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# Response behaviour in wintering wigeon (*Mareca penelope*) due to motor/electric boat disturbance: explorative data suggest a recurrent pattern

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**Abstract –** The behavioural response of a wintering focal flock of Wigeon *Mareca penelope* in relation to the periodic passage of the motor/electric boats was studied during an Environmental Impact Assessment. A recurring escape model emerged. At each passage of the boats, birds resting in the fields along the lake banks first flew to the neighbouring waters (averaged escape distance: 116.6 m ± 25.8), then (ii) flew away, (iii) returned in the waters (near the banks) and, finally, (iv) returned in the neighbouring fields. These first data could stimulate further research on the escape behaviour from this anthropogenic disturbance.

**Key-words**: anthropogenic disturbance; escape distance; recurrent escape model; threat analysis.

Waterfowl are sensitive to anthropogenic disturbances (Keller 1991, Galicia & Baldassarre 1997, Burton 2007) and, among them, to motor/electric boats (Korschgen & Dahlgren 1992, Mori et al. 2001, Scarton 2018a, 2018b, Mayer et al. 2019). From a conservation perspective, it is important to assess the role of these types of disturbances that may adversely affect energy reserves of wintering waterfowl, which, in turn, may affect their nesting success, fecundity, and survival in breeding period (Pease et al. 2005). However, data from the Mediterranean are still scanty.

In February 2020 a bathymetric-morphological survey was carried out in the Lake Martignano (central Italy), an important wintering site (Special Protection Area IT6030085) for waterbirds of conservation concern (e.g. Red-crested pochard *Netta rufina*; Bernoni 2009, Baldi et al. 2018, Bernoni et al. 2019; Wigeon, *Mareca penelope*; for which the lake represent a wintering site of national importance; Baccetti et al. 2002, Brunelli et al. 2004).

This survey used a motor boat followed by a second electric-powered boat (linked to the first boat with a flexible cable, 5 meters long). In this last boat, there was an EchoBoat-ASVTM detection platform for hydrographic survey applications (Multi Beam Echo Sounder system installed onboard an Autonomous Surface Vehicle). It was involved in the mapping of the lake by bordering the banks carrying out concentric navigation, repeated three times in the same day consecutively (20 February 2020), at low speed.

Given that the banks of the lake are resting site for wintering waterfowls of conservation concern (147/2009 "Bird" EU Directive), an Environmental Impact Assessment procedure has been started. In this regard, a standardized survey from a fixed observation point, located along the north-western side of the lake (42° 07' 05.7" N, 12°18'28.6" E), was carried out. It was focused on monitoring the response of a wintering focal flock of Wigeon and, secondarily, of Red-crested pochard, in relation to the periodic passage both of the motor/electric boats (approx. once every hour). This circumstance allowed to collect preliminary data on this disturbance in relatively controlled conditions (constant duration, frequency, and intensity of the threat; no other human-induced disturbances being present).

Regarding the focal flock of Wigeon, located on the north-western side of the lake (approx. 280 individuals), the behaviour of birds was observed, according to the following categories: (i) resting in the fields (these last located neighbouring, on the border of the lake: 10-50 m from the waters), (ii) moving from fields toward the neighbouring waters; (iii) escape flight (toward other sides of lake); (iv) return to the water near the fields (lake banks); (v) return to the neighbouring fields. The timing was recorded for each periodic passage of the motor/electric boats. The

 

**Table 1**. Timing of relationship between recurrent disturbance events (motor/electric boats) and Wigeon's responses (north-western side of Martignano lake, central Italy; n = 3 passages).

| | | I boat passage | | | | II boat passage | | | | | III boat passage | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Timing** | 08:00-9.00 | 09.10 | 09.15 | 09.24 | 09.36 | 10.00 | 10.55 | 11.00 | 11.25-11.40 | 11.45 | 11.52 | 12.01 | 12.03 | 12.21 | 12.25 |
| **Disturbance event (boats)** | | *progressive approach* | | *move away* | | | *progressive approach* | | *move away* | | | *progressive approach* | | *move away* | |
| **Wigeon's status and response** | | | | | | | | | | | | | | | |
| *resting in the fields* | ■ | | | | | ■ | | | | | ■ | | | | |
| *moving to the water* | | ■ | | | | | ■ | | | | | ■ | | | |
| *escape flight* | | | ■ | | | | | ■ | | | | | ■ | | |
| *return near the fields (lake banks)* | | | | ■ | | | | | ■ | | | | | ■ | |
| *return to the fields* | | | | | ■ | | | | | ■ | | | | | ■ |

minimum distance between the birds and the motor/electric boats (escape distance, with an approximation of ± 50 m; measured by Google Earth software) was also recorded, also for a neighbouring flock of Red-crested pochard (approx. 300 individuals), wintering on the eastern sector of the lake. The research effort was 13 hours, including occasional observations.

Whenever the boats approached flocks, birds flew away toward other areas of the lake. For Wigeons the escape distance was 116.6 m (± 25.8; range: 100-150 m; n = 6 events), lower than that observed for Red-crested pochard (266.7 m ± 76.4; range: 200 - 350 m; n = 3 events), apparently this latter being more sensitive.

A recurring escape model has been found in the Wigeons. At each passage of the boats, Wigeons resting in the fields along the lake banks first flew to the neighbouring waters (after 6, 21 and 16 minutes respectively), then (ii) flew away, (iii) returned in the waters and, (iv) returned in the neighbouring fields on lake banks (after 8, 12 and 4 minutes; Tab. 1).

Although these explorative data are based only on a limited number of replications, they could suggest a recurring behavioural pattern, needing to be explored in other circumstances with more representative records. For example, there may be a threshold in terms of the intensity, duration and frequency of disturbance events beyond which the response of the animals could be not more reversible.

The flight escape in Wigeons has been studied in relation to pedestrian and recreational disturbance (e.g. Tuite et al. 1983, Laursen et al. 2005, Bregnballe et al. 2009), but data about the role of motor/electric boats are scant. Therefore, these data could stimulate further research testing the impact on the behavioural pattern of waterfowls of this largely diffused human-induced disturbance (also using a threat analysis approach: e.g., Salafsky et al. 2008; Battisti et al. 2016).

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