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Human disturbance affecting sensitive components (waterbirds) of wetlands; A case study on waterbirds in Libyan Ramsar sites

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.**Key words:** Human disturbance, waterbirds, Libyan Ramsar sites

Abstract

The impact of human disturbance on natural ecosystems and wildlife is a worldwide phenomenon and increasing rapidly. Human disturbance is widely regarded as a cause of concern for many taxa, including birds. Disturbance can cause mortality, reduce productivity and affect the movement of individuals. This study investigated some kinds of disturbance that affect waterbirds at the two Libyan Ramsar sites (Ain Azzargha and Ain Ashaghigha) in the eastern part of Libya. The number of waterbirds was significantly negatively affected by the increase of sand collecting sites (habitat change) and heavy traffic of Trucks. Conversely, fishing and recreational activities have no significant effects on waterbirds in Ain Azziana wetland. Habitat change and destruction are the key factors that cause losing of natural ecosystems components.

Introduction

The impact of human disturbance on natural ecosystems and wildlife is a worldwide phenomenon. The major impact of humans on wildlife is their effect on important resources, such as food and breeding habitat. Restriction of access to these resources can occur through species avoiding disturbed areas. As the human population continues to grow, exploiting an increasing proportion of the world's surface, the potential impact of human disturbance on wildlife remains a pressing problem. In recent years, many studies have intensively examined the effects of human disturbance (e.g. Hockin *et al*., 1992; Fernández-Juricic and Tellería, 2000; Haskins, 2000; Fernández-Juricic and Jokimäki, 2001; Gill *et al*., 2001; Blumstein *et al*., 2005; Gill, 2007; Markovchick-Nicholls *et al*., 2008), and numerous studies have assessed the way in which species' populations and habitats are affected (e.g. Robert and Ralph, 1975; Gill *et al*., 1996; Finney *et al*., 2005; Langston, 2007a; Liley and Sutherland, 2007; Mallord *et al*., 2007b; Murison *et al*., 2007; Pearce-Higgins *et al*., 2007; Stillman *et al*., 2007). The responses of individuals or populations vary depending on the source of disturbance (e.g. roads, grazing or shooting; reviewed in Sutherland 1998). For example, Hockin *et al*. (1992) gave an example of some sources of disturbance for waders and wildfowl and their responses, but the overall picture that emerges of the impacts of human activities on wildlife is a negative one (Beale, 2004).

The impact of human disturbance on birds comes from diverse human activities and through many different interactions (Banks and Bryant 2007; Langston *et al*., 2007a). Disturbance can reduce breeding productivity of species (Robert and Ralph, 1975; Langston *et al*., 2007b; Mallord *et al.,* 2007a; Murison *et al.,* 2007), and human activities that affect breeding success of the species are varied, ranging from habitat destruction to direct interference such as entering breeding sites, disturbing incubation, collecting eggs and chicks, etc. The response of species to these activities varies markedly, but there are likely to be adverse effects if disturbance persists for sustained periods of time (Burger, 1981). In some cases, such disturbance is simply a by-product of human activity, but the number of humans involved in activities geared toward viewing wildlife is also increasing swiftly. For many years, it was believed that such activities were harmless to wildlife and could actually help in conservation efforts by generating income and publicity. However, it has become obvious that even recreational visits by those most interested in protecting wildlife can have negative effects (Carney and Sydeman, 1999).

However, human disturbance can contribute to the rate of mortality directly and indirectly (Burger, 1981; West *et al*., 2002) and several experimental studies have demonstrated adverse effects of human disturbance on chick, fledgling and adult survival rates (e.g. Hunt and Jr, 1972; Tremblay and Ellison, 1979; Ebbing, 1991; West *et al*., 2002; Baudains and Lloyd, 2007).

In this paper, we used the two Ramsar sites (Ain Azzargha and Ain Ashaghigha) as a case study to provide some information on the impacts of human disturbance (collect the sand from the beach and the establishment of passageways) on water birds species existence at the two sites. Comparison between these two sites and Ain- Azziana where there are only fishing activities.

Methods

Data were collected on waterbirds from Ain Azzargha and Ain Ashaghigha for the years 1998 to 2013 (2005-2013 from national winter census; EGA-RAC/SPA, 2012; Bourass *et al*., 2013). For Ain Azziana data were available from 2001 to 2012. Sand collecting sites (SCS) and their passageways at the coastal area of Ain Azzargha and Ain Ashaghigha were observed during the field visits and from the reports of environmental NGO's at the area (Fig. 1, 2). Recreational and fishing activities were reported during birds accounting at Ain Azziana. A linear regression model was fitted to investigate the relationship between numbers of waterbirds and the increase of sand collecting sites.

.**Fig. 1.** Collecting of the sand from the coast of study area

.Fig. 2. Passageway to the sand collecting site at the study area

Study area

Ain Azzargha and Ain Ashaghigha (32º46-47'N,21º21-22'E). Coastal lagoons, covering a few hundred hectares , fed partly by incursions of sea water through channels connecting the site to the sea, but also by springs probably of karstic origin. Situated in the coastal plain below the limestone plateau of the Jebel Akhdar (Fig. 2), and unusual in being surrounded not by sand dunes but by limestone formations. Vegetation on the inland side included extensive fringe of *Tamarix,* with more freshwater-loving plants such as *Juncus* (Defos *et al*. 2001; Azafzaf *et al*. 2005).

Ain Azziana, 32° 12,616 N 20°09,766 E (Fig. 2). A typical coastal sebkha, just north of Benghazi, (about 500 hectares). About half of it has a man-modified direct connection to the sea and shows the features of a lagoon. It is surrounded with extensive saltmarshes of *Arthrocnemum sp*. and bordered with coastal sand dunes in the West. There are beds of macrophytes including *Ruppia sp*. There is one natural connection with the sea; in addition, some small dikes and, apparently, a further artificial connection with the sea were built in a recent past (Defos *et al*. 2001Azafzaf *et al*. 2005).

Fig. 2. Locatlon of the study areas

Results

The present study dealt with total numbers of waterbirds at the three sites for each year during the period of study (table 1). The number of sand collecting sites (SCS) and their passageways at the coastal area of Ain Azzargha and Ain Ashaghigha (about 9 Km) has increased during the recent years up to 14 site (fig. 3).

This study found that the number of waterbirds at Ain Azziana tend to be fluctuated and increased with only normal fishing and some recreational activities such as; walking and picnic around the area. Whilst, the number of birds at Ain Ashaghigha and Ain Azzargha has decreased during the study period (Fig. 4). The results showed that the number of waterbirds was negatively affected by the increase of sand collecting sites (SCS) at Ain Ashaghigha ($r^2 = 0.67$, $t = 9.74$, $p = 0.001$; fig. 5a), and in Ain Azzargha($r^2 = 0.61$, $t = 7.81$, $p = 0.002$; fig. 5b).

Table 1. Numbers of waterbirds at study sites Through the Study Period (1998 - 2013)

Study years	Ain Ashaghigha	Ain Azzargha	Ain Azziana
1998	258	266	*
1999	266	158	*
2000	237	265	*
2001	249	196	310
2002	218	200	270
2005	221	275	452
2006	276	38	960
2007	5	58	1125
2008	*	*	4919
2009	152	53	588
2010	84	82	*
2011	*	*	1235
2012	6	11	2792
2013	0	0	*

Note: *** = No collected data**

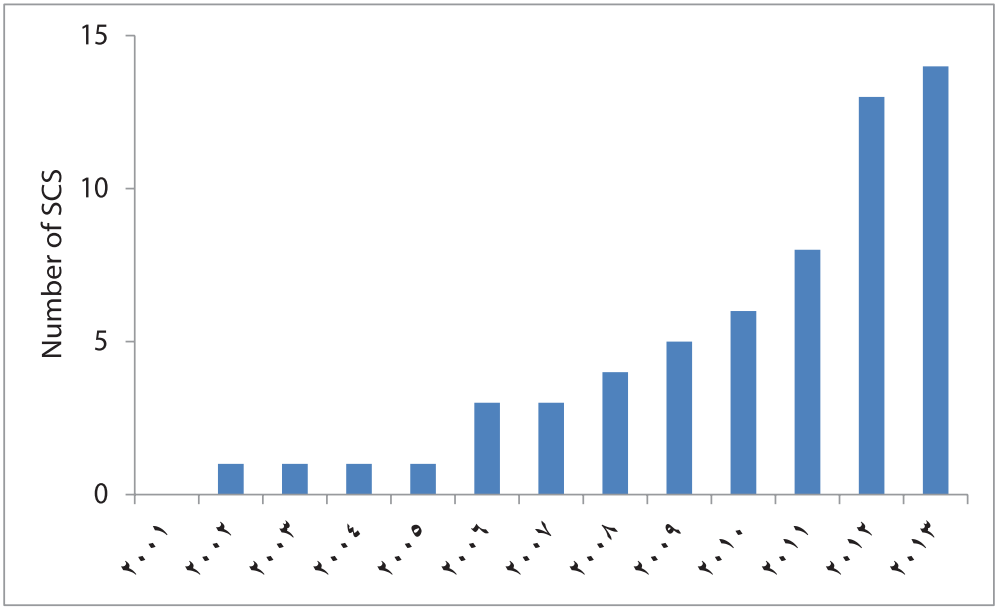


Fig. 3. Number of SCS at the coastal area of study sites throughout the Study years.

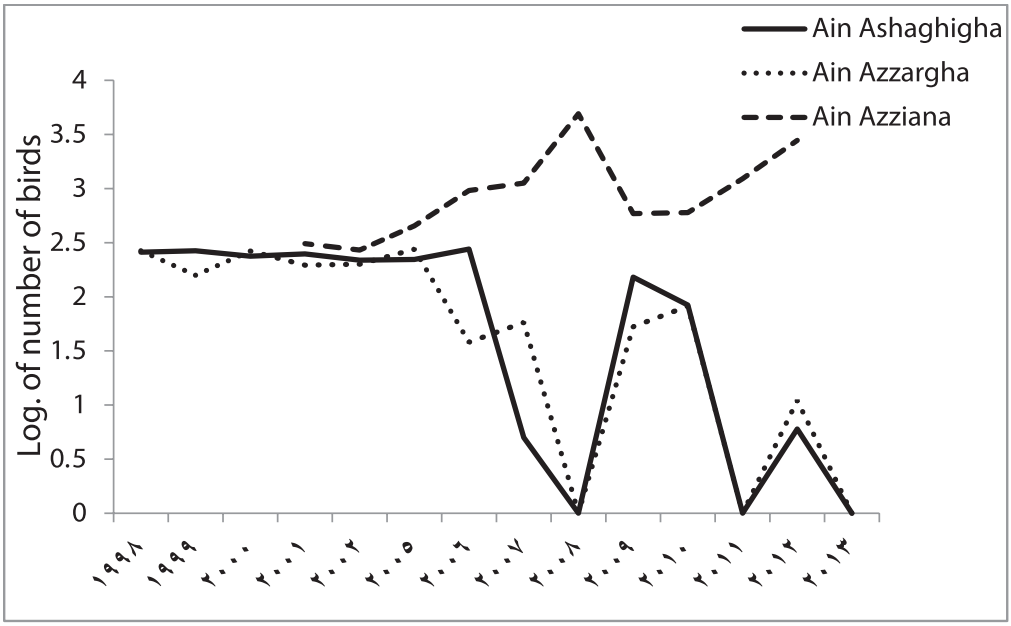
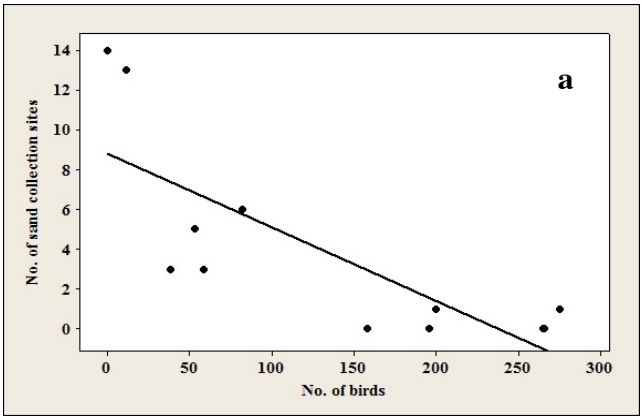


Fig. 4. Population trend of waterbirds in the study areas



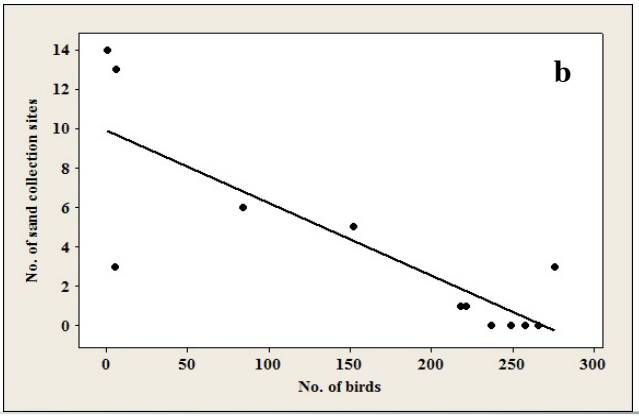


Fig. 5. The relationship between bird numbers and the increase of SCS at Ain Ashaghigha (a) and at Ain Azzargha (b).

Discussion

As a result of habitat destruction due to the changes in natural structure of the coastal area of the two Ramsar sites due to the sand collecting and the establishment of passageways, the number of waterbirds at Ain Ashaghigha and Ain Zarga has decreased with the increase of SCS along the years of study. However, human disturbance is widely regarded as a cause of concern for many species (Baudains and Lloyd, 2007; Holm and Laursen, 2009). Vigilance and movement away from perceived threats are common responses towards human disturbance, although responses obviously differ according to the source of disturbance. Moreover, habitat destruction considered as the most important cause of mortality and exclusion of species. This study investigated the numbers of waterbirds that wintering at Ain Azzargha and Ain Ashaghigha before the establishing of SCS and their tracks at the coastal area during the period from 1998 to 2006. The numbers were stable and fluctuated at the same level (Fig. 4). After that, the number of birds has significantly dropped during the years 2007 and 2008 with the establishing of SCS. Although, there was a recovery in 2009 and 2010 due to a government ban, but, since 2011 this activity has continued and increased due to the absence of the law. This reflects that the impact of habitat destruction on the components of ecosystems is a permanent damage, recovery process is difficult and takes long time. Whilst, the impacts of temporal disturbance can be recovered easier in shorter time (Sheldon *et al*., 2005).

Our study reported the sources of disturbance at Ain Azziana such as; recreational and fishing activities (temporal disturbance) which are not significantly affecting the number of birds at the area. Sutherland (1998) in his review mentioned the impacts of some sources of disturbance for instance, shooting, grazing and roads are varied depending on individuals or population response, these are not necessary causing the disappearance of birds. However, the response to disturbance also varies among species, its maybe affecting their behaviour, abundance or breeding success (Beale and Monaghan, 2005; Ficetola *et al*., 2007). Many species are also known to become habituated to human presence (Møller, 2008), this possibly explain the presence of waterbirds in good numbers at Ain Azziana, despite the existence of

fishing and recreation activities.

Conclusions

Human disturbance is happening at an accelerated speed and it is negatively affecting many bird species. In addition, the changes in ecosystems affecting the migratory bird species in both levels of habitat loss and migration rhythm. The present study showed a significant negative impact of the increase of sand collecting sites on birds numbers at the two Libyan Ramsar sites (Ain Ashaghigha and Ain Azzargha). Whilst, normal fishing and recreational activities have no significant impact on birds numbers at Ain Azziana wetland.

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تأثير الإزعاج بفعل الإنسان على المكونات الحساسة للأراضي الرطبة (الطيور المائية)

دراسة عن الطيور المائية بالمواقع التابعة لإتفاقية رامسار في ليبيا.

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الكلمات المفتاحية:

الملخص

تأثير الإزعاج بفعل الإنسان على الأنظمة البيئية الطبيعية والحياة البرية يعتبر ظاهرة واسعة الإنتشار وتتزايد بسرعة. وعلى نطاق واسع، فإن الإزعاج يعتبر مصدراً للقلق بالنسبة لكثير من الكائنات، بما في ذلك الطيور. الإزعاج يمكن أن يكون سبباً في الوفيات، ويحد من عملية التكاثر كما يؤثر في تحركات الأفراد. هذه الدراسة ركزت على تأثير بعض أنواع الإزعاج على الطيور المائية بمواقع تابعة لاتفاقية رامسار في المنطقة الشرقية لليبيا (عين الزرقاء وعين الشقيقة). حيث أوضحت أن أعداد الطيور المائية قد تأثرت سلبا وبشكل معنوي بزيادة عدد مواقع جرف الرمال (تغيير في البيئة) وحركة الشاحنات. وعلى عكس ذلك، ففي منطقة عين الزيانة لم يسجل تأثير معنوي على أعداد الطيور المائية من جراء عمليات صيد الأسماك والأنشطة الترفيهية الأخرى. ولذلك فإن تغيير البيئات وتدميرها يعتبران من العوامل الرئيسية التي تسبب فقد واختفاء مكونات الأنظمة البيئية الطبيعية.