



## ALIEN SPECIES RECORDED IN THE UNITED ARAB EMIRATES: AN INITIAL LIST OF TERRESTRIAL AND FRESHWATER SPECIES

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**Abstract:** Little is documented on the alien terrestrial and freshwater species in the United Arab Emirates. To address this, an assessment of terrestrial and freshwater alien species was conducted using various techniques such as a questionnaire, fieldwork data, networking with relevant people, and a detailed literature review. The results of the initial assessment show that there are 146 alien species recorded in the following seven major taxonomic groups: invertebrates 49 species, freshwater fish five species, amphibian one species, reptiles six species, birds 71 species, mammals six species and plants eight species. To inform decision makers a full list of the 146 species identified in this assessment is presented.

**Keywords:** Alien species, invertebrates, United Arab Emirates, vertebrates and plants.

### Arabic Abstract:

لا يوجد توثيق كافي لأنواع الغريبة البرية وللحميات العذبة في دولة الإمارات العربية المتحدة، ولتبيان ذلك، فقد تم إجراء تقييم لأنواع الغريبة البرية وللحميات العذبة وباستخدام وسائل مختلفة كالإستبيان والعمل الميداني والتواصل مع الأخصائين المعنيين إضافة إلى التحري المرجعي الدقيق.

بينت نتائج التقييم الأولى تسجيل 146 نوعاً غريباً ضمن المجموعات التصنيفية السبعة وكما يلي: اللافقاريات 49 نوعاً، أسماك المياه العذبة 5 أنواع، البرمائيات نوع واحد، الزواحف 6 أنواع، الطيور 71 نوعاً، الثدييات 6 أنواع والنباتات 8 أنواع.

تم تقديم قائمة شاملة بالـ 146 نوعاً غريباً لإعلام أصحاب القرار بها

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## INTRODUCTION

The United Arab Emirates (UAE) is a federation of seven emirates: Abu Dhabi, Dubai, Sharjah, Ajman, Umm Al Quwain, Ras Al Khaimah and Fujairah that altogether cover an area of approximately 89,000km<sup>2</sup> (which includes offshore islands). The UAE is located in the northern part of the Arabian Peninsula and is bordered to the west and south by Saudi Arabia, Oman to the east and the Arabian Gulf to the north. UAE's climate can be described as hot and dry throughout most of the year, and according to the UNEP classification of dry lands is regarded as hyper arid (Middleton & Thomas 1997). The UAE is a unique case in that its harsh hyper arid climate itself poses a challenge for the survival and establishment of alien species, which are found to be limited mainly to degraded and transformed (e.g., urban) habitats.

Consequently, a project was initiated by the Environment Agency ABU DHABI (EAD) to conduct an assessment of terrestrial and freshwater alien species within the UAE. This was considered an initial step to document the types of species that are non-native to the UAE and which may pose a high risk to the natural ecosystem if they become established. A sub-regional workshop for western Asia and northern Africa to address alien species and to achieve the Aichi Biodiversity Target 9 (By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment <http://www.cbd.int/sp/targets/>) was held in the UAE in February 2013. This workshop was organized by the Ministry of Environment and Water (which has a federal level mandate covering all seven emirates) to start addressing the issues of invasive alien species (IAS) at a sub-regional level. Within a regulatory framework, management of alien species is required as the UAE is a signatory to the Convention on Biological Diversity (CBD) as per Article 8—In situ Conservation, Part H—Prevent the introduction of, control or eradicate those alien species, which threaten ecosystems, habitats, or species (<https://www.cbd.int/idb/2009/about/cbd/>).

Hence, this paper presents an initial list of known terrestrial and freshwater alien species in the UAE, with the aim to present this knowledge in one list so that any future efforts can be based upon this baseline list shown in Appendix 1.

## METHODS

The alien species knowledge in the UAE is dispersed and hence a multi-pronged approach was employed to collect data. The methods used were a detailed questionnaire and literature review to initially gauge the knowledge of alien species within the UAE. The EAD conducts biodiversity surveys in Abu Dhabi Emirate and these surveys also collect information on non-native species that are encountered. The EAD is also the UAE's CITES Scientific Authority and has long-term data on confiscated species within the UAE mainly CITES listed species and some of these are collected from the wild.

### Questionnaire and literature review

We initially conducted an extensive literature search to collect information on alien species recorded within the UAE. This literature search was focused on the years 1993–2011 (not many data sources were found prior to the early 1990s) and used the following search terms: UAE, invasive, exotic, non-native species. This review provided a baseline level of valuable information from various publications and provided a starting point for gathering information on alien species. This information was then built upon by using a questionnaire survey. Conducting a literature review also provided valuable information as a starting point.

A questionnaire is a useful tool as it gives you an idea of the knowledge available on the subject and also identifies gaps where more emphasis needs to be placed. The response also provided key contacts of relevant people that could be used later in an alien species project for networking purposes. Therefore, we designed a questionnaire and emailed this to relevant government agencies, individuals linked to natural history groups and other interested individuals within the UAE (a total of 35 people/agencies). A targeted approach was used because our target frame was those individuals or agencies involved in alien species research or management. The questionnaire consisted of four sections as follows:

- Section 1: general information such as contact details, which included name, title, full name of organization/agency, mailing address, telephone, e-mail and date;
- Section 2: species details such as taxon, family, genus, species, sub-species, common name, Arabic name, whether species is record of a species occurrence (present at one point in time but did not become established) or established (maintains a breeding

population), means of introduction (known or inferred), year first recorded, possible impacts to environment and control methods (if known);

- Section 3: species geographical information, including the native range of a species, UAE recorded distribution, particular Emirate and GPS location (if known); and

- Section 4: miscellaneous information such as literature reference(s), website addresses, references and notes.

We received a 30% response to the questionnaires, which is a good response rate for mail and email surveys (see Shough & Yates 2002; Brennan & Charbonneau 2009). As is typical with mail-out/email surveys, not all fields were completed in many instances (e.g., Trenouth et al. 2012). Particular fields that were commonly omitted included the year of introduction, on which very little information was received.

#### Confiscated species database and terrestrial baseline surveys

A review of EAD's environmental databases to pinpoint further records of alien species was conducted. EAD, which conducts wildlife assessment and monitoring activities, has databases on species distribution mainly native species but occasionally alien species are also recorded. EAD is also the UAE CITES Scientific Authority agency for the UAE at the Federal level and it therefore maintains records of CITES species confiscations within the UAE. The CITES confiscations include occasional records of non-native species which have been collected in the wild such as Ball Pythons *Python regius* (P. Soorae, pers. obs. 2004). The CITES confiscation records provided some useful data on species collected from the wild which are mainly escapees. Therefore, these two datasets also added to the initial alien species list developed through the questionnaire and literature review. All the species identified through these various methods are illustrated in Appendix A (supplemental material).

## RESULTS

A total of 146 alien species were recorded in seven major taxonomic groups as shown in Table 1. The highest number of alien species were birds recorded at 49%, followed by invertebrates at 34%, plants and reptiles and amphibians both at 5%, mammals at 4% and freshwater fish at 3% as shown in Table 1.

## Invertebrates

**Invasion trends & introduction pathways:** The main reports of invertebrate alien species are from the 1990s (one in 1980s) with the majority having an unknown date of first introduction. Almost a third (32%) of the alien species records are listed as 'accidental introductions' with the remainder of 68% having an 'unknown' pathway/vector. There are various terrestrial alien species such as ants, spiders, weevils, slugs and snails that have been recorded within the UAE. The majority of these species, and those that have become naturalized, are mainly found in urbanized and disturbed habitats (Collingwood et al. 1997). The tropical Fire Ant *Solenopsis geminata* is a Central American endemic and was first recorded from Arabia in the Dubai Emirate, UAE. This species is an aggressive predator and can have a very negative impact on the ecology, by altering the local fauna through both predation and competition for food (Balfour 2003). The presence of Australian Red-back Spiders *Latrodectus hasselti* has also been recorded from Dubai Emirate (Balfour 2003). In the year 2010, a Red-back Spider collected in Abu Dhabi, has been confirmed as *Latrodectus erythromelas* by a collaborative study done by the EAD (Saji & Al Dhaheri 2010) (Image 1). These spiders are reported from domestic gardens and further research is required to understand whether these spiders are able to survive within UAE's natural habitat.

The Red Palm Weevil *Rhynchophorus ferrugineus* is another alien species that is an important insect pest of date palms in the UAE and has widespread distribution in tropical Asia (Murphy & Briscoe 1999). The excessive use



Image 1. Red-back Spider *Latrodectus erythromelas*

**Table 1. The percentage of alien species in seven major taxa**

Major Taxonomic Group	Invasive Alien Species	Percentage
Invertebrates	49	34%
Freshwater fish	5	3%
Reptiles & Amphibians	7	5%
Birds	71	49%
Mammals	6	4%
Plants	8	5%
Total	146	100%

of insecticides may limit the activity of natural enemies in plantations and thereby the red palm weevil has had a devastating impact in the countries of the Middle East (Murphy & Briscoe 1999). Non-native mollusk species have been recorded such as the southern Flat Coil Snail *Polygyra cereolus*, a native of Florida, USA, which is present in pest proportions in some lawns and garden environments. The Garden Slug *Laevicaulis alte* is found in regularly watered landscaped areas and cultivated sites within the UAE and these snails may compete for food with native snails. They are often imported with their nests to the UAE, in agricultural products such as soil, potted plants and compost (Feulner & Green 2003). A number of other non-native pest species have been recorded from imported foodstuffs, fruits and vegetables in the UAE (see Appendix 1).

### Freshwater fish

**Invasion trends & introduction pathways:** Freshwater fish have been recorded since the year 2000 and all listed as 'accidental introductions'. Freshwater ecosystems in the UAE are limited to seasonal rivers in mountainous areas known as 'wadis', and in dams that collect water during the rainy season. A majority of these are located in the northern part of the country. Different Tilapias *Oreochromis* spp. have been recorded in some wadis and also in dams and other freshwater bodies. In Wadi Wurayah, Fujairah Emirate, the Mozambique Tilapia *Oreochromis mossambicus* and mainly tropical aquarium fish such as Armored Catfish *Plecostomus* sp., Shark Catfish *Pangasianodon hypophthalmus* and Common Carp *Cyprinus carpio* have been recorded (Smart-Beadsmore et al. 2008; Tourenq et al. 2011). Tilapias have also been recorded in Al Ain City in wadis and other water bodies (Soorae, pers. obs.) (Image 2). Mollies *Poecilia* spp. are established in irrigation ditches at Ruwayyah outside Dubai City in Dubai Emirate (Feulner 2005).

**Image 2. Tilapia (*Oreochromis* sp.)**

### Amphibians & Reptiles

**Invasion trends & introduction pathways:** Like the freshwater fish, amphibians and reptiles have only been recorded since the year 2000 onwards with the majority noted between the years 2000 and 2009. A total of 72% of these alien species have been categorized as 'escape from captivity', with 14% as 'accidental introductions' and 14% as having 'unknown' pathways.

In general, amphibians and reptiles do not pose a major threat, as most of the records so far have been of individuals that have escaped from captivity. The Green Toad *Bufo viridis*, collected in Abu Dhabi City in 2006 (Soorae, pers. obs. 2006) was an obvious released pet or one that had escaped from captivity. Freshwater turtle species can pose a threat in freshwater ecosystems such as the record of a Red-eared Slider *Trachemys scripta elegans* from Wadi Wurayah, Fujairah Emirate (Tourenq & Shuriqi 2010). A Leopard Tortoise *Stigmochelys pardalis* was recorded from Bul Sayeef Island, Abu Dhabi Emirate during a routine biodiversity survey in 2008, which was most likely an abandoned pet that was left on this island (P. Soorae, pers. obs. 2008) (Image 3).

### Birds

**Invasion trends & introduction pathways:** The majority of alien bird species records have been between the years 1980 and 2009. Two species have been recorded from 2010 to present. The main pathways are 'accidental introductions' (41%), followed by 'escape from captivity' (34%) and 25% as 'unknown'. The most common alien bird species in the UAE is the Common Mynah *Acridotheres tristis* and Indian House Crow *Corvus splendens*. The Ring-necked Parakeet *Psittacula krameri* (Image 4) and White-eared Bulbul *Pycnonotus leucotis* are also naturalized within the UAE and seen commonly in urbanized areas (Khan 1993). The Grey Francolin *Francolinus pondicerianus*





Image 3. Leopard tortoise *Stigmochelys pardalis*



Image 4. Ring-necked Parakeet *Psittacula krameri*

*mecranensis* is another widespread species and there is some controversy on whether it was naturally occurring in parts of the Arabian peninsula or whether it is an introduced species as its native range is described as Afghanistan and Iran. This species has nevertheless spread widely in the UAE with greening of roadways and spread of farms, gardens and urban areas (Khan & Javed 2005). The majority of these avian species are usually found in urban and disturbed habitats. Although Indian House Crows occur in small numbers at the moment, over the years a noticeable increase in the frequency of sighting has been reported, mostly in areas close to human habitation and along the coastal strip (Ryall & Meier 2008). Several thousand house crows are present on Delma Island in the Arabian Gulf but have not fortunately spread to other nearby uninhabited islands that are used by seabirds for breeding. This could be due to the absence of human habitation and roosting trees. In the future with some islands undergoing development, the likelihood of their range extension cannot be ruled out as many offshore islands in the UAE host breeding colonies of several seabird species, many of them regionally and internationally important (Javed 2008).

### Mammals

**Invasion trends & introduction pathways:** Only one out of the six mammal species has a known date of first introduction in 1999 and the other five are unknown. The main pathways are 50% accidental introductions and 50% escape from captivity. The main mammalian alien species is the feral cat *Felis domesticus*, feral dog *Canis familiaris* and rodents such as the Black Rat *Rattus rattus*, Brown Rat *Rattus norvegicus* and House Mouse *Mus musculus*. All of these alien species are common in

transformed and degraded habitats. These are species that easily spread via anthropogenic activities and are also disease vectors (Shoukry 2001) and very efficient predators of native biodiversity (Javed & Khan 2005; Javed 2008; Javed et al. 2012).

With a worldwide distribution, the Brown Rat is commonly found in towns of the Arabian Peninsula (Harrison & Bates 1991). The House Mouse is found as a commensal species in towns and settlements throughout the UAE. As human settlements expand into previously unsettled areas, new habitat is 'created' for House Mice. Consequently, the population is thought to be expanding its geographic range and increasing in absolute numbers. This species is also found on islands of the Arabian Gulf, such as Zirku and Arzanah, Abu Dhabi Emirate where it constitutes a threat to seabird species of conservation concern (Drew et al. 2003; Javed et al. 2004). In 2014, House Mice were also recorded from Marawah Island, Abu Dhabi Emirate (P. Soorae, pers. obs. 2014). Feral cats and feral dogs have been recorded in some high biodiversity areas via camera traps and these have had a negative effect on biodiversity (P. Soorae, pers. obs. 2015). Feral cats predate on ground nesting birds feeding on eggs and chicks. The native Gordon's Wild Cat *Felis silvestris gordonii* is threatened by genetic pollution due to interbreeding with feral domestic cats (Aspinall et al. 2005).

### Plants

**Invasion trends & introduction pathways:** The records of alien plant species are from the year 2000 to present and 50% are categorized as unknown pathway, 25% each as accidental introduction and escape from cultivation. One of the main invasive alien plant species in the UAE is the Mesquite Tree *Prosopis juliflora*, which

is introduced from Central America and has spread quite extensively within the UAE. It has also colonized the many wadi environments, which have higher moisture availability, compared to the more true desert environments (El-Keblawy & Rawai 2007; Tourenq & Shuriqi 2010).

The Sea-purslane *Sesuvium portulacastrum*, which is native to Africa, Asia, Australia, North and South America, and the Goat Creeper *Ipomoea pes-caprae* that is native to South America, have become naturalized in the UAE. These are low risk species widely used for landscaping in coastal areas or where soil salinity is high (S. Sakkir, pers. obs. 2012). The common invasive grass is the Fountain Grass *Pennisetum setaceum*, which is a native of northern Africa, has been introduced into the UAE as an ornamental grass for its attractive inflorescence and is highly invasive with long-lived wind dispersed seeds making its control extremely difficult. It has been observed in wadis on Jebel Hafeet (S. Sakkir, pers. obs. 2014).

## DISCUSSION

On an ecosystem basis (terrestrial versus freshwater) the majority of alien species were recorded from terrestrial environments (95%), and freshwater aquatic species comprised 5% of records (freshwater fish, crocodile, amphibian and aquatic turtle). The majority of alien species have been observed in urban and semi-urban habitats and those that have been disturbed by anthropogenic activities. The hyper-arid climate in the UAE ensures that alien species find it extremely difficult to get established in more wild, pristine areas as these are very challenging environments and are mainly inhabited by native species that have become highly adapted to living in these extreme conditions.

The more vulnerable are the freshwater wadi ecosystems in which the UAE's three main native fish species and two species of regionally endemic toads are vulnerable to introduced species such as Tilapia, tropical aquarium fish, aquatic turtles and the amphibian chytridiomycosis fungus that has decimated amphibian populations worldwide (Soorae et al. 2012). This is a priority area for raising public awareness to prevent unintentional releases in these freshwater wadi systems. The main threat on native fish species would be predation, disease introduction and competition for resources. The very low numbers of fish species can be severely impacted by any freshwater alien species becoming established in these fragile ecosystems.

In conclusion this survey has highlighted the terrestrial and freshwater alien species of the UAE and this information will be useful for biodiversity conservation and management within the UAE. It would also be useful in the future to extend such a project to cover the marine environment given the high volume of international shipping in the UAE and the associated threat of alien species introduction through ballast water discharges.

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AHMED ALI has recently joined the Terrestrial Assessment & Monitoring unit and besides working on herpetology is an authority on using drones and other modern technologies for wildlife monitoring and assessment.

Appendix 1. Table listing the terrestrial and freshwater species with their date of first record and introduction pathway

	Taxon	Family	Species	Date of first record (year) or Unknown	Introduction pathway, e.g., EC, AI, UNK	Collection Reference number	References
1	Arachnida	Theridiidae	Red-back Spider <i>Latrodectus erythromelas</i>	UNK	UNK	ICEAD (Insect Collection Environment Agency Abu Dhabi) - Wet collection	Saji & Al Dhaheri 2010
2	Arachnida	Theridiidae	Australian Red-back Spider <i>Latrodectus hasselti</i>	UNK	UNK	ICEAD –Wet collection	Balfour 2003
3	Annelida	Oligochaeta: Opisthopora	Earthworm (unidentified species)	UNK	UNK	ICEAD –Wet collection	Saji 2008
4	Mollusca	Gastropoda: Pulmonata: Polygyridae	Southern Flat Coil <i>Polygyra cereolus</i>	UNK	AI	ICEAD –Wet collection	Feulner & Green 2003
5	Mollusca	Gastropoda: Pulmonata: Veronicellidae	Flat African Slug <i>Laevicalius alte</i>	UNK	AI	ICEAD –Wet collection	Feulner & Green 2003
6	Mollusca	Gastropoda: Pulmonata: Ariophantidae	Indian Garden Snail <i>Macrochlamys indica</i>	UNK	AI	ICEAD –Wet collection	Feulner & Green 2003
7	Mollusca	Gastropoda: Pulmonata: Subulinidae	Garlic Glass Snail <i>Allopeas gracilis</i>	UNK	UNK	ICEAD –Wet collection	Feulner & Green 2003
8	Insecta	Orthoptera: Gryllidae	House Cricket <i>Acheta domestica</i>	UNK	UNK	ICEAD-IC3-D8	Saji 2008
9	Insecta	Blattodea: Blattellidae	German Cockroach <i>Blattella germanica</i>	UNK	UNK	ICEAD-IC4-D12	Balfour 2003
10	Insecta	Blattodea: Blattidae	Brown Banded Cockroach <i>Supella longipalpa</i>	UNK	UNK	ICEAD-IC4-D12	Balfour 2003
11	Insecta	Blattodea: Blattidae	American Cockroach <i>Periplanata americana</i>	UNK	UNK	ICEAD-IC4-D12	Balfour 2003
12	Insecta	Heteroptera: Pentatomidae	Southern Green Stinkbug <i>Nezara viridula</i>	UNK	UNK	ICEAD-IC2-D14	Saji 2008
13	Insecta	Homoptera: Aleyrodidae	Cotton Whitefly <i>Bemisia tabaci</i>	UNK	UNK	ICEAD-IC3-D9	Gassouma 2003
14	Insecta	Homoptera: Aphididae	Cotton Aphid <i>Aphis gossypii</i>	UNK	UNK	ICEAD-IC2-D25	Gassouma 2003
15	Insecta	Homoptera: Aphididae	Green Peach Aphid <i>Myzus persicae</i>	UNK	UNK	ICEAD-IC2-D25	Gassouma 2003
16	Insecta	Homoptera: Diaspididae	Long Scale Insect <i>Fiorinia phoenicis</i>	UNK	UNK	ICEAD-IC2-D25	Gassouma 2003
17	Insecta	Homoptera: Pseudococcidae	Citrus Mealy Bug <i>Planococcus citri</i>	UNK	AI	ICEAD-IC2-D25	Gassouma 2003
18	Insecta	Diptera: Muscidae	Stablefly <i>Stomoxys calcitrans</i>	UNK	UNK	ICEAD-IC1-D6	Balfour 2003
19	Insecta	Diptera: Muscidae	Common Housefly <i>Musca domestica domestica</i>	UNK	UNK	ICEAD-IC1-D6	Balfour 2003
20	Insecta	Diptera: Tephritidae	Oriental Fruit Fly <i>Bactrocera dorsalis</i>	UNK	UNK	ICEAD-IC1-D3	Gassouma 2003
21	Insecta	Hymenoptera: Formicidae	Ant <i>Cardiocondyla emeryi</i>	(1997)	UNK	ICEAD-IC1-D14	Collingwood et al. 1997
22	Insecta	Hymenoptera: Formicidae	Singapore Ant <i>Monomorium destructor</i>	(1997)	UNK	ICEAD-IC1-D17	Collingwood et al. 1997
23	Insecta	Hymenoptera: Formicidae	Argentine Ant <i>Linepithema humile</i>	(1997)	UNK	ICEAD-IC1-D16	Collingwood et al. 1997
24	Insecta	Hymenoptera: Formicidae	Black Common Ant <i>Camponotus compressus compressus</i>	(1997)	UNK	ICEAD-IC1-D14	Collingwood et al. 1997
25	Insecta	Hymenoptera: Formicidae	Big-headed Ant <i>Pheidole teneriffana teneriffana</i>	(1997)	UNK	ICEAD-IC1-D17	Collingwood et al. 1997
26	Insecta	Hymenoptera: Formicidae	Pavement Ant <i>Tetramorium bicarinatum</i>	(1997)	UNK	ICEAD-IC1-D17	Collingwood et al. 1997
27	Insecta	Hymenoptera: Formicidae	Tropical Tyrant Ant <i>Iridomyrmex anceps</i>	(1997)	UNK	ICEAD-IC1-D16	Collingwood et al. 1997
28	Insecta	Hymenoptera: Formicidae	Tramp Ant <i>Tapinoma simrothi</i>	(1997)	UNK	ICEAD-IC1-D16	Collingwood et al. 1997



	Taxon	Family	Species	Date of first record (year) or Unknown	Introduction pathway, e.g., EC, AI, UNK	Collection Reference number	References
29	Insecta	Hymenoptera: Formicidae	Black-headed Ant <i>Tapinoma melanocephalum</i>	(1997)	UNK	ICEAD-IC1-D16	Collingwood et al. 1997
30	Insecta	Hymenoptera: Formicidae	Ant <i>Paratrechina falvipes</i>	(1997)	UNK	ICEAD-IC1-D16	Collingwood et al. 1997
31	Insecta	Hymenoptera: Formicidae	Tramp Ant <i>Paratrechina jaegerskioeldi</i>	(1997)	UNK	ICEAD-IC1-D16	Collingwood et al. 1997
32	Insecta	Hymenoptera: Formicidae	Crazy Ant <i>Paratrechina longicornis</i>	(1997)	UNK	ICEAD-IC1-D16	Collingwood et al. 1997
33	Insecta	Hymenoptera: Formicidae	Samsam Ant <i>Pachycondyla sennaarensis</i>	(1997)	UNK	ICEAD-IC1-D5	Collingwood et al. 1997
34	Insecta	Hymenoptera: Formicidae	Tropical Fire Ant <i>Solenopsis geminata</i>	(1997)	UNK	n/a	Collingwood et al. 1997
35	Insecta	Lepidoptera: Noctuidae	Cabbage Looper <i>Trichoplusia ni</i>	UNK	AI	ICEAD-IC2-D8	Gassouma 2003
36	Insecta	Lepidoptera: Noctuidae	Corn Earworm <i>Helicoverpa armigera</i>	UNK	UNK	ICEAD-IC2-D10	Gassouma 2003
37	Insecta	Lepidoptera: Nolidae	Egyptian Bollworm <i>Earias insulana</i>	UNK	AI	ICEAD-IC2-D8	Gassouma 2003
38	Insecta	Lepidoptera: Plutellidae	Diamondback Moth <i>Plutella xylostella</i>	UNK	AI	ICEAD-IC2-D2	Gassouma 2003
39	Insecta	Lepidoptera: Pieridae	Imported Cabbageworm <i>Artogeia rapae</i>	UNK	AI	ICEAD-IC2-D13	Gassouma 2003
40	Insecta	Lepidoptera: Pyralidae	Warehouse Moth <i>Cadra cautella</i>	UNK	AI	ICEAD-IC2-D2	Saji 2008
41	Insecta	Lepidoptera: Pyralidae	Indian Meal Moth <i>Plodia interpunctella</i>	UNK	AI	ICEAD-IC2-D2	Saji 2008
42	Insecta	Coleoptera: Anobiidae	Cigarette Beetles <i>Lasioderma serricorne</i>	UNK	AI	ICEAD-IC5-D5	Saji 2008
43	Insecta	Coleoptera: Anobiidae	Drugstore Beetle <i>Stegobium paniceum</i>	UNK	AI	ICEAD-IC5-D5	Saji 2008
44	Insecta	Coleoptera: Curculionidae	Red Palm Weevil <i>Rhynchophorus ferrugineus</i>	(1986)	UNK	ICEAD-IC5-D8	Gassouma 2003
45	Insecta	Coleoptera: Curculionidae	Sweet Potato Weevil <i>Cylas formicarius</i>	UNK	AI	ICEAD-IC5-D8	Saji and Mayas 2006
46	Insecta	Coleoptera: Curculionidae	Rice Weevil <i>Sitophilus granarius</i>	UNK	AI	ICEAD-IC5-D8	Saji and Mayas 2006
47	Insecta	Coleoptera: Cucujidae	Merchant Grain Beetle <i>Oryzaephilus mercator</i>	UNK	AI	ICEAD-IC5-D8	Saji and Mayas 2006
48	Insecta	Coleoptera: Dermestidae	Khapra Beetle <i>Trogoderma granarium</i>	UNK	AI	ICEAD-IC4-D5	Saji and Mayas 2006
49	Insecta	Coleoptera: Dynastidae	Date Palm Beetle <i>Oryctes rhinoceros</i>	UNK	UNK	ICEAD-IC4-D6	Gassouma 1991
50	Pisces	Cichlidae	Tilapia <i>Oreochromis mossambicus</i> and other unidentified species)	2008	AI	n/a	Tourenq et al. 2011; Smart-Beadsmore et al. 2008; Soorae, personal observation
51	Pisces	Pangasiidae	Shark Catfish <i>Pangasianodon hypophthalmus</i>	2008	AI	n/a	Tourenq et al. 2011; Smart-Beadsmore et al. 2008
52	Pisces	Cyprinidae	Carp <i>Cyprinus carpio</i>	2008	AI	n/a	Tourenq et al. 2011; Smart-Beadsmore et al. 2008
53	Pisces	Loricariidae	Armored Catfish <i>Plecostomus</i> sp.	2008	AI	n/a	Tourenq et al. 2011; Smart-Beadsmore et al. 2008
54	Pisces	Poeciliidae	Mollies <i>Poecilia</i> sp.	UNK	AI	n/a	Feulner 2005
55	Amphibia	Bufonidae	Green Toad <i>Bufo viridis</i>	2006	EC	Live specimen was donated to Sharjah Wildlife breeding Center	Soorae, personal observation
56	Reptilia	Crocodylidae	Nile Crocodile <i>Crocodylus niloticus</i>	UNK	UNK	n/a	Gardner 2005
57	Reptilia	Emydidae	Red-eared Slider <i>Trachemys scripta elegans</i>	2010	AI	n/a	Tourenq 2010

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58	Reptilia	Testudinidae	Leopard Tortoise <i>Stigmochelys pardalis</i>	2008	EC	n/a	Soorae, personal observation
59	Reptilia	Gerrhosauridae	Black-lined Plated Lizard <i>Gerrhosaurus nigrolineatus</i>	2007	EC	n/a	Soorae, personal observation
60	Reptilia	Iguanidae	Common Iguana <i>Iguana iguana</i>	2007	EC	n/a	<a href="http://gulfnews.com/news/gulf/uae/general/runaway-iguana-triggers-panic-among-residents-1.205299">http://gulfnews.com/news/gulf/uae/general/runaway-iguana-triggers-panic-among-residents-1.205299</a>
61	Reptilia	Pythonidae	Ball Python <i>Python regius</i>	2006	EC	n/a	Soorae, personal observation
62	Birds	Struthionidae	Ostrich <i>Struthio camelus</i>	2002	AI	n/a	Javed and Khan, personal observation 2012
63	Birds	Numididae	Helmeted Guineafowl <i>Numida meleagris</i>	2010	AI, EC	n/a	Pedersen & Aspinall 2010
64	Birds	Phasianidae	Chukar Partridge <i>Alectoris chukar</i>	UNK	UNK	n/a	Javed 2008
65	Birds	Phasianidae	Arabian Partridge <i>Alectoris melanocephala</i>	1989	AI, EC	n/a	Pedersen & Aspinall 2010
66	Birds	Phasianidae	See-see Partridge <i>Ammoperdix griseogularis</i>	1989	AI, EC	n/a	Pedersen & Aspinall 2010
67	Birds	Phasianidae	Grey Francolin <i>Francolinus pondicerianus mecranensis</i>	UNK	UNK	n/a	Javed 2008; Khan 1993
68	Birds	Phasianidae	Black Francolin <i>Francolinus francolinus</i>	1980'S	AI	n/a	Pedersen & Aspinall 2010
69	Birds	Phasianidae	Common Pheasant <i>Phasianus colchicus</i>	2002	AI	n/a	Javed & Khan, personal observation; Pedersen & Aspinall 2010
70	Birds	Phasianidae	Green Peafowl <i>Pavo muticus</i>	2010	AI, EC	n/a	Pedersen & Aspinall 2010
71	Birds	Phasianidae	Indian Peafowl <i>Pavo cristatus</i>	UNK	UNK	n/a	Pedersen & Aspinall 2010
72	Birds	Phasianidae	Yellow-necked Spurfowl <i>Francolinus leucoscepus</i>	UNK	UNK	n/a	Pedersen & Aspinall 2010
73	Birds	Anatidae	Black Swan <i>Cygnus atratus</i>	1991	AI, EC	n/a	Pedersen & Aspinall 2010
74	Birds	Anatidae	Black-necked Swan <i>Cygnus melanocorypha</i>	1989	AI, EC	n/a	Pedersen & Aspinall 2010
75	Birds	Anatidae	Egyptian Goose <i>Alopochen aegyptiacus</i>	1997	EC, AI	n/a	Javed 2008; Pedersen & Aspinall 2010
76	Birds	Anatidae	Hawaiian Goose <i>Branta sandvicensis</i>	1989	AI	n/a	Pedersen & Aspinall 2010
77	Birds	Anatidae	Mallard <i>Anas platyrhynchos</i>	1980's -	EC	n/a	Richardson 1997; Javed 2008; Khan 1993
78	Birds	Ciconiidae	Marabou Stork <i>Leptoptilos crumeniferus</i>	2007	AI, EC	n/a	Pedersen & Aspinall 2010
79	Birds	Ciconiidae	Yellow-billed Stork <i>Mycteria ibis</i>	1999	EC	n/a	Richardson 2003; Pedersen & Aspinall 2010
80	Birds	Threskiornithidae	Sacred Ibis <i>Threskiornis ethiopicus</i>	1980's	EC	n/a	Richardson 2003; Pedersen & Aspinall 2010
81	Birds	Threskiornithidae	Scarlet Ibis <i>Eudocimus ruber</i>	1993	AI, EC	n/a	Pedersen & Aspinall 2010
82	Birds	Accipitridae	Dark Chanting Goshawk <i>Melierax metabates</i>	1988	AI	n/a	Pedersen & Aspinall 2010
83	Birds	Ardeidea	Cattle Egrets <i>Bubulcus ibis</i>	UNK	UNK	n/a	Richardson 1997; Javed 2008
84	Birds	Ardeidea	Goliath Heron <i>Ardea goliath</i>	1993	EC	n/a	Pedersen & Aspinall 2010
85	Birds	Otididae	White-bellied Bustard <i>Eupodotis senegalensis canicollis</i>	1996	AI	n/a	Pedersen & Aspinall 2010
86	Birds	Rallidae	African Swamphen <i>Porphyrio porphyrio madagascariensis</i>	1997	AI	n/a	Pedersen & Aspinall 2010
87	Birds	Gruidae	Common Crane <i>Grus grus</i>	1997	EC	n/a	Richardson 1997
88	Birds	Gruidae	Grey-crowned Crane <i>Balearica regulorum</i>	1994	EC	n/a	Richardson 2003; Pedersen & Aspinall 2010
89	Birds	Columbidae	Diamond Dove <i>Geopelia cuneata</i>	UNK	AI	n/a	Pedersen & Aspinall 2010

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90	Birds	Columbidae	Ringed Turtle Dove <i>Streptopelia roseogrisea</i>	1990's	AI	n/a	Pedersen & Aspinall 2010
91	Birds	Columbidae	Speckled Pigeon <i>Columba guinea</i>	2005	AI	n/a	Pedersen & Aspinall 2010
92	Birds	Pteroclididae	Pin-tailed Sandgrouse <i>Pterocles alchata</i>	1997	AI	n/a	Richardson 2003; Pedersen & Aspinall 2010
93	Birds	Psittacidae	Alexandrine Parakeet <i>Psittacula eupatria</i>	1997	AI	n/a	Richardson 1997; Javed 2008
94	Birds	Psittacidae	Blossom-headed Parakeet <i>Psittacula roseata</i>	1997	AI	n/a	Richardson 1997; Pedersen & Aspinall 2010
95	Birds	Psittacidae	Budgerigar <i>Melopsittacus undulatus</i>	UNK	AI, EC	n/a	Pedersen & Aspinall 2010
96	Birds	Psittacidae	Monk Parakeet <i>Myiopsitta monachus</i>	2005	AI	n/a	Pedersen & Aspinall 2010
97	Birds	Psittacidae	Nanday Parakeet <i>Nandayus nenday</i>	2007	EC	n/a	Pedersen & Aspinall 2010
98	Birds	Psittacidae	Plum-headed Parakeet <i>Psittacula cyanocephala</i>	1996	AI, EC	n/a	Pedersen & Aspinall 2010
99	Birds	Psittacidae	Rose-ringed Parakeet <i>Psittacula krameri</i>	UNK	UNK	n/a	Javed 2008; Khan 1993
100	Birds	Corvidae	House Crow <i>Corvus splendens</i>	UNK	UNK	n/a	Richardson 1997; Javed 2008; Khan 1993
101	Birds	Corvidae	Large-billed Crow <i>Corvus macrorhynchus</i>	1998	EC	n/a	Pedersen & Aspinall 2010
102	Birds	Pycnonotidae	Red-vented Bulbul <i>Pycnonotus cafer</i>	1997	UNK	n/a	Richardson 1997; Javed 2008; Khan 1993
103	Birds	Pycnonotidae	Red-whiskered Bulbul <i>Pycnonotus jocosus</i>	1997	UNK	n/a	Richardson 1997; Javed 2008
104	Birds	Pycnonotidae	White-eared Bulbul <i>Pycnonotus leucotis</i>	UNK	UNK	n/a	Javed 2008; Khan 1993
105	Birds	Sturnidae	Bank Mynah <i>Acridotheres ginginianus</i>	UNK	UNK	n/a	Javed 2008
106	Birds	Sturnidae	Brahminy Starling <i>Temenuchus pagodarum</i>	1997	UNK	n/a	Richardson 1997; Javed 2008
107	Birds	Sturnidae	Common Mynah <i>Acridotheres tristis</i>	UNK	UNK	n/a	Javed 2008; Khan 1993
108	Birds	Sturnidae	Common Starling <i>Sturnus vulgaris</i>	1997	UNK	n/a	Javed 2008
109	Birds	Sturnidae	Javan Mynah <i>Acridotheres javanicus</i>	1990's	EC	n/a	Pedersen & Aspinall 2010
110	Birds	Sturnidae	Jungle Mynah <i>Acridotheres fuscus</i>	1980's	AI	n/a	Pedersen & Aspinall 2010
111	Birds	Sturnidae	Pied Myna <i>Gracupica contra</i>	1997	UNK	n/a	Richardson 1997; Javed 2008
112	Birds	Sturnidae	Rose-colored Starling <i>Pastor roseus</i>	1997	UNK	n/a	Richardson 1997; Javed 2008
113	Birds	Sturnidae	Superb Starling <i>Lamprotonis superbus</i>	2010	AI, EC	n/a	Pedersen & Aspinall 2010
114	Birds	Ploceidae	Baya Weaver <i>Ploceus philippinus</i>	1995	AI, EC	n/a	Pedersen & Aspinall 2010
115	Birds	Ploceidae	Bengal Weaver <i>Ploceus benegalensis</i>	2006	AI, EC	n/a	Pedersen & Aspinall 2010
116	Birds	Ploceidae	Chestnut Weaver <i>Ploceus rubiginosus</i>	1995	EC	n/a	Richardson 2003; Pedersen & Aspinall 2010
117	Birds	Ploceidae	Lesser Masked Weaver <i>Ploceus intermedius</i>	UNK	UNK	n/a	Pedersen & Aspinall 2010
118	Birds	Ploceidae	Rueppell's Weaver <i>Ploceus galbula</i>	UNK	UNK	n/a	Pedersen & Aspinall 2010
119	Birds	Ploceidae	Streaked Weaver <i>Ploceus manyar</i>	1995	AI, EC	n/a	Richardson 1997; Richardson 2003
120	Birds	Ploceidae	Village Weaver <i>Ploceus cucullatus</i>	UNK	UNK	n/a	Pedersen & Aspinall 2010
121	Birds	Ploceidae	Vitelline Masked Weaver <i>Ploceus vitellinus</i>	UNK	UNK	n/a	Pedersen & Aspinall 2010
122	Birds	Ploceidae	Golden-backed Weaver <i>Ploceus jacksoni</i>	2003	AI	n/a	Richardson 2003

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123	Birds	Ploceidae	Black-winged Bishop <i>Euplectes hordeaceus</i>	UNK	AI, EC	n/a	Pedersen & Aspinall 2010
124	Birds	Ploceidae	Red-billed Quelea <i>Quelea quelea</i>	1995	AI, EC	n/a	Richardson 1997; Richardson 2003; Pedersen & Aspinall 2010
125	Birds	Ploceidae	Southern Red Bishop <i>Euplectes orix</i>	UNK	AI, EC	n/a	Pedersen & Aspinall 2010
126	Birds	Ploceidae	Yellow-crowned Bishop <i>Euplectes afer</i>	2005	AI	n/a	Pedersen & Aspinall 2010
127	Birds	Estrildidae	Chestnut Munia <i>Lonchura atricapilla</i>	UNK	UNK	n/a	Pedersen & Aspinall 2010
128	Birds	Estrildidae	Common Waxbill <i>Estrilda astrild</i>	2007	AI, EC	n/a	Pedersen & Aspinall 2010
129	Birds	Estrildidae	Indian Silverbill <i>Lonchura malabarica</i>	1997	UNK	n/a	Richardson 1997; Khan 1993
130	Birds	Estrildidae	Java Sparrow <i>Padda oryzivora</i>	UNK	UNK	n/a	Pedersen & Aspinall 2010
131	Birds	Estrildidae	Red Avadavat <i>Amandava amandava</i>	1988	AI, EC	n/a	Richardson 1997; Pedersen & Aspinall 2010
132	Birds	Viduidae	Pin-tailed Whydah <i>Vidua macroura</i>	1997	AI, EC	n/a	Richardson 1997; Pedersen & Aspinall 2010
133	Mammalia	Felidae	Feral Cat <i>Felis domesticus</i>	UNK	EC	n/a	Soorae, personal observation (2011)
134	Mammalia	Rodentia	Black Rat <i>Rattus rattus</i>	UNK	AI	n/a	Aspinall, Hellyer & Drew 2005
135	Mammalia	Rodentia	Brown Rat <i>Rattus norvegicus</i>	UNK	AI	n/a	Aspinall, Hellyer & Drew 2005
136	Mammalia	Canidae	Feral Dog <i>Canis domesticus</i>	UNK	EC	n/a	Soorae, personal observation
137	Mammalia	Rodentia	House Mouse <i>Mus musculus</i>	UNK	AI	n/a	Drew et al. 2003
138	Mammalia	Procaviidae	Rock Hyrax <i>Procavia capensis</i>	1999	EC	n/a	Cunningham 1999
139	Plants	Mimosaceae	Mesquite <i>Prosopis juliflora</i> (Sw.) DC.	UNK	UNK	TERC (Terrestrial Environment Research center) 01460	Tourenq et al. 2010; Brown 2008; El-Keblawy et al. 2007
140	Plants	Mimosaceae	Coffee Senna <i>Cassia occidentalis</i> (L.)	2010	UNK	TERC00981	Sakkir & Kabshawi, personal observation 2010
141	Plants	Convolvulaceae	Goat Creeper <i>Ipomoea pes-caprae</i> (L.)	2010	AI	n/a	Sakkir & Kabshawi, personal observation 2010
142	Plants	Orchidaceae	Soldier's Orchid <i>Zeuxine strateumatica</i>	2006	AI	n/a	<a href="http://www.enhg.org/trib/v16n1/TribulusV16N1P19.pdf">http://www.enhg.org/trib/v16n1/TribulusV16N1P19.pdf</a>
143	Plants	Aizoaceae	Sea Purslane <i>Sesuvium portulacastrum</i>	2011	UNK	n/a	Sakkir, personal observation 2011
144	Plants	Poaceae	Fountain Grass <i>Pennisetum setaceum</i>	UNK	UNK	TERC00320	<a href="http://www.nps.gov/plants/alien">http://www.nps.gov/plants/alien</a>
145	Plants	Cactaceae	Prickly Pear <i>Opuntia ficus-indica</i>	2014	EC*	WAM3215	Sakkir, personal observation 2014
146	Plants	Fabaceae	Manila Tamarind <i>Pithecellobium dulce</i>	2015	EC*	WAM3210	Sakkir, personal observation 2015

EC - Escape from Captivity; AI - Accidental Introduction; UNK - Unknown

