)

Nazari, V. 2003a. Butterflies of Iran. Department of Environment, Tehran, 564 pp. + 74 colour plates (in Farsi language).

Nazari, V. 2003b. Checklist of the Butterflies of Iran (unpublished English language excerpt from Nazari 2003a).

Open Herbarium online. Pakistan, Balochistan. *https://openherbarium.org/ident/key.php?cl=141&proj=7&taxon=All+Species* (accessed 25 February 2020).

Savela, M. online. *http://ftp.funet.fi/pub/sci/bio/life/insecta/lepidoptera/ditrysia/papilionoidea/nymphalidae/heliconiinae/argynnis/* (accessed 23 February 2020).

Tuzov, V.K. & G.C. Bozano (eds.) 2017. Guide to the butterflies of the Palaearctic Region: Nymphalidae 1: Tribe Argynnini. *Argynnis*, *Issoria*, *Brenthis*, *Argyreus*. Omnes Artes, Milano.

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Long-flange Millipede *Orthomorpha coarctata* (De Saussure, 1860) – a new exotic arthropod for the UAE

by Reza Khan

Over the course of the last few decades, a growing number of species of fauna and flora have been introduced, deliberately or accidentally, to the United Arab Emirates, now comprising a significant element of the country's biodiversity. Many have established self-sustaining populations.

While considerable amounts of data have been collected on some of the most visible species, in particular introduced and self-sustaining birds, like Common Myna and White-eared Bulbul, studies have been undertaken, less is known of some other orders.

Some species have been deliberately released or are escapees from captivity. Others, however, have been imported accidentally, often as a result of the import of soil, manure, organic compost and plants for use in parks and gardens. It has been suggested, for example, that one such species, the Brahminy Blind Snake or Flowerpot Snake, *Indotyphlops braminus* (Daudin, 1981), recorded in Dubai since the 1980s, "is frequently transported in the root ball of shrubs and trees" (Gardner 2013).

This note places on record the identification of a new species of arthropod for the UAE, the Long-flange Millipede *Orthomorpha coarctata*, formerly known as *Asiomorpha coarctata*.

Orthomorpha coarctata is not recorded on the Alien Species Database being developed by the Environment Agency – Abu Dhabi, EAD. No other millipede species have been recorded in the UAE (P. Soorae, pers. comm.).

I first identified the presence of this millipede species during a visit in May 2019 to the public park in Hatta, the mountain exclave of the Emirate of Dubai. I assumed that the specimen seen had been imported with manure, compost or at the base of imported plants that had been planted in the park and that it would not survive the heat of summer. During a return visit in October 2019, however, a number of specimens were noted, suggesting a flourishing population.

Through an Internet search, I identified an author of scientific papers on millipedes, Dr. Peter Decker, of the Department of Soil Zoology of the Senckenberg Museum of Natural History in Germany, and sent him a short video clip and several still photographs of the millipede.

Dr. Decker kindly provided a tentative identification of the species as Long-flanged Millipede and asked me to supply him with several specimens to permit confirmation. He will now undertake detailed taxonomical study and possibly genetic analysis, with results to be published at a later date.

Presumed native to South-East Asia, Long-flange Millipede now occurs widely in tropical and sub-tropical areas throughout the world, thanks to transport by humans, including the Cook Islands, Hawaiian Islands, the West

Figure 1. Long-flange Millipede, Orthomorpha coarctata photographed in Hatta Park, Emirate of Dubai (photo by Reza Khan).

Indies, the Gulf of Mexico coast of North America and the Galapagos Islands (*https://en.wikipedia.org/wiki/Orthomorpha_coarctata*).

It belongs to the genus *Orthomorpha*, or flat-topped millipedes, each species in the genus having only 20 segments. The Long-flanged Millipede is dark or chocolate-brown in colour, with prominent yellow sides to each segment.

Active in daytime, it is found in moist soil or sand containing damp and decaying plant matter. It is active by daytime and feeds only on moist organic matter.

Since the number of millipedes in Hatta Park appeared in October 2019 to be increasing, I have notified my employers, the Public Parks and Leisure Facilities Department of Dubai Municipality who have subsequently taken appropriate action to control this newly-found alien invasive species.

Acknowledgements

I am grateful to Dr. Peter Decker for identifying the millipede and to Pritpal Soorae of the Environment Agency – Abu Dhabi, EAD, for reviewing a draft and for providing information about alien species recorded in the UAE.

References

Gardner, A.S. 2013. The amphibians and reptiles of Oman and the UAE. Edition Chimaira, Frankfurt am Main.

https://en.wikipedia.org/wiki/Orthomorpha_coarctata (accessed 20th February 2020).

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A checklist of the butterflies of Dhofar, Oman and a record of the Common Evening Brown butterfly *Melanitis leda* (Linnaeus, 1758) in Dhofar

by Peter J. Cowan & Elaine M. Cowan

The doyen of studies of Arabian butterflies, Torben Larsen, died in May 2015 (Fee & Collins 2015) whilst Herbert Otto, author of "Butterflies of the Kruger National Park & Surrounds" who had recently moved from South Africa to Oman, died in October 2016 (Otto & Bode 2016). Otto had been passed the baton by Larsen to produce an updated "Butterflies of Oman" (H. Otto *in litt.*, Fee & Collins 2015). We are not aware of Otto's progress on that project. Larsen (1984a) considered nearly two-thirds of the 148 butterfly species then recorded for the Arabian Peninsula to be of Afrotropical origin. Dhofar governorate (hereafter Dhofar) occupies southwestern-most Oman. Below, a checklist (63 species) of the butterflies of Dhofar is presented, based almost entirely on Larsen's (1983) monograph of the butterflies of Arabia. The Pearl Charaxes butterfly *Stonehamia varanes bertrami* (Riley, 1931) is a speciality of Dhofar (Figure 2).

Larsen (1980) reported on the butterflies collected by P. Granville White and K.M. Guichard during the September/October 1977 Oman Flora and Fauna Survey in Dhofar and on previous butterfly material for Dhofar. Twenty nine species new to Dhofar were recorded by the survey, which concentrated on the mountain chain of southern Dhofar, which brought the Dhofar list to 54. Larsen visited Dhofar in October 1979 to conduct further research for "Butterflies of Oman" (Larsen & Larsen 1980) which presented his understanding of Oman's butterflies and included useful natural history notes, photographs of set butterflies and relevant field photographs together with a checklist of Oman's butterflies. Larsen's (1984b) semi-popular book "Butterflies of Saudi Arabia and its neighbours," which includes Dhofar, provided 23 plates of photographed set butterflies and many field photographs of butterflies and their habitats and was intended to complement Larsen (1983). There are a few post Larsen-era publications on the butterflies of Dhofar, namely Polak & Verovnik (1998, 2009) and illustrated formal reports by Tomalin (2012) and Ball (2013) on butterfly surveys in southwesternmost Dhofar (mainly in the Wadi Sayq area). Polak & Verovnik (2009) reported *Colotis liagore* (Klug, 1829), the Desert Orange Tip, new to Dhofar.

Checklist of the butterflies of Dhofar

This is based entirely on Larsen (1983) with the sole addition of *Colotis liagore* (Polak & Verovnik 2009). Species nomenclature and sequence is as Larsen (1983). There are 63 species.

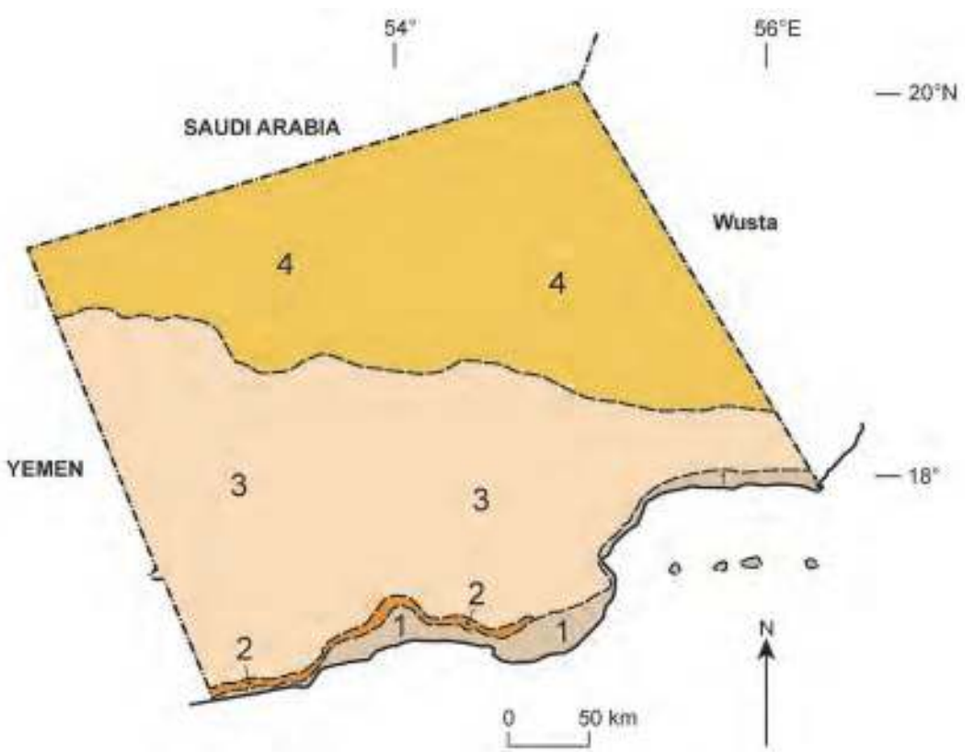

Figure 1. The geographic regions of Dhofar, Oman (Cowan & Cowan 2018). 1: Coastal Plains, 2: Monsoon Slopes, 3: Dry Slopes, 4: Northern Desert. Wusta is the adjoining Omani governorate to Dhofar. The four islands off the southeast coast represent the Hallaniyat islands archipelago (Kuria Muria islands), part of the Coastal Plains region (region 1).

Figure 2. Pearl Charaxes *Stonehamia varanes bertrami* at site above Wadi Darbat, 17th January 2017, Dhofar, Oman (photo by Elaine M. Cowan).

Figure 3. Wadi Darbat (in region 2 of our map, Fig. 1), Dhofar, Oman, 8th October 2014 (photo by Elaine M. Cowan).

Figure 4. Common Evening Brown (Twilight Brown) *Melanitis leda*, wet season form, Wadi Darbat 11.45 a.m, 8th October 2014, Dhofar, Oman (photo by Elaine M. Cowan).

Papilionidae
Papilio demodocus demodocus Esper, 1798
– African Lime Butterfly

Pieridae
Pontia glauconome (Klug, 1829)
– Desert White
Anaphaeis aurota (Fabricius, 1793)
– Caper White
Pinacopteryx eripha tritogenia (Klug, 1829)
– Zebra White
Colotis calais amatus (Fabricius, 1775)
– Small Salmon Arab
Colotis phisadia phisadia (Godart, 1819)
– Blue-spotted Arab
Colotis chrysonome chrysonome (Klug, 1829)
– Golden Arab
Colotis halimede halimede (Klug, 1829)
– Yellow Patch White
Colotis danae eupompe (Klug, 1829)
– Scarlet Tip
Colotis eucharis evarne (Klug, 1829)
– Sulphur Orange Tip
Colotis antevippe zera (Lucas, 1852)
– Large Orange Tip
Colotis daira daira (Klug, 1829)
– Black-marked Orange Tip
Colotis liagore (Klug, 1829)
– Desert Orange Tip
Colotis eris contractus Gabriel, 1954
– Banded Gold Tip
Madais fausta fausta (Olivier, 1804)
– Salmon Arab
Nepheronia buqueti buchanani Rothschild, 1921
– Plain Vagrant
Catopsilia florella (Fabricius, 1775)
– African Emigrant
Eurema hecabe solifera (Butler, 1875)
– Common Grass Yellow

Lycaenidae
Myrina silenus nzoiae Stoneham, 1937
– Fig Blue
Apharitis acamas bellatrix (Butler, 1886)
– Leopard Butterfly
Spindasis scotti Gabriel 1954
– Scott's Silverline
Axiocerces harpax kadugli Talbot, 1935
– Common Scarlet
Epamera glaucus (Butler, 1886 [1885])
– Arabian Sapphire
Deudorix livia (Klug, 1834)
– Pomegranate Playboy
Anthene amarah amarah (Guérin, 1849)
– Leaden Ciliate Blue
Lampides boeticus (Linnaeus, 1767)
– Pea Blue
Cacyreus virilis (Aurivillius, 1924)
– Bush Blue
Syntarucus pirithous (Linnaeus, 1767)
– Common Zebra Blue
Tarucus theophrastus (Fabricius, 1793)
– African Pierrot
Tarucus rosaceus (Austaut, 1885)
– Mediterranean Pierrot
Tarucus balkanicus (Freyer, 1844)
– Balkan Pierrot
Zizeeria knysna (Trimen, 1862)
– African Grass Blue
Zizula hylax hylax (Fabricius, 1775)
– Tiny Grass Blue
Azanus jesous (Guérin, 1847)
– African Babul Blue
Azanus ubaldus (Cramer, 1782)
– Desert Babul Blue
Azanus moriqua (Wallengren, 1857)
– Black-bordered Babul Blue
Euchrysops osiris (Hopffer, 1855)
– African Cupid
Euchrysops lois (Butler, 1885)
– Somali Cupid
Chilades parrhasius (Fabricius, 1793)
– Small Cupid
Freyeria trochylus trochylus (Freyer, 1844)
– Grass Jewel

Nymphalidae
Danaus chrysippus chrysippus (Linnaeus, 1758)
– Plain Tiger
Charaxes hansali arabica Riley, 1931
– Cream-bordered Charaxes
Stonehamia varanes bertrami (Riley, 1931)
– Pearl Charaxes (Figure 2)
Byblia ilithyia (Drury, 1773)
– Joker
Vanessa cardui cardui (Linnaeus, 1758)
– Painted Lady
Junonia orithya here Lang, 1884
– Blue Pansy
Junonia hierta cebrene Trimen, 1870
– Yellow Pansy
Hypolimnas misippus (Linnaeus, 1767)
– Diadem
Hypolimnas bolina bolina (Linnaeus, 1764)
– Giant Eggfly
Melitaea deserticola scotti Higgins, 1941
– Desert Fritillary
Acraea neobule neobule Doubleday, 1848
– Glass Tip Acraea
Melanitis leda leda (Drury, 1773)
– Common Evening Brown (Figure 4)
Ypthima asterope asterope (Klug, 1832)
– Common Three-Ring

Hesperiidae
Coeliades anchises jucunda (Butler, 1881)
– Giant Skipper
Sarangesa phidyle (Walker, 1870)
– Orange Flat
Spialia doris doris (Walker, 1870)
– Desert Grizzled Skipper

Spialia colotes semiconfluens de Jong, 1978
– Transvaal Grizzled Skipper
Spialia mafa higginsi Evans, 1937
– Mafa Grizzled Skipper
Spialia mangana (Rebel, 1899)
– Arabian Grizzled Skipper
Spialia zebra bifida (Higgins, 1924)
– Zebra Grizzled Skipper
Gomalia elma elma (Trimen, 1862)
– African Mallow Skipper
Pelopidas mathias mathias (Fabricius, 1798)
– Lesser Millet Skipper
Gegenes pumilio (Hoffmannsegg, 1804)
– Pygmy Skipper.

The Khareef-influenced escarpment of Dhofar, the Monsoon Slopes region (Figure 3 [region 2 in Figure 1]), is distinctive (Shaw Reade *et al.* 1980, Miller & Morris 1988, Pickering & Patzelt 2008). During June–September, fog wetting and drizzle are frequent on southwesterly facing slopes and annual rain-gauge rainfall rises to more than 300 mm on the mountains behind Salalah city (El-Baz 2002, Sargeant *et al.* 2008). During the Khareef (Monsoon), vegetation on the seaward-facing scarps becomes lush and springs and related pools and streams are full (Figure 3). The western slopes of the Sarawat mountains in western Yemen and southwest Saudi Arabia, south of the Tropic of Cancer, are also 'wet' (Cowan 2006, Hall *et al.* 2009, Larsen 1982, Le Houerou 2003).

On 8th October 2014, EMC photographed (Figure 4) a Common Evening Brown (Twilight Brown) butterfly *Melanitis leda*, a nymphalid, on the western side of Wadi Darbat just after photographing the eastern side of the wadi opposite (Figure 3). Wadi Darbat is a popular tourist site north of the town of Taqah. The butterfly was on leaf litter under trees. Neither of us was aware of its identity at the time. It was the wet season form, with prominent ocelli markings on the underwing.

There are previous records (Larsen 1983) of this species from three Dhofari sites (Sarfait, Ain Arzat and near Ain Arzat). Otherwise, Larsen (1983) lists records of this sole *Melanitis* species for Arabia from southwest Saudi Arabia and Yemen. We presume our record is not of the very similar African species *M. libya* Distant, 1882.

Melanitis leda occurs widely in sub-Saharan Africa, the Indian Ocean islands and further east and Williams (2018) also noted …"widespread, crepuscular butterfly that spends the day roosting among dead leaves and leaf litter in the shade of trees."…and added that it remains active till after midnight, may be attracted to light and is strongly attracted to fermenting fruit.

Bibliography

Ball, L. 2013. An inventory of butterfly species from Wadi Sayq. Pp. 85–91 *in:* Ball, L. 2013. Observations in the Empty Quarter and a rapid biodiversity assessment of Wadi Sayq, Dhofar. British Exploring Society, London.

Cowan, E.M. & P.J. Cowan 2018. The Odonata (Insecta) of Dhofar, southern Oman. **Journal of Threatened Taxa 10(11):** 12499–12514.

Cowan, P.J. 2006. Sites of interest: Wadi Rijaf, Jebel Bura', Yemen (an update). **Phoenix 22:** 13, 16.

El-Baz, F. (ed.) 2002. Wadis of Oman. Satellite image atlas. Office of Adviser for Cultural Affairs to The Sultan, Muscat, 218 pp.

Fee, N. & S. Collins 2015. Obituary—Torben Bjorn Larsen 12th January 1944–21st May 2015. **Metamorphosis 26:** 1–40.

Hall, M., P. Scholte, A.W. Al-Khulaidi, A.G. Miller, A.H. Al-Qadasi, A. Al-Farhan & T.M. Al-Abbasi 2009. Arabia's last forests under threat II: remaining fragments of unique valley forest in southwest Arabia. **Edinburgh Journal of Botany 66(2):** 263–281.

Larsen, T.B. 1980. The butterflies of Dhofar and their zoogeographic composition. **Journal of Oman Studies Special Report 2** (The Scientific Results of the Oman Flora and Fauna Survey, 1977, Dhofar): 153–186.

Larsen, T.B. 1982. The butterflies of the Yemen Arab Republic. **Biologiske Skrifter 23(3):** 1–61, 78–82.

Larsen, T.B. 1983. Insects of Saudi Arabia Lepidoptera; Rhopalocera (A monograph of the butterflies of the Arabian Peninsula). **Fauna of Saudi Arabia 5:** 333–478.

Larsen, T.B. 1984a.The zoogeographical composition and distribution of the Arabian butterflies (Lepidoptera; Rhopalocera). **Journal of Biogeography 11:** 119–158.

Larsen, T.B. 1984b. Butterflies of Saudi Arabia and its neighbours. Stacey International, London.

Larsen, T. & K. Larsen 1980. Butterflies of Oman. Bartholomew, Edinburgh. [*www.enhg.org/resourcesebooks/BoO/BoOSearchable.pdf*]

Le Houerou, H.N. 2003. Bioclimatology and phytogeography of the Red Sea and Aden Gulf basins: A monograph (with particular reference to the highland evergreen sclerophylls and lowland halophytes. **Arid Land Research and Management 17:** 177–256.

Miller, A.G. & M. Morris 1988. Plants of Dhofar. Office of Adviser for Conservation of the Environment, Diwan of Royal Court, Oman, 361 pp.

Otto, B. & J. Bode 2016. Obituary—Herbert Otto (22.09.1966–19.10.2016). **Metamorphosis 27:** 5–6.

Pickering, H. & A. Patzelt 2008. Field guide to the wild plants of Oman. Kew Publishing, London, 281 pp.

Polak, S. & R. Verovnik 1998. A contribution to the knowledge of the butterfly fauna of Dhofar—Sultanate of Oman (Lepidoptera: Rhopalocera). **Acta Entomologica Slovenica 6(1):** 55–65.

Polak, S. & R. Verovnik 2009. Second contribution to the knowledge of the butterfly fauna of the Sultanate of Oman (Lepidoptera: Rhopalocera). **Acta Entomologica Slovenica 17:** 37–44.

Sargeant, D.E., H. Eriksen & J. Eriksen 2008. Birdwatching guide to Oman. Al Roya, Muscat.

Shaw Reade, S.N., J.B. Sale, M.D. Gallagher & R.H. Daly (eds.) 1980. The scientific results of the Oman flora and fauna survey 1977 (Dhofar). **Journal of Oman Studies Special Report 2:** 1–400.

Tomalin, C. 2012. A brief survey of butterfly species in desert and wadi environments, in the Dhofar region, Oman—January to February 2012. Joint report by British Schools Exploring Society, UK and Office for Conservation of the Environment, Diwan of Royal Court, Sultanate of Oman.

Williams, M. C. 2018. Genus *Melanitis* Fabricius, 1807. Afrotropical Butterflies. 17th edition. [*www.lepsocafrica.org/?=publications&s=atb*]

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A giant water bug (Insecta: Heteroptera: Belostomatidae) in the Nizwa area, northern Oman

by Peter J. Cowan & Elaine M. Cowan

Giant water bugs are nepomorph bugs of the family Belostomatidae (Nesemann & Sharma 2013). Only one belostomatid occurs in the Near and Middle East including the Arabian Peninsula, *Lethocerus patruelis* (Stål, 1854) (Limnavuori *et al.* 2011). There have been two published records for the United Arab Emirates (UAE), and apparently none for Oman (Limnavuori *et al.* 2011). On 2nd June 2015, EMC photographed (Figure 1) a giant water bug at the wadi called, by us, 'dragonfly pool' (23°4.5' N, 57°21.6' E, 680 m a.s.l.), which is situated between Al Hamra and Tanuf in the Jebel Akhdar foothills (Cowan & Cowan 2013, 2015). Figure 1 depicts well the raptorial forelegs, the relatively large size of the animal, flat body and an egg mass. We have previously reported water-scorpions (Heteroptera: Nepidae), also nepomorphs, at the pool (Cowan & Cowan 2014, 2016). The egg mass was seen again 10th June 2015 and at least nine of the eggs looked as though they were hatching (Figure 2).

The giant water bug photographed by EMC was probably a male as members of this family exhibit paternal care of their eggs. However, there is another potential explanation for the scene in Figure 1. Perhaps the giant water bug is considering whether the Arabian Toad *Duttaphrynus arabicus* (Heyden, 1827) (Gardner 2013) at the bottom of the picture is a potential meal. Belostomatids can and do eat small vertebrates (Benard 2007, Limnavuori *et al.* 2011).

We suspect the species is widespread but not common in the Hajar mountains of Oman and nearby areas of the UAE. Gillett & Howarth (2004) stated "The large aquatic bugs such as … *Lethocerus patruelis* (Stål) (Belostomatidae) … are common in permanently flowing water in the region [UAE, Oman]…" They go on to say they are apparently absent from Jebel Hafit. A giant water bug was sketched on a page entitled 'Insects (wadis)' of Jongbloed (1991).

Figure 1. Giant water bug on egg mass, 2 June 2015, at the wadi 'dragonfly pool' in the Jebel Akhdar foothills near Nizwa, Oman. Arabian Toad below (photo by Elaine M. Cowan).

Figure 2. Hatching egg mass, 10 June 2015, at the wadi 'dragonfly pool' in the Jebel Akhdar foothills near Nizwa, Oman (photo by Elaine M. Cowan).

Figure 3. Egg mass, 21 September 2016, at the wadi 'dragonfly pool' in the Jebel Akhdar foothills near Nizwa, Oman (photo by Elaine M. Cowan).

Figure 4. Egg mass, 21 September 2016, at the wadi 'dragonfly pool' in the Jebel Akhdar foothills near Nizwa, Oman (photo by Elaine M. Cowan).

Figure 5. Egg mass at Wadi Tiwi, Eastern Hajar, Oman, 27 August 201 (photo by Elaine M. Cowan).

There were two egg masses, presumably of giant water bug, at the wadi 'dragonfly pool' on 21st September 2016 (Figures 3, 4) and one on 19th April 2013. There was an egg mass at Wadi Tiwi (Cowan & Cowan 2017), eastern Hajar, Oman (Figure 5) on 27th August 2015. The eggs of Figures 3–5 seem greener than those of Figures 1–2, perhaps indicating level of maturity.

References

Benard, M.F. 2007. Predators and mates: conflicting selection on the size of male Pacific Treefrogs (*Pseudacris regilla*). **Journal of Herpetology 41:** 317–320.

Cowan, E.M. & P.J. Cowan 2013. The dragonflies and damselflies of a wadi pool near Nizwa, northern Oman, 2012–2013. **Tribulus 21:** 14–23.

Cowan, P.J. & E.M. Cowan 2014. Observations of waterscorpions (Insecta: Heteroptera: Nepidae) in the Nizwa area, northern Oman. **Tribulus 22:** 75–77.

Cowan, P.J. & E.M. Cowan 2015. Odonata (Insecta) at a wadi pool near Nizwa, northern Oman. **Journal of Threatened Taxa 7(9):** 7538–7546.

Cowan, P.J. & E.M. Cowan 2017. The Odonata (Insecta) of northern and central Oman. **Journal of Threatened Taxa 9(10):** 10776–10791.

Cowan, P.J. & E.M. Cowan 2016. The Arabian waterscorpion (Insecta: Heteroptera: Nepidae) can fly. **Tribulus 24:** 144–145.

Gardner, A.S. (2013). The amphibians and reptiles of Oman and the UAE. Chimaira, Frankfurt am Main.

Gillett, M.P.T. & B. Howarth 2004. The insects of Jebel Hafit. Pp. 94–143 *in:* Aspinall, S. & P. Hellyer (eds.). Jebel Hafit, a natural history. Emirates Natural History Group, Abu Dhabi.

Jongbloed, M. 1991. The green guide to the Emirates. Motivate, United Arab Emirates.

Linnavuori, R.E., Kment, P. & A. Carapezza 2011. Order Hemiptera, Suborder Heteroptera. Infraorders Nepomorpha, Gerromorpha, and Leptopodomorpha. **Arthropod Fauna of the UAE 4:** 72–107.

Nesemann, H. & G. Sharma 2013. Observations on the life history of giant water bugs *Lethocerus* Mayr, 1853 (Heteroptera: Nepomorpha: Belostomatidae) in the Gangetic plains of India and Nepal. **Journal of Threatened Taxa 5(10):** 4474–4482.

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First record of *Diplacodes trivialis* (Rambur, 1842), a new dragonfly for Oman

by Vicky Dobson & Andrew Childs

On 20th October 2019, the Indian Meteorological Department, IMD, and the Joint Typhoon Warning Centre, JWTC, began to track an area of low pressure over the south-eastern Arabian Sea for possible development into a tropical cyclone. A Tropical Cyclone Formation Alert was issued by the JWTC on 24th October, with the cyclone being named by IMD later that day as Kyarr. On 25th October, a period of rapid intensification led to Kyarr being described as a 'very severe cyclonic storm' and then an 'extremely severe cyclonic storm.' On 27th October, it intensified into a 'super cyclonic storm', the first in the basin since Cyclone Gonu in 2007. Later that day, it reached its peak intensity of 3-minute sustained winds of 250 kmph (155 mph, 135 kt), according to IMD. It then began to weaken.
https://en.wikipedia.org/wiki/Cyclone_Kyarr (accessed 12th January 2020)

Lasting until 3rd November, Kyarr's path skirted close to Oman's east coast as it weakened.

During a trip to Oman later in November, we visited the offshore island of Masirah, to search for any unusual seashells that might have been washed up as a result of Kyarr. This produced some success. At the same time, we devoted some time to searching for dragonflies and butterflies. Following recent rains, more vegetation was present than we believe to be normally the case.

On 14th November 2019, we observed and VD photographed a male dragonfly on the south-west of the island near to Ra's Sanaghal at 20°13.569' N, 58°37.647' E. The individual (Figure 1) was later identified by Antoine van der Heijden via VD's Facebook post on Worldwide Odonata as *Diplacodes trivialis*, a new record for Oman.
https://www.facebook.com/groups/odonata/?ref=nf_target&fref=nf

Figure 1. Male *Diplacodes trivialis* observed on 14th November 2019 on Masirah Island near to Ra's Sanaghal, Oman (photo by Vicky Dobson).

This was later confirmed by Klaas-Douwe B. Dijkstra (pers. comm.).

The dragonfly was observed on large pebbles at the back of a sandy beach. The surrounding terrain consisted of sparse, grassy hummocks on sand and a small rocky hill with similar grassy growth. Around one kilometre away was a well, but no open running water sources. There were a few water puddles in the vicinity.

We have been advised by Gary Feulner (pers. comm.), who is familiar with the species in Nepal, that there it is always a ground-hugging species – typically in grass on hillsides or along paths – and that it can often be found some distance away from permanent water, which is also applicable to our Masirah sighting.

This small dragonfly, in the family Libellulidae, is found widely in Asia including India, Nepal, China, Japan and southwards to New Guinea and Australia. It is known commonly as the Chalky Percher or Ground Skimmer, although as Blue Ground Skimmer in India. It had not previously been recorded in Oman or elsewhere in Arabia.

Forty-four species of Odonata have previously been listed for Oman (Schneider & Ikemeyer 2016). This lone individual, most probably brought by Cyclone Kyarr, is, therefore, the 45th dragonfly species for Oman.

Like several other sole records on the Oman list such as *Anax tristis* Hagen, 1867 recorded in the Central Desert after a storm on 5th November 1992 (Schneider & Dumont 1997), and *Ischnura nursei* Morton 1907, collected on the east coast in 2003 (Kunz 2015), it is unlikely to become a regular visitor or resident.

The species is assessed as being of Least Concern (LC) on the IUCN Red List of Threatened Species. *https://www.iucnredlist.org/species/167372/6336761* (accessed 12th January 2020)

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Bibliography

Kunz, B. 2015. First record of *Ischnura nursei* Morton 1907 from Oman (Coenagrionidae). **Libellula 34:** 117–124.

Schneider, T & D. Ikemeyer 2016. Dragonflies of Oman – a revised illustrated checklist (Odonata). **Entomologische Zeitschrift 126(3):** 137–147.

Schneider, W. & H. J. Dumont 1997. The dragonflies and damselflies (Insecta: Odonata) of Oman. An updated and annotated checklist. **Fauna of Saudi Arabia 16:** 89–110.

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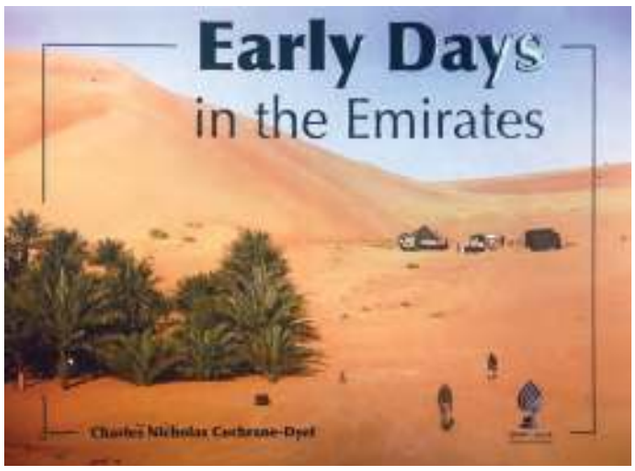

Early Days in the Emirates, by Charles Nicholas Cochrane-Dyet. Qindeel Printing, Publishing and Distribution, Dubai. 2019. 155 pp. ISBN 978-9953-498-66-9.

Over the last few years, the number of books being published about the United Arab Emirates has begun to turn from a steady trickle into a torrent. Some have been detailed academic investigations, of varying quality, depending to some extent on the personal familiarity of the authors with the country. Pottering through old newspaper cuttings or, these days, carrying out Internet searches not only turns up information that might be inaccurate but also gives little insight the reasons why individual decisions were taken. An in-depth knowledge of the country can, in my view, contribute significantly to the quality of books about the UAE. That applies both to the academic works and to those written in a lighter, less academic style and designed to appeal to a wider, more general audience.

'Early Days in the Emirates' is a book that falls firmly into the latter category. Its author, better known simply as Nick Cochrane-Dyet, first came here in the 1960s, at the age of eight, when his father was an officer in the Trucial Oman Scouts. Spending every school holiday in Al Ain, he came to live here full-time in the 1970s, to manage the stables of the UAE's first President, Sheikh Zayed bin Sultan Al Nahyan, at Mezyad, just south of Al Ain. That job, a wonderful opportunity for a teenager, meant that Cochrane-Dyet was in regular contact with Sheikh Zayed, not on matters of the affairs of state, but in connection with one of his passions, the breeding of Arabian horses.

From there, at Sheikh Zayed's suggestion, Cochrane-Dyet went to the Royal Military Academy at Sandhurst, a classmate being Sheikh Mohamed bin Zayed, and served with the Gurkha battalion of the British Army In the Far East for five years before returning to the UAE in 1985 to join a bank in Dubai. In 1989, he returned to Abu Dhabi to work with BP, from which he formally retired last year, though still working part-time as an Adviser and serving as Chairman of the local British Business Group.

He is, he believes, the last remaining British expatriate in Abu Dhabi who worked closely with Sheikh Zayed.

In his Introduction to this brief memoir, Cochrane-Dyet writes that: "I have grown up enmeshed with the locals, befriended boys who have grown into the men on whose noble and tireless efforts the country was built, lived with the Bedouins, nursed many of their wounds and illnesses, was fortunate enough to work for Sheikh Zayed, one of the greatest men I have ever known."

This is not a history *per se*, nor an exhaustive autobiography, but, rather, a collection of tales of life in the UAE, particularly Al Ain, nearly half a century ago, along with a telling of the lessons and insights that the author learned from his close association with the UAE's Founding Father.

Among those are insights into the foundations of the tolerance that continues to underpin the nature of UAE society today. With regards to religion, for example, in a chapter entitled 'Sheikh Zayed as Mentor", Cochrane-Dyet quotes Sheikh Zayed as telling him: "We have churches here. You can practice your religion, and we accept it fully. But you shall never proselytise or attempt to convert my Muslim brothers to Christianity."

And, recounting an incident in the majlis when Sheikh Zayed interjected a comment in Arabic into a conversation in English, a language few realised he could understand, Cochrane-Dyet cites a subsequent comment that many would do well to remember: "Be careful of what you say behind someone's back, people may understand more than you think."

Tales such as these and an underlying message that people in the UAE today would do well to learn from Zayed's style of leadership are woven throughout this book.

Buy the detailed works on UAE history by all means. They offer valuable information about the country. Make sure, however, that a copy of 'Early Days in the Emirates' is also on your reading list and, preferably, on your bookshelves.

The Military and Police Forces of the Gulf States: Volume 1: Trucial States and United Arab Emirates, 1951–1980. Athol Yates & Cliff Lord. Middle East @ War series No. 16. Helion & Company, Warwick, UK. 2019. ISBN 978-1-913290-61-8.

The Naval Force of Abu Dhabi, 1967–1976. Athol Yates & Cliff Lord. Collaborative Publications, Australia. 2019. ISBN-13. 978-0-9874332-9-9.

Since its inception, *Tribulus* has always focussed on the natural history and archaeology of the United Arab

Emirates, with occasional ventures into geology and palaeontology. It has, however, always had a place for contributions related to the country's history, including its more recent history, including little-studied elements such as its involvement in the Second World War (see Vol. 24, 2017). A paper elsewhere in this volume, by Athol Yates, sheds light for the first time on the involvement of the British military in anti-locust campaigns in the 1940s, an unusual overlapping of military history and natural history.

These two books, by Athol Yates, a professor at Khalifa University, and Cliff Lord, are more directly relevant to the military history of the Emirates, covering the period from 1951–1980, when the basis for today's UAE Armed Forces was laid down.

They trace the evolution of the military from the establishment of the Trucial Oman Levies, in 1951, and the early years of Abu Dhabi's navy, from 1967. The extensive research undertaken by the authors has included the tracking down and interviewing of many veterans of the forces involved, including both Emiratis and expatriates and obtaining access not only to their memories, but also to their diaries and photographs, a hugely-important contribution to the recording and archiving of this aspect of UAE history.

Aficionados of military history *per se* will find the detail of organisational structures, of cap badges and uniforms and of equipment of considerable interest. Many others, I think, will enjoy the many old photographs and reproductions of old newspaper cuttings that are lavishly used.

Both books are simply written, rather than being academic tomes, and would be ideal for students.

Peter Hellyer