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Effects of Elimination of Ali Siah Island on Breeding and Wintering Population of Waterbirds in Karun River

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Abstract
There are 28 islands in Karun River in Ahwaz City that one of them is Ali Siah. The islandis covered by *Phragmites australis, Populus euphratica, Prosopis* sp. and *Tamarix* sp. This study assessed the species composition, relative abundance and species diversity of waterbirds found on and around this island. A total of twenty one species, seven families and two orders were identified. From each twenty one species, nine species belonged to waders and wading birds and 12 species belonged to waterbirds. Five species of Ardeidae, namely Little Egret *Egretta garzetta*, Cattle Egret *Bubulcus ibis*, Black-crowned Night Heron *Nycticorax nycticorax*, Squacco Heron *Ardeola ralloides* and Grey Heron *Ardea cinerea* were breeders. Nests of five mentioned species counted in nine years 2002–2015 on this island. Breeding population reduced from 736 in 2002 to 312 pairs in 2014 and zero in 2015. The reduction was 57.61% in 2014 and 100% in 2015. The Little Egret was dominant in winter and in breeding colony (maximum 365 individuals in winter 2003 and maximum 245 pairs in 2007 and 2010 respectively). Wintering population reduced from 946 to 32 individuals. The reduction was 96.6% in 2014 and 100% in 2015. The reason of absence of breeding and wintering population of birds in 2015 was elimination of Ali Siah Island.

1. Introduction

Birds are commonly utilized as indicators of ecosystem integrity (Kushlan 1993; Carignan & Villard 2002). Population levels, species density, diversity and breeding success have beenmonitored at many different geographical scales to assess environmental change and to determine future conservation (Girma *et al.* 2014; Carignan & Villard 2002; Asmawi 2007; Behrouzi-Rad 2013, 2014; Sharma & Minakshi 2014; Behrouzi-Rad & Ghaemi 2015). Many components of the environment affect the distribution, density, diversity and population of bird species (Rotenberry *et al.* 1979). For example, the type of habitat greatly influences the presence of species, including through the restriction of nesting and breeding areas, nutrition, temperature, natural resources (Francle & Schnell 2002). The diet of species depends on availability and abundance of biotic resources to satisfy nutritional requirements (Francle & Schnell 2002). Water also serves as a critical factor determining diet. Space is critical for location of food resources; sufficient cover is required for protection from predators and shelter for nesting and from the natural elements (Sharma & Minakshi 2014).

Wading birds serve as bioindicator species in rivers and estuarine ecosystems (US Fish and Wildlife Service 2002) and are important predators by feeding at the top of the food chain. They serve as valuable indicators of environmental quality, including resource abundance and health; levels of toxic substances, such as organic contaminants and heavy metals as well as human disturbance.

In 2012, the Karun River beaches development project was initiated in the city of

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Ahwaz, Iran. As a result of the project, one of the riverine islands of Ali Siah was completely eliminated in 2015 and beaches along Karun River were converted to city parks by removing trees and reeds. The main objective of this study was to track these urban developments and demonstrate the effect on diversity of breeding and wintering waterbirds.

2. Materials and Methods

2.1. Study area

The Karun River is one of the largest rivers in Iran that arises in the Zagrous Mountain, flows for about 920 km before entering the Persian Gulf in Khor-Al-Umaieh near Abadan (Afshin 1994) (Fig. 1). This river passes through the city of Ahwaz and alonga 32 km course through the city has 28 small islands that are suitable habitats for waterbirds especially for wading birds (Behrouzi-Rad 2014). This study focused on and around Ali Siah Island (31°19'58"N, 48°40'55"E) and is about 1.2 ha (Fig.1).

The interior of the island was covered by *Populus ephratica*, *Lysium* spp., *Prosopis ssp*. and *Tamarixs* sp., while the perimeter had small patches of *Phragmites australis* (Fig. 2). Prior to the establishment of the beach parks along the Karun River near the island were covered by *Phragmites australis* and some tree species.

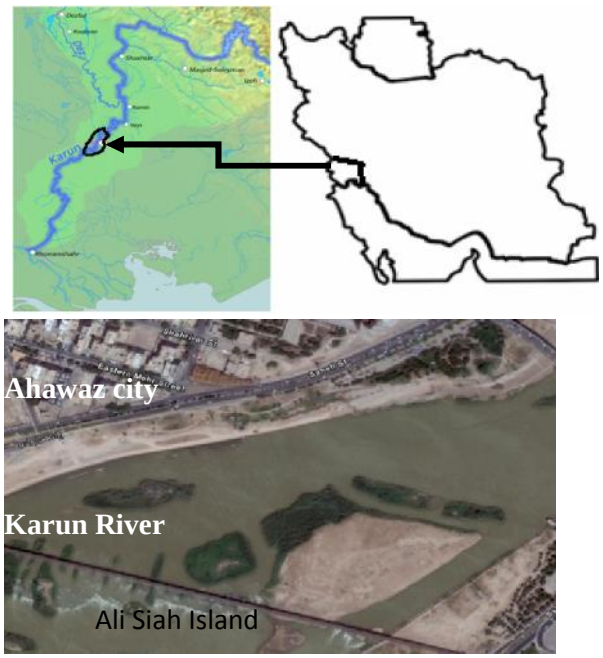

Fig. 1. Location of Ali Siah Island in Karun River, Ahwaz City, Iran (source: Google 2015).

2.2. Data collection

A total count method was used for assessing numbers of waterbirds on Ali Siah Island by using binocular (Zeiss 10×40 magnification) and walking on the island or from a small motor boat that was around the island. Counts were conducted between 10−15 January each year between 2003–2014 (with the exception of between 2004–2006 and 2008–2009). Number of nests of herons and egrets were counted directly between 9:00 am and 11:00 am between 15 and 20 May each year between 2002–2014 (with the exception of 2004–2006 and 2008–2009). The nests were on trees and reed beds and were counted easily (Fig. 2). Birds were identified using two popular field guides, Field Guide to the Birds of Middle East (Porter *et al.* 1996) and A Field Guide to the Waterbirds of Asia (Sonobe & Usui 1993).

3. Results

3.1. Breeding species

A total of five species, two egrets (Little Egret and Cattle Egret) and three herons (Black-crowned Night Heron, Squacco Heron and Grey Heron) bred on Ali Siah Island (Table 1). The Little Egret was the most abundant breeder (with maximum 245 nests in 2007 and 2010 respectively), while the Grey Heron only had a maximum of six nests in 2003. The total number of nests reduced from 736 in 2002 to 312 nests in 2014 and zero in 2015 (Table 1).

A total of 312 nests in 2014, Most nests were made in *Populus euphraticus* (239 nests or 76.6%) with only one nest on *Prosopis* sp. (0.3%), 11 (3.52%) nests in *Phragmites australis*, 61 nests (19.55%) in *Tamarix* sp. in 2014 (Table 2). Most 101 (66.9%) Little Egret nests were made in *Populus euphraticus*, 38 (25.2%) on *Tamarix* sp., 11(7.3%) on *Phragmites australi*s and 0.7% on *Prosopis* sp. in 2014. In this year, 80.5% of nests of Black-crowned Night Heron were made in *Populus euphraticus* and the remainder (19.5%) on *Tamarix* sp. The Cattle Egret, Squacco Heron and Grey Heron had made their nests in *Populus euphraticus* in 2014 (Table 2).

Fig. 2. Natural features of Ali Siah Island before elimination (two picturesat the top in 2012). Bottom pictures (3, 4) are showing features of the island when its elimination started (2014).

Table 1. Number of nests of Ardeidae species on Ali Siah Island between 2003 and 2015.

Species	2002	2003	2007	2010	2011	2012	2013	2014	2015	Max	% max
Little Egret	222	183	245	245	213	205	201	151	0	245	33,3
Cattle Egret	234	150	148	149	118	111	111	11	0	234	31,8
Black-crowned Night Heron	132	190	167	167	150	128	145	135	0	190	25,8
Squacco Heron	144	86	22	65	54	56	11	13	0	144	19,6
Grey Heron	4	6	4	2	0	0	2	2	0	6	0,8
Total	**736**	**615**	**586**	**628**	**535**	**500**	**470**	**312**	**0**	**245**	**33,3**

Table 3. Overview of wintering waterbirds recorded at Ali Siah Island 2003−2015 (no data in 2004−2006 and 2008−2009). Number in parentheses are species number.

Species	2003	2007	2010	2011	2012	2013	2014	2015	Max	Average
Great Cormorant *Phalacrocoraxcarbo*	204	196	162	211	10	12	2	0	211	26.4
Pygmy cormorant *Phalacrocorax pygmeus*	8	13	10	12	8	4	0	0	13	1.6
Little Egret *Egretta garzetta*	365	189	167	178	114	3	4	0	365	45.6
Great White Egret *Casmerodius albus*	3	0	9	9	1	2	1	0	9	1.1
Squacco Heron *Ardeola ralloides*	2	8	5	8	1	3	3	0	8	1.0
Grey Heron *Ardea cinerea*	15	6	7	7	2	1	0	0	15	1.9
Black-crowend Night Heron *Nycticorax nycticorax*	127	154	171	234	5	1	2	0	234	29.3
Cattle Egret *Bubulcus ibis*	111	134	204	214	1	4	2	0	214	26.8
Slender-billed Gull *Larus genei*	50	32	161	12	5	20	5	0	161	20.1
Black-headed Gull *Larus ridibundus*	13	43	17	45	153	15	5	0	153	19.1
Yellow–legged Gull *Larus cachinnans*	10	0	17	0	0	15	0	0	17	2.1
Pallas's Gull *Larus ichthyaetus*	1	2	0	3	7	4	3	0	7	0.9
Lesser Black-backed Gull *Larus fuscus*	6	6	14	7	1	6	5	0	14	1.8
Common Coot *Fulica atra*	3	8	2	0	0	0	0	0	8	1.0
Common Moorhen *Gallinula chloropus*	3	0	2	3	2	2	0	0	3	0.4
Black-winged Stilt *Himantopus himantopus*	10	8	12	11	1	5	0	0	12	1.5
Red-wattled Plover *Vanellus indicus*	11	9	8	11	0	5	0	0	11	1.4
White-tailed Lapwing *Vanellus leucurus*	2	6	6	5	0	5	0	0	6	0.8
Little Ringed Plover *Charadrius dubius*	1	1	1	0	0	0	0	0	1	0.1
Common Sandpiper *Tringa hypoleucos*	0	1	0	1	0	0	0	0	1	0.1
Little Stint *Caldris minuta*	1	1	0	0	1	0	0	0	1	0.1
Total	**946 (20)**	**817 (18)**	**975 (18)**	**971 (17)**	**312 (15)**	**107 (17)**	**32 (10)**	**0 (0)**	**975 (21)**	**-**

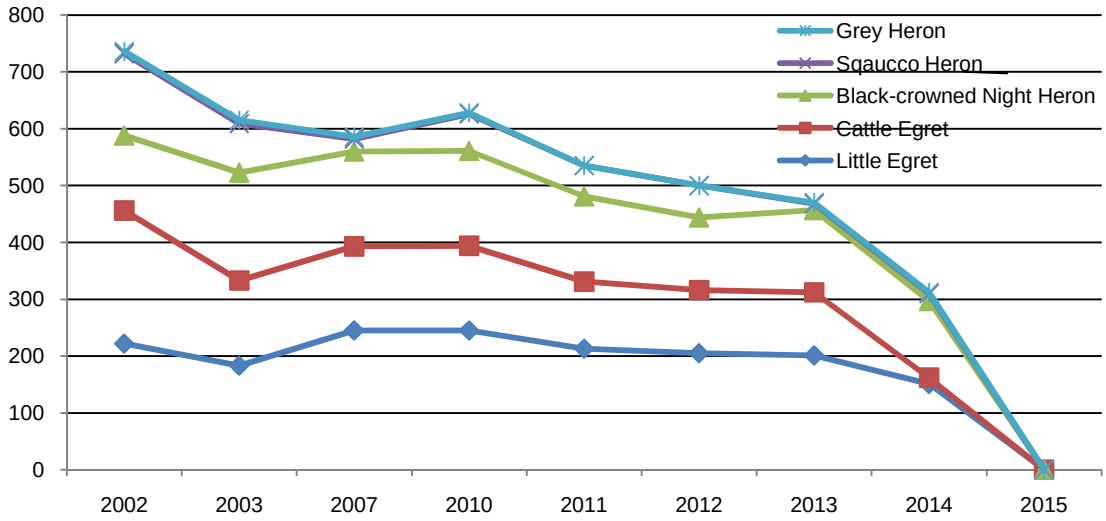

Fig.3. Changes in nest number of five Ardeid species on Ali Siah Island 2002-2015.

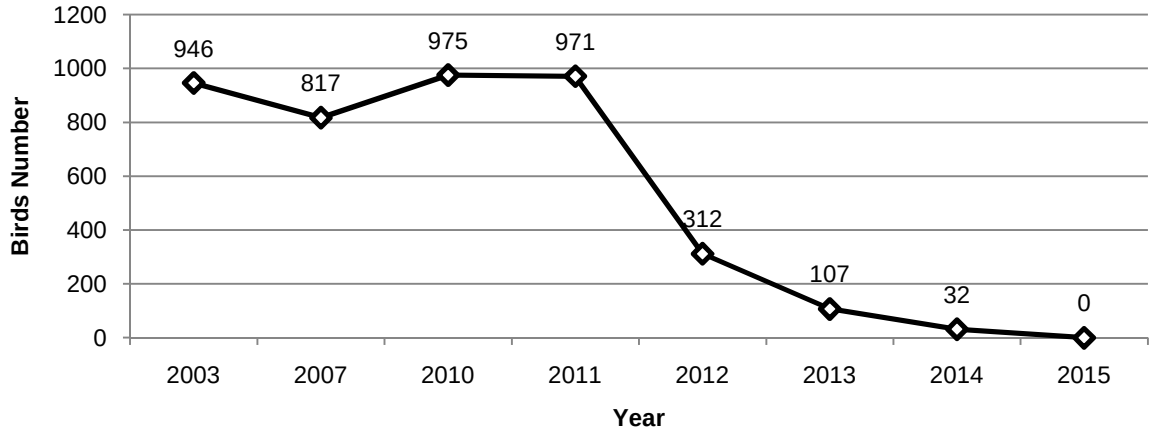

Fig. 4. Trend of waterbirds population on Ali Siah Island in January 2003−2015 (no data in 2004−2006 and 2008−2009).

3.2. Wintering waterbird populations

The results of the annual January waterbird counts between 2003 and 2015 cover 21 species of waterbirds of 7 families (Table 3). The highest number of bird species (20 species) was recorded in 2003, while the highest number of birds (975 individuals) was recorded in 2010, and the lowest number was counted in 2014 (10 species and 32 individuals), implying a reduction of nearly 97%. The island was eliminated completely in 2015 and no birds were recorded around this location. The trend of reducing the wintering population of waterbirds is shown in Fig. 4.

Table 2. Nest site of Ardeidae breeding species on Ali Siah Island in 2014.

Breeding species	Nest site	Nest number	%
Little Egret	*Populus euphraticus*	101	
Grey Heron	*Populus euphraticus*	2	
Black-crowned Night Heron	*Populus euphraticus*	112	76.6
Squacco Heron	*Populus euphraticus*	13	
Cattle Egret	*Populus euphraticus*	11	
Black-crowned Night Heron	*Tamarix* sp.	23	19.6
Little Egret	*Tamarix* sp.	38	
Little Egret	*Phragmites australis*	11	3.5
Little Egret	*Prosopis* sp.	1	0.3
Total		312	100

3.3. Species composition

The highest number of species were Ardeidae (six species), followed by Laridae and Charadriidae with five species each and Phalacrocoracidae, Rallidae and Scolopacidae with two species each, while Recurvirostridae was represented by a single species (Table 3). Overall, the Little Egret was the most abundant with an annual average of 45.6, followed by Black-crowned Night Heron (29.3) Cattle Egret (26.8), Great Cormorant (26.4) and Slender-billed Gull (20.1). The remaining species had an average of less than 20. As mentioned above, the number of birds reported dropped through the study. Density, diversity and population composition of birds in and around the Ali Siah island make the island beautiful place for birdwatchers who can see herons, egrets and gulls during the day.

4. Discussion

Bird populations are considered to be a good indicator of the broad state of wetland biodiversity because they occupy a wide range of wetland habitats, tend to be near the top of the food chain and considerable long-term data on bird populations are available from which to examine changes (Noble *et al.* 2008). Initially the vegetation on Ali Siah Island was suitable habitat for breeding refuge and foraging habitat for breeding of Ardeidae and foraging habitat for wintering waterbirds. However, within the nine years of the study, significant decline in numbers and diversity have been observed.

With the initiation of the Karun River beach development project in 2012, all beaches were converted to parks for recreation and natural vegetation cover along the banks and on Ali Siah Island was completely eliminated by 2015. The time series of counts taken before the developments were initiated were compared to immediately after when the bird numbers were reported to have crashed in the same year. This clearly demonstrated the impact of the developments.It would be important to study the bird diversity in the long term in the area to evaluate the impact of these developments on the Karun River ecosystem.

Elsewhere in Iran, Behrouzi-Rad & Ghaemi (2015) reported that there was a great variation between species and notable declines in number of species of waterfowl and waders in Gomishan wetland due to human activities. This study also supports other research which has noted the effect of habitat disturbance on wintering migrant birds (e.g. Colombini *et al.* 1995).

Kushlan reported (1993) waterbirds population depended on status of wetlands and they are bio-indicators of wetland changes. Conservation problems and threats faced by waterbirds in the region have been discussed elsewhere (Evans 1994; Scott 2008) and included in incidental take, human disturbance, habitat reduction, fishing and hunting in wetlands. Annually hundreds of waterbirds particularly waders, coots and gulls migrated to use the Karun River islands include Ali Siah Island as their wintering habitat.

All Ardeidae species are protected in Iran (Department of the Environment 2002). Existence of six protected species on Ali Siah Island demonstrated the importance of the islandas a breeding habitat for these species and wintering waterbirds. The remaining islands in the Karun River are the most threatened habitats in the Khuzestan Province, under pressure of human activities and development.

During our survey visits, we recorded the number of people present on the islands including on Ali Siah Island during the Ardeidae breeding season. Waterbirds are dependent on localized, limited habitat, and are, therefore, vulnerable.

Understanding the composition, species richness and species diversity of bird is a central question in community ecology (Guadagnin *et al.* 2005). The study revealed that anthropogenic pressures of land use and clearing cover of the island have negatively impacted wetland bird diversity and population at the island (Girma *et al.* 2014). Relatively high bird species diversity, wintering and breeding population were observed on and around the island where there was good vegetation cover relatively around undisturbed in 2003. Birds that are dependent on Karun River bank habitats are ubiquitous along the banks of the Karun River. Species richness patterns of waterbirds wintering in the gulf of Gabès are in relation to habitat and anthropogenic features estuarine (Foued & Slaheddine 2015).

The Little and Cattle Egrets, and three heron species bred in three wetlands (Shadeghan,

Hour-al-Azim and Ali Siah Island) in Khuzestan Province (Pandam Consultant 2002). All three breeding colonies collapsed in 2015, because the Hour-al-Azim Wetland was dry, Shadegan marsh has low water and the island of Ali Siah was eliminated.

Recommendations

Planning and implementation of urban development projects along the Karun River in important bird habitats should include bird specialists from the initial planning stage. This is important to ensure that development projects can be planned through finding of sustainable solutions that do not negatively affect avian diversity and their habitats. It is usually preferable to define mutually compatible uses of areas both for their natural values and for recreation development. As the remaining islands in the Karun River may provide important natural breeding and wintering habitats for waterbirds, including protected species, they need to be retained in their natural state. These islands can also provide a place for birdwatchers and naturalists to enjoy nature.

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