

Albatross mandible at archeological site in Amsterdam, the Netherlands, and WP records of *Diomedea* albatrosses

Edward Soldaat, Mardik F Leopold, Erik H Meesters & Christopher J R Robertson

On 19 October 1977, the upper mandible of a large seabird was found in the soil of Amsterdam, Noord-Holland, the Netherlands. The bill was initially labeled as 'large gull' and filed by the Bureau of Monuments & Archaeology (Bureau Monumenten & Archeologie), Amsterdam, where it rested on a shelf for nearly three decades. In 2005, it was displayed at an exhibition at the Amsterdam Historical Museum (Amsterdams Historisch Museum) and noticed by Louwe Kooijmans (2005), who mentioned the bill briefly in passing. His casual remark on 'an albatross bill' drew our attention and the specimen was further studied. It was confirmed to belong to a *Diomedea* albatross and concerns the first (modern, ie, after the Pliocene era) albatross found in Dutch soil. The bill is kept under collection number MC6-1163 at the Bureau of Monuments & Archaeology.

Several albatrosses have been observed in recent times in European seas, including the North Sea (eg, Bourne 1967, 1992, Dymond et al 1989, Harrop 1994, Leopold et al 1994, Gustad 1995, Bonaccorsi 2003, Gantlett & Pym 2007, Pitches 2007). To date, however, no albatross has been accepted to the Dutch list. The find of an albatross upper mandible in Amsterdam is therefore remarkable. This paper describes the finding circumstances, the identification of the species involved and summarizes known records and reports of *Diomedea* albatrosses in the Western Palearctic (WP). The taxonomy in this paper follows Robertson & Warham (1992, 1994), Nunn & Stanley (1998), Robertson & Nunn (1998) and Burg & Croxall (2004), and not Dickinson (2003).

Finding locality

The location of the find (known as MC6; 52°22'37.50"N, 04°54'08"E) is situated in the old city centre of Amsterdam. Today, this is the Prins Hendrikkade but, before 1876, this location was known as Camperhoofd, a north-east facing bul-

wark at the open harbour front. It was the stage for the coming and going of trade vessels of the Dutch East India trading company (Vereenigde Oostindische Compagnie, VOC), whalers, merchants and passenger ships that sailed the globe. Shallow waters in front of this prominence prevented sea-going vessels from docking directly at the harbour front; instead, they were moored on poles in the IJ, the open water just north of the city. Goods and people were ferried back and forth by smaller boats. In 1876, the location was filled up with town and shipping waste and covered with sand for the building of the Central Railway Station. In 1977, large scale digging took place for the construction of a subway line. During these works, the bill was found at a depth of c 5 m below street level.

Description

Only the upper mandible was found. The cranium, lower mandible and all soft parts, including the horny sheath (ramphotheca), are missing. The bill is large, with a total length of the bone of 162 mm and 'culmen' length without ramphotheca of 152 mm. The width at the base of the upper mandible is 38 mm. It is concave when viewed laterally and has marked nasal openings and a hooked tip (figure 1). A shallow groove, corresponding with the sulcus between the bill plates in albatrosses, runs laterally along the bone, from the nasal opening towards the bill-tip. The tip has c 25 (nerve) ducts.

Dating

Dating the bill by C14 has been considered but will be practically impossible because of its recent origin (Hans van der Plicht in litt). The results would be biased by the so-called 'Marine Reservoir Effect' (Reimer & Reimer 2001). Unlike trees that take up C14 directly from the atmosphere, marine predators incorporate C14 from a range of prey organisms, that themselves have acquired their



FIGURE 1 Lateral (upper two), ventral and dorsal (lower) views of upper mandible of *Diomedea albatross* found in Amsterdam, Noord-Holland, Netherlands, on 19 October 1977 (*Wiard Krook/Bureau of Monuments & Archaeology, Amsterdam*)



FIGURE 2 Mandible of *Diomedea albatross* found in Amsterdam, Noord-Holland, Netherlands, on 19 October 1977 (middle) compared with similarly sized bills (brain case and upper mandible only) of Wandering Albatross *Diomedea exulans* (top) and Waved Albatross *Phoebastria irrorata* (bottom) (Edward Soldaat (top and bottom) and Wiard Krook (centre)). Note different profiles: clearly curved in *Diomedea* and much straighter in *Phoebastria*. *Phoebastria* also has more delicate bill-tip than *Diomedea*.

C14 from pools in which C14 may have circulated for a long time. As a result, deviations of up to 400 years make this method useless for recent marine top predators. Therefore, dating the bill by analyzing the local circumstances seems the most realistic approach. However, location MC6 is problematic in this respect. The old harbour front has been filled up with refuse, and the 20th century digging did not produce a clear stratigraphy. Only artifacts from the second half of the 15th century and from the 19th century were found (Wiard Krook in litt) and artifacts from the centuries in between were lacking. As pointed out below, it is very likely that the albatross bill belonged to a bird that was caught by a sailor or ship passenger and discarded in the harbour directly, or that it ended up in town

or shipping waste that was later used to fill up the site. Under this hypothesis, a deposition date in the 15th century seems unlikely because at that time there was hardly any overseas traffic from Amsterdam to the southern oceans. The 17th and 18th century comprised the era of the great sailing vessels of the VOC that followed routes across the Atlantic and Indian Ocean to India, Indonesia and Sri Lanka (Ceylon) (figure 4). On these voyages, ships passed several breeding sites of albatrosses and they were often accompanied by albatrosses at sea (see below). The VOC ceased to exist in 1799 but other Dutch sailing vessels kept using the same routes until the 19th century, when sailing ships were gradually phased out and replaced by ships using steam power. Given this circum-



FIGURE 3 Bill-tip of *Phoebastria* albatross (lower), discovered among many fossil bones from late Neogene (supposedly Pliocene) deposits at Mill, Noord-Brabant, Netherlands (Erik Wijnker). Specimen is kept in Prehistoric Times Museum (Oertijdmuseum 'De Groene Poort'), Boxtel, Noord-Brabant, Netherlands (# MAB F3399). See also Olson & Hearty (2003, figure 3A) for similar fossil *Phoebastria* bill-tip found on Bermuda. Upper mandible (without ramphotheca) of modern Black-footed Albatross *Phoebastria nigripes* included for comparison.

stantial evidence, the most likely period for this bill to originate from is the early 17th century until 1876, when the old harbour front was filled up.

The possibility of a Pleistocene or Pliocene fossil was also investigated. Once, large albatrosses lived in the northern Atlantic. No less than five species have been described from late Neogene (Pliocene) deposits from North America, all referable to the modern North Pacific genus *Phoebastria*: *P. anglica*, *P. aff. albatrus*, *P. aff. nigripes*, *P. aff. immutabilis* and *P. rexsularum* (Olson & Rasmussen 2001). *P. anglica* has also been recorded from Pliocene deposits in Europe (East Anglia, England; Lydekker 1891, Harrison & Walker 1978ab, Dyke et al 2007) and several *Phoebastria* fossils have been found in Pliocene deposits at Mill, Noord-Brabant, the Netherlands (Wijnker 2005; Erik Wijnker pers comm; figure 3) but these bones are clearly much older than the bone found in Amsterdam. The most recent occurrence of *Phoebastria* in the northern Atlantic dates to the Pleistocene, 400 000 years ago, when a breeding colony of *P. albatrus* resided on Bermuda (Olson & Hearty 2003). The Amsterdam bill looks 'fresh', showing no obvious signs of discoloration or fossilization. It has the typical curved shape of the genus *Diomedea*, rather than the 'Roman nose'

profile of *Phoebastria* (figure 2). Therefore the possibility of a prehistoric origin can be ruled out.

Breeding sites of *Diomedea* albatrosses along old sailing routes

If the albatross had come ship-assisted to Amsterdam, a possible carrier could have been a VOC trade vessel. When sailing to the Far East, VOC ships crossed the Atlantic twice, to optimally use the trade winds. Their route took them first to the vicinity of Tristan da Cunha and Gough Island, where Tristan Albatrosses *D. dabbenena* breed (this taxon is considered a synonym of nominate *D. exulans* by Dickinson (2003) but is clearly much smaller, see below), then past Cape of Good Hope, South Africa, and along a string of islands where Wandering Albatrosses *D. exulans* breed and finally past Amsterdam Island where Amsterdam Albatrosses *D. amsterdamensis* reside (figure 4). South Georgia was passed at a large distance and during the breeding season its foraging adults (Wandering) stay clear of the old VOC route (BirdLife International 2004). Non-breeding birds, however, range much further afield and can reach the region of Cape of Good Hope (Prince et al 1998). The remaining *Diomedea* albatrosses breed much further east, far beyond the old trading

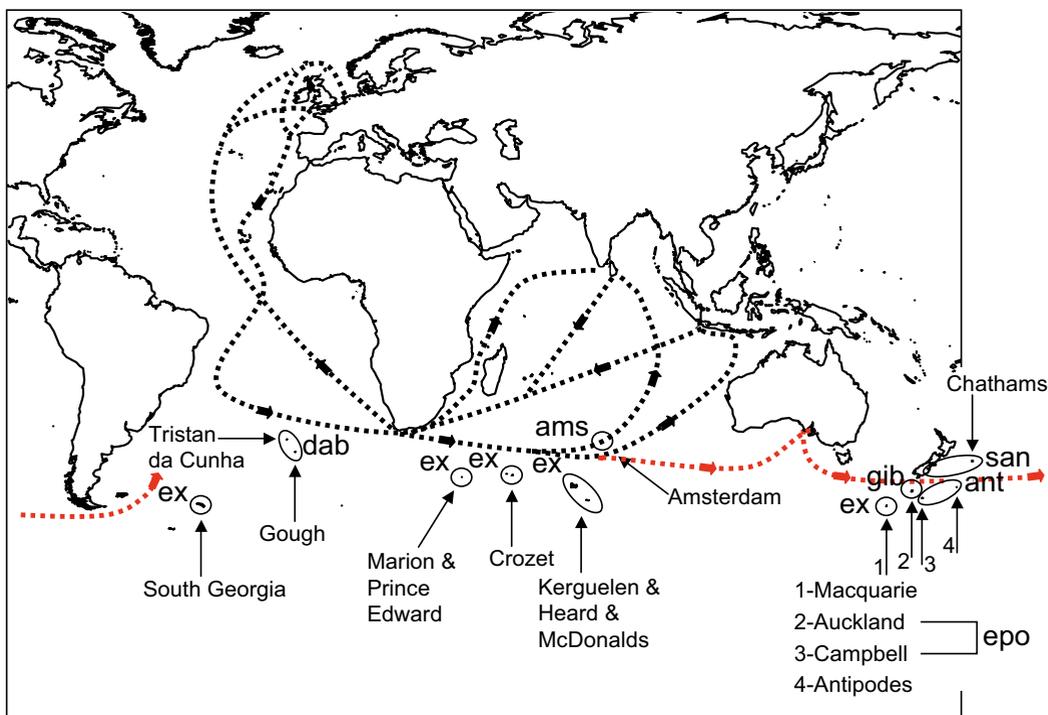


FIGURE 4 Routes taken by VOC ships (black) from Amsterdam to trading posts in Far East and back, and breeding sites (mostly islands) of different *Diomedea* albatrosses: *dabbenena* (dab), *exulans* (ex), *amsterdamensis* (ams), *epomophora* (epo), *gibsoni* (gib), *antipodensis* (ant) and *sanfordi* (san). In addition (red), 19th century ships, both under sail and under steam, sailed further east to Australia and New Zealand and these mostly continued downwind for their return voyage, rounding Cape Horn and passing South Georgia (with more *exulans*) to re-enter Atlantic (after Jenkins 1973, map 5308, and Jacobs 1991).

routes (figure 4) and breeding adults will not have been in contact with VOC ships. Of this group, Antipodean Albatross *D antipodensis* and Gibson's Albatross *D gibsoni* (considered a subspecies of *antipodensis* by, eg, Burg & Croxall 2004) are the least likely to ever have come into contact with a VOC vessel. *Antipodensis* flies east from its home waters off south-eastern New Zealand and the Tasman Sea to spend the non-breeding season off south-western Chile. From these waters, it probably returns along the same route. *Gibsoni* seems to be confined to Australasian seas and possibly west to Perth when non breeding. Both Northern Royal Albatrosses *D sanfordi* and Southern Royal Albatrosses *D epomophora* circumnavigate the globe and reach the waters around the Cape of Good Hope (Nicholls et al 2002, BirdLife International 2004, Brooke 2004, Onley & Scofield 2007), where they must have met the VOC sailors principally during the months of July to October. Thus, it would seem that only *an-*

tipodensis and *gibsoni* can be discarded as a candidate for VOC-assisted transport to Amsterdam harbour. However, in the 19th century, the sailing routes were extended to Australia and New Zealand, when many ships with emigrants and goods sailed from Europe, and all New Zealand albatrosses came within reach of Dutch sailors (figure 4). Many *Diomedea* albatrosses were caught *en route*, often for pleasure (Medway 1998). Therefore, any *Diomedea* albatross occurring in the waters between the Cape of Good Hope and Western Australia ran the risk of being bagged. Because the bill shape and size exclude almost all other albatross species (genera *Thalassarche*, *Phoebastria* and *Phoebastria*; see below), the distribution of these species is not discussed here.

Identification

The size and shape of the mandible exclude all but the largest (sea)birds. However, even the

Albatross mandible at archeological site in Amsterdam, the Netherlands

TABLE 1 Culmen lengths (mm) of great albatrosses *Diomedea*: minimum-maximum or average \pm SD; (n). References are Tickell (2000) (T); Shaffer et al (2001) and Scott Shaffer (in litt) (S); Cuthbert et al (2003) and Richard Cuthbert in litt (C); Brooke (2004) (B); Robertson: fresh fisheries bycatch victims and beached birds in New Zealand, live birds in colonies (R_f), and museum specimens (R_m); Jouventin et al (1989) (J). Figures printed in **bold** relate to species or sexes that are possible candidates regarding the mandible found in Amsterdam, considering their range of culmen lengths.

| Species | Ref | Male | Female |
|-----------------------|--|---|---|
| <i>exulans</i> | B | South Georgia 163-180 (21) | South Georgia 155-171 (23) |
| | T | 162-177 (52) | 152-172 (53) |
| | C | 162.6-180.4 (30) | 158.1-173.8 (30) |
| | R_m | South Georgia (unsexed) 157-182 (12) | |
| | R_m | Marion Island (unsexed) 159.8-178.4 (5) | |
| | S | Possession Island, Crozets 161-174; 169 \pm 3.4 (20) | Possession Island, Crozets 157-170; 164.2 \pm 4.1 (16) |
| R_m | Kerguelen Island (unsexed) 159-180 (6) | | |
| T | Macquarie Island 158-181; 166 (17) | Macquarie Island 156-166; 158 (10) | |
| <i>dabbenena</i> | C | 144.3-158.2 (30) | 138.3-150.6 (30) |
| | R_m | 138-153.5 (12) | 135-149 (16) |
| | R_m | (unsexed) 136-155 (33) | |
| <i>antipodensis</i> | B | 151\pm4.0 (62) | 143 \pm 4.1 (66) |
| | R_f | 144.0-160.8 (21) | 137.2-151.7 (27) |
| <i>gibsoni</i> | B | 136-162 (362) | 133-157 (371) |
| | R_f | 145.9-164.0 (15) | 136.0-153.0 (15) |
| <i>amsterdamensis</i> | J | 142.2-156.2 (8) | 138.2-145.2 (8) |
| | | (unsexed) 135.0-156.2 (36) | |
| <i>epomophora</i> | T | 179-188 (5); 185.8 \pm 5.2 (11) | 163-177 (5); 171.7 \pm 5.2 (7) |
| | R_f | 167.1-193.6 (10) | 167.0-173.6 (4) |
| <i>sanfordi</i> | B | 165-172 (5) | 154-160 (5) |
| | R_f | 161.2-175.7 (34 probable males) | 149.9-165.7 (37 probable females) |

largest seabirds (rarely) occurring in north-western Europe, ie, Yellow-billed Loon *Gavia adamsii*, Black-browed Albatross *Thalassarche melanophris*, Northern Gannet *Morus bassanus*, Great Cormorant *Phalacrocorax carbo*, Magnificent Frigatebird *Fregata magnificens* and Greater Black-backed Gull *Larus marinus*, fall far short of this size, while several of these also have straight rather than hooked bills. All but Black-browed Albatross lack nasal openings of this size and shape (see, eg, www.seabird-osteology.info). The

bill shape also excludes large marsh and land birds such as pelicans, herons, storks, spoonbills, flamingos, raptors or cranes. Comparison with similar material clearly shows that the bill belongs to a large albatross (figure 2).

With a culmen length of c 155 mm (152 plus c 3 mm for the missing ramphotheca), the typical nostrils and the strongly hooked tip, the bill most likely belongs to a member of the group of the 'great albatrosses' of the genus *Diomedea*. With one exception, all other albatrosses have bills that

are much smaller than the Amsterdam specimen. Only Waved Albatross *Phoebastria irrorata* has a culmen length of up to 160 mm (Tickell 2000) but this species has a bill profile that is much straighter than that of the Amsterdam specimen (figure 2) and therefore can safely be ruled out. The other northern albatrosses of the genus *Phoebastria*, the sooty albatrosses *Phoebetria* and the 'mollymawks' *Thalassarche* are all too small (Tickell 2000, Brooke 2004). The extinct *Phoebastria anglica* can also be ruled out. *Diomedea* is therefore the only group left. The bone is fully ossified and shows no juvenile characteristics such as incomplete fusion or a granular surface structure.

Within the genus *Diomedea*, there is a choice between seven albatrosses (five wandering and two royal, respectively): *exulans*, *antipodensis*, *gibsoni*, *amsterdamensis*, *dabbenena*, *sanfordi* and *epomophora*. Known culmen lengths of these taxa are given in table 1. Table 1 shows that the Amsterdam culmen (c 155 mm) is smaller than most *exulans*. Only the smallest females from South Georgia have a culmen size matching the Amsterdam specimen but note that few culmen sizes from Marion, Prince Edward, Kerguelen, Heard and McDonalds or Macquarie Island were available. Culmen sizes of male *antipodensis*, *gibsoni*, *amsterdamensis* and *dabbenena* all reach the size of the Amsterdam specimen. Only in *gibsoni* females have been found with culmen lengths similar to the Amsterdam bird; females of the other three taxa are substantially smaller. Of the two 'royal albatrosses', only some female *sanfordi* are small enough to match the Amsterdam culmen. *Epomophora* is the only taxon where both males and females are too large to be a candidate.

Most publications on albatross bill morphology only give culmen length and bill depth. Culmen lengths overlap considerably between taxa (table 1), while bill depth could not be taken from the Amsterdam specimen, as only the upper mandible was found. Murphy (1936) shows that bills of 'royal albatrosses' are wider than those of 'wandering albatrosses' and we have used this characteristic, in conjunction with culmen length, in an attempt to better separate the different *Diomedea* albatrosses. Bill width was measured at its widest point (at the base of the bill, eg, the proximal end of the latericorn) in specimens available in Dutch museums with additions from collections of museums around the world (see Acknowledgements for the full list), and some smaller collections. Most museum material is rather old, was collected at sea, and predates the split of '*exulans*' (sensu lato) in four to five and '*epomophora*' (sensu lato)

in two species (cf Penhallurick & Wink 2004). As a result, *exulans* could not always be separated from *dabbenena*, *antipodensis* or *gibsoni*. *Dabbenena* is small compared with *exulans*, and small '*exulans*' from the Atlantic have been assigned '*dabbenena*' if culmen lengths are <152 mm (cf Tickell 2000, table 1). This is conservative, as Cuthbert et al (2003) put the divide between *dabbenena* and (South Georgian) *exulans* at 158 mm. Plumage criteria and wing length were used as supporting evidence to identify small birds in the Atlantic as *dabbenena*. Birds collected at sea around New Zealand were probably often named '*exulans*' to distinguish them from 'royal albatrosses'. Such birds were likely *antipodensis* or *gibsoni* but since *dabbenena* can also reach eastern Australian waters, specific identity could not be established and birds from that area collected at sea were not used. *Amsterdamensis* is a special case, as only a few *amsterdamensis* specimens are available in any museum world wide: the type specimen in Paris and two or three probable *amsterdamensis* for which specific identity needs to be confirmed. Culmen length of the rather small, unsexed type specimen was given as 140 mm in the original publication (Roux et al 1983), but the proximal end of the bill sheath was abraded and our own measurements put culmen length at c 145.5 mm (range of 16 living birds was 138.2-156.2 mm; Jouventin et al 1989). We have included one probable *amsterdamensis* in our database (Paris CG1986-433; culmen 145 mm, bill width 46 mm).

The plot of 350 culmen lengths versus bill widths (figure 5) shows a continuum from very small to very large bills, across the various species. Culmen length ranges (minimum-maximum) from the literature and our own data show that all but the largest species (*epomophora*) have bills that match the Amsterdam find. Remarkably, the bill found in Amsterdam does not clearly belong to one of the species clusters but rather sits in a void, at the edge of several species. If we assume that the data are from a bivariate normal distribution (ie, both culmen and bill width are normally distributed), we can construct a two-dimensional boxplot-type graph with pairs of concentric ellipses that include 50% and 99% of the data, respectively. The inner ellipse, or 'hinge', provides a conservative visualization of the variance in the data while the outer ellipse, or 'fence', delineates potential outliers (Goldberg & Iglewicz 1992). Figure 5 shows that the Amsterdam bill does not fit into any of the 50% hinges, but does fit into the 99% fences for *exulans*, *sanfordi* and *antipoden-*

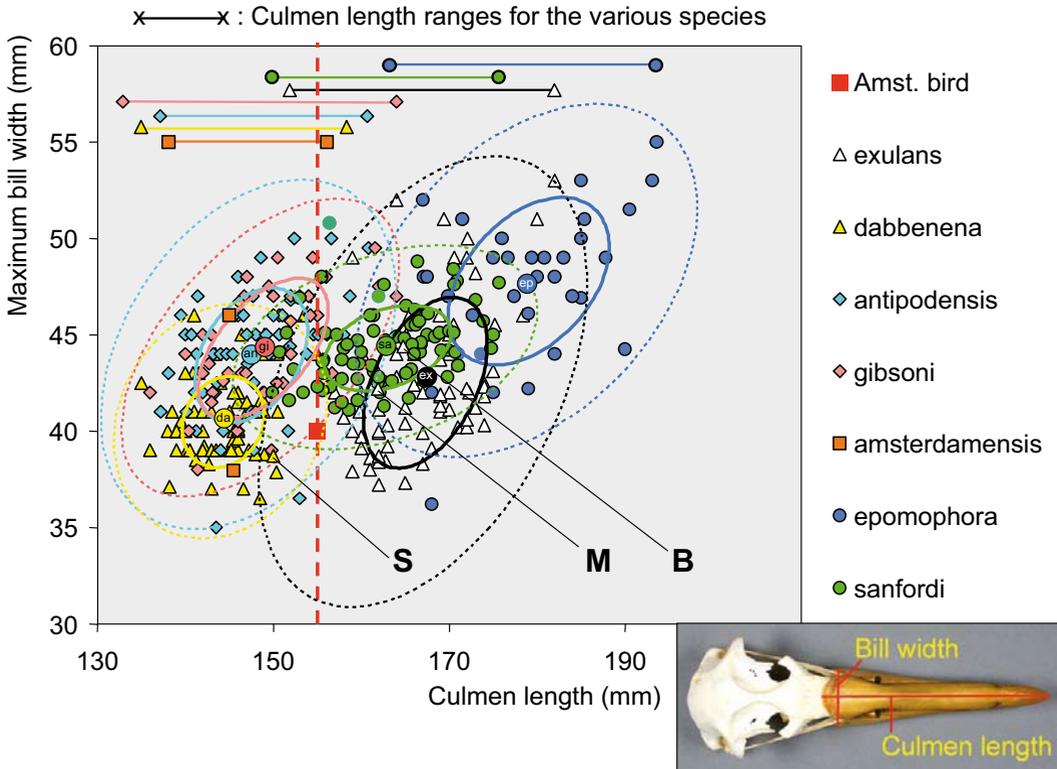


FIGURE 5 Maximum bill width as function of culmen length in seven species of *Diomedea* albatrosses. Mandible found in Amsterdam, Noord-Holland, Netherlands, on 19 October 1977 is represented by red square; vertical red broken line intersects with known culmen length ranges for six out of seven species (given in top part of graph). The birds found in Sicily, Italy (October 1957), Morocco (c 1885) and Blankenberge, West-Vlaanderen, Belgium (April 1887) are indicated by S, M and B, respectively. Inset depicts where measurements were taken. Smaller ellipses (or ‘hinges’: solid lines) include 50% of data for each species, while outer ellipses, or ‘fences’, delineate potential outliers (after Goldberg & Iglewicz 1992). Midpoints of each dataset indicated by larger points, with lettering. Note insufficient data for Amsterdam Albatross *D. amsterdamensis*.

sis, and sits at the edge of the fences for *dabbenena* and *gibsoni*. Linear discriminant analysis was used to identify the most likely species for the bill found in Amsterdam among the various datasets. This gives probabilities of 0.48 for *sanfordi*, 0.20 for *exulans* and 0.17 for *dabbenena*. *Antipodensis* (0.08) and *gibsoni* (0.07) are both considerably less likely candidates and *epomophora* (<0.001) is highly unlikely. Note that there are insufficient bill width data for *amsterdamensis* but given that length/width ratios are similar for the different species, and that the largest male *amsterdamensis* have culmen lengths comparable with the Amsterdam bird (Jouventin et al 1989), this species cannot be ruled out. A logistic regression (GLM using binominal distribution) with culmen, bill width and species (using only the bills for

which the sex was known, n=93 males and 96 females across the various species) correctly predicted sex in 83% of the known cases. Given the small size of the bill found in Amsterdam, the model indicates a 99.9% probability that it belonged to a female, if we assume the species to be *sanfordi* (cf table 1). Likewise, if the bill stems from an *exulans*, this bird would also have been a female but if it were a *dabbenena*, it would probably have been a male (cf table 1).

The measurements of the bill exclude only *epomophora* (table 1). The statistical analysis of available biometric data suggests that *sanfordi* is the most likely candidate. This might also suggest a 19th century origin, if this bird was taken by Dutch sailors in its home waters, around New Zealand. However, since *sanfordi* travels widely

outside the breeding season, an Atlantic origin, and therefore also an earlier date, cannot be ruled out. Moreover, several other species of *Diomedea* albatross remain possible candidates. *Exulans* is the most widespread and most numerous breeding 'wandering albatross' and the most numerous species in museum collections of birds collected at the high seas but most *exulans* have larger bills than the one found in Amsterdam: only the smallest females match its size. The 99% fence for *exulans* (figure 5) is relatively wide and is stretched by three data points from rather large individuals. This may overrate the probability of this species and a (South Georgia female) *exulans* may thus be a less likely candidate than the discriminant analysis suggests.

Dabbenena breeds closest to western Europe (Gough/Tristan da Cunha Islands group) of all *Diomedea* albatrosses and is relatively common at sea north-west of Cape Town, ie, along the final part of the return voyage. We know from the Moroccan and Blankenberge skulls (see below) that 'wandering albatrosses' were taken by European sailors and we also know that *dabbenena* has been found in Europe (Sicily). In contrast, there are no earlier cases of New Zealand *Diomedea* albatrosses in Europe. We have relatively few biometrical data for these species, and these are rather closely clumped, resulting in tight 50% and 99% ellipses (figure 5). It is possible that a larger dataset could have resulted in a higher probability.

Amsterdamensis is very rare, with an estimated population of only 130-150 birds (Ebels 2001, Duriez et al 2005, ACAP 2007). They are now confined to breeding on an inaccessible part of the central plateau of Amsterdam Island in the southern Indian Ocean but were once more abundant given finds of bones over a much wider area on the island (Jouventin et al 1989). Therefore, it was probably much more numerous in the past and thus more likely to be captured by passing sailors. As yet, there is insufficient material to evaluate the candidacy of this species but given that known bill sizes fall inside the ranges of *dabbenena*, *antipodensis* and *gibsoni*, each of which could not be ruled out, this species remains a possibility.

In conclusion, the specific identification of the Amsterdam mandible can not be resolved by comparative biometrics. DNA analysis may solve the problem, as DNA of all *Diomedea* albatrosses has been studied (Nunn et al 1996, Nunn & Stanley 1998, Burg & Croxall 2004). At present, however, analysis of old DNA would need so much bone material that it would destroy the

specimen. It probably will not take too long before ancient-DNA techniques are sufficiently refined to identify the Amsterdam bone without destroying it. For the time being however, it is considered more prudent to wait for these developments (Peter de Knijff in litt).

History of wanderers in Europe – stragglers or hunting trophies?

Could the albatross of Amsterdam be a true straggler or was it more likely a captured bird brought to Amsterdam onboard one of the many ships that called into the port of Amsterdam? Despite the folklore culminating in the famous *Rime of the ancient mariner* (Coleridge 1949), old mariners and, later on, their passengers caught many albatrosses on their voyages during the 19th century (see Medway 1998 for a vivid description of these practices). They hooked or shot birds at sea and collected eggs, chicks and breeding adults during visits to breeding islands. Birds were taken for the pot but also for fun, and parts were taken home as souvenir. Skins were used for feather rugs and muffs, legs and feet for tobacco pouches, wing bones as pipe stems and beaks as paperclips (Alexander 1955, Jameson 1958, Medway 1998). Many of the albatross skulls in Dutch museums and private collections have a history as souvenir, some with documentation, many without. Warham (1990) comments that many museum specimens from VOC times have small nicks in the cutting edge of the bill tip (at the inside of the hooked part) made by the sailors' catching device: a sharp metal open triangle baited with fat that was towed behind the ship on a line (Jones 1936). Apparently, several birds caught were kept alive and shipped back to Europe. Some ended up in market places; others probably escaped or were discarded, dead or alive. Bourne (1967) pointed out that many records of *Diomedea* albatrosses in Europe concern birds found near major harbours and argued that the majority of these, if not all, were likely brought in by man. Good examples are the records of Antwerpen, Antwerpen, Belgium; Blankenberge, West-Vlaanderen, Belgium; Dieppe, Seine-Maritime, France; and London, England (see below and table 2). The Wandering Albatross from Morocco in 1885 fits this pattern as well, as it was found along the major shipping route to Europe. Alexander (1955) suggested that the habit of catching albatrosses alive died out with the introduction of the faster steam ships. Since then, however, *Diomedea* albatrosses have still been found or seen in European waters. Of the very few birds that were reported alive at sea, none were accompa-

Albatross mandible at archeological site in Amsterdam, the Netherlands

TABLE 2 Reports of *Diomedea* albatrosses in Europe and north-western Africa. Note that most '*exulans*' should be regarded as *Diomedea* species (at best: Bauer & Glutz von Blotzheim (1966) state that old records of albatrosses were often referred to as *D exulans*, regardless of species). Note also that the first record is probably false and that most others, with the exceptions of the preserved Sicilian bird and the preserved bones from Morocco, Blankenberge, London and Amsterdam, must be considered 'inadequately described' by today's standards.

| | | | |
|---------------------------|---------------------|---|---|
| <i>(exulans)</i> | November 1758 | Etang de Chaumont, Orne, France | Killing of three individuals on inland lake (Letacq 1897) (improbable) |
| <i>exulans</i> | 1764 | Norway or Denmark | Bourne (1967) |
| <i>exulans</i> | November c 1830 | Dieppe, Seine-Maritime, France | Killed or obtained (?) by customs official (Bourne 1967) |
| <i>exulans</i> | September 1833 | Antwerpen, Belgium, | Killed with oars by fishermen off Antwerpen. Possibly same bird as the one reported from Dieppe, France (Mayaud et al 1936, Bourne 1967, Lippens & Wille 1972) |
| <i>exulans</i> | 1868 | Borkum, Germany | Single wing 'supposedly washed ashore' (Bauer & Glutz von Blotzheim 1966) |
| <i>exulans</i> | pre-1880 | Tenerife, Canary Islands | One bird in company of giant petrel <i>Macronectes</i> sp (Bourne 1967) |
| <i>exulans</i> | 1885 | Morocco | Capture of <i>D exulans</i> on coast, later wrongfully assigned to <i>epomophora</i> . Skull in collection AMNH, New York, USA (Vaucher & Vaucher 1915, Hartert 1923, Bourne 1967) |
| <i>exulans</i> | 27 April 1887 | Blankenberge, West-Vlaanderen, Belgium | Captured and clubbed to death on breakwater. Skull in collection Royal Belgian Institute of Natural Sciences, Brussels, Belgium (Dupond 1943, Jacobs & Dirx 1945, Lippens & Wille 1972, 1986) |
| <i>exulans</i> | c 1891 | Ilford, Essex, England | Find of ulna. Earlier invalidly assigned to late Pleistocene <i>Phoebastria (Diomedea) anglica</i> (Harrison & Walker 1978) |
| <i>exulans</i> | c 1900 | Hull, Yorkshire, England | Head found in shop of dealer in live stock and curios, which was taken from intact but decomposing bird washed ashore there c 30 years before (Jones 1936) |
| <i>exulans</i> | 18 July 1894 | 20 nm off Orkney | Juvenile, ship follower (Bourne 1992) |
| <i>exulans</i> | December 1909 | London, England | One specimen hanging and dripping blood among turkeys in Leadenhall Market, London (Bourne 1967) |
| <i>exulans</i> | c 1912 | Fischen, Ammersee, Bayern, Germany | Emaciated but live bird, ended up in collection of a Dr Francke but has since been lost (Wüst 1982); possibly different species (Bauer & Glutz von Blotzheim 1966) |
| <i>dabbenena</i> | 4 October 1957 | Palermo, Sicily, Italy | Immature male, crashed by wind sheer on coastal road, captured and killed by passing motorist (Orlando 1958) |
| <i>exulans</i> | 18 October 1963 | 80 km off south-western Portugal | Immature, observed following HMS Protector (Bourne 1966) |
| <i>exulans?</i> | September 1969 | Morocco | Possible wandering albatross (Harrop 1994, citing M Thevenot (pers comm) without further details; correspondence has been lost) |
| <i>exulans</i> | 19 October 1977 | Amsterdam, Noord-Holland, Netherlands | Find of bill, excavated from former harbour front (this paper) |
| <i>exulans/epomophora</i> | July or August 1990 | Off Sumburgh Head, Shetland, Scotland | Sighting by Sarah Wanless (pers comm) |
| <i>exulans/epomophora</i> | 7 October 1991 | North Sea, 20 km off Holland, Netherlands | Two birds flying together, sighted from seabirds survey plane (Baptist & Wolf 1991) |



FIGURE 6 Wandering Albatross / Grote Albatros *Diomedea exulans*, found at Moroccan west coast, around 1885 (Peg Hart/American Museum of Natural History, New York)

nied by 'hard evidence' such as photographs (table 2). There is only one indisputable case, of a *Diomedea* crashing on a coastal road near Palermo, Sicily, Italy, where it was killed by a passing motorist. This is the only case of a bird that has properly been described, photographed and preserved (Orlando 1958; see below).

Of the 19 European records, reports and claims of *Diomedea* albatrosses in the Western Palearctic that we could trace (table 2), very few stem from their natural environment, the open sea. Bourne (1967, 1992) considers that only the birds seen off Orkney, Scotland, in 1894, on Sicily, Italy, in 1957 and off Portugal in 1963 might be genuine records of wild birds. Since then, two intriguing but unconfirmed sightings have been made by professional marine ornithologists (one off Sumburgh Head, Shetland, Scotland, in August 1990 and one concerning two birds off the Dutch coast in October 1991). Another bird was reputedly seen at sea off Morocco in September 1969 (Harrop 1994) but the documentation concerning this sighting has been lost (Hugh Harrop in litt). None of these last three records was forwarded to the appropriate rarities committee, however, and these were thus not further considered for the Western Palearctic list. Of only four birds, excluding the mandible found in Amsterdam, hard evidence (ie, bones) has been preserved; these are discussed in more detail below.

Morocco, c 1885

Around 1885, an albatross skull was 'obtained from an Arab' (Vaucher & Vaucher 1917). It was presumably caught and killed on the Moroccan west coast and first identified as *D exulans* but

later considered to be *D epomophora* by Hartert & Jourdain (1923), and mentioned as such by Bauer & Glutz von Blotzheim (1966) and Cramp & Simmons (1977). Hartert & Jourdain (1923) had doubts about its origin and considered its occurrence 'most unexpected, but not impossible'. The skull was kept in the Vaucher collection in Tanger, Morocco, and was later donated to the Natural History Museum in Tring, England (Heim de Balsac & Mayaud 1962). Today, it is kept in the American Museum of Natural History, New York, USA (AMNH526798). At our request, photographs of this specimen were e-mailed (figure 6) and since the ramphotheca is present we could confirm the identification as *D exulans* by bill, tube shape characteristics and coloration (no black cutting edge). Culmen (161.9 mm) and bill width (42.4 mm) also identify this bird as *exulans* and not *epomophora*; see figure 5). The cranium shows a series of cracks which may confirm a violent death and the inner bill-tip shows a nick such as mentioned by Warham (1990).

London, England, c 1891

A single ulna was found 'near the port of London' in c 1891. This specimen was first identified as *D exulans* but later as a possible late Pleistocene *Phoebastria (Diomedea) anglica*. Later again, this was corrected by Harrison & Walker (1978b) as a bone of a modern Wandering Albatross (*sensu lato*).

Blankenberge, Belgium, April 1887

Dubois (1890), cited by Bourne (1967), first mentioned a 'great albatross' that was found and clubbed to death on a breakwater at the seaport of



FIGURE 7 Wandering Albatross / Grote Albatros *Diomedea exulans*, found at Blankenberge, West-Vlaanderen, Belgium, on 27 April 1887 (George Lenglet/Royal Belgian Institute of Natural Sciences, Brussel)

Blankenberge on 27 April 1887. The story goes that the bird was eaten by the port warden's family but that the head was kept, although it only just escaped being eaten by a cat or by rats (Jacobs & Dirx 1945). The head ended up in the collection of a small zoo in Gent, Oost-Vlaanderen. When this zoo went out of business, the head was acquired by the count De Hemptinne for his private collection. Shortly after the count's death in September 1942, Dupond (1943) visited the count's widow to verify the find. He found the head in a poor state ('badly eaten by mites'). De Hemptinne's collection was transferred to baron P de Moffarts, who donated it in May 1958 to the Royal Belgian Institute of Natural Sciences in Brussels where it is still kept (KBIN 54107) (figure 7). The bird can be identified as *exulans*, with a culmen of 164.8 mm and a bill width of 44.4 mm (figure 5). The bill is nicked at the cutting edge of the inner hook.

Sicily, Italy, October 1957

On 4 October 1957, Guagliardo Gaetano, driving along the coastal road from Palermo to Termini Imerese, Sicily, noticed a very large bird that was brought down by a gust of wind. He got out of his car, killed it and took it to the local hunters club. The bird was photographed, measured and stuffed and identified as *D. exulans*. Orlando (1958) no-

ticed that with a culmen length of 150 mm this bird could be a *dabbenena* but he dismissed this taxon as being too unlikely. However, the bill width of this bird was c 39 mm (taken from Orlando 1958, figure 4) and this puts it clearly in the *dabbenena* realm (figure 5).

In addition to the collected birds or bones, two live offshore sightings and one sighting from the shore may be considered credible, although they all lack good evidence. John Harvie-Brown reported an immature albatross ('brown and mottled plumage on the back; this bird was no gannet') following a ship for hours, c 20 nautical miles off Orkney, Scotland, on 18 July 1894. He saw the bird as close as 200-300 m with Northern Gannets in all plumages around, and noted 'a heavy thick and short' (?) bill. A second young (brown) '*exulans*' was seen following a ship for four hours on 18 October 1963, c 50 nautical miles off south-western Portugal. It was described as 'larger than Gannets and Black-backed Gulls and brown all over with white cheeks and underwings, a pale cream bill, and light brown legs; there seems little room for error' (Bourne 1966, 1967). Finally, Sarah Wanless (pers comm) saw a 'great albatross' off Sumburgh Head, Shetland, in July or August 1990 but since she could not identify the bird to species, she never submitted it.

Discussion

The Sicilian record is possibly the only proven, genuine case of a vagrant *Diomedea* albatross in Europe (Bourne 1967, 1992), if one assumes that this bird entered the Mediterranean unassisted, only to crash into Sicily later. The Moroccan record from 1885, relatively close to the western entrance to the Mediterranean Sea from an albatross point of view, provides little support for the idea that birds may regularly stray (far) north of the equator. This bird was caught alive at the shore and killed on the spot, as was the Sicilian bird. However, a nick in the inner bill tip hints at an earlier, live capture by sailors in the southern hemisphere prior to a release later (cf Jones 1936, Warham 1990) and it probably did not reach Morocco unaided. Another report from Morocco concerns an unconfirmed and undocumented sighting in 1969 and carries little weight. The three other cases for which proof exists in the form of preserved bones (including the Amsterdam find) all stem from European seaports and therefore these birds probably all came ship-assisted. Further evidence for this hypothesis is provided by the nick in the bill of the Belgian bird. Lippens (1954), Lippens & Wille (1972, 1986), Bourne (1967, 1992) and Harrison & Walker (1978b) all proposed that the birds from Blankenberge, Morocco and London did not fly to the Western Palearctic but were somehow carried, and the same is most likely true for the Amsterdam bird. These four cases also have in common that they were found (or presumably were deposited) before 1900, in the era of sailing. In all likelihood, therefore, most if not all of the pre-1900 birds were brought to the Western Palearctic by ocean going ships and were either lost or discarded along the way or in the port of destination.

The bill fragment found in Amsterdam fits in with the larger set of pre-1900 cases of *Diomedea* albatrosses dotted along the north-western African and European coasts (table 2). Furthermore, given that the chances of finding an albatross bill in the harbour of Amsterdam from a straggler that had arrived by its own power are remote, the Amsterdam bill most likely belonged to a bird that was captured and brought to Amsterdam by a sailor or ship passenger before 1876, the year in which the old harbour front was filled up.

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Possession Island to be included in table 1; likewise, Richard Cuthbert (Royal Society for the Protection of Birds) sent us his measurements of Tristan Albatrosses and included measurements taken by Richard Philips of South Georgian birds. Robert Brasseur, the current count (Xavier) de Hemptinne, Dominick Verschelde (Zoology Museum, Gent University, Belgium) and Georges Lenglet (Royal Belgian Institute of Natural Sciences, Brussel, Belgium) helped finding the Blankenberge head and George Lenglet kindly took photographs and the necessary measurements. Eric Pasquet and Marie Portas (Muséum National d'Histoire Naturelle, Paris) kindly made the *amsterdamensis* type specimen available to us and chased several probable collected *amsterdamensis*. Carl Gustaf Lundin and Katja Philippart measured the *amsterdamensis* type skull in Paris. Erik Wijnker kindly allowed us to use the photograph of the fossil *Phoebastria* bill-tip (figure 3). Thanks also go to Peter Stallegger who provided us with the original text about the supposed killing of three albatrosses on a pond in Normandy, France, and to Robert Brasseur who translated this paper for us. Guido Keijl and Roy Kleukers translated the Italian paper on the Tristan Albatross crashing on Sicily. Sebastian Werner of the Landesbund für Vogelschutz in Bayern, Germany, was very helpful in trying to find remains of the alleged wanderer of the Ammersee, Bayern (table 2). Nils van Duivendijk and Roland van der Vliet (CDNA) searched the CDNA archive to unearth details on several of the Dutch albatross claims. Finally, Hans van der Plicht (Center for Isotope Research, Groningen University & Faculty of Archaeology, Leiden University) and Jan de Leeuw (Royal Netherlands Institute for Sea Research) advised us on the (im)possibilities of C14 dating and Peter de Knijff (Forensic Laboratory for DNA Research, Leiden University Medical Center) and Judith van Bleijswijk (Royal Netherlands Institute for Sea Research) advised us on ancient-DNA analyses.

Samenvatting

ARCHEOLOGISCHE VONDST VAN ALBATROSSNAVEL IN AMSTERDAM EN WP-GEVALLEN VAN *DIOMEDEA*-ALBATROSSEN In oktober 1977 werd bij graafwerkzaamheden voor een nieuwe metrolijn in Amsterdam, Noord-Holland, een deel van een albatrossnavel gevonden op een diepte van c 5 m. De locatie, schuin tegenover het Centraal Station is een oude havenbodem van het IJ aan de voet van het voormalige bolwerk Camperhoofd. Ten tijde van de Vereenigde Oostindische Compagnie (VOC) en de vroege stoomvaart was dit het centrum van de Nederlandse handelsvaart. In 1876 werd de locatie volgestort met stads- en scheepsafval en afgedekt met zand voor de

aanleg van onder andere het Centraal Station. De snavel bevindt zich in de collectie van de Dienst Monumenten & Archeologie van de gemeente Amsterdam en werd aanvankelijk gelabeld als 'grote meeuw'. Expositie van deze snavel, bijna 30 jaar later, vormde de aanleiding tot nader onderzoek naar de identiteit en mogelijke herkomst. Vergelijking met skeletmateriaal uit diverse collecties en van verschillende vogelsoorten toonde aan dat het om een bovensnavel van een van de 'grote albatrossen' *Diomedea* gaat. Andere albatrossoorten konden worden uitgesloten, evenals een paleontologische vondst. De datering is problematisch omdat een onduidelijke bodemstratificatie onvoldoende aanknopingspunten biedt door een mix van materiaal uit verschillende periodes. Datering met behulp van C14 is onbetrouwbaar vanwege het 'Mariene Reservoir-effect' dat afwijkingen tot 400 jaar met zich meebrengt bij dit soort materiaal. Op grond van de bekende gegevens is geconcludeerd dat snavel tussen de 15e en de 19e eeuw op de vindplaats terecht is gekomen.

Voor een goede determinatie biedt een bovensnavel zonder hoornlaag beperkte mogelijkheden tot biometrische vergelijking. Om toch tot een nadere identificatie te komen zijn van alle *Diomedea*-taxa van bekende herkomst de snavelmaten (culmenlengte en breedte aan de basis) met elkaar vergeleken (waarbij een taxonomie met zeven *Diomedea*-soorten wordt gehanteerd: vijf 'wandering' en twee 'royal'). De Amsterdamse snavel blijkt precies in het overlapgebied te vallen van meerdere soorten. Een nauwkeurige determinatie is daarom niet mogelijk. Alleen Zuidelijke Koningsalbatros *D epomophora* valt met zekerheid af. Statistische analyse wijst een vrouwtje Noordelijke Koningsalbatros *D sanfordi* als meest waarschijnlijke kandidaat aan, maar ook Grote Albatros *D exulans* en Tristanalbatros *D dabbenena* zijn goede kandidaten, terwijl nog drie andere soorten, inclusief Amsterdameilandalbatros *D amsterdamensis* tot de mogelijkheden behoren. In de toekomst, wanneer technieken om 'oud' DNA te onderzoeken zijn verbeterd, biedt een DNA-analyse wellicht een sluitende determinatie.

Om de vondst in een historische context te plaatsen is een overzicht gemaakt van gevallen en meldingen uit Europa en Noordwest-Afrika en is gekeken naar de geschiedenis van de Amsterdamse haven, de scheepvaart in de onderhavige periode en de interacties tussen zeeleden en albatrossen. Sinds een vorig overzicht (Bourne 1967, 1992) zijn enkele nieuwe gevallen bekend geworden en een eerder gemist geval werd ontdekt (Hull). De beschrijvingen van de oude gevallen zijn waar mogelijk geverifieerd. Hierbij is van twee vogels waarvan de snavel bewaard is gebleven (Marokko en Blankenberge, West-Vlaanderen, België) de identiteit vastgesteld op grond van biometrisch onderzoek en uiterlijke kenmerken. Beide bleken echter een beschadiging aan de snavelpunt te vertonen die erop wijst dat ze met een haak zijn gevangen. Een dergelijke beschadiging is afwezig bij de vogel (*dabbenena*) die op 4 oktober 1957 op Sicilië, Italië, werd verzameld.

Van een groot deel van de gevallen mag op grond van vindplaats en omstandigheden worden aangenomen dat

zeevarenden de hand hebben gehad in de verschijning op het Noordelijk Halfrond. De scheepsbewegingen uit de VOC-tijd en later voerden langs vrijwel alle broedplaatsen van 'grote albatrossen' en het vangen en doden van albatrossen kwam veelvuldig voor. Daarom is het waarschijnlijk dat ook de Amsterdamse albatros niet op eigen kracht Nederland heeft bereikt.

References

- ACAP (Agreement on the Conservation of Albatrosses and Petrels) 2007. Amsterdam Albatross *Diomedea amsterdamensis*. Website: www.acap.aq/en/species_assessments/Amsterdam_Albatross_ACAP_Species_Assessments.pdf.
- Alexander, W B 1955. Birds of the ocean, a handbook for voyagers. Revised edition. London.
- Baptist, H J M & Wolf, P A 1991. Twee albatrossen voor de Nederlandse kust. Sula 5: 157-158.
- Bauer, K M & Glutz von Blotzheim, U N (editors) 1966. Handbuch der Vögel Mitteleuropas 1. Frankfurt am Main.
- BirdLife International 2004. Tracking ocean wanderers: the global distribution of albatrosses and petrels. Results from the Global Procellariiform Tracking Workshop, 1-5 September 2003, Gordon's Bay, South Africa. Cambridge, UK. Website: www.birdlife.org/action/science/species/seabirds/tracking.html.
- Bonaccorsi, G 2003. Lesprocellariiformes (Diomedidae, Procellariidae et Hydrobatidae) non nicheurs en Méditerranée occidentale: une synthèse. Alauda 71: 1-7.
- Bourne, W R P 1966. Observations of seabirds. Sea Swallow 18: 9-36.
- Bourne, W R P 1967. Long distance vagrancy in petrels. Ibis 109: 141-167.
- Bourne, W R P 1992. Debatable British and Irish seabirds. Birding World 5: 382-390.
- Brooke, M 2004. Albatrosses and petrels across the world. Oxford.
- Burg, T M & Croxall, J P 2004. Global population structure and taxonomy of the wandering albatross species complex. Mol Ecol 13: 2345-2355.
- Coleridge, S T 1949. The rime of the ancient mariner. London.
- Cramp, S & Simmons, K E L (editors) 1977. The birds of the Western Palearctic 1. Oxford.
- Cuthbert, R J, Phillips, R A & Ryan, P G 2003. Separating the Tristan Albatross and the Wandering Albatross using morphometric measurements. Waterbirds 26: 338-344.
- Dickinson, E C (ed) 2003. The Howard and Moore complete checklist of the birds of the world. Third edition. London.
- Dubois, A 1890. Observations ornithologiques. Ornis 6: 343.
- Dupond, Ch 1943. Ma visite à la collection d'oiseaux de feu le comte Joseph de Hemptinne. Gerfaut 33: 108-122.
- Duriez, O, Jornvall, H & Shirihai, H 2005. Birds and wildlife of the French sub-antarctic islands: Crozet, Kerguelen and Amsterdam & St Paul. Dutch Birding 27: 87-115.
- Dyke, G J, Nudds, R L & Walker, C A 2007. The Pliocene *Phoebastria* ('*Diomedea*') *anglica*: Lydekker's English fossil albatross. Ibis 149: 626-631.
- Dymond, J N, Fraser, P A & Gantlett, S J M 1989. Rare birds in Britain and Ireland. Calton.
- Ebels, E B 2001. Amsterdam and its albatross. Dutch Birding 23: 7-12.
- Gantlett, S & Pym, T 2007. The Atlantic Yellow-nosed Albatross from Somerset to Lincolnshire – a new British bird. Birding World 20: 279-295.
- Goldberg, K M & Iglewicz, B 1992. Bivariate extensions of the boxplot. Technometrics 34: 307-320.
- Gustad, J R 1995. Sjeldne fugler i Norge i 1993 og 1994. Rapport fra Norsk sjeldnehetskomité for fugl (NSKF). Vår Fuglefauna 18: 259-302.
- Harrison, C J O & Walker, C A 1978a. The North Atlantic Albatross *Diomedea anglica*, a Pliocene-lower Pleistocene species. Tertiary Res 2:45-46.
- Harrison, C J O & Walker, C A 1978b. The invalidity of Pleistocene records of Wandering Albatross *Diomedea exulans*. Ibis 120: 229-230.
- Harrop, H 1994. Albatrosses in the Western Palearctic. Birding World 7: 241-245.
- Hartert, E & Jourdain, F C R 1923. The hitherto known birds of Morocco. Novitates Zoologicae 30: 91-152.
- Heim de Balsac, H & Mayaud, N 1962. Les oiseaux de nord-ouest de l'Afrique. Paris.
- Jacobs, E M 1991. Varen om peper en thee. Zutphen.
- Jacobs, J & Dirckx, H 1945. Autour d'une tête d'Albatros hurleur. Gerfaut 35: 186-187.
- Jameson, W 1958. The Wandering Albatross. London.
- Jenkins, H L 1973. Ocean passages of the world. Third edition. Taunton.
- Jones, F W 1936. The wanderings of the albatrosses. Emu 36: 103-105.
- Jouventin, P, Martinez, J & Roux, J-P 1989. Breeding biology and current status of the Amsterdam Island Albatross *Diomedea amsterdamensis*. Ibis 131: 171-182.
- Leopold, M F, Renner, M & Drees, C 1994. The Black-browed Albatross in the North Sea. Sula 8: 268-272.
- Letacq, A L 1897. Oiseaux tués à l'étang de Chaumont à la Trappe (Orne) en novembre 1758. Bull de la Société des amis des Sciences Naturelles de Rouen.
- Lippens, L 1954. Les oiseaux d'eau de Belge. Brugge.
- Lippens, L & Wille, H 1972. Atlas van de vogels in België en West-Europa. Tielt.
- Lippens, L & Wille, H 1986. Uitzonderlijke vogels in België en West-Europa. Private publication.
- Louwe Kooijmans, J 2005. De oudste Grutto van Amsterdam. Vogeljaar 53: 131-132.
- Lydekker, R 1891. Catalogue of the fossil birds in the British Museum (Natural History). London.
- Mayaud, N, Heim de Balsac, H & Jouard, H 1936. Inventaire des oiseaux de France. Paris.
- Medway, D G 1998. Human induced mortality of Southern Ocean Albatrosses at sea in the 19th century: a historical review. In: Robertson, G & Gales, R (editors), Albatross biology and conservation, Chipping Norton, Australia, pp 189-198.
- Murphy, R C 1936. Oceanic birds of South America.

- New York.
- Nicholls, D G, Robertson, C J R, Prince, P A, Murray, M D, Walker, K J & Elliott, G P 2002. Foraging niches of three *Diomedea* albatrosses. *Mar Ecol Prog Ser* 231: 269-277.
- Nunn, G B & Stanley, S E 1998. Body size effects and rates of cytochrome *b* evolution in tube-nosed seabirds. *Mol Biol Evol* 15: 1360-1371.
- Nunn, G B, Cooper, J, Jouventin, P, Robertson, C J R & Robertson, G G 1996. Evolutionary relationships among extant albatrosses (Procellariiformes: Diomedidae) established from complete cytochrome-*b* gene sequences. *Auk* 113: 784-801.
- Olson, S L & Hearty, P J 2003. Probable extirpation of a breeding colony of Short-tailed Albatross (*Phoebastria albatrus*) on Bermuda by Pleistocene sea-level rise. *Proc Natl Acad Sci USA* 100: 12825-12829.
- Olson, S L & Rasmussen, P C 2001. Miocene and Pliocene birds from the Lee Creek Mine, North Carolina. In: Ray, C E & Bohaska, D J (editors), *Geology and paleontology of the Lee Creek Mine, North Carolina, III*, Smithsonian Contr to Paleobiol 90: 233-365.
- Onley, D & Scofield, P 2007. Albatrosses, petrels and shearwaters of the World. London.
- Orlando, C 1958. Cattura di Albatro urlatore (*Diomedea exulans*, Linnaeus) in Sicilia. *Riv Ital Ornitol* 28: 101-113.
- Penhallurick, J & Wink, M 2004. Analysis of the taxonomy and nomenclature of the Procellariiformes based on complete nucleotide sequences of the mitochondrial cytochrome *b* gene. *Emu* 104: 125-147.
- Pitches, A 2007. News and comment: The one that got away (twice). *Br Birds* 100: 512-513.
- Prince, P A, Croxall, J P, Trathan, P N & Wood, A G 1998. The pelagic distribution of South Georgia albatrosses and their relationships with fisheries. In: Robertson, G & Gales, R (editors), *Albatross biology and conservation*, Chipping Norton, Australia, pp 137-167.
- Reimer, P J & Reimer, R W 2001. A marine reservoir correction database and on-line interface. *Radiocarbon* 43: 461-463.
- Robertson, C J R & Nunn, G B 1998. Towards a new taxonomy for albatrosses. In: Robertson, G & Gales, R (editors), *Albatross biology and conservation*, Chipping Norton, Australia, pp 13-19.
- Robertson, C J R & Warham, J 1992. Nomenclature of the New Zealand Wandering Albatross (*Diomedea exulans*). *Bull Br Ornithol Cl* 112: 74-81.
- Robertson, C J R & Warham, J 1994. Measurements of *Diomedea exulans antipodensis* and *D. e. gibsoni*. *Bull Br Ornithol Cl* 114: 132-133.
- Roux, J-P, Jouventin, P, Mougou, J-L, Stahl, J-C & Weimerskirch, H 1983. Un nouvel albatros *Diomedea amsterdamensis* n. sp. découvert sur l'île Amsterdam (37°50'S, 77°35'E). *L'Oiseau et RFO* 53: 1-11.
- Shaffer, S A, Weimerskirch, H & Costa, D P 2001. Functional significance of sexual dimorphism in Wandering Albatrosses, *Diomedea exulans*. *Funct Ecol* 15: 203-210.
- Tickell, W L N 2000. Albatrosses. Mountfield.
- Vaucher, H & Vaucher, A 1917. Liste des oiseaux observés au Maroc. *Rev Française d'Ornithol* 7 & 8: 137.
- Warham, J 1990. The petrels: their ecology and breeding systems. London.
- Wijnker, E 2005. Miocene and Pliocene marine birds from Mill, the Netherlands. Unpublished MSc thesis, Wageningen University, Wageningen.
- Wüst, W, Bandorf, H, Heiser F, Krauss W & Nitsche, G (editors) 1982. *Avifauna Bavariae – die Vogelwelt Bayerns im Wandel der Zeit I*. Second edition. Altötting.
- Edward Soldaat, Margrietstraat 5, 9491 BE Zeijen, Netherlands (edward@shearwater.nl)*
Mardik F Leopold, Dutch Seabird Group & Wageningen IMARES, PO Box 167, 1790 AD Den Burg, Texel, Netherlands (mardik.leopold@wur.nl)
Erik Meesters, Wageningen IMARES, PO Box 167, 1790 AD Den Burg, Texel, Netherlands (erik.meesters@wur.nl)
Christopher J R Robertson, PO Box 12397, Wellington 6144, New Zealand (cjrr@wildpress.org)