

Notes on the School Composition of Killer Whales in the Southern Hemisphere

By

Nobuyuki MIYAZAKI

Department of Zoology, National Science Museum, Tokyo

Abstract To improve knowledge of school structure of killer whale, *Orcinus orca* (LINNAEUS, 1758), the composition of 18 schools (705 individuals in total) were analyzed from the sighting information obtained through a 57-day sighting survey in the Southern Ocean between 115°E and 160°W. The fundamental units of the school of killer whales are considered to be the single adult male, the adult female with calf, and other whales including the juvenile whale and/or the adult female without calf. An aggregation of schools seems to be formed by combination of several large schools, each of which has some unit schools.

Killer whales are a genuinely cosmopolitan species, occurring among ice floes in polar latitudes and in equatorial region (HERSHKOVITZ, 1966; LEATHERWOOD and REEVES, 1983). BERZIN and VLADIMIROV (1983) reported that *Orcinus glacialis* (BERZIN et VLADIMIROV, 1983), which is distinguished from *Orcinus orca* (LINNAEUS, 1758) based on the morphological and biological-ecological information, is distributed in the high latitudes of Indian Ocean sector of the Antarctic. However, this is the unsolved controversial problem. MIYAZAKI and KATO (1988) suggested that there are at least two populations of the killer whale between the high latitudes and the temperate-tropical waters in the Southern Hemisphere based on the discontinuity of the distribution between these areas. Thus, in the present study *O. glacialis* is tentatively treated as a synonym of *O. orca*. School composition and social structure of the killer whale off Vancouver Island, British Columbia were systematically studied from identification of individuals in the school using photographs (BALCOMB, BORAN, OSBORNE & HAENEL, 1980; BALCOMB, BORAN & HEIMICH, 1982; BIGG, 1982). This study was undertaken to report the school composition of killer whales obtained through the sighting survey in the Southern Ocean between 115°E and 160°W, to compare the school composition between areas and to discuss the school formation of killer whales.

Materials and Methods

The present study of the school composition of killer whales was conducted from the Japanese research vessel *Toshimaru 11* during the sighting and marking survey of minke whales in the Southern Ocean adjacent to the Antarctic pack ice edge between

Table 1. School composition of killer whales observed from the *Toshimaru II* in the minke whale assessment cruise in the Southern Hemisphere (17 December 1980 and 11 February 1981).

School no.	Date	Position	Size*	Composition					Total
				Adult male	Adult female with calf	Calf	Others		
1	5 Jan. 1981	63°50'S, 139°59'E	3					3	3
2	6 Jan. 1981	64°02'S, 136°25'E	6	1				5	6
3	16 Jan. 1981	64°07'S, 161°31'E	6	1				5	6
4	"	64°33'S, 162°06'E	14	2	4	4		4	14
5	"	64°38'S, 162°01'E	6	1	2	2		1	6
6	18 Jan. 1981	66°47'S, 165°23'E	6					6	6
7	"	67°02'S, 166°12'E	(A)	1	2	2		10	15
	"	"	(B)	1	2	2		5	10
	"	"	25 (A+B)	2	4	4		15	25
8	23 Jan. 1981	73°48'S, 171°19'E	(A-1)	10	3	3		20	36
	"	"	(A-2)	6	2	2		25	35
	"	"	(A-3)	3	2	2		11	18
	"	"	(A-4)	3	2	2		12	19
	"	"	(A-5)	2	2	2		9	15
	"	"	(A-6)	2	1	1		6	10
	"	"	(A-7)	3	2	2		13	20
	"	"	(A-8)	4	1	1		8	14
	"	"	(A-9)					9	9
	"	"	(A-10)					10	10
	"	"	(A: 1-10)	33	15	15		123	186
	"	"	(B-1)		1	1		2	4
	"	"	(B-2)	1	1	1		2	5
	"	"	(B-3)		1	1		3	5
	"	"	(B-4)					6	6
	"	"	(B-5)	1				6	7
	"	"	(B-6)		1	1		3	5
	"	"	(B-7)					3	3
	"	"	(B-8)	1				5	6
	"	"	(B: 1-8)	3	4	4		30	41

9	24 Jan. 1981	74°27'S, 168°48'E	1	1	1	2	4
10	25 Jan. 1981	75°46'S, 169°07'E	1	1	5	6	
	"	"	1		3	4	
	"	"			3	3	
	"	"		1	4	6	
	"	"		1	2	4	
	"	"	1	1	2	5	
	"	"	1	1	3	6	
	"	"			2	2	
	"	"			3	3	
	"	"	1	1	1	4	
	"	"	5	6	30	47	
	"	"	15	10	70	105	
	"	"	56	35	253	379**	
11			379 (A+B+C+D)				
	24 Jan. 1981	74°27'S, 168°48'E	1			1	
	25 Jan. 1981	75°46'S, 169°07'E	2	2	6	12	
	"	"	3	2	7	14	
	"	"	1	1	1	4	
	"	"	6	5	14	30	
	"	76°02'S, 168°26'E	1	1	7	10	
	"	"	1		4	5	
	"	"	2	1	11	15	
12	26 Jan. 1981	77°13'S, 170°35'E	8	3	36	50	
13	27 Jan. 1981	77°53'S, 178°44'W	8		42	50	
14	28 Jan. 1981	77°58'S, 172°18'W	6		24	30	
15	30 Jan. 1981	77°59'S, 163°43'W	6		14	20	
16	"	78°00'S, 162°59'W	5		10	15	
17	"	77°51'S, 162°17'W	10		10	10	
18	1 Feb. 1981	75°48'S, 168°36'W	2		6	8	
	"	"	3	2	11	18	
	"	"	2	1	9	13	
	"	"	7	3	26	39	
Total			705	112 (8.1)	57 (8.1)	479 (67.9)	705 (100)

* Both alphabets and alphabets with figures indicate unit school.

** The figure is revised from the largest school size (345 individuals) described by MIYAZAKI and KATO (1988).

115°E to 160°W from 17 December 1980 to 11 February 1981 under the International Whaling Commission/International Decade of Cetacean Research Program. The sighting method and track chart of the vessel are described in MIYAZAKI and KATO (1988). Killer whales within each school were assigned to the separate classes: (1) adult male (identified by its large body size and proportionally high dorsal fin), (2) adult female with calf (adult size whale swimming in close company with a small individual) and (3) juvenile whale and/or adult female without calf.

Results and Discussion

During the cruise, 705 killer whales in 18 schools were observed (Table 1). Composition of the schools is shown in Table 2. One school (5.6% of the total) was composed of single adult male; eight schools (44.4%) contained adult male(s) and adult female(s) with calf; six schools (33.3%) were composed of adult male(s) in addition to juvenile whales and/or adult females without calf, and three schools (16.7%) comprised only juvenile whales and/or adult females without calf.

Adult males represented 15.9% of the total individuals (112/705), which was about twice as much as the percentage of adult females with calf (8.1%, 57/705). The proportion of adult females without calf and/or juvenile animals was 67.9% of the total individuals (479/705). The proportion of total adult females in the schools is probably higher than the proportion of adult females observed with calf (8.1%) because some adult females may not have had calf.

School no. 8 was an aggregation comprising 4 separate large schools of killer whales (A, B, C and D), each of which was made up of 8–19 unit schools ranging in number from several to about 40 individuals (Fig. 1 and Table 1). The killer whales within these unit schools were dispersed over an area 20–100 m in diameter. These four large schools of killer whales comprising school no. 8 were each 200–600 m in diameter and separated by distances of 0.5–3 nautical miles within the aggregation of schools (Fig. 1). A similar school structure was also

Table 2. Comparison of school composition of killer whales between the Antarctic Ocean and Vancouver Island.

No.	School component	Antarctic Ocean (Present study)		Vancouver Island (BIGG, 1982)	
		No.	(%)	No.	(%)
1	Single adult male	1	5.6	2	6.7
2	Adult male(s) & adult female(s) with calf	8	44.4	10	33.3
3	Adult female(s) with calf & no adult male	0	0	2	6.7
4	Others (no adult male & no adult female with calf)	3	16.7	4	13.3
5	Adult male(s) & others	6	33.3	12	40.0
Total		18	100	30	100

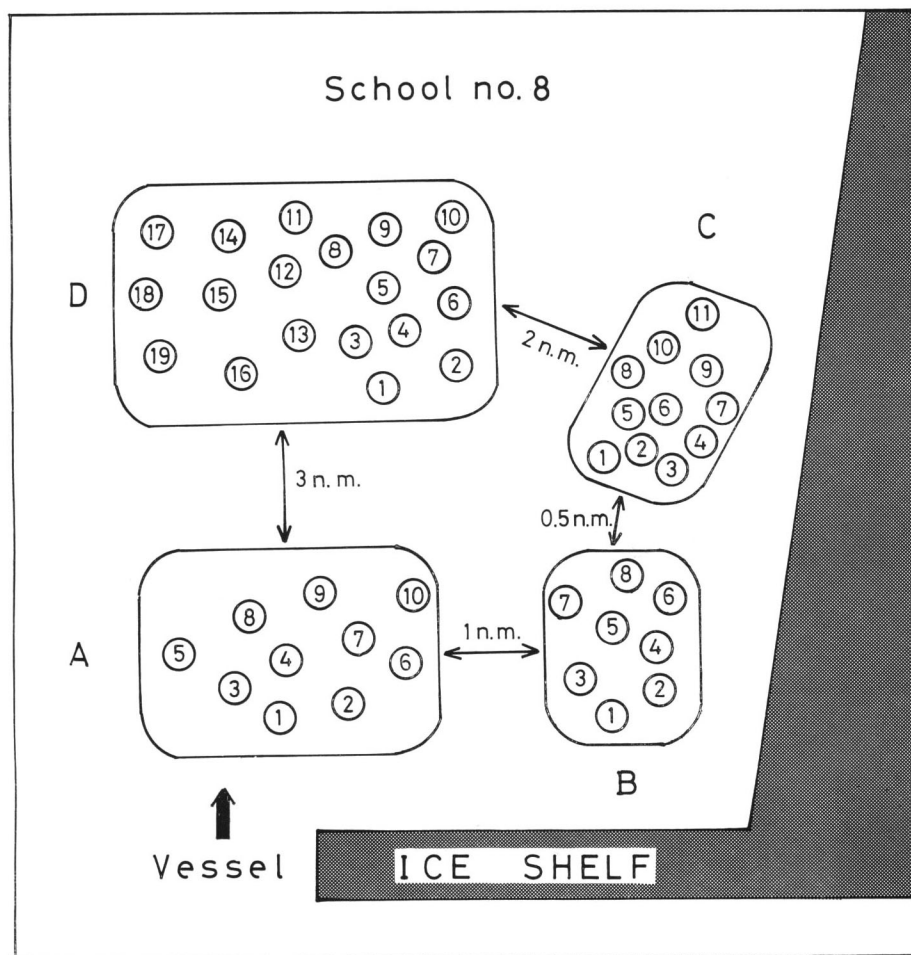


Fig. 1. Spatial relationship of schools of killer whales within an aggregation of schools (school no. 8) observed near the Ross Ice Shelf ($73^{\circ}48'S$, $171^{\circ}19'E$), Antarctic. Four large schools (A, B, C and D) contained 10, 8, 11 and 19 unit schools, respectively. Figures shown in the circles indicate the number of unit school (see Table 1).

observed in school nos. 7, 10, 11 and 18, which were large schools containing several unit schools. Figure 2 shows the relative location of unit schools inside two large schools (school nos. 7 and 10) and also the distribution of individuals within one school in each of these schools (school nos. 7-A and 10-A). The distribution of all the individual whales in school 12 is also shown in Fig. 2. Both adult females with calf and adult males were usually observed inside the school rather than near the periphery. These findings indicate that single adult male, adult females with calf, and several other juvenile whales and/or adult females without calf might be considered

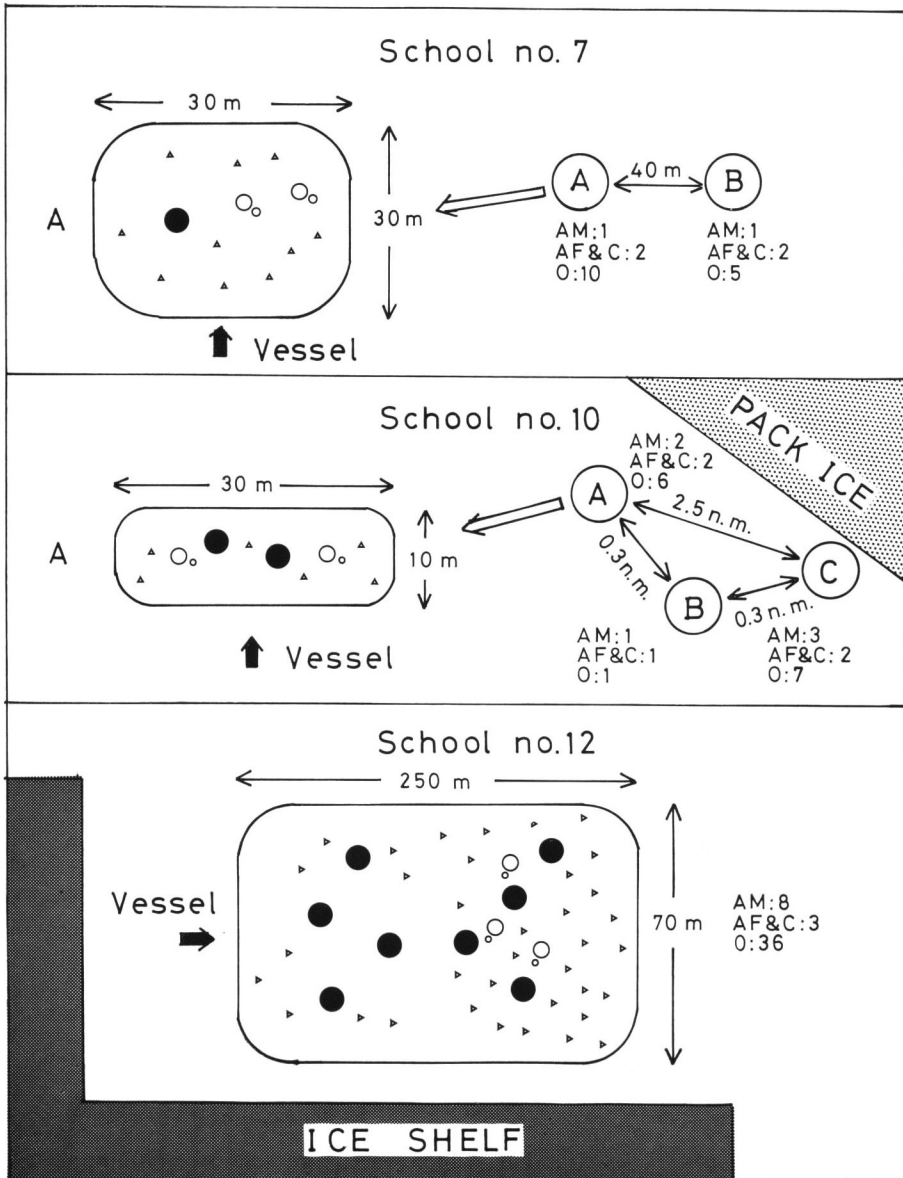


Fig. 2. Spatial relationship of killer whales within a school (school no. 12) and in sections of the large school (school nos. 7 and 10) observed in the Ross Sea, Antarctic. ● and AM: adult male, ○○ and AF & C: adult female with calf, △ and O: juvenile and/or adult female without calf. All killer whales of the school observed here moved into the opposite direction to the vessel. Note the relative position of adult male and adult female with calf in these schools. The spatial relationship of killer whales within the unit school (school nos. 7-A and 10-A) is shown on the left side by the arrow (↔).

as the fundamental unit of the school of killer whales. The aggregation of schools is probably formed by combination of several large schools, each of which has some unit schools. The unit school is composed of several fundamental units of killer whales.

According to BIGG (1982), a pod of killer whales off Vancouver typically contained 5–20 individuals, and usually contained adult males, adult females, some juveniles and occasionally a new calf. Although there is some difficulty on identification between subadult male and adult female without calf and between juvenile and calf, the school composition of the killer whales observed in the present study is considered to be very similar to the pod composition of the species observed off Vancouver Island (Table 2). The composition of school no. 8, which was extraordinarily large in size and was sighted at 73°48'S, 171°19'E, near the ice shelf of the Ross Sea, was similar to that of the community described by BIGG (1982). This aggregation might have been formed when several large schools had aggregated along the ice shelf because of some reasons.

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