

KINGDOM OF SAUDI ARABIA

INTRODUCTION

by Stephen F. Newton

Area: 2,145,000 sq.km.

Population: Approximately 15 million.

The population growth rate is deemed one of the highest in the region.

The Kingdom of Saudi Arabia is the largest state on the Arabian Peninsula, with extensive coastlines on both the Red Sea and the Arabian Gulf and common borders with all other Arabian countries and Jordan and Iraq in the north. Topographically, the country is very varied, with extensive mountain ranges reaching 3,000 m and limestone escarpments, vast sand deserts, lava deserts and coastal and inland sand/gravel plains. However, the basic physiographic units are well defined and, in a southwest to northeast transect across the country, the major units are the Red Sea coastal plain or Tihamah, the mountains of the Red Sea rift valley (Hejaz in the north, Asir in the south), the western plateau and northern plains including several major lava desert areas (harrats), the central and eastern sand deserts (Nafud in the north and Rub 'al Khali in the south and east) linked by other dune systems, and finally the eastern, Gulf, coastal plain (see Newton & Symens, 1994, for more details). The climate is essentially arid to hyper-arid, although the southwestern mountain ranges receive higher than average (<50 mm) rainfall (300500 mm) and, when combined with the often persistent low cloud, effective precipitation is high enough to support evergreen juniper forest. These high orographic rainfalls are primarily supported by the Northwest Indian Ocean summer monsoon (Siraj, 1984; Tinley, 1994). As the Kingdom spans 16°-32°N and altitude ranges from sea level to 3,000 m, temperature and humidity vary greatly. Subzero nights are frequent in the north and daily summer temperatures are often in the range 35°-45°C. Humidity is highest in the summer, especially on the Gulf and southern Red Sea coastlands.

Biogeographically, the Kingdom has a unique setting. The Saharo-Sindian desert belt spans the country, with a distinctive faunal and floral assembly of its own, but this is overlain with significant Western Palearctic elements in the north, some Indo-Malaysian influence in the east and a near total Afrotropical fauna and flora present in the southwest. The latter area exhibits the highest degree of faunal endemism on the Arabian Peninsula (ICBP, 1992).

The Saudi Arabian economy is largely dependent on its oil wealth and the associated petrochemical industry. Poor oil prices and unpredictable markets in the 1990s have somewhat tempered the nation's rapid development characteristic of the preceding 20-30 years. However, other industrial and agricultural sectors are now being developed to provide the country with broader-based economic security. Despite the apparent wealth of the country, living standards vary dramatically, with a significant component of the population away from the industrial zones around the Gulf, Riyadh and Jeddah largely dependent on pastoral and subsistence agriculture.

Summary of Wetland Situation

Although Saudi Arabia has an extremely arid climate, a wide variety of natural wetland types are located within the Kingdom, and each major physiographic unit supports some permanent wetlands as well as a plethora of ephemeral types. In recent decades, many man-made wetlands have been created, and away from the coastal zones, these are often very significant features in the landscape. Eight wetland systems were identified in the Kingdom by Tinley (1994).

Coastal systems: include coral islands, reefs, mud-, sand- and algal-flats, mangroves, lagoons and inlets, as well as perennial freshwater marshes and artesian springs.

Dunefield systems: include relatively minor aquifer seeps on both Red Sea and Gulf coasts and a major wetland in the Rub 'al Khali.

Sabkha systems: extensive sabkhas (erratically flooded salt-flats) are present on both Gulf and southern Red Sea plains; additionally, much of the terrain between the lower Gulf and the Rub 'al Khali is sabkha dominated; smaller sabkhas are also present in the northern harrats and in inland drainage basins on the central plateau.

Karst systems: of very limited occurrence, although perhaps forming the only truly permanent lakes in central Arabia *e.g.* the aquifer-fed karst crater lakelets of the Al Aflaj/Layla district.

Mountain systems: support a range of small wetlands *e.g.* ponded pockets, other pools and seeps, especially in granite mountains and inselbergs; various seeps and marshes in volcanic/harrat areas.

Geothermal systems: very limited wetlands confined to the southern Tihamah *e.g.* Am Wakrah springs at Malaki Dam.

Wadi systems: abundant features of the Red Sea escarpment mountains, although only a relatively small proportion support perennially flowing rivers. They can flow either westwards towards, though rarely reaching, the Red Sea or eastwards *i.e.* inland.

Man-made systems: include large open expanses of water (dams and reservoirs) and linear canal systems feeding irrigated farmland or outflows from sewage treatment plants (Riyadh and Makkah water courses) or industrial areas (Gulf area).

Both inshore and coastal waters and those surrounding offshore islands support major fisheries. Until recently, most fishing was done on a subsistence basis by local communities (hereafter referred to as the artisanal fishery), which is relatively sustainable. More recently, two commercial fisheries have appeared: the state-owned Saudi Fisheries Company (industrial fishing, often with large trawlers) and Investor Fisheries where "speculators" purchase small boats and man them with cheap Asian labour. In some coastal lagoons, fish (usually prawn) farms are beginning to develop. Other activities in coastal waters yielding economic returns are the remnant pearl-fishery in the Red Sea Farasan Islands and recreational diving, especially on reefs around coastal conurbations, *e.g.* Jeddah and Yanbu on the Red Sea and the Jubail/Damman/Dhahran area on the Gulf coast.

Small-scale natural wetlands have had a pivotal role in the subsistence economics of many inland areas; such oasis areas have a long history of date palm cultivation. Saudi Arabia has recently become one of the world's major wheat growing nations. However, the majority of irrigation water comes from boreholes, and the impact of over-abstraction on wetlands in the aquifer source areas has yet to be assessed. Dams and reservoirs, both large and small, are very important to the agricultural economics in mountainous areas with high precipitation, but in most cases such water storage and distribution schemes have simply replaced ingenious small-scale systems that local communities had developed over centuries in the wise use of meagre water supplies in their cultivations.

Saudi Arabian coastal wetlands support internationally important populations of breeding seabirds, wintering shorebirds, breeding turtles, dugongs, fish and a vast array of corals and other invertebrate taxa (Abuzinada & Krupp, 1994; Gladstone, 1994a). Floristically, they show less diversity, although the Red Sea coast supports extensive mangrove forests, seagrass beds and algal-flats. These communities are also present in the Gulf, but vast reclamation projects have destroyed over 40% of inter-tidal areas and intact areas are limited to the Gulf of Salwah in the south. Until recently, inland wetlands were not a major feature of the landscape, although perennial wadis inconspicuously support a surprisingly wide variety of endemic fish and amphibians. The major man-made wetlands (dams and wastewater rivers) have altered considerably the behaviour of many waterbird species formerly only known in the Kingdom as passage migrants. Nowadays, many more overwinter in the country, and in some cases conditions are suitable for some species to breed, well to the south of their normal Palearctic limits.

With the exception of these man-made water bodies, wetlands are under severe threat in Saudi Arabia. Coastal zones are now subject to high pressure from expanding commercial and industrial fisheries, and many former fish nurseries have been lost to coastal reclamation from industrial, residential and recreational facilities. The Gulf has lost over 40% of its inter-tidal area to development, and the Red Sea 8% (Sambas & Symens, 1993). Burgeoning human populations in the Gulf and Jeddah, Jizan and Yanbu areas on the Red Sea are resulting in considerable pollution from domestic sewage and industrial discharges. Recent events have proved how vulnerable the Gulf coast is to oil pollution.

Natural inland wetlands are most at threat from over-abstraction by the expanding intensive crop growing agro-industry and to a lesser extent by inland conurbations for domestic consumption.

Wetland Research

Two governmental agencies have been responsible for the majority of pure research on wetlands and their flora and fauna: the Meteorological and Environmental Protection Administration (MEPA) in Jeddah and the National Commission for Wildlife Conservation and Development (NCWCD) in Riyadh. Industry has sponsored applied wetland research *e.g.* Saudi Aramco (the partially state-owned oil company) and the Saudi Fisheries Company, but the results of such environmental impact assessments and fisheries monitoring are seldom available publicly. Universities, particularly those in coastal locations, have a long tradition of marine research, notably King Fahd University of Petroleum and Minerals, Dhahran, and King Abdulaziz University, Jeddah.

MEPA and NCWCD have sponsored jointly the Zoological Survey of Saudi Arabia since the early 1980s and dissemination of the results through publication of "Fauna of Saudi Arabia". This has included substantial inventories of the biodiversity of the Kingdom's wetlands, with various insect groups, corals, fish, amphibians and turtles well covered. NCWCD has more recently supported a wide range of wetland monitoring programmes, and in the aftermath of the Gulf War established the Wildlife Sanctuary for the Gulf Region in Jubail. The Kingdom has contributed to the Asian Waterfowl Census since 1990, and has funded long-running research projects on turtles, seabirds and mangroves in the Gulf. Similar marine research is now being established in the Red Sea, particularly around the Farasan Islands.

Wetland Area Legislation

Saudi Arabia is a signatory of several regional agreements (see Newton & Symens, 1994) for the protection of and pollution control in the Gulf and Red Sea areas. In view of recent events in the Gulf, such accords appear of little practical conservation value. The NCWCD "System Plan of Protected Areas for Wildlife Conservation and Sustainable Rural Development in Saudi Arabia" (Child & Grainger, 1990) provides the principal legislative framework for developing a national conservation policy through site protection. Implementation of the System Plan is an ongoing and slow process. Initially, 56 prime terrestrial and 52 marine/coastal sites (grouped into 42 units) were listed for protection, with approximately one third of the former having significant wetland interest. The Kingdom has announced its intention to become a signatory of the Ramsar Convention, but as yet ratification cannot proceed until wetland sites have been protected and declared nature reserves under national policy.

Wetland Area Administration

Ten terrestrial sites in the System Plan have received formal protection, but only two of these, the Farasan Islands and 'Umm al Qamari (both in the Red Sea) are included in this Directory. Although the latter are island archipelagos, protection currently applies only to their terrestrial fauna and flora. At the time of writing, management plans for two major marine wetlands, the Gulf Wildlife Sanctuary (including the Gulf Coral Islands and the Abu Ali-Ras' as-Zawr proposed protected areas) and the Farasan Islands marine protected area (Gladstone, 1994b) are being considered by the Government and their implementation is anticipated in the near future. Two other regional development agencies are involved peripherally in wetland protection: The Royal Commission for Jubail and Yanbu protects several mangrove areas within the Yanbu industrial area, and the Riyadh Development Authority manages the al Ha'ir wetland with support from NCWCD rangers.

Organizations involved with Wetlands

National Commission for Wildlife Conservation and Development
Protected area management, research and monitoring.

Wildlife Sanctuary for the Gulf Region (NCWCD and European Union)
Research and monitoring, Gulf. National Wildlife
Research Center (NCWCD)
Research and monitoring, southwest and Red Sea.

Meteorological and Environmental Protection Administration (MEPA), Ministry of
Defence and Aviation
Water and air quality, pollution monitoring, some research.

Ministry of Agriculture and Water Policy, major
land owner.

Food and Agricultural Organisation of the United Nations (FAO)

Dam construction and irrigation projects, southwest.

Saudi Aramco

Research, monitoring, environmental impact assessments, Gulf.

King Fahd University of Petroleum and Minerals, Dhahran

Research, Gulf.

King Abdulaziz University, Jeddah

Research, Red Sea, Makkah Waste Water River.

IUCN-The World Conservation Union

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WETLANDS

The site descriptions were compiled by Stephen F. Newton on behalf of the Wetlands and Ornithology Section, Research and Monitoring Department, National Commission for Wildlife Conservation and Development. For sites not visited on the ground by the author, the name in parentheses refers to the author of the report from which most material was abstracted.

Wetland Name: Dawhat ad-Dafi and Dawhat al-Musallamiya

Country: Kingdom of Saudi Arabia

Coordinates: 27°15'N, 49°25'E

Location: on the Gulf coast north of Jubail, Eastern Province.

Area: 20,000 ha.

Altitude: Sea level.

Overview: This site comprises the two largest, combined embayments in the northern Gulf, situated between Jubail and Abu Ali in the south-southeast and Ra's as Zawr in the northwest. The relatively sheltered waters were heavily polluted during the 1991 oil spill in the aftermath of the Gulf War. With a wide variety of supra-, inter- and sub-tidal habitats, the site was selected for detailed study on the recovery of oil impacted coastline and its fauna and flora.

Physical features: Musallamiya is the northern and ad-Daft the southern embayment. Several large (over 5 km in length) islands are present, as well as an army of smaller ones. The embayments support a wide variety of substrates: dunes, sand sheets, sabkha and rocky outcrops on land; extensive inter-tidal mudflats, rocky shores and sandy beaches.

Ecological features: Some shores support saltmarsh type vegetation and mangrove (*Avicennia marina*) stands are locally abundant. The inter-tidal areas are often covered with blue-green algal mats. Seagrass beds are relatively extensive in some sub-tidal areas, though coral reefs are more restricted.

Land tenure: Primarily Government owned.

Conservation measures taken: The site has received considerable research effort in the joint CEC/NCWCD programme. Permanent transect lines have been established, and are monitored on a monthly basis.

Conservation measures proposed: The area was proposed as a Resource Use Area in the NCWCD System Plan for Protected Areas, but did not receive formal protection. In the aftermath of the Gulf War, the site has been included in the greater Wildlife Sanctuary for the Gulf Region, alongside Abu Ali, the Gulf Coral Islands and Sabkhat al-Fasl. A comprehensive management plan has been prepared, and rangers recruited, in readiness for its final ratification as a reserve/protected area.

Land use: Artisanal and recreational fisheries are the main occupations offshore, whilst terrestrial areas are used as rangeland for livestock, mainly camels and sheep. A cement factory and some quarries are present in the western boundary of the proposed reserve. Possible changes in land use: None envisaged, but greater control of livestock grazing and fishing after ratification as a reserve. The military have used the area for manoeuvres and may wish to do so again, although currently the authorities have ruled in favour of nature conservation.

Disturbances and threats: Having borne the brunt of one of the largest oil spills in history, it is hoped that such an event will not recur; the continual threat of oil pollution always hangs over coastal sites in the northern Gulf.

Social and cultural values: Jinna Island in Musallamiya supports the remains of an abandoned fishermen's town; the ruins are well preserved and are one of few good examples of traditional Arabian Gulf architecture.

Noteworthy fauna: Given the intensive research, faunal diversity for the site must be one of the highest in the Gulf, especially for invertebrate groups. Green Turtles *Chelonia mydas* and Hawksbill Turtles *Eretmochelys imbricata* feed within the embayments, and four species of cetacean have been recorded: Indo-Pacific Humpback Dolphin *Sousa chinensis*, Bottlenose Dolphin *Tursiops truncatus*, Common Dolphin *Delphinus delphis* and Finless Porpoise *Neophocoena phocoenoides*. Shorelines are now recovering rapidly, and shorebirds formerly using Sabkhat al-Fast are now foraging preferentially in the inter-tidal zone. In forthcoming winters and passage periods, the embayments will almost certainly hold internationally important populations of many shorebird species (see Sabkhat al-Fasl). Western Reef Egrets *Egretta gularis* breed, and both Great Cormorant *Phalacrocorax carbo* and Socotra Cormorant *P. nigrogularis* forage in the offshore waters. Terrestrial habitats are important for migratory Houbara Bustards *Chlamydotis undulata macqueeni*, and also support a healthy population of Asiatic Jackals *Canis aureus*.

Noteworthy flora: Many areas of saltmarsh and mangrove appeared well and truly dead in the aftermath of the oil spill; however, many are now "returning to life", and hopefully the embayments will again support a healthy inter- and supra- tidal flora.

Scientific research and facilities: The research programme rationale was covered in above sections; the reserve is very close to extensive CEC/NCWCD marine research facilities at the Jubail Wildlife Research Center. It is envisaged that a new purpose-built marine research centre will be located within the southern border of the proposed reserve.

Management authority and jurisdiction: Royal Commission for Jubail and Yanbu and other Government departments; soon to be NCWCD.

References: Abuzinada & Krupp (1994).

Reasons for inclusion: 1a, 2a, 2b & 3b. The site is a sparsely populated area of great scenic beauty close to Jubail Industrial City. It is an important site for sea turtles, cetaceans and migratory shorebirds, at which recovery from chronic oil pollution has been monitored in detail.

Source: Stephen Newton (Peter Symens).

Wetland Name: Abu Ali

Country: Kingdom of Saudi Arabia

Coordinates: 27°20'N, 49°40'E

Location: in the Gulf northeast of Jubail, Eastern Province. Area: Approximately 12,500 ha.

Altitude: Sea level.

Overview: This site consists of two long, flat islands, Batima and Abu Ali, close to shore northeast of Jubail in the Arabian Gulf. They are connected to the mainland north of Jubail Industrial City by causeways. Access outside week-ends is restricted, owing to the presence of an important oil and military installation, and there is an abundance of pipelines crossing the area. The north and west coasts were affected severely by the 1991 Gulf oil spill.

Physical features: Sand and sabkha dominate the terrestrial habitats, but the northern shores are exposed, and beyond the sandy beaches there are some fringing reefs. Along the more sheltered southern shores there are inter-tidal mud- and sand-flats, surrounded by saltmarshes.

Ecological features: The sandy central areas of the islands become well vegetated with grasses and herbs following winter rains.

Land tenure: The islands are owned by the Government and Aramco.

Conservation measures taken: Inadvertently, the military protect much of the site by fencing off large areas and restricting access to most of the islands. Thus the vegetation is not grazed by domestic livestock. The islands have been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: The NCWCD System Plan for Protected Areas proposed the site as a Resource Use Reserve. The area is part of the extensive Marine Sanctuary for the Gulf Region, and formal Protected Area status is anticipated in the near future.

Land use: As most of the land is fenced off and access is prohibited, there is not the usual problem of overgrazing, and vegetation can flourish when rainfall permits. An accommodation compound for oil industry personnel is present. Substantial areas are given over to the petrochemical installations and pipelines.

Possible changes in land use: None anticipated.

Disturbances and threats: Some fishing camps have been established, and many recreational visitors use the site, particularly at week-ends. Jubail Industrial City continues to expand, and this may increase the numbers of visitors and thus disturbance. The coastline shape renders it particularly vulnerable to damage from oil spills in the northern Gulf.

Social and cultural values: The site is valued by fishermen and recreational visitors.

Noteworthy fauna: Asiatic Jackals *Canis aureus* are relatively common in the area, and cetaceans are frequent offshore. Comparatively small numbers of White-cheeked Tern *Sterna repressa* (120-150 pairs) and a few (c.10 pairs) of Saunders' Little/Little Tern *S. saundersi/albifrons* breed on the islands, but many terns congregate to moult here after the breeding season; approximately 14,000 Saunders' Little/Little Terns, in excess of 8,000 White-cheeked Terns in September, 2,000-3,000 Sandwich Terns *S. sandvicensis* and nearly 5,000 Lesser Crested Terns *S. bengalensis*. Additionally, up to 8,000 Great Cormorants *Phalacrocorax carbo* winter around the islands. A maximum of 135 Crab Plovers *Dromas ardeola* has been recorded passing through the site on migration.

Noteworthy flora: Seagrass beds, principally *Halodule uninervis*, are extensive in the area from low water mark down to 3 m.

Scientific research and facilities: The bird community has been quite well studied.

Management authority and jurisdiction: Military/oil industry.

References: Newton & Symens (1994); Symens *et al.* (1993a).

Reasons for inclusion: 1a, 2c, 3a & 3c. The islands are especially important for their large concentrations of moulting terns, and are an important research and monitoring location for NCWCD staff based at the Jubail Marine Research Center.

Source: Stephen Newton (Peter Symens).

Wetland Name: Sabkhat al-Fasl Lagoons

Country: Kingdom of Saudi Arabia

Coordinates: 27°00'N, 49°40'E

Location: on the southwest edge of Jubail Industrial City, Eastern Province.

Area: Approximately 500 ha.

Altitude: About 2 m above sea level.

Overview: These are man-made, evaporation lagoons, using organic waste water supplied from Jubail Industrial City. The site was a key foraging and roosting site for waterbirds,

principally shorebirds, displaced from oil impacted areas of the north Gulf coastline subsequent to the Gulf War. Four years after the event, it is still utilised by a wide variety of species, but many have now returned to adjacent "recovered" inter-tidal habitats as preferred foraging areas.

Physical features: The site is situated in a sabkha area that has been shaped by landfill, with banks to divide up the area. The water supply comes from excess treated sewage waste. The depth of water, at only 0-30 cm on average, is very shallow and is thus very susceptible to movement by wind, with a resultant tidal effect whenever the wind changes direction. Waste water is only supplied to the site from October to May and so the lagoons often dry up during the summer months, unless there has been some rainfall. Rainwater increases the volume of water, sometimes dramatically, and the surface can increase greatly, up to a maximum recorded of c.2,500 ha. In addition to these lagoons, three large (c.100 ha) concrete reservoirs are included in the site.

Ecological features: The treated organic water results in the production of a huge biomass of microflora and of microfauna, which in turn provide the basis of the food chain for enormous flocks of feeding birds. The concrete reservoirs and some areas of the lagoon edges are fringed with reeds *Phragmites* and *Tamarix* scrub.

Land tenure: Royal Commission for Jubail and Yanbu.

Conservation measures taken: Primarily monitoring, although researchers have successfully lobbied the Royal Commission to prevent ammonia-tainted waste being dumped in the area. The lagoons have been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: This site is part of the larger coastal area designated as the Wildlife Sanctuary for the Gulf Region. Ratification of the sanctuary as a Marine Protected Area is anticipated in the near future.

Land use: The area surrounding the lagoons is principally occupied by industrial and commercial properties and a golf course.

Possible changes in land use: The city boundaries may well extend further and occupy the side currently open to exposed sabkha.

Disturbances and threats: A decrease in the water supply is anticipated as Jubail Industrial City continues to expand, with a concurrent increase in the amount of water needed to irrigate urban trees, shrubs and gardens. Falcon-trapping and shooting of birds are a frequent hazard at this site. Power lines have caused considerable mortality in the past.

Social and cultural values: The educational potential of this site is enormous, with a large human population nearby who could be shown the importance of the area in general to wild birds and the value of man-made wetlands in providing much needed habitat and feeding areas in an overwhelmingly urban area.

Noteworthy fauna: The area is used by considerable numbers of shorebirds on passage, with some over-wintering and several species remaining to breed. The site supports the only breeding colony of Avocet *Recurvirostra avosetta* in Saudi Arabia, with 45 breeding pairs and up to 420 birds in winter. The Kentish Plover *Charadrius alexandrinus* is common throughout the year, with 70 breeding pairs, up to 2,800 birds in winter, and up to 3,500 birds passing through as migrants. Up to 1,800 Lesser Sand Plover *C. inongolus*, over 3,000 Curlew Sandpiper *Calidris ferruginea*, 700 Broad-billed Sandpiper *Limicola falcinellus*, more than 2,500 Ruff *Philomachus pugnax* and 650 Ruddy Turnstone *Arenaria interpres* have been recorded on spring passage; in late autumn, nearly 5,000 Little Stint *Calidris minuta* have been recorded. Dunlin *C. alpina* pass through on migration in early autumn in huge numbers (over 11,000), but also some stay for the winter, with a maximum of nearly 6,000. Other shorebirds present in reasonable numbers on passage include Sanderling *Calidris alba* (c.650 in spring) and Marsh Sandpiper *Tringa stagnatilis* (almost 200 in early autumn). The Peregrine *Falco peregrinus* occurs regularly, both as a passage migrant (with up to 20 in one season) and winter visitor (1-3 birds). Greater Flamingos *Phoenicopterus ruber* have attempted, unsuccessfully, to breed but over-winter

in large numbers, with up to 1,200 recorded. More than 5,000 ducks winter in the area, including 800-900 Common Shelduck *Tadorna tadorna* (the largest wintering concentration of this species in the Kingdom), Eurasian Wigeon *Anas penelope*, Gadwall *A. strepera*, Common Teal *A. crecca*, Mallard *A. platyrhynchos*, Pintail *A. acuta* and Shoveler *A. clypeata*. Reed Warbler *Acrocephalus scirpaceus* is suspected to breed in the areas of denser vegetation.

Noteworthy flora: None known.

Scientific research and facilities: Much information has been gathered on the ornithological importance of the area; the site is very close to the new NCWCD Marine Research Center.

Management authority and jurisdiction: Royal Commission for Jubail and Yanbu.

References: Evans & Keiji (1993a, 1993b); Newton & Symens (1994); Symens *et al.* (1993a).

Reasons for inclusion: 2b, 3a & 3c. This is an internationally important site for passage and wintering wildfowl and shorebirds.

Source: Stephen Newton (Peter Symens).

Wetland Name: Gulf Coral Islands

Country: Kingdom of Saudi Arabia

Coordinates: 27°56'N, 49°41'E

Location: Harqus; Karan 27°44'N, 49°50'E; Kurain 27°39'N, 49°50'E; Jana 27°22'N, 49°54'E; Juraid 27°11'N, 49°52'E; in the northern Arabian Gulf, Eastern Province.

Area: Approximately 190 ha, excluding surrounding reefs. (Harqus 2 ha, Karan 128 ha, Kurain 8 ha, Jana 33 ha and Juraid 20 ha).

Altitude: Sea level to 4 m.

Overview: This group is composed of five coral islands (listed above with their locations), situated about 35-90 km offshore. A sixth island, al-Arabiyyah, has been excluded as all wildlife interest has been lost subsequent to the building of a coastguard station.

Physical features: The coral islands are surrounded by extensive, shallow coral reefs. Each island has wide, sand beach platforms.

Ecological features: The larger of the islands have dense vegetation, principally of *Salsola* and *Suaeda* but, following substantial rainfall, *Mesembryanthemum*.

Land tenure: Government.

Conservation measures taken: Since 1991, biologists have been present continuously on the larger islands of Karan and Jana for long periods during the summer nesting season of terns and turtles. This presence has significantly diminished and controlled disturbance from fishermen (collecting eggs) and recreational divers. The islands have been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: The NCWCD System Plan for Protected Areas proposed these islands as a Special Nature Reserve and Resource Use Reserve. More recently, the islands have been included within the boundaries of the proposed Wildlife Sanctuary for the Gulf Region, which should be ratified as a Marine Protected Area in the near future. They have also been proposed as a potential Ramsar Site, but there has been no recent progress towards ratification of the Ramsar Convention by Saudi Arabia. Suggested conservation measures include strict control of access during the birds' and turtles' breeding seasons; a ban on military activity on the islands; control or eradication of introduced mice, rats and any other non-indigenous species; and the inclusion of the islands

as priority sites in oil contingency plans. Monitoring of the breeding success of terns and turtles will continue, and ongoing work is assessing the importance of the islands to terrestrial migrant birds in spring.

Land use: The islands have no permanent habitation; lee shores are used for shelter by local fishermen during bad weather, and shore visits are made to collect seabird and turtle eggs in the absence of researchers or coastguards. The fringing reefs are popular recreational dive sites; such groups often use the islands for picnics etc.

Possible changes in land use: None anticipated.

Disturbances and threats: As the numbers of fishermen and recreational divers are increasing and the area is militarily sensitive, the threat from disturbance is difficult to alleviate unless formal management as a protected area is enforced. Fishermen commonly collect eggs, but this is not thought to constitute a major threat, unless undertaken regularly and systematically or on a commercial basis. Proposals to build a coastguard station on Kurayn and an oil plant on Jana would have disastrous consequences, with the probable loss of all breeding seabirds and turtles (as happened on al-Arabiya, following the establishment of a coastguard station). Oil pollution is a continual threat. Introduced mammals pose a very real threat; a cat and a rat have been removed. House Mice *Mus musculus* are not so easily controlled, and the increase in visitors to the islands indicates that this will be a continuing problem (most fishing boats harbour their own populations of mice).

Social and cultural values: Recreational pursuits are the main reason for visits to these islands, with the coral reefs providing very good diving opportunities. The reefs also provide good fishing, and are thus important to the local economy.

Noteworthy fauna: The islands are important nesting grounds for both Hawksbill Turtles *Eretmochelys imbricata* and Green Turtles *Chelonia mydas*. The coral reefs surrounding the islands are probably the most diverse in the Arabian Gulf, and support a wide variety of invertebrate species. For breeding terns, the islands are unparalleled in the upper Gulf. The site is probably one of the most important sites in the world for breeding Lesser Crested Tern *Sterna bengalensis*, with approximately 24,250 breeding pairs. Approximately 34,400 pairs of Bridled Tern *S. anaethetus*, 10,400 pairs of Whitecheeked Tern *S. repressa* and 3,500 pairs of Great Crested Tern *S. bergii* breed on the islands. Two to three pairs of Saunders' Little Tern *S. saundersi* breed irregularly, but up to 50 may pass through as visitors in June. On average, about 30 pairs of Socotra Cormorant *Phalacrocorax nigrogularis* breed on Kurayn, the only colony now extant north of Bahrain. Terrestrial species breeding on the islands include Crested Lark *Galerida cristata* and Lesser Short-toed Lark *Calandrella rufescens*, with Bimaculated Lark *Melanocorypha bimaculata* and Short-toed Lark *Calandrella brachydactyla* breeding sporadically. Many species of birds pass through on migration, including considerable numbers of Corncrake *Crex crex* and migrant flocks of Black-winged Pratincole *Glareola nordmanni*, while Red-necked Phalaropes *Phalaropus lobatus* use surrounding waters. Large numbers of passerines, such as wheatears *Oenanthe* spp., Marsh Warblers *Acrocephalus palustris*, Willow Warblers *Phylloscopus trochilus* and Red-backed Shrikes *Lanius collurio*, regularly rest and feed on the islands during daylight hours.

Noteworthy flora: None known.

Scientific research and facilities: Much scientific research has been conducted on these islands, principally on breeding seabirds, nesting sea turtles and passage migrants. Research facilities are dependent on temporary camps, which are mostly erected and removed before and after each field season.

Management authority and jurisdiction: No information.

References: Newton & Symens (1994); Symens & Evans (1993); Symens & Suhaibani (1994).

Reasons for inclusion: 1a, 2a, 2b, 2c, 3a & 3c. The Gulf Coral Islands are very important because they provide breeding grounds for both seabirds and turtles and also support a viable fishing industry. Additionally, the coral reefs are probably among the best in the Arabian Gulf.

Source: Stephen Newton and Peter Symens.

Wetland Name: Tarut Bay

Country: Kingdom of Saudi Arabia

Coordinates: 26°40'N, 50°10'E

Location: on the Gulf coast east of Qatif and north of Dammam, Eastern Province.

Area: Approximately 41,000 ha.

Altitude: Sea level.

Overview: The bay is the single most important site for passage and wintering waterbirds on the Saudi sector of the Arabian Gulf coast, though continual landfill, reclamation and pollution are persistent threats. The cities of Qatif and Dammam form the backdrop to the west and south sides of the bay.

Physical features: Tarut Bay is a large, shallow, sandy and, in places, muddy bay, with one of the richest and most diverse inter-tidal habitats in the Arabian Gulf. The extensive sand- and mud-flats receive nutrients from sewage effluent and agricultural run-off from the Qatif oasis. Tarut Bay is very sheltered, and thus is not buffeted by the wind, resulting in the sedimentation of very fine particles. Oil installations and urban sprawl probably constitute the dominant landscape features. There are two islands in the bay, Za'l and Tarut; the latter is connected to the mainland by a bridge and is almost wholly developed. During low tide, many sand banks are exposed.

Ecological features: Mangroves, seagrasses and saltmarshes used to be one of the most striking features of the bay, but land-claim by man has removed most of these, so that only small patches now remain. The rich waters support an important shrimp and fishing industry, as well as providing food for the many birds that use the area.

Land tenure: Government, Aramco and private.

Conservation measures taken: Development and ensuing economic benefits dominate the management strategy for the area. Other Government ministries and municipalities probably have the right of veto over any conservation proposals. Tarut Bay has been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: The site has been proposed as a Resource Use Reserve in NCWCD's System Plan for Protected Areas.

Land use: Industrial and urban areas surround much of the bay, though palm groves and small farms are a significant feature near Qatif.

Possible changes in land use: The inter-tidal areas are still subject to landfill.

Disturbances and threats: Threats and disturbances are many and manifest. Firstly, there is always the very real and potent threat of oil pollution, and many small and medium-sized oil spills have already occurred. Much of the bay has been dredged, and dredging operations still take place. Landfill and reclamation of inter-tidal areas continue, with further losses of important feeding areas for the birds. The fishing and shrimp industries must surely suffer if such habitat degradation continues unchecked. Bird-trapping using mist-nests in both inter-tidal and agricultural areas is of frequent occurrence.

Social and cultural values: The industrial development of the area has no doubt contributed to the wealth and prosperity of Eastern Province.

Noteworthy fauna: Sea snakes, Green Turtles *Chelonia mydas* and Dugong *Dugong dugon*

occur in the bay. Two threatened species of birds have been recorded here, both as rare winter visitors: Pallas's Fish Eagle *Haliaeetus leucotyphus* and White-tailed Eagle *H. albicilla*. Other raptors of note include Spotted Eagle *Aquila clanga*, though numbers have decreased from about 20 in 1983 to only six or so today, possibly because of the removal of mangroves. Up to 11 Osprey *Pandion haliaetus* occur in winter. Some seabirds breed in the bay, with just under 200 pairs of Western Reef Egret *Egretta gularis* including a colony on Za'l. An important colony of terns breeds on Za'l Island: 2,330 pairs of Lesser Crested Tern *Sterna bengalensis*, 2,060 pairs of White-cheeked Tern *S. repressa* and 8,900 pairs of Bridled Tern *S. anaethetus* were estimated in the summer of 1994. However, the site really assumes its importance as a wintering and passage site for waterbirds, especially shorebirds. For example, in spring 1991 more than 20,000 waterbirds were present, whilst in 1991/92, approximately 58,000 waterbirds over-wintered. Peak counts in winter have included the following: Great Cormorant *Phalacrocorax carbo* (4,850), Western Reef Egret (435), Great Egret *Egretta alba* (121), Grey Heron *Ardea cinerea* (467), Black-winged Stilt *Himantopus himantopus* (390), Kentish Plover *Charadrius alexandrinus* (2,755), Greater Sand Plover *C. leschenaultii* (900), Eurasian Curlew *Numenius arquata* (1,820), Redshank *Tringa totanus* (4,900), Dunlin *Calidris alpina* (7,800), Slender-billed Gull *Larus genei* (4,480), Yellow-legged Gull *L. cachinnans* (2,840), Gull-billed Tern *Gelochelidon nilotica* (420) and Caspian Tern *Sterna caspia* (236). Shorebirds occurring in large numbers both in winter and on passage include Grey Plover *Pluvialis squatarola* (1,700 in winter, 1,470 on passage), Lesser Sand Plover *Charadrius mongolus* (2,160 in winter, 2,580 on passage), Bar-tailed Godwit *Limosa lapponica* (1,800 in winter, 5,135 on passage), Whimbrel *Numenius phaeopus* (180 in winter, 190 on passage), Terek Sandpiper *Tringa cinerea* (1,670 in winter, 2,900 on passage), Ruddy Turnstone *Arenaria interpres* (1,100 in winter, 1,500 on passage) and Broad-billed Sandpiper *Limicola falcinellus* (645 in winter, 280 on passage). Over 100 Great Knot *Calidris tenuirostris* have been recorded on passage.

Noteworthy flora: Mangroves *Avicennia marina* and seagrasses.

Scientific research and facilities: Waterbirds are censused annually as part of the Saudi contribution to the Asian Waterfowl Census, and the tern colony on Za'l will be monitored regularly.

Management authority and jurisdiction: Multifarious.

References: Evans & Keiji (1993a); Newton & Symens (1994); Symens & Suhaibani (1994).

Reasons for inclusion: 1a, 2a, 2c, 3a & 3c. Tarut Bay is the most important bay on the Gulf coast of Saudi Arabia for wintering and passage shorebirds. Additionally, the bay is the largest shrimp nursery in the country.

Source: Stephen Newton (Peter Symens).

Wetland Name: Al-Hasa Lagoons

Country: Kingdom of Saudi Arabia

Coordinates: 25°30'N, 50°00'E

Location: near the towns of Hofuf and Abqaiq in Eastern Province.

Area: Approximately 7,500 ha.

Altitude: 100-150 m.

Overview: This, the only large freshwater system in the Eastern Province, is formed primarily from run-off from al-Hasa oasis, but is lightly enriched by sewage water from Hofuf, Abqaiq and a plethora of small towns.

Physical features: The wetland comprises a long, narrow river, flowing in an east-southeast direction from Hofuf and Abqaiq towards al-'Uqair. Often, the river goes

underground beneath sand dunes for several kilometres before resurfacing. There are many pools, some of which can be quite large, up to 250 ha. Adjacent areas are composed of sand dunes in places and sabkhas and aeolian sand fields elsewhere.

Ecological features: Large reed-beds surround many of the larger river pools.

Land tenure: Complex and largely unknown.

Conservation measures taken: No conservation measures have been taken to date. Some pools are protected naturally by virtue of their inaccessibility, as they lie amidst sabkha and sand dunes. The lagoons have been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: The site is proposed as a Special Nature Reserve, Biological Reserve and Resource Use Reserve in the NCWCD System Plan for Protected Areas.

Land use: Much of the area surrounding the river is not subjected to agricultural developments, comprising sand dunes and sabkha.

Possible changes in land use: Intensification of cultivation is likely to occur.

Disturbances and threats: Shooting and hunting disturb the site regularly, and at weekends the area is used heavily for recreational purposes by town dwellers for the al-Hasa region. A major threat may lie in the increased demand for sewage waste water for agricultural and other development uses, which will reduce greatly the amount of water flowing in the river.

Social and cultural values: The area is widely used for recreational pursuits and by shooters and hunters.

Noteworthy fauna: The area probably supports a fair diversity of oasis fishes, including *Aphanius dispar*, and an important population of the frog *Rana ridibunda* and the pond turtle *Mauremys caspica*. Asiatic Jackals *Canis aureus* also occur. Houbara Bustards *Chlamydotis undulata* are reputed by local people to pass through the area regularly on migration and in winter. Significant numbers of Black-winged Stilt *Himantopus himantopus* breed in the area, and about 200 are known to over-winter. The Great Bittern *Botaurus stellaris* occurs both as a winter visitor and passage migrant, while the Ferruginous Duck *Aythya nyroca* breeds in unknown, but possibly important, numbers. It is not known whether Black Francolin *Francolinus francolinus* breeds here; if not, this species is likely to be extinct in the Kingdom. Other breeding species include Little Bittern *Ixobrychus minutus*, Ruddy Shelduck *Tadorna ferruginea*, Cream-coloured Courser *Cursorius cursor*, Moustached Warbler *Acrocephalus melanopogon* (the only known breeding site in Saudi Arabia) and, probably, Savi's Warbler *Locustella luscinioides*. During a number of aerial surveys of the area, large concentrations of wintering and migrating waterbirds have been recorded, notably 50-60 Grey Heron *Ardea cinerea*, up to 100 Little Egret *Egretta garzetta*, 10,000-15,000 ducks including 50 Ruddy Shelduck, 22 Common Crane *Grus grus* and small flocks of Ruff *Philomachus pugnax* and Black-tailed Godwit *Limosa limosa*.

Noteworthy flora: None known.

Scientific research and facilities: Apart from casual visits and aerial surveys to census wintering waterfowl, little work has been conducted at this site, and no specific research facilities exist.

Management authority and jurisdiction: Al-Hasa Irrigation and Drainage Authority.

References: Balletto *et al.* (1985); Newton & Symens (1994); Ross (1985).

Reasons for inclusion: 1d, 2b & 3b. Even though poorly understood, this waterway covers a large area and, from the information available, must hold large number of waterbirds.

Source: Stephen Newton (Peter Symens).

Wetland Name: Gulf of Salwah

Country: Kingdom of Saudi Arabia

Coordinates: 25°15'N, 50°40'E

Location: on the Gulf coast in Eastern Province.

Area: 62,500 ha.

Altitude: Sea level.

Overview: The Gulf of Salwah is a large embayment between the Saudi Gulf coast and Qatar Peninsula. The wetland under consideration here is the coast of the inner part of the Gulf and associated islands, to the south of the main Eastern Province conurbations.

Physical features: The inter-tidal area is mainly composed of sand flats and sand-rock. In places, close to the shore, some islands have formed, the most notable of which are Judhaim, Samamik and Zakhnuniyah. These tend to consist of a more muddy substrate than is found on the mainland. One island, Unaibir, to the south of the bay is composed of fossil coral rock. Inland from the mainland coast, the area is characterised by large sabkhas, elevated banks with shallow, hypersaline lagoons in-between.

Ecological features: Surrounding the bay, the coast is generally well vegetated, with date palms and reeds *Phragmites* growing to the sea's edge. In places, reeds grow in the seawater, supported by freshwater from a high water table below. Extensive seagrass and algal beds occur in the shallow waters. On the islands, salt-tolerant plants thrive and, in the more sandy areas, seabirds breed.

Land tenure: Government.

Conservation measures taken: The site as yet is not formally protected, and so no conservation measures are in force. The Gulf of Salwah has been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: The area is proposed as a Resource Use Reserve in the NCWCD System Plan for Protected Areas, but has not yet been declared.

Land use: See below, yet remarkably undeveloped.

Possible changes in land use: Continual southward spread of development from the Dhahran and Al Khobar area.

Disturbances and threats: Quarrying is extensive in many areas of the elevated coastline, destroying vegetation in the process. Vegetation is also being removed in some areas to improve access to the coast for recreational purposes. Some landfill has taken place near al-'Uqair, but this will be expanded if plans to create a large residential and recreational complex, with marinas and artificial beaches, proceed. Should a large oil spill occur to the north, then the bay would be in grave danger from severe pollution. Some Socotra Cormorant *Phalacrocorax nigrogularis* chicks are harvested annually by local people.

Social and cultural values: None known, except for traditional fishery and seabird harvesting.

Noteworthy fauna: An internationally important population of Dugong *Dugong dugon* lives in the Gulf. Ornithologically, the area is probably most important for supporting the largest breeding colonies of Socotra Cormorant in the country, with a minimum estimate of 30,000 breeding pairs in 1994/95 (28,000 pairs on Judhaim and 1,500-1,800 pairs on Unaibir). These birds breed in winter, and in summer thousands of terns also breed. Recent surveys have shown that the largest concentration of terns is on Judhaim, with 900 pairs of Lesser Crested Tern *Sterna bengalensis*, 9,700 pairs of White-cheeked Tern *S. repressa* and 3,100 pairs of Bridled Tern *S. anaethetus*; 800 pairs of Lesser Crested Tern also breed on Zakhnuniyah alongside the only known colonies of Gull-billed Tern *Gelochelidon nilotica*

(12 pairs in 1994) and Caspian Tern *Sterna caspia* (3-5 pairs) on the Gulf coast of Saudi Arabia. About 100 pairs of Western Reef Egret *Egretta gularis* breed around the Gulf. Large numbers of waterbirds winter in the area; peak counts have included over 1,000 Great Crested Grebes *Podiceps cristatus*, 2,375 Black-necked Grebes *P. nigricollis*, nearly 500 Western Reef Egrets, 150 Grey Herons *Ardea cinerea*, almost 200 Great Black-headed Gulls *Larus ichthyaeus*, 1,260 Slender-billed Gulls *L. genei* and 2,500 Yellow-legged Gulls *L. cachinnans*.

Noteworthy flora: Seagrass and algal beds occur in the shallow water, while *Phragmites* and salt-tolerant plants abound on land.

Scientific research and facilities: The Socotra Cormorants have been studied in detail for four winters (1991/92-1994/95), and much information has been gathered on other bird species. No permanent research facilities exist in the immediate area.

Management authority and jurisdiction: Not known.

References: Newton & Symens (1994); Symens *et al.* (1993a, 1993b); Symens & Suhaibani (1994); Suhaibani & Symens (1994); Werner (1993).

Reasons for inclusion: 1a, 2a, 2c, 3a & 3c. The site is important both for the numbers of breeding and wintering birds and for its Dugong population. It is one of the least disturbed/degraded marine environments on the Gulf coast of Saudi Arabia.

Source: Stephen Newton (Peter Symens).

Wetland Name: Uruq al-Mutaridah

Country: Kingdom of Saudi Arabia

Coordinates: 20°41'N, 54°42'E

Location: in the Rub' al Khali (Empty Quarter) in Eastern Province.

Area: 40 ha.

Altitude: 150-200 m.

Overview: This is a remarkable, apparently permanent, wetland in the otherwise hyper-arid Empty Quarter, in a small part of the area known as Uruq al-Mutaridah.

Physical features: The site comprises a series of pools filling basins amongst some of the highest sand dunes in the world. The pools appear to be spring-fed. Areas of sabkha are widespread in the general area, and after good winter rains may form seasonal wetlands.

Ecological features: The site was only "discovered" in 1990, and is poorly known; *Phragmites* reed-beds appear to fringe most of the pools.

Land tenure: Government.

Conservation measures taken: None, although the area lies in a general non-hunting zone.

Conservation measures proposed: The site forms part of a larger area, listed in NCWCD's System Plan for full protection as a Resource Use Reserve and Natural Reserve, to preserve sand dunes up to 200 m high. Designation as an International Biosphere Reserve has been proposed.

Land use: Presumably none, although infrequent visits by Bedouin and their livestock may occur.

Possible changes in land use: None foreseen.

Disturbances and threats: Unauthorised hunting and oil exploration could take place in this area.

Social and cultural values: None known.

Noteworthy fauna: Knowledge of the fauna is scant; the only visit by an ornithologist took place in February 1990, so the area's real significance to migrant and breeding birds is largely unknown. At that time, at least five Water Rails *Rallus aquaticus* and four Moorhens

Gallinula chloropus were present. Both species could be potential breeders. Water Pipits *Anthus spinoletta* were the only other waterbirds of note present.

Noteworthy flora: None known.

Scientific research and facilities: Only one basic survey has been undertaken, in February 1990.

Management authority and jurisdiction: Not known; the area is probably patrolled by Saudi Frontier Forces.

References: Pambour & Al Karrairy (1991).

Reasons for inclusion: Id. This is possibly the only permanent wetland in the Saudi portion of the Rub'al Khali.

Source: Stephen Newton.

Wetland Name: Dawmat al-Jandl

Country: Kingdom of Saudi Arabia

Coordinates: 29°48'N, 39°53'E

Location: on the eastern outskirts of Dawmat al-Jandl, Al-Jawf Emirate.

Area: Approximately 2,500 ha (covering the original marsh plus the new reservoir).

Altitude: 700 m.

Overview: This is one of the largest (of few) conspicuous permanent wetlands in the northern provinces of Saudi Arabia. A maximum of 10,000 birds has been recorded on the waterbody, particularly during harsh winters in the Levant.

Physical features: Once a reasonable-sized lake surrounded by a large marsh of reeds and sedges (900 ha in total), since 1983-1984 this area has now largely been drained and converted to agricultural land. The water is pumped to a reservoir of some 150 ha in a basin in the hills overlooking this lower (now agricultural) land. Only small pockets of marshland now remain, and the area is criss-crossed with irrigation channels.

Ecological features: Sedges and rushes occur in the small marshes.

Land tenure: Not known.

Conservation measures taken: The area is within a non-hunting zone which surrounds NCWCD's large northern reserves, but there is virtually no enforcement of this. The wetland has been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: None.

Land use: Agricultural small holdings lie between the towns and reservoir; livestock graze elsewhere in the vicinity.

Possible changes in land use: Continued agricultural development will probably occur as long as water remains available.

Disturbances and threats: Shooting is known to occur, and recreational activities on the reservoir can also disturb the birds, which now have nowhere else nearby to go.

Social and cultural values: Fish (*Tilapia* sp.) have been introduced, presumably for human consumption.

Noteworthy fauna: Riippell's Fox *Vulpes rueppelli* occurs in the area. Large flocks of Common Coot *Fulica atra* have been recorded (1,346 out of a total of 2,294 waterbirds in January 1993), and up to 10,000 occurred in the cooler winter of 1991/92. Flocks of White-winged Black Tern *Chlidonias leucopterus* numbering over 1,000 have passed through in April. The White-headed Duck *Oxyura leucocephala* may possibly occur in cold winters, but this needs confirmation. A single specimen of Pallas's Fish Eagle *Haliaeetus leucoryphus* was found shot in January 1990, and one Saker *Falco cherrug* has been recorded in April.

Noteworthy flora: None known.

Scientific research and facilities: Occasional censuses of wintering waterfowl have been carried out.

Management authority and jurisdiction: Presumably the Ministry of Agriculture and Water and local emirate (Al Jawf).

References: Green (1984); Newton & Symens (1994).

Reasons for inclusion: 1d & 3b. The site is one of the few remaining wetlands in the northern deserts of Saudi Arabia, and is highly attractive to wintering waterfowl.

Source: Stephen Newton.

Wetland Name: Tabuk (King Faisal Airbase)

Country: Kingdom of Saudi Arabia

Coordinates: 28°23'N, 36°38'E

Location: to the west of Tabuk City, Tabuk Emirate.

Area: Not defined.

Altitude: 770 m.

Overview: The site consists of sewage settling lagoons and a reservoir, situated within a military airbase. As at Dawmat al-Jandl, these new man-made wetlands are a poor substitute for the large natural marshland that formerly occurred in the vicinity of Tabuk. This has been almost totally lost to agricultural development.

Physical features: The man-made lakes are formed from sewage settling lagoons. There is also a reservoir of 100 ha, located at about 10 km distance from the airbase and about 5 km from Military City. Mountains surround the Tabuk area on three sides.

Ecological features: Large *Phragmites* reed-beds thrive on the lagoons, which are surrounded by sand and scrub desert, interspersed with areas of irrigated trees, mostly *Eucalyptus*, and shrubs and grasses. Outside the military training areas, much of the desert is now being cultivated intensively.

Land tenure: Ministry of Defence and Aviation.

Conservation measures taken: There is no formal protection, but as the area is within a military zone, it is in effect protected from hunting and human disturbance, other than military training manoeuvres, but these are likely to be within the greater desert area and not immediately in the vicinity of the lagoons. The wetland has been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: None known.

Land use: Military training area.

Possible changes in land use: Unlikely in the foreseeable future.

Disturbances and threats: If the sewage system is upgraded, as has been proposed, then the lagoons may disappear.

Social and cultural values: The area is a bird-watching site for any interested military personnel.

Noteworthy fauna: Birds recorded breeding on the sewage lagoons include, possibly Little Bittern *Ixobrychus minutus*, 4-9 pairs of Ferruginous Duck *Aythya nyroca*, Water Rail *Rallus aquaticus*, Little Crake *Porzana parva*, possibly Baillon's Crake *P. pusilla*, Little Ringed Plover *Charadrius dubius*, Clamorous Reed Warbler *Acrocephalus stentoreus* and 10-15 pairs of Desert Finch *Rhodospiza obsoleta*. In spring 1990, grebes, approximately 1,000 ducks, about 700 Common Coot *Fulica atra*, shorebirds and about 400 White-winged Black Tern *Chlidonias leucopterus* were recorded at the reservoir.

Noteworthy flora: *Phragmites* and *Tamarix* are the dominant plants around the lagoons.

Scientific research and facilities: There is no access to the site, other than for military

personnel, and the area has only been visited by an ornithologist twice, both times in spring 1990.

Management authority and jurisdiction: Ministry of Defence and Aviation.

References: Newton & Symens (1994); Stagg (1989).

Reasons for inclusion: 2b & 3b. Although the site has been visited infrequently and therefore its true importance for wintering and breeding waterfowl is unknown, the numbers and species of birds recorded indicate the potential of this area.

Source: Stephen Newton (Arthur Stagg).

Wetland Name: Jabal Qaraqir

Country: Kingdom of Saudi Arabia

Coordinates: 27°27'N, 36°36'E

Location: approximately 80 km south of Tabuk Town, Tabuk Emirate.

Area: 160,000 ha.

Altitude: 450-1,750 m.

Overview: Jabal Qaraqir is a spectacular sandstone plateau, cut by deeply incised canyons, rising abruptly from the sandy coastal plain; to the east it is overlain by lava flows. The main canyons contain perennial streams and permanent pools of considerable interest in a region with a mean annual rainfall of less than 50 mm.

Physical features: Jabal Qaraqir is composed of a sequence of three formations: the uppermost red Rumm sandstone, the middle cream to orange coloured Quweira sandstone and the lower, massive dark red Siq sandstone and conglomerates, standing on a base of eroded Pre-Cambrian rocks. The sandstone massif is deeply eroded into precipitous pinnacles and steep-walled, narrow canyons. Water comes to the surface in boulder beds forming canyon floors and from seeps along the side where impervious strata occur in the basal sandstones. Between small surface pools are riffle areas of faster running water over pebbles where small rapids and small falls (<1 m) occur. The surface water flow disappears and reappears along the course of the canyons before sinking into the body of the bedload sediments that fill the wadis. Ad Disah village occurs at the confluence of the three major canyons.

Ecological features: Reed-beds and areas with bulrushes and sedges alternate with thickets of Oleander *Nerium oleander* scrub up to 4 m high. This plant is at the southern limit of its distribution here. Open water areas support submerged aquatic plants such as *Miriophyllum spicatum*. *Acacia tortilis*, Doum Palm *Hyphaene thebaica* and *Ficus sycomorus* occur in places, and the blue form of *Capparis spinosa* has been recorded. Hanging gardens of ferns are present along canyon wall seeps.

Land tenure: Uncertain, but includes Government, tribal and private lands.

Conservation measures taken: None to date.

Conservation measures proposed: The site has been proposed as a Special Nature Reserve, Natural Reserve and Resource Use Reserve in NCWCD's System Plan, although to date it has not been ratified. The site has also been earmarked as a potential World Heritage Area.

Land use: The canyons and wetlands are relatively untouched, but there is some grazing. Irrigated cultivation is quite intensive in the vicinity of Ad Disah.

Possible changes in land use: Local residents have become aware of the conservation interest in Jabal Qaraqir and "smart" individuals are beginning to stake claims of "ownership" by developing the terrain. An example of a large bull-dozed field with 3 m bunds has recently appeared at the mouth of a lateral gorge entering one of the main canyons (Shaib Wadi Gamrah).

Disturbances and threats: See above; over-abstraction of water for cultivation around Ad Disah from the wadi bed will eventually lead to a drying out of the canyon's wetlands. Some illegal hunting no doubt takes place.

Social and cultural values: None known.

Noteworthy fauna: This has been poorly studied, though Bonelli's Eagles *Hieraetus fasciatus* have been recorded. The area is perhaps best known for its population of Nubian Ibex *Capra ibex nubiana*, which occur on the plateau but probably come down to the canyon wadi floors at night to graze the lush vegetation. Some adjacent wadis just to the south, for example Wadi al Jizl, are reputedly the northernmost in the Red Sea drainage to contain freshwater fish. Their occurrence in the canyon wetlands is unknown.

Noteworthy flora: No published information is available.

Scientific research and facilities: A hydro-terrain survey has been undertaken and the ibex population has been censused. No facilities are available.

Management authority and jurisdiction: Not known; probably local authorities.

References: Habibi (1994); Tinley (1994).

Reasons for inclusion: 1 d (possibly also 2d). This is an area of outstanding natural beauty with sandstone canyon wetlands; the area probably supports the highest density of Nubian Ibex in Saudi Arabia outside a formally protected reserve.

Source: Stephen Newton (Ken Tinley).

Wetland Name: Wadi Rabigh Springs

Country: Kingdom of Saudi Arabia

Coordinates: 23°00'N, 39°30'E

Location: on the Tihamah plains, Makkah and Al-Madinah Emirates.

Area: 35 ha.

Altitude: Not known.

Overview: Wadi Rabigh *is* a very small, permanent wetland; an unusual feature on the Tihamah plains north of Jeddah.

Physical features: The wetland is a small natural lake sustained by several permanent freshwater springs. Some cliffs lie adjacent to the springs.

Ecological features: Reeds *Phragmites* surround the lake; no other details are available.

Land tenure: Unknown.

Conservation measures taken: None.

Conservation measures proposed: The site is proposed for protection in the NCWCD System Plan for Protected Areas, though the wetland area covered here is but a small part of the overall wadi system. The springs have been identified as an "Important Bird Area" by BirdLife International.

Land use: Much of the land surrounding the lake and springs is given over to grazing, while cultivation is relatively unimportant.

Possible changes in land use: Cultivation may become more prevalent in the future.

Disturbances and threats: People using the area for recreational purposes can cause disturbance to wildlife. Hunting is known to occur on a small scale. Damming and water diversions are not a large problem at present but, should agricultural development proceed in the area, these may then pose a threat to the quality and quantity of water in the lake. Grazing and extensive wood-cutting and charcoal-making have a detrimental impact on the surrounding habitat.

Social and cultural values: The area is primarily used for recreational purposes.

Noteworthy fauna: Baboons *Papio hamadryas*, Hyaena *Hyaena hyaena*, Wolf *Canis*

lupus and Caracal *Caracal caracal* occur in the area around the lake. The lizard *Uromastyx philbyi* also occurs. The area is also important from an ornithological viewpoint with breeding species potentially including small numbers of Little Bittern *Ixobrychus minutus*, Philby's Rock Partridge *Alectoris philbyi*, Collared Pratincole *Glareola pratincola*, Little Tern *Sterna albifrons* and European Kingfisher *Alcedo atthis*. In winter, up to 14 Black Stork *Ciconia nigra* have been recorded, rendering this site nationally significant. Migrating raptors pass over this area in autumn on the way to Bab al-Mandab, with Common Buzzards *Buteo buteo* being especially numerous.

Noteworthy flora: *Acacia tortilis* is one of the dominant trees in the area.

Scientific research and facilities: No current, or proposed, research is conducted in the area, and no facilities exist.

Management authority and jurisdiction: Unknown.

References: Newton & Symens (1994).

Reasons for inclusion: 1d & 2b. This is a small permanent wetland area within easy reach of Jeddah and Yanbu, supporting an unusual waterbird community.

Source: Stephen Newton (Brian Meadows).

Wetland Name: Al-Ha'ir

Country: Kingdom of Saudi Arabia

Coordinates: 24°30'N, 46°50'E

Location: c.25 km south of Riyadh City, Riyadh Emirate.

Area: 2,500 ha.

Altitude: 450-550 m.

Overview: A perennial river became established in Wadi Hanifah when large volumes of treated sewage waste water were discharged from a sewage works on the eastern outskirts of Riyadh City. Although man-made, it follows the course of a natural wadi.

Physical features: The river course follows Wadi Hanifah for about 50 km, frequently through rocky cliffs but, especially further downstream, through flatter land where lagoons and large pools form amidst sand dunes.

Ecological features: Around the rocky river banks, vegetation is sometimes sparse but elsewhere it is lush and abundant. *Tamarix* and *Phragmites* are the most common plants. Some pivot-irrigation farms have become established, especially in the lower reaches, using water from the river.

Land tenure: Much of the land is Government owned, though presumably some has been sold to agricultural concerns.

Conservation measures taken: Since 1988, part of the river and its surrounding vegetation has been formally accorded protected area status by the NCWCD and it is patrolled by NCWCD rangers on behalf of the Riyadh Development Authority. The wetland has been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: Given its proximity to Riyadh, the site has considerable potential for increasing public interest and involvement in conservation or bird-watching.

Land use: Land surrounding the river is used for grazing by goats, sheep, camels and cattle. Some areas are now irrigated by central-pivot for crop growing, principally wheat and fodder crops.

Possible changes in land use: An increase in the numbers of pivot-irrigated farms may occur in the future.

Disturbances and threats: The area is used widely by visitors for recreational and picnic purposes which, in addition to resulting in the accumulation of large amounts of litter, cause disturbance to waterfowl. Grazing may also limit the development of vegetation. Proposed plans to increase the use of water for agricultural and other developments may deplete severely the volume of water flowing down the wadi, perhaps by as much as 80%, and this will have repercussions on the number and diversity of birds using the area.

Social and cultural values: The protected area has been used for educational purposes, by NCWCD and local universities. Permanent displays do not currently exist, but would illustrate the importance of the area and increase public awareness of its conservation interest amongst those who currently use the area purely for recreation.

Noteworthy fauna: Reptiles and amphibians occur here, including the Desert Monitor *Varanus griseus*, several species of *Agama* and *Uromastyx*. Exotic, introduced fish, including *Tilapia*, are abundant, and are presumably an important food source for waterbirds. However, the area is renowned chiefly because of its rich bird community and, by 1991, 311 species had been recorded. Species occurring in regionally important numbers include: Black-crowned Night Heron *Nycticorax nycticorax*, which both breeds and winters (up to 130 have been recorded); Little Egret *Egretta garzetta*, with a maximum of 340 over-wintering; Grey Heron *Ardea cinerea*, with up to 366 over-wintering; Ferruginous Duck *Aythya nyroca*, which breeds in small numbers and over-winters (up to 70 recorded); and Black-winged Stilt *Himantopus himantopus*, with 236 recorded over-wintering. Other breeding species include Little Bittern *Ixobrychus minutus*, Squacco Heron *Ardeola ralloides*, Purple Heron *Ardea purpurea* and Reed Warbler *Acrocephalus scirpaceus*. Other wintering species of note include Black Stork *Ciconia nigra*, Spotted Eagle *Aquila clanga* and Marsh Harrier *Circus aeruginosus*. Rarer species that occur sporadically and in small numbers include White Pelican *Pelecanus onocrotalus*, Marbled Teal *Marmaronetta angustirostris*, Imperial Eagle *Aquila heliaca*, Kestrel *Falco naumanni*, Corncrake *Crex crex* and Sociable Plover *Vanellus gregarius*.

Noteworthy flora: *Tamarix* and *Phragmites* dominate the area, but lush grasses and sedges also thrive, and good stands of *Acacia* trees grow in places relatively close to the water's edge.

Scientific research and facilities: To date, the area has been surveyed for birds during the breeding, migration and wintering periods; over-wintering birds have been counted on several occasions as part of the Saudi Arabian contribution to the annual Asian Waterfowl Census. Bird ringing has been carried out, principally in spring. Portacabins are available as a base for NCWCD activities, including bird ringing. Ranger patrols occur on most days and a "security guard" lives on site.

Management authority and jurisdiction: Riyadh Development Authority and NCWCD.

References: Newton & Symens (1994); Stagg (1994).

Reasons for inclusion: 2b & 3c. An important site for breeding and wintering waterfowl, and an amenity site close to Riyadh City, with good public awareness potential.

Source: Stephen Newton.

Wetland Name: 'Uyun Layla

Country: Kingdom of Saudi Arabia

Coordinates: 22°15'N, 46°45'E

Location: about 10 km south of Layla Town, Riyadh Emirate.

Area: 3,000 ha.

Altitude: 540 m.

Overview: 'Uyun Layla (also known as Layla Lakes and Al-Aflaj Lakes) are a series of small to medium sized limestone karst lakes, unique in the Arabian Peninsula. Formerly the site was well vegetated, but now it is seriously degraded owing to direct abstraction of water for agricultural irrigation.

Physical features: The site comprises a total of 23 doline and sinkhole subsidence craters, of which five are shaped irregularly, the largest at about 1,500 by 500 m, and the other four ranging in size down to 250 by 75 m. The remainder are circular in shape, of which four measure between 100 and 175 m in diameter, and four are less than 100 m in diameter. Thirteen craters are now dry. The lakes are clustered in three main groups, with one outlier at 2.7 km to the north. Each group is located within saucer-shaped depressions; additionally, in the past, deposition of fine lime sediments when the lakes used to overflow their rims led to the formation of small convex mounds. The water surfaces lie at different levels in each crater, although the waters of the main lake are connected to all the other lakes and sinkholes. Over-abstraction has caused extreme desiccation of the shallower dolines and sediments forming the crater walls and surrounding terrain.

Ecological features: Prior to 1984, the lakes had fringing reed-beds and clumps of *Tamarix*; tall grasslands of *Desmostachya bipinnata* covered the surrounding area. The remaining lakes are now almost barren; the continual fall in water level (one cm every three days) and collapse of crater walls prevent any recolonisation of fringing vegetation.

Land tenure: Unknown.

Conservation measures taken: None.

Conservation measures proposed: The site is listed in NCWCD's System Plan for Protected Areas as a proposed Natural Reserve. More recently, full restoration of the system has been advocated, and deemed feasible, although the full cooperation of the Ministry of Agriculture and Water would be necessary.

Land use: There is intensive cultivation using water abstracted directly from the crater lakes by a pumping station. The surrounding area is heavily overgrazed by domestic livestock. A tourist resort has been constructed, though never used, presumably due to the concurrent demise of the lakes.

Possible changes in land use: The restoration of the ecosystem would be an outstanding opportunity to educate people at all levels. Alternative aquifers are present beneath the agricultural area responsible for the over-abstraction.

Disturbances and threats: See above. The abundance of used cartridges in the area indicates considerable hunting pressure on waterfowl.

Social and cultural values: Presumably the area was a popular recreational area in the past, given its proximity to Riyadh and al Kharj.

Noteworthy fauna: There is virtually none left. The site was the only known locality in Arabia for the African Dragonfly *Enallagma vansomereni*, originally collected in 1981; thorough searches in 1990 failed to locate this species. Fish appear to have been introduced, with *Aphanius dispar* and Tilapiine cichlids recorded; these are known to be aggressive predators and could have a serious impact on other indigenous freshwater fauna. The area is probably still an important drinking source for sandgrouse. It was formerly a breeding site for Little Grebe *Tachybaptus ruficollis* and Moorhen *Gallinula chloropus*, with Common Coot *Fulica atra*, Little Bittern *Ixobrychus minutus*, Little Ringed Plover *Charadrius dubius* and Savi's Warbler *Locustella luscinioides* as other potential breeders. Migrant and wintering duck, including Garganey *Anas querquedula*, were presumably numerous at one time.

Noteworthy flora: Little of interest remains.

Scientific research and facilities: No serious scientific research has been undertaken,

except with regard to water abstraction and engineering. A policy procedure for restoration has been prepared.

Management authority and jurisdiction: Presumably Ministry of Agriculture and Water.

References: Jennings (1985, 1987); Schneider & Krupp (1993); Tinley (1994).

Reasons for inclusion: 1d (possibly also 2d). A unique wetland ecosystem in Arabia, but on the verge of total destruction.

Source: Stephen Newton (Ken Tinley, Michael Jennings).

Wetland Name: Makkah Wastewater Stream

Country: Kingdom of Saudi Arabia

Coordinates: 21°17'N, 39°41'E

Location: southwest of Makkah City, Makkah Emirate.

Area: Approximately 300 ha.

Altitude: 100-200 m.

Overview: This is a man-made river system, created by the discharge of sewage effluent from Makkah City down wadis, including Wadi Uranah, to the southwest of the city.

Physical features: The river flows through rather flat terrain for 20-30 km southwest from Makkah, petering out in the Tihamah sandy desert. For the first 15 km or so, the river flows quite strongly, but thereafter pools and channels tend to become somewhat ephemeral, depending on the amount of effluent discharged.

Ecological features: The river and pools are surrounded by, in some places, dense stands of vegetation of which *Calotropis procera*, *Phragmites* and grasses are the most important.

Land tenure: Not known.

Conservation measures taken: This area is not protected and no conservation measures have been taken. The wetland has been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: None.

Land use: Most of the surrounding land is heavily grazed by Bedouin livestock.

Possible changes in land use: None apparent at present, although some land may be developed for cultivation on a small scale.

Disturbances and threats: People stopping close to the main roadside pools can locally disturb wildfowl, and some hunters may shoot duck there, but there are thought to be no major threats to the area.

Social and cultural values: None in particular; the site is popular with expatriate bird-watchers.

Noteworthy fauna: A wide variety of waterbirds has been recorded during the migration seasons and in winter. Six pairs of Black-winged Stilt *Himantopus himantopus* breed at the site, and up to nearly 1,000 have occurred in winter on the roadside pools on the Makkah bypass. Other wintering birds include a wide variety of duck and shorebird species. Notable concentrations of birds on passage have included up to 600 Glossy Ibis *Plegadis falcinellus* and 450 Collared Pratincole *Glareola pratincola*. Both Common Crane *Grus grus* and Demoiselle Crane *Anthropoides virgo* utilise the site in small numbers on migration. The Arabian Bustard *Ardeotis arabs* occurred locally in the past, but there is probably too much disturbance in the area now for any birds to remain, and there have been no records of this species in recent years. Lichtenstein's Sandgrouse *Pterocles lichtensteinii* and Chestnut-bellied Sandgrouse *P. exustus* can be locally abundant, particularly in

periods following heavy rainfall.

Noteworthy flora: None known, although *Salvadora persica* occurs in places.

Scientific research and facilities: The site was subject to systematic survey by researchers from King Abdulaziz University in Jeddah, and the area close to the Makkah bypass is surveyed most years for wintering waterbirds as part of the Asian Waterfowl Census.

Management authority and jurisdiction: Not known.

References: Felemban & Al-Banna (1993); Newton & Symens (1994).

Reasons for inclusion: 3b & 3c. The supply of water to this river is unlikely to diminish in the near future, and thus the area should continue to provide breeding, stopover and wintering habitat for a wide variety of bird species in an otherwise very arid area.

Source: Stephen Newton.

Wetland Name: Wadi Turabah

Country: Kingdom of Saudi Arabia

Coordinates: 20°30'N, 41°10'E

Location: 80 km north of Al-Baha, Baha and Makkah Emirates.

Area: Approximately 5,000 ha.

Altitude: c.1,100-1,700 m.

Overview: Wadi Turabah is one of the largest wadi systems draining the Asir mountains. It rises near Al Mandaq, just north of Al-Baha, and follows a northeasterly course as a prominent landscape feature for over 200 km to beyond Turabah town. The 35 km section from the vicinity of Jabal Ibrahim (Batharah), fairly close to the source, to the main highway between Taif and Al-Baha is perhaps best known from a wildlife perspective, although wetland interest continues at least as far as Turabah town, but no ground work has been done to ascertain its importance.

Physical features: The wadi surrounds are dominated by mountainous terrain, including a large granite pluton (Jabal Ibrahim). The wadi frequently narrows between steep-sided gorges, alternating with more leisurely meandering sections through flatter ground, although these miniature plains are often bounded by steeply rising cliffs. Perennial running water and lush vegetation occur along various sections of the wadi.

Ecological features: On the higher western slopes, mixed montane woodland occurs, including some juniper *Juniperus excelsa*. Along the wadi, several species of *Ficus*, *Ziziphus spina-christi* and *Phoenix caespitosa* are particularly prevalent. Rushes, *Mentha longifolia*, *Pluchea dioscoridis* and other water-loving plants grow along the water's edge in many places. Somewhat away from the water itself, in areas where the wadi floor widens out, *Acacia* scrub and woodland can be moderately extensive.

Land tenure: Land tenure is unknown, but is probably a mixture of Government and, in cultivated areas, private ownership.

Conservation measures taken: No conservation measures are in place to protect this important site. Wadi Turabah and the nearby Jabal Ibrahim have been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: The site (also including Jabal Ibrahim) is proposed in the NCWCD System Plan for Protected Areas as a Natural Reserve, Biological Reserve and Resource Use Reserve, but has not yet been ratified.

Land use: Grazing is the most commonplace activity, but in places settlements are becoming more permanent and some cultivation now occurs.

Possible changes in land use: As more nomadic pastoralists settle down into permanent

dwellings, it is likely that the level of cultivation will increase significantly.

Disturbances and threats: This site is frequently disturbed and faces a wide array of threats. Large numbers of visitors use the area for recreational purposes, ranging from naturalists and people on picnic to parties fishing (sometimes illegally using electro-fishing tackle) and hunters who shoot a wide variety of mammals and birds. Overgrazing is a severe threat, and the huge numbers of livestock continue to denude increasingly barren slopes. Permanent dwellings mean that land is now continually grazed and cultivated, whereas previously vegetation was intermittently allowed to recover. Other threats include over-abstraction of water for the nearby city of Taif, sand and gravel extraction and a local "factory" within the wadi producing building bricks. This wadi, of nearly unparalleled natural scenic beauty and diversity, is now being destroyed at an alarming rate; the complexities of ownership only serve to exacerbate the problem as they hinder any progress with respect to ratifying the site as a protected area.

Social and cultural values: The area is widely used for recreation, and supports a denser human population than would be expected at first sight.

Noteworthy fauna: The area is important with respect to fish, amphibians, reptiles, mammals and birds. At least three species of endemic fish occur in the wadi: *Cyprinion mahalensis*, *Garra buettikeri* and *Barbus apoensis*, and there is a healthy assemblage of amphibians. Baboons *Papio hamadryas* are resident and probably still live naturally, rather than commensally on man's waste as in more urban areas. Large carnivores, including Hyaena *Hyaena hyaena*, Wolf *Canis lupus* and Caracal *Caracal caracal*, still occur, but these are heavily persecuted by man. The Hyrax *Procavia capensis* is abundant on rocky slopes, and Porcupine *Hystrix indica* and Genet *Genetta felina* both occur. Although the wetlands of the wadi hold no internationally important concentrations of birds either during the breeding season or in winter, there are several populations of national importance. The site is one of the best known breeding sites for Hamerkop *Scopus umbretta* in Saudi Arabia, with up to 50 individuals counted along a 35 km stretch and several active nests known. Also, the wintering population of around 20 Black Storks *Ciconia nigra* is nationally significant. Other breeding waterbirds include Grey-headed Kingfisher *Halcyon leucocephala* and Moorhen *Gallinula chloropus*, whereas Little Egret *Egretta garzetta*, Grey Heron *Ardea cinerea*, Common Sandpiper *Actitis hypoleucos* and Green Sandpiper *Tringa ochropus* are regular winter visitors. Rocky slopes and lush forested areas near the source, especially around Jabal Ibrahim, hold most of the montane southwest Arabian endemic bird species; only the Yemen Warbler *Parisoma bulyi*, Asir Magpie *Pica pica asirensis* and Golden-winged Grosbeak *Rhynchostruthus socotranus* have yet to be recorded. Other significant breeding species include Verreaux's Eagle *Aquila verreauxii*, Bonelli's Eagle *Hieraaetus fasciatus*, Mountain Nightjar *Caprimulgus poliocephalus* and Bruce's Green Pigeon *Treron waalia*; Cinereous Buntings *Emberiza cineracea* occur on spring passage.

Noteworthy flora: No information is available, though a high diversity of plants certainly occurs.

Scientific research and facilities: Surveys of fish, birds, reptiles and amphibians have been conducted, but no current research is underway. No specific facilities exist.

Management authority and jurisdiction: Not known.

References: Eichaker (1990); Krupp (1983); Newton *et al.* (1994); Newton & Symens (1994).

Reasons for inclusion: 1a, 2b & 2d. Wadi Turabah, with perennially running water, is an important site incorporating a wide biological diversity in several vertebrate groups and great natural scenic beauty.

Source: Stephen Newton.

Wetland Name: Shallal ad-Dahna

Country: Kingdom of Saudi Arabia

Coordinates: 18°55'N, 42°12'E

Location: 90 km north of Abha City, just south of Tanumah village, Asir Emirate.

Area: Approximately 200 ha.

Altitude: 2,100-2,200 m.

Overview: Shallal ad-Dahna used to be one of the very few permanent mountain streams and waterfalls in Saudi Arabia, but a recently constructed dam higher up the watercourse has resulted in its demise.

Physical features: The site comprises a semi-circular cliff-line (20-30 m high) in a small, shallow wadi, close to the main escarpment, cut by a small stream. A large plunge pool used to be present at the base.

Ecological features: Juniper *Juniperus excelsa* trees grow on the slopes adjacent to the old waterfall, intermixed with *Acacia* scrub and *Buddleja polystachya*. Some wetland plants still persist in the plunge pool depression.

Land tenure: Unknown, probably Government.

Conservation measures taken: No formal protection. The stream and surrounding hills (an area of 5,000 ha) have been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: The site was listed in the NCWCD System Plan for Protected Areas, but one of the prime reasons for its inclusion, namely its amphibian fauna, will almost certainly be lost in the future.

Land use: Grazing occurs on the surrounding hillsides and cultivation in the valley bottom.

Possible changes in land use: Further development as a recreational (picnic) area.

Disturbances and threats: The conservation and wetland interest of this site has now been largely destroyed by damming and unsympathetic landscaping as a recreational area. Planting of exotic trees, primarily *Eucalyptus*, has added to its demise. Considerable litter accumulates, and the surrounds suffer fairly high grazing pressure. Much of the flatter wadi bottom area has been cultivated and has lost most of its botanical interest. Picnics are a favoured occupation here, and car parks and roads are being provided.

Social and cultural values: This is a popular recreational area with local people and tourists.

Noteworthy fauna: While the waterfall and pool existed, this area was totally unique in Saudi Arabia, with the sympatric occurrence of three species of anuran, one endemic and two Palearctic relicts. It is not known whether viable populations will persist, but of note were the toad *Bufo arabicus* and two species of frog *Rana ridibunda* and *Hyla savignyi*. The site was also important for harbouring the snake *Eirenis coronella fennelli* and the shrew *Crocidura russula*. The site holds no species of waterbirds, though an unconfirmed report of a Northern Bald Ibis *Geronticus eremita* in November 1993 gives further support for the hypothesis that the species may breed in southwest Arabia. Shallal adDahna superficially appears to be an ideal cliff site for a colony. The general area holds a large number of the southwest Arabian endemics (Arabian Red-legged Partridge *Alectoris melanocephala*, Philby's Rock Partridge *A. philbyi*, Arabian Woodpecker *Picoides dorae*, South Arabian Wheatear *Oenanthe lugentoides*, Yemen Thrush *Turdus menachensis*, Asir Magpie *Pica pica asirensis*, Arabian Serin *Serinus rothschildi* and Yemen Linnet *Carduelis*

yemenensis) and several Afrotropical species including Spotted Eagle Owl *Bufo africanus*.

Noteworthy flora: The wetland plants have mostly been lost, although damp patches under cliff overhangs may support an interesting community of moss and liverworts, where *Primula verticillata* also grows.

Scientific research and facilities: Some surveys have been conducted in the past, particularly with respect to amphibians and reptiles, and ornithological records are collected when opportunities permit.

Management authority and jurisdiction: Not known.

References: Balletto *et al.* (1985); Newton & Symens (1994).

Reasons for inclusion: 1d (possibly also 2d). Formerly a unique site in the Asir mountains; sympathetic management could restore some of the lost wildlife interest.

Source: Stephen Newton.

Wetland Name: Wadi Lajb

Country: Kingdom of Saudi Arabia

Coordinates: 17°35'N; 42°54'E

Location: near the village of Ar Rayth some 40 km northeast of Baysh Town, Jizan Emirate.

Area: Approximately 250 ha.

Altitude: 700-1,500 m.

Overview: Wadi Lajb is the southern equivalent of Jabal Qaraqir; an incredibly deep canyon cutting through sandstone mountains in one of the upper tributaries of Wadi Baysh, a vast drainage system of the southern mountains/Tihamah. Pristine, perennial wetlands occur along the wadi floor with a rich, moist, tropical flora.

Physical features: The Wadi Lajb canyon runs southwest to northeast for about 5 km, bisecting two sandstone mountains, Jabal al-Qahar (2,041 m) to the north and Jabal Shaqra (1,946 m) to the south. Canyon walls are up to 400 m high in places, often overhanging, and the wadi is often only 3-20 m wide. The watercourse comprises streams, rapids, waterfalls and plunge pools, with canyon-wall seep-lines abundant.

Ecological features: The canyon is luxuriantly vegetated and very African in character, with *Minuscops laurifolium*, *Trichilia emetica*, the Long-stemmed Palm *Phoenix reclinata* and *Ficus* as the dominant large trees; ferns, including *Pteris vittata*, abound in the humid environment. Often "hanging" forests occur along seep-lines.

Land tenure: Not known.

Conservation measures taken: None.

Conservation measures proposed: The canyon and surrounding jabsals have only recently been discovered to have high conservation interest. As the site is remote and relatively inaccessible, urgent formal protection is probably not needed for the time being.

Land use: The canyon is scarcely utilised at present.

Possible changes in land use: None foreseen.

Disturbances and threats: None known.

Social and cultural values: Not known.

Noteworthy fauna: The site probably holds important populations of amphibians and fish, including several endemics, but these have not been surveyed. Additionally, the bird fauna is not well known, but Hamerkop *Scopus umbretta* undoubtedly occurs. Arabian Serin *Serinus rothschildi* and Masked Shrike *Lanius nubicus* have been recorded in winter. The surrounding mountains hold the largest known breeding population of Asir Magpies *Pica pica asirensis*, and are possibly one of the few places where the Arabian Leopard *Panthera pardus nimr* still persists.

Noteworthy flora: An incredibly diverse flora has been recorded in the canyon and jabal (*S. Collette*, pers. comm.). Other trees (not mentioned above) include *Berchemia discolor*, *Celtis africana* and *Diospyros mespiliformis*.

Scientific research and facilities: Although visited by ornithologists, botanists and hydrologists, no data have been published.

Management authority and jurisdiction: None in place, although the local tribe is apparently able to limit access to some degree.

References: Tinley (1994).

Reasons for inclusion: Ia (possibly also id). This is one of the most spectacular topographic features in Saudi Arabia; its plant communities are likely to be unique in the Kingdom.

Source: Stephen Newton (Ken Tinley).

Wetland Name: Malaki Dam

Country: Kingdom of Saudi Arabia

Coordinates: 17°03'N, 42°58'E

Location: 15 km east of Abu Arish, Jizan Emirate.

Area: 2,500 ha.

Altitude: 120-250 m.

Overview: Malaki Dam (also known as Malakiyah, Wadi Jizan Dam or Hakima Dam) is probably the largest and most variable expanse of freshwater habitats in the southwestern provinces of Saudi Arabia.

Physical features: The Malaki Dam structure closes a narrow gap where Wadi Jizan passes between rocky foothills; this gap is just below the point of confluence of four major wadis. It was constructed to provide year-round water for irrigation purposes and for flood control. The reservoir is supplied by water from the major wadis and has a very large catchment area, extending south into Yemen. The depth of the reservoir has been reduced following sedimentation and, in flood periods, the reservoir can cover an area of 1,000 ha. To the north of the dam are basaltic lava plains, while to the south are many rocky outcrops, some containing hot springs such as at Ain Wakrah. Close to the main reservoir and in the lower reaches of the wadis there are several marshy areas. Large quantities of silt have effectively cut off some pools and larger expanses of open water from the main reservoir; one can be regarded as an almost permanent lake of about 60 ha.

Ecological features: *Tamarix* woodland, with a lush understorey of herbs, grasses and sedges including *Cynodon dactylon*, *Cyperus alopecuroides* and *C. articulatus*, covers many of the silt-deposition banks and borders the main wadis and areas of open water. Reeds *Typha* sp. occur in places. When water levels permit, sorghum is grown on accessible lake shores and wadi beds. Palms *Phoenix reclinata* and *Hyphaene*, the succulent *Adenium obesum* and the rare *Acacia alba* grow amidst rocky outcrops. In the more open and sandy areas, *Dobera glabra* trees, *Acacia* scrub and *Salvadora persica* predominate. In some areas with shallow water, the dead remains of flooded trees are exposed and form ideal roost sites for a variety of herons and egrets.

Land tenure: The land is under a combination of private and Government (Ministry of Agriculture and Water) ownership.

Conservation measures taken: The area is not protected and no formal conservation measures have been undertaken. Malaki Dam has been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: The area forms part of the larger Wadi Jawwah/Juwa

system, and was proposed as a Special Nature Reserve, a Natural Reserve, Biological Reserve and Resource Use Reserve in the NCWCD System Plan for Protected Areas. Ratification as a Protected Area was expected in the early 1990s, but land ownership by other Government ministries has stalled the process for the foreseeable future.

Land use: When water levels in the reservoir drop, all available land is tilled intensively, mostly for sorghum. On the surrounding slopes, goat grazing is the principal activity.

Possible changes in land use: Intensive cultivation continues to increase as the local human population expands. This is resulting in the continued loss of scrub to the bulldozer. Further development is likely along the newly built al-Arida road. Insecticide spraying against malarial mosquitoes occurs frequently, and agricultural pesticides may also be used, but their impact on wildlife and water quality are unknown.

Disturbances and threats: The increase in the local human population poses the biggest threat to the wildlife of the area as more and more land is cleared for housing and agriculture. Wood-cutting for firewood is likely to be a major concern.

Social and cultural values: Methods of cultivation, field sizes and typical circular thatched dwelling huts give the Malaki Dam area, including nearby Wadi Juwa, a unique African character. Water from the Ain Wakrah hot springs is reputed to have special properties. The springs have now been fenced, and a spa-type resort is being developed at the site. Thus, recreational pressure is likely to increase.

Noteworthy fauna: Four anurans have been recorded, *Bufo tihamicus*, *B. dhufarensis*, *B. arabicus* and *Euphlyctis ehrenbergii*, as well as the Side-necked Turtle *Pelomedusa subrufa*. The fish fauna is likely to be of interest, though exotic species have been introduced in the area and their impact on indigenous species could be high. This wetland usually supports 5,000-10,000 waterfowl in mid-winter, but little is known of the breeding community. Wintering species present in substantial numbers include Cattle Egret *Bubulcus ibis* (over 3,000), Glossy Ibis *Plegadis falcinellus* (over 900) and Ferruginous Duck *Aythya nyroca*. The site holds the largest regular wintering populations of White Stork *Ciconia ciconia* (over 300) and Common Cranes *Grus grus* (occasionally over 100) in Saudi Arabia, and is one of the few places where Pallas's Fish Eagle *Haliaeetus leucoryphus* is regularly recorded. Many other species of waterbirds are present in nationally important numbers, notably Black-crowned Night Heron *Nycticorax nycticorax*, Little Egret *Egretta garzetta*, Spoonbill *Platalea leucorodia*, Black Stork *Ciconia nigra*, Black-tailed Godwit *Limosa limosa* and Ruff *Philomachus pugnax*. The White Pelican *Pelecanus onocrotalus* is an occasional visitor. Large roosts of harriers *Circus* spp., including most Eurasian species, are often present, and Spotted Eagles *Aquila clanga* are regular. The surrounding area of semi-natural and farmland habitats has a high diversity of predominantly Afrotropical terrestrial bird species, and includes notable populations of Arabian Helmeted Guineafowl *Numida meleagris*, Little Button Quail *Turnix sylvatica*, Grey-headed Kingfisher *Halcyon leucocephala*, White-browed Coucal *Centropus superciliosus*, Abyssinian Roller *Coracias abyssinicus* and Little Grey Hornbill *Tockus nasutus*.

Noteworthy flora: *Dobera glabra* trees used to be quite abundant here, but their numbers have dwindled as they have been chopped down for firewood, or during field construction.

Scientific research and facilities: A wide variety of surveys has been conducted, but no serious research is currently underway and no facilities exist, although the Food and Agricultural Organisation (FAO) has generously allowed NCWCD staff to use their guest house at the dam.

Management authority and jurisdiction: The Ministry of Agriculture, through the

auspices of the FAO Agricultural Development Centre, manages the reservoir for water supply and agricultural priorities.

References: Newton & Symens (1994); Rahmani *et al.* (1994).

Reasons for inclusion: 2a, 2b, 3b & 3c (possibly also 2d). The site is internationally important for several waterfowl species.

Source: Stephen Newton.

Wetland Name: Al-Wajh Bank

Country: Kingdom of Saudi Arabia

Coordinates: 25°35'N, 36°45'E

Location: in the northern Red Sea, about 120 km south of Al-Wajh, Tabuk Emirate.

Area: Approximately 288,000 ha.

Altitude: Sea level.

Overview: This is a large area comprising mainland coast, shallow water and reef systems and a plethora of Red Sea islands lying offshore between Al-Wajh and Umm Lajj.

Physical features: The archipelago has approximately 50 islands, ranging in size from 1 ha to 1,100 ha. Some are sandy whereas others are rocky with low cliffs, usually of less than 5 m height.

Ecological features: Some islands support vegetation, with mangrove and salt-tolerant bushes, but elsewhere they are barren. Large beds of seagrass offshore are of interest.

Land tenure: Unknown, probably Government.

Conservation measures taken: No conservation measures have been implemented; surveys of seabirds and raptors have been undertaken in the past. Al-Wajh Bank has been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: The area has been proposed as a Resource Use Reserve in NCWCD's System Plan for Protected Areas.

Land use: The islands are not inhabited on a permanent basis, although they no doubt support seasonal fishing camps.

Possible changes in land use: No change is anticipated.

Disturbances and threats: Collection of seabird and turtle eggs is likely to take place, although no current information is available.

Social and cultural values: The area is important to the local artisanal fishery.

Noteworthy fauna: Dugong *Dugong dugon* and sea turtles occur in the area, the latter nesting on the islands; considerable populations of breeding Osprey *Pandion haliaetus* and Sooty Falcon *Falco concolor* occur. The islands have not been surveyed for breeding seabirds since the summer of 1982; at that time, colonies of Brown Booby *Sula leucogaster*, Sooty Gull *Larus hemprichii*, White-eyed Gull *L. leucophthalmus*, White-cheeked Tern *Sterna repressa* and Bridled Tern *S. anaethetus* were present.

Noteworthy flora: Mangrove *Avicennia marina* and the salt-tolerant bushes *Salicornia* are the most important plants on the islands.

Scientific research and facilities: No research and monitoring have been undertaken, except for Osprey; detailed surveys of breeding seabirds should be a priority. No facilities exist on the islands.

Management authority and jurisdiction: Not known.

References: Evans (1987); Gallagher *et al.* (1984); Gaucher *et al.* (1994); Newton & Symens (1994).

Reasons for inclusion: 1a, 2a & 2c. The site has a valuable and extensive reef system, and is an important breeding site for turtles and seabirds.

Source: Stephen Newton.

Wetland Name: Yanbu Royal Commission Zone

Country: Kingdom of Saudi Arabia

Coordinates: 23°56'N, 38°14'E

Location: at Madinat Yanbu al-Sinaiyah on the Red Sea coast, Al-Madinah Emirate.

Area: Approximately 700 ha.

Altitude: Sea level.

Overview: The site is composed of three areas of mangrove along the delta of Wadi Farrah, adjacent to the new industrial city of Madinat Yanbu al-Sinaiyah, which is itself located 25 km south of Yanbu al-Bahr.

Physical features: The area includes coral reefs, sandy beaches, saltmarshes and sabkha. Ecological features: This site is important for its dense stands of mangrove *Avicennia marina* that extend along 11 km of Red Sea coastline.

Land tenure: The Royal Commission for Jubail and Yanbu manages the site.

Conservation measures taken: The three mangrove areas have been designated as Conservation Areas by the Royal Commission for Jubail and Yanbu. As such, they are afforded complete protection from disturbance and are to remain in their natural state.

Conservation measures proposed: Plans exist to build a new marine laboratory and public environmental awareness centre. The site was proposed as a Biological Reserve in NCWCD's System Plan for Protected Areas. The mangroves have been identified as an "Important Bird Area" by BirdLife International.

Land use: Nature conservation, though surrounded by the largest oil terminal in the Saudi Red Sea.

Possible changes in land use: None expected.

Disturbances and threats: Oil pollution poses the main threat to the area, though presumably contingency planning is well advanced and good clean-up and containment facilities exist.

Social and cultural values: None known, although the mangroves are an educational source.

Noteworthy fauna: The Dugong *Dugong dugon* inhabits surrounding waters. Internationally important numbers of Terek Sandpiper *Tringa cinerea* winter in the area, with up to 700 recorded. Typical mangrove birds breed here, and further studies would probably reveal more. Those species that are currently known to breed include a minimum of two pairs of Striated Heron *Butorides striatus*, two colonies of Western Reef Egret *Egretta gularis*, a maximum of three pairs of Purple Heron *A. purpurea*, three pairs of Osprey *Pandion haliaetus*, approximately 45 pairs of African Reed Warbler *Acrocephalus baeticatus* and about 10 pairs of Clamorous Reed Warblers *A. stentoreus*. Goliath Heron *A. goliath* has bred in the past. Two species of tern are also known to breed in the area: approximately 10 pairs of White-cheeked Tern *Sterna repressa* and about 30 pairs of Saunders' Little Tern *S. saundersi*. A maximum of 200 Crab Plovers *Dromas ardeola* has been recorded wintering at the site.

Noteworthy flora: Mangrove *Avicennia marina* is the dominant plant species.

Scientific research and facilities: Considerable bird recording has been conducted.

Management authority and jurisdiction: Royal Commission for Jubail and Yanbu.

References: Ash *et al.* (1989); Baldwin & Meadows (1988); Meadows (1986, in press); Newton & Symens (1994).

Reasons for inclusion: 1 a, 2b, 2c & 3c. This is one of the best examples of mangrove in the northern Red Sea.

Source: Stephen Newton (Brian Meadows).

Wetland Name: Jeddah South Corniche and Central

Country: Kingdom of Saudi Arabia

Coordinates: Jeddah (central) north of Port 21°30'N, 39°10' E; South Corniche 21°23'N, 39°07'E

Location: on the Red Sea coast, Makkah Emirate.

Area: Approximately 900 ha.

Altitude: Sea level.

Overview: The site comprises two adjacent, important coastal wetlands separated by Jeddah Sea Port and a naval base; they are principally of interest for their concentrations of non-breeding waterbirds.

Physical features: The northern area consists of an embayment between the sea port and royal palaces adjacent to central downtown Jeddah. The southern area is along the South Corniche Road, south of a large military area. The latter site comprises extensive mud-and sand-flats and shallow lagoons with sandbar islands or peninsulas. Extensive sabkha stretches inland of the coast road, though it has been partitioned and in some places infilled for industrial expansion. Much of the intervening area between the two sites is fenced off as a military area, and no access is possible.

Ecological features: A high inflow of nutrients from largely untreated sewage effluent enhances invertebrate productivity and supports a large concentration of waterbirds. Coral reefs, where unpolluted, have a high diversity of fishes.

Land tenure: Government.

Conservation measures taken: None; although the military area reduces disturbance, it does not curtail pollution. The wetlands have been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: Part of this area has been proposed as a Natural Reserve in NCWCD's System Plan for Protected Areas.

Land use: The northern area flanks Jeddah City centre and holds the fish market. Along the South Corniche, roads have been constructed and much of the area infilled for potential industrial expansion. There is some livestock grazing and a small fishing village in this area.

Possible changes in land use: Continued industrial expansion along the South Corniche.

Disturbances and threats: Both sites are heavily visited by people, and disturbance to birds must occur. However, the best areas are either unattractive to man, such as near the sewage outfall where large numbers of birds feed, or inaccessible, including offshore islets and the military area. The threat of oil spills is ever present. An unidentified pathogen or toxic food source killed considerable numbers of Western Reef Egrets *Egretta gularis* in December 1993 along the South Corniche.

Social and cultural values: The area is much valued as a recreational resource.

Noteworthy fauna: Five species of waterbirds occur in internationally important numbers during winter: Spoonbill *Platalea leucorodia* (maximum 280), Western Reef Egret (335), Slender-billed Gull *Larus genei* (nearly 5,500), Gull-billed Tern *Gelochelidon nilotica* (372) and Caspian Tern *Sterna caspia* (120). Greater Flamingos *Phoenicopterus ruber* attempted to nest in 1990, but failed due to flooding by spring tides. Otherwise, the area harbours an interesting assemblage of waterbirds, with particularly large numbers of Little Stint *Calidris minuta* and Ruff *Philomachus pugnax*.

Noteworthy flora: There is little vegetation in the area, although a small patch of mangrove *Avicennia marina* is present on the southern boundary of the South Corniche.

Scientific research and facilities: Waterbirds are counted annually as part of the Saudi contribution to the Asian Waterfowl Census.

Management authority and jurisdiction: Jeddah Municipality, Port Authority and Ministry of Defence and Aviation.

References: Newton & Symens (1994)

Reasons for inclusion: 1a, 3b & 3c. The site holds internationally important populations of at least five species of waterbirds in winter; relatively unspoilt areas of saltmarsh vegetation in the military base may be of interest.

Source: Stephen Newton.

Wetland Name: Qishran Bay

Country: Kingdom of Saudi Arabia

Coordinates: 20°15'N, 40°10'E

Location: on the Red Sea coast north of Al-Lith, Makkah Emirate.

Area: Approximately 40,000 ha.

Altitude: Sea level.

Overview: This is one of the largest lagoon systems on the Red Sea coast, still relatively unspoilt, with considerable tracts of mangrove on islands.

Physical features: Qishran Bay is isolated from the open sea by the presence of one long narrow barrier island and a smaller one at its mouth. Inside this shallow bay there are eight other islands. On the mainland shore, the foothills of the Asir mountain range approach very closely to the coast; this narrow lowland belt may play a role in concentrating migrant birds.

Ecological features: The islands are covered with dense vegetation, mostly the salt-tolerant succulent *Salicornia*, and surrounded by mangrove trees *Avicennia marina*. There are seagrass beds in the bay.

Land tenure: Government

Conservation measures taken: Leaflets explaining the importance of the area for breeding Sooty Falcons *Falco concolor* have been distributed to local people in an attempt to curtail the trapping of this species. Qishran Bay has been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: The area has been proposed as a Special Nature Reserve in the NCWCD System Plan for Protected Areas.

Land use: Artisanal fisheries; livestock grazing (camels); falcon trapping.

Possible changes in land use: None foreseen.

Disturbances and threats: Trapping of migrant falcons is conducted each autumn, with significant numbers of some species being taken each year. On average, about 30 Lanner Falcons *Falco biarmicus*, 15 Saker *F. cherrug*, 40 Peregrine *F. peregrinus* and 30 Barbary Falcons *F. pelegrinoides* are trapped for sale to falconers. It is known that some Sooty Falcons have been trapped, and at least one nest has been robbed. Increasing recreational pursuits are a potential problem.

Social and cultural values: The area is a lucrative source of high quality falcons.

Noteworthy fauna: The Dugong *Dugong dugon* occurs in the area, and both the Hawksbill Turtle *Eretmochelys imbricata* and Green Turtle *Chelonia mydas* breed here. The inner islands support the densest population of breeding Sooty Falcons in Saudi Arabia, and probably in the world, with approximately 40 pairs breeding on a handful of small islands. The falcons breed on the ground underneath the mangroves. In the region of 50 pairs of Bridled Tern *Sterna anaethetus* also breed, though a full survey of breeding

seabirds has not been undertaken. The site was one of the first proven breeding locations for Pink-backed Pelicans *Pelecanus rufescens* in Arabia (8-10 pairs in 1981).

The Goliath Heron *Ardea goliath* is a rare summer visitor, and the White-collared Kingfisher *Halcyon chloris* has been recorded and may breed in the area. The Crab Plover *Dromas ardeola* is present all year round and is another potential breeding species.

Noteworthy flora: Large stands of mangrove *Avicennia marina*.

Scientific research and facilities: The breeding biology of the Sooty Falcon has been studied in some detail for several years. No facilities exist in the area.

Management authority and jurisdiction: Not known.

References: Gaucher *et al.* (1994); Jennings *et al.* (1982); Newton & Symens (1994).

Reasons for inclusion: 1a, 2a & 2c. The site supports a large population of breeding Sooty Falcons nesting in a unique setting.

Source: Stephen Newton.

Wetland Name: Umm al-Qamari

Country: Kingdom of Saudi Arabia

Coordinates: 18°59'N, 41°06'E

Location: in the Red Sea southwest of Qunfudah, Makkah Emirate.

Area: 14.7 ha.

Altitude: Sea level.

Overview: These are an example of relatively unspoilt Red Sea islands with an interesting community of terrestrial breeding birds and high vegetation cover.

Physical features: The site comprises two small flat, fossil coral islands, one of 12 ha, the second of 2.7 ha, within 5 km of the coast.

Ecological features: Dense stands of *Salvadora persica* up to 3 m in height and *Suaeda fruticosa* cover much of the islands.

Land tenure: Government (NCWCD).

Conservation measures taken: The island is a Special Nature Reserve, within the NCWCD's network of established Protected Areas. Traditional hunting laws have apparently protected the islands for a long time. The islands have been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: More regular wardening to safeguard breeding bird populations.

Land use: There is no established human use on the islands, but they are visited occasionally by coastguards and fishermen.

Possible changes in land use: None anticipated

Disturbances and threats: The islands are small and a fair distance offshore, and are thus difficult to warden; it is not known how many people really visit the islands or how much disturbance a visit during the breeding season entails. Hunting and egg-collecting may occur, but there is no information available to date.

Social and cultural values: Supposedly these islands are a respected non-hunting "hema".

Noteworthy fauna: The African Collared Dove *Streptopelia roseogrisea* is the single most numerous bird species, with a minimum estimate of 500 pairs. Important numbers of Cattle Egret *Bubulcus ibis* (65 pairs) and Spoonbill *Platalea leucorodia archeri* (10-15 pairs) breed on the island. The Sooty Gull *Larus hemprichii* breeds (with 50-100 pairs in two colonies) and over-winters. Small numbers of White-eyed Gull *L. leucophthalmus* roost on the beaches in winter, along with Pink-backed Pelican *Pelecanus rufescens*. Two pairs of

Striated Heron *Butorides striatus*, seven pairs of Western Reef Egret *Egretta gularis* and two pairs of Osprey *Pandion haliaetus* have also bred. Graceful Warblers *Prinia gracilis* are numerous and resident.

Noteworthy flora: *Salvadora persica* and *Suaeda* form the densest, tallest thickets, with *Cyperus conglomeratus*, *Atriplex farinosa* and *Zygophyllum album* predominating on more open ground.

Scientific research and facilities: The islands have been visited periodically by NCWCD staff to inventory the flora and to survey birds. No facilities exist.

Management authority and jurisdiction: NCWCD.

References: Alwelaie *et al.* (1993); Newton & Symens (1994); Symens (1988b).

Reasons for inclusion: 1a, 2c & 3c. This is a unique site, holding one of the densest known breeding concentrations of African Collared Doves.

Source: Stephen Newton.

Wetland Name: Khawr 'Amiq

Country: Kingdom of Saudi Arabia

Coordinates: 18°26'N, 41°26'E

Location: on the Red Sea coast, 30 km northwest of al-Birk, Makkah Emirate.

Area: Approximately 150 ha.

Altitude: Sea level.

Overview: Khawr 'Amiq, also known as Amq or Omq, is situated at the northern end of a predominantly mangrove-fringed coastline backed by a black lava plain (harrat) with extinct volcanic cones, extending south for about 60 km to Al Qahmah.

Physical features: The site comprises a complex of shallow, muddy and sandy saline lagoons and channels.

Ecological features: Large stands of mangrove *Avicennia marina* surround the bay, and the sub-tidal area is characterised by extensive beds of seagrass. The area supports a local fishery.

Land tenure: Not known.

Conservation measures taken: None.

Conservation measures proposed: The site has been proposed as a Resource Use Reserve in the NCWCD System Plan for Protected Areas, and has been identified as an "Important Bird Area" by BirdLife International.

Land use: Artisanal fishing; camel grazing.

Possible changes in land use: None known.

Disturbances and threats: Grazing by camels is causing extensive damage, and small-scale mangrove-cutting also threatens the site.

Social and cultural values: None known.

Noteworthy fauna: The Dugong *Dugong dugon* inhabits the coastal waters. The White-collared Kingfisher *Halcyon chloris* is probably resident (estimated minimum of 3-5 pairs). Other breeding species include Striated Heron *Butorides striatus*, Osprey *Pandion haliaetus* and possibly Pink-backed Pelican *Pelecanus rufescens* (with up to 20 wintering), Spoonbill *Platalea leucorodia*, Clamorous Reed Warbler *Acrocephalus stentoreus* and African Reed Warbler *A. baeticatus*.

Noteworthy flora: Mangrove *Avicennia marina* is the dominant plant.

Scientific research and facilities: Only a few visits have been made, primarily to monitor waterfowl and kingfishers. No facilities exist.

Management authority and jurisdiction: Not known.

References: Newton & Symens (1994); Stagg (1984a).

Reasons for inclusion: 1a (possibly also 2a & 3c). The site is a characteristic example of a largely undisturbed, mangrove-fringed lagoon of the southern Red Sea coast.

Source: Stephen Newton.

Wetland Name: Kutambil Island

Country: Kingdom of Saudi Arabia

Coordinates: 17°53'N, 41°42'E

Location: in the Red Sea northwest of Shugaiq, Jizan Emirate. Area: Approximately 8 ha.

Altitude: Sea level to 100 m.

Overview and physical features: Kutambil is a volcanic island situated 5 km offshore. A 100 m peak of volcanic clinker dominates the island. The south and southeast parts of the island are flat and sandy. Rich coral reefs lie offshore.

Ecological features: Salt-tolerant bushes grow in profusion along the base of the clinker mound, and a few trees are found on its slopes, growing as tall as 3 m.

Land tenure: Not known, probably Government.

Conservation measures taken: None. The island has been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: None.

Land use: This is an uninhabited island, occasionally visited by fishermen.

Possible changes in land use: None anticipated.

Disturbances and threats: In 1982, about 50% of eggs or young of the breeding Spoonbills were taken by humans; exploitation of other seabird species may occur.

Social and cultural values: None known.

Noteworthy fauna: In 1982, 60 pairs of Spoonbill *Platalea leucorodia* (of the scarce Red Sea race *archeri*) were counted, with small numbers of breeding Western Reef Egret *Egretta gularis*, Striated Heron *Butorides striatus*, Osprey *Pandion haliaetus* and Sooty Falcon *Falco concolor* also recorded. In winter, hundreds of gulls and terns use the island as a roost, along with Brown Boobies *Sula leucogaster* and up to 65 Pink-backed Pelicans *Pelecanus rufescens*. Other seabird species may breed on the island.

Noteworthy flora: None known.

Scientific research and facilities: No serious research has been conducted, though the island has been visited several times by ornithologists; a more complete summer survey would be desirable.

Management authority and jurisdiction: Not known.

References: Newton & Symens (1994); Stagg (1984b).

Reasons for inclusion: 1d & 3c. This is an unusual, rocky island with an important breeding colony of Spoonbills *Platalea leucorodia archeri*.

Source: Stephen Newton (Arthur Stagg).

Wetland Name: Shugaig Mangrove

Country: Kingdom of Saudi Arabia

Coordinates: 17°48'N, 41°52'E

Location: on the southern Red Sea coast, Jizan Emirate.

Area: Approximately 200 ha.

Altitude: Sea level.

Overview: A small bay with stands of mangrove and some inter-tidal mudflats, on the southern Red Sea coast; of particular interest for its breeding bird community. **Physical features:** Shupiq Mangroves are also known as Ad-Darb in Asian Waterfowl Census reports and marked as Sharm at Ta'nah on some maps. The area comprises a fairly small embayment at a point where basaltic harrat comes down to the waterline, with some inter-tidal mudflats separating mangrove stands.

Ecological features: Mangroves line the coast, and there are extensive beds of seagrass offshore. The area supports a local fishery.

Land tenure: Government, Ministry of Agriculture and Water.

Conservation measures taken: None. The site has been identified as an "Important Bird Area" by BirdLife International, but is not included in NCWCD's System Plan for Protected Areas.

Conservation measures proposed: Recommendations for the protection and conservation of the site have been made to NCWCD.

Land use: There is a small fishing village, and the site is a very popular recreational area.

Possible changes in land use: The Ministry of Agriculture has commenced developing the area as a fish (prawn) farm, and much of the area has now been fenced off. The mudflats and sabkha inland of the mangroves have been partitioned by causeways.

Disturbances and threats: The fish farm seriously jeopardises the ecological health of the site. Recreational visitors, especially week-end fishermen, litter the area, but probably cause little disturbance. There is some disturbance by small-scale cutting of mangrove and camel grazing.

Social and cultural values: Primarily recreational.

Noteworthy fauna: The site supports perhaps the largest population of White-collared Kingfisher *Halcyon chloris* on the Saudi Red Sea coast. Clamorous Reed Warblers *Acrocephalus stentoreus* and African Reed Warblers *A. baeticatus* are also common residents. In spring 1994, a population of white-eyes *Zosterops* sp. (possibly a new species or subspecies of *Z. abyssinica*) was discovered. The Goliath Heron *Ardea goliath* occurs, and Purple Heron *A. purpurea* is a possible breeding species.

Noteworthy flora: Mangrove *Avicennia marina* is the dominant plant.

Scientific research and facilities: Currently, standard-effort mist-netting is being conducted throughout the year to determine numbers, breeding chronology and longevity of kingfishers and other avian members of the mangrove community.

Management authority and jurisdiction: Ministry of Agriculture and Water.

References: Newton & Newton (1994); Newton & Symens (1994); Stagg (1984a).

Reasons for inclusion: 1a & 2b (possibly also 2d). Despite damaging developments, the site holds an important population of White-collared Kingfishers and other poorly known breeding passerines.

Source: Stephen Newton.

Wetland Name: Jizan Bay

Country: Kingdom of Saudi Arabia

Coordinates: 16°53'N, 42°32'E

Location: on the southern Red Sea coast, Jizan Emirate.

Area: 200 ha.

Altitude: Sea level.

Overview: This is the principal "beach" of Jizan City, highly enriched by sewage effluent and consequently supporting the largest shorebird populations on the Saudi Red Sea coast.

Physical features: The site comprises a 4 km long by about 500 m wide stretch of intertidal mud- and sand-flats between Jizan Port and the northern outskirts of the city. Similar habitat extends to the north, but is largely inaccessible and unsurveyed from the ground.

Ecological features: None outstanding, though invertebrate productivity must be high.

Land tenure: Government/Jizan Municipality/Jizan Port Authority.

Conservation measures taken: None. Jizan Bay has been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: NCWCD ornithologists have on several occasions asked senior management to approach the Jizan Municipality/Emirate with a request to slow down or stop the continual loss of mudflats to reclamation for housing or garbage disposal.

Land use: Urban; the bay is used as mooring area by artisanal fishermen, and there is a fish market nearby.

Possible changes in land use: Further landfill and urbanisation; a new breakwater harbour appeared under construction in January 1995, through the middle of prime mudflats.

Disturbances and threats: The site is much disturbed and faces a multitude of threats. Pollution by oil, sewage effluent and rubbish and extensive land reclamation for further urbanisation all threaten the site, the latter reducing the area of inter-tidal flats available for feeding waterbirds. Human disturbance to birds using the area is high.

Social and cultural values: None; in most people's eyes, the land is there to be developed.

Noteworthy fauna: The site regularly holds between 6,000 and 20,000 waterbirds in winter, with at least six species occurring in internationally important numbers: Crab Plover *Dromas ardeola* (maximum 480), Lesser Sand Plover *Charadrius mongolus* (maximum 1,125), Grey Plover *Pluvialis squatarola* (maximum 2,232), Dunlin *Calidris alpina* (maximum 3,160), Broad-billed Sandpiper *Limicola falcinellus* (maximum 311) and Gull-billed Tern *Gelochelidon nilotica* (maximum 294). Several others approach significance, for example Bar-tailed Godwit *Limosa lapponica* (2,740) and Terek Sandpiper *Tringa cinerea* (418).

Noteworthy flora: None.

Scientific research and facilities: The area is censused annually as part of the Saudi contribution to the Asian Waterfowl Census.

Management authority and jurisdiction: Jizan Port Authority.

References: Newton & Symens (1994).

Reasons for inclusion: 1a & 3c. The site supports an internationally important wintering shorebird population.

Source: Stephen Newton.

Wetland Name: Khawr Wahlan

Country: Kingdom of Saudi Arabia

Coordinates: 16°45'N, 42°40'E

Location: on the southern Red Sea coast, approximately 35 km south of Jizan, Jizan Emirate.

Area: Approximately 1,000 ha.

Altitude: Sea level to 3 m.

Overview: The site comprises a representative stretch of southern Red Sea coastline with a wide diversity of marine habitats (lagoon, mudflats, sabkha, mangroves) and a unique fresh to

brackish water wetland. The latter is known locally as Sawarma Marsh.

Physical features: The coastal zone is composed of two inlets and a small island. The latter has now been connected to the mainland by a causeway across the sabkha. At low tide, rich mudflats are exposed. The marsh occurs inland of the southern inlet (Khawr Wahlan), where springs arise by lateral seep from an adjacent dune plateau aquifer or artesian leakage from a buried geological fault line.

Ecological features: Stands of the mangrove *Avicennia marina* occur on the inland parts of both inlets; some seagrass beds are present close to the shoreline. The fresh to brackish marsh is predominantly covered by a short sward of the sedge *Cyperus laevigatus*.

Land tenure: Not known.

Conservation measures taken: None. Khawr Wahlan has been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: The coastal part of the site is proposed as a Special Nature Reserve in NCWCD's System Plan for Protected Areas, though at the time the significance of the freshwater marsh was apparently not known.

Land use: Khawr Wahlan is used as an anchorage by local fisheries and a small harbour has been constructed. The whole area is heavily grazed by camels and goats.

Possible changes in land use: None identified.

Disturbances and threats: Camels regularly bathe and wallow in the wet area, causing extensive damage to the marshland vegetation. A fairly large garbage dump is present on the northern edge of the marsh.

Social and cultural values: None known.

Noteworthy fauna: The site regularly holds 2,000-3,000 waterfowl in winter, though no species are present in internationally significant numbers. In a national context, the site holds Saudi Arabia's only known wintering population of Pacific Golden Plover *Pluvialis fulva* and good numbers of Pintail *Anas acuta*, Crab Plover *Dromas ardeola*, Lesser Sand Plover *Charadrius mongolus*, Curlew Sandpiper *Calidris ferruginea*, Bar-tailed Godwit *Limosa lapponica* and Redshank *Tringa totanus*. A flock of 75 White Stork *Ciconia ciconia* was present in February 1993. All four Eurasian species of harrier have been recorded in winter (Marsh *Circus aeruginosus*, Hen *C. cyaneus*, Pallid *C. macrourus* and Montagu's *C. pygargus*), and this is one of the few coastal sites where Bateleur *Terathopius ecaudatus* occurs.

Noteworthy flora: The freshwater marsh flora has yet to be described in detail.

Scientific research and facilities: The shorebirds of the area have been surveyed in several winters by ornithologists as part of the Saudi contribution to the Asian Waterfowl Census.

Management authority and jurisdiction: Not known; the coastguard service controls access to the causeway and fishing harbour.

References: Newton & Symens (1994); Tinley (1994).

Reasons for inclusion: 1a, 1d, 2b & 3b. The site contains a unique freshwater marsh, holding the only known wintering population of Pacific Golden Plover in Saudi Arabia.

Source: Stephen Newton.

Wetland Name: Farasan Islands

Country: Kingdom of Saudi Arabia

Coordinates: 16°20'-17°20'N, 41°24' -42°26'E

Location: in the southern Red Sea, Jizan Emirate.

Area: The main archipelago lies within an area of 75 by 50 km; the site includes approximately 70,000 ha of land with 605 km of coastline; the proposed Marine Protected Area covers 331,000 ha.

Altitude: Sea level.

Overview: The Farasan Island group is a large archipelago of Red Sea coral islands lying 40 km offshore from Jizan.

Physical features: The proposed Marine Protected Area includes 128 islands, one coral cay and 18 shoal areas. The islands were formed by uplift from a rising salt dome beneath the area. The extant coral reefs are about 7,000 years old. The archipelago includes two large islands connected by a bridge, Farasan Kebir and Segid, the former being over 50 km in length. Nowhere on the islands lies further than 3 km from the sea. The islands are situated on a broad, shallow shelf 125 km wide.

Ecological features: Marine biotopes include coral-dominated fringing and patch reefs, algae-dominated fringing and patch reefs, coral-algal fringing reefs, platform reefs, pavement, shoals, mudflats and sub-tidal sand expanses. Sheltered coastal areas support extensive stands of mangrove *Avicennia marina*, and northeast Farasan Kebir supports the largest patch of another mangrove species, *Rhizophora mucronata*, in the Saudi Red Sea. Above the inter-tidal zone, beaches usually have a wide or narrow band of *Suaeda monoica*, *Halopeplis petfoliata*, *Limonium axillare* and several species of *Zygophyllum*. Inland, vegetation cover is sparse except in gullies between fossil coral outcrops, but supports a *Commiphora-Acacia-Salvadora* scrub community with occasional thickets of *Euphorbia fractiflexa*.

Land tenure: Government.

Conservation measures taken: The terrestrial area forms an established NCWCD Reserve, including an overall non-hunting zone, and several Special Nature Reserves and Natural Reserves. A ranger force is employed to prevent poaching of gazelles. The Farasan Islands have been identified as an "Important Bird Area" by BirdLife International.

Conservation measures proposed: A large part of the archipelago has been proposed as the first Red Sea Marine Protected Area in Saudi Arabia. Ratification is expected in the near future, and marine rangers will be recruited to supervise fishing activity according to a predetermined zonation and to control other detrimental activities such as the collection of seabird eggs.

Land use: The human population is in the region of 5,000, mostly restricted to one large town on Farasan Kebir and several villages on this and Segid. Only one smaller island is inhabited permanently (Qummah). The principal occupation is fishing, though herds of goats and camels are grazed in the vicinity of villages. Several small areas are cultivated with date palm plantations or sorghum. Small fishing camps are occupied intermittently on many of the smaller islands. Continuously manned coastguard stations occur both on the main island and several smaller ones, such as Zifaf and Romain.

Possible changes in land use: The industrial and investor fisheries sectors are likely to increase. Few changes are expected on land, although a large part of southeastern Farasan Kebir has been earmarked for a naval base.

Disturbances and threats: Development of the naval base could have disastrous consequences for the terrestrial and marine wildlife of the area, especially shorebirds, coral reefs and loss of a prime gazelle area. Uncontrolled and intensive fishing causes considerable damage to reefs, from anchors, and threatens the viability of the traditional artisanal fishery. It appears that seabird eggs are collected widely for sale or personal consumption. This practice and the abundance of introduced predators, notably feral/domestic cats and

rats, probably severely limit the reproductive success of the species concerned (White-cheeked Tern *Sterna repressa* and Bridled Tern *S. anaethetus*). Human visitation to Brown Booby *Sula leucogaster* breeding colonies can cause premature fledging of young into the sea; some of these have difficulty in returning to their colonies on cliff-lined islands. On some islands, migrant passerines, especially shrikes (Lanidae), are trapped in spring for rendering their fat into cooking oil. The annual harvest may take over 30,000 birds.

Social and cultural values: The traditional harvest of passerines is mentioned above; in addition, the harvest of inshore spawning parrotfish at one locality on Farasan Kebir is the scene of another spring festival, the "harrid". The Farasan Islands are the last locality in the Saudi Red Sea in which pearl fishing is still practised.

Noteworthy fauna: In total, 231 species of fish and 49 species of reef-building coral have been recorded in the Farasans. Both Green Turtle *Chelonia mydas* and Hawksbill Turtle *Eretmochelys imbricata* are common and widespread in and around the archipelago, though there has been no recent census or inventory of nesting beaches. A remnant population of endangered Dugong *Dugong dugon* persists, but only one or two individuals have been sighted in recent years. They appear to be confined to the extensive seagrass beds in Khawr Ma'adi between Farasan Kebir and Segid. Three species of dolphin frequent coastal waters: the Bottlenose *Tursiops truncatus*, Indo-Pacific Humpback *Sousa chinensis* and Long-snouted Spinner *Stenella longirostris*, though the latter is only seen in relatively deep water (over 20 m). During recent surveys, Bryde's Whales *Balaenoptera edeni* have been recorded in both summer and winter; these are the first records for the Red Sea and suggest the species may be resident in the area. The islands hold large numbers of breeding seabirds; preliminary surveys in the summer of 1993 counted a total of 8,300 White-cheeked Terns *Sterna repressa* and 12,150 Bridled Terns *S. anaethetus*. Common Noddies *Anous stolidus* nest on a small number of better vegetated islands: the largest colony is on Abu Shugar, where 500 individuals were seen in 1993. Around 4,700 Brown Boobies have been recorded during summer, though most probably breed in winter on a small number of islands. The Farasans are the only known confirmed breeding site for Crab Plover *Dromas ardeola* on the Red Sea coast of Arabia (three colonies known), and the *Rhizophora* mangroves support perhaps the largest breeding colony of Pink-backed Pelican *Pelecanus rufescens* in the whole Red Sea (90 active nests in January 1995). Other breeding waterbirds include Western Reef Egret *Egretta gularis*, Goliath Heron *Ardea goliath*, Spoonbill *Platalea leucorodia*, Sooty Gull *Larus hemprichii*, Caspian Tern *Sterna caspia*, Lesser Crested Tern *S. bengalensis* and Saunders' Little Tern *S. saundersi*. Populations of breeding Ospreys *Pandion haliaetus* (40-50 pairs) and Sooty Falcons *Falco concolor* (20-40 pairs) are also of considerable importance in a Red Sea context. In winter (September to late April), large numbers of shorebirds are present on southeast Farasan Kebir and around Khawr Abu Tuq Island (just off the north tip of Segid), notably Crab Plover, Lesser Sand Plover *Charadrius mongolus*, Ruddy Turnstone *Arenaria interpres* and Saunders' Little Tern. Although not dependent upon Farasan wetland resources, the islands hold the largest wild population of gazelles in Saudi Arabia; an endemic subspecies of the Mountain Gazelle *Gazella gazella farasani*.

Noteworthy flora: The *Rhizophora mucronata* stand is of interest in a national context; seven species of seagrass occur.

Scientific research and facilities: Considerable research and monitoring have been conducted on both fauna and flora in marine and terrestrial habitats. No specific facilities exist, but accommodation is available at the ranger camp for visiting scientists.

Management authority and jurisdiction: NCWCD (for Protected Areas), Farasan Port Authority, coastguard services (for fishery monitoring).

References: Alwelaie *et al.* (1993); Gladstone (1994a, 1994b); Goldspink *et al.* (1995); Jennings (1988); Newton & Symens (1994); Symens (1988a).

Reasons for inclusion: 1a, 2a, 2b, 2c, 3a & 3c. The Farasan Islands are a large Red Sea archipelago with a high diversity of marine biotopes and many internationally important vertebrate groups including breeding turtles and seabirds and wintering shorebirds.

Source: Stephen Newton.

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