Observations of killer whales off East Antarctica, 82°-95°E, in 2009

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ABSTRACT

Observations of killer whales (*Orcinus orca*) during a survey off East Antarctica, 82°–95°E revealed previously undescribed variations in pigmentation and group associations. During the survey 24 killer whale groups were sighted south of 60°S and classified, when possible, to Types A, B, or C based on their external morphology. Sufficient observation was available for nine groups to be classified: 2 groups of Type A; 1 mixed group of Type A and Type B; 3 groups of Type C; and 3 groups with eyepatch pigmentation intermediate in size between Types B and C. These whales may represent an intergrade between Types B and C or a previously unrecognised form. One of the 'intermediate' groups was observed feeding in a multi-species aggregation with other cetaceans in deep water. Clearly distinguishable Type A and Type B whales were observed feeding together in a mixed aggregation, the first time that this has been documented.

KEYWORDS: KILLER WHALE, ANTARCTIC, COLOURATION, TAXONOMY

INTRODUCTION

During an International Whaling Commission-Southern Ocean Whale and Ecosystem Research (IWC-SOWER) cruise off East Antarctica, 82°–95°E, in 2008–2009, killer whales (*Orcinus orca*) were sighted frequently. In all, 24 groups totalling 360 individuals were sighted during 25 survey days south of 60°S (Ensor *et al.*, 2009). Given the recent interest in the taxonomy of Antarctic killer whales (LeDuc *et al.*, 2008; Morin *et al.*, 2010; Pitman and Ensor, 2003; Pitman *et al.*, 2007), the observations yield relevant new information on the pigmentation, behaviour and distribution of these whales in a geographic area with little previously reported information.

Pitman and Ensor (2003) described field characteristics and biological observations on three visually recognisable forms of killer whales found in Antarctica. The forms are distinguished by the presence or absence of a dorsal cape and the relative size and orientation of the white eyepatch, resulting in the classification of three types. Type A, similar to killer whales that occur worldwide, does not exhibit a dorsal cape and has a medium-sized eyepatch oriented parallel to the body axis. Type B has a dorsal cape and a large eyepatch (described as at least twice as large as that of Type A) oriented parallel to the body axis. Type C has a dorsal cape and a small, forward-slanted eyepatch at an angle to the body axis. Pitman and Ensor (2003) proposed that the types are different ecotypes and may represent separate species. Subsequent research has investigated this theory, although definitive taxonomic status is yet to be confirmed. Pitman *et al*. (2007) found that total body lengths of Type C killer whales, based on aerial photogrammetry, were substantially shorter than those of Type A. Examining mitochondrial DNA, LeDuc *et al.* (2008) reported a slight level of divergence between Types A, B and C, also finding that Types B and C were closely related. Analysing complete mitochondrial genomes, Morin *et al.* (2010) obtained similar results, with Type A more divergent from Types B and C, which were more closely related. Krahn *et al.* (2008) used stable isotope analysis to explore the prey preferences of Type C, confirming that it is a fish-eater. All of the Type C killer whales sampled for these investigations were from the Ross Sea region of Antarctica (165°E–165°W longitude), a minimum distance of 2,700km from our study area.

METHODS AND RESULTS

The 2008–2009 research cruise was a whale sighting survey conducted as part of the IWC-SOWER programme. This long-term research has primarily been aimed at obtaining circumpolar data for estimation of abundance of the Antarctic minke whale (*Balaenoptera bonaerensis*). The main focus of the 2008–2009 cruise was to study temporal changes in the spatial distribution of Antarctic minke whales in relation to pack ice recession. The research area ranged from 82° to 95°E and from the pack ice edge north 111 km (60 n.miles). The area was surveyed multiple times on constructed survey lines from 19 January through 12 February 2009, using the research vessel *Shonan Maru No.2* (length 64m). The research protocol included closing and passing modes, i.e. some cetacean sightings were approached with the ship for data collection, and other sightings were 'passed' and data were collected without turning the ship toward the sighting. (For more information about the cruise see Ensor *et al.*, 2009.)

During the survey, researchers attempted to classify every encountered group of killer whales to type (A, B or C). This was difficult in some cases when the survey was in passing mode and the whales did not come close to the ship, thus most of those groups remain unclassified. Eight sightings were photographed, which aided in the determination of type. Two groups were identified as Type A; 1 mixed group of Type A and Type B; 3 groups of Type C; and 3 groups with

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eyepatch characteristics intermediate between Types B and C. Details of four of the sightings (1 mixed Type A and Type B group and the 3 B/C intermediate groups) are given below.

Observation of mixed Type A and Type B group

The mixed type group was sighted at 05:47hr on the morning of 21 January, 28km from the ice edge (sighting no. 001). A total of 20 minutes was spent observing and photographing this group at 63°45'S 92°18'E. There were 18 killer whales feeding in a slick about 40m in diameter, together with feeding seabirds. Blood was apparent in the slick but no carcass or animal remains were seen. The slick was suggestive of a marine mammal kill. Sixteen of the killer whales were clearly Type A (Fig. 1a). Two of the whales in the group were clearly Type B (Fig. 1b). The Type A and B whales intermingled, although the two Type B whales were often swimming together. Different individuals (Type A and Type B) would submerge and then emerge in different places with many changes of direction. No aggressive interactions were observed between the types. The whales appeared focused on feeding and the subsurface activity.

Observations of potential Type B/C intermediates

On three occasions groups were encountered that exhibited features of both Type B and C whales. All whales had dorsal capes (common to Types B and C). The eyepatches were forward-slanted (Type C), but the size and shape of the eyepatch varied within the groups, ranging from small to medium-large in size. Type C whales typically have small, narrow eyepatches (Jefferson *et al.*, 2008; Pitman and Ensor, 2003; Pitman *et al.*, 2007); Fig. 2 provides an example. The larger eyepatches observed were relatively longer and wider – intermediate in size between Type C and Type B (Figs 3a and b). Details of the observations follow.

19 January

A group of 15 killer whales (sighting no. 010) was photographed in passing mode on 19 January at 63°33'S 95°06'E, 9km from the ice edge. This group exhibited a variety of moderately-sized eyepatches, all forward-slanted. The eyepatches were larger than that of typical Type C whales from the Ross Sea yet still slanted. The whales had a yellowish diatom film visible on the body. A group of 45 Type C killer whales (sighting no. 011) was subsequently sighted 2km from this group. We photographed a third of this group. Most of the photographed whales had smaller, typical Type C eyepatches, but three whales had eyepatches of a moderate size, so it is possible that this may also have been an 'intermediate' type group.

26 January

On 26 January (sighting no. 033), a group of 30 killer whales was sighted at 64°12'S 83°20'E, 24km from the ice edge, 169km from the continental slope front (1,000m contour) and in >3,000m of water. The whales were travelling in several subgroups; individuals in the larger subgroups were clustered tightly together. Photographs reveal individuals with dorsal capes and with small to moderate size, forward-slanted eyepatches. Two whales had large forward-slanted eyepatches. The group was photographed in passing mode. Interestingly, this group was sighted 2km from another group

Fig. 1a. Type A killer whales seen feeding with Type B's on 21 January 2009.

Fig. 1b. Type B killer whale seen feeding with Type A's on 21 January 2009. Note the large eyepatch, dorsal cape and yellowish cast.

Fig. 2. Type C killer whale from the Ross Sea, 29 January 2004 with a small eyepatch and yellowish cast. (Photo T. Miura, IWC-SOWER 2003–2004.)

of killer whales (sighting no. 036), unclassified to type, group size 17, that was later observed to be joined by a pair of baleen whales classified taxonomically as 'like minke whale'. Sighting no. 036 was viewed in passing mode and no photographs were obtained.

9 February mixed species feeding aggregation

On 9 February, a mixed-species feeding aggregation was encountered (sightings no. 034–038) that included scattered groups of killer whales (totalling 51 individuals), 2 Antarctic minke whales, 2 fin whales (*Balaneoptera physalus*), 1 humpback whale (*Megaptera novaeangliae*) and feeding flocks of seabirds numbering several thousands. Large numbers of shearwaters (*Puffinus* spp.) were among the flocks. The sightings were centred at 64°19'S 88°53'E, near the ice edge among scattered belts of ice floes, and approximately 148km from the slope front in 3,000m of water. About an hour was spent observing the aggregation and several groups of killer whales were approached for

Fig. 3a. Killer whale with a medium-large size, forward-slanted eyepatch, 9 February 2009. The eyepatch is larger than a Type C from the Ross Sea, appearing intermediate in size between Types C and B. This whale is from a different group than the whale in Fig. 3b.

Fig. 3b. Killer whale with a medium-large size, forward-slanted eyepatch, 9 February 2009. The eyepatch is larger than a Type C from the Ross Sea, appearing intermediate in size between Types C and B. This whale is from a different group than the whale in Fig. 3a.

photographs and skin biopsy sampling. One biopsy sample from a killer whale was collected. A sonobuoy was deployed near the aggregation but no sounds attributed to killer whales, Antarctic minke, fin or humpback whales were detected during one hour of recording.

There were 10–12 groups of killer whales, with group sizes ranging from 4–15 whales. While the groups were associated, they remained distinct with no observed exchange of individuals. The groups included mixed sex and age classes; most contained one or more juveniles, and calves were present in at least three groups. (Age classes were based on relative body size and calves swimming in echelon position.) The mature animals appeared smaller in body size than Type A killer whales. The pigmentation varied subtly between groups: all exhibited dorsal capes, but the capes of some were minimally present while others were quite pronounced. Many groups consisted of individuals with a yellowish cast. There was variation in eyepatch size relative to the body, both between and within groups. All eyepatches observed (minimum number = 39) were markedly forward-slanted; many were of a medium-large size, thus appearing to be intermediate between Type B and C eyepatches (Figs 3a and b). The degree of variation in pigmentation between groups, and that no interchange of individuals between groups was observed, suggests these whales represented a temporary aggregation.

All of the species in this aggregation appeared to be feeding. A fin whale rolled on its side at one point and the killer whales were diving and milling. Small groups of killer whales (4–6 whales) were observed following the fin whales, sometimes diving closely by a fin whale's head or tail. The behaviour did not seem aggressive and the fin whales did not appear to be agitated by the close approaches of the killer whales. Similarly, the behaviour of the Antarctic minke whales and the humpback whale appeared unaffected by the killer whales' presence. Prey items may have included krill and mesopelagic fish.

DISCUSSION

The whales in three sightings described here off east Antarctica exhibited larger than usual eyepatches for Type C killer whales. Given the variation in eyepatch size between individuals within groups, these whales may represent an intergrade of Types B and C. Previous accounts of the Antarctic killer whale types have not reported intermediates between types (LeDuc *et al.*, 2008; Pitman and Ensor, 2003). Genetically Types B and C are very similar (LeDuc *et al.*, 2008; Morin *et al.*, 2010), although Morin *et al*. (2010) found a shallow divergence between them (three fixed differences among 16,290 mitochondrial base pairs). Given the genetic similarity, LeDuc *et al.* (2008) mentions the possibility of a B/C intermediate although such a form was not known at the time. The Type C samples in the Morin *et al.* (2010) and LeDuc *et al*. (2008) studies were from the Ross Sea, a minimum distance of 2,700km from our study area, and the Type B samples were from the Antarctic Peninsula/South Georgia/South Sandwich Islands/Falkland Islands regions, a minimum distance of 5,500km from our study area. Another explanation for the B/C 'intermediate' that we report is that it may not be an intermediate but a previously undescribed form characteristic of this region of East Antarctica, whether a unique form or a variant Type C. Genetic analysis of killer whales from east Antarctica, as well as additional photographs and field observations, may clarify the distinctiveness of the B and C Types and where the form we observed fits into the taxonomy.

The mixed feeding group of Type A and B killer whales was the first reported encounter of this kind. Prior to our cruise there were no observations of mixed type schools (Berzin and Vladimirov, 1983; Pitman and Ensor, 2003). It seems likely that the killer whales formed a temporary association during a feeding event. Both types are known to prey on marine mammals (Pitman and Ensor, 2003). Given that the Type B whales were yellow with diatoms and the Type A's were not supports a short-term association since it would be unlikely that the whales had been occupying the same water masses over time. Thus it appears that different types do mix, at least occasionally, during feeding events such as the one reported here. This is new information relevant to the sympatry of killer whale populations in the Antarctic.

Currently the taxonomic status of the different morphological forms (body size and pigmentation) of killer whales in Antarctica and their roles within the Antarctic ecosystem are not completely understood. Continued field observations and photographic and biological sampling of all forms are needed to clarify their status.

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