

# Identification of Short-tailed Shearwater in the North Atlantic Ocean

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illustrations by John Gale

**Abstract** The Short-tailed Shearwater *Ardenna tenuirostris* is an abundant species of the Pacific Ocean. We reviewed records for the Indian and Atlantic Oceans and suggest that a regular pattern of movement in these oceans is hitherto unrecognised. It follows that the vagrancy potential of Short-tailed Shearwater to the North Atlantic probably is greater than suggested by the few documented records. Short-tailed may have been overlooked or confused with the similar-looking Sooty Shearwater *A. grisea* and, in the northeast Atlantic, dark-plumaged Balearic Shearwater *Puffinus mauretanicus*. Criteria for the separation of these three species at sea are presented in a bid to establish a clearer picture of the status of Short-tailed Shearwater in the North Atlantic. Separation of Short-tailed from Sooty Shearwater builds on existing criteria; characters for separation from dark-plumaged Balearic Shearwater are new.

The Short-tailed Shearwater *Ardenna tenuirostris* is an abundant species of the Pacific Ocean, where its trans-equatorial migration from breeding colonies in Australia (occupied during October to May) to the Bering Sea is well understood, but it is considered ‘exceptional’ in the Atlantic Ocean (Howell 2012). There were just two published records before 2017: one found moribund in July 2000 off Florida, USA (Kratter & Steadman 2003), the other found recently dead in May 2005 off Salvador City, Brazil (Souto *et al.* 2008). Identification of the carcasses was straightforward based on biometrics and plumage. Four sightings, probably involving at least two individuals (based on progression of primary moult and the fact that many thousands of shearwaters were present during this period; table 1), between August and October 2017 off the coast of Massachusetts, USA, were thus a

major surprise. The identification involved careful analysis of photos (e.g. plates 139–142). In addition, a Short-tailed Shearwater was photographed 55 nautical miles (102 km) south of Cape Point, South Africa, in August 2014 (plate 143), while there is a published record of an individual on 18th January 1998 off Virginia, USA (Brinkley *et al.* 2001), although it was later withdrawn by the observers primarily because the sighting lacked photographic documentation (N. Brinkley *in litt.*). Are these records the tip of an iceberg?

## Short-tailed Shearwater vagrancy potential

Data logging and satellite tracking of Short-tailed Shearwaters has revealed movements of breeding birds from Australian colonies to high latitudes of the southeast Indian Ocean, with the westernmost record at 64°S 37°E

(Klomp & Schultz 2000; Einoder *et al.* 2010). Ryan *et al.* (2017) documented the occurrence of thousands of Short-tailed Shearwaters in high latitudes of the South Atlantic Ocean in mid March 2017, between 55°S 0°E and 50°S 8°E, in the vicinity of Bouvetøya Island. This extends the species’ known range by about 2,000 km west. Given the date, these birds may have been non-breeders. Several flocks of dark shearwaters observed in April 2008 in high latitudes of the South Atlantic, at approximately 56.4°S 40.0°E, originally recorded as Sooty Shearwaters *A. grisea*, may in hindsight have been Short-tailed (Ryan 2009; Ryan *et al.* 2017). The known Atlantic records are summarised in table 1.

The evidence cited above suggests that Short-tailed Shearwaters regularly travel east–west across the high latitudes of the South Indian Ocean and at least occasionally thousands reach the high latitudes of the South Atlantic. If birds near Bouvetøya Island

in March were to join the main population that migrates to the northwest Pacific in May/June, then a shortcut via the North Indian Ocean and waters off Southeast Asia makes sense. Indeed, a modest annual passage of healthy birds occurs in these regions during April–June (Flood & Fisher in prep.). This shortcut would save birds from a long return journey to Australia in order to join the main migration. However, birds heading north from high latitudes of the South Atlantic may instead enter the main body of the Atlantic Ocean and continue north to the North Atlantic. The vagrancy potential of Short-tailed to the North Atlantic probably is greater than the few documented records suggest. A clearer picture of actual vagrancy may emerge over time using the identification criteria presented below. In the North Atlantic the confusion species are Sooty Shearwater and dark-plumaged Balearic Shearwater *Puffinus mauretanicus*.

**Table 1.** Records of Short-tailed Shearwater *Ardenna tenuirostris* in the Atlantic Ocean.

date	no. birds	location	primary moult	age	source
7th July 2000	1	Sanibel I., Florida, USA	P1–P5 new, P6 shed, P7–P10 old	3rd cycle or older <sup>1</sup>	Kratter & Steadman (2003)
28th May 2005	1	Salvador City, Brazil	Not recorded	juvenile? <sup>2</sup>	Souto <i>et al.</i> (2008)
17th August 2014	1	55 nautical miles south of Cape Point, South Africa	Approx. P1–P5 new	2nd cycle or older	D. Rollinson <i>in litt.</i>
mid March 2017	thousands	55°S 0°E to 50°S 8°E, vicinity of Bouvetøya I.	Not recorded	unknown	Ryan <i>et al.</i> (2017)
18th August 2017	1	Race Point, Provincetown, Massachusetts, USA	P1–P5 new, P6 growing, P7 shed, P8–P10 old	2nd cycle or older	S. Arena <i>in litt.</i>
23rd September 2017	1	Race Point, as above	P1–P8/P9 new, P9/P10 growing	2nd cycle or older	S. N. G. Howell <i>in litt.</i>
24th September 2017	1	Race Point, as above	P1–P8 new, P9–P10 growing	2nd cycle or older	G. R. Lazaro <i>in litt.</i>
14th October 2017	1	Race Point, as above	P1–P9 new, P10 growing	2nd cycle or older	P. Flood & K. Sutherland <i>in litt.</i>

**Notes:**

<sup>1</sup> Examination of the Sanibel Island bird showed that it lacked the bursa of Fabricius – a pouch on the wall of the cloaca and part of the immune system found only in very young birds. The occurrence of an individual 3CY or older lends weight to the idea that birds previously visited the Atlantic. <sup>2</sup> Measurements of the Salvador City bird were thought to suggest a juvenile (Mike Imber *in litt.*), but this seems unlikely given the date.

## Methods

Sightings of Short-tailed Shearwaters outside the Pacific were compiled by literature search and by communication with observers and record keepers (see acknowledgments). Criteria for the separation of the three shearwaters at sea are built on the existing literature, the authors' experience of the species, analysis of photographs and video clips, and examination of museum specimens. Experience at sea was gained across all oceans from a variety of pelagic trips, ferry crossings and headland watches. These facilitated observations, photographs, videos and sketches of birds of various ages and different states of moult and wear. Hundreds of photographs and video clips were compiled to analyse: (1) plumage variation in the underwings; (2) structural characteristics; and (3) flight behaviour. Skins were examined at the American Museum of Natural History (New York, USA), the Natural History Museum (Tring), and Barcelona Museu de Ciències Naturals (Spain) to take bill measurements for ratio comparisons and to study variation in underwing pattern.

Measuring bill length and length of the nasal tubes of museum specimens was straightforward, but less so the maxillary unguis (see fig. 3, p. 257). The maxillary unguis of some specimens is only slightly swollen and the plate join where the culminicorn meets the maxillary unguis (where C meets D in fig. 3) lacks an obvious kink, and thus a distinct point of measurement. Hence the point of measurement for the rear of the maxillary unguis was taken to be the point of perceptible rise of the maxillary unguis from the culminicorn. This is subjective when there is no obvious kink, and in a minority of cases we found no point of perceptible rise, making it difficult to calculate all three bill proportions. Balearic and Sooty Shearwaters proved to be most tricky because their unguis were only slightly swollen and about 20% of the specimens lacked an obvious kink/point of measurement, but the criterion worked for the majority of Short-tailed Shearwaters.

## Separation at sea

Withdrawal of the 1998 Virginia record by experienced seabirders is a measure of the challenge posed by a vagrant Short-tailed

Shearwater in the North Atlantic. With so few records, the species is not anticipated and many observers are not prepared for an encounter. If a Short-tailed flew by, then alarm bells might ring, but without ID criteria at your fingertips the record might be lost. Alternatively, a Short-tailed might be overlooked because it closely resembles a Sooty Shearwater or, in the northeast Atlantic, a dark Balearic Shearwater. Learning the following ID criteria is vital preparation for an encounter with Short-tailed in the North Atlantic. As a starting point, video footage of Short-tailed Shearwater in flight is available at: <https://bit.ly/2FyhAr5>

The full suite of main characteristics of typical Short-tailed, Sooty, and dark-plumaged Balearic Shearwaters is summarised in table 2 for direct comparison, and illustrated in figs. 1 & 2 and plates 144–149. The following text explains the vital characteristics. The presentation benefits from existing literature (Gilson 2008; Sibley 2011; Howell 2012). Colours described assume fairly fresh plumage and intermediate light intensity. Colour of the dark feathers differs with light intensity giving complete overlap between species: dark feathers may look blackish in dull light, dark sooty-brown in intermediate light, and browner again in strong light and direct sunlight. In addition, dark feathers bleach browner with wear.

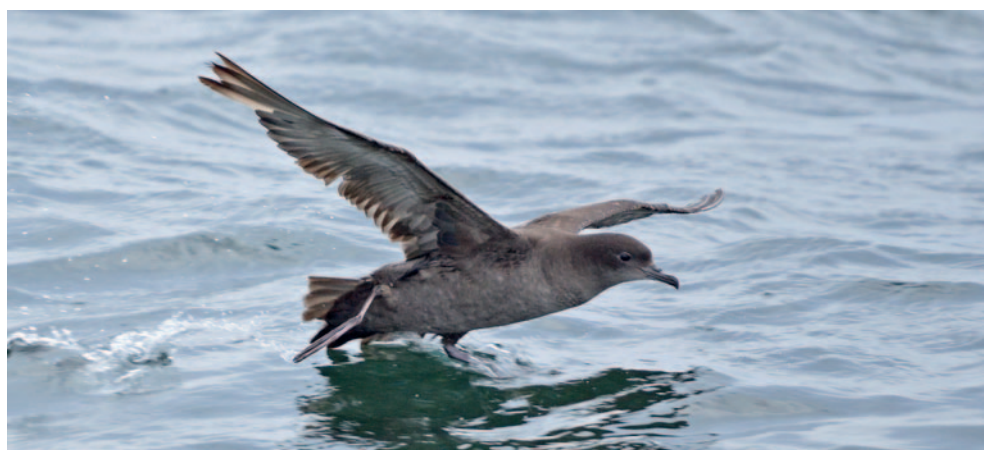
## The defining characteristics

The defining characteristics of a typical example of each species, seen well in good light, should permit straightforward identification to experienced observers. Even to a less experienced watcher a typical Short-tailed Shearwater in the North Atlantic should register as 'different'. Compared with Sooty Shearwater in similar conditions, a Short-tailed demonstrates greater manoeuvrability, faster flight, and shallower and quicker wingbeats; it has shorter and narrower wings, the centre of gravity is behind mid-wing (mid-wing on a Sooty), a squarer head, shorter front-end projection, a lighter and more compact body, and subdued underwing panels that may appear uniform at range. Compared with Balearic Shearwater, a

*Continued on page 256*



Steve Arena



Steve Arena



Peter Flood



Peter Flood

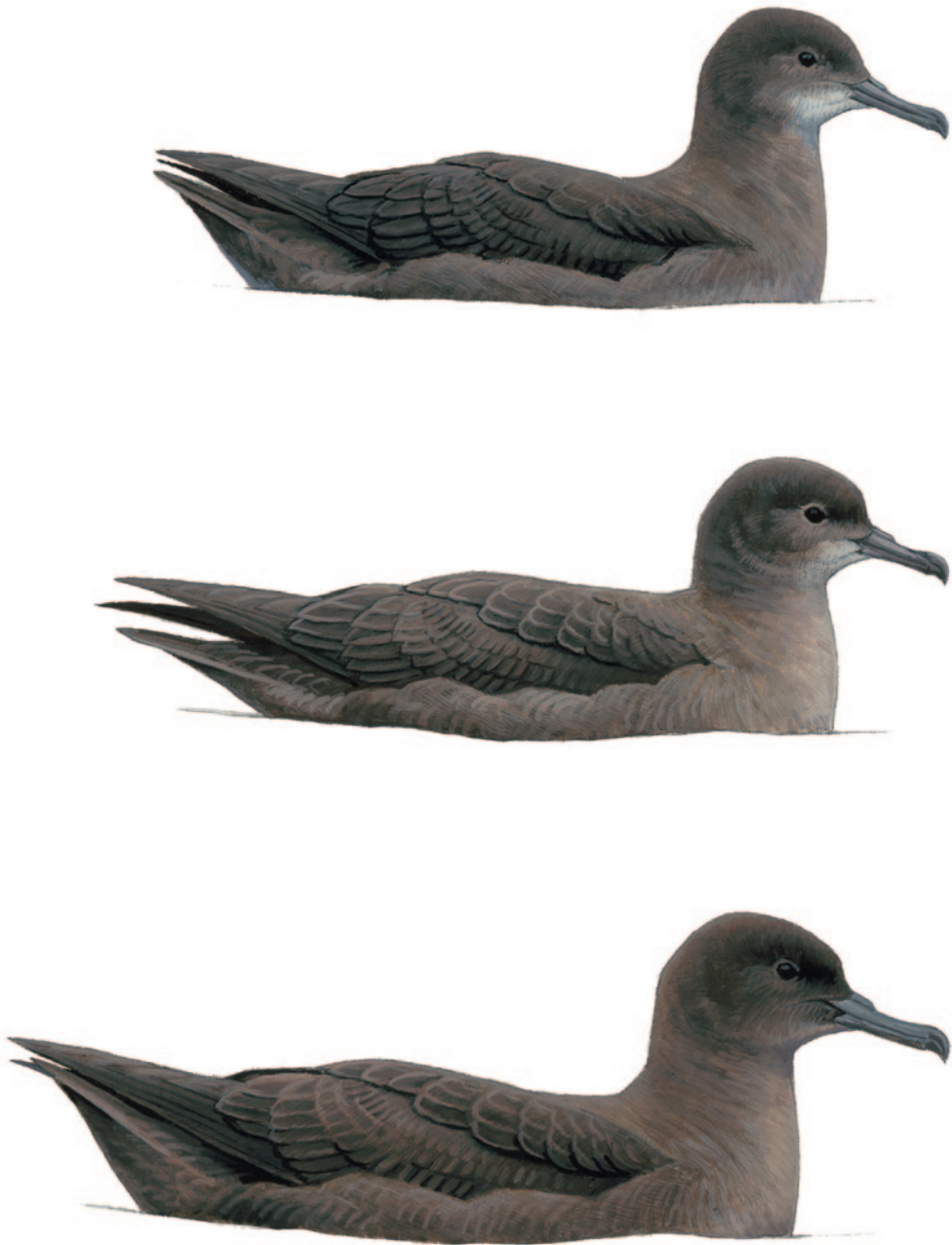
**139–142.** Short-tailed Shearwaters, Race Point, Massachusetts, USA, 18th August 2017 (139 & 140); 14th October 2017 (141 & 142). Probably two different individuals, given the progress in primary moult and the numbers of shearwaters present. The August bird shows P1–P5 new, P6 growing, P7 shed, P8–P10 old; and the October bird P1–P9 new, P10 growing (nearly complete). These are both classic individuals, with compact build, cute face, relatively short bill (with short mid-section gap on the top side), steep forehead, short thick neck, and diffuse and subdued pale underwing-covert panel.





John Gale

**Fig. 1.** Dark-plumaged Balearic *Puffinus mauretanicus* (left), Short-tailed *Ardena tenuirostris* (centre), and Sooty Shearwaters *A. grisea* (right); approximately to scale. Note the shorter neck, squarer head, and relatively short bill of Short-tailed compared with the other two; also the pale centre to the belly and pot belly of Balearic, and the subdued underwing-covert panel of Short-tailed. Compared with Short-tailed, Sooty has a more athletic build, longer neck, snouty face, longer bill and very long wings. From Flood & Fisher (in prep.).



John Gale

**Fig. 2.** Dark-plumaged Balearic *Puffinus mauretanicus* (top), Short-tailed *Ardenna tenuirostris* (centre), and Sooty Shearwaters *A. grisea* (bottom); approximately to scale. Note the diagnostic short 'mid-section gap' of Short-tailed's bill compared with the other two. This is visible with close, in-profile views and for reassurance the proportions can be calculated from photos and checked against information in table 4. Also note the cute and dinky look of Short-tailed compared with Sooty resulting from its relatively short bill, small squarish head, steep forehead, shorter neck, and smaller size. Swimming dark-plumaged Balearic and Short-tailed look very similar since some key differences are submerged – Balearic's plumpish body, pot belly, and pale central underbody. If seen well, the small squarish head and steep forehead of Short-tailed differ from the drawn-out face of Balearic. From Flood & Fisher (in prep.)

**Table 2.** Summary of the main characteristics of typical dark-plumaged Balearic *Puffinus mauretanicus*, Short-tailed *Ardenna tenuirostris*, and Sooty Shearwaters *A. grisea*.

	dark-plumaged Balearic	Short-tailed	Sooty
Defining characteristics of typical bird	Plump body with pot-belly; snouty face; centre of gravity behind mid-wing; pale central underbody; contrasting whitish underwing-covert panel	Compact build; cute face, steep forehead, short thick neck; centre of gravity behind mid-wing; diffuse and subdued pale underwing-covert panel of even width	Athletic build, very long narrow wings; snouty face; centre of gravity mid-wing; contrasting whitish underwing-covert panel, shaped like a butter knife
Flight behaviour	High wing loading (mass divided by wing area); steady, relatively effortful flight	Medium wing loading; highly manoeuvrable and fast; quick, shallow wingbeats	High wing loading; rapid, powerful and energetic flight
Overall size	Small to mid-sized	Mid-sized	Fairly large
Structure			
Centre of gravity	Behind mid-wing; front- and rear-end projections about equal	Behind mid-wing; front-end projection shorter than rear-end	Mid-wing; front- and rear-end projections about equal
Head and neck	Smallish head, snouty face, mid-length neck	Small squarish head, steep forehead, short thick neck	Very small head, snouty face, long thick-based neck
Bill	See table 4	See table 4	See table 4
Wings	Fairly long, medium-width, fairly pointed wing-tips	Fairly long, narrow, fairly pointed wing-tips	Very long, narrow, pointed wing-tips
Body	Plumpish, pot-bellied, high arched back	Compact, spindle-shaped, low arched back	Powerful, broad muscular shoulders, thickish cigar-shaped, high arched back
Rear-end projection	Mid-length; fairly long base, very short tail, short toe projection	As Balearic except short tail	As Balearic except short tail
Head-on	Mid-sized rounded body, high arched back, smallish head, fairly long wings	Mid-sized roundish body, low arched back, smallish head, fairly long wings	Large roundish body, high arched back, very small head, very long wings
Plumage	Mid greyish-brown, in dull light sooty-coloured, pale central underbody	Dark sooty-brown	Dark sooty-brown
Hood	Not hooded	Contrasting	Moderate contrast
Typical underwing	Contrasting whitish underwing-covert panel, primary coverts paler than secondary coverts	Diffuse and subdued pale underwing-covert panel, secondary coverts paler than primary coverts	Contrasting whitish underwing-covert panel, primary coverts paler than secondary coverts
On sea	Mid greyish-brown, small to mid-sized, snouty face; check bill proportions	Dark sooty-brown, mid-sized, small squarish head, steep forehead, short neck; check bill proportions	Dark sooty-brown, fairly large size, snouty face; check bill proportions

Short-tailed has lighter and more dashing flight, a leaner overall structure, shorter front-end projection, subdued underwing panels and it lacks a pot belly. If a Short-tailed is suspected, then register as much as possible about flight behaviour, size, overall structure,

bill structure, and underwing pattern and tones. These are the most important aspects for identification. Video footage captures jizz and flight behaviour, still photographs capture the detail; both media are invaluable for analysis after the event.

Size

Table 3 summarises the key biometrics for each species relevant to at-sea separation. The species exhibit sexual dimorphism (on average males are larger than females) and age-related differences (on average juveniles are smaller than adults). An adult male Sooty Shearwater is typically the largest of the shearwaters under consideration, while juvenile female Balearic is the smallest. Size extremes may eliminate Short-tailed Shearwater. Otherwise ages and sexes occur in overlapping sizes. Of course, the size of a lone bird is difficult to assess accurately.

Overall structure

The overall structure of each species is important, and this can be assessed at range when details of plumage cannot.

*Balearic* has the front-end and rear-end projections about equal in length; a pot belly that places the centre of gravity behind mid-wing; and a plumpish body, high arched back, and longish, medium-width wings.

*Short-tailed* has a compact build, with the front-end projection shorter than the rear-end projection; the centre of gravity behind mid-wing; and a spindle-shaped body, low arched back, and longish, narrow wings. Measurements do not support the suggestion that Short-tailed is shorter-tailed than Sooty Shearwater (Sibley 2011).

*Sooty* has an athletic build, with a disproportionately small head, and front-end and rear-end projections about equal in length; the centre of gravity mid-wing; and broad, muscular shoulders, a thickish, cigar-shaped body, high arched back, and very long, narrow wings.

Bill structure

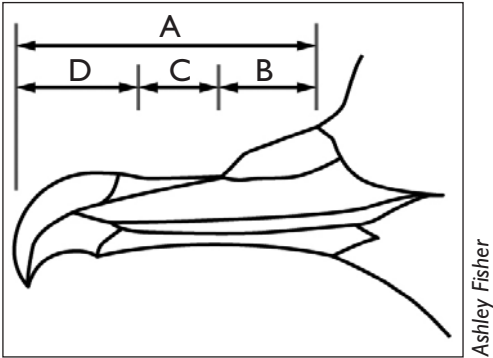
Fig. 3 illustrates the relevant components of the bill for this analysis. Differences in the proportions of these parts separate Short-tailed and Sooty Shearwaters while Balearic is intermediate (table 4). Estimating the proportions requires close views and ideally good photos. Luckily, all three shearwaters

**Table 3.** Key biometrics (mm) relevant for separation of Balearic *Puffinus mauretanicus*, Short-tailed *Ardena tenuirostris* and Sooty Shearwaters *A. grisea*. Bill lengths from table 4; total length and wingspan from Howell (2012) for Short-tailed and Sooty and from Gil-Velasco *et al.* (2015) for Balearic.

	Balearic	Short-tailed	Sooty
total length	350–410	405–430	430–455
wingspan	780–900	910–990	970–1,060
bill length	36–40	29–34	37–43

readily come to chum. Bill proportions were also discussed by Sibley (2011). Note that the specific part of the scientific name of Short-tailed Shearwater, *tenuirostris*, literally means ‘slender-billed’, but the bill is, on average, proportionally thicker than that of Sooty Shearwater (Sibley 2011).

*Short-tailed vs Sooty* (1) Bill length of Short-tailed shorter, with no overlap: 29–34 mm vs 37–43 mm. (2) Length of nasal tubes proportionately longer: 30.9% vs 25.7% (see also Pyle 2008, Carboneras *et al.* 2018). (3) Mid-section gap proportionately *much* shorter: 28.0% vs 34.4% and detectable at close range. The bill length and proportions are diagnostic. We disagree with Sibley



**Fig. 3.** Representation of bill length and bill proportions of shearwaters (see table 4). Total length (A) is measured from the feathers at the base of the bill to the tip of the maxillary unguis. Length of the nasal tubes (B) is measured from feathers at the base of the bill to where the nostrils meet the culminicorn. Length of the culminicorn is the mid-section gap (C) between the end of the nostrils on the culminicorn and the first perceptible rise of the maxillary unguis from the culminicorn. Length of the maxillary unguis (D) is measured from the first perceptible rise on the culminicorn to the tip of the maxillary unguis.



Dominic Rollinson



**143.** Short-tailed Shearwater, south of Cape Point, South Africa, 17th August 2014. This bird was investigating a longline vessel and stood out as quite different from Sooty Shearwaters present at the time. This is one of a sequence of three photos in which the bird shows the classic compact build, cute face, relatively short-looking bill (with a seemingly short mid-section gap), steep forehead, and short thick neck.

(2011) that the differences are explained by visual illusion.

*Short-tailed vs Balearic* (1) Bill length of Short-tailed shorter, with no overlap: 29–34 mm vs 36–40 mm. (2) Length of nasal tubes proportionately longer: 30.9% vs 28.0%. (3) Mid-section gap proportionately shorter: 28.0% vs 31.9%.

*Sooty vs Balearic* (1) Bill length of Sooty

on average longer: 37–43 mm vs 36–40 mm. (2) Length of nasal tubes proportionately shorter: 25.7% vs 28.0%. (3) Mid-section gap proportionately longer: 34.4% vs 31.9%.

**Plumage**

All three species look superficially similar with generally dark plumage and pale underwing panels.

**Underwings**

The tone of dark feathers and overall plumage pattern are important for the separation of the three species. A typical Short-tailed Shearwater underwing differs in appearance from typical underwings of the other two species, which are similar to each other. There is, however, considerable variation, especially in Short-tailed, and additional criteria are recommended for safe identification.

*Sooty Shearwater typical underwing* Dark brownish-grey primaries, secondaries, greater primary and secondary coverts, but pale grey when reflecting light. Dark marginal coverts.

**Table 4.** Comparison of lengths (mm) and proportions (%) of the bills of Balearic *Puffinus mauretanicus*, Short-tailed *Ardena tenuirostris*, and Sooty Shearwaters *A. grisea* (illustrated in fig. 3; n = sample size, x = mean, s = standard deviation, r = range, p = proportion of total length). Measurements of Balearic skins involved 12 male (of which one immature), ten female (of which two immature), rest unknown – all bycatch victims killed off Catalonia, Spain (Barcelona Museu de Ciències Naturals); Short-tailed skins involved seven male, seven female, rest unknown – four birds collected Bering Sea, six Japan, one Thailand, rest Australia (NHM, Tring); Sooty skins involved 13 male, eight female, rest unknown – 11 birds collected Chile, seven Falkland Islands, six Peru, three California (USA), one Ecuador (NHM, Tring).

species	A: bill length	B: nasal tubes	C: mid-section gap	D: maxillary unguis
Balearic (n = 24)	x = 37.9 s = 1.41 r = 36.0–40.0	x = 10.6 s = 0.93 r = 9.0–12.0 p = 28.0%	x = 12.1 s = 1.31 r = 10.0–14.0 p = 31.9%	x = 15.2 s = 0.96 r = 13.0–16.0 p = 40.1%
Short-tailed (n = 27)	x = 30.7 s = 1.35 r = 29.0–34.0	x = 9.5 s = 0.89 r = 8.0–11.0 p = 30.9%	x = 8.6 s = 0.57 r = 8.0–10.0 p = 28.0%	x = 12.6 s = 0.69 r = 12.0–14.0 p = 41.1%
Sooty (n = 28)	x = 40.4 s = 1.37 r = 37.0–43.0	x = 10.4 s = 1.06 r = 9.0–14.0 p = 25.7%	x = 13.9 s = 1.36 r = 11.0–17.0 p = 34.4%	x = 16.1 s = 1.00 r = 14.0–18.0 p = 39.9%

Longest lesser and the very long median primary coverts whitish with a dark shaft streak (Howell 2012, plate 148) and variable amounts of dark mottling usually concentrated at the base of the feathers. Centres of shorter lesser primary coverts dark brownish-grey with variable white fringes/tip, hence chequered, but appearing dark at range. Median secondary coverts variably dark and the longest three tracts of lesser secondary coverts dark with an increasing though variable amount of white in the outer feathers. The axillaries are solidly dark greyish-brown forming a large, dark triangle. The overall effect is a large whitish panel across the underwing shaped like a 'butter knife' (Gilson 2008), with three dark bars running from the axillaries across the inner wing and steadily petering out (plate 148). The primary coverts are paler than the secondary coverts – the opposite to Short-tailed (Sibley

2011), but like dark-plumaged Balearic. The pale panel is less even in width compared with Short-tailed and contrasts strongly with the underside of the remiges (Howell 2012). *Variation in underwing* A subdued panel, like Short-tailed, is uncommon, while a fairly uniform dark underwing is very rare (plate 149). Beware that a whitish covert panel may appear subdued in dull light, suggesting Short-tailed.

*Short-tailed Shearwater typical underwing* This differs from Sooty Shearwater as follows. The pale areas are typically greyish rather than whitish, and the dark feathers a shade paler at mid brownish-grey (plate 146). The overall



Joe Pender



David Atkin

**144 & 145.** Balearic Shearwater, Scilly, 8th September 2008 (144) and 17th August 2013 (145). Note the pale central belly, long bill (relatively deep on the bird in plate 145, suggesting a male), snouty face, smallish head, medium-length thickish neck and pot belly. In the underwings, the longest lesser and the very long median primary coverts are whitish with a dark shaft streak – like Sooty but unlike Short-tailed.

result is a much more subdued pale panel, which does not contrast strongly with the underside of the remiges. The panel is more even in width than that of Sooty. The secondary coverts are paler than the primary coverts – the opposite to Sooty and dark-plumaged Balearic (plates 142 & 146). Dark shaft streaks in the longest lesser and the very long median primary coverts are either absent, faint, or obscured by darker feathering. *Variation in underwing* A fairly uniform darkish underwing (plate 147) and an underwing like a typical Sooty Shearwater are uncommon. Beware that a subdued pale covert panel may appear whitish in strong light and

suggest Sooty (left wing in plate 146).

The typical underwing of a dark-plumaged Balearic is similar to that of a typical Sooty Shearwater and hence the same differences with Short-tailed Shearwater apply (plate 145).

### Hood

Short-tailed Shearwater has a dark hood. The pale chin can emphasise this hooded appearance. In direct light the pale chin becomes more obvious, leaving the impression of a thick collar on the underside of the neck. Given strong direct light, the underside of the neck is lighter than the upperside of the neck and crown, and sometimes the face and forehead, giving a capped impression. In general, the dark hood of Sooty Shearwater is less contrasting and dark-plumaged Balearic does not appear hooded.

### Appearance on the sea surface

Short-tailed Shearwater appears dinky when swimming alongside Sooty Shearwater because of its small squarish head, steep fore-

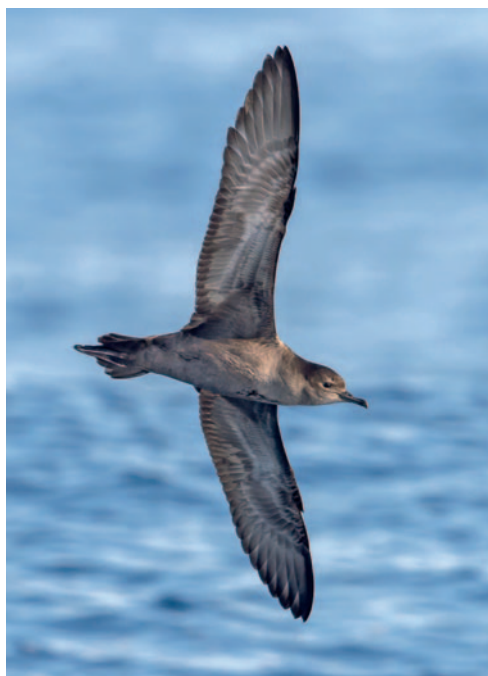
head, shorter neck and smaller size. Swimming dark-plumaged Balearic Shearwater and Short-tailed look more alike than birds in flight because some of the key points of separation are submerged – Balearic's plumpish body, pot belly, and pale central underbody. When seen well, the small squarish head and short steep forehead of Short-tailed contrasts with the drawn-out head shape of Balearic and Sooty. The relatively short mid-section gap of the bill of a Short-tailed separates it from the other two shearwaters. This can be observed with good close views and the proportions measured using good profile photos. Sooty and Short-tailed are dark sooty-brown, while dark-plumaged Balearic is mid greyish-brown though in dull conditions it can look sooty-coloured.

### Primary moult timing and ageing

Shearwaters moult in cycles, typically replacing all the feathers once a year; adults moult mainly after breeding, whereas juveniles and young immatures commence moult



Kirk Zufelt



Kirk Zufelt

**146 & 147.** Short-tailed Shearwater, Torishima, Japan, 11th May 2015 (146) and 14th May 2015 (147). Classic individuals on migration to the Bering Sea. Note the compact build, cute face, relatively short bill, steep forehead, short thick neck, subdued pale underwing-covert panel with secondary coverts paler than primary coverts. The bird in plate 146 has a strong, contrasting hood, which is how the species often appears in flight, while direct light on the underside of the neck and throat of the bird in plate 147 leaves the region paler and results in a less-typical, capped look.

earlier than adults. Below, we focus on primary moult because gaps in the primaries and moult contrast between new (blackish) and old (brown) feathers can be registered in the field. Short-tailed and Sooty Shearwaters (breeding in the southern hemisphere) overlap in primary moult timing with Balearic Shearwater (breeding in the northern hemisphere) because Balearic breeds early in the calendar year, between February and late June.

**Short-tailed Timing** In the Pacific, adult wing moult is rapid and occurs from May to late July/early September, juveniles possibly January–May in southern hemisphere and April–August in northern hemisphere (Howell 2012). Of the limited data from the North Atlantic, primaries P1–P5 (primaries numbered descendantly, i.e. P1 is the innermost) are new July/August with primary moult complete by about October (table 1); this timing is consistent with an older immature or adult moult schedule in the Pacific.

**Ageing** In April–August/September, juvenile

plumage is uniform and relatively fresh; birds in their second cycle (which follows the juvenile cycle) are similar but not uniform; and breeders and older immatures are bleached and may be moulting. The outer primaries of juveniles are heavily worn January–April, just prior to moult.

**Sooty Timing** Presumed adults and older immatures complete primary moult with P7–P10 in July–August, mainly in waters off northeast Newfoundland, and around the Mid-Atlantic Ridge and Rockall Bank (Keijl 2011; Hedd *et al.* 2012; Carvalho *et al.* 2015; Carvalho & Davoren 2016). This explains why Sooty is rarely seen in moult from short-range pelagic trips off North Carolina (USA) – the vast majority (around 99%) of birds seen in late May/June are presumed juveniles or immatures that have completed their first moult (Howell 2012). Consequently, moulting birds off the east coast of the eastern USA in May–August invite close inspection. Birds have been observed completing primary moult off the Isles of Scilly in



Ashley Fisher



Luc Hoogenstein

**148 & 149.** Sooty Shearwaters, Scilly, 14th August 2009 (148) and off the Netherlands, 13th September 2010 (149). Plate 148 shows a classic individual with an athletic build, snouty face, long narrow wings, centre of gravity mid-wing, and striking whitish underwing-covert panel. Plate 149 shows the classic structure of a Sooty, but it is a very rare example of an individual with a fairly uniform dark underwing, which could cause confusion with Short-tailed.





Peter Ryan

**150.** A small section of the flock of thousands of Short-tailed Shearwaters off Bouvetøya Island, South Atlantic, 11th March 2017.

early September (pers. obs.). *Ageing* In April–August/September, juvenile plumage is uniform and relatively fresh, second-cycle similar but not uniform, and breeders and older immatures are bleached and may be moulting. The outer primaries of juveniles are heavily worn December–February, just prior to moult.

**Balearic Timing** Balearic Shearwaters that breed successfully moult their inner primaries in the northeast Atlantic between late May and late July, and outer primaries from early July to mid September (Yésou 1986). Many hundreds of presumed immature Balearics had completed primary moult by mid May in the northeast Atlantic off north-west Spain (Mouriño *et al.* 2003). *Ageing* In May–September/October, the juvenile plumage is uniform and relatively fresh, second cycle is similar but not uniform, breeders and older immatures are bleached and may be in moult. The outer primaries of juveniles are heavily worn March–May, just prior to moult.

### Separation in the hand

Excluding mass, the main biometrics of the three species overlap only slightly making identification in the hand straightforward.

Typical birds can be separated on plumage as well as measurements (tables 2–4).

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