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SHORT NOTE

Observations of a distinctive morphotype of killer whale (*Orcinus orca*), type D, from subantarctic waters

Robert L. Pitman · John W. Durban · Michael Greenfelder · Christophe Guinet · Morton Jorgensen · Paula A. Olson · Jordi Plana · Paul Tixier · Jared R. Towers

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Abstract Studies have shown that killer whale (*Orcinus orca*) communities in high latitudes regularly comprise assemblages of sympatric 'ecotypes'—forms that differ in morphology, behavior, and prey preferences. Although they can appear superficially similar, recent genetic evidence suggests that breeding is assortative among ecotypes within individual communities, and species-level divergences are inferred in some cases. Here, we provide information on a recently recognized 'type D' killer whale based on photographs of a 1955 mass stranding in New Zealand and our own six at-sea sightings since 2004. It is the most distinctive-looking form of killer whale that we know of, immediately recognizable by its extremely small white eye patch. Its geographic range appears to be circumglobal in subantarctic waters between latitudes 40°S and 60°S. School sizes are relatively large (mean 17.6; range 9–35; $n = 7$), and although nothing is known about the type D diet, it is suspected to include fish because groups have been photographed around longline vessels where they reportedly depredate Patagonian toothfish (*Dissostichus eleginoides*).

Keywords Killer whale · *Orcinus orca* · Subantarctic · Type D

R. L. Pitman (✉) · J. W. Durban · P. A. Olson
Protected Resources Division, Southwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, 8604 La Jolla Shores Drive, La Jolla, CA 92037, USA
e-mail: robert.pitman@noaa.gov

M. Greenfelder
14940 Elton St. SW, Navarre, OH 44662, USA

C. Guinet · P. Tixier
CEBC-CNRS, Villiers-en-Bois, 79360 Beauvoir-sur-Niort, France

M. Jorgensen
Broagergade 1, 3.th, 1672 København V, Denmark

J. Plana
Quaternary Research Center (CEQUA), Avenida Bulnes 01890, Casilla 737, Punta Arenas, Chile

J. R. Towers
Marine Education and Research Society, Box 554, Alert Bay, BC V0N 1A0, Canada

Introduction

Research on killer whales (*Orcinus orca*) has revealed that, at least in high latitudes, their communities are often comprised of different 'ecotypes'—sympatric, non-interbreeding populations that differ in their prey preferences, social structure, acoustic behaviors, and morphological traits (Ford et al. 2000; Pitman and Ensor 2003; Foote et al. 2009). Recent genetic evidence suggests that at least some of these ecotypes represent well-established divergences and should be considered separate species (LeDuc et al. 2008, Morin et al. 2010).

Three readily field-identifiable killer whale ecotypes have been described from Antarctic waters (types A, B, and C; Pitman and Ensor 2003). A fourth and markedly different-looking killer whale from the southern hemisphere was described by Jefferson et al. (2007); it was referred to as 'type D' and was easily recognizable by its extremely small white post-ocular eye patch. It seems clear now, based on comparisons with photographs from recent at-sea sightings, that this is the same distinctly patterned killer whale that mass-stranded in Paraparaumu, New Zealand in 1955 (Baker 1983). Here, we provide new information on

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the appearance and distribution of type D killer whale based on observations and photographs from six recent at-sea encounters and the 1955 stranding.

Results and discussion

Since 2004, we have recorded at-sea sightings of type D killer whales from six different locations in the southern hemisphere. These, along with the New Zealand stranding, are plotted in Fig. 1; additional details of these encounters are provided in Table 1, and photographs from each are shown in Fig. 2.

Its distinctive pigmentation patterning and morphology make type D killer whale readily identifiable in the field (Fig. 2). It is a typical black and white form of killer whale, without the conspicuous dorsal cape of Antarctic types B and C (Pitman and Ensor 2003). Also, types B and C killer whales often appear yellow- or brownish-colored due to a diatom film on their skin (Pitman and Ensor 2003), but none of the 269 photographs of type D killer whales that we reviewed showed this condition. The saddle (the light-pigmented area directly behind and below the dorsal fin) is moderately conspicuous, unlike killer whales found in the tropics which typically have faint, often barely discernable saddles (Baird et al. 2006; Pitman et al. 2007).

The most distinctive feature of type D killer whale is the extremely small post-ocular white eye patch (Visser and Mäkeläinen 2000). As in most killer whale ecotypes, the eye patch is oriented parallel to the body axis. Noting the small size of the eye patch from published photographs of the 1955 stranding, Pitman and Ensor (2003) suggested that they might have been type C killer whales, but the latter has a distinctly downward-slanted and somewhat larger eye patch. Visser and Mäkeläinen (2000) reported that at least two of the animals from the 1955 stranding had angled eye patches, but our large photographic sample of live animals over a broad geographic range (Fig. 2) shows that the eye patch is oriented parallel with the body axis. The relative size of the eye patch in type D is not obviously sex- or age related because it appears to be of similar relative size in adult males and females, as well as in calves (Fig. 2).

Type D also has a noticeably bulbous head, so much so that in at least some individuals the head shape appears more similar to a pilot whale (*Globicephala* spp.) than do other types of killer whales (Fig. 2c, e, g). The dorsal fin is also distinctive being narrow with a sharply pointed tip and usually quite backswept (Fig. 2d, f, g). This was especially

Table 1 Records of type D killer whales from the southern hemisphere

Record	Date	Latitude (S)	Longitude	School size
1	13 May 1955	40°55′	174°59′E	17
2[a]	24 Nov 2004	53°33′	42°02′W	>10
3	26 Dec 2006	52°34′	2°28′E	35
4	17 Feb 2009	46°38′	48°29′E	9
5	20 Nov 2009	58°39′	64°32′W	15–20
6	12 Dec 2009	51°39′	169°06′E	20–25
7	4 Mar 2010	60°10′	68°37′W	10–15

[a] position approximate

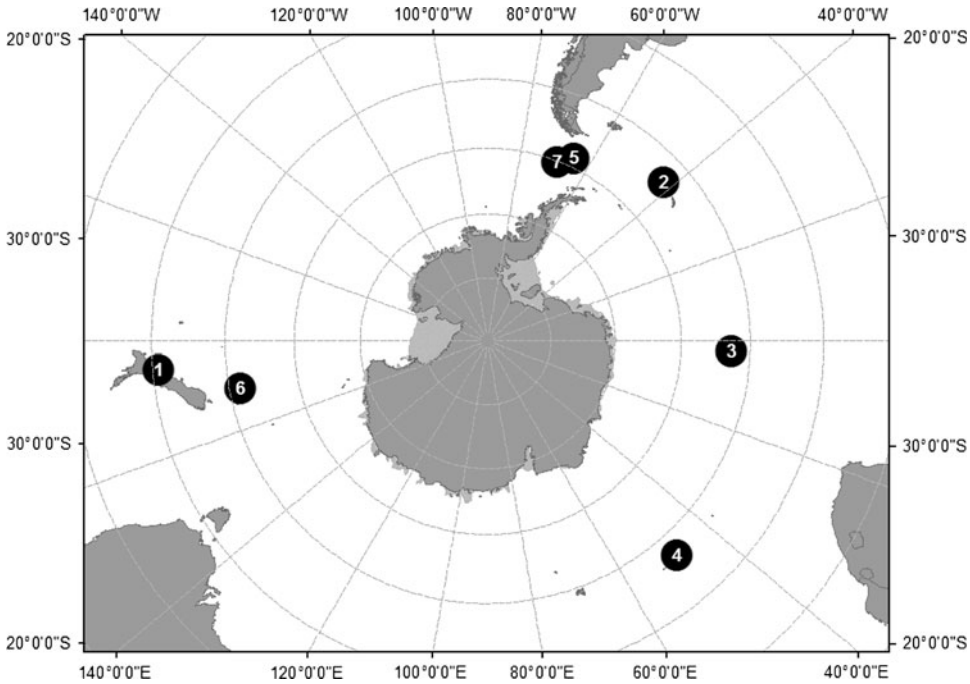

Fig. 1 Locations of a stranding (1) and six at-sea sightings (2–7) of subantarctic killer whales (*Orcinus orca*), type D; see Table 1 for details

Fig. 2 Photographs of seven currently known records of subantarctic killer whales (*Orcinus orca*), type D; the numbers in parentheses correspond to individual record numbers in Fig. 1 and Table 1: (1) a, stranding in Paraparaumu, New Zealand, May 1955, photo courtesy Evening Post Collection, Alexander Turnbull Library; (2) b–c, South Georgia, photos M. Greenfelder; (3) d, southeast Atlantic, photo P. Olson; (4) e, Crozet Island, photo P. Tixier; (5) f, Drake Passage, photo J. Plana; (6) g, Campbell Island, New Zealand, photo M. Jorgensen; (7) h, Drake Passage, photo A. Scott. Notice the extremely small white eye patch of this type, along with a moderately conspicuous saddle, lack of a visible dorsal cape, and rather bulbous head

evident among adult males (e.g., Fig. 2b, h)—none of the photos showed the broad-based, erect, triangular dorsal fin often found among adult males of other ecotypes. There is, however, marked sexual dimorphism with respect to dorsal fin size and shape, as in other forms of killer whales.

The plotted locations of the sightings and the stranding indicate a circumglobal distribution in the southern hemisphere (Fig. 1). Furthermore, the sightings all occurred between 40°S and 60°S (one was at 60°10′S) suggesting a subantarctic distribution. Although some of the at-sea sightings were near subantarctic islands (Records 2 and 6, near Crozet Archipelago and Campbell Island, respectively), the majority were in deep, oceanic water. School sizes were relatively large, averaging 17.6 animals/school (range 9–35; $n = 7$).

At least two types of killer whales are known to occur at Crozet. A form that looks similar to Antarctic type A occurs there commonly year-round and appears to have a generalist diet; it has been observed taking minke whales (*Balaenoptera acutorostrata*), southern elephant seals (*Mirounga leonina*), and penguins and fish near the islands (Guinet 1992; Guinet et al. 2000). This is also the form most commonly involved in the depredation of demersal longlines targeting Patagonian toothfish (*Dissostichus eleginoides*) near Crozet and Kerguelen Islands (Roche et al. 2007; Tixier et al. 2010). Type D has been recorded on 14 occasions at Crozet (Tixier unpubl. data) but only in offshore waters where it also interacts with the toothfish longliners, suggesting that its diet probably also includes fish.

Although the at-sea range of type D killer whale likely overlaps at times with all three of the known Antarctic ecotypes (Visser 1999; Pitman and Ensor 2003, Tixier unpubl. data), to date there have been no observed

interactions among any of them. The one exception that we are aware of was when a group of type A and a group of type D were at the same longline fishing vessel at Crozet. Not only did the two groups not intermingle but they 'kept their distance' (Guinet and Tixier unpublished data). And, there is no evidence of intergradation with respect to eye patch size and shape among these forms to suggest interbreeding.

Variation in the size, shape, and orientation of the white eye patch of killer whales in the pelagic waters of the southern hemisphere allows for human observers to readily distinguish among several different forms and these same features may also be important for species or ecotype recognition among killer whales. Based on its marked morphological divergence and sympatric occurrence with other ecotypes of killer whales within its range, we suggest that type D likely represents yet another ecotype or possibly even species of killer whale in the Southern Ocean. Further genetic analyses will be important for assessing the phylogenetic status of type D killer whale. In the meantime, we suggest a more descriptive common name for this very distinctive morphotype: 'subantarctic killer whale'.

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