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Contents

Cover Illustrations:

Front: An Arabian toad-headed agamid (*Phrynocephalus arabicus*) near Sweihan.
Picture: Gary R. Feulner

Back: A male *Paragomphus sinaiticus*, a dragonfly from the Hajar Mountains.
Picture: Richard Hornby

The Editorial Board of TRIBULUS and the Committee of the Emirates Natural History Group acknowledge, with thanks, the support of the Group's Corporate members, a full list of whom can be found on Page 2, and without whom publication would be impossible. We also acknowledge the support and encouragement of our Patron, H.E. Sheikh Nahayan bin Mubarak Al Nahayan, UAE Minister of Higher Education & Scientific Research.

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EDITORIAL

With the ever-accelerating pace of development throughout the United Arab Emirates, it is good to be able to report in this issue (*see page 21*) that a new Marine Protected Area has been declared in the Emirate of Abu Dhabi. To be managed by the Environment Agency - Abu Dhabi, EAD, it covers an area of over 480 sq. km. around the Yasat group of islands in the far west of the UAE, with important marine habitats, including coral reefs, and complements the much larger Marawah MPA declared a couple of years ago, and also managed by EAD. The islands themselves are also included, and although, sadly, a substantial amount of development has recently taken place, affecting archaeological sites of regional importance, it is to be hoped that the declaration of the MPA will provide effective protection for what remains, both onshore and offshore.

There's been progress, too, on the UAE's East Coast, where a proposal has been put forward to the Ruler of Fujairah on the establishment of a Mountain Protected Area in the Wadi Wurayah watershed, home, amongst other things, to the only perennial waterfalls in the emirates as well as to the endangered Arabian tahr and, possibly, the Arabian leopard. The proposal has been prepared by the WorldWide Fund for Nature, WWF, and its local affiliate, the Emirates Wildlife Society, working with the Fujairah Municipality and has been received with interest by the Fujairah Government, although no formal decision has yet been taken on whether or not the proposal will be implemented.

It is particularly encouraging to be able to note these initiatives at a time when in other parts of the UAE the drive for development appears to be riding roughshod, to put it mildly, over the landscape (and sea-scape). The picture is, we happily concede, somewhat different in Abu Dhabi, where the Environment Protection Division, EPD, of EAD is increasingly showing its teeth in terms of demanding that would-be developers carry out proper environmental baseline studies and impact assessments, and then implement the conditions laid down by EAD before work can proceed. Some of the developers may not be too happy now, but in the long-term it is only through such measures that anything resembling a sustainable balance of development can be achieved.

In some other areas, though, no proper baseline studies at all seem to be required, while in yet others the studies are commissioned in such a way that there is scarcely time to finish preliminary fieldwork before the bulldozers move in. As for the long-term impact, we will have to wait and see but, as we've noted before, a little bit more research and planning now might well pay dividends in the long run, not just in terms of protection of the country's environment, wildlife and heritage, but in terms of the viability of the projects being built.

As our Patron, Minister of Higher Education and Scientific Research, Sheikh Nahayan bin Mubarak Al Nahyan, noted in remarks in mid-June, the carrying out of scientific research into the UAE's environment and heritage is a "must."

"The late President Sheikh Zayed bin Sultan Al Nahyan taught us the importance of studying and protecting our environment and our heritage, so that we are properly equipped to deal with the challenges of today and to face the tasks of tomorrow," he noted. "The carrying out of scientific research into these topics is a 'must'. It is something that all those concerned with protecting our country for the generations of the future have a duty to undertake. "

"Unless we take seriously the need for scientific research - in all fields - then we will not be able to meet the objectives for the country's development that have been laid down by our leaders, headed by President HH Sheikh Khalifa bin Zayed Al Nahyan. Investment in research, by Government, by the private sector and by individuals, has a crucial role to play in our future," Sheikh Nahyan added.

Such research, of course, should not simply be driven by the need to carry out studies ahead of bulldozers, but should be a continuing process, and this issue of ***Tribulus*** has several papers and notes that indicate, yet again, that there is still much that is to be discovered about the UAE's environment. One reports on new discoveries in north-eastern Abu Dhabi of the large mollusc *Terebralia palustris*, a species once believed to have been extinct in the lower Gulf since the pre-Islamic period, and another the discovery of a previously-undescribed type of Neolithic stone tool for Eastern Arabia. Other notes cover a new species of orchid for the Emirates, a new foodplant for the Blue Pansy butterfly and a preliminary report on an EAD satellite-tracking programme for greater flamingos that is revealing valuable new data on movements both within the UAE and northwards to Iran and Turkmenistan of populations of this bird, rightly described as a "flagship species" for protection. Finally, our lead paper shows that there is much in the way of historically-available data that needs to be coherently analysed and presented, with an important study of rainfall and climate records from Sharjah.

As usual, it's an eclectic mix, yet one which, we believe, reflects the great variety of the scientific research that is being done in the UAE, and which needs to be done. We look forward to reporting more results of research in future issues.

Corporate Members of the ENHG

Production of ***Tribulus***, and many of the other activities of the Emirates Natural History Group, including the grant programme of the Group's Conservation Fund, would not be possible without the generous support of the the Group's Corporate Members, many of whom have provided consistent assistance over many years. The Editorial Board and the Group Committee acknowledge, with thanks, the invaluable support of the following companies and bodies, currently Corporate members of the Group, and all past Corporate sponsors:

Abu Dhabi Company for Onshore Oil Operation, ADCO; Al Fahim Group; Al Nasser Holdings; BP; Environment Agency - Abu Dhabi, EAD; Kanoo Group; Al Masaood; Intercontinental Hotels; Jashanmal National Company; METCO; Motivate Publishing; Nama Development; National Bank of Abu Dhabi; Omeir Travel Agency; Richards Butler; Rotana Beach Hotel; URS Dames and Moore.

Rainfall and climate records from Sharjah Airport: Historical data for the study of recent climatic periodicity in the U.A.E.

by Gary R. Feulner

"A cloud gathers, the rain falls, men live; the cloud disperses without rain, and men and animals die." - Wilfred Thesiger, Prologue to ***Arabian Sands***

Introduction

The most notorious feature of the natural history of Arabia is the extreme aridity of the climate. Coupled with high summer temperatures, this presents a formidable natural challenge to living organisms. Plants, animals and humans all have had to adapt in order to successfully colonise Arabia, including the UAE. Some species (including especially strong fliers such as many butterflies and dragonflies) simply migrate and are not seen during the driest periods. Resident species have evolved mechanisms or strategies for coping with extended periods of drought. There is good evidence, too, that in the pre-modern era, human civilization in Eastern Arabia flourished or declined in parallel with major climatic fluctuations.

Yet we know that rain falls and water flows from time to time. In the UAE, rain is welcomed and even prayed for, but it can also be destructive. Wadis are flooded, roads are washed out, property is damaged and lives may be lost. When and why? It is a commonplace that rainfall in Arabia is erratic and unpredictable. But is this strictly true? Or are there patterns in the rainfall that might allow us to better understand the constraints to which natural life in the UAE must adjust, and which form the basis for the mechanisms and strategies that have been evolved to do so?

Authoritative examination of these questions has been impeded by the lack of data. The countries of eastern Arabia - the UAE and Oman - have only recently been integrated into the modern practice of detailed meteorological record-keeping and, for the most part, systematic data do not pre-date the federation of the UAE.

The Sharjah Airport Data

The records from Sharjah Airport are the exception within the UAE and Oman. Basic climatic data have been recorded and maintained there since 1934, with the result that there now exists a database spanning more than 70 years -- a sufficient time period to give hope that meaningful generalisations can be made about the possible existence of short-term periodicity.

It is true that rainfall in the UAE, even significant rainfall, is often very localised, so that records at any particular site will not constitute an exact record of events at any other site. But it seems reasonable to suppose, at least as a working hypothesis, that patterns (if any) appearing over 70 years at a single site are indicative of patterns in the broader causative phenomena, and are therefore likely to be correlated with events and patterns at UAE sites more generally.

Sharjah's meteorological records are currently maintained and have been compiled by the Meteorological Office, Air Traffic Services, Department of Civil Aviation. Data from 1934 to 1976 were recorded at the old Sharjah Airport, now on the outskirts of downtown Sharjah, about 4 kilometers from the coast. Since 1977, data have been collected at Sharjah International Airport, some 12 kilometres inland. Annual compilations have been privately published by the Meteorological Office and may be requested from the Meteorological Officer (c/o Meteorological Office, Department of Civil Aviation, Sharjah International Airport, P.O. Box 8, Sharjah, U.A.E., e-mail: shjmet@emirates.net.ae, www.sharjahairport.gov.ae). The annual reports include information about the methodology and equipment used. Each annual report also includes updates of the principal historical compilations as well as a capsule summary of the UAE's annual weather patterns. Excerpts from this information are published in the Appendix to this note.

At the urging of UAE naturalists who have seen these publications, the Meteorological Office has very kindly supplied updated compilations of rainfall data, with the express aim of making this information more readily available to the community of individuals and institutions engaged in the study of the natural history of the UAE. In addition to publication in ***Tribulus***, the information has been conveyed in electronic form to each of the UAE's three natural history groups (in Abu Dhabi, Al-Ain and Dubai), among others.

In the following pages are found four of the most significant compilations from the Sharjah Airport data. The Appendix to this note contains a brief description of the general climatic regime of the Arabian Gulf and a summary of the normal annual UAE weather pattern, excerpted from Climatological Report 2003, published by the Meteorological Office.

The compilations presented are:

Fig. 1: Annual rainfall totals (1934-2004)
Fig. 2: Monthly rainfall means and extremes (1934-2004)
Fig. 3: Monthly rainfall totals (1934-2004)
Fig. 4: Monthly temperature and other data (1977-2004)

Among the interesting generalizations that emerge from the Sharjah rainfall data are the following:

(1) Annual rainfall totals show an apparent (visual) periodicity.

(2) June is unequivocally the driest month.

(3) The drought of recent years has been the most severe within the 70-year recording period: the years 2000-2003 had the lowest 4-year rainfall total (with less than half the rainfall of the next lowest 4-year period), as well as 4 of the 16 lowest annual totals.

(4) In contrast, the period 1995-1998 was the wettest 4-year period on record, having 3 of the top 5 annual rainfall totals, and 4 of the top 10.

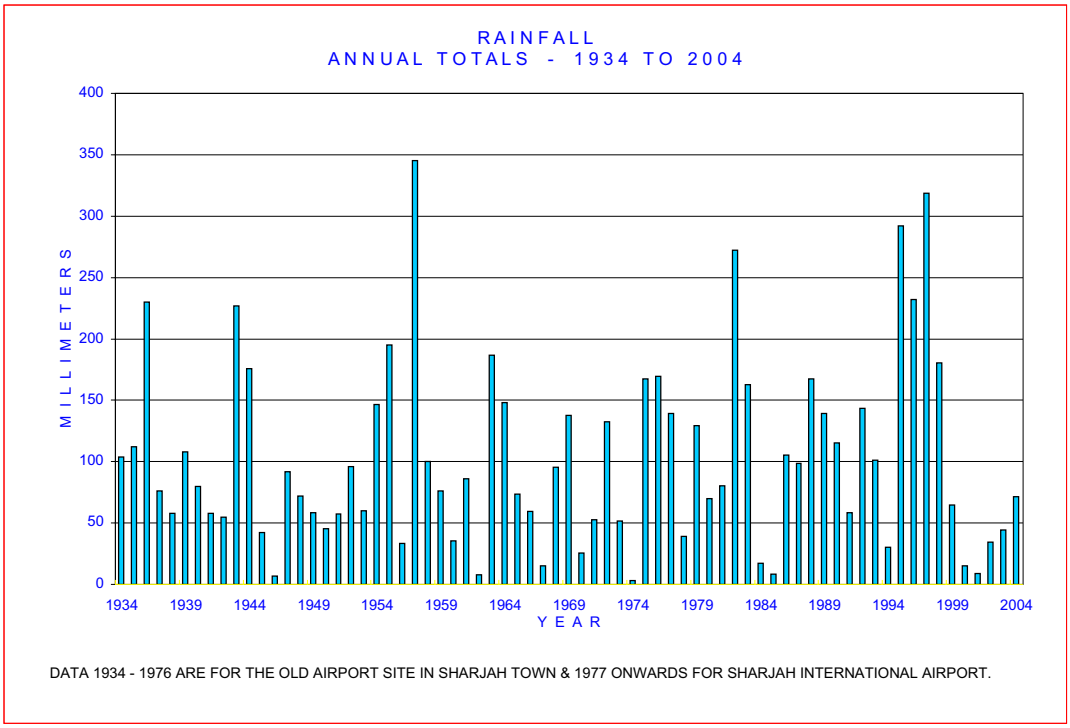

Figure 1: Annual rainfall totals at Sharjah Airports (1934-2004).

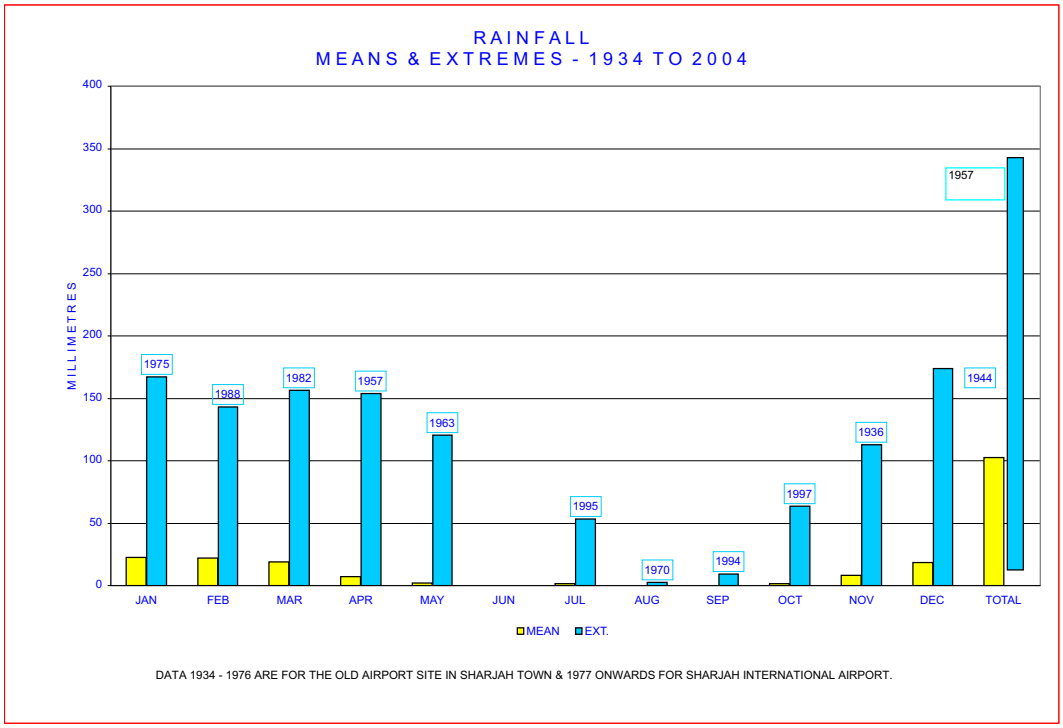

Figure 2: Monthly rainfall means and extremes at Sharjah Airports (1934-2004).

MONTHLY RAINFALL TOTALS (mm) FOR SHARJAH, UNITED ARAB EMIRATES.
1934 TO 2004

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1934	10.0	NIL	48.0	NIL	NIL	NIL	NIL	NIL	NIL	NIL	1.0	45.0	104.0
1935	2.0	106.0	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	4.0	112.0
1936	48.0	1.0	2.0	3.0	NIL	NIL	NIL	NIL	NIL	NIL	113.0	63.0	230.0
1937	1.0	25.0	16.0	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	34.0	76.0
1938	31.0	5.0	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	22.0	58.0
1939	59.0	36.0	1.0	11.0	NIL	NIL	NIL	NIL	NIL	NIL	NIL	1.0	108.0
1940	46.0	7.0	7.0	NIL	NIL	NIL	NIL	NIL	NIL	NIL	20.0	NIL	80.0
1941	NIL	2.0	26.0	30.0	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	58.0
1942	1.0	41.0	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	13.0	55.0
1943	53.0	62.0	17.0	4.0	NIL	NIL	NIL	NIL	NIL	NIL	NIL	91.0	227.0
1944	NIL	2.0	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	174.0	176.0
1945	39.0	NIL	1.0	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	2.0	42.0
1946	NIL	NIL	7.0	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	7.0
1947	27.0	7.0	24.0	NIL	NIL	NIL	NIL	NIL	NIL	NIL	24.4	9.6	92.0
1948	NIL	41.0	5.0	NIL	NIL	NIL	NIL	NIL	NIL	15.6	2.5	8.1	72.2
1949	4.5	NIL	N/A	N/A	N/A	N/A	N/A	N/A	NIL	TR	45.0	9.0	58.5
1950	18.6	2.0	10.2	TR	2.1	NIL	0.3	NIL	NIL	NIL	3.3	8.8	45.3
1951	0.7	TR	14.4	NIL	5.9	NIL	NIL	NIL	NIL	NIL	NIL	36.4	57.4
1952	65.2	TR	0.5	2.4	TR	NIL	NIL	NIL	NIL	NIL	NIL	27.8	95.9
1953	NIL	53.2	0.5	1.7	TR	NIL	NIL	NIL	NIL	NIL	NIL	4.5	59.9
1954	NIL	59.6	17.4	TR	NIL	NIL	NIL	NIL	NIL	NIL	69.4	0.2	146.6
1955	88.2	0.4	50.1	NIL	TR	NIL	NIL	TR	NIL	NIL	NIL	56.1	194.8
1956	7.1	TR	1.0	0.5	NIL	TR	15.6	NIL	5.4	0.7	NIL	2.9	33.2
1957	95.1	4.9	2.0	154.0	0.6	NIL	NIL	TR	TR	NIL	76.7	12.1	345.4
1958	16.0	TR	0.1	NIL	NIL	NIL	3.0	NIL	NIL	NIL	19.2	61.7	100.0
1959	56.8	4.0	TR	TR	NIL	NIL	NIL	TR	NIL	TR	12.2	3.2	76.2
1960	7.8	TR	4.8	19.6	NIL	NIL	NIL	NIL	TR	TR	TR	3.3	35.5
1961	8.6	34.0	14.6	28.8	NIL	NIL	TR	TR	TR	TR	TR	TR	86.0
1962	TR	NIL	TR	0.3	NIL	TR	TR	NIL	NIL	NIL	NIL	7.5	7.8
1963	TR	2.4	13.2	8.4	120.6	NIL	8.3	NIL	NIL	NIL	30.4	3.4	186.7
1964	35.2	29.6	2.8	TR	NIL	TR	TR	NIL	NIL	NIL	TR	80.7	148.3
1965	59.7	TR	0.7	11.8	TR	NIL	TR	NIL	TR	NIL	NIL	1.4	73.6
1966	0.3	59.1	NIL	TR	NIL	NIL	NIL	TR	NIL	NIL	NIL	TR	59.4
1967	TR	3.4	6.9	1.2	TR	TR	TR	TR	TR	TR	TR	3.6	15.1
1968	1.6	76.3	TR	0.3	TR	TR	TR	TR	TR	TR	TR	17.2	95.4
1969	112.5	0.3	TR	5.2	TR	TR	TR	TR	TR	19.5	TR	0.3	137.8
1970	22.7	0.5	TR	TR	TR	TR	TR	2.4	TR	TR	TR	TR	25.6
1971	4.9	0.6	0.2	5.1	TR	TR	TR	TR	TR	TR	27.8	14.2	52.8
1972	12.0	NIL	114.8	5.6	NIL	NIL	NIL	NIL	NIL	NIL	NIL	TR	132.4
1973	45.0	6.7	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	51.7
1974	3.1	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	3.1
1975	167.4	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	167.4
1976	NIL	128.2	20.0	19.9	NIL	NIL	NIL	NIL	NIL	NIL	NIL	1.6	169.7
1977	34.6	29.8	13.1	14.7	NIL	NIL	NIL	NIL	NIL	TR	41.6	5.4	139.2
1978	NIL	25.6	11.1	2.5	TR	NIL	TR	NIL	NIL	NIL	TR	NIL	39.2
1979	4.0	TR	68.2	NIL	NIL	NIL	NIL	TR	NIL	NIL	NIL	57.1	129.3
1980	1.2	38.2	28.6	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	1.7	69.7
1981	TR	0.3	21.8	37.7	20.6	NIL	TR	TR	NIL	NIL	NIL	NIL	80.4
1982	2.7	82.4	156.4	TR	TR	NIL	NIL	NIL	NIL	NIL	15.0	15.8	272.3
1983	26.4	85.7	25.9	20.1	NIL	NIL	NIL	0.6	NIL	NIL	NIL	3.9	162.6
1984	0.5	TR	7.6	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	9.2	17.3
1985	5.7	NIL	2.0	0.7	TR	NIL	NIL	NIL	NIL	NIL	NIL	0.2	8.6
1986	21.2	24.5	6.7	2.5	NIL	NIL	TR	NIL	NIL	NIL	0.5	49.9	105.3
1987	NIL	TR	90.0	1.2	NIL	NIL	NIL	TR	NIL	NIL	NIL	7.2	98.4
1988	1.4	142.9	0.5	17.7	NIL	NIL	0.7	NIL	NIL	NIL	NIL	4.0	167.2
1989	TR	13.8	40.4	6.5	NIL	NIL	0.5	NIL	NIL	NIL	18.5	59.7	139.4
1990	30.4	75.3	1.2	8.2	NIL	NIL	NIL	TR	NIL	NIL	TR	TR	115.1
1991	15.1	3.2	21.6	TR	NIL	NIL	NIL	NIL	NIL	NIL	0.7	17.9	58.5
1992	29.3	34.8	0.7	43.7	TR	NIL	NIL	TR	NIL	NIL	NIL	35.0	143.5
1993	2.1	95.8	1.0	TR	NIL	NIL	NIL	NIL	NIL	NIL	NIL	2.2	101.1
1994	14.2	TR	3.7	0.2	3.0	NIL	TR	NIL	9.2	NIL	TR	TR	30.3
1995	NIL	33.2	58.4	0.9	NIL	NIL	53.1	NIL	NIL	NIL	NIL	146.5	292.1
1996	53.3	24.5	152.6	1.0	NIL	NIL	NIL	NIL	NIL	NIL	TR	0.5	231.9
1997	71.6	TR	125.0	2.7	NIL	NIL	NIL	NIL	TR	63.4	39.1	17.1	318.9
1998	97.8	18.0	17.5	16.5	NIL	NIL	29.6	NIL	NIL	NIL	NIL	0.9	180.3
1999	20.7	37.2	6.9	NIL	NIL	NIL	TR	NIL	NIL	NIL	NIL	TR	64.8
2000	TR	NIL	0.2	NIL	NIL	NIL	NIL	NIL	NIL	TR	2.0	12.8	15.0
2001	8.2	TR	TR	NIL	NIL	NIL	TR	NIL	NIL	NIL	0.8	NIL	9.0
2002	3.6	0.2	29.4	0.4	TR	TR	NIL	TR	NIL	NIL	NIL	0.6	34.2
2003	3.6	7.3	20.7	12.5	0.0	0.0	TR	TR	0.0	0.0	TR	TR	44.1
2004	12.5	NIL	TR	TR	0.0	0.0	0.0	0.0	NIL	NIL	8.5	50.5	71.5
MEAN	22.7	22.2	18.9	7.1	2.2	0.0	1.6	0.0	0.2	1.4	8.1	18.6	102.8
EXT.	167.4	142.9	156.4	154.0	120.6	TR	53.1	2.4	9.2	63.4	113.0	174.0	345.4

Data for April & December 1976 are not available for Sharjah. In the table, Dubai Airport totals have been used for these two months. There is no data for the period March to August 1949.

Data Sources:1934-1946 from SHARJAH TOWN, 1949-1971 from the OLD AIRPORT SHARJAH and 1977 onwards, from SHARJAH INTERNATIONAL AIRPORT, 13 Km East of the OLD AIRPORT.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
MEAN	22.7	22.2	18.9	7.1	2.2	0.0	1.6	0.0	0.2	1.4	8.1	18.6	102.8
EXT.	167.4	142.9	156.4	154.0	120.6	TR	53.1	2.4	9.2	63.4	113.0	174.0	345.4
YEAR	1975	1988	1982	1957	1963	2000	1995	1970	1994	1997	1936	1944	1957

Figure 3: Monthly rainfall totals at Sharjah Airports (1934-2004).

Climatological Data for Sharjah International Airport - 1977 To 2004 inclusive

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	YEAR	TOTALS
DRYBULB TEMPERATURE - °C														
Mean daily max.	24.4	25.7	29.0	34.2	39.1	41.3	42.4	42.2	40.1	36.3	31.1	26.5	34.4	=
Mean daily min.	12.1	13.0	15.5	18.4	22.2	25.0	27.9	27.8	24.6	21.0	16.9	13.8	19.9	=
Extreme max.	32.5	35.4	42.5	44.6	46.4	49.2	47.8	48.2	46.7	43.0	37.3	33.9	49.2	=
Exterme min.	3.4	2.5	5.8	10.9	13.0	17.8	21.7	22.2	18.4	12.3	8.1	4.9	2.5	=
WETBULB TEMPERATURE - °C														
Mean daily max.	14.4	15.1	16.9	19.1	21.6	24.5	26.1	26.4	24.9	22.3	18.5	16.0	20.5	=
Extreme max.	22.0	23.1	25.0	26.7	30.2	32.1	33.0	33.5	31.5	32.1	27.2	24.1	33.5	=
RELATIVE HUMIDITY - %														
Mean daily max.	90	90	88	82	76	82	80	80	87	89	87	90	85	=
Mean daily min.	41	38	33	25	21	23	26	27	26	28	33	40	30	=
SUNSHINE - hours														
Mean total hours	234	225	251	293	340	337	320	317	300	294	265	234	284	3410
Percentage of possible	73	74	70	80	85	85	79	82	85	86	84	75	80	=
Mean daily hours	7.4	8.0	8.1	9.8	11.0	11.3	10.3	10.2	10.0	9.5	8.8	7.6	9.3	=
RAINFALL - millimeters														
Monthly mean	17.9	31.9	38.0	7.9	1.0	0.0	3.5	0.0	0.4	2.6	4.9	21.0	10.8	=
Monthly extreme	97.8	142.9	156.4	43.7	20.6	TR	53.1	0.6	9.2	63.4	41.6	146.5	156.4	=
Highest 24 hr. max.	62.7	115.5	76.7	36.6	14.4	TR	35.2	0.6	5.5	62.6	41.6	60.7	115.5	=
Mean no. of rain days	6.0	5.9	8.1	2.5	0.4	0.1	0.7	0.4	0.1	0.2	1.3	4.6	2.5	30.3
ATMOSPHERIC PRESSURE - hPa														
Mean m.s.l. pressure	1018	1016	1014	1010	1006	1000	997	999	1005	1012	1016	1018	1009	=
WEATHER - Mean no. of days														
Fog - vis.1Km or less	1.7	2.3	3.6	2.5	1.9	3.1	1.0	1.1	3.3	3.8	1.3	1.3	2.2	26.9
Dust/haze - vis. 1 Km or less	0.2	0.1	0.5	0.1	0.0	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	1.7
Thunder	0.5	1.4	2.3	0.9	0.1	0.0	0.3	0.3	0.1	0.2	0.8	0.8	0.6	7.7
Hail	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.5
WINDSPEED - knots *														
Monthly mean	6	6	7	7	7	7	7	6	6	5	5	5	6	=
Highest monthly mean	11	12	13	13	13	13	13	13	12	12	11	10	12	=
Monthly extreme	40	33	42	36	34	32	41	29	28	25	32	28	42	=
GUST - knots **														
Monthly extreme	61	70	61	58	45	45	72	39	38	39	45	43	72	=

NB: (a) The data in this table refer to the Airport only and are not representative of coastal locations.

(b) A gust of 72 kts occurred during the storm of the 20th July 1998.

* Windspeeds are '**10 minute mean**' values. ** Gust is an '**instantaneous**' value.

Figure 4: Monthly temperature and other data at Sharjah International Airport (1977-2004).

Scope for Further Investigation

Basic data such as these should both inform and empower students of UAE natural history. Several preliminary efforts seem called for. Perhaps foremost among such efforts, the apparent rainfall periodicity should be investigated using recognised mathematical methods such as Fourier analysis. [Fourier analysis would first represent the annual rainfall totals as a curve of deviations from the long-term annual mean, and then attempt to reproduce that curve mathematically as the sum of a set of sine waves of different wavelengths (periodicity), weighted as necessary to match the actual curve. If certain sine waves make a significantly greater contribution to the result, this is indicative of a fundamental periodicity at the corresponding wavelengths.]

In addition, the observed pattern of low summer rainfall, with a consistent rainfall minimum in June, means that a recalculation of annual rainfall, based on a July 1 to June 30 year, has the potential to clarify any possible periodicity in the annual pattern, by consolidating each winter season's rainfall within a single annual total. The data show that the Sharjah Airport area does not generally receive significant rain from localised summer showers of the sort that more frequently affect the UAE's mountain regions. [In only seven years did summer rain (May through September) constitute 10% or more of total annual rainfall, and in only four of those years did it constitute 25% or more. Of the latter, three were years with total rainfall 20-70% below the annual mean. The fourth was exceptional: the 120.6 mm that fell in May 1963 exceeded the annual mean and constituted 66% of that year's total of 186.7 mm.]

The author has performed such a recalculation of the annual data, using a July to June year. The results are shown in *Fig. 5.* These do not appear to make a great difference, visually or otherwise, in the patterns recorded. In particular, the same rainfall minima are shown at essentially the same intervals (approximately 12-16 years) and the overall distribution of departures from the mean annual rainfall remains the same (in each case, only 24 years are more than 10% above the mean, whereas 37 years are more than 10% below the mean). The recalculation does, however, re-order somewhat the ranking of peak rain years, most notably by highlighting the record winter rains of 1995-96. The recalculation also further emphasizes the severity of the drought of mid-1999 to mid-2004.

Finally, the Sharjah Airport data should be compared with similar data from other UAE weather stations in order to assess whether any patterns appearing in the one are observable in the other, i.e. whether they are of regional or strictly local significance. *Fig. 6* shows annual rainfall records from Abu Dhabi and Al Ain for the period 1971-2004. [For the period 1971-1992, the sites were Bateen Airport on Abu Dhabi Island and Al Ain Agricultural Station and the data was published in Bottomley (1996). For the period 1993-2004, the information is from Abu Dhabi International Airport and Al Ain International Airport. Al Ain data for 1993 was not available.]

The Abu Dhabi and Al Ain data represent a much shorter period of time than the Sharjah data, and annual rainfall totals are lower at both of the former sites (averaging ~59.1 mm at Abu Dhabi and ~85.8 mm at Al Ain, versus 102.6 mm for Sharjah Airport), but it can be seen that there is a relatively good correlation (i) between the Abu Dhabi and Al Ain sites and (ii) between the Abu Dhabi/Al Ain data and the Sharjah Airport data. In particular, the graphs share essentially the same pattern of peaks and troughs, and all reflect the singular intensity of the drought of recent years (which in the Abu Dhabi/Al Ain data is shifted to 1999-2002). Such a correlation strengthens the working hypothesis that the Sharjah Airport data can tell us something meaningful about climatic periodicity for the country as a whole.

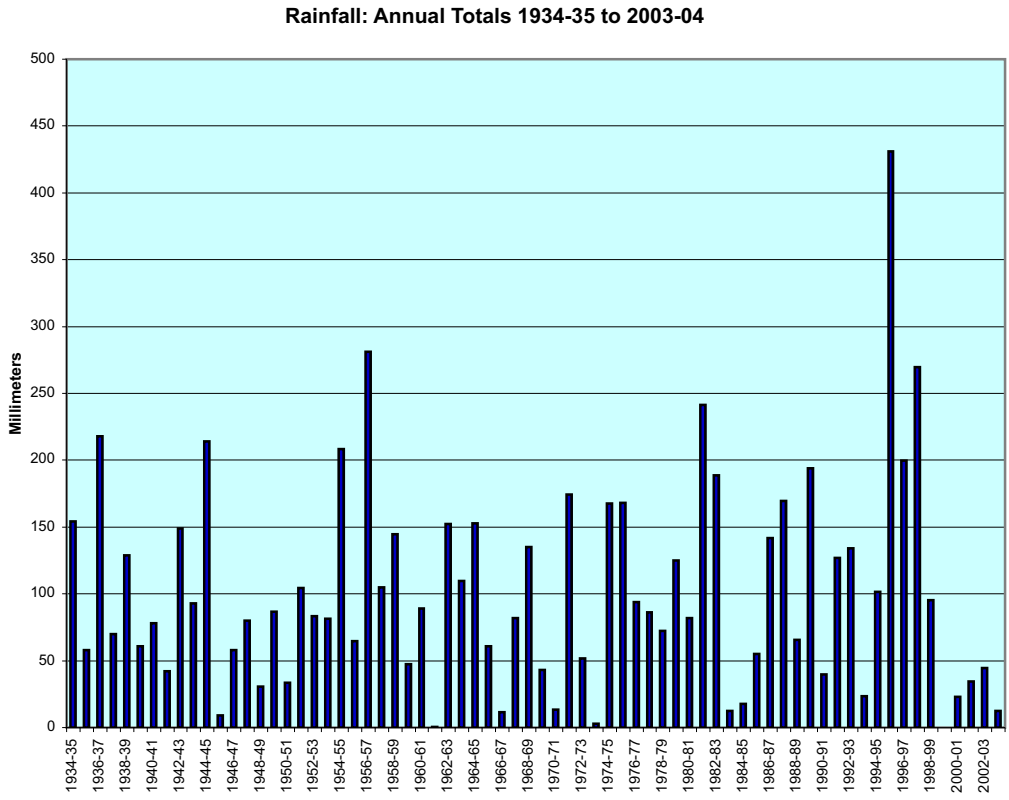

Figure 5: Annual rainfall totals at Sharjah Airports (1934-35 to 2003-04), as recalculated by the author on the basis of a July 1 to June 30 year.

Acknowledgements

It is a pleasure to thank and acknowledge the Meteorological Office of the Sharjah Department of Civil Aviation, and in particular Mr. Abraham Jacob, the current Meteorological Officer, as well as their predecessors over the past 70 years, for their efforts in recording and compiling the Sharjah Airport data and their interest in disseminating it for broader intellectual use. Thanks are also due to the Meteorological Office of the Abu Dhabi Department of Civil Aviation, and especially to Senior Meteorological Officer Mr. Mohammed Al-Abri, for providing a current update of rainfall data for Abu Dhabi and Al-Ain, and to Mr. Humayn Kabir and Ms. Hanna C. Nordell, respectively, for their assistance with the recalculations and the graphics undertaken by the author.

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Appendix

[Excerpts from Climatological Report 2003, Meteorological Office,
Department of Civil Aviation, Sharjah (2004)]

Early Climatological Stations and Recordings

The earliest meteorological observatories to be established in the Arabian Gulf region were at Bushire (1876), Muscat (1893) and Jask (1892). It was not until the 1930s that stations were set up on the shores of the Gulf, following the discovery of oil and the simultaneous expansion of aviation operations requiring staging posts on routes to the Far East. Observatories were opened at Bahrain in 1931 and Sharjah in 1993. The latter, near Al Mahatta district: 25º20'N, 55º24'E , 18 ft. (5.5 m) above mean sea level, was the first meteorological office in the U.A.E. In 1977, the observatory moved to the new location of Sharjah International Airport: 25º19'N, 55º31'E, 33.3 m (111 ft.) above mean sea level. Now several of the larger meteorological stations are equipped with the latest weather satellite systems together with high speed communications, modern computers, weather radar, radio-sonde units, automatic weather stations and cloud base recorders, etc. Only 20 years ago these stations probably had little more than a thermometer screen, barometer and rain gauge.

Present Day Climate of the Arabian Gulf

The Arabian Gulf is almost totally enclosed by the arid landmasses of the northern desert belt. Prevailing winds over the area are north-westerly because of the very frequent pressure pattern of a ridge of high pressure extending southwards into central Saudi Arabia and low pressure over the eastern Gulf. The mountain barrier along the Iranian coast further enhances this prevailing flow by naturally channeling any eastward moving low-level airflow towards the south-east.

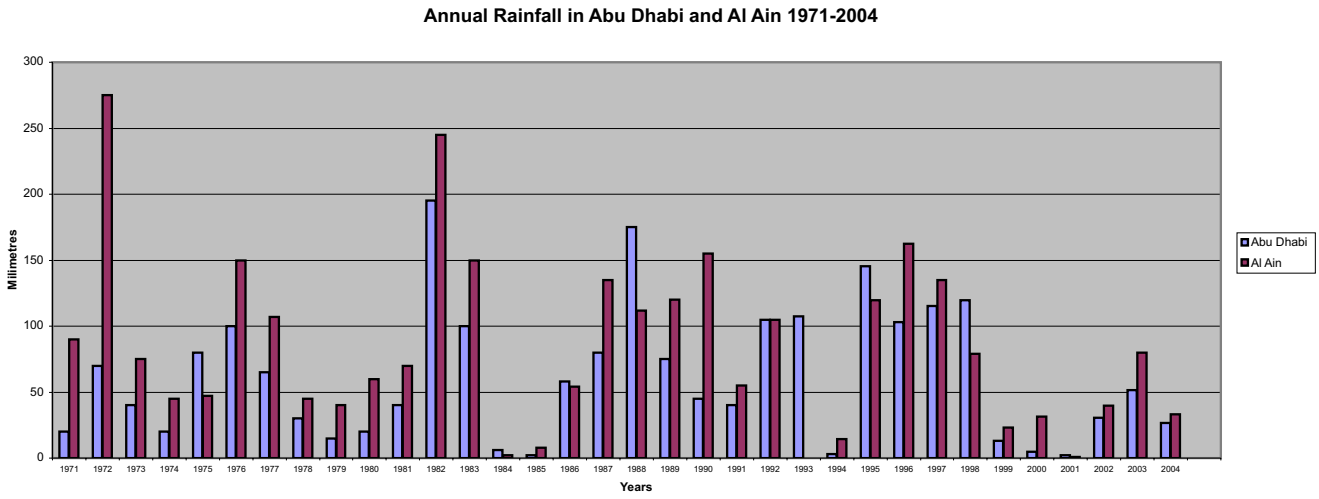

Figure 6: Annual rainfall totals for Abu Dhabi and Al Ain (1971-2004). Data for 1971-1992 is from Al Bateen Airport, Abu Dhabi, and Al Ain Agricultural Station (Bottomley 1996). Data for 1993-2004 is from Abu Dhabi International Airport and Al Ain International Airport, courtesy of the Meteorological Office, Abu Dhabi Department of Civil Aviation. Al Ain data for 1993 was unavailable.

All areas experience sporadic winter rainfall derived from Mediterranean-type depressions and local convergence phenomena. Cold fronts associated with the Mediterranean depressions travel east across Saudi Arabia and Iraq, sometimes penetrating as far as the Arabian Sea, but generally producing only small amounts of rain. Most of the rainfall seems to be derived from the warm waters of the Gulf itself, which provides a reservoir of moist air at low levels. Local boundary fronts develop between this warm, moist air and the cooler drier continental air to produce convergence situations which can give very heavy rainfall, thunderstorms, and line squalls and occasionally hailstorms.

The Gulf waters also have a major effect on the temperature and humidity of the surrounding coastal zones, with places near the shore having higher humidity and a smaller diurnal temperature range than interior sites.

A significant feature of Gulf weather is visibility restrictions caused by sandstorms, dust storms, thick dust haze, mist and fog, all of which are occasionally experienced in the UAE. Such phenomena can sometimes be the cause of much personal discomfort as well as being potential hazards to air and maritime navigation. Dust from the Iraqi dustbowl is frequently carried across the Gulf by the prevailing north-west winds, which can be strong at times and are then known locally as *shamal*, from the Arabic word for north. Not all *shamals* are dusty but when the wind speed exceeds force six, rising dust and sand can be expected to reduce visibility significantly.

During May and June, and sometimes well into July, the "40-day *shamal*" occurs. This is a seasonal increase in the frequency of strong, dry, hot and dust-laden, north-westerly winds associated with the developing monsoon low pressure centre over Pakistan.

As is well known, the Gulf is blessed with abundant sunshine. Even in winter, there is an average of at least eight hours of bright sunshine per day and this rises to over 12 hours per day in the summer.

Annual U.A.E. Weather Patterns

Winter (December - March)

This is the most unsettled time of the year and over 80% of the annual rainfall can be expected during this 4-month period. Some of the rainfall comes from eastward-moving cold fronts arriving from temperate the Mediterranean latitudes. To the rear of those fronts the stronger north-westerly *shamals* may develop. Most of the rain, however, usually originates from extensive cloud adverted across the Arabian Peninsula from the Sudan and Ethiopia ahead of sow-moving frontal disturbances. Rain can be expected on an average of 4 to 8 days per month but variations are considerable and some winters have been known to be completely dry.

The wind pattern throughout the year is dominated by the diurnal land and sea breezes. Typically, the overnight land breeze is 4 to 8 knots south-easterly and the sea breeze is 8 to 13 knots north-westerly. The sea breeze sets in by midday and dies quickly after sunset. Mean wind speeds in excess of 20 knots are rare and usually only last for a few hours. However, during thunderstorms, gusts of more than 70 knots have been recorded. February and March have the highest incidence of thunderstorms, the most severe usually occurring during the passage of active cold fronts.

Exceptionally good visibility is a feature of early winter and the mountains of the Northern Emirates, more than 80 km away, can sometimes be seen.

Spring (April - May)

Winter disturbances now decrease as they fail to penetrate south into the Arabian Peninsula and consequently skies are mainly clear with an average of 10 or 11 hours of bright sunshine per day. Rainfall is infrequent and is usually associated with an isolated thunderstorm.

Temperatures increase, with the mean maxima reaching 34ºC to 39ºC and extremes of 43ºC to 46ºC are not uncommon.

The sea breeze phenomenon tends to be stronger during these months due to the higher land/sea temperature contrast. On rare occasions, a strong southeasterly wind can overcome the sea breeze, and when this happens very high temperature and low humidity results. At the end of May, the "40-day shamal" often becomes a major feature of the weather.

Summer (June - September)

Early summer is dominated by the presence of a deep monsoon low pressure area centered over Pakistan. As this low develops, the north-westerly wind strengthens over the Arabian Gulf. This increase in frequency and persistence of the north-west wind is known as the "40-day shamal." This is characterised by a fall in daily temperatures as winds blow in from the sea.

Sometimes thick dust haze can be advected into the Emirates from Iraq, occasionally giving visibilities below 1000 metres. Visibilities are generally at their worst during the summer, with a great deal of dust haze. Early morning radiation fog is quite frequent in June, early July and September due to a favourable combination of light winds and clear skies.

Dry dust squalls from distant storms can sometimes affect the airfield and lightning can often be seen in the evenings, but rain is rare during the summer months. Such occurrences have been either as a result of afternoon thunderstorms over the Hajar Mountains moving westwards or, exceptionally, from a westward extension of the Indian Monsoon.

Temperatures exceed 40ºC on most days and with humidity slowly increasing during the summer, late August and September can be very uncomfortable. Some relief can be expected after the onset of the sea breeze, but sea temperatures in the Arabian Gulf during this period are the highest in the world, reaching 35ºC in the open sea and up to 40ºC in some of the shallow coastal lagoons.

Autumn (October - November)

These months experience the most settled weather conditions of the year and rainfall is again rare, especially in October. The first of the winter rains usually come in late November and December. Winds are generally light, the land/sea breezes being weak during this period.

Although there is a marked improvement in visibility as the dust of the summer clears, October has the second highest incidence of radiation fog, which can be rather reluctant to clear at times, especially late in the season. During November the mountains to the north and east can sometimes be seen.

Nighttime temperatures fall to around 16ºC by the end of November and with daytime temperatures rising to near 30ºC, the weather can be very pleasant and favourable for outdoor recreational activities.

Temperature Extremes

Absolute maximum temperatures have reached 50ºC at many places in the Arabian Gulf region and are within a few degrees of this at all recording stations except islands and offshore installations. The highest temperature so far recorded is 53.5ºC at Ahwaz. Kuwait recorded an absolute maximum of 50.8ºC in June 1954 and Sharjah recorded an absolute maximum of 49.2ºC in June 1978. It can easily be seen that inland can expect daily summer maximums of around 45ºC while locations on the coast may be a good bit cooler, although not necessarily more comfortable as increased humidity will often make conditions seem worse.

An archaeological and ecological curiosity - *Terebralia palustris* (Linnaeus, 1767) in the north-east of the Emirate of Abu Dhabi

by Peter Hellyer and Simon Aspinall

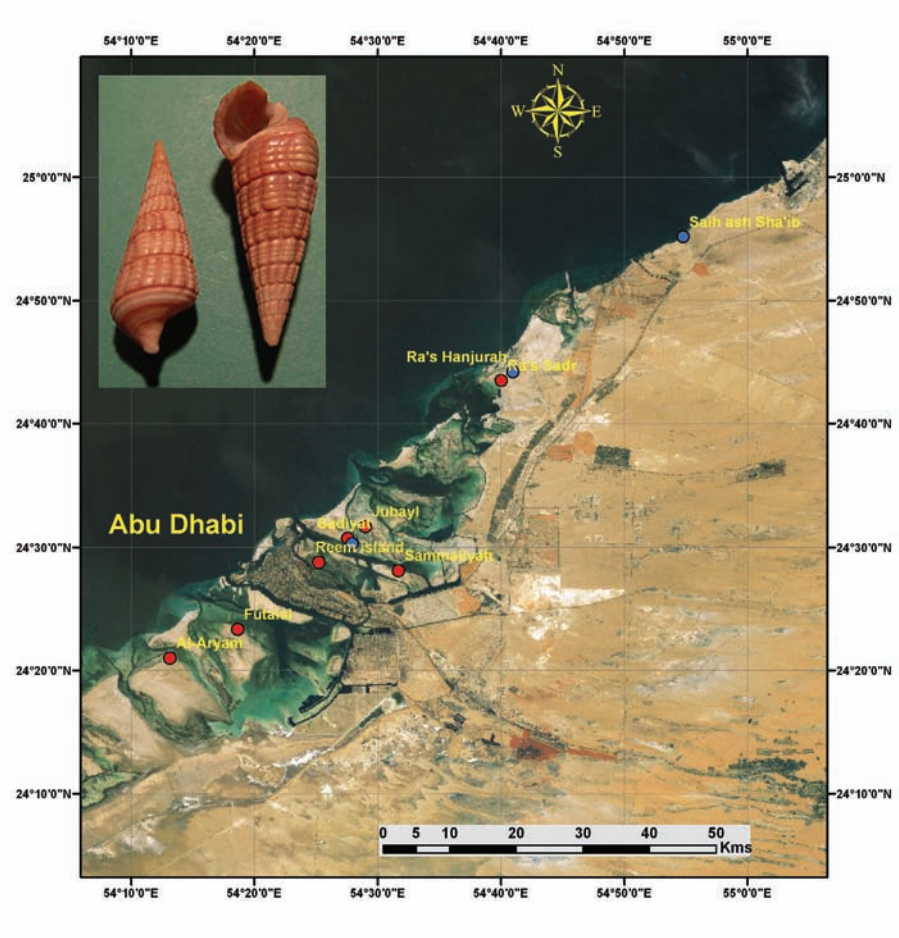

Fig. 1: Distribution of *Terebralia palustris* in north-eastern Abu Dhabi Emirate. The red dots indicate archaeological sites where *T. palustris* have been found, and the blue dots sites where *T. palustris* have been identified in a non-archaeological context. Mapping by Dr. Mark Beech

Introduction

A recent study (Feulner 2000) of the distribution of the large mangrove mud creeper *Terebralia palustris* (Linnaeus, 1767) in non-mangrove environments in south-eastern Arabia noted that this large and easily identifiable gastropod is now believed to be extinct in the Arabian Gulf, at least on the Arabian side. Further investigation of Iranian sources has since disclosed the existence of populations at two areas in Iran, within and adjacent to the Straits of Hormuz (Feulner, *pers. comm.*, citing information provided by Dr. Peter J. Hogarth, Department of Biology, University of York, from written and oral sources).

T. palustris is recorded from archaeological sites on the Arabian Gulf coast of the Northern United Arab Emirates dating from the Neolithic (Late Stone Age) period (c. 5,500 BC - 3,500 BC) to the late pre-Islamic period, (300 BC - 650 AD), initially being common, and then gradually becoming less so during the early centuries of the Christian era, apparently disappearing around 400 AD (Glover 1998). Subsequent work by Glover may substantially extend the date of final disappearance but the overall record remains one of steady decline (Feulner, *pers. comm.*).

Feulner also noted (citing personal communications from PH and from Dr. Mark Beech) that "with three exceptions [these all being on archaeological sites that have been ascribed a Late Islamic date - i.e. 16th - early 20th Century AD], it [*T. palustris*] is absent from beach sands, sedimentary deposits and archaeological contexts in Abu Dhabi emirate" (Feulner 2000: 17) and also that the species "is essentially absent at [Arabian Gulf] sites [in the Northern Emirates] dating from the early Christian era to the present."

Glover (1998:73)) commented that "there are still areas of mangrove remaining in the Arabian Gulf, particularly in Abu Dhabi, which would appear to be suitable for *Terebralia*," although she was not aware when she wrote her paper that *T. palustris* shells had already been identified on Late Islamic sites in the Emirate of Abu Dhabi, referring only to the fact that they were not present at sites on the island of Dalma, in the far west of the Emirate.

Recent discoveries in the north-east of the Emirate of Abu Dhabi and immediately-adjacent areas of Dubai, both archaeological and environmental, have, however, shown that dead *T. palustris* shells are more common there than was previously realised, albeit in a relatively limited area, and that they are found both on archaeological sites and in non-archaeological contexts that suggest that a live population of the species continued to survive well into the Late Islamic period *(Fig. 1)*.

Previous data

The three then-known sites to which Feulner and his informants referred were the following (Site codes, where mentioned, are those included on the Abu Dhabi Archaeological Sites Database, initiated by the Abu Dhabi Islands Archaeological Survey, ADIAS):

Ra's Sadr (Site RS0004)

A shell scatter and possible cairn adjacent to the northern side of a shallow tidal creek at Ra's Hanjurah, c. 50 km. to the north-east of Abu Dhabi island. The Ra's Hanjurah and Ra's Sadr area forms the north-eastern end of a large area of small islands and shallow lagoons bounded, on the south-west, by the island of Abu Dhabi. A few *T. palustris* shells were present, with other molluscs, although there were no associated finds to permit dating.

Jubayl (Site JUB0001)

A Late Islamic pottery scatter with "several dozen" *T. palustris* shells (also shells of another large edible gastropod *Hexaplex kuesterianus*) in a depression on a dune on the south-west side of Jubayl island, to the north-east of Abu Dhabi island. A secondary site on the same sand dune, approximately 25 metres away, allocated the separate site code of JUB0002, had a scatter of Late Islamic "Julfar" ware with more associated *T. palustris* and *H. kuesterianus* shells.

Al-Aryam (Site ARY0005)

The site of the former Late Islamic fishermen's village of Bu Karwah, on the east side of the island of Al-Aryam (formerly known as Bu Khushaishah), c. 15 kilometres to the west of Abu Dhabi island. Mollusc shells present include *T. palustris*, *H. kuesterianus*, *Pinctada radiata* (pearl oyster) and *Spondylus marisrubri*. *T. palustris* represents less than one per cent of all shells present. The site is believed to have been abandoned in the late 19th / early 20th Century.

Taken together, these three sites suggested that *T. palustris* might once have been present in the area of islands and lagoons that stretch from Ra's Sadr / Ra's Hanjurah, in the north, past Abu Dhabi island to Al-Aryam and Dabb'iya, the peninsula immediately to the west of Al-Aryam. Of particular interest was the fact that, where *T. palustris* shells were associated with pottery, this appeared all to be of Late Islamic date - this certainly being the case with Site ARY0005, which is known from oral tradition to have been occupied into recent times and from which no earlier material has been identified.

Only a small number of shells were found at each of these three sites and, in view of the fact that the species was not known from elsewhere in the Emirate of Abu Dhabi, and that, according to Feulner (2000) it was known from naturally-occurring beach deposits no nearer than Jebel Ali, in south-western Dubai, it was initially speculated that *T. palustris* might have been imported to the sites from a considerable distance, perhaps as a "luxury" item or, as a long-lasting "travel snack", since it can survive, once collected, in edible condition for some days.

New data

During the course of subsequent (post-2000) archaeological and ecological surveys carried out by the authors and others on islands close to Abu Dhabi island and in the Abu Dhabi / Dubai border area, further finds have permitted a re-assessment of the former status of *T. palustris* in the Emirate of Abu Dhabi, and it now appears certain that the species was not only exploited during the Late Islamic period but that it was naturally present. A previously overlooked published record of the presence of *T. palustris* in the Emirate has also been traced (Biggs 1973). In terms of exploitation of the species, the following previously-unrecorded archaeological sites have been identified:

One, Futaisi, lies to the west of Abu Dhabi.

Futaisi (Site FUT0006)

Several species of molluscs were collected here, adjacent to a small Late Islamic mosque and a Late Islamic pottery scatter. Species present included *T. palustris*, *P. radiata* and *Conus sp*. The mosque was originally recorded (by J. Czastka) in 1996, with the pottery and shell scatter being recorded by D. Hull and PH in 2001 (Hull & Hellyer, 2001).

Other new records come from islands to the north-east of Abu Dhabi.

Sadiyat (Site SAD0016)

On the island of Sadiyat, an archaeological survey undertaken in June 2005 by the Abu Dhabi Islands Archaeological Survey, ADIAS, identified a shell midden, site SAD0016, on a rocky outcrop on the north-east side of the island in which several mollusc species were present, including, *Pinctada radiata*, *Hexaplex kuesterianus* and *Murex sp.*, as well as a large number of *T. palustris* shells (Kallweit & Hellyer 2005). In the same area are several other archaeological sites, SAD0003, SAD0013, SAD0014, SAD0017 and SAD0018, including shell-middens, hearths, stone structures and pottery scatters. The pottery sherds, of which over 2,600 have been collected, are Late Islamic in date, although there is a very small number of Late Stone Age lithics, indicating an earlier occupation of the site (Kallweit, Beech and Cuttler 2006; Kallweit and Hellyer 2006). Thus it is not possible, without dating of the *T. palustris* shells, to determine to which phase, or phases, of occupation they may relate.

"Reem Island"

"Reem Island" (formerly known as Abu Shuum) lies between Sadiyat and Abu Dhabi island. This site was first identified (by the authors) in mid-June 2006, and comprises a loose midden of shells with an associated scatter of Late Islamic pottery and evidence of simple fireplaces, at the south-eastern corner of the island. Mollusc shells observed during a very preliminary examination included *Marcia sp*. *Hexaplex kuesterianus* and a single *T. palustris*. Although, in itself, the single shell is of minimal significance, it complements other evidence of the former presence of the species during the Late Islamic period on the islands of Sadiyat and Jubayl, immediately to the north-east.

Sammaliah (Site SAM0001)

Around 10 kilometres to the east, a site on the island of Sammaliah, SAM0001, initially identified by Dr. Ron Loughland of the Department of Environmental Research of the Emirates Heritage Club, has produced *T. palustris* shells in association with Late Islamic pottery (Loughland, *pers. comm.*). Due to the difficulty of access, very little archaeological survey work has been done in the area of islets immediately to the north of Sammaliah, and it is possible that further archaeological sites remain to be identified in this area.

Discussion

Dating of archaeological sites with *T. palustris*

A secure dating of all of the archaeological sites is not possible, since there were no associated finds at the Ra's Sadr / Ra's Hanjurah site, RS0004. The group of shell middens on Sadiyat is loosely associated with a small collection of Late Stone Age lithics (Kallweit & Hellyer 2006) although the pottery present is from the Late Islamic period (Beech, Kallweit & Cuttler 2006). In the case of the Al-Aryam,

Al-Futaisi, Sammaliah and Jubayl sites, the *T. palustris* shells are associated with Late Islamic pottery (Hellyer 2000; Hull & Hellyer 2001; Hellyer, Czastka & Aspinall 1995). The same is true of the site on "Reem Island."

It seems reasonable, therefore, to conclude that a population, or populations, of *T. palustris* existed in the lagoons and mangroves of north-eastern Abu Dhabi Emirate in the Late Islamic period, and possibly earlier. It should be noted, though, that no *T. palustris* shells have been reported from the Bronze Age site at Umm al-Nar, or from the Late Stone Age / Bronze Age site at Abu Dhabi International Airport.

The species has also not been identified on archaeological sites or in natural locations, such as beach deposits, anywhere in western Abu Dhabi (i.e. to the west of the Dabb'iya peninsula), while, as noted earlier, it virtually disappears from archaeological sites in the Northern Emirates during the early centuries of the Christian era.

Non-archaeological evidence of *T. palustris*

The lagoons and mangrove forests to the north-east of Abu Dhabi have not yet been subjected to a detailed environmental study. However, there are now three records of *T. palustris* shells being found in natural environments in the north-east Abu Dhabi area.

The first record dates back to between 1961 and 1965, but has only just been noted locally. Between those years, a team of geologists from Imperial College London, led by Professor Graham Evans, collected molluscs from beaches, inter-tidal flats, lagoons and near-shore zones along the coast of the Emirate of Abu Dhabi, the results of which were published in Biggs (1973). Two damaged *T. palustris* shells were collected at Station 51, a beach on the south-west of Sadiyat island, these then being the first records for the Arabian Gulf. Biggs commented that "It seems remarkable that such a large and conspicuous species has not been recorded before, and there is just the possibility that these specimens may have come in with ballast." (Biggs 1973:358).

Neither Evans and his colleagues nor the Reverend Biggs were aware of the existence of archaeological sites containing *T. palustris* shells in the vicinity (these being identified much later), while there had also been no publication of the presence of the species on middens in the Northern emirates.

The second and third new records, however, are the sites of former coastal lagoons identified by one of the authors (SA), which appear to confirm the earlier presence of live populations of *T. palustris* north-east of Abu Dhabi city.

On a former inter-tidal flat near Ra's Hanjurah, several hundred *T. palustris* shells are widely scattered over an area of several hundred square metres *(Fig. 2).* There are no archaeological sites known in the immediate vicinity, and the shells appear to be in a natural position. It is unlikely, moreover, that they have been deposited by man, since in locations where *T. palustris* has been collected for food, the empty shells then being discarded, they are normally found in clusters or heaps, not scattered singly.

Fig.2: *T. palustris in situ* on a now dry inter-tidal lagoon at Ra's Hanjurah. Picture: Simon Aspinall

At the inner edge of the inter-tidal flat, now cut off from the sea by a road, there is flotsam evidently deposited as a result of tidal activity, including planks of wood which have not rotted to any significant degree, suggesting that the the area continued to be affected by tidal activity until relatively recently, perhaps in the last decade or so.

No attempt has yet been made to date the *T. palustris* shells from Ra's Hanjurah, and they could, of course, have been dead for some considerable time. Most, however, are complete, with the exception of the breakage of the tips, in some cases, and they do not appear to have been affected to any significant degree by weathering, although many have a slight reddish tint. It has been suggested by Feulner (*pers.comm.*), based on observations in the Northern Emirates, that the latter feature may come about as a result of shallow burial in a relatively oxidising environment, particularly in a coarse shell bed (a lag deposit), and that the shells in question may have been only recently exhumed. *T. palustris* is usually, but not exclusively, found in association with mangroves (Feulner 2000). No evidence of mangroves formerly being present is visible at the exact location where the shells were found, however, small stands of mangroves Avicennia marina are present in the tidal creek at Ra's Hanjurah, a few hundred metres away, as well as being widely spread between Ra's Hanjurah and Abu Dhabi island

A further series of now-infilled lagoons, with *T. palustris* shells *in situ* in non-archaeological contexts, exists just north of the Abu Dhabi / Dubai border, at Saih ash Sh'aib. This area appears to have a similar history to that of the Ra's Hanjurah area. The coastal lagoons at Saih ash Sh'aib have infilled progressively, satellite imagery clearly showing the full extent of the once extensive embayments system to around 3 km inland of the present-day shoreline. Whether or not mangroves were at that time present at Saih ash Sh'aib is not known, although coring might reveal confirmatory evidence.

Today the lagoons immediately behind the beach at Saih ash Sh'aib have been modified by "borrowing" of material to supply aggregate. The configuration of the inner lagoonal embayments remains clear, however, having once been connected to the Gulf through the area of the new man-made workings, but unaffected by modern-day extraction or other activities. Indeed, the inland supra-tidal flats still occasionally flood on storm tides or following heavy rainfall in winter. Progressive infilling, or perhaps even a catastrophic event, such as a single storm, which blocked the narrow entrance, ultimately spelt the demise of both the lagoons and the population of *T. palustris*. Coring or excavation would be necessary to decipher the evolution and timing of the change in environment here

Conclusion

The presence of *T. palustris* shells on Late Islamic archaeological sites to the south-west of Abu Dhabi island, and more abundantly to the north-east, coupled with the presence of shells in non-archaeological shoreline contexts on Sadiyat and, particularly, at Ra's Hanjurah and further north-east at Saih ash Sh'aib, suggests that a live population of the species was formerly present in the area. This represents a significant extension westwards of known former populations of *T. palustris* in the Gulf.

The archaeological evidence further suggests that such populations were present in the north-east Abu Dhabi lagoons long after they had disappeared from the Northern Emirates or, at least, after the latter populations had declined to such an extent that they were no longer exploited for food.

These results raise interesting questions for further inquiry. For example, why is it that *T. palustris* seems to have been limited to this relatively small area of the coastline of the Emirate of Abu Dhabi and immediately adjacent areas of Dubai, at Saih ash Sh'aib? What accounts for its presence here long after its apparent disappearance in the Northern Emirates? What caused the population finally to disappear? And is there still a population of live *T. palustris* somewhere among the mangroves within Abu Dhabi's north-eastern lagoons?

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A new type of tool from Umm az-Zamul Neolithic sites, United Arab Emirates

by Heiko Kallweit

Assemblages of Neolithic stone artifacts from the Arabian Peninsula are mainly known for the variety of large and small projectile points, commonly referred to as spearheads and arrowheads respectively. The bifacial pressure retouch process during the manufacture of this type of weaponry results in a highly sophisticated technical standard with great aesthetic value, which has, sadly, led to them being highly prized by private collectors. These eye-catching objects often overshadow less spectacular objects found in toolkits, such as scrapers, awls, drills and wedges.

These tool types have long been internationally classified. While the majority of the classifications are widely accepted, modifications are made from time to time, and some of the classifications are still subject to debate. This is the case for Neolithic tool kits found on the Arabian Peninsula.

Initial descriptions (Kapel 1967; Gramly 1971; Edens 1982; Edens 1988; Inizan 1988) were made over twenty years ago, and there is now considerable discussion among lithics specialists on material from recent excavations and stored material from previous excavations. This note introduces and describes a new tool type, not previously reported from Neolithic sites inside the territory of the United Arab Emirates.

The new tool type forms part of an assemblage recorded from Neolithic (Late Stone Age) sites in the south-eastern deserts of the UAE, immediately north of Umm az-Zamul.

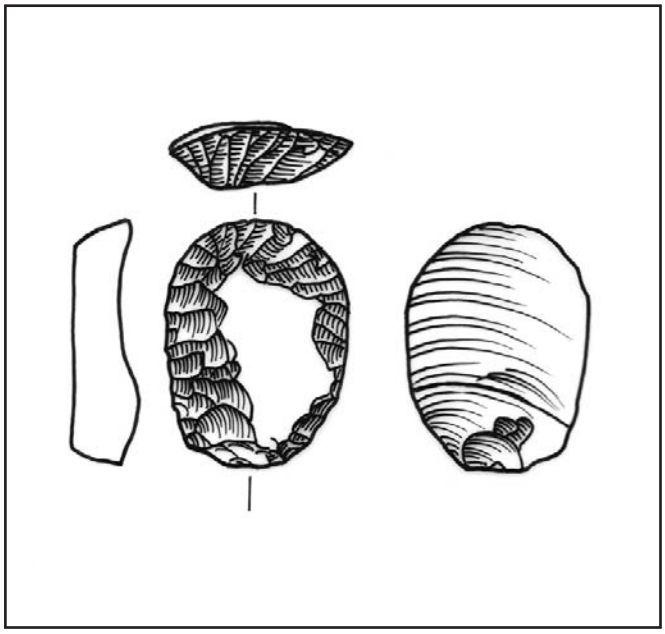

Fig 1:Thumbnail-scraper from Umm az-Zamul.

Fig 2: Newly-discovered scraper.

Fig 3: Newly-discovered scraper.

Fig 4: Newly-discovered scraper.

During the course of terrestrial habitat and wildlife surveys conducted by the Environmental Agency of Abu Dhabi, EAD, (previously ERWDA, Environmental Research and Wildlife Development Agency), the presence of lithic surface scatters were reported to the Abu Dhabi Islands Archaeological Survey (ADIAS).

An ADIAS team carried out a reconnaissance of the area in late 2003. During the subsequent three seasons of systematic survey and excavations, from 2004 to 2006, undertaken in association with the Department of Antiquities and Tourism in Abu Dhabi's Eastern Region, (now part of the Abu Dhabi Authority for Culture and Heritage), more than 2,600 Neolithic tools and pieces of tool production waste (debitage) were recorded and plotted in three dimensional positions from sites at Kharimat Khor al-Manahil and Khor al-Manahil (KAM). Additionally, areas of dense scatters were sieved and yielded more finds. Among the finds recorded during the field seasons were spearheads and arrowheads, awls and scrapers.(Beech *et al.* 2006a; Beech *et al.* 2006b; Kallweit *et al.* 2004; Kallweit *et al.* 2005; Kallweit *et al.* forthcoming) The provision of a grant, awarded by the Emirates Natural History Group (ENHG) to ADIAS in early 2006, has enabled the author to examine the collection in more detail.

The new tool type discovered belongs to the class of scrapers or scraping tools, which is further divided into sub-types, according to both the shape and the method of manufacture of the tool. Scrapers are also known from ethnographic research, and described in such publications. (Holmes 1974). As indicated by the name, the function is to scrape off material from a surface, mainly organic in origin. One example of the use of stone-made scrapers, shown from ethnographic studies, is to clean animal skins. A certain type of wear results from such actions, and a so-called "scraper-face" is created on the working edge of the tool *(Fig.1)*. It is likely that scrapers of different sizes were shafted by Neolithic toolmakers, for different purposes, such as the processing of skin, wood or even inorganic material like soft stone. Unlike the types of scrapers commonly found, which tend to have a rounded or almost straight working edge, the newly-identified type shows a concave working edge *(Figs. 2-4)*. As a pre-form, the toolmakers chose a crested shaped flake.

A total of six such scrapers have been identified by the author from the Umm az-Zamul assemblages, whilst the purpose of one fragment remains uncertain. The concave working edge is regularly and steeply pressure retouched. The retouched notch is always between 2-3 centimetres wide. In the case of item KAM 282, *(Fig.4)*, the opposite edge is similarly pressure retouched. In all other cases, the opposite edge is naturally backed. Similar objects are reported from lithic collections from south-western and eastern Arabia (Edens 1982(Edens 1988). They are generally referred to as retouched flakes, or, with certain exceptions, as side-scrapers. However, they differ significantly from the Umm az-Zamul artifacts in terms of their pre-form, since none of the other tools reported by Edens are made on crescent shaped flakes. Compared to other scrapers, the new type found at the KAM sites is easy to distinguish by its concave working edge and the crescent shaped flake it is made on.

It is, therefore, considered to be a newly-identified tool type within the typology of the Desert Neolithic.

Further studies of other Neolithic assemblages from the UAE and other parts of eastern and south-eastern Arabia are required to determine whether the new tool type is restricted in terms of its geographical distribution, or whether it had a broader distribution.

Acknowledgements

Fieldwork at the Kharimat Khor al-Manahil and Khor al-Manahil sites undertaken by the author and colleagues was carried out as part of work undertaken by the Abu Dhabi Islands Archaeological Survey, ADIAS, in collaboration with the Department of Antiquities and Tourism in Abu Dhabi's Eastern Region, the latter now part of the Abu Dhabi Culture and Heritage Authority.

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Satellite tracking of Greater Flamingos *Phoenicopterus roseus* from the United Arab Emirates

by Sàlim Javed, Shahid B. Khan, Rashid Al Mansouri and Entesar Ahmed Al Hosani

Fig 1: A greater flamingo with satellite transmitter at Al Wathba Lake. Picture: Sàlim Javed

In one of the first-ever instances of the capture and satellite tracking of greater flamingos *Phoenicopterus roseus* in the Arabian Peninsula, several birds were captured in late 2005 and fitted with satellite transmitters at Al Wathba Wetland Reserve in Abu Dhabi, a protected area managed by the Environment Agency - Abu Dhabi, EAD. The capture and tagging of the flamingos was done as part of the Seabird Satellite Tracking Project, implemented by EAD's Terrestrial Environment Research Centre, TERC. One of the key objectives of the study is to understand the movement of flamingos between different coastal and inland wetlands within the Emirates and also to document their migration. The bulk of the UAE's flamingo population is believed to originate from breeding colonies further north, possibly in Iran, Turkey and Central Asian countries. Birds are present at favoured sites, including Al Wathba, throughout the year, although numbers increase between autumn and spring because of migrants and winter visitors.

Flamingo of different age classes are observed throughout the year at Al Wathba and in other wetlands in the Emirates. Regular monitoring of birds at Al Wathba has shown that the flamingo numbers fluctuate according to the season (Javed and Khan 2003). Evidence of movement of greater flamingos between northern Iran and the southern Caspian Sea and the United Arab Emirates has previously been obtained from ringing recoveries of birds ringed at Lake Uromiyeh, in Iran, at Dubai's Ra's al-Khor wildlife sanctuary in 1974 (2), 1981, 1989 and 1992, and on the Abu Dhabi island of Dayyinah in 1999 (Platt 1992, Aspinall *pers. comm.*) with another bird ringed in the southern part of the former USSR being recovered in Abu Dhabi in 1986. Further recoveries of birds ringed at Lake Uromiyeh have been made in Bahrain, Qatar and Oman (Platt 1992). It is possible that the UAE flamingo population is a mixture of adult and juvenile migrants and/or birds resident within the Arabian Gulf which engage in local movements.

Between 26-28th November 2005, five greater flamingos were captured at Al Wathba Wetland Reserve in Abu Dhabi. Of the five captured birds, four were fitted with satellite transmitter. S.A backpack harness method, successfully used on many large birds such as flamingos in Africa and Spain (Childress *et al.* 2004; Amat *et al.* 2005) and on geese and cranes in India (Javed *et al*. 2000, Javed *et al.* 2003) was used to place the satellite transmitters on the captured flamingos. The captured flamingos were also marked with "DARVIC" plastic rings, provided by the Station Biologique Tour du Valat, France, as part of the international flamingo ringing scheme of the IUCN-SSC Flamingo Specialist Group.

Initial results obtained from the satellite-tagged greater flamingos have already, by mid-June 2006, provided valuable information on the movement patterns of flamingos between coastal and inland wetlands in the Emirates. Within a few days of being tagged and released, the birds began to move away from Al Wathba and by 5th December 2005, three of the four satellite-tagged birds had moved to Dabb'iya and Al Aryam on the coast, west of Musaffah and about 25 km from Al Wathba. This confirmed that, as suspected, flamingos from Al Wathba make extensive use of the coastal wetlands between Musaffah and Dabb'iya. The flamingo movements between Al Wathba and the Abu Dhabi coastal wetlands highlight the dependence of flamingos, both for feeding and successful breeding, on the protection of multiple sites within their daily movement ranges, not just one or two isolated sites. Greater flamingos successfully bred at Al Wathba in 1999 while a 1993 flamingo breeding attempt at Al Wathba, foiled by human interference after a first chick had hatched, was the first known breeding in the Arabian Peninsula since 1922 in Kuwait (Aspinall & Hellyer, 1999).

By 19th December 2005, one of the birds had moved to the Ra's al-Khor wildlife sanctuary, Khor Dubai, then to Khor al-Beida in Umm al-Qaiwain, before returning to Ra's al-Khor. The movements of flamingos tracked from Al Wathba to Abu Dhabi coastline, and then to wetlands in Dubai and Umm al-Qaiwain, also reaching as far north as the coast of Ra's al-Khaimah, indicates a regular interchange of birds between these sites. Although both Al Wathba and Khor Dubai support flamingos throughout the year, this is the first occasion on which such interchange of populations between the UAE's Arabian Gulf wetlands and coastal areas has been clearly proven. This emphasises the necessity for greater co-operation between the UAE's member emirates to protect greater flamingos, as a 'flagship species', and, more importantly, to conserve key wetland sites.

Two of the Al Wathba birds have successfully migrated into Iran. One of these birds, named Sindbad by EAD, was the first bird to cross the Arabian Gulf. The bird started its return migration from the Al Aryam coast, west of Abu Dhabi, on 27th February and en route stopped over at Khor al-Beida in Umm al-Qaiwain for a few days before crossing over the Gulf. The first satellite data of its locations in Iran were obtained from Nariz Lake in south-west Iran on 4th March 2006, where it stayed for nearly two months. It resumed its northward migration on 7th May and was recorded in south-west Turkmenistan, a few kilometres from south-eastern shore of the Caspian Sea in early June, by which time the bird had covered 2100 kilometres and had used 11 different wetlands as stopover sites to rest and feed during its spring migration. A last location, obtained on 25th June 2006, just before this issue of ***Tribulus*** went to press, indicated that Sindbad had moved further north along the east coast of the Caspian.

Although an interchange of flamingos between the UAE and Lake Uromiyeh, in northern Iran and south-west of the Caspian Sea, was already known from previous ring recoveries, the movement of another Al Wathba bird to the same location suggests that this population interchange

and use of this migration route is regular. Lake Uromiyeh is estimated to hold about 25,000 breeding pairs (Sadegh Zadegan, *in litt.*).

This study of the Al Wathba birds has, for the first time, documented the route taken during the spring migration and stopover sites used both in the UAE and in Iran. Such data are vital for the long-term conservation of flamingos along their breeding and wintering distribution range and effective protection of such sites will also help protect many other waterbirds which share similar habitats along the migratory flyway.

Given the scale and frequency of the use of several wetlands by the tagged flamingos, preliminary results from this study provide strong support for the view that maintaining wetland connectivity, both during breeding and non-breeding period, is essential for the conservation and management of greater flamingos and other waterbirds. The satellite tracking data also show additional evidence of the importance of long-term protection and availability of key wetland sites such as Khor al-Beida in Umm al-Qaiwain, which has been designated as an Important Bird Area for the Middle East by BirdLife International. Besides being an important wintering site, Khor al-Beida is also a migration springboard for many species crossing the Gulf during spring and autumn migration. Unfortunately, Khor al-Beida and its extensive inter-tidal mud flats are under threat from a massive urban development project. It is imperative that such sites are given high priority and immediate protection from development, to ensure the future of flagship species such as the greater flamingos and crab plovers to be found there, as well as many other bird species.

Besides receiving location data from the Argos satellite of the satellite-tagged greater flamingos, EAD is also ground monitoring the birds which are still on the Abu Dhabi coast, by using higher accuracy Argos and/or GPS locations and searching for ringed birds in flamingo flocks. On 20th June 2006, locations recorded the previous day were used to track three tagged flamingos between Musaffah and Al Aryam, two with satellite transmitters and one with only a plastic ring. One of the birds was in a group of 171 flamingos and the other two in another group of 202 flamingos. All three showed a normal level of activity and were part of larger groups of adult, immature and a few juvenile birds. Additional data to be collected in future are likely to be of great value in learning more about the movement of the UAE's greater flamingos and their use of wetland habitats. EAD will continue to use the data from this study and promote conservation of important wetlands in the UAE by seeking cooperation from relevant bodies in other emirates.

Note:

Greater Flamingo has now been split by the Taxonomic Advisory Committee of the Association of European Records and Rarities Committees (TAX-AERC), into three separate, monotypic species, Greater Flamingo (*P. roseus*), Caribbean Flamingo (*P. ruber*) and Chilean Flamingo (*P. chilensis*) based on plumage colouration and pattern, bill colour and leg colour, their different vocalisation and display and the fact that they are hosts to different species of head lice (Mallophaga) (Collinson, 2006).

Their breeding ranges are also well separated and there is no reason to believe that they will ever merge. *Phoenicopterus ruber* has formerly been applied to Greater Flamingos in the Gulf, but the name *Phoenicopterus roseus* should now apply. The Emirates Bird Records Committee will review and adopt, where appropriate, these and other taxonomic changes in due course.

The new name has also been adopted by the IUCN's Flamingo Specialist Group which has also proposed a revision of the Western Palearctic population of the greater flamingo from 430,000 to 585,000 (Childress et al. 2005). Based on previous ring recoveries, the entire Western Palearctic greater flamingo metapopulation is considered as one large population (Bechet, 2005) and our tracking data lend further support to this view.

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Lindenbergia indica (Scrophulariaceae) a newly-recorded foodplant for the Blue Pansy butterfly *Junonia orithya here* in Arabia (Lepidoptera: Nymphalidae)

by Michael P.T. Gillett

Butterflies belonging to the family Nymphalidae are few in numbers of species in the United Arab Emirates and northern Oman and, whilst conspicuous, make up only about 15 % of the total number of species found in the region. They include a single member of the subfamily Danaeinae (*Danaus chrysippus chrysippus*), four of Nymphalinae (Painted Lady - *Vanessa cardui*, Blue Pansy - *Junonia orithya here*, Yellow Pansy - *J. hierta cebrene* and Diadem - *Hypolimnas misippus*) and three of Satyrinae (*Ypthima asterope asterope*, *Y. bolanica* and *Hipparchia parisatis*) (Gillett, 1995).

The three satyrines are all more or less sedentary butterflies feeding on various grasses in oases or mountain wadis. However, all of the other local members of the family are migratory and they appear sporadically, produce one or more local broods of offspring, and then disappear again until their next invasion. Their success in establishing themselves temporarily within this region depends very much upon their powers of adaptation and choice of larval foodplants.

In October and November 2003, wadis in the Hajar Mountains adjacent to Al Ain contained large numbers of *V. cardui* and *J. orithya here* together with smaller numbers of *J. hierta cebrene*, but only *V. cardui* was present in Al Ain City.

Surveys were conducted in three wadis (Khadrah, A'bul and Khutwah), in an attempt to identify larval food-plants for these three species of Nymphalinae. Larvae of the Painted Lady and the Blue Pansy were found, but not those of the Yellow Pansy. In all three wadis, Painted Lady larvae were found on plants of *Forsskaolea tenacissima* (Urticaceae) in plantations and open fields. Some were taken back to Al Ain and reared on the same plants - the adults hatched in early December and were released. This larval foodplant has previously been recorded in Oman for the Painted Lady (Larsen, 1983). Blue Pansy caterpillars were found only in Wadi Khutwah on plants of *Lindenbergia indica* (Scrophulariaceae) (Jongbloed, 2003) growing in damp spots caused by seepage from the *falaj (see above)*. Larvae of all stages were present with a total of about 20 individuals. Several were reared to adulthood and hatched in mid-December, thus confirming their identification. This is a newly recorded food-plant for the Blue Pansy.

In Africa, various members of the Lamiaceae (formerly Labiatae) are used, but in Arabia, the family Acanthaceae seems to be preferred. For instance, in SW Arabia, species of Barleria have been recorded, but this genus is absent from the UAE and N. Oman. Other Arabian records, however, are for widely different plants, including *Phyla nodiflora* (Verbeniaceae), *Plantago amplicaulis* (Plantaginaceae) and *Kickxia* species (Scrophulariaceae) (Larsen, 1983). Several *Kickxia* species, which are related to *Lindenbergia indica*, grow in the Hajar Mountains, but they are scarce and none were found during the caterpillar survey.

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Soldier's Orchid *Zeuxine strateumatica* marches on

by Simon Aspinall

Figure 1: Soldier's orchid *Zeuxine strateumatica*. Picture: Dave Clark

Figure 2: Close-up of the flower. Picture: John Stewart

A group of birdwatchers looking for migrant birds at the newly-laid golf course at Al Maqam, near Al Ain, suspended their search, temporarily, when an orchid was found on one of the fairways in February 2006. The UAE only has one native species of orchid, the helleborine *Epipactis veratrifolia*, and this was not it. A leisurely stroll around the course soon found there to be many hundreds, if not thousands, of specimens present. The newcomer has since been confidently identified as the Soldier's Orchid *Zeuxine strateumatica* (Linnaeus) Schlecter, a species which originates from Asia and which, over the past seventy years, has managed to colonise various far-flung corners of the globe. Botanists in the UAE are used to finding accidentally introduced species, so-called 'aliens'. This one appears likely to have come in with imported grass seed.

This small orchid is now described as being widespread in the Old World, although, in Arabia, it has, hitherto, apparently only been recorded in Saudi Arabia (Thomas 1998). It occurs in open (mainly tropical) grassland and lawns, often in some numbers. With an inflorescence shaped like a pixie's cap, densely flowered, and most often less than 5cm high, it is not the most conspicuous of orchids, but it does possess a beautifully fragrant scent. The flowers are tiny (c3mm), white with a green lip, somewhat like the snowdrop *Galanthus nivalis* or ladies tresses *Goodyera/Spiranthes* spp. in appearance. The flower spike is rather concealed by the long, pointed, erect leaves.

The soldier's orchid *Zeuxine strateumatica* (Linnaeus) Schlecter, is native to Asia, from China to the tip of India including south-east Asia and adjacent islands. Linnaeus originally named the plant *Orchis strateumatica* in 1753, taken from the Greek *strateuma* meaning a band, company, or army. Schlecter moved it to the genus *Zeuxine* in 1911. It goes by other common names, including Indian Orchid and Field Zeuxine, and has also acquired several scientific names as synonyms involving both its genus and specific species names.

Oakes Ames (*Botanical Museum Leaflets*, Harvard University, 1938) reported the appearance of soldier's orchid in 1936 in Indian River County, Florida, USA. The tiny orchid is believed to have been imported with seeds of "centipede grass". Since that time, soldier's orchid has spread across Florida to Georgia, Texas, and Louisiana. In the U.S., soldier's orchid has been described as "a 'here-now, gone-tomorrow' orchid - emerging in winter and blooming in late December and January. ….. The following year, they may return; then again, they may not". The species has also now been found in Mexico.

For those interested, some useful weblinks, from which much of the above is culled, are:

http://www.killerplants.com/plant-of-the-week/20030310.asp
http://www.orchidspecies.com/zuexstrateumatica.htm
http://www.hear.org/starr/hiplants/images/hires/html/starr_020102_9001_zeuxine_strateumatica.htm

Reference

Thomas, S. 1998. “The advance of *Zeuxine strateumatica*, a new record for Saudi Arabia.” **Orchid Rev, 106**. (1221): 153-154 (1998).

Acknowledgement

It is a pleasure to credit Graham B. Giles of High Wycombe, Bucks, England, known for his expertise in Arabia's Odonata and author of the illustrated checklist of dragonflies of the UAE (see ***Tribulus 8.2***: 9-15 (1998)) and an orchid enthusiast, who first proposed the correct identity of the mystery orchid and provided the weblinks cited above. Graham has also kindly arranged for expert confirmation through the courtesy of Prof. Richard M. Bateman of The Natural History Museum in London.

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Conferences

Status and Conservation of dugongs

Symposium On Status and Conservation of Dugongs of the Arabian Gulf, Red Sea and Western Indian Ocean, May 29 - 31, 2006, Abu Dhabi.

This symposium was organised by the Environment Agency - Abu Dhabi, (EAD) and was sponsored by Total Abu Al Bukhoosh (TOTAL). It provided an up-to-date appraisal of the status of dugongs in the Western Indian Ocean region.

The following keynote addresses were given on the first morning: Dr. Anthony Preen (Northern Rivers Catchment Management Authority, Kempsey, Australia) on the "Status of Dugongs in the Arabian Gulf, the Red Sea and the East African Countries"; Prof. Helene Marsh (James Cook University, Australia) on the "Biology and Conservation of Dugongs"; and Dr. John Reynolds (Co-Chair, IUCN Sirenian Specialist Group) on "International and Regional cooperation for conservation of dugong and its habitat". A series of Country Reports then followed in the afternoon which included presentations on the status of dugongs in the UAE (Dr Himansu Das, EAD), Bahrain (Ebrahim A. Abdulqadaer and Mohammed Al-Rumaidh, Bahrain Centre for Studies and Research) and Qatar (Ghanem Abdullah Mohammed and Nasser Sultan Al-Mureikhi, Supreme Council for Environment and Natural Reserves). A presentation giving an archaeological perspective on the exploitation of dugongs in the Arabian Gulf was given by Dr Mark Beech (Head of Division - Cultural Landscapes, Abu Dhabi Authority for Culture and Heritage).

The second day was devoted to the remainder of the Country Reports, including the Seychelles (Lindsay Chong Seng, Seychelles Island Foundation), Mayotte (Jeremy Liszka, OMMM), Kenya (Sam Weru, WWF-Kiunga MNRC&D Project), Tanzania (Catharine Muir, Sea Sense) and Mozambique (Almeida Guissamulo, Museu de Historia Natural, Maputo). A discussion session followed which led to the development of the Abu Dhabi declaration on the "Conservation and Management of Dugongs in the Arabian Sea, Red Sea and Western Indian Ocean Region" (*see below*).

The third and final day of the symposium comprised a field trip to the Marawah Marine Protected Area. After travelling from Abu Dhabi to Mirfa, the symposium delegates then went by speedboat to the waters within the Marawah Marine Protected Area. Dr Mark Beech gave a tour of an archaeological site known as MR11, on the island of Marawah, the earliest Late Stone Age settlement known in the United Arab Emirates. Excavations directed by Dr Beech there in 2004 discovered traces of dugong bones within one of the stone houses, as well as a flint spear which may have been used for the hunting of dugongs.

The following draft declaration was prepared as a result of the meeting:

Declaration of Intent on Co-operation on the Conservation of Dugongs and their Habitats in the Arabian Gulf, Red Sea and Western Indian Ocean - Abu Dhabi, 29-31 May 2006

Dugong range countries of the Arabian Gulf, Red Sea and Western Indian Ocean, hereinafter called "the region".

Aware, based upon the best available scientific evidence, that most of the dugong populations and their habitats, such as seagrass areas, are threatened throughout the range of their occurrence in the region;

Recognising that dugongs travel over large distances and have a wide range of distribution within the region, thereby requiring regional cooperation and coordination among the range states in the region;

Acknowledging that some human activities threaten dugong populations directly or indirectly and that these activities include fishing activities, particularly gillnet fishing, unsustainable coastal development, pollution, uncontrolled mariculture, tourism, boat strikes, and illegal take of the species;

Noting that dugongs have a priority for conservation action by virtue of their being listed in various international agreements including the Convention of Migratory Species of Wild Animals (CMS), the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES), and the International Union for the Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species;

Realising that there is a general lack of scientific information required for conservation of dugongs in the region, especially pertaining to the status of dugong populations and their habitats;

Acknowledging that, despite limited resources, government and non-government agencies, and international organisations have taken up varying degrees of conservation actions for dugongs and their habitats at local, national and regional levels;

Further noting recommendations of relevant international organisations including the seventh and eighth sessions of the Convention of Migratory Species (CMS) Conference of the Parties and the first and second meetings on Dugong conservation and management held in Thailand in August 2005 and May 2006 respectively, calling on dugong range states to develop and actively participate in regional cooperative endeavours on dugong conservation;

Hereby agree:

1. To work closely together to improve (or maintain as appropriate) the conservation status of dugongs and the habitats on which they depend.
2. To make every effort to formulate, review, revise and harmonise local/national legislation or regulations pertaining to dugongs and their habitats as appropriate.
3. To develop mechanisms towards facilitating exchange of scientific expertise, information, research findings and outcomes of conservation actions among the countries of the region.
4. To undertake joint research programmes and collaborative studies on population abundance, distribution, biology, ecology and conservation of dugongs and their habitats, especially across trans-boundary sites, and including studies of the social and economic aspects of conservation initiatives to promote capacity building.
5. To develop and implement a Memorandum of Understanding and Regional and Sub-Regional Conservation and Management Action Plans on dugongs and their habitats.
6. To endeavour to participate in all Regional and International initiatives on dugong conservation and work towards concluding agreements designed to foster cooperation in dugong conservation as appropriate.
7. To develop research and management capacity within and among the range states.

Mark Beech

Annual Archaeological Symposium in Al Ain

The *Fourth Annual Symposium on Recent Palaeontological and Archaeological Discoveries in the Emirates*, organised by the Zayed Centre for History and Heritage, was held in Al Ain on 29th-30th March 2006. The following papers were presented.

Umm al-Ishtan and Bida al-Mutawa: new Late Miocene fossil sites in the Western Region of Abu Dhabi Emirate
Dr. John Stewart, (*University College, London*), Dr. Mark Beech (ADIAS), Dr. Heiko Kallweit (ADIAS)

Abrupt Holocene Climate Change from Southeast Arabia and the Nature of Cultural Transitions in the Gulf Archaeological Record
Adrian G. Parker (*Oxford Brookes University*), Gareth W. Preston, Helen Walkington & Martin J. Hoson

Ortho-Photography and Archaeological Information Systems as tools for the excavator: The example of Al-Buhais 85
Johannes Schmitt and Adelina Uerpmann (*University of Tubingen*)

Prehistoric News from Sharjah Emirate
Hans-Peter Uerpmann, Margarethe Uerpmann, Sabah A. Jasim, Marc Händel & Johannes Schmitt (*University of Tubingen*)

Investigating the Desert Neolithic: a report on the 3rd season of archaeological survey and excavations at Umm az-Zamul, Abu Dhabi Emirate
Dr. Heiko Kallweit (ADIAS), Richard Cuttler (*Birmingham University*), Dr. Mark Beech (ADIAS) and Dr. Walid Yasin al-Tikriti (*Department of Antiquities and Tourism, Al Ain / Abu Dhabi Authority for Culture and Heritage*).

Synthesis of the eighth season of excavations at Hili N, Al Ain
Dr. Sophie Mery, (*CNRS, Paris*), Dr. Walid Yasin al-Tikriti, (*Department of Antiquities and Tourism, Al Ain / ADACH*) and Dr. Julio Bendezu-Sarmiento (*CNRS*).

Archaeological survey and excavations on Sadiyat island, Abu Dhabi Emirate: 2005 and 2006 seasons
Dr. Heiko Kallweit, (*ADIAS*), Richard Cuttler (*Birmngham University*) and Dr. Mark Beech (*ADIAS*)

The Archaeological Landscape of Dhayah, Recent Observations and Surveys
by Christian Velde, Imke Moellering and Ahmed Hilal (*National Museum of Ra's al-Khaimah*)

Some thoughts on the Islamic Archaeology of the Al-Ain/ Buraimi Oasis based on aerial photographs
Andrew Peterson (*Emirates University*)

Tales from the old guards: Bithnah Fort, Fujairah, U.A.E.
Michele C Ziolkowski & Abdullah S. al-Sharqi (*Fujairah*)

News, Reviews and Publications

Yasat islands declared as MPA

The Yasat group of islands in Western Abu Dhabi have been formally declared as the UAE's second Marine Protected Area, MPA, under the terms of Emiri Decree no. 33 for 2005, issued late last year by President HH Sheikh Khalifa bin Zayed Al Nahyan in his capacity as Ruler of Abu Dhabi.

The group consists of four islands, Upper Yasat (Yasat al-Ulya), Lower Yasat (Yasat Sufla), Esam and Karsha, and the MPA includes both the islands and their surrounding seas, covering a total area of 482 sq. km. The managing authority for the MPA will be the Environment Agency - Abu Dhabi, EAD, which also manages the other, larger, Marawah Marine Protected Area.

The seas around the Yasat group have been declared a no-take zone for fishermen.

According to EAD, the group of islands and surrounding waters in the MPA are of considerable ecological and cultural significance. There are extensive coral reefs, with at least eight species of corals present, which provide suitable habitat for a number of over-exploited fish species, including *Hamour* and *Sha'ari*, while populations of the critically endangered hawksbill turtle, the endangered green turtle and the dugong are also present. Upper Yasat also holds an important breeding colony of Socotra cormorants, a near-endemic bird species for the UAE.

In terms of cultural and historical importance, surveys undertaken by the Abu Dhabi Islands Archaeological Survey, ADIAS, in the early 1990s identified a number of sites dating back to the late pre-Islamic period (1st - 7th Century AD) as well as extensive evidence of occupation during the Late Islamic period, some sites being considered of national or regional importance.

Under the terms of the Emiri decree, all hunting, fishing or other catching of wildlife, whether marine or otherwise is banned, as well as any damage to nesting areas of birds and turtles. Within a three nautical mile zone around the islands, fishing is restricted while the berthing of boats on non-designated areas is forbidden.

As part of preparation for the designation of the Yasat MPA, EAD undertook extensive research, including surveys and assessment of the coral reef habitats, installation of permanent monitoring stations to monitor the regeneration of the coral reefs and satellite tracking of turtles after egg-laying.

Over twenty marine marker buoys are being installed to delineate the limits of the MPA.

(Source: EAD press release, 18th June 2006).

State of the Environment, SoE, report due in November

The first State of the Environment, SoE, report for the Emirate of Abu Dhabi is due to be released in November, according to an Environmental Agency - Abu Dhabi, EAD, press release.

The report will identify and analyse key issues in environmental areas according to each of their Drivers, Pressures, State, Impact and Response, DPSIR, in accordance with a model designed by the United Nations Environment Programme, UNEP.

Core data being used in the development of the State of Environment report was compiled by EAD and its partners, including local and federal government bodies, academia and non-governmental agencies.

The report will be produced in Arabic and English and will be available to the general public and decision makers in both electronic and hard copy formats at www.ead.ae and through the AGEDI portal which will be launched soon.

The report is being produced in collaboration with UNEP and GRID-Arendal, a UNEP-approved centre based in Norway.

The SoE is part of the Abu Dhabi Global Environmental Data Initiative, AGEDI, which was launched by the UAE Government in 2002 at the World Summit for Sustainable Development in Johannesburg, South Africa.

(*Source: EAD press release 5th June 2006*)

Falcon Release Programme

The annual falcon release programme undertaken by the Environment Agency - Abu Dhabi, EAD, took place in May 2006 for the twelfth successive year,with the Pakistani district of Chitral, close to the border with Afghanistan, being used as the release site, for the third time. Chitral has been identified

as being on the normal migration route north for falcons returning to their breeding grounds in central Asia after the winter.

26 sakers and 34 peregrines were released, all being fitted with rings and several with satellite transmitters, so that their movements could be tracked. The birds were provided by a number of leading UAE falconers, continuing the traditional practice of releasing wild-caught birds back into the wild at the end of the falconry season.

The programme, originally called the Sheikh Zayed Falcon Release Programme, began in 1995, when falcons were released in the Kharan District of Pakistan's western province of Baluchistan. In subsequent years, releases have taken place in the Gilgit district of Pakistan's Northern Areas, in the Lake Issyk-kul area of Kyrgyzstan and in Iran's Gurgan province.

In all, a total of 1,008 falcons have now been released under the programme, with several having been tracked by satellite to their breeding grounds and then on return migration, with, in some cases, birds being tracked over a period of several years, providing useful information on migration routes and on the behaviour of the birds in their breeding and wintering grounds.

(*Source: EAD press release 21st May 2006*).

Livestock grazing regulated

Regulations have been issued to regulate the grazing of livestock in the Emirate of Abu Dhabi, in accordance with Emiri law no. 13 for 2005. A committee is to be formed to handle the regulation, with representatives from areas used for grazing and from relevant bodies, which will make a register of areas used for grazing, the number of livestock and their owners, before issuing the relevant permits

The committee will also establish a record of traditional water wells and will prepare a report on well maintenance and measures whereby traditional grazing areas can be protected as well as specifying areas that may be used for grazing.

New regulations on grazing prohibit the use of all vehicles in activities related to the grazing of livestock and place restructions on the cutting or burning of vegetation, hunting or otherwise harming animals, including birds, and the collection of birds' eggs or destruction of nests.

The regulations also specify that any residential compound must be at least one kilometre from a water well used by livestock and that water from the well may only be used within a one kilometre radius.

Permits for the grazing of livestock will only be issued to UAE citizens.

The new rules, to be implemented by the Environment Agency - Abu Dhabi, EAD, are intended to place controls on, and eventually to reduce the amount of domestic livestock being grazed in the desert areas of Abu Dhabi, where uncontrolled grazing has had a significant and damaging effect on the natural vegetation.

(*Source: Emirates News Agency, WAM, 7th February 2006*).

New Site on Emirates Birds

The Recorder of the Emirates Bird Records Committee, Tommy Pedersen, has launched a website on UAE birds - http://www.tommypedersen.com

The site contains a regular update of all reported sightings since the beginning of 2006, now gradually being extended backwards to include older data, photographs, a list of those who have obtained membership of the 300 Club (i.e. those people who have seen more than 300 species in the Emirates), details of how to find particular sites, including GPS co-ordinates and maps, and much, much more.

ANNOUNCEMENT

WILDLIFE MIDDLE EAST - NEWS - A NEW REGIONAL NEWSLETTER FOCUSING ON ZOO AND WILDLIFE ISSUES IN THE MIDDLE EAST

We are pleased to announce the creation of ***Wildlife Middle East - News***, a new bilingual regional newsletter focusing on zoo and wildlife issues in the Middle East. The newsletter aims to contribute to the development of a network between zoo and wildlife professionals working in the Middle East with the objective of being the premier source of regional information on zoo and wildlife management, husbandry and care. The newsletter will publish articles with an emphasis on practical, useful and relevant material. Proposed categories include:

- Conservation education & environmental awareness.
- Husbandry & nutrition.
- Design of zoological facilities.
- Capture and translocation techniques.
- Wildlife diseases and preventive medicine
- Products, book reviews & research.
- Summaries of recent literature on Arabian animals.
- Letters

Wildlife Middle East - News will be produced as a dual language (English-Arabic) quality newsletter and will be published quarterly. The newsletter will be distributed to biology departments and libraries of institutes of higher education, agricultural and environmental agencies, conservation groups, wildlife projects, zoos, zoologists, veterinarians working with wild animals, veterinary hospitals involved in wildlife medicine, municipality veterinarians and pet shops. A PDF format newsletter will be e-mailed to a wider circulation of interested readers within and beyond the region.

We are interested to hear from individuals, institutions, zoos and conservation projects working with wildlife within the Middle East region or with wildlife species from the Middle East managed outside the region. If you have interesting findings, news or observations please submit or request further information from the editors:

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Obituary

Professor Ronald Phillips

Professor Doctor Ronald Phillips died in November 2005, after returning from Florida to his family in the Ukraine. Many *Tribulus* readers will know and fondly remember him, either as a highly professional researcher, or as an extremely friendly and charming companion, or both.

Ronald was a seagrass specialist with many years of experience throughout the world and more recently experience in the Arabian region, in particular the Emirate of Abu Dhabi. He was undoubtedly the father of seagrass research and published over 70 papers and five books on the subject during his long career.

He was one of the pioneers of seagrass conservation, being active back in the 1960s and 1970s, and assisted substantially in spreading awareness of the values of these habitats to marine and coastal users.

In 1997 he fulfilled a lifelong dream to study seagrass in the southern Arabian Gulf when he was invited to assist the Environment Agency - Abu Dhabi, EAD, (formerly ERWDA) to undertake seagrass research in Abu Dhabi Emirate.

Ronald continued his efforts in Abu Dhabi with the Emirates Heritage Club throughout the late 1990s and into this century, and was one of the first researchers to collect extensive baseline data on the rich seagrass resources of Abu Dhabi.

Ronald was also invited on several occasions to work with the regional UNESCO office on important publications on seagrass research methods. In 2002 he was one of the most eminent of the keynote lecturers in Qatar at the QUEST 2002 conference. In 2003 he assisted UNESCO and the Kingdom of Bahrain with their plans to establish a World Heritage Site covering the Hawar archipelago, based on the presence of some of the world's most productive seagrass beds, which support entire Gulf food chains, including dugongs and numerous other marine species.

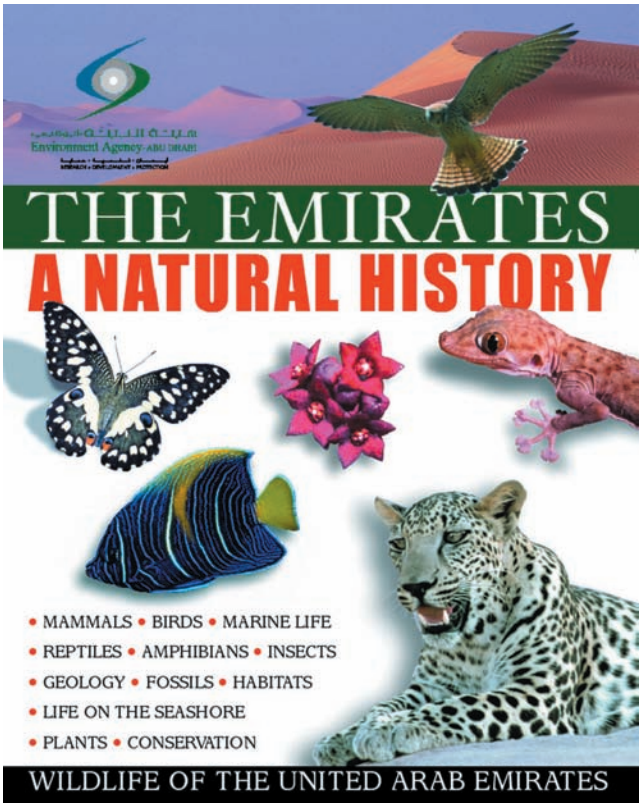
During his frequent research trips throughout the marine and coastal areas in the Gulf, Ronald collected extensive field data and also trained local Emirati postgraduate students on the techniques to monitor seagrass, and on its ecological values and general environmental importance. In 2002 and 2005 Ronald published his survey results with Abu Dhabi-based researchers and students, as part of the Emirates Heritage Club's Abu Dhabi Marine Atlas programme.

Ronald was liked by all people he came in contact with, regardless of age, cultural, or ethnic differences, and he will be sadly missed by his family, colleagues, friends and students, particularly those of us here in Abu Dhabi.

We are thankful for the time Professor Phillips spent with us, and for the knowledge he shared with us. We will not forget him, or the tremendous importance of his pioneering work. Professor Phillips was an inspiration to us all, and, in his memory, we continue to work towards the conservation of seagrass resources in the Gulf region.

Ronald Loughland
Emirates Heritage Club,
Abu Dhabi, UAE

Benno Boer
Ecological Sciences Advisor -
UNESCO Arab Region.
UNESCO Regional Office in the
Arab States of the Gulf.
Doha, Qatar



Reviews and Publications

The Emirates - A Natural History. Edited by Peter Hellyer and Simon Aspinall. Trident Press Ltd. (2005). Published with the support of the Environment Agency - Abu Dhabi, EAD, Mubadala, First Gulf Bank, Dolphin Energy, Aldar Properties, Total & Shell. Trident Press Ltd. (2005). ISBN 1-905486-02-02

At first glance, the names of contributing authors of The Emirates - A Natural History, (published by Trident Press in November 2005) reads like a short list of some of the most prominent contemporary Arabian naturalists, all of whom are professionally known to the two editors, Peter Hellyer and Simon Aspinall. This is a strong editorial duo, both of whom have considerable relevant experience in the UAE, one as expert professional naturalist and the other as naturalist, writer, archaeologist and journalist of some standing.

This massive undertaking comes as the ambitious sequel to the previous "Natural Emirates", published in 1996, which was in itself a very useful mini-encyclopaedia for amateur and professional alike. What the present work gains in much increased coverage it loses in reader-friendliness. But how could you make it any smaller and still retain its appeal, its hundreds of photographs, which are of a very high quality, and all the textual detail? Nevertheless, it remains a somewhat cumbersome object to read. A large inclined museum desk would be perhaps the easiest method. It has all the trappings of an addition to the reference section of your local library.

The book represents not only a staggering scholarly review of every domain of the natural world within the borders of the UAE, but is also testimony to how the work of recording the data has gradually moved into the hands of professionals from the beginnings of data collection carried out by enthusiastic amateurs of the Emirates Natural History Group in the late 1970s. The next obvious goal for subsequent editions would be to have contributions by UAE citizens to the scientific investigation of their own environment.

The success of the present venture is that every area of natural history has been included within the 432 pages of the book, with the lists of species recorded. It also contains two

sets of bibliographies: one for each chapter and one general one at the end. From a scientific standpoint, the bibliographies themselves add great value to this work and should prove useful to future researchers.

A few critical comments, however, seem to suggest themselves, apart from the occasional mis-spelling. First of all, the number of pages devoted to the geology and distribution of sand in the UAE, bears little relationship to the physical presence of sand, particularly in Abu Dhabi emirate, which occupies 86% of the total surface area of the country, most of which is sand sheets or sand dunes. Sand is arguably the defining feature of the UAE. It deserves a more detailed coverage. There is almost as much on lichens as sand! That is not to say that Gary Feulner's chapter on geology is not excellent, as it provides scientific insights that make this chapter one of the best.

Another lacuna is the lack of detailed coverage of the northern emirates. The professional experts seem to have drawn their data more from the seas and deserts of Abu Dhabi than from anywhere else. I would like to see more examples and photographs from the north and east coast, where there is greater floral and faunal biodiversity and less sand.

The next omission, of a number of recent discoveries, should not be attributed to the editors as discoveries are constantly being made in every field of scientific endeavour. The text of the book had been at the printers for some time when they were made aware of these discoveries. No doubt the new information will appear in a subsequent edition. Particularly as a result of Dr. Richard Hornby's investigations, a little known shoreline creature, the spoonworm, (Phylum Echiura) has been discovered on several sites along the UAE coast (see Tribulus 15.1, pp. 3-8). These investigations are still at a preliminary stage, but constitute an exciting addition to the marine species of the UAE. Other new discoveries, of birds, reptiles and plants, have also been made in recent months.

There is good coverage of the sand desert vegetation by Brown and Boer, but the floral selection is short of local examples, particularly of the northern and eastern emirates, and lacks photographs of some of the showiest species: *Tecomella undulata*, *Eremobium aegyptiacum*, *Aloe vera*, *Anagallis arvensis*, *Anthemis deserti*, *Lavandula subnuda*, among others. There are very few pictures of graminoids, which is surprising, as irrigation today is currently increasing the distribution and variety of grasses and sedges.

Human intervention in the environment has been well covered from the historical viewpoint on pp. 27-37, and it has been shown how *Homo sapiens* has changed the environment from at least the Hafit period onwards. What needs to be included is the contemporary record. The effect on the environment of continuing irrigation and agro-forestry programmes is not mentioned.

Chapters of excellence abound throughout the book. Although invidious to single out separate chapters for praise, worth mentioning are: the Geological Overview, Insects and other arthropods, Terrestrial Reptiles, Marine Fish, Birds, and Terrestrial Mammals. The exhaustive lists of species have already been mentioned and also the very useful bibliographies. There is never any comparison to be made with the glossy would-be publications that find their way onto booksellers' shelves. It is what it sets out to be: a thoroughgoing illustrated scientific account. No doubt it will serve as a catalyst for further research at a time when the UAE desert is being covered with concrete and roads as never before. The editors are to be congratulated on orchestrating such a harmonious and colourful symphony of nature in all its aspects in this corner of the Arabian Peninsula.

Allestree Fisher

Other Books received

Wadis of Oman - Satellite Image Atlas. Farouk El-Baz (ed.). (2004). Prepared by the Center for Remote Sensing, Boston University, U.S.A. Office of The Advisor to His Majesty The Sultan for Cultural Affairs, Muscat, Sultanate of Oman. Reg.no. 163/2004.

This very handy sized 22 x 18cm sized atlas contains 150 satellite images at 1:250,000 scale. Each image covers 50 x 50 kilometres. Also included is an index of wadi names in Arabic and English, along with the length of the wadi in kilometres, as well as an index of towns and villages in Arabic and English. The Atlas is also available in CD format. Both products are available from the Family Bookshop in Muscat.

The Architecture of the United Arab Emirates. Salma Samar Damluji (*ed.*). (2006). Garnet Publishing, Reading, U.K. ISBN-13: 978-1-85964-156-9. 325 pages.

This book discusses Modern as well as Vernacular Architecture in the United Arab Emirates. Of particular interest from the historical point of view are the following chapters:

F. Heard-Bey: 'Adapting to Change - An historical background to traditional and modern living conditions in the United Arab Emirates' (4-19).
G. King: 'The Islamic Architecture of Dalma Island' (151-178).
K. Olroyd-Robinson: 'The Urban Architecture of Al Bastakiyyah' (179-204).
D. Willems: 'The Ancient Mosques of Ra's al Khaymah' (205-222).
H.M. Al Naboodah: 'The Forts and Towers of Al 'Ayn' (223-238).
A.S. Al-Azzawi: 'Analysis of the Square: Al Murabba'ah' (239-264).
S.S. Damluji: 'In Search of the Vernacular' (254-307).

The Desert of Southeast Arabia. Kenneth W. Glennie. (2005). GeoArabia. Gulf PetroLink, Manama, Bahrain. ISBN 99901-04-89-1. Hardbound, 215 pages, over 200 coloured illustrations, photos and satellite images. This book can be ordered from the website:

http://www.gulfpetrolink.net/spGlennie/spGlennieidx.htm

In his book "The Desert of Southeast Arabia", Ken Glennie takes us on a journey back in time to when Arabia was a much greener place, and he explains how global climate change made it so barren. Ken started writing this book 10 years ago for students; this is one reason for the extensive Glossary at the back. After many modifications and revisions, his book now provides a different perspective to a well-known topic. Its simplicity, detailed descriptions and illustrations will undoubtedly appeal to students, desert travellers and scientists. Of great value, especially when used in conjunction with studies on the ground, are the satellite images (Landsat) seen here in spectacular colour. None of these images, however, can replace seeing the desert rocks and sediments first hand. In this book, Ken shares his vast knowledge of the Arabian Desert, and an exquisite collection of photos taken on the ground and from the air.

The Islamic Coinages of the Bahrain Region during the Abbasid Caliphate (132-656 Hijri/750-1260 CA). Abdullah Khamis Al-Sulaiti. (2005). Ministry of Information, Bahrain. ISBN 99901-90-17-8. 205 pages, 37 colour plates.This book contains a rare collection of Islamic golden, silver and bronze coins which circulated in the region of Bahrain during the Abbasid Caliphate. The author spent more than three years compiling the book which makes an important contribution to the study of numismatics in the region.

Traditional Crafts of Saudi Arabia. John Topham. (2005). Hardbound, 192 pages, colour photographs throughout. First published by Stacey International 1982. Revised edition published 2005 by Stacey International, London. This book can be ordered online at:

http://www.stacey-international.co.uk

This is a new issue of an acknowledged classic in the field of Saudi Arabian desert crafts. With new photographs and updated text, it has already become the standard work for a new generation of Arabian enthusiasts. Covering the costumes, equipment, and artefacts of the Bedouin of Saudi Arabia, it examines the work of jewellery makers, leather workers, basket weavers, carpenters and metal workers, with stunning colour photographs to illustrate each example. In the engaging text, written by experts in the field, we get a real sense of the traditional lifestyle and ethnology of this enigmatic people. The majority of the costumes, jewellery and weavings shown in this book belong to John Topham, whose important collection has been exhibited throughout the USA and Arabia.

Articles & Papers

The following published papers dealing with the UAE and adjacent areas have been received or noted.

Archaeology

Adumatu: No. 13 (January 2006), P.O. Box 10071, Riyadh 11433, Kingdom of Saudi Arabia. Published by the Abdul Rahman Al-Sudairy Foundation, Riyadh, Kingdom of Saudi Arabia. Email: adumatu@suhuf.net.sa – Web: www.adumatu.com - ISSN 1319-8947

Adumatu is an international academic refereed journal on the archaeology of the Arab World. More details can be found on its website at: www.adumatu.com

Volume 13 contains a number of articles of interest to the archaeology of this region including:

Dr. Abdulaziz S. Ghizzi: 'Characteristics of and Research on al-Ubaid Pottery in the Eastern Region, Saudi Arabia: a Descriptive Study.'

Ali R. Al-Medeilwi: 'Civilization Connections between Oman Province and Neighbouring Urban Centers during the Fourth and Third Millennia BC.'

Prof. Khalaf Al-Tarawneh & Najla Ahmad Ali: 'Coins' Information Role during the Umayyad Period.'

Arabian Archaeology and Epigraphy Vol. 17.1 (May 2006) Blackwell Publishing. Web: http://www.blackwellpublishing.com/journal.asp?ref=0905-7196 - ISSN 0905-7196

Gerd Weisgerber: 'The mineral wealth of ancient Arabia and its use. I: Copper mining and smelting at Feinan and Timna - comparison and evaluation of techniques, production, and strategies' (pp. 1-30)

An De Waele and Ernie Haerinck: 'Etched (carnelian) beads from northeast and southeast Arabia' (pp. 31-40)

L. Nehmé, Th. Arnoux, J.-Cl. Bessac, J.-P. Braun, J.-M. Dentzer, A. Kermorvant, I. Sachet, L. Tholbecq and J.-B. Rigot: 'Mission archéologique de Madain Salih (Arabie Saoudite) : Recherches menées de 2001 à 2003 dans l'ancienne Hijrsa des Nabatéens' (1) (pp. 41-124).

Bulletin of the Society for Arabian Studies, No. 11 (2006).

Society for Arabian Studies, c/o the British Academy, 10, Carlton House Terrace, London, SW1 5AH, UK. ISSN 1361-9144.

Much, as usual on the UAE, including the annual news round-up of archaeological activity throughout the country, reviews of two recent publications (Jebel Hafit - A Natural History, edited by Simon Aspinall and Peter Hellyer and published by the Emirates Natural History Group and the Abu Dhabi Company for Onshore Oil Operations, ADCO, and The Emirates - A Natural History, edited by Peter Hellyer and Simon Aspinall and published by Trident Press with the support of the Environment Agency - Abu Dhabi, EAD), and the following paper:

'Neolithic sites in Umm az-Zamul, SE desert of Abu Dhabi, UAE'. Mark Beech, Heiko Kallweit, Richard Cuttler and Walid Yasin Al-Tikriti. pp. 17-26.

A preliminary report on the December 2005 / January 2006 work at Umm az-Zamul, undertaken by the Abu Dhabi Islands Archaeological Survey, ADIAS, and the Department of Antiquities and Tourism, Al Ain (now part of the Abu Dhabi Authority for Culture and Heritage).

Journal of Oman Studies Vol. 13 (2004)
(N.B. not released until late 2005)
Ministry of Heritage and Culture, Sultanate of Oman - ISSN 0378-8180.

M.R. and B. Bhacker: 'Qalhat in Arabian History: Context and Chronicles' (11-56).

L. Korn, J. Häser, J. Schreiber, A. Gangler, M. Nagieb, S. Siebert and A. Buerkert: 'Tiwi, Ash Shab and Wadi Tiwi: the Development of an Oasis on the North-Eastern coast of Oman' (57-90).

B. Mershen: 'Ibn Muqarrab and Naynuh: A Folk-tale from Tiwi' (91-98).

A. Sheriff: 'Sur: The World of a Dhow Port' (99-112).

D. Insall: 'Ash Shibabiyah: the Indigenous Flute of the Eastern Hajar Mountains' (113-126).

W. and F. Lancaster: 'Ar Rawdah in the Musandam' (127-138).

A. Patzelt: 'Flora and Vegetation of Juzur al Hallaniyat (the Kuria Muria Islands) with a Report of Additional Species' (139-154).

M.D. Robinson, H. bin Ali ar Ra'isi and A. Spalton: 'Group Size and Composition of the Arabian Tahr (*Hemitragus jayakari* Thomas, 1894)' (155-164).

M. Wark: 'Weft-twined Purses from the Wadi Sarin' (165-174).

N. Whalen: 'Lower Palaeolithic Sites in the Huqf Area of Central Oman' (175-182).

S. Bandyopadhyay: 'Harat al Bilad (Manah) - Tribal Pattern, Settlement Structure and Architecture' (183-262).

M. Kervran: 'Archaeological Research at Suhar 1980-1986' (263-381).

Other Archaeology

Beech, M. (2006). Book review of "The Early Dilmun Settlement at Saar", edited by Robert Killick and Jane Moon, London-Bahrain Archaeological Expedition Saar Excavation Report 3. xii+367 pages, 536 colour illustrations, tables. 2005. Ludlow: Archaeology International; 0-9539561-1-3 hardback". **Antiquity 80 (No.307, March 2006):** pp. 227-228.

Beech, M. and E. Glover. (2005). The environment and economy of an Ubaid-related settlement on Dalma island, United Arab Emirates. **Paléorient 31/1**: pp. 97-107.

Carter, R.A. (2005). “The History and Prehistory of Pearling in the 'Persian' Gulf.” **Journal of the Economic and Social History of the Orient 48/2:** pp. 139-209.

Crawford, H. (2005). “Mesopotamia and the Gulf: The history of a relationship.” **Iraq 67 (2)**: pp. 41-46.

Magee, P. (2005). “The chronology and environmental background of Iron Age settlement in southeastern Iran and the question of the origin of the qanat irrigation system.” **Iranica Antiqua 40**: pp. 217-231.

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response to some recent comments by Muscarella." **Ancient West and East 4 (1)**: pp. 160-169.

Magee, P. (2005). "The production, distribution and function of Iron Age bridge-spouted vessels in Iran and Arabia: results from recent excavations and geochemical analysis." **Iran - Journal of the British Institute of Persian Studies 16:** pp. 93-115.

Potts, D.T. (2006). "Elamites and Kassites in the 'Persian' Gulf." **Journal of Near Eastern Studies 65 (2)**: pp. 111-120.

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Botany

Gallacher, D. J. and J. P. Hill (2006). 'Effects of camel grazing on the ecology of small perennial plants in the Dubai (UAE) inland desert.' **Journal of Arid Environments 66 (4):** pp. 738-750.

El-Keblawy, A. and A. Al-Rawai (2006). 'Effects of seed maturation time and dry storage on light and temperature requirements during germination in invasive *Prosopis juliflora*.' **Flora - Morphology, Distribution, Functional Ecology of Plants 201 (2):** pp. 135-143.

Marwah, R. G., M. O. Fatope, R.A. Mahrooqi, G.B. Varma, H.Al-Abadi and S.K.S. Al-Burtamani. (*in press*). 'Antioxidant capacity of some edible and wound healing plants in Oman.' **Food Chemistry.**

Fisheries and Marine

Ben Meriem, S., A. Al-Marzouqi and J. AL-Mamry. (2006). 'Fisheries exploitation pattern of narrow-barred Spanish mackerel, Scomberomorus commerson, in Oman and potential management options.' **Journal of Applied Ichthyology 22 (3):** 218-224.

Govender, A., H. Al-Oufi, J.L. McIlwain and M.C. Claereboudt. (2006). 'A per-recruit assessment of the kingfish (*Scomberomorus commerson*) resource of Oman with an evaluation of the effectiveness of some management regulations.' **Fisheries Research 77 (2)**: 239-247.

Grandcourt, E. M., T. Z. Al Abdessalaam, F. Francis and A.T. Al Shamsi. (2006). 'Fisheries biology of a short-lived tropical species: *Gerres longirostris* (Lacepede, 1801) in the Arabian Gulf.' **ICES Journal of Marine Science 63 (3)**: 52-459.

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van Herwerden, L., J. McIlwain, H. Al-Oufi, W. Al-Amry and A. Reyes. (2006). 'Development and application of microsatellite markers for *Scomberomorus commerson* (Perciformes; Teleostei) to a population genetic study of Arabian Peninsula stocks.' **Fisheries Research 79 (3)**: 258-266.

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Rodgers, A., A.-R. Fowler, A.M.S. Al-Amri and A. Al-Enezi. (2006). 'The March 11, 2002 Masafi, United Arab Emirates earthquake: Insights into the seismotectonics of the northern Oman Mountains.' **Tectonophysics 415 (1-4)**: pp. 57-64.

Ornithology

The Phoenix, No. 22, January 2006. Compiled by Michael Jennings, Warners Farm House, Wartners Drove, Somersham, Cambridgeshire, PE28 3WD, UK. E-mail: arabianbirds@dsl.pipex.com Sponsored and published by the National Commission for Wildlife Conservation and Development, PO Box 61681, Riyadh, Saudi Arabia. ISSN 0268-487X.

The usual round-up of news on the breeding birds of Arabia. This issue contains only one short note of direct relevance to the UAE, *viz*.

Pleasance, B., Castell, C. Mason, J. & Williams, S. Peter Castell, John Mason & Steve Williams (2006). 'White-collared Kingfisher breeding at Khor Kalba.' 27-28.

Palaeontology

Bibi, F., Shabel, A., Kraatz, B., and Stidham, T.A. (2006). 'New Fossil Ratite (Aves: Palaeognathae) Eggshell Discoveries from the Late Miocene Baynunah Formation of the United Arab Emirates, Arabian Peninsula.' **Palaeontologia Electronica**: 1-13. Available online at: http://palaeo-electronica.org/2006_1/eggshell/issue1_06.htm

Leonard, L. M., G. J. Dyke and C.A. Walker. (2006). 'New specimens of a fossil ostrich from the Miocene of Kenya.' **Journal of African Earth Sciences.**

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Other

Alamer, M. (2006). 'Physiological responses of Saudi Arabia indigenous goats to water deprivation.' **Small Ruminant Research 63 (1-2)**: 100-109.

Al-Subhi, A. M., A. O. Al-Adawi, et al. (2006). '*Ceratocystis omanensis*, a new species from diseased mango trees in Oman.' **Mycological Research 110 (2)**: 237-245.

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Compiled by Mark Beech and Peter Hellyer

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Gillett, M.P.T. [2002a]. Occurrence of the Western Pygmy Blue butterfly *Brophidium exilis* [Boisduval] on offshore islands of Abu Dhabi, including Marawah island (Lepidoptera: Lycaenidae). **Vol. 12.2. pp. 20-21.**
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Gillett, M.P.T. & Naseer, O. [2005a]. An aberrant Caper White butterfly, *Anaphaeis aurota*, at Khutwah, Oman (Lepidoptera: Pieridae). **Vol. 15.1. p. 20.**
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Hogarth, P. & Beech, M. [2001]. A first modern record of the Mangrove Crab *Scylla serrata* in the U.A.E. and south-eastern Arabian Gulf. **Vol. 11.2. p.30.**
Hornby, R. J. [2005a]. An Intertidal Spoon Worm (Phylum: Echiura) in the United Arab Emirates: Occurrence, Distribution, Taxonomy and Ecology. **Vol. 15.1. pp. 3-8.**
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تريبيلوس

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