EVIDENCE OF KRILL IN THE DIET OF BALEARIC SHEARWATERS *PUFFINUS MAURETANICUS*

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Seabird diets are generally composed of a few major taxa such as pelagic fish, squid and crustaceans (Shealer 2002), with small pelagic fish being the main foraging resource in temperate regions (Furness & Monaghan 1987). This is also true for the critically endangered Balearic Shearwater *Puffinus mauretanicus*. Its diet includes small pelagic fish and demersal fish obtained from trawling discards (Gutiérrez & Figuerola 1995, Arcos & Oro 2002, Louzao *et al.* 2006b, Käkelä *et al*. 2010). Direct observations at sea determined that this species also feeds on plankton, although the species of plankton have not been identified (Arcos *et al.* 2000, Arcos & Oro 2002). In this study, we report observations that, during breeding season, the diet of the endemic Balearic Shearwater includes macrozooplankton, specifically the krill *Nyctiphanes couchii*.

METHODS

We monitored the breeding population of Balearic Shearwaters located in the south of Sa Conillera Island (southwest of Ibiza Island in the Mediterranean Sea) during the chick-rearing period (May) of 2013. Sa Conillera Island is part of the protected area *Reserves Naturals des Vedrà, es Vedranell i els Illots de Ponent*, where approximately 400 breeding pairs of Balearic Shearwater nest (Arcos 2011). The chick-rearing period starts in late April and can last until early July (Ruiz & Martí 2004, Louzao *et al*. 2006b). During this period, adults visit the colony to feed their young during the night. In May 2013, we collected a Balearic Shearwater regurgitation, which contained crustaceans only (Fig. 1), and we preserved the sample in 70% ethanol. Body length measurements of the prey were taken using a Nikon AZ100 microscope (10× magnification) fitted with a Nikon DS-Fi1 camera and NIS-Elements software.

Fig. 1. Regurgitation from a Balearic Shearwater obtained in May 2013, composed solely of *Nyctiphanes couchii* (Photo by M. Louzao).

RESULTS AND DISCUSSION

The entire regurgitation was composed of the euphausiid *Nyctiphanes couchii*. A subsample of this material was deposited in the Biological Reference Collections (CBR) of the Institut de Ciències del Mar (CSIC), Barcelona (reference code ICMR000001).

We measured both the total and cephalothorax length of 100 individuals in the sample (Fig. 2). The mean total length was 14.36 mm ± 1.73 mm (SD), ranging from 11.26 mm to 18.27 mm, and the mean cephalothorax length was 4.09 mm ± 0.55 mm (SD), ranging from 3.27 mm to 5.76 mm. Both measurements were positively related ($y = 0.268 + 0.265 * x$, $F_{1,83} = 215.6$, $P > 0.001$, R^2-adjusted = 0.718). Based on the characteristics of the related *N. australis* (Ross & Quetin 2000), all individuals were adults.

This is the first evidence that Balearic Shearwaters feed on krill during the breeding season (chick-rearing), a period when the species forages in productive waters of the continental shelf of the western Mediterranean (Louzao *et al*. 2006a, 2012; Arcos *et al*. 2012). According to previous studies, the diet of the chicks consisted mainly of anchovies, a high-energy source (Navarro *et al.* 2009).

In the Mediterranean, euphausiids are most abundant in waters of the continental slope deeper than 200 m, and at night they perform diel vertical migrations that reach the sea surface (Wiebe & D'Abramo 1972). During this period, this species could be accessible to Balearic Shearwaters, which are able to dive to 26 m depth (Aguilar *et al.* 2003). Among krill species, *Meganyctiphanes norvegica* is the most abundant species found in the deeper waters over Mediterranean continental slopes, while *N. couchii* is generally restricted to the continental shelf (Lindley 1982). The habitat of Balearic Shearwaters matches the distribution of *N. couchii* (Louzao *et al*. 2006a, 2012), and the birds have been observed feeding on unidentified zooplankton (Arcos *et al.* 2000, Arcos & Oro 2002).

Further research in needed to accurately assess the importance of euphausiids in the diet of the Balearic Shearwater. However, given that this species is critically endangered, i.e. very few birds remain, it does not lend itself to intensive research. Thus, opportunistic observations, such as the present study, are very important in learning more about the natural history of this species.

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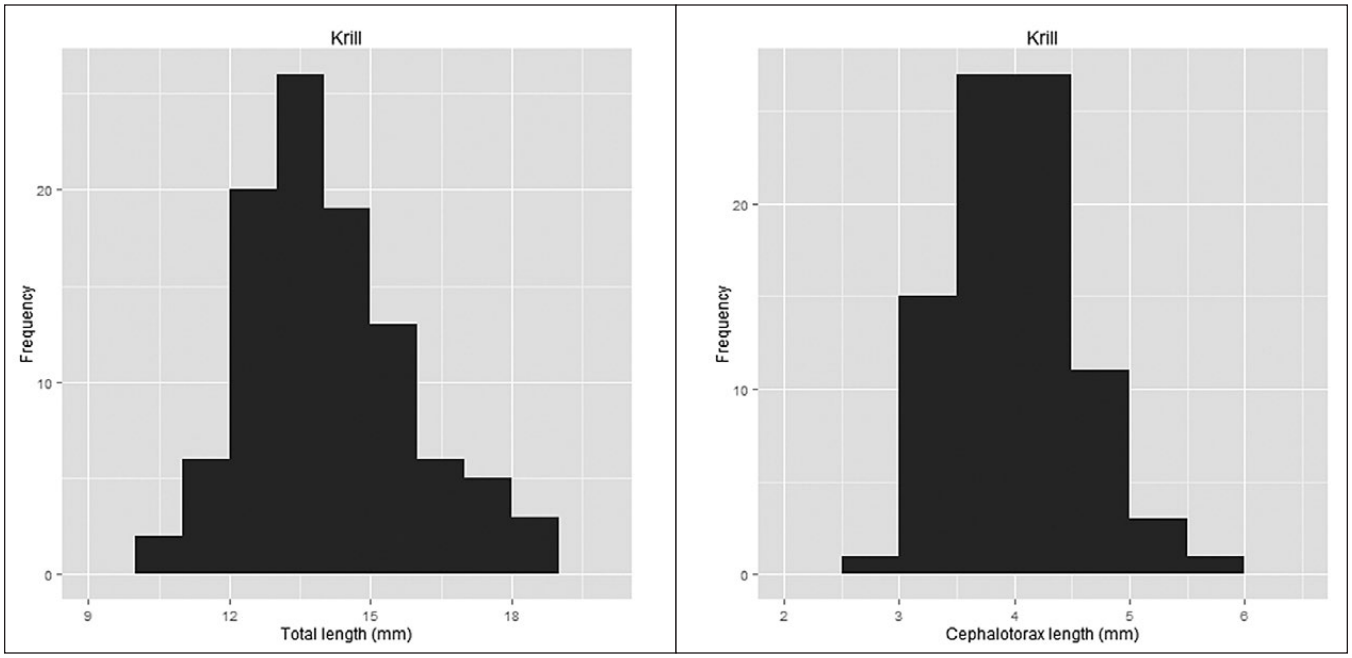

Fig. 2. Histogram of *Nyctiphanes couchii* measurements: total length and cephalothorax length (mm) were taken from the Balearic Shearwater regurgitation in Fig. 1.

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