

First records from the Mediterranean of a Sooty Shearwater *Ardenna grisea* caught accidentally by a surface longline

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Bycatches of seabirds in Mediterranean fisheries threaten not only the most abundant species but also species that are only occasional. Here, we provide the first two records of accidental catches of Sooty Shearwater *Ardenna grisea* on a surface longline in the Mediterranean. The shearwaters were caught in April 2015 (dead) and December 2017 (alive) south off Tarragona, Spain, over the continental shelf. The dead specimen was a young male, as indicated by the testes and bursa of Fabricius examined during necropsy. The live bird could not be aged, although its biometry suggests that it too was a male. Interactions between Sooty Shearwaters and Mediterranean longline fisheries are exceptional events that, *a priori*, probably only have a low global impact on the conservation of this species. However, could be of relevance given that this species is in decline and is catalogued as Near Threatened by the IUCN.

Key words: Sooty Shearwater, *Ardenna grisea*, seabird bycatches, longline fisheries, Procellariiformes, Mediterranean Sea.

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Received: 20.10.17; Accepted: 13.02.18 / Edited by O. Gordo

Bycatches are relevant to seabird conservation throughout the world (Anderson *et al.* 2011, Croxall *et al.* 2012) and affect many species in the Mediterranean Sea, including residents such as Scopoli's *Calonectris diomedea* and Balearic *Puffinus mauretanicus* Shearwaters, as well as Yellow-Legged *Larus michahellis* and Audouin's *Ichthyæetus audouinii* gulls. The negative impact of fisheries on seabird populations is particularly significant in the case of Procellariiformes given their life history traits (Tuck *et al.* 2001, Anderson *et al.* 2011, Genovart *et al.* 2017). In the Mediterranean, bycatches of these species occur mainly on demersal and surface longlines (Sánchez & Belda 2003, García-Barcelona *et al.* 2010a) and all the endemic shearwater species that coexist in the Mediterranean Sea – Scopoli's, Balearic and Yelkouan *Puffinus yelkouan*

Shearwaters (Zotier *et al.* 1999) – are affected. The most abundant seabird species bycaught by surface longliners is Scopoli's Shearwater (García-Barcelona *et al.* 2016); on the other hand, demersal longliners catch both Scopoli's and Balearic/Yelkouan shearwaters in differing proportions depending on the region, fishing grounds and season (Cortés *et al.* 2017).

Some species of shearwaters with extra-Mediterranean distributions occasionally enter this basin, usually on their own but also in the company of other species. The Sooty Shearwater *Ardenna grisea* breeds on several islands in the Southern Hemisphere and migrates into the Northern Hemisphere across the Atlantic and Pacific oceans (Warham *et al.* 1982). Although a common-to-abundant autumn migrant along the northern Iberian coast in July-November, it is

very rare in the Mediterranean (Paterson 1997). Nevertheless, despite the fact that the number of observations from the Mediterranean has increased significantly compared to observations from the twentieth century (Oliosio 2015), no bycatch of this species has ever been reported in any type of fishery in the Mediterranean until now. In this article, we report the first bycatch of Sooty Shearwaters with a surface longline in the Mediterranean and provide details of the circumstances of these events and the characteristics of the involved individuals.

Materials and methods

Since 1996, the Spanish Institute of Oceanography performs an on-board observation program for surface longline fisheries in the Mediterranean that meets the requirements of regional fishery management organisations (RFMOs) such as the International Commission for the Conservation of Atlantic Tunas (ICCAT). This program aims to complete a representative sampling of the effort and catches of fleets using all the various modalities of longline. During this observation program, two catches of Sooty Shearwaters were recorded.

Following van Franeker (2004), the dead birds were frozen (-18°C) for necropsy in the laboratory to determine their age and sex through the inspection and measurement of their sexual organs. As well, to distinguish juvenile and immature birds from adults the presence and size of the bursa of Fabricius was used (Broughton 1994). Live birds were ringed and released if possible.

For future determination of the sex of Sooty Shearwater using biometrics, we recorded the typical biometric measures: culmen length (from the bill-tip to feathering); head and culmen length (from the bill-tip to the lump of the supraoccipital region of the skull); bill depth at the base of the bill; bill depth at nostril (distal edge of nares); bill depth at gonys; minimum bill depth (minimum distance between upper and lower parts of the rhamphotheca); right tarsus length (from the middle tarsal joint to the distal length of the tarsometatarsus of the right leg); and right wing length (from the carpal joint to the tip of the longest primary feather – P10 – of the right-hand wing). All measurements were taken using

a digital calliper (accuracy ± 0.1 mm), except wing length, which was measured using a ruler (± 1 mm). The two birds were measured by different people (the researcher in the laboratory and the observer on the fishing vessel).

Results

The first bycatch occurred on 23 April 2015 when setting a longline over the continental shelf 19 miles southeast of Tarragona, to the north of the Ebro Delta (NE Spain). The surface longline was targeting albacore and small tunas. For more information about the characteristics of this type of fishing gear, see García-Barcelona *et al.* (2010a). An observer from the Spanish Institute of Oceanography collected the carcass when the vessel docked in its homeport of Castellón. The shearwater was identified as a young male due to the presence of very small, thin dark-coloured testes (Figure 1A; Table 1, Van Franeker 2004) and of the bursa of Fabricius (Figure 1B) (Siegel-Causey 1990). The small size of the bursa (Table 1) suggest that it was a second-year bird (van Franeker 2004). Another feature suggestive of a young age were the slightly paler edges to the lower mandible (Onley & Scofield 2007). The feathers reflected strong natural wear, being in general very brownish with deteriorated edges. All primary feathers were old and hence the moult score was 0 (Ashmole 1962). The cause of death was probably due to internal haemorrhaging caused by the hook.

The second event occurred on 23 December

Table 1. Biometry of the Sooty Shearwater caught in April 2015.

Biometria de la baldriga grisa capturada l'abril de 2015.

Measure	Biometry (mm)
Right tarsus length	56.3
Head + bill length	97.7
Culmen	43.1
Minimum bill depth	8.6
Bill depth at gonys	10
Bill depth at base	14.65
Bill depth at nostrils	8.2
Right wing length	295
Right testis size	4.7 x 2.2
Left testis size	5.1 x 2.55
Bursa of Fabricius size	7.7 x 7.45

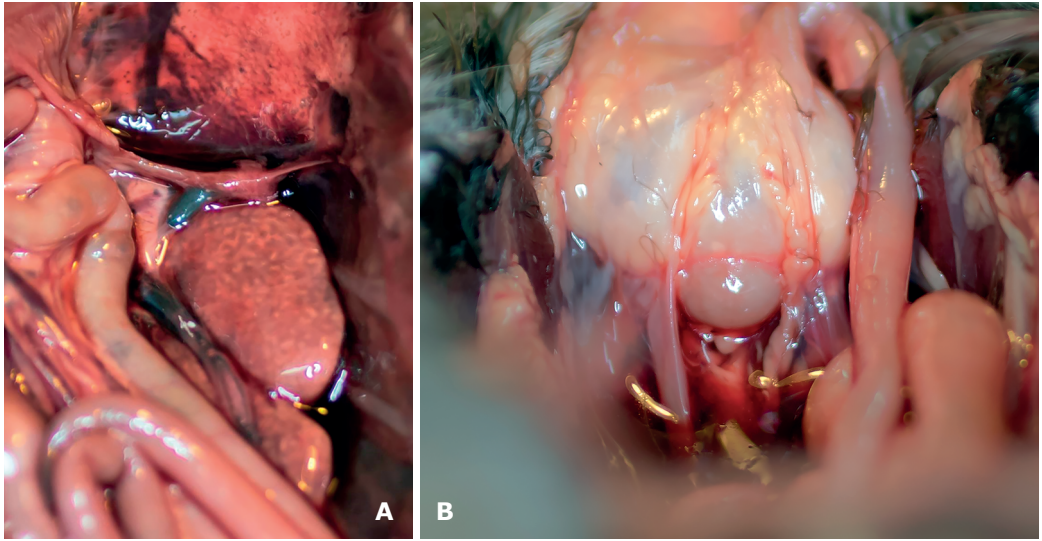


Figure 1. Left testis of the Sooty Shearwater caught in April 2015 (A) and bursa of Fabricius (B).
Testicle esquerra de la baldrigra grisa capturada l'abril de 2015 (A) i bossa de Fabrici (B).

2017, also during line setting, with the same type of gear, this time approximately 10 miles south of Tarragona. A scientific observer was on board and handled the bird, which was alive and in good condition despite having swallowed the hook (presumably in the oesophagus). It was marked with a metal ring (ICONA 6221640) and released alive in the same place a few minutes later. This Sooty Shearwater was therefore the first ever to be ringed in the Mediterranean Sea. A few studies have attempted to separate sexes in Procellariiformes using morphometric measures and/or molecular analyses. Bull *et al.* (2005) only found sexual size dimorphism in the bill-depths of some *Puffinus* species, including the Sooty Shearwater (bills in males are deeper).

Table 2. Comparison of Sooty Shearwater bill sizes between Bull *et al.* (2005) (n = 247), Bugoni & Furness (2009) (n = 2) and the bird caught in December 2017. *Comparació dels becs de les baldrigues grises entre Bull et al. (2005) (n = 247), Bugoni & Furness (2009) (n = 2) i l'exemplar capturat al desembre de 2017.*

Reference	Sex	Culmen	Bill depth at base
Bull <i>et al.</i>	♂	42.02	13.44
	♀	40.64	13.08
Bugoni & Furness	♂	44.4	14.7
	♀	42	14.4
This study		44	17

Bugoni & Furness (2009) report similar findings in two specimens caught off Brazil. Thus, taking into account this SSD, we believe that our individual was a male. A comparison of bill measures obtained by Bull *et al.* (2005), Bugoni & Furness (2009) and those of our specimen is given in Table 2.

Discussion

The Sooty Shearwater is in decline and catalogued as Near Threatened by the IUCN (BirdLife International 2017). Bycatches of Sooty Shearwaters have previously been documented in the Pacific and Atlantic Oceans from set nets, trawlers, longlines and purse-seines (Robertson *et al.* 2003, Uhlmann & Jeschke 2011). Therefore, bycatching could be a conservation threat to this species.

This species migrates southwards on its pre-nuptial migration through the eastern Atlantic in August–October (Cramp & Simmons 1977), which is when it comes closest to the coasts of the Iberian Peninsula. Interestingly, however, most records in the western Mediterranean are from March–May (Paterson 1997, Olioso 2015), as is the case of our first observation. Brown (1988) and Cooper (1991) remark that the North Atlantic Sooty Shearwater population

could be composed mostly of young and immature birds, although this issue has not yet been resolved (Keijl 2011). According to the details given by Brown (1988) and Cooper (1991), our first specimen was a young bird. We could not determine the age of the second Sooty Shearwater.

Olioso (2015) has remarked that Sooty Shearwaters may join groups of other shearwaters in the Mediterranean and it is possible that our specimen accompanied individuals of other species with coastal habits (such as the Balearic Shearwater) in their search for food as it can be also a rather coastal shearwater (Adams *et al.* 2012). It has been reported in the western Mediterranean that Balearic Shearwaters regularly follow fishing vessels, mainly trawlers, and obtain food from discards (Arcos & Oro 2002). However, in the absence of trawlers (i.e. on non-working days) shearwaters may compensate for the lack of discards by feeding on longline baits (García-Barcelona 2010b, Laneri *et al.* 2010). April 23 2015 (the date of the first Sooty Shearwater bycatch) was a public holiday in Catalonia (St. George's Day) and the trawlers stayed in the port, thereby increasing the probabilities of a bycatch on longline fisheries. Furthermore, the second Sooty Shearwater was caught on a Saturday, a day that trawlers and purse seiners do not work in the Mediterranean. Therefore, fishing vessel activities may be relevant to the bycatch probability of seabirds.

The surface longline involved in the second bycatch was targeting albacore and small tunas. This type of gear floats very close to the surface and only spend a few hours drifting; it usually has just 5–10 hooks placed close together between buoys. These characteristics may help keep a larger percentage of captured seabirds alive than other longline modalities (García-Barcelona *et al.* 2017), as in the case of the second Sooty Shearwater reported here. Two main factors contribute to the survival of birds caught in longlines. First, the presence of fish caught on the hooks that are closest to the longline; these fish swim toward deeper waters, thereby submerging the longline as they swim and drowning birds. Second, is the position of the hook in relation to the buoy. Survival is greater when birds are hooked closer to buoys and consequently nearer the surface. In addition, the diving capacity of Sooty Shearwaters may prevent them from choking. The caught bird could not be landed and, as it was alive, it was

ringed and so in the future information may be obtained regarding its survival.

Until the capture of the first individual, only 62 Sooty Shearwaters had ever been reported in the western Mediterranean (Olioso 2015). Although the second individual is another relevant record for this scarce species, we do not know with certainty the number of total sightings in 2016 and 2017 in the western Mediterranean, which may in fact be notable (e.g. five sightings just for Catalonia, four in 2017; www.ornitho.cat). Therefore, due to the low numbers of Sooty Shearwaters entering the Mediterranean, any interaction with longline fisheries will be anecdotal and unlikely to have any serious global impact on its conservation. However, if the species begins to frequent the area more often (e.g. due to climate change), bycatch events could become a threat to this shearwater.

Long-term monitoring of longline fisheries could provide more information on these incidences and on the occurrence or even arrival of new or occasional species such as the Sooty Shearwater in the western Mediterranean.

Acknowledgements

To all the crew of the vessel *Kranki*, for their generosity and altruism in their collaboration with the Spanish Institute of Oceanography, and to Ricard Gutiérrez for facilitating the Sooty Shearwater sightings from www.ornitho.cat. We would also like to thank two anonymous referees and the editor for their comments that greatly improved this manuscript.

Resum

Primers registres de captures accidentals de baldriga grisa *Ardenna grisea* per palangres de superfície a la Mediterrània

Les captures accidentals d'aus marines a les pesqueries de la Mediterrània poden afectar no només les espècies més abundants en aquesta regió, sinó també espècies ocasionals, les quals també estan exposades a aquesta amenaça. En aquest estudi donem a conèixer els primers casos de captura accidental de baldriga grisa *Ardenna grisea* en palangre de superfície a la Mediterrània. Les aus es van capturar l'abril de 2015 (morta) i desembre de 2017 (viva) en aigües al sud de Tarragona, sobre la plataforma continental. L'individu mort era un mascle probablement de segon any, en base a la presència i característiques dels testicles i la

bossa de Fabrici observats durant la seva necropsia. L'exemplar viu no es va poder datar i la seva biometria sembla indicar que també era un mascle. Tot i que la interacció d'exemplars d'aquesta espècie amb les pesqueres de palangre de la Mediterrània són esdeveniments excepcionals que han de tenir a priori un baix impacte global en la conservació de l'espècie, no deixen de ser rellevants per a una espècie en declivi i catalogada com Gairebé Amenaçada per la UICN.

Resumen

Primeros registros de capturas accidentales de pardela sombría *Ardenna grisea* por palangres de superficie en el Mediterráneo

Las capturas accidentales de aves marinas en las pesquerías del Mediterráneo pueden afectar no solamente a las especies más abundantes en esta región, sino también a especies ocasionales, las cuales también están expuestas a esta amenaza. En este estudio damos a conocer los primeros casos de captura accidental de pardela sombría *Ardenna grisea* en palangre de superficie en el Mar Mediterráneo. Las aves fueron capturadas en abril de 2015 (muerta) y en diciembre de 2017 (viva) en aguas al sur de Tarragona, España, sobre la plataforma continental. El ejemplar muerto fue un macho probablemente de segundo año, en base a la presencia y características de testículos y bolsa de Fabricio observadas durante su necropsia. El ejemplar vivo no se pudo datar y por su biometría también pudo ser un macho. Aunque la interacción de ejemplares de esta especie con las pesquerías de palangre del Mediterráneo son eventos excepcionales que deben tener a priori un bajo impacto global en la conservación de la especie, no dejan de ser relevantes para una especie en declive y catalogada como Casi Amenazada por la UICN.

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