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Short communication

Presence of plastic particles in waterbirds faeces collected in Spanish lakes☆

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ABSTRACT

Plastic intake by marine vertebrates has been widely reported, but information about its presence in continental waterfowl is scarce. Here we analyzed faeces of waterbirds species (European coot, *Fulica atra*, mallard, *Anas platyrhynchos* and shelduck, *Tadorna tadorna*) for plastic debris in five wetlands in Central Spain. We collected 89 faeces of shelduck distributed in four lakes, 43.8% of them presented plastic remnants. Sixty percent of 10 faeces of European coot and 45% of 40 faeces of mallard contained plastic debris. Plastic debris found was of two types, threads and fragments, and were identified as remnants of plastic objects used in agricultural fields surrounding the lakes. Differences in prevalence of plastic in faeces, number of plastic pieces per excrement and size of the plastic pieces were not statistically significant between waterfowl species. Thus, our results suggest that plastic may also be frequently ingested by waterfowl in continental waters, at least in our study area. Future studies should address this potential problem for waterbird conservation in other wetlands to evaluate the real impact of this pollutant on waterbirds living in inland water.

1. Introduction

Plastic pollution is a major emerging environmental problem (UNEP, 2011), whose effect has been studied mainly in marine environments (Derraik, 2002; Tourinho et al., 2010; Andrady, 2011; Ivar do Sul and Costa, 2014). Global plastic production has increased rapidly since mass production began in the 1950s and currently exceeds 311 million tons per year (PlasticsEurope, 2015). An estimated 10% of this plastic ends up in oceans (Thompson, 2007). Eriksen et al. (2014) estimate a minimum of 5.25 trillion plastic particles, weighing 268,940 tons, to be floating in the world's oceans. Hundreds of species have been affected, including marine mammals (Madeira Di Benedito and Arruda Ramos, 2014), seabirds (Brandão et al., 2011; Provencher et al., 2014), sea turtles (Bugoni et al., 2001; Tomás et al., 2002; Schuyler et al., 2013), fish (Boerger et al., 2010; Carson, 2013), benthic biota and plankton (Laist, 1987; Cole et al., 2011).

In the last few years, many studies have shown how this problem affects birds (Rohstein, 1973; Watanuki, 1985; Brandão et al., 2011; van Franeker et al., 2011; Bond and Lavers, 2013; Provencher et al., 2014; Gall and Thompson, 2015). Plastic debris has been found to be ingested in more than half the world's 300 seabird species (Vlietstra and Parga, 2002; Moore, 2008; Gall and Thompson, 2015). Spear et al. (1995) reported a negative relationship between plastic ingestion and physical condition in seabirds. Rochman et al. (2016) in a recent review of the evidence of the ecological consequences of marine debris found that most (89%) of the demonstrated impacts were at suborganismal level of organization and were due to plastic debris. They conclude that, despite the deficiencies detected in some studies, there is sufficient

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evidence to begin to mitigate the plastic effects to avoid future risks. The potential effects of plastic consumption on seabirds include: internal and external wounds, blocked digestive tract, impaired feeding capacity, reduced reproductive capacity, and poisoning from absorbed toxic compounds (Gregory, 2009). Plastic debris can have deleterious effects on seabirds' health (Provencher et al., 2010). Seabird populations stressed by changing environmental conditions and reduced prey abundances may be more vulnerable to the negative impacts of plastics (Tanaka et al., 2010). Several researchers have even show seabirds to be biomonitors of plastic pollution (Ryan, 2008).

Information about the incidence of remains of plastics in the stomach of waterfowl and other species living in wetlands is apparently lacking (Provencher et al., 2015; Wagner et al., 2014; but see English et al., 2015), despite plastic debris being also present in some wetlands. Microplastic and coal ash have been observed in the Laurentian Great Lakes of the United States, and in Lake Hovsgol of Mongolia (Eriksen et al., 2013; Free et al., 2014). Gasperi et al. (2014) report that 27 tons of floating plastic debris are intercepted annually in the River Seine, which correspond to 2.3 g per Parisian inhabitant/year. Such data could serve to provide a preliminary evaluation of floating plastic inputs conveyed by rivers.

As data on the effect of plastic debris on waterfowl are lacking, the aim of this paper is to publicise the first evidence of plastic ingestion by the shelduck *Tadorna tadorna*, categorised as near to threatened among Spanish bird species (Robledano, 2004), mallard (*Anas plathyrhynchos*) and European coot (*Fulica atra*).

2. Methods

We collected faeces from wetlands spread through the provinces of Cuenca (Manjavacas: 39° 25′ N, 2° 51′ W; Dehesilla: 39° 26′ N, 2° 50′ W), Ciudad Real (Alcahozo: 39° 23′ N, 2° 52'W; Camino de Villafranca: 39° 25'N, 3° 20′ W) and Toledo (Grande de Villafranca: 39° 27′ N, 3° 20′ W; Mermejuela: 39° 32′ N, 3° 8′W), which cover most of La Mancha Húmeda Biosphere Reserve (Fig. 1). More information about the study area can be found in Florín et al. (1993) and Peinado and Gosálvez (2007).

We collected 89 fresh shelduck faeces between December 2013 and April 2015 in four lakes: Alcahozo (1), Dehesilla (10), Mermejuela (11), and Manjavacas (67). Forty fresh mallard faeces were collected in October 2013 and April 2014 in Manjavacas and 10 fresh faeces of European coot in March 2014 in Grande de Villafranca Lake. To collect faeces we search for monospecific flocks resting in particular sectors of the shore or islands that presented bare soil and were frequented by these species. We waited 30–45 min and then approached the flock, which left the resting place. We collected a sample of fresh faeces scattered through the area occupied by the flock to minimize the probability of collecting several faeces from the same individual. Size of the flocks sampled ranged between 6 (shelduck in Mermejuela lake) to 1308 (Mallard). We carefully removed the faeces from the ground, with a spatula avoiding including in the sample ground particles.

Collected faeces were placed in paper bags, dried at room temperature, weighted and then frozen. We disaggregated each faeces in water, using tweezers and a mounted needle, and they were analyzed by mean a binocular magnifying glass. Plastic remains were assigned to the categories described by van Franeker et al. (2011) and their colour was also registered. Samples of abandoned plastic on cereal cultures and vineyard land were obtained to identify the plastic remains occurring in the faeces. Prevalence was computed as the proportion of faeces analyzed that contained plastics. We compared the prevalence of plastic in faeces between lakes (only shelduck data) and among species using

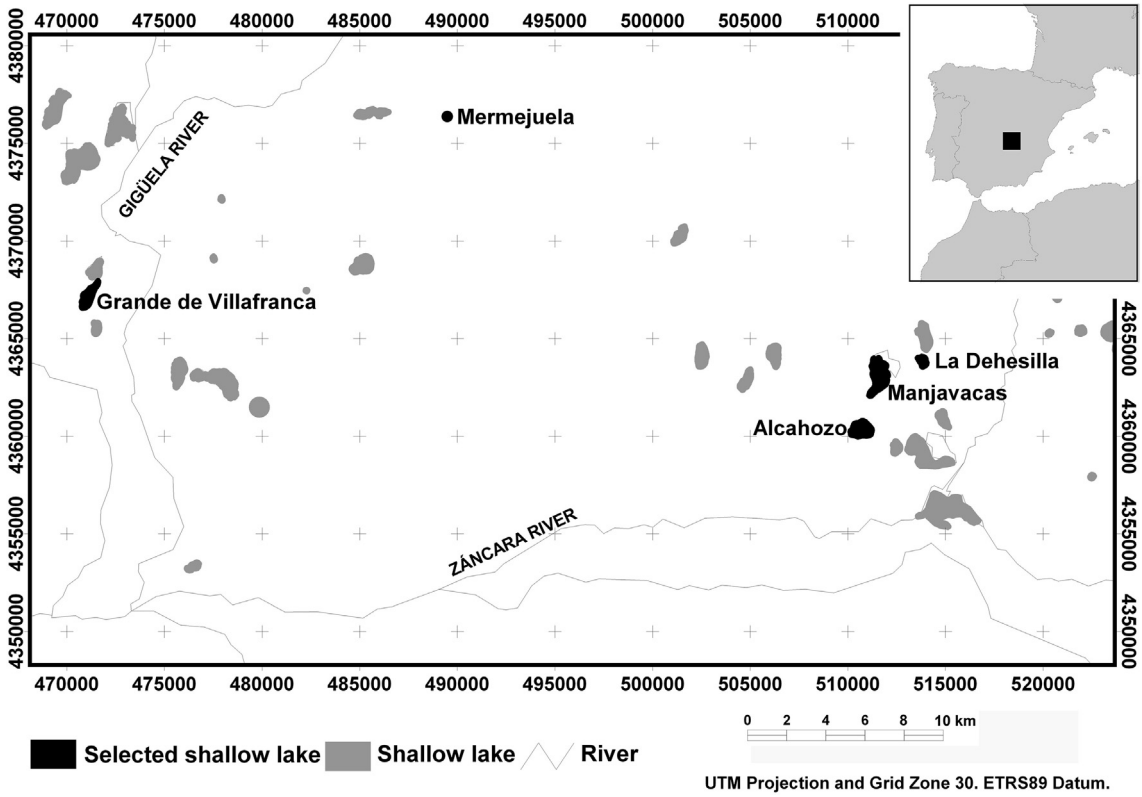

Fig. 1. Location of the studied lakes (black) in Central Spain.