INTRODUCTION

The Sooty Shearwater Puffinus griseus is one of the most numerous seabirds in the world, with an estimated population over 20 million (Reyes-Arriagada et al. 2007). Its population is decreasing globally because of the impact of fisheries, harvesting of its young and probably climate change, leading to a “near-threatened” status on the IUCN Red List (Birdlife International 2000). It is a transequatorial migrant from the southern hemisphere, breeding largely on islands around New Zealand and Chile (Reyes-Arriagada et al. 2007, Warham et al. 1982), continental New Zealand, Australia (Lane and White 1983) and islands in the vicinity of Cape Horn and the Falkland Islands (Reyes-Arriagada et al. 2007). From May to September, during the austral winter, it occurs mainly in the northern hemisphere. In the Pacific, the Sooty Shearwater occurs offshore from California, where flocks from 1000 to 20 000 birds were regularly encountered (Briggs and Chu 1986), as well as on the Aleutian Islands and Japan (Shaffer et al. 2006). In the North Atlantic, it is found from Newfoundland to the British Isles. Some also winter in the Benguela Current off South Africa, where a few remain during the breeding season (Philips 1962, Cooper et al. 1991). This paper reports the sighting in early October 2007 of almost 2000 of these birds from an offshore platform off Gabon, West Central Africa, outside of previously known migration routes for this species.

METHODS

Birds were observed from the helideck of an offshore drilling platform 30 m above the sea level, providing an excellent 300° view within a radius of 3 km around the platform using 10 × 25 Leica binoculars. On this type of platform, the helideck is oriented against the prevailing winds for safety reasons, and is off-centre and higher than the platform body. In this case, the helideck was oriented towards the north, the origin of all the Sooty Shearwaters observed during this period.

The platform used for observation (00°53’S, 08°39’E) was located 15 km away from the nearest coastline, and roughly 20 km south of Cape Lopez, the westernmost point of Gabon (Fig. 1). Sooty Shearwaters were observed for a total of 36 hours, usually from 06h30 to 09h30 daily between 1 October and 18 October 2007. Data were collected every minute and summed in 15 min intervals. Observations were terminated whenever a decline in numbers was noticed during two successive 15 min intervals after 08h30. On 10 and 12 October observations ceased earlier than 08h30. Throughout the observation period, the weather was usually rather calm with a moderate wind and little swell. The wind was stronger on the two first days and on 11 October, whereas the swell increased from 1 m to 2 m during 10–14 October. The sky was generally cloudy and
this, together with early-morning observations, afforded very good visibility owing to the absence of heat haze.

**RESULTS**

From 1 to 18 October 2007, 1909 Sooty Shearwaters were observed passing the platform. All birds were heading south-southwest to south-southeast. The peak rate of passages was from 7 to 11 October, with >95% of birds passing between 4 and 14 October (Fig. 2). Most were in groups of one to seven birds (maximum 51, Fig. 3), with singles less numerous than those migrating in pairs or groups (Fig. 3). Sooty Shearwater groups mainly travelled in lines, birds following slightly beside the bird ahead.

Sunrise was at about 06h30, and Shearwater passage rose progressively from 06h30 to 07h30 (Fig. 4). The activity of the birds before 07h30 remains unknown, as no birds were seen around the platform at this time of the day. Numbers passing continued to be high up to 09h30; thus, many Sooty Shearwaters probably passed later in the day. Indeed, on several occasions during the period of study, small flocks of five to 10 birds were seen casually at about 17h30, just before sunset. Moreover, on the 11 October 2009, the Sooty Shearwater migration was monitored onshore from the Cape Lopez lighthouse from 07h30 to 11h00, and 27% of the 130 birds were seen after 09h30. Hence, I estimate that a minimum of several thousand Sooty Shearwaters may have been migrating in early October 2007 offshore from Cape Lopez.

In addition to the Sooty Shearwaters, I counted some hundreds of Arctic/Common Terns *Sterna hirundo/paradisea*, five Sabine’s Gulls *Larus sabini*, seven Arctic Skuas *Stercorarius parasiticus*, two Lesser Black-backed Gulls *Larus fuscus*, one Brown Booby *Sula leucogaster*, and some other unusual offshore migrants (one Peregrine Falcon *Falco peregrinus*, one Willow Warbler *Phylloscopus trochilus*, one Icterine Warbler *Hippolais icterina* and one House Martin *Delichon urbicum*).

**DISCUSSION**

There is a general lack of data and knowledge about movements of seabirds off West and Central Africa, except for Senegal, where data have been gathered regularly since 1995 (Dubois *et al.*).
Indeed, this region is commonly considered to be outside of the migration routes of most pelagic birds (Philips 1962). Bird observers on West African coasts have never been numerous. For instance, in Senegal, the extent of Sooty Shearwater migration was largely underestimated in the 1980s, and the Sooty Shearwater was noted as “apparently uncommon” (Dupuy 1984), but up to 9739 birds were seen recently from 5 to 28 October 2007 (Dubois et al. 2009). There have been few sightings elsewhere in Central and West Africa. The first record from the Ivory Coast dates back to 1985 (Cheke 1987). Before this, three years of seabird observations around Lagos, Nigeria, failed to record it (Wallace 1972). The Sooty Shearwater has not been reported from Guinea Bissau to Sierra Leone, Ghana to Benin, Cameroon and Congo, and it is noted as a vagrant in Liberia, Nigeria, Sao Tome, Annobon and Bioko in Equatorial Guinea (Dowsett and Forbes-Watson 1993). In Gabon, it was considered to be regular offshore Cape Lopez, with maxima of 114 individuals on 19 October 1986 and 59 individuals on 28 October 1989 (Alexander-Marrack unpubl. data, available upon request). According to these observations, along with this paper and the observation of 130 birds on 11 October 2009, it seems that the Sooty Shearwater is a regular migrant in good numbers offshore from Gabon in October. Elsewhere in Africa, it is commonly found on the Atlantic coast, with large numbers wintering in the Benguela Current off South Africa, and reduced numbers observed throughout the year (Jackson 1988, Cooper 1991).

The occurrence of Sooty Shearwaters off Gabon in such high numbers may be due to several factors. First, a small percentage of birds out of the huge number of the Sooty Shearwaters potentially wintering in North Atlantic, roughly estimated at one million (Barrett et al. 2006), may not use the prevailing winds as an energy-saving strategy. At least one geolocator-tracked Cory’s Shearwater did not follow these low-cost corridors (González-Solís et al. 2007), and some young and inexperienced Sooty Shearwaters may not choose the best low-cost corridors. This may be enhanced by the fact that the current studies about migration efficiency are not iterative, but only consider the final cost of the route, whereas a traveling bird can refer to the local weather conditions but not to the weather conditions ahead in choosing its trajectory. Second, the average prevailing winds in West Central Africa south of Gabon head toward the north (Atlas et al. 1996), and are against the Sooty Shearwater migration direction. Some birds may thus be “trapped” by corridors with an initial low-cost pattern along the West African Coast from Senegal to Gabon, until they face an energy barrier that greatly increases the final energetic cost of the migration path. Finally, there is a one-month difference between the migration dates of the studied Cory’s Shearwater and the Sooty Shearwaters seen offshore Gabon. Apparently, the Cory’s Shearwaters wait for the West African westerly winds, also named ITCZ (Intertropical Convergence Zone), to cease before moving to the southern hemisphere in November (Feliciísimo et al. 2008), but the Sooty Shearwater migration occurs one month earlier. The geographic pattern of the low-cost corridors has not been studied at this time of the year and may be very different.

Sooty Shearwaters banded in the Falkland islands have been recovered in Barbudos, West Indies, and off Newfoundland, Canada (Otley 2008), but the exact origin of the birds wintering in either the North, and potentially migrating offshore from Gabon, or South Atlantic is little known. The Atlantic known breeders are located in Cape Horn and the Falkland islands, where the population is estimated at 100 000 pairs, mainly on Kidney Island (Otley 2008). There is little known about the population of the Cape Horn colonies, but they seem to be much greater, with estimates of up to 300 000 individuals on Wollaston islands (Reyes-Arriagada et al. 2009). The recent use of geolocators for Sooty Shearwaters in the Pacific (Shaffer et al. 2006) and Cory’s Shearwaters in the Atlantic (González-Solís et al. 2007) showed that the tracked birds follow a figure-eight pattern in each ocean, in the direction of the prevailing winds. They perform a clockwise loop in the northern part of the ocean, and a counter-clockwise loop in the southern hemisphere. In the North Atlantic, field observations tend to confirm the same migration routes for the Sooty Shearwaters. They are almost absent offshore Cape Lopez, many of the shearwaters were probably not visible onshore even with the use of a telescope.

The Sooty Shearwater migration off Gabon contrasts with the commonly recognized migration routes in the Atlantic. Indeed, the recent use of geolocators for Sooty Shearwaters in the Pacific (Shaffer et al. 2006) and Cory’s Shearwaters in the Atlantic (González-Solís et al. 2007) showed that the tracked birds follow a figure-eight pattern in each ocean, in the direction of the prevailing winds. They perform a clockwise loop in the northern part of the ocean, and a counter-clockwise loop in the southern hemisphere. In the North Atlantic, field observations tend to confirm the same migration routes for the Sooty Shearwaters. They are almost absent offshore Cape Lopez, many of the shearwaters were probably not visible onshore even with the use of a telescope.

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Nonbreeding birds from Australasia may also be part of the birds wintering in the Atlantic, since it takes an estimated minimum of five years before the Sooty Shearwater reaches sexual maturity (Cooper et al. 1991). New Zealand breeders seem to be excluded from the birds observed offshore from Gabon, as 99% of the burrows were occupied by 28 September in Snares Island, New Zealand (Warham et al. 1982). On the other hand, breeding starts around the end of October in the Falkland islands, so breeders from the Falkland islands and Cape Horn may be part of the birds migrating offshore from Gabon (Cawkell and Hamilton 1961). More studies, including additional geolocator tracking of the Sooty Shearwaters breeding in South Atlantic and an energetic cost-related analysis would help to assess the migration strategy and the origin of three groups of birds: breeders from South Atlantic, nonbreeders summering in the Benguela Current and Australasian nonbreeders returning to the breeding area.

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