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Sivand Dam as an Alternative Wetland for Wintering Waterbirds in Fars Province, Southern Iran

Leila Joolaee[1], Behrouz Behrouzi-Rad[2], Hamid-Reza Esmaeili[3] & Omid Tabiee[4]

1) Department of Environment, Science and Research Branch, Islamic Azad University, Khuzestan, Iran
2) Department of Environment, Science and Research Branch, Islamic Azad University, Khuzestan, Iran
3) Biology Group. Shiraz University, Shiraz, Iran
4) Natural Resource Branch, Islamic Azad University, Arsanjan, Iran

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Abstract
This survey was carried out at Sivand Dam in Fars Province, Iran, during six months from October 2009 to March 2010. In total, 46 species of waterbirds were identified at the dam. Of these, Eurasian Coot *Fulica atra* and Common Teal *Anas crecca* were the most abundant (71.7% and 11.5% of all birds counted, respectively). Five species currently included in the IUCN Red List categories, Dalmatian Pelican *Pelecanus crispus* (VU),White-headed Duck *Oxyura leucocephala* (EN), Marbled Teal *Marmaronetta angustirostris* (VU), Ferruginous Duck *Aythya nyroca* (NT) and Black-tailed Godwit *Limosa limosa* (NT), were observed at the dam. The survey has revealed that this artificial wetland is able to support significant numbers of waterbirds during periods of drought when many natural wetlands are in a critical condition. Further studies on the aquatic fauna of this dam and other artificial wetlands are recommended to complement the results of this preliminary study.

1. Introduction

Fars Province is located in the southwest of Iran and possesses a variety of aquatic ecosystems, some of which are internationally important (Scott 1995). These habitats are vital for many waterbirds as wintering and breeding sites, but they are also under heavy pressure from human activities, mainly agriculture, other environmental changes and decreasing annual precipitation (Evans 1994). In recent years, most of the valuable aquatic habitats in Fars such as Lake Parishan and Lake Bakhtegan have dried out completely because of the low precipitation. According to the Water Resource Research Department of Fars, the mean annual rainfall in 2009 and 2010 was 175 mm, while the long-term average annual rainfall has been 300 mm. This represents a 43% decline compared with the long-term precipitation in Fars Province (Keshavarz, pers. comm.).

Wetlands in the north of Fars Province are remarkable for wintering waterbirds. One of these wintering sites is Koftar Lake. This is the first staging site for wintering waterbirds entering Fars in autumn. Because of the prolonged drought, this wetland has been completely dry for three years. With this lake and many other natural wetlands now completely dry, artificial wetlands such as water-storage reservoirs and hydro-electric dams provide alternative sites for migratory birds. The objectives of this survey were to monitor the fluctuations in waterbird numbers at Sivand Dam, a large reservoir in Fars Province, and to collect basic data on species diversity in the wetland.

* *Corresponding: leila.joolaee@gmail.com*

2. Study Area and Methods

Sivand Dam is situated in the north of Fars province. This dam was constructed in 2001 by the Ministry of Power on Sivand River in Tang-e Bolaghi valley. Sivand River flows from Kooh-Sefid (White Mountain) to the south of Eghlid town. The Sivand catchment is a part of the Bakhtegan watershed. The mean annual rainfall in this area is 280 mm. The Sivand area has cold winters and mild summers. The dominant plant cover is Mount Atlas Pistachio *Pistacia atlantica*. Many species of waterbirds use Sivand Dam and its surrounding areas as wintering habitat.

The wetland consists of Sivand River and the lake behind the dam wall. Sivand Dam is located at 30°08'30"N, 53°04'56"E, 78 km northeast of Shiraz and 10 km southwest of Pasargad and Pasargad World Heritage Site (Fig. 1). During the present study, the lake covered an area of 700 ha. Reed-beds on both sides of the river provided good habitat for surface-feeding ducks and various herons. In the deepest part of the lake, pelicans, cormorants and grebes were present. Pistachio trees around the lake provided good habitat for egrets and birds of prey.

Four sites suitable for counting birds were selected during the first field visit to the lake. A GPS-device was used to ensure that the same count sites were used in all field visits and also to assist in the preparation of a site map. These count sites were considered sufficient to enable reliable counts to be made, while at the same time not causing undue disturbance to the birds. The bird counts were undertaken once a month and the "Total Count" method was used throughout. The main tools for counting were a telescope (Swarovski 20-60xS), binoculars (Swarovski 10×40) and various field guides (Svensson *et al.* 2006, Message & Taylor 2007, Mansoori 2008, Porter & Aspinall 2010). Three people participated in each of the counts.

3. Results

The results of the counts of waterbirds at Sivand Dam are shown in Table 1. During the six-month survey, 46 species of waterbirds were identified at the dam. The Eurasian Coot *Fulica atra* and Common Teal *Anas crecca* were the most abundant species, comprising 71.7% and 11.5% of the birds counted, respectively (Table 1). Four species were recorded only on a single occasion: Purple Heron *Ardea purpurea,* Squacco Heron *Ardeola ralloides,* White Stork *Ciconia ciconia* and Jack Snipe *Lymnocryptes minimus*. Table 1 shows that the total number of waterbirds decreased gradually from 12,000 individuals in October to about 2,000 individuals in March. During the present study, five species of waterbirds currently included in the IUCN Red List categories (IUCN 2010) were found to be using Sivand Dam as a wintering site: Dalmatian Pelican *Pelecanus crispus* (VU), White-headed Duck *Oxyura leucocephala* (EN), Marbled Teal *Marmaronetta angustirostris* (VU), Ferruginous Duck *Aythya nyroca* (NT) and Black-tailed Godwit *Limosa limosa* (NT). The largest numbers of waterbirds were observed in November and the lowest numbers in March (Fig. 2). Species diversity was highest in November and lowest in February (Fig. 3). In the last month of the study, Dalmatian Pelicans had settled down to breed at the lake. The birds started nesting in mid-March and egg-laying occurred in April. A total of eight pairs bred here, five of which had clutches of 2 eggs and the rest one egg (Fig. 4).

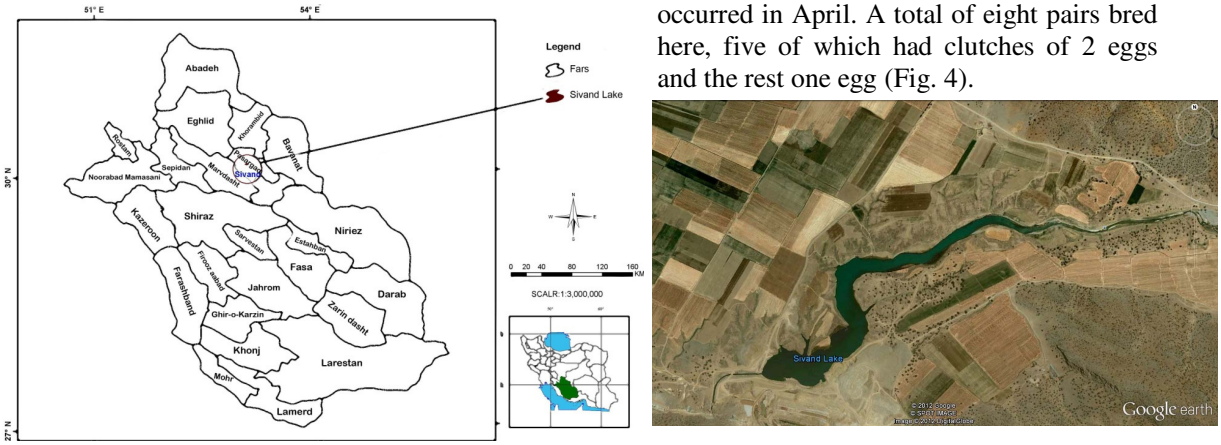

Fig. 1. Location of Sivand Dam in Fars and Iran.

Table 1. Results of waterbird counts at Sivand Dam, October 2009 to March 2010.

Common name	Scientific name	Oct 09	Nov 09	Dec 09	Jan 10	Feb 10	Mar 10	Mean Num	Relative abundance
Little Grebe	*Tachybaptus ruficollis*	376	364	256	22	27	34	179.8	2.17
Great Crested Grebe	*Podiceps cristatus*	85	97	102	27	31	37	63.2	0.76
White Pelican	*Pelecanus onocrotalus*	2	3	3	0	0	3	1.8	0.02
Dalmatian Pelican	*Pelecanus crispus*	33	38	34	33	22	28	31.3	0.38
Great Cormorant	*Phalacrocorax carbo*	5	74	138	114	219	172	120.3	1.45
Grey Heron	*Ardea cinerea*	183	50	33	35	37	11	58.2	0.7
Purple Heron	*Ardea purpurea*	0	0	0	0	0	1	0.2	0.002
Great White Egret	*Egretta alba*	36	26	51	121	93	7	55.7	0.67
Little Egret	*Egretta garzetta*	20	12	14	0	0	0	7.7	0.09
Squacco Heron	*Ardeola ralloides*	1	0	0	0	0	0	0.2	0.002
Night Heron	*Nycticorax nycticorax*	8	0	0	0	0	0	1.3	0.02
White Stork	*Ciconia ciconia*	0	0	0	0	0	1	0.2	0.002
Eurasian Spoonbill	*Platalea leucorodia*	3	0	0	3	1	6	2.2	0.03
Greater Flamingo	*Phoenicopterus roseus*	23	84	63	1	0	19	31.7	0.38
Ruddy Shelduck	*Tadorna ferruginea*	133	280	0	0	0	3	69.3	0.84
Eurasian Wigeon	*Anas penelope*	10	25	42	27	32	45	30.2	0.36
Gadwall	*Anas strepera*	0	1	7	0	0	0	1.3	0.02
Common Teal	*Anas crecca*	1,425	1,300	954	1,023	863	157	953.7	11.52
Mallard	*Anas platyrhynchos*	325	413	486	573	494	117	401.3	4.85
Northern Pintail	*Anas acuta*	-	126	133	154	91	16	104.0	1.05
Northern Shoveler	*Anas clypeata*	17	11	14	12	19	16	14.8	0.18
Marbled Teal	*Marmaronetta angustirostris*	0	1	1	0	0	0	0.3	0.004
Common Pochard	*Aythya ferina*	0	281	47	34	53	4	69.8	0.84
Ferruginous Duck	*Aythya nyroca*	0	5	3	0	0	0	1.3	0.02
Tufted Duck	*Aythya fuligula*	0	2	0	5	5	0	2.4	0.02
White-headed Duck	*Oxyura leucocephala*	0	0	5	0	0	0	0.8	0.01
Common Crane	*Grus grus*	0	52	23	0	0	0	12.5	0.15
Common Moorhen	*Gallinula chloropus*	2	5	0	0	0	0	1.2	0.01
Eurasian Coot	*Fulica atra*	9,653	9,375	8,704	5,000	1,874	1,005	5,935.0	71.7
Black-winged Stilt	*Himantopus himantopus*	4	0	0	0	0	0	0.7	0.01
Pied Avocet	*Recurvirostra avosetta*	0	0	0	0	0	1	0.2	0.01
Ringed Plover	*Charadrius hiaticula*	0	0	0	0	0	8	1.3	0.02
Kentish Plover	*Charadrius alexandrinus*	7	0	0	0	0	0	1.2	0.01
Black-tailed Godwit	*Limosa limosa*	3	3	0	2	0	0	1.3	0.02
Common Redshank	*Tringa totanus*	0	0	0	2	0	5	1.4	0.01
Marsh Sandpiper	*Tringa stagnatilis*	1	0	0	0	0	1	0.3	0.004
Common Greenshank	*Tringa nebularia*	3	0	0	5	0	0	1.3	0.02
Green Sandpiper	*Tringa ochropus*	0	1	0	2	1	0	0.7	0.01
Common Sandpiper	*Tringa hypoleucos*	0	0	0	1	1	0	0.3	0.004
Jack Snipe	*Lymnocryptes minimus*	0	0	0	0	1	0	0.2	0.002
Little Stint	*Calidris minuta*	50	0	0	0	0	0	10.0	0.10
Black-headed Gull	*Larus ridibundus*	0	0	0	13	2	4	3.8	0.95
Pallas's Gull	*Larus ichthyaetus*	0	139	65	0	0	266	78.3	0.04
Slender-billed Gull	*Larus genei*	0	22	0	0	0	8	6.0	0.06
Little Gull	*Larus minutus*	1	2	1	0	0	0	0.7	0.01
Unidentified Gulls	*Larus* sp.	180	16	15	9	7	5	38.7	0.47
Total Number		**12,589**	**12,808**	**11,194**	**7,218**	**3,873**	**1,980**	**8,277**	
Relative Density in 700 ha		**17.98**	**18.30**	**15.99**	**10.31**	**5.53**	**2.82**	**11.82**	

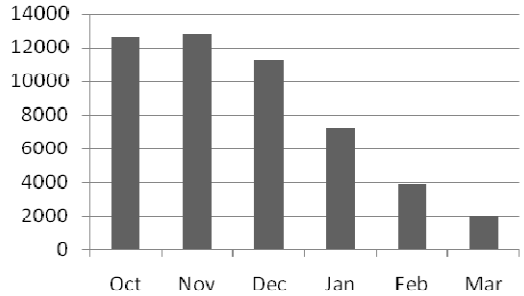

Fig. 2. Variation in waterbird numbers at Sivand Dam (October 2009 to March 2010).

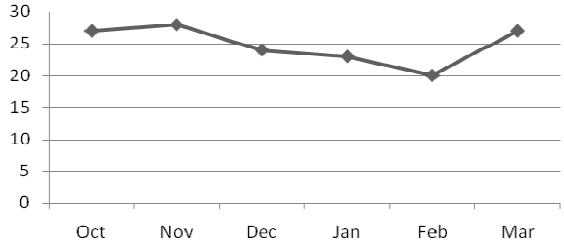

Fig. 3. Variation in numbers of waterbird species at Sivand Dam (October 2009 to March 2010).

Fig. 4. Dalmatian Pelican *Pelecanus crispus* breeding colony at Sivand Dam.

4. Discussion

Waterbird counts have been carried out in Fars Province for almost 40 years as a part of the Department of the Environment's (DOE) duties. This monitoring programme is carried out every year in mid-winter as part of the International Waterbird Census in Europe and the Middle East, coordinated by Wetlands International. The annual monitoring of waterbird populations is a good way to monitor the condition of wetlands. According to the Fars DOE reports, the wetlands in Fars Province have suffered serious degradation in recent years mostly because of the prolonged drought. Most of the important wetlands for migratory birds, including two internationally important Ramsar Sites, Lake Parishan and Lake Bakhtegan, have almost disappeared. In the past three years, there has been a continuous drought in Fars Province and many important wetlands such as Koftar Lake in the north of the province have dried out. The results of the Mid-winter Waterbird Censuses of the Fars Provincial Office of the Department of the Environment (DOE) show a continuous decrease in numbers of waterbirds wintering in the wetlands of Fars (Table 2). In this critical situation, the artificial lake of Sivand Dam has provided a good alternative wintering site for migratory birds in the north of the province. Table 2 shows that Sivand Dam supported 11%–13% of the total wintering waterbirds recorded during the 2008-2010 January counts in the wetlands of Fars Province. This artificial wetland is supporting many waterbird species during a critical period when natural wetlands are rapidly disappearing.

The results of this study are in accordance with the conclusions of Davidson & Delany (1999) who emphasised that the artificial wetlands created by dams in arid areas can provide sustainable conditions for waterbirds. Species diversity and total numbers of birds were found to be highest at Sivand Dam in the autumn. Similar results were also reported in a study of waterbirds at Abshineh Dam in Hamedan Province (Barati *et al.* 2009). The high counts at Sivand Dam in early autumn and late winter show that Sivand is on the migration route for birds wintering farther south in Fars Province. The high diversity of species using this site can be attributed to the wide range in depth of the lake and good fish stocks. The lake also provides a good nesting site for the Dalmatian Pelican *Pelecanus crispus*. The main breeding site of this vulnerable species in Iran was formerly at Lake Parishan in the southwest of Fars Province, but this lake has dried out. Given the importance of Sivand Dam for waterbirds, as demonstrated by the present study, it is suggested that a guard station be built in Tang-e Bolaghi and that the lake be patrolled by game guards. The lake could also be promoted as a bird-watching site for eco-tourism due to its proximity to the World Heritage Site at Pasargad.

Table 2. Results of the mid-winter waterbird censuses at wetlands in Fars Province from 2001 to 2011 (Fars Provincial Office of the Department of the Environment (DOE), unpubl. data).

Wetland name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Annual precipitation (mm)	**151.9**	**212.9**	**387.4**	**293.6**	**391.2**	**428.6**	**256.2**	**351**	**115**	**186.5**	**248.5**
Tashk*	15,853	208,470	47,149	139,048	792	7,654	8,755	10,734	7,992	12,455	10,856
Bakhtegan*	8,006	125,246	28,620	69,422	119,958	68,670	88,788	28,767	37	0	94
Kamjan*	?	?	47,149	?	44,609	19	11,600	746	12	27	166
Arjan marsh*	18,979	17,301	33,476	38,754	19,930	22,710	6,908	3,306	3,064	2,343	1,007
Parishan*	9,144	6,322	21,713	16,849	4,013	19,592	25,098	19,600	4,345	200	4
Maharloo	41,186	30,114	30,060	58,162	47,332	19,670	24,132	13,622	17,516	24,889	8,837
Doroodzan Dam	5,142	5,565	1,539	3,768	479	1,597	1,563	3,099	3,791	1,718	3,735
Molla Sadra Dam	–	–	–	–	–	–	–	19	355	963	228
Sivand Dam	–	–	–	–	–	–	–	12,868	4,687	6,233	129
Koftar Lake	33	1	26,251	43,602	6,029	31,302	3,305	509	2	0	0
Hirm	1,655	1,185	1,520	7,247	2,013	1,754	3,354	3,862	1,306	44	2,524
Harm	850	1,734	1,192	7,096	8,915	7	2,387	142	0	1,165	9
TOTAL	**100,484**	**395,938**	**238,669**	**383,948**	**254,070**	**140,825**	**173,887**	**97,759**	**42,980**	**53,612**	**27,906**
Percentage of birds at Sivand Dam	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**13.2**	**10.9**	**11.6**	**0.5**

*Ramsar Site

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