

Current Status of the Breeding Population of the Western Reef Heron *Egretta gularis* along the Northern Coasts of the Persian Gulf and Oman Sea, and its Wintering Population in the South of Iran

FARZANEH ETEZADIFAR^{*1} & HAMID AMINI^{1&2}

1. Department of Environment and Energy, Science and Research Branch, Islamic Azad University, Tehran, IRAN

2. Ornithology Unit, Wildlife Bureau, Department of the Environment (DOE), Tehran, IRAN

*Correspondence Author; Email: f.etezadifar@gmail.com

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Abstract: The Western Reef Heron *Egretta gularis* is a native breeding waterbird along the south coast of Iran and on offshore islands. It has been found nesting on trees, shrubs and bushes at 13 sites consisting of nine islands and four tidal areas. The total breeding population was estimated at about 400 pairs during the 2006–2010 period. The largest breeding colony of this heron, with at least 180 pairs, was in the mangrove forests of Hara Protected Area (Biosphere Reserve) in 2009. The main threats to the breeding population of Western Reef Herons in this site were habitat destruction and invasive species, especially the Black Rat *Rattus rattus*. Further studies on the status of the breeding populations and threats to the species will be useful for monitoring ecological changes in coastal and wetland ecosystems in southern Iran. According to the DOE mid-winter waterbird census data, the average wintering population of the species in southern Iran was 1,168 individuals (min. 97 and max. 2,125 individuals) during the period 2000–2009.

Keywords: Breeding, *Egretta gularis*, Iran, Persian Gulf, threats, Western Reef Heron, wintering.

INTRODUCTION

The Western Reef Heron *Egretta gularis* is a polytypic species with a discontinuous tropical range along the coasts of West Africa (*E. g. gularis*), East Africa, the Red Sea, Persian Gulf and southwest India (*E. g. schistacea*) (Brown *et al.* 1982, Martínez-Vilalta & Motis 1992, Kushlan & Hancock 2005); it also occasionally wanders to Europe (*e.g.* Dies *et al.* 2001). It occurs in the breeding areas throughout the year and distribution maps do not generally distinguish between breeding and non-breeding ranges. It can occur inland as a straggler (Porter *et al.* 1996). The Western Reef Heron prefers rocky and sandy coasts, reef areas and sometimes salt marshes, mudflats, estuaries, tidal creeks and lagoons (Snow & Perrins 1998). It builds its nest on shrubs and trees near the coast (Mansoori 2008) and breeds in colonies with other herons. The colonies sometimes consist of up to 100 pairs, but the birds may occasionally breed solitarily or in

low numbers. The nests, which comprise a platform of twigs and seaweed, are built on low shrubs and trees and sometimes among boulders. In some cases, the nest is situated as high as 2–3 m above the ground (Snow & Perrins 1998, Etezadifar 2009), while on low-lying islands with little vegetation, the nest is sometimes built on the ground (D.A. Scott, pers. com. in 2008). The breeding season of the form *schistacea* in the Red Sea is from June to August, while that of the nominate form in West Africa is from late April to late September.

As a large and conspicuous waterbird that is relatively easy to study, the Western Reef Heron could be used as an indicator species to monitor the health of the wetland ecosystems in southern coastal areas of Iran. The aim of this study was to review the past and present status of the breeding population of the Western Reef Heron in Iran and to give an estimate of its wintering population in Iran.

MATERIALS AND METHODS

Surveys of the breeding population were carried out during April–July from 2006 to 2010, and involved field visits to some coastal sites and islands and interviews with local people and experts in the four provinces (Khuzestan, Bushehr, Hormozgan and Sistan-Baluchestan) along the coasts of the Persian Gulf and Oman Sea, as well as a review of the literature. At each colony, the plants that were used for nest building were identified (a few additional species were found in the literature). In field visits to find the breeding colonies, we used a motorboat and undertook ground surveys together with local guides and rangers. Geographical coordinates of breeding areas were registered with a GPS handset, and each colony (in Hara Protected Area, Hengam Island and Hendurabi Island) was visited for data collection and monitoring of changes. The threats to the breeding colonies during the study period were assessed directly or indirectly according to any signs of damage to the nests or predation.

Information on the numbers of Western Reef Herons wintering in Iran has been taken from the results of the annual mid-winter waterbird counts undertaken by the Department of the Environment as part of the International Waterbird Census (IWC) co-ordinated by Wetlands International. Data are stored in the Mid-winter Waterbird Census Database at the Department of the Environment in Tehran. Birds were counted using the Total Count Method during January of each year; counters were equipped with binoculars (8×30 or 10×40) and also in many cases with telescopes (20×60), GPS, tally counter and related map of the site.

RESULTS AND DISCUSSION

Current status of breeding populations

According to past and current studies, the Western Reef Heron breeds in 13 areas in Iran (Tables 1–2) comprising nine islands (Ghabr-e Nakhoda, Khan, Morghoo, Nakhilu, Ummal Gorm, Sheedvar, Hendurabi, Hengam and Hormoz) and four tidal areas (Shadegan marshes, Hara Protected Area in Khouran Strait, Rud-e Gaz and Rud-e Hara deltas, and Gabrik Protected Area). A description of these

habitats is presented in Table 3. According to our observations, breeding was successful in Hara Protected Area (maximum 180 pairs), Hendurabi Island (9 pairs), Hormoz Island (at least 2 pairs) and Gabrik Protected Area (30 pairs), but was unsuccessful on Hengam Island (10 pairs) mainly because of strong winds destroying the nests. On Nakhilu Island, the breeding population increased rapidly from 10 nests in 2005 to 44 nests in 2007 and 92 nests in 2008 (Behrouzi-Rad & Tayfeh 2008). The total breeding population in the above-mentioned colonies was about 400 pairs (Table 2). Hara Protected Area supported the largest breeding population of this species in 2009 with an estimated 180 pairs. The Western Reef Heron is also reported to breed in Negin Island and Sedandan Creek in Mond Protected Area (F.H. Tayfeh, pers. com., 2010) and in mangroves in Govater Bay in the Gando Protected Area in Baluchestan (B.A. Arbabi, pers. com., Behrouzi Rad, pers. com.), but no information is available on the numbers of birds present.

The main breeding season of this species in Iran is from mid-April to early July (Scott 2008). We found the species breeding in mixed-species colonies with Great White Egrets *Egretta alba* in Hara Protected Area and in mangrove forests in the deltas of the Rud-e Gaz and Rud-e Hara in "Gaz and Hara Protected Areas". The Western Reef Heron has also been found breeding in colonies with Eurasian Spoonbill *Platalea leucorodia* in the Grey Mangrove *Avicennia marina* forest in Hara Protected Area (F. Etezadifar, pers. obs.).

Current status of wintering populations

According to the mid-winter waterbird census data for the ten years from January 2000 to January 2009, the average wintering population of the Western Reef Heron in Iran was 1,168 individuals. During this period, the maximum count was 2,125 individuals in January 2005 (Table 4). About 400 pairs breed in Iran, this would suggest a wintering population of about 1,200 individuals. This is supported by an observation of at least 300 individuals around Qeshm Island alone in January 2004. However, the best estimates of total population size are likely to come from comprehensive mid-winter counts (D.A. Scott per Editor).

During the 2000–2009 period, the following sites hosted over 100 individuals in at least one

of the mid-winter counts: Bushehr Bay and surroundings, Helleh P.A., Hara P.A., coast from Bandar Abbas to Bandar-e Khamir, Gabrik P.A., coastal wetlands of Jask-e Gharbi,

Tiab and Minab P.A., Qeshm Island (north coast), Khuzestan coast, Naseri marsh, Shadegan P.A., and Govater Bay and Hoor-e Bahu (Table 4).

Table 1. Records of Western Reef Herons breeding in Iran from 1970 to 1978 (Scott 2007).

Location	Position of nests	Details
Southern parts of Shadegan marshes	-	40 pairs in 1974
Morghoo (Tahmadon) Island	On <i>Salicornia</i> sp. and low shrubs	20 pairs in 1975
Ummal Gorm Island	On low shrubs	26 pairs in 1975
Sheedvar Island	On low shrubs of <i>Chenopodiaceae</i>	8–12 pairs in 1972, 1976 & 1977
Hara Protected Area	On <i>Avicennia marina</i> trees	At least 50 pairs in 1975

Table 2. Records of Western Reef Herons breeding in Iran from 2003 to 2010.

Location	Position of nests	Description	Reference
Ghabr-e Nakhoda Island, Mouth of Khour-e Musa	On <i>Suaeda fruticosa</i> shrubs	20 pairs	Behrouzi-Rad 2008
Ummal Gorm Island	On <i>Halimodendron halodendron</i> shrubs	18 pairs	Behrouzi-Rad 2008
Nakhilu Island	-	60 pairs	Behrouzi-Rad 2008
Khan Island	-	70 pairs	Behrouzi-Rad 2008
Sheedvar Island	-	20 pairs	Behrouzi-Rad 2008
Sheedvar Island	-	47 pairs on 17 April 2004	Balmer & Betton 2004
Sheedvar Island	On <i>Salsola</i> shrubs	42 active nests and low number of chicks were hatched in 2010	A. Mobaraki, pers. obs.
Hormoz Island	On cashew <i>Prosopis cineraria</i> tree	At least 2 pairs in 2006; present but not counted in 2003	S. Ghasemi, pers. comm.
Hormoz Island	-	10 pairs	Behrouzi-Rad 2008
Rud-e Gaz and Rud-e Hara deltas (Sirik mangrove)	<i>Avicennia marina</i> or <i>Rhizophora mucronata</i> trees	Present but not counted in 2009	M. Ghasemi, pers. comm.
Gabrik P.A (eastern & western Jask)	On <i>Avicennia marina</i> trees	30 active nests in 2009	M. Barmude, pers. comm.
Hendurabi Island	On <i>Ficus benghalensis</i> tree	9 pairs in 2008	T. Ghadirian, pers. obs.
Hengam Island	On cashew <i>Prosopis cineraria</i> tree	9 pairs in 2009 (failed)	T. Ghadirian & F. Etezadifar, pers. obs.
Khouran Strait (Hara P.A.)	On <i>Avicennia marina</i> trees	At least 168 pairs in 2008	T. Ghadirian & F. Etezadifar, pers. obs.
Khouran Strait (Hara P.A.)	On <i>Avicennia marina</i> trees	180 pairs in 2009	T. Ghadirian & F. Etezadifar, pers. obs.
Khouran Strait (Hara P.A.)	On <i>Avicennia marina</i> trees	At least 120 pairs in 2010	T. Ghadirian & F. Etezadifar, pers. obs.

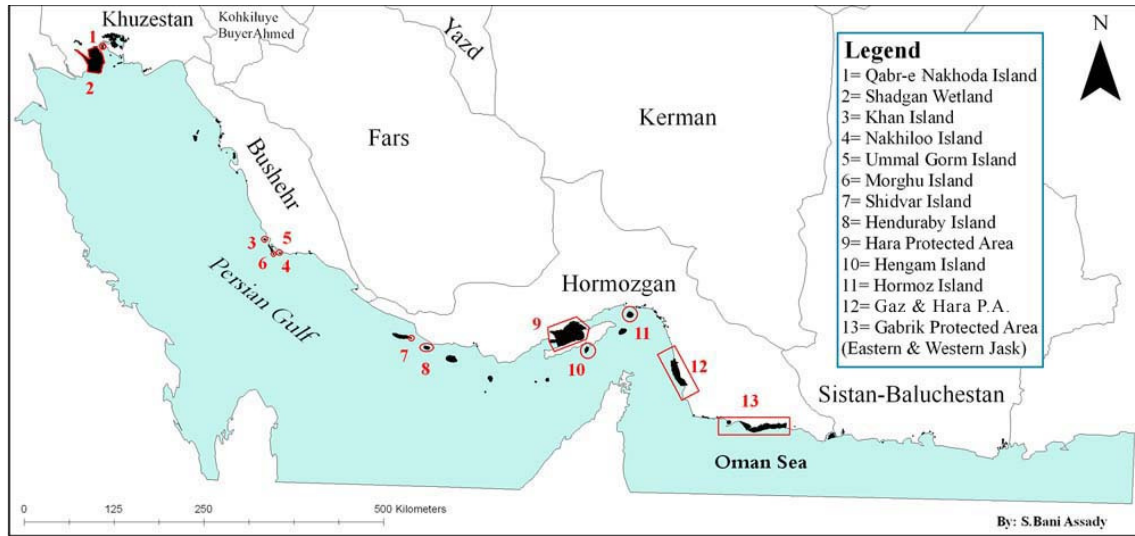


Figure 1. Location of breeding sites of the Western Reef Heron in southern Iran, © S. Bani Assady.

Table 3. Description of breeding sites of the Western Reef Heron in Iran (Evans 1994, Scott 1995, Tork Qashqai 2003, Firouz 2005).

Province	Site name	Coordinates	Area	Altitude	Remarks on habitat	Main threats	Conservation
Khuzestan	Shadegan marshes (tidal mudflats of Khor-al Omayeh and Khor-e Musa)	30°10'N, 48°40'E	425,140 ha	0–15 m	A marine-coastal wetland with a maximum depth of 6 m. There are fresh, saline and brackish water areas in different parts of the wetland	Waste water, oil pollution, road construction, grazing by domestic animals and agricultural intensification	Ramsar, IBA (64), Wildlife Refuge
Khuzestan	Ghabr-e Nakhoda Island, Mouth of Khor-e Musa	30°19'N, 48°56'E	4.2 ha at high tide	-	Small Island with rocky and sandy coast. Uninhabited. Very low plant density.	Oil pollution and fishermen movements as well as bird eggs culling by local people	Non-protected area
Bushehr	Khan Island (Umm Sileh)	27°29'– 28°2'N, 51°16'–22'E	1,000 ha	-	A very low-lying island, almost without plant cover. All except the southern part of the island is covered by high tides	-	IBA (92), Protected Area
Bushehr	Morghoo Island (Tahmadon or Jebrin)	27°50'N, 51°30'E	c. 2000 ha	0–4 m	A small island with extensive mudflats. There are sandy hills with low shrubs in some parts of the island. Uninhabited. Plant cover mainly <i>Arthrocnemum macrostachyum</i> (Mostafavy et al. 2008)	-	IBA (93), Protected Area
Bushehr	Nakhilu Island	27°50'N, 51°30'E	15 ha	0–3 m	A small island with rocky and sandy coasts. There are low hills around the island and the center is flat and covered by dense bushes. Uninhabited. Plant cover mainly <i>Atriplex leucoclada</i> and <i>Arthrocnemum macrostachyum</i> (Mostafavy et al. 2008)	-	IBA (93), Protected Area

Province	Site name	Coordinates	Area	Altitude	Remarks on habitat	Main threats	Conservation
Bushehr	Ummal Gorm Island	27°50'N, 51°30'E	30 ha	0–3 m	A small island with rocky and sandy coasts and sandy hills. Mudflats around the island are covered at high tide. Uninhabited. Mainly <i>Ephedra foliolata</i> and <i>Arthrocnemum macrostachym</i> (Mostafavy <i>et al.</i> 2008)	Culling bird and turtle eggs by local people	IBA (93), Protected Area
Hormozgan	Sheedvar Island	26°48'N, 53°24'–E	160 ha	0–6 m	A small island with rocky and sandy coasts and some low cliffs. Much of the interior is covered by dense low shrubs.	Harvesting of bird and turtle eggs by local people, and invasive plant species (<i>Prosopis juliflora</i>)	Ramsar, IBA (94), Wildlife Refuge
Hormozgan	Hendurabi Island	26°39'–42'N, 53°35'–40'E	2,110 ha	-	A small, nearly flat island	Invasive plant species and disposal of garbage by local people	-
Hormozgan	Khouran Strait, Hara P.A.	26°50'N, 55°40'E	100,000 ha	0–50 m	A complex of low-lying islands, inter-tidal mudflats and mangrove forest. This region has the biggest mangrove forests in the Persian Gulf and Sea of Oman and contains 86% of the mangroves in Iran (Daneshkar 2001)	Oil pollution, cutting of mangroves and animal invasive species such as Black Rat <i>Rattus rattus</i>	Biosphere Reserve, Ramsar, IBA (96), Protected Area
Hormozgan	Hengam Island	26°49'–52'N 55°51'–55'E	3,360 ha	-	A large, inhabited island with rocky and sandy coasts. Shrubs and bushes are the main plant cover.	Degradation of the natural landscapes of seashores	-
Hormozgan	Hormoz Island	27°3'N, 56°28'E	4,000 ha	0–235 m	A large, inhabited island. Shrubs and bushes are the main plant cover. The soil is salty and there are no fresh water resources	Degradation of the natural landscapes and exploitation of minerals	IBA (98)
Hormozgan	Rud-e Gaz and Rud-e Hara deltas	26°40'N, 56°50'E	15,000 ha	0–50 m	A coastal-marine wetland with sandy beaches and some mudflats.	Oil pollution & excessive disturbance from motor boats	Ramsar, IBA (100), Protected Area
Hormozgan	Gabrik P.A (Jask-e Gharbi & Jask-e Sharghi)	25°41'N, 57°48'E	34,000 ha)	0–50 m	A coastal-marine wetland to the north of Jask city	Excessive disturbance from motor boats and expansion of Jask city	IBA (102), Protected Area

Table 4. Mid-winter censuses of Western Reef Herons along the Persian Gulf and Gulf of Oman during January 2000–2009.

PROVINCE	SITE NAME	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Bushehr	Rig Harbour		5								
Bushehr	Bushehr Bay and surroundings	30	1	12	9	245	20	12	18	1	30
Bushehr	Helleh P.A.			83	21	42	10	300	5		4
Bushehr	Mond P.A.			22	47	8	1	27	16	4	2
Bushehr	Nayband Bay NP	3	2	25	10	9	17	22	57	14	12
Hormozgan	West coasts of Hormozgan (Bandar Charak Khood & Harbour, Bandar Mogham Harbour, Bandar Charak–Bandar Khamir, Bandar Lengeh–Bandar Khamir, Bandar Mogham–Bandar Charak)			2	2	8		30	40		
Hormozgan	Hara P.A. (or Khood-e Khoodoran)	75		108	78	158	138	173	395	325	379
Hormozgan	Bandar Abbas to Bandar Khamir (Bandar-e Pol– Bandar Abbas (Rud-e Kul), Khood-e Hadish & Bandar Abbas seashore, Khood-e Sayeh Khosh)				5	91		458	21	172	193

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PROVINCE	SITE NAME	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Hormozgan	Bandar Abbas coast to Rud-e Shur	3				33	32	72	40	4	
Hormozgan	Gaz and Hara P.A. (Khood-e Azini (Keretan) & Khood-e Ziarat)			37	13	23	28	2	32	54	32
Hormozgan	Gabrik P.A. (Jagin shore, Khoors of Chal, Chilliki, Had, Kashani, Kohneh Koor, Kontaki, Nehor, Neyzei, Noktarash, Pahnoo, Soorgalm, and Sim seashore (Khood-e Kashani- Khood-e Had))	26		21	16	75	95	27	87	48	100
Hormozgan	Jask-e Gharbi P.A. and Jask-e Kohneh P.A. (Jask intertidal area, Jask-e Gharbi P.A., Jask-e Kohneh seashore, Khood-e Markazi Jask)			17	18	45	18	23	28	23	11
Hormozgan	Jask-e Sharghi P.A. (Bahal seashore, Khood-e Shahreno, Khood-e Khalasi)			21	8	36	23	20	32	29	37
Hormozgan	Coastal wetlands west of Jask (Khoors of Sirik, Nogar, Bahmadi, Tafarkan, Berizk, Bonji, Kuh-e Mobarak, Gangan, Gavbandi (Jaso), Kargoushki, and Kohestak seashore)	35		40	14	63	178	91	75	44	87
Hormozgan	Coastal wetlands of eastern Hormozgan (Khood-e Meydani, Kalirag-Vanak beach, Googsar-Karati, Abd-Googsar, Googsar lagoon, Khood-e Sedich)			10	31	16		77	38	40	30
Hormozgan	Tiab and Minab P.A. (Khargi, Khoors of Bandzark, Kargan, Kolahi, Tiab, Kooleghan, Namaki, Takhteriz, Hasan Langi, and Rud-e Shur & Rud-e Shirin)		24	42	116	58	311	9	201	223	87
Hormozgan	22th Bahman Pond						5	10		2	
Hormozgan	Minab Dam			1							
Hormozgan	Qeshm Island (north coast)			66	145	11	433		239		292
Hormozgan	Faroor Island			4				5			
Hormozgan	Hendorabi Island			1							
Hormozgan	Hengam Island			2							
Hormozgan	Hormoz Island			7							
Hormozgan	Larak Island			12							
Hormozgan	Lavan Island			16							
Hormozgan	Kish Island										33
Khuzestan	Khuzestan coasts (Bandar Mahshahr and Sarbandar salt exploitation sites, Hendijan - Bandar Deylam, Khood-e Ghoban)	14		46	3	162	66	2	27	222	122
Khuzestan	Hoor Al-Azim marshes						9				
Khuzestan	Miangaran marsh						16				
Khuzestan	Naseri marsh						52		85	165	47
Khuzestan	Shadegan W.R. and Khood-e Musa			85	99	77	53	20	9	180	54
Sistan & Baluchistan	Chabahar Bay to Khood-e Park (Chabahar Bay and shore, Tiss Harbour, Goordim seasonal marsh, Khood-e Cheshak, Khood-e Parak)				16	20	25	29	22	53	53
Sistan & Baluchistan	Govater Bay and Hoor-e Bahu	24	10		57	11	71	38	34	112	51
Sistan & Baluchistan	Khoors of West Baluchestan (Humedan & Kalat Harbour, Khood-e Galak, Khood-e Tang)	16	40	11	31	35	7	38	56	39	52
Sistan & Baluchistan	Konarak and Pozm khoors and bays (Khood-e Konarak, Konarak Bay & beach, Pozm Khood & Bay)	16	12	4	69	8	26	47	23	33	56
Sistan & Baluchistan	Pasa-Bandar Harbour		2		3	3	2	9	3		2
Sistan & Baluchistan	Ramin Harbour		4			2	1	2	2	9	14
TOTAL (N)		247 (11)	97 (9)	700 (26)	903 (22)	1140 (22)	2125 (27)	1044 (24)	1728 (24)	1917 (22)	1784 (25)
Average per site		22	11	27	41	52	79	44	72	87	71

Table 5. Proportion of dark- and white-morph birds in the adult population of Western Reef Herons on the south coast of Iran, 1971–1975 (D.A. Scott, pers. com.).

Region	Sample	Dark	White	% dark
Northern Persian Gulf – Khuzestan to Bandar-e Lengeh	129	69	60	53.5
Khouran Straits, Bandar Abbas & Strait of Hormoz	431	268	163	62.2
Makran Coast – Jask to Govater on Pakistan border	195	105	90	53.8
TOTAL	755	442	313	58.5

Past status of the Western Reef Heron in Iran

A review of the old literature revealed that there is little information on the status of the Western Reef Heron in Iran (Cheesman 1922, Tuck 1974, Chilman 1982, Gallagher *et al.* 1984, Summers *et al.* 1987) except for reports of its occurrence on Hengam Island in March and May in the early 1900s and an observation of two birds and a nest with three eggs on Lesser Tonb (Nabi-u-Tanb) Island on 28 May 1905 (Ticehurst 1925). Loppenthin (1951) describes *Demiegretta sacra asha* (as the Western Reef Heron was then known) as fairly common throughout the northern Persian Gulf in the two winters of 1936/37 as well as 1937/38, and states that the blue morph seemed to be slightly more numerous than the white morph. He did not find any breeding localities. Some chicks of the Western Reef Heron were ringed in the mangroves in Hara P.A. in the mid-1970s (F.B. Argyle, pers. com.) and on Sheedvar Island in the 1980s (Behrouzi-Rad, pers. com.). Mansoori (1987) recorded eight adults with six juveniles on Sheedvar Island in the summer of 1982, and there were 36 nests on this island in 1990 (H. Amini, pers. obs.).

However, it is now known that the species is a common resident along the entire south coast of Iran from the Iraqi border in the west to the Pakistan border in the east (D.A. Scott, pers. com. in 2008, Hùe & Etchécopar 1971, Porter *et al.* 1996), breeding on the coasts of the Persian Gulf and Oman Sea and also on some offshore islands (Mansoori 2008). In a review of the status of breeding waterbirds in Iran in the 1970s, Scott (2007) reported breeding colonies of this species in Shadegan marshes, on Morghoo, Ummal Gorm and Sheedvar islands and in Hara Protected Area, and estimated the total breeding population in Iran at about 150 to 200 pairs (Table 1, Scott 2007). However, large parts of the south coast were not surveyed during the breeding season in the 1970s (Scott 2007).

The total population of Western Reef Herons in Iran in mid-winter (January) in the 1970s was estimated at 700–1,000 birds (Scott 1995). This estimate was based on the results of the annual



Figure 2. The two morphs of the Western Reef Heron *Egretta gularis* in Hara Protected Area (Biosphere Reserve) © T. Ghadirian.

mid-winter waterbird counts and, in particular, aerial surveys of the entire south coast of Iran on 25–28 January 1974 and 18–22 January 1975. The aerial survey in January 1974 was the most comprehensive and produced a total of 691 Western Reef Egrets, of which 458 individuals were counted in the Khouran Strait, Hara P.A., Qeshm Island and Bandar Abbas area. The total of 691 was a minimum count as not all the offshore islands were covered during the survey, and many birds could have been missed in the mangrove areas in the Khouran Strait and along the Baluchestan coast (D.A. Scott, *in litt.* 2008). Regarding the white and dark morphs of the species (Fig. 2), according to Ziaie (1988), of 15 individuals observed on Sheedvar Island in June 1987, 12 were of the white morph and the rest of the dark morph. The colour phase of birds was recorded on many occasions between February 1971 and October 1975. In a sample of 755 birds, 442 (58.5%) were dark-morph birds and the rest were of the white morph (Table 5). The proportion of dark-morph birds in the northern Persian Gulf (53.5%) was very similar to the proportion on the Makran coast in the southeast (53.8%) and somewhat lower than the proportion in the Khouran Strait and Strait of Hormoz (62.2%; Table 5), but this difference is probably not significant (D.A. Scott, *in litt.* 2008).

Threats

The Western Reef Heron can be used as an indicator species to monitor the health of the coastal ecosystems in southern Iran. It therefore seemed necessary to carry out a study of the natural and human threats to the breeding population and how these threats were affecting selection of breeding sites and population size. The Western Reef Heron was heavily persecuted and hunted for the plume trade in the past, but has since recovered (BirdLife International 2009). In many of the wetland ecosystems in Iran, populations of all species of herons and egrets (Family Ardeidae) have decreased due to the destruction and pollution of rivers and wetlands (Firouz 2005).

No threats were identified to breeding Western Reef Herons at the breeding colonies at Ghabr-e Nakhoda, Khan, Nakhilu and Ummal Gorm islands (Behrouzi-Rad 2008). Excluding human factors, the threats to the Western Reef Heron breeding colonies in Hara Protected Area, on Hengam and Hendurabi islands, and in "Gaz and Hara" and Gabrik Protected Areas in 2008 and 2009 could be categorised in five groups: predators, unusually high tides, camels, strong winds and very high temperatures.

The Black Rat *Rattus rattus* is the only resident rodent in the mangrove forest of Hara Protected Area. This species is a well-known exotic species in many parts of the world and is supposed to have been introduced into Iran by ships (Ziaei 2008). It occurs in many cities in Iran (Etemad 1961) and is one of the main predators of birds in the forests (Pryde *et al.* 2005). The Black Rat is considered to be the main cause of damage to eggs, chicks and adult birds on the mainland of New Zealand (King 2005). In this study, we observed signs of Black Rat predation on both eggs (Fig. 3) and chicks of the Western Reef Heron. It was apparent that the rats were feeding on the eggs and also on chicks of various ages. According to a previous study, the density of Black Rats in the mangrove forests of Hara Protected Area was estimated to be 7 individuals per hectare (Ghadirian 2007). The breeding success of the Western Reef Heron in Hara Protected Area in 2008 and 2009 was 58% and 32% respectively. It seems that one reason for the lower breeding success in 2009 was an increase in predation by Black Rats in 2009 compared to 2008

(Etezdifar 2009). In 2008, the Black Rat was considered to be the second most important natural threat to the Western Reef Herons breeding in Hara Protected Area, while in 2009 it was considered to be the most important threat (Etezdifar 2009). Thus, further study of the impact of Black Rats on the breeding success of birds in this area would be desirable. The domestic cat is also present in Hara Protected Area, but we have not found any direct evidence of cat predation on eggs or chicks of Western Reef Herons in this area. Fishermen may also remove the eggs of the herons and damage their nests. Some local fishermen use traditional fishing nets called 'moshta'. These people believe that herons, especially Western Reef Herons, take fish that are caught in their nets.



Figure 3. Predation of Western Reef Heron eggs by Black Rat in Hara Protected Area © T. Ghadirian.

According to our observations, other threats to chicks of the Western Reef Heron include predation by Greater Spotted Eagles *Aquila clanga* in Hara Protected Area and Brown-necked Ravens *Corvus ruficollis* on Hendurabi Island. Two unusually high tides in the 2008 breeding season, reported by elderly local fishermen as being unequalled during the last 50 years, caused damage to eggs and destroyed some nests. Strong winds, storms, heavy rain and unusually low temperatures in Hara Protected Area and on Hengam Island in April 2009 caused a delay in breeding activities compared with 2008 and in some cases posed a threat to nests and eggs. In Gabrik Protected Area, we observed that camels were a serious threat to mangrove trees and destroyed the breeding habitat of Western Reef Herons.

The camels were feeding on mangrove leaves and halting the growth of the trees. At various sites, we found that in general herons building their nests in tall trees were less successful in rearing young (there are more rats in the tall forest) than those were building their nests nearer to the ground, while colonies accessible to humans had less breeding successful than those in remote areas. Finally, we believe that further studies of the breeding populations of this species are necessary for an understanding of the breeding ecology of the Western Reef Heron, particularly in Hara Protected Area. This would provide baseline information for management to improve the wetland ecosystems and facilitate the development of appropriate measures for the control of predation by Black Rats.

CONSERVATION

The Western Reef Heron requires no specific conservation measure in Iran (Mansoori 2000, Firouz 2005) and the global status of the species is considered as Least Concern (LC) in the IUCN Red List categories and criteria from 1988 to 2008 (BirdLife International 2009). As the conservation status of the Western Reef Heron in its breeding and non-breeding areas is not well-known, further study on the species in the south of Iran seems necessary. Monitoring the breeding sites and threats to the various populations would provide valuable information on the ecological status of southern coastal and wetland ecosystems in Iran. The largest breeding and wintering populations of the Western Reef Heron in Iran have been found in Hara Protected Area. The factors threatening the breeding population in this protected area have been identified in a recent study (Etezadifar 2009), but more investigation is required to determine how best to control these factors. Physical control of Black Rats by traps (live and snap traps) in the heron colonies during the breeding season can be the most important measure for conservation of the Western Reef Heron in Hara Protected Area. It seems that this method is safer than biological or chemical control methods in a complex and sensitive mangrove ecosystem. At the same time, further research needs to be carried out on the impact of predation by the Black Rat on the heron breeding colonies.

The Western Reef Heron has a limited distribution in the south of Iran and is a popular species for many birdwatchers, especially visitors from other regions of the country. By conserving the herons and their breeding sites, we would be protecting one of the special attractions of the coastal wetland ecosystems of southern Iran for present and future generations.

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