MOVEMENTS OF THE KELP GULL *LARUS DOMINICANUS VETULA* TO, FROM AND WITHIN SOUTHERN SOUTH AFRICA

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SUMMARY

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Adult Kelp Gulls *Larus dominicanus vetula* appear to be relatively sedentary, most movements occurring within 30 km of the ringing site. Juvenile birds dispersed rapidly, most movements being of less than 30 km, but some dispersed up to 935 km from the natal site. Adults and juveniles from two south coast colonies exhibited differing patterns and distances of movements and dispersal. Most birds from the Swartkops Estuary colony travelled to the south and west; those from the Keurbooms River colony, Plettenberg Bay, tended to go north and east. On average, dispersing juveniles travelled greater distances than adults did. It is possible that some juvenile birds followed the annual sardine migration towards the coast of KwaZulu–Natal. The Kelp Gull population within the study region appears to be ecologically separate from those found farther west, although a few birds ringed as pulli in the study area were recorded in the southwestern Cape. Movement patterns of Kelp Gulls in New Zealand and Australia are not dissimilar to those recorded in this study. Movements of Kelp Gulls away from the breeding colonies were almost certainly related to the availability and abundance of food. Dispersal among Kelp Gull juveniles allows birds to exploit easily obtainable food sources where competition from adults is less severe.

Key words: Kelp Gull, movements, juvenile dispersal, distance travelled, Swartkops, Keurbooms

INTRODUCTION

The Kelp Gull *Larus dominicanus* is found through much of the Southern Hemisphere (Urban *et al.* 1986). The nominate form *L. d. dominicanus* occurs in South America and Australasia, but the birds in southern Africa belong to the subspecies *L. d. vetula* (Brooke & Cooper 1979, Jiguet 2002).

In southern Africa, the Kelp Gull is a breeding resident and partial migrant (Steyn 1996, Crawford *et al.* 1997). Breeding has been recorded between southern Angola and the Eastern Cape province of South Africa (Crawford *et al.* 1982, Dean *et al.* 2002). Non-breeding and young birds are recorded on the coast of KwaZulu–Natal, South Africa (Crawford 1997) and are uncommon visitors to the coast of southern Mozambique (Parker 1999, Underhill *et al.* 1999). Vagrants have been recorded in Mauritania, France, and in the Caribbean (Jiguet & Defos du Rau 2004). The source of these vagrants is unknown, but had they come from the nearest breeding population in Senegal (Keijl *et al.* 2001), the Paris bird would have travelled 4200 km, and the Caribbean bird, 5000 km (Jiguet & Defos du Rau 2004).

To establish the direction and magnitude of movements of Kelp Gulls from the eastern side of the South African distribution, adults and nestlings were colour-ringed at the Keurbooms River mouth, Plettenberg Bay [Fig. 1(a)], and at two breeding sites at the Swartkops Estuary, Port Elizabeth [Fig. 1(b)]. Regional movements were further investigated by an analysis of re-sightings and recoveries of ringed birds from the national dataset.

STUDY AREA AND METHODS

The study area (see Fig. 1) comprised approximately 354 km of coastal belt between the Robberg Peninsula, Plettenberg Bay (34°05′S 23°22′E), and the mouth of the Great Fish River (33°29′S 27°08′E) (Whittington *et al.* 2006b). This area includes the Keurbooms River mouth, which has the largest breeding colony of Kelp Gulls on the south coast—estimated to be 1450 pairs in 2003 (Whittington *et al.* 2006b), and the eastern limit of the breeding range (Crawford *et al.* 1982).

Between 1948 and 2002, 11 990 Kelp Gulls in southern Africa were fitted with individually numbered metal rings, the vast majority having been ringed as nestlings at breeding colonies (Underhill *et al.* 1999). Of 8677 birds ringed between 1975 and 2002, 4518 were ringed within the study area. A further 1933 rings were used on birds in the southwestern Cape, 8 in KwaZulu–Natal, South Africa; 2214 birds were ringed in Namibia, and 4, at Marion Island in the southern Indian Ocean [South African Bird Ringing Unit (SAFRING) unpub. data]. An analysis of re-sightings of live and recoveries of dead ringed birds was made for this study, using data from the national ringing database held by SAFRING at the

Animal Demography Unit, University of Cape Town. Patterns of movements of birds within the study area, of birds ringed in the study area to other regions, and of birds ringed outside the study area and subsequently found within it were investigated over the period 1957–2004. "Adult" birds refer to those in full adult plumage. Breeding adults are assumed to be at least four years old (see Crawford *et al.* 2000). The term "juvenile" refers to birds in their first year of life and birds in immature or sub-adult plumage were considered to be between 13 and 36 months of age. Attempts were made to age birds as one, two or three years old according to the characters given by Crawford *et al.* (2000), but because of individual variation, these attempts were not considered to be accurate (see Whittington 2007).

In addition, 33 adult Kelp Gulls were captured at nests at Redhouse saltpan (33°50′S 25°35′E), Port Elizabeth [Figs. 1(b) and 2], and fitted with two colour rings (as well as the standard metal rings) by APM between 20 October and 29 November 1983. A further

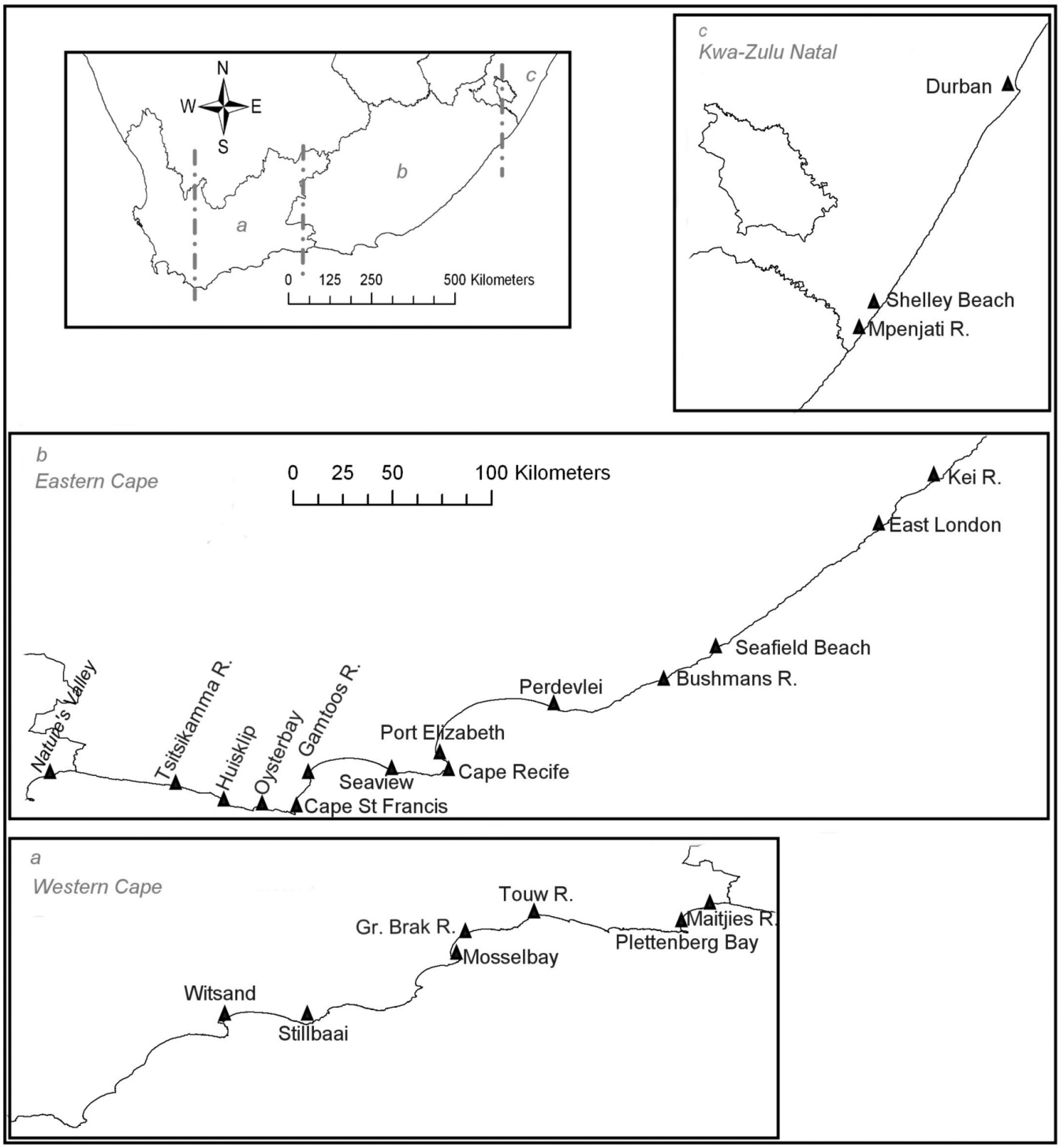

Fig. 1. Southern South Africa, showing localities where Kelp Gull *Larus dominicanus vetula* chicks and adults were ringed or flagged and subsequently re-sighted. (a) Indian Ocean part of the Western Cape province. (b) Eastern Cape province as far east as the Kei River. (c) Southern KwaZulu–Natal.

40 adults were colour-ringed between 31 October and 3 December 1984. These birds were individually recognisable by the sequence of colours. All, bar two, of the 1983 birds had their underparts stained yellow with picric acid dye, which should have remained visible until the bird underwent body moult in mid-July to early October (Higgins & Davies 1996) of the following year. In October 1999, 14 breeding Kelp Gulls were caught at the nest and colour-marked at Bird Island, Algoa Bay, and four others were colour-ringed there in November 2001. Of these birds, 13 were given a blue-colour ring on the left leg and a metal ring on the right. A further 143 adult birds were captured at the nest at the Keurbooms River mouth [Fig. 1(a)] between 24 October and 8 November 2006 (Whittington 2007). In addition to the standard metal ring, they were each fitted with a white plastic ring with a two-letter alphanumeric code in black. Five adult birds caught at the nest at the Gamtoos River mouth [33°58′S 25°01′E, Fig. 1(b)] on 21 November 2006 were fitted with an orange leg flag on the left leg and the standard metal ring on the right.

At Redhouse saltpan, 644 nestlings in total were fitted with a blue, coil-design colour ring on the left leg and a metal ring on the right between 21 November 1976 and 29 November 1987 (Table 1). On 29 November 2003, 96 nestlings were ringed on the Swartkops Estuary: seven at Redhouse salt pan and 89 on the Brickfields Island, a vegetated island in the main river about 1.5 km downstream from Redhouse saltpan. They were fitted with a standard 10 mm incoloy ring on the right leg and a blue, Darvic colour-flag on the left. Incoloy is an alloy of nickel, chromium and iron (De Beer *et al.* 2001). A further 22 chicks were ringed at Brickfields Island on 1 January 2004 by APM, bringing the total of colour-flagged birds to 118. At the Keurbooms River mouth, 728 nestlings were similarly ringed on 2 December 2003, but using white Darvic colour-flags. Colour-flags were 10 mm in diameter and 8 mm deep, and were fastened on the leg using a clip mechanism. The clip protruded approximately 4.5 mm from the ring, forming a short "flag." Compared with the coil-design colour rings used in the 1970s and 1980s, this design was preferred because the ring was less likely to slip down the leg or to fall off. Although these colour-marked birds could not be individually recognised, it was still possible to monitor the post-fledging dispersal of chicks from their natal colony. The use of engraved plastic rings such as those used on adults in 2006 would have allowed for individual recognition of re-sighted individuals, thus permitting the proportion of re-sighted birds to be accurately estimated; however, this approach was prohibitively expensive on this number of nestlings.

Colour-ringed birds were sought by APM during regular (at least monthly) visits to the Swartkops Estuary between August 1983 and August 1986 and at least bi-annually thereafter, with occasional visits to the coast between Cape Recife (34°01′S 25°41′E) and the Sundays River mouth (33°43′S 25°50′E). Searches for colour-flagged gulls were made by PAW during routine monthly counts of roosting and resting Kelp Gulls in the Port Elizabeth area between January and August 2004, and at 90 feeding and resting sites (90% of the total) between Robberg Beach (34°05′S 23°22′E), Plettenberg Bay, and the Fish River estuary, including those in the Port Elizabeth area, between 15 March and 5 June 2004 (Appendix 1). Other visits to sites within these areas were made on an opportunistic basis. All gull flocks were scanned with 10×42 binoculars and a 20–60× zoom telescope to check for the occurrence of colour-flagged individuals. The area covered and the methods used during monthly counts around Port Elizabeth are described by Whittington *et al.* (2006a).

Searches for the adult birds colour-marked in 2006 were made by PAW in the Port Elizabeth area between March and September 2007 and between Port Elizabeth and Plettenberg Bay in May and August of 2007. An additional visit was made to the Keurbooms River breeding colony in November 2007. Other sightings of colour-ringed or dyed birds ringed between 1976 and 1987 were made by members of the public or other researchers, but no concerted effort was made on the part of other observers to search for ringed birds.

In 2003, the colour-flagging project was publicised in bird club newsletters in the Western Cape, Eastern Cape and KwaZulu–Natal, the University of Port Elizabeth Bulletin, via local and national e-mail–based mailing lists, in the *Herald* newspaper, and on national television and radio, with the intention of having members of the public contribute sightings of colour-flagged gulls. Observers were requested to record the colour and position of the colour-flag, the date, locality and approximate age of the bird concerned and to submit their sightings to SAFRING. A similar publicity effort was made in 2006 to encourage observers to report sightings of colour-ringed adult birds.

Numbers of birds moving in each direction were compared between colonies for each age group using a chi-square test with Yates correction for one degree of freedom. Median distances travelled by adults from the Swartkops and Keurbooms colonies were each tested using the Mann–Whitney *U*-test for unmatched samples. Where sample sizes exceeded 20, the Mann–Whitney *U* statistic was converted into a Z-score using the formula

$$z = \frac{\left[U - E(U)\right]}{\Sigma} \qquad [1]$$

where

$$E(U) = \frac{n1n2}{2}$$

and

$$\Sigma = \sqrt{\frac{n1n2(n1 + n2 + 1)}{12}}.$$

TABLE 1
Numbers of Kelp Gull *Larus dominicanus vetula* pulli colour-ringed[a] at Redhouse saltpan, 1976–1987

	Breeding season								
	1976	**1977**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**
Ringed birds (n)	1	1	3	31	60	33	158	160	197

[a] Most birds were ringed in November or December; some, in the following January.

RESULTS

In the database held by SAFRING, 555 recoveries and 89 retraps or re-sightings of ringed Kelp Gulls were recorded (SAFRING unpub. data). Of these 644 records, 370 were of birds either ringed or found within the study area, 356 having been ringed as pulli. Of the remaining 14 birds, 12 were ringed when adult and one when between six months and one year of age. The age of the other bird was not recorded by the ringer.

Movements of birds ringed when adult

Of the 33 adult Kelp Gulls that were colour-ringed at Redhouse saltpan in 1983 and the 40 colour-ringed there in 1984, 33 and 38 respectively were subsequently re-sighted—that is, 97% of the total. The number of known re-sightings of each bird ranged from two to 42, the median being 11. In addition to the birds that were colour-ringed, 37 Kelp Gulls were ringed as adults with standard SAFRING alloy rings within the study area, all within the Eastern Cape province [Fig. 1(b)]. Of 11 birds later recovered dead, one had been ringed at Bird Island, Algoa Bay; three at St Croix Island; and six at Redhouse saltpan. One had been rehabilitated and released at Hobie Beach, Summerstrand, Port Elizabeth (33°58′S 25°39′E). There were 153 sightings made of 86 individual birds ringed at the Keurbooms River mouth in 2006. This represents 60% of the total number of adults ringed.

More than 70% of birds ringed when adult were subsequently recorded within 10 km of their breeding colony (Table 2). All sightings and recoveries of Swartkops ringed birds were made within 30 km of the ringing site. Of the 71 birds re-sighted that had been colour-ringed at Redhouse saltpan, 42 were not seen outside the Swartkops River system. Of these colour-ringed adults, 20 were seen at localities more than 10 km away from where they were ringed (Fig. 2). Of 11 birds with alloy rings recovered dead, five were found at the place of ringing, one had travelled five kilometres from the ringing location, two were found between five and 10 km away, and two had travelled more than 10 km when recovered, one covering the 15 km between St Croix Island and Bluewater Bay, and the other travelling 24 km from Redhouse saltpan to The Willows, between Cape Recife and Schoenmakerskop.

Of the 86 birds ringed at the Keurbooms colony and subsequently re-sighted, 38 were recorded only from the Keurbooms colony where they had been ringed. An additional five birds were seen

TABLE 2
Proportion of adult Kelp Gulls *Larus dominicanus vetula* ringed when incubating and subsequently re-sighted at various distances from the breeding colony

Breeding colony	Re-sightings (%) at				
	0 km (ringing locality only)	≤5 km	6–10 km	11–30 km	>30 km
Swartkops	11	43	19	27	0
Keurbooms	43	6	22	1	28

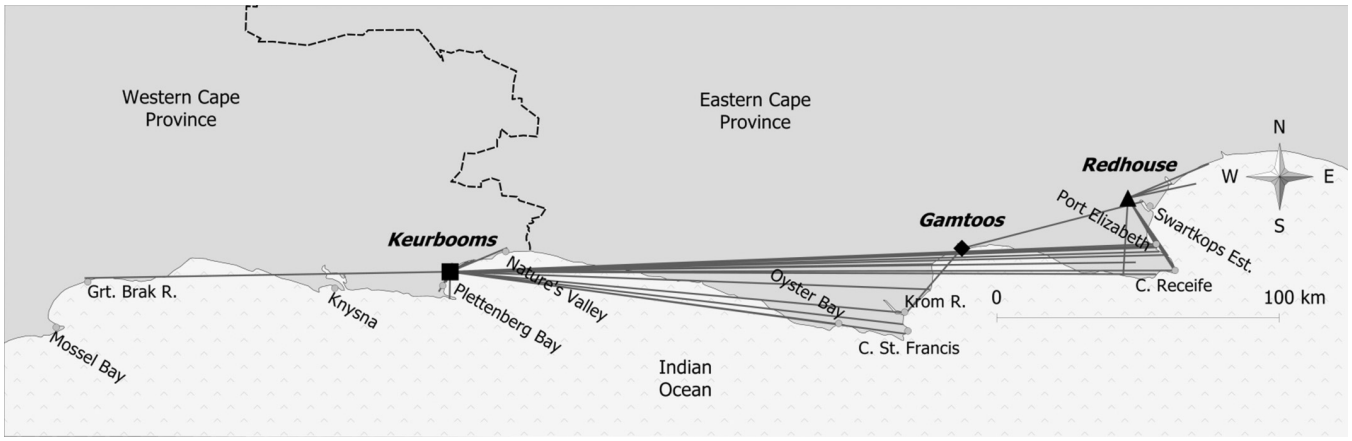

Fig. 2. Movements of colour-ringed adult Kelp Gulls *Larus dominicanus vetula* from three breeding colonies on the south coast of South Africa.

TABLE 3
Distances travelled by Kelp Gulls *Larus dominicanus vetula* ringed as adults and recorded outside of the Swartkops and Keurbooms river systems[a]

	Swartkops		Keurbooms	
	East/north	West/south	East/north	West/south
Birds (n)	9	21	29	19
Mean distance (km)	9	19	151	11
Median distance (km)	6	23	201	6
Maximum distance (km)	23	24	212	108

[a] The difference in direction travelled between the two colonies was statistically significant, as was the average distance travelled in different directions for each colony.

within a five-kilometre radius of the breeding colony and a further 19 birds were recorded between five and 10 km from the colony, 16 of which were foraging at Robberg rubbish tip. There were 28 sightings made more than 10 km from the Keurbooms mouth, 25 of which exceeded 100 km. These totals include multiple sightings for some birds and therefore do not add up to 86. Of the 25 birds that travelled more than 100 km, 16 were seen within the vicinity of Port Elizabeth (Fig. 2).

Most adult birds ringed at the Swartkops colony (66%) were subsequently recorded to the south and west; most Keurbooms-ringed adults (60%) had moved to the east or north (Fig. 2, Table 3). This polarity between the colonies was statistically significant ($\chi^2_1 = 5.673$, $P < 0.05$). Average distances travelled were also greater to the south and west for Swartkops birds ($U = 24$, $P < 0.05$, Mann–Whitney *U*-test) and to the north and east for Keurbooms birds ($U = 23$, $P < 0.05$, Mann-Whitney *U*-test).

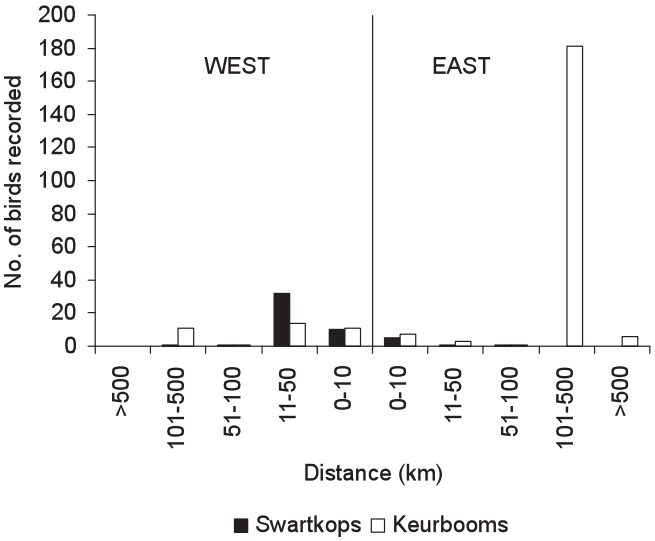

Fig. 3. Distances travelled from the breeding colony by colour-flagged Kelp Gull *Larus dominicanus vetula* chicks.

Mean distances travelled by birds ringed at the Keurbooms colony were considerably greater than distances travelled by birds from the Swartkops Estuary (Table 4). However, median distances for the two colonies were not dissimilar, being actually greater for birds from the Swartkops colony if birds recorded only at the ringing site are included (Table 4, Z = –1.579, nonsignificant).

Three of the five adult birds colour-flagged at the Gamtoos River mouth were seen subsequently after ringing. Two travelled 25 km west to the Krom River mouth, one being present there for at least four months. The other bird was seen at the Brickfields on the lower Swartkops River in the Port Elizabeth area, 54 km to the east of the Gamtoos River.

An adult ringed in KwaZulu–Natal was found entangled in fishing net 453 km to the west at East London, Eastern Cape province. Another bird ringed in KwaZulu–Natal was found dead 576 km to the west at Port Alfred. The age of the latter bird was not recorded at ringing.

Movements of birds ringed as pulli

Because the birds ringed as pulli were not given individually recognisable colour-rings, it was not possible to accurately record the number of colour-ringed individuals that were re-sighted. There were 152 sightings of Kelp Gulls colour-ringed as pulli at Redhouse saltpan between 1976 and 1987, of which 47 were made by APM within the Lower Swartkops river system. The latter sightings were mostly of birds estimated on plumage characters to be between one month and three years old. There were no sightings of birds that were six to 11 months from the date of ringing. Twenty observations were made of colour-ringed birds that had returned to Redhouse saltpan, their natal site. The youngest of these birds was 11 months old when re-sighted. Adult birds bearing a blue colour ring on the left leg were recorded breeding on two occasions. Both birds were probably ringed before 1982; they were recorded on 6 and 22 November 1985.

Most other sightings (n = 54) of birds colour-ringed as pulli were made within the vicinity of Cape Recife [Fig. 1(b)], 24 km to the

TABLE 4
Distances travelled by Kelp Gulls *Larus dominicanus vetula* ringed as breeding adults or as pulli at the Swartkops and Keurbooms breeding colonies

	Swartkops	Keurbooms[a]
Ringed as adults		
Mean distance (km), all birds	8.0	65.1
Mean distance (km), excluding birds not recorded away from the colony	15.7	90.3
Median distance (km), all birds	11.1	6.4
Median distance (km), excluding birds not recorded away from the colony	16.3	18.5
Ringed as pulli[b]		
Mean distance (km), all birds	68.5	149.1
Mean distance (km), excluding birds not recorded away from the colony	87.2	157.9
Median distance (km), all birds	22.7	136.0
Median distance (km), excluding birds not recorded away from the colony	23.1	141.2

[a] Birds ringed as pulli at the Keurbooms colony travelled significantly greater distances than did those ringed at the Swartkops colony.
[b] Kelp Gulls ringed as pulli covered significantly greater distances than did those ringed as adults.

south of Redhouse saltpan. Up to six colour-ringed birds were seen at any one time. Nine other sightings were made on the coast to the south of the natal site, five of which were made between the Swartkops River mouth and Cape Recife (Fig. 2). One was observed feeding around fishing boats about three kilometres offshore between Schoenmakerskop and Sardinia Bay. A first- or second-year bird was seen at Nature's Valley, a distance of 187 km from the ringing site (M. Ralfe pers. obs.).

There were 18 sightings of colour-ringed birds made within 30 km to the north and east of Redhouse saltpan. Three birds were seen at the mouth of the Coega River on 30 November 1984 and appeared to be of various ages, probably ranging from one to three years old. There were 14 sightings of colour-ringed birds at the mouth of the Sundays River, 28 km from the ringing site, between October 1986 and April 1987. Two individuals were present on 30 January 1987 and three on 16 March 1987. One bird in its first or second year was seen feeding around fishing boats four kilometres out to sea and 10 km to the east of the Sundays River mouth. Three birds were recorded more than 30 km east of Redhouse saltpan. One was present on the Kowie estuary, Port Alfred, from 19 February until at least 13 April 1984, 124 km east of Redhouse saltpan where it had been ringed about three months previously. There were two sightings of birds in the vicinity of East London. One was feeding at a sewage outfall at Bat Cave on 15 March 1984, 238 km from Redhouse saltpan, probably about four months after it had been ringed. Another was recorded at the nearby Nahoon River mouth on 27 April 1985 and was in adult plumage. A bird in adult plumage with a blue colour ring on the left leg was seen at the Kei River mouth on 13 January 2001. If this bird was one of those ringed as a pullus at Redhouse saltpan, it would have been at least 13 years old and 290 km east of Redhouse saltpan when seen. However, it may have been one of the breeding adults from Bird Island that was ringed 15 months previously in 1999. If so, the bird would have travelled 234 km to the east.

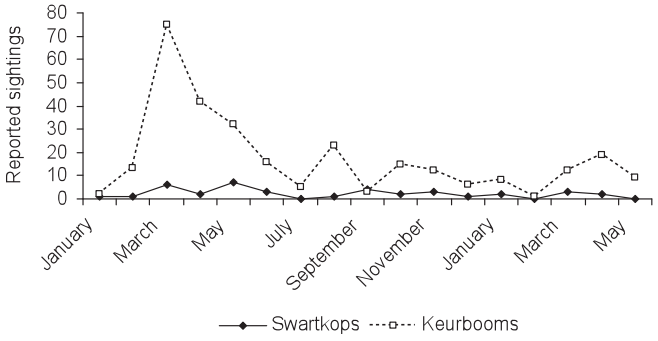

Fig. 4. Monthly totals of colour-flagged birds submitted by members of the public, January 2004–May 2005.

By 18 May 2005, there had been 131 sightings of birds that were colour-flagged as nestlings at Swartkops in 2003. All but one related to live birds recorded in the field. Taking into account the maximum number of birds recorded at each site and conservative judgement as to which sightings at various localities might relate to the same individuals, a minimum of 51 birds flagged at the Swartkops Estuary (43% of the total flagged there) were estimated to have been re-sighted. Sightings of colour-ringed birds on any one day in the Port Elizabeth area were assumed to relate to different individuals.

Of the birds flagged at the Swartkops River estuary, 34 (67% of those re-sighted) were estimated to have moved south and west of the breeding colony, seven (14%) had moved north and east and 10 (19%) appeared to have remained within the Swartkops River estuary. Most observations of Swartkops birds were made between 11 km and 50 km to the south and west of the ringing site (Fig. 3) and were clustered around the Port Elizabeth area. The maximum distance travelled westwards was 372 km by a bird found dead near Stillbaai [34°24′S 21°36′E, Fig. 1(a)] on 7 May 2004; the maximum travelled eastwards was 60 km. The latter bird was observed while on a beach drive near Perdevlei [33°44′S 26°13′E, Fig. 1(b)] in the Woody Cape Nature Reserve, Algoa Bay, on 24 May 2004. Median distances travelled west and east were 20 km and 10 km; mean distances were 27 km and 16 km respectively.

According to the national database, of the 356 birds ringed as pulli in the study area and later re-sighted or recovered, 289 had been ringed at the Swartkops River colony, 17 on islands in Algoa Bay and 50 at the Keurbooms River mouth (SAFRING unpubl. data). Of the 306 birds ringed at the Swartkops River or on the Algoa Bay islands, 133 (43%) were found dead at the breeding colony when less than two months old and therefore had failed to fledge. Of the remaining 173 pulli that fledged, 58 (34%) were recorded only from the site at which they were ringed. One of these was re-sighted alive, one was found sick, one was found oiled, and another was entangled with fishing line. The ring of one bird was found without any sign of the bird itself, and the remaining 53 were recovered dead. Of those found dead, 17 were breeding-age adults, and the rest were between six months and four years old. A further 38 pulli were both ringed and re-sighted or recovered within the lower Swartkops River system, having travelled between two and six kilometres from where they were ringed. Of 68 birds that were known to have travelled farther than six kilometres from their site of ringing, 34 travelled north and east along the coast, and 34 travelled south or west (Table 5). The remaining nine birds were found sick or injured and were taken to Bayworld in Port Elizabeth for rehabilitation, but the locality from where they had been found was not recorded.

TABLE 5
Direction and distance travelled by 98 Kelp Gull *Larus dominicanus vetula* pulli ringed in the study area that had travelled farther than six kilometres from their natal site

Origin (direction)	Distance travelled (km)					
	7–25	26–50	51–100	101–200	>200	Total
East Cape (east or north)	8	2	0	4	20	34
East Cape (south or west)	24	1	5	0	4	34
Keurbooms (east or north)	2	0	2	4	13	21
Keurbooms (south or west)	1	0	0	7	1	9

Of the 34 birds that travelled more than six kilometres to the north and east, 10 (29%) were recorded within 50 km of the ringing site, and 22 (65%) were found outside the study area, 16 of them in KwaZulu–Natal. The mean and median distances travelled north and east by birds from Eastern Cape colonies were 343 km and 243 km respectively. The farthest distance travelled eastwards was 686 km by a bird ringed on the Brickfields Island, Swartkops Estuary, which was found sick on Beachwood Golf Course, four kilometres north of Umgeni, KwaZulu–Natal. Of the 34 birds recorded south or west of the ringing site, 25 (74%) were seen or found within 50 km of where they were ringed. Four of the remaining 10 birds were found to the west of the study area in the Western Cape province. All four had been ringed at Redhouse saltpan on the Swartkops Estuary. The mean and median distances travelled south or west by birds ringed at Eastern Cape colonies were 67 km and 22.5 km respectively. The maximum distance travelled in this direction was 598 km by a bird ringed at Redhouse saltpan and found dead at Kleinmond (34°19′S 19°07′E), four months and 21 days later.

Up to 18 May 2005, 662 sightings in total were made of birds colour-flagged as chicks at the Keurbooms River mouth in 2003, involving an estimated 241 individuals (33% of those flagged). Birds ringed at the Keurbooms River mouth were recorded both east and west of the ringing site (Fig. 3). Sightings were clustered mainly around the Plettenberg Bay area, St Francis Bay and Port Elizabeth. Most birds (76%) were recorded in the Eastern Cape province, but at least five were seen on the coast of southern KwaZulu–Natal [Fig. 1(c)]. Of the estimated 241 individuals, 28 (12%) were estimated to have travelled west of the Keurbooms River, 196 (81%) to have moved to the east, and 17 (7%) to have remained within the Plettenberg Bay area. Most observations were made between 200 km and 210 km east of the ringing site, just to the south and west of Port Elizabeth. The maximum distance travelled in a westerly direction was 236 km by a bird re-sighted at Witsand [34°24′S 20°51′E, Fig. 1(a)] on 26 April 2004. The median distance travelled in this direction was 40 km, and the mean, 58 km. A bird seen at Bayhead, Durban, on 8 March 2004 was 907 km to the east of the Keurbooms River mouth. What may have been the same bird was recorded again on 31 March 2005. The median distance travelled by birds that went eastwards was 206 km, and the mean was 205 km.

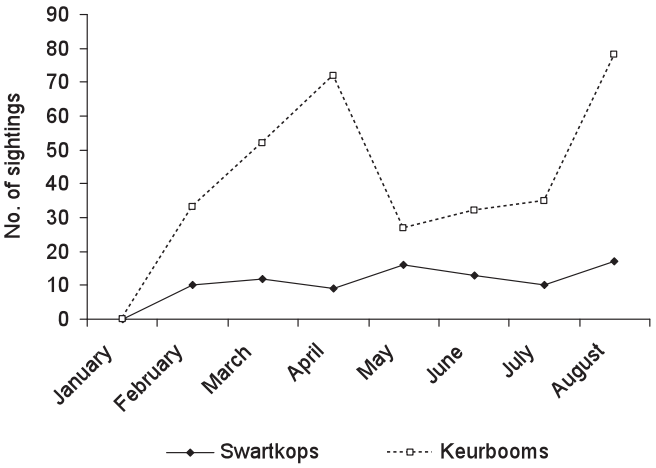

Fig. 5. Totals of colour-flagged birds recorded on monthly counts in the Port Elizabeth area, January–August 2004.

The national dataset contained recovery and re-sighting data for 50 pulli ringed at the mouth of the Keurbooms River. Four of these birds failed to fledge and were found dead at the colony. Of the 46 birds that fledged successfully, seven were seen only at the ringing site. A further seven were found within two kilometres of where they were ringed, and four between two kilometres and 10 km. Of the 30 birds that were recorded more than six kilometres from the colony, nine (30%) had travelled to the west and 21 (70%) to the east (Table 5). Of those that travelled eastwards, one (5%) was recorded within 50 km of the colony, and one had gone beyond the study area into KwaZulu–Natal. The latter bird had completed 935 km before being caught and released at the Tugela Estuary. The mean and median distances covered by the 21 birds that went east were 202 km and 206 km respectively. Eight of the nine birds that travelled west were recorded outside of the study area and had travelled more than 100 km. The mean and median distances travelled were 123 km and 116 km respectively, and the maximum distance was 220 km covered by a bird found dead at Dassieklip Farm, near Heidelberg (34°14′S 21°00′E).

The first of the Swartkops birds colour-flagged in 2003 to be reported was seen at Cape Recife on 18 January 2004, 23 km from the ringing site and between 17 days and 50 days from the date of ringing. Apart from birds found dead at the breeding site, the first of the colour-flagged Keurbooms birds was seen at the mouth of the Touw River (34°00′S 22°34′E), Wilderness [Fig. 1(a)], on 24 January 2004, 53 days after ringing. Sightings of birds ringed at the Swartkops Estuary rose in March 2004 and again in May of that year (Fig. 4). After that, low numbers continued to be reported throughout the period. There was a noticeable peak in March 2004 of sightings of birds ringed at the Keurbooms (Fig. 4). More modest increases in the numbers of colour-flagged birds reported occurred in August 2004 and April 2005. Regular counts in the Port Elizabeth area recorded more of the Swartkops-ringed birds than were otherwise reported. Peak counts occurred in March and

TABLE 6
Proportions of Kelp Gulls *Larus dominicanus vetula* ringed as pulli re-sighted or recovered within various distances from the breeding colony[a]

Breeding colony	Re-sightings or recoveries (%) at				
	0 km (Ringing locality only)	≤5 km	6–10 km	11–30 km	>30 km
Swartkops	34	18	2	20	23
Keurbooms	15	15	9	2	59

[a] Birds found at the colony that had failed to fledge are excluded. The remaining 3% of Swartkops birds were taken to Bayworld for rehabilitation, but there was no record of where they had been found.

May 2004, but another peak occurred in August (Fig. 5). A peak in numbers of Keurbooms-flagged birds was recorded in April 2004. As per sightings from the rest of the country, another peak was recorded in August, but numbers seen on monthly counts in the Port Elizabeth area in that month were much higher than those reported by members of the public throughout the country (Figs. 4 and 5).

If the colour-ring or flag and national data from SAFRING are combined, most Swartkops chicks (52%) were recorded within five kilometres of the breeding colony, with 23% having been seen or found dead more than 30 km away (Table 6). However, most Keurbooms birds were located more than 30 km from the colony, with 30% having been recorded only within five kilometres (Table 6). Most of the pulli ringed at the Swartkops Estuary (73%) that were subsequently recorded outside of the estuary system had moved to the south and west (Table 7); most of those ringed at the Keurbooms mouth (80%) had moved to the east and north. This polarity between the colonies was again statistically significant ($\chi^2_1 = 130.301$, $P < 0.01$). However, the distances travelled by pulli ringed at the Swartkops averaged higher for those that had travelled east and north ($Z = -4.89$, $P < 0.01$)–as was clearly the case for birds ringed at the Keurbooms Estuary (Table 7, $Z = -8.28$, $P < 0.01$). Maximum distances travelled also reflected this pattern. On average, birds banded as chicks at the Keurbooms River appeared to travel greater distances than did those at the Swartkops Estuary (Table 4, $Z = -7.007$, $P < 0.01$).

Overall, birds ringed or flagged as chicks appeared to travel farther than did those ringed as adults for the Swartkops ($Z = -4.87$, $P < 0.01$) and for the Keurbooms ($Z = -5.29$, $P < 0.01$) colonies.

All but one of the birds found in the study area had also been ringed there. The other bird was ringed as a chick on Robben Island in December 2002 and was seen near Schoenmakerskop on 30 April 2004. It was seen again to the east of the study area at Qolora, about five kilometres east of the Kei River mouth, on 28 April 2006 (R. & J. Furlong, pers. comm.). At least 67 birds ringed within the study region were recorded outside of it. Thirty had travelled to the east, and 37 to the west. The median distances travelled by these birds were 613 km eastwards and 115 km westwards.

DISCUSSION

There is no doubt that the pattern described in this study of the movements of adult and juvenile Kelp Gulls reflects to a high degree the areas to which most of the observational effort was directed. For instance, of the coastal sites around Port Elizabeth that are used for foraging and roosting by Kelp Gulls, Cape Recife is probably the one most regularly visited by birdwatchers, which could explain the relatively high number of sightings of colour-ringed or flagged birds at that locality. The large peak in sightings of colour-flagged Keurbooms birds 200 km to the east of the breeding colony is likely to be a result of the regular re-sighting effort made by PAW in the Port Elizabeth area from January to August 2004. However, if colour-flagged birds re-sighted on these regular counts are excluded from the analysis, the peak in sightings of birds from both colonies in the Port Elizabeth area remains, although reduced in size. The peaks in the numbers of colour-flagged birds reported are likely to be a result of juvenile birds moving away from their breeding colonies into areas where they were more likely to be seen by observers. It is also likely that the level of interest in searching for colour-flagged birds was greatest soon after the project was publicised and that fewer observers were inclined to search for or report sightings as the year progressed, although some observers continued to report birds up to May 2005. Although some observers were aware of the project, they often neglected to report sightings for several months or did so only in passing when meeting the project organiser!

The lack of sightings of colour-marked adult birds from the Swartkops colony more than 30 km from the ringing site is not thought to be purely an effect of observer effort, however, because the same pattern was revealed by recoveries and re-sightings of birds held in the SAFRING database. At Nelson Boulder Bank in New Zealand, most banded Kelp Gulls remained within 30 km of the breeding colony (Higgins & Davies 1996). Of all adult Kelp Gulls ringed in the Eastern Cape province, 82% of those recovered dead were found within six kilometres of their place of ringing, the largest distance travelled having been 24 km. Underhill *et al.* (1999) found six kilometres to be the median distance travelled by Kelp Gulls ringed as adults.

Although the median distance travelled by adult gulls ringed during incubation at the Keurbooms River colony, Plettenberg Bay, was six kilometres as found by Underhill *et al.* (1999), the mean distance travelled was more than 10 times greater, at 65 km, and eight times the mean distance travelled by adults from Redhouse saltpan. Although most birds were recorded within a 10-km radius of the breeding colony, 37% of sightings were more than 30 km away from it, 34% being more than 100 km, at least four times the maximum distance travelled by breeding adults from Redhouse saltpan.

The reasons for the different patterns of movements between the two colonies are not readily apparent. Searches for colour-ringed birds

TABLE 7
Direction and distances travelled by Kelp Gulls *Larus dominicanus vetula* ringed as pulli and subsequently recorded outside of the Swartkops and Keurbooms river systems[a]

	Swartkops		Keurbooms	
	East/north	West/south	East/north	West/south
Birds (n)	52	143	219	55
Mean distance (km)	189	36	205	56
Median distance (km)	28	23	206	40
Maximum distance (km)	686	598	935	220

[a] The difference in direction travelled is statistically significant between the two colonies, as is the average distance travelled in each direction for both colonies.

were made at a greater distance from the Keurbooms colony than from the Swartkops colony, thus increasing the likelihood of longer distances being recorded for the Keurbooms birds. For distances of more than 30 km to have been recorded for adult birds from the Swartkops colony, sightings and recoveries would have to have been reported by members of the public. It is also possible that Swartkops birds do not have to go far to find sufficient food after the breeding season, whereas some birds from the larger Keurbooms colony may need to search beyond the local environment to find other sources of natural and human-provided food, particularly towards the east. This possibility is discussed further in the following paragraphs pertaining to movements of juvenile birds.

Although the adult-plumaged bird with a blue colour-ring seen at Kei River mouth in 2001 could have been a bird ringed as a chick at Redhouse saltpan, it is thought unlikely that a colour ring would have remained intact for 13 years, chicks at Redhouse saltpan having last been colour-ringed in November 1987. Most plastic bands are eventually lost as they become brittle through exposure to sunlight or loosen and slide off over the foot (Crawford *et al.* 2000). Adult Kelp Gulls have also been known to attack and destroy darvic bands (E. Woehler *in litt.*). However, it is thought that very few colour-rings or flags would have been lost during the year after ringing, and such loss would have had little effect on the patterns of movements or distances recorded. The metal incoloy rings show long-term resistance (10–20 years) to abrasion and corrosion, including in seawater (De Beer *et al.* 2001). It is therefore unlikely that loss of metal rings would have affected the results of this study.

Regular counts made in the Port Elizabeth area between February 2003 and August 2004 (Whittington *et al.* 2006a) and on the Swartkops Estuary between September 1983 and August 1985 (Martin & Baird 1987), suggest that there is an influx of adult Kelp Gulls into the area in late summer to autumn and that some, if not most, of these birds must originate from colonies farther to the west. At Wellington Harbour, New Zealand, non-breeding flocks of Kelp Gulls included birds from as far south as Southland, South Island, and as far north as Auckland (Fordham 1968), approximate distances of 745 km and 480 km respectively. The lack of evidence from re-sightings and recoveries of ringed birds in South Africa to support long-distance movements of adults is probably a result of the small sample of adult birds that has been ringed. Adult Kelp Gulls are difficult to catch, being very wary of traps, even when baited with fish, and most ringed adults were initially caught in traps placed over the nest.

Kelp Gull chicks dispersed rapidly from their natal sites, travelling both eastwards and westwards along the coast. Many had left the vicinity of their natal colony within two months after ringing. Peaks in the numbers of colour-flagged birds recorded occurred within 3–4 months from ringing. The birds ringed at the Swartkops Estuary that travelled the greatest distances east and west had done so within six months of ringing. Of the colour-ringed Keurbooms birds, the one that was recorded farthest to the west was observed within five months of ringing; the longest travelling bird of all had completed the 907 km from the Keurbooms River to Durban Bay within 99 days. At Bird Island, most fledged juvenile Kelp Gulls had left the island by April, and at Dassen Island on the west coast of South Africa, most juvenile birds had left the breeding colony by winter (Crawford *et al.* 1997, Whittington *et al.* 2006a). At Nelson Boulder Bank, New Zealand, no juveniles were present after March (Higgins & Davies 1996). The pattern of sightings of Keurbooms colour-flagged birds in the Port Elizabeth area suggests that there were two episodes of birds moving into the area, one in April and the other in August. This pattern may be attributable to birds moving out of the area and returning later in the winter or to some of the original birds continuing to move eastwards and then another group arriving from the west later in the year. Peaks of juvenile birds in the Port Elizabeth area in late summer and winter were also recorded in 2003 (Whittington *et al.* 2006a.).

Dispersal of colour-flagged birds from the Swartkops and Keurbooms colonies showed a different pattern. Most of the birds (73%) ringed at the Swartkops Estuary were recorded to the south and west of the breeding colony, whereas 80% of the Keurbooms birds had moved to the east. Distances travelled by Keurbooms birds were generally greater than those travelled by birds ringed at the Swartkops Estuary. Although the farthest travelled west was by a bird from the Swartkops Estuary, the median distance travelled in this direction by Keurbooms birds was nearly double that travelled by birds from Swartkops. One explanation for this pattern of movements is that Swartkops birds do not need to move far to find good foraging. The river estuary provides an abundance of natural prey, such as the Mudprawn *Upogebia africana,* in addition to fish offal and bait from the numerous fishermen and bait collectors (Martin & Baird 1987). However, many first-year birds have dispersed from the estuary by April (Martin & Baird 1987). This dispersal may be a result of increased competition from large numbers of adult birds that come into the estuary during the autumn months. Port Elizabeth Harbour and Arlington Waste Disposal Site also offer an abundant and readily available food source for juvenile gulls. Both sites are within 20 km of the breeding colony. Birds from the Keurbooms River mouth appear to travel farther to find abundant sources of supplementary food, although some is available to them at the nearby Robberg rubbish tip. There seems to be some concentration of birds in the St Francis Bay area, where birds can benefit from natural food sources and the fish scraps available at Port St Francis. At least 10 colour-flagged Keurbooms birds were seen foraging at the latter locality and were still being seen there in May 2005. However, Port Elizabeth offers the largest amount of supplementary food, and 67% of the sightings of white-flagged birds (47% of the estimated number of individuals) were from within the Port Elizabeth area.

Evidence from the SAFRING database suggests that some juvenile Kelp Gulls from the Swartkops colony move just as far eastwards as those from the Keurbooms colony, and if the colour-ring data were omitted, the mean distance travelled was actually greater for birds from Swartkops. This suggests that either members of the public were more likely to find and report a dead bird with a metal ring than they were to notice a live bird with a blue colour-flag, in spite of the publicity given to the 2003 colour-flagging project, or that few young Kelp Gulls from the Swartkops colony dispersed eastwards in 2004. Reports of blue flags sighted by members of the public comprised 16% of the total number of sightings of blue-flagged birds as compared with 35% of the total number of observations of white-flagged birds recorded. Blue flags are more difficult to see, especially at a distance (PAW pers. obs.), which may explain the relative paucity of observations of birds ringed at the Swartkops Estuary.

Steele and Hockey (1990) found that directions of dispersal and the distances travelled by juvenile Kelp Gulls varied at different

colonies on the West Coast and in the southwestern Cape of South Africa. These differences were attributed to the availability of supplementary, human-produced food and to a possible mechanism to reduce intraspecific competition (Steele & Hockey 1990). In New Zealand, dispersal of juvenile Kelp Gulls from well-studied colonies was found to be randomly directed and to vary between colonies, generally being related to food availability (Fordham 1968, Higgins & Davies 1996). In the Chubut region of Argentina, most Kelp Gulls dispersed from the vicinity of the breeding colony at the end of the breeding season. Many were present at urban waste tips and were found feeding on fishery refuse tips outside of the breeding season (P. Yorio *in litt.*).

As with adults, most sightings of birds ringed as chicks at the Swartkops colony were within 30 km of the ringing site, although this was not the case for birds ringed at the Keurbooms colony. In southern North Island, New Zealand, the mean distance travelled by first-year birds was *c.* 27 km (Higgins & Davies 1996). Comparison of Tables 2 and 6 shows that, as compared with adults, a greater proportion of birds ringed as pulli in the study area travelled more than 30 km from the ringing site. Average and maximum distances travelled by birds ringed as pulli were greater than corresponding values for adults, although median distances travelled south and west from Swartkops and north and east from Keurbooms were similar for the two age groups. In the SAFRING database, 17 birds (16 from the Eastern Cape and one from Keurbooms) and five colour-flagged birds from Keurbooms were found in KwaZulu–Natal, possibly having followed the annual Sardine *Sardinops sagax* migration, as do several other marine predators (Armstrong & Thomas 1989). The *Atlas of Southern African Birds* shows that the reporting rate of Kelp Gulls in KwaZulu–Natal was highest during the autumn and winter (Crawford 1997) when the "sardine run" is in progress. Of the 22 ringed birds found in KwaZulu–Natal, 15 (68%) were recorded between April and August, five in February or March, and one each in September and October.

Long-distance movements were also recorded in New Zealand and Australia, some juveniles dispersing up to 600 km (Higgins & Davies 1996). The tendency for young birds, as compared with adults, to disperse farther from breeding colonies is a feature of most seabird species (Furness & Monaghan 1987). Dispersal patterns of juveniles are presumably related to distribution of food resources and may be necessary to avoid competition with adults. Several studies show that young gulls are less efficient than adults in a variety of foraging situations and may be forced into suboptimal foraging areas because of competition from older birds (Moyle 1966, Barash *et al.* 1975, Siegfried 1977, Ingolfsson & Estrella 1978, Furness & Monaghan 1987, Burger 1988). The need for large numbers of adults to satisfy the requirements of growing chicks may result in a partial exhaustion of food resources in the immediate vicinity of the breeding colony, leading to dispersal of birds out of the area (Dorst 1971). Although the resources remaining around the breeding colonies may be insufficient to support all juveniles of a cohort, small numbers may be able to subsist without the need for dispersal. Juveniles that disperse are still likely to have to compete with adults for food, but where food resources are abundant and easily obtainable, such as at waste tips and around fish quays, their chances of meeting their daily food requirements are considerably higher (Steele & Hockey 1990).

Although there was a re-sighting of a Kelp Gull ringed in the southwestern Cape at East London Oceanarium in the Eastern Cape (Steele & Hockey 1990), only one of the 4147 birds ringed to the west of Plettenberg Bay was subsequently recorded within the study area. This bird was ringed as a chick at Robben Island, a breeding colony that was first established in 2000 (Calf *et al.* 2003). Thousands of Kelp Gulls were observed moving westwards off Keurboomstrand, near Plettenberg Bay, in mid-August 1996, perhaps returning after following the KwaZulu–Natal "sardine run" (Van der Bijl 1996). However, evidence from the study of ringing recoveries would lend support to the theory that the populations of Kelp Gulls on the west coast and in the southwestern Cape are essentially separate from those farther east, and that there is little mixing between them. Both of the birds ringed in KwaZulu–Natal were found in the Eastern Cape province, more than 400 km from their site of ringing. It is likely that these birds had originally come from Eastern Cape breeding sites and dispersed to KwaZulu–Natal after fledging. One was known to have been ringed in adult plumage and so had presumably remained in KwaZulu–Natal for a number of years.

Adult Kelp Gulls in the study area would appear to obtain most of their food requirements within 30 km of their breeding colonies, but may move greater distances to take advantage of an abundant food source such as that provided by humans in fishing harbours and at rubbish tips (Steele & Hockey 1990). Birds in their first year of life probably disperse to areas where they can find easy food resources, particularly those provided by humans. Such places are available in parts of the study area, but some birds moved farther east, perhaps to exploit the annual Sardine migration.

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APPENDIX 1
Location of Kelp Gull *Larus dominicanus vetula* roosts, with dates and times when visited in 2004

Locality	Geographic coordinates[a]		Date and time visited
	Latitude (S)	Longitude (E)	
Fish River Estuary	33°29′45″	27°08′09″	5 May: 11h40–11h55
Port Alfred (Fish River mouth)	33°31′20″	27°06′55″	5 May: 09h45–11h40
Kowie River	33°35′30″	26°54′02″	5 May: 12h50
Kowie Road bridge (Port Alfred)	33°35′40″	26°53′30″	5 May: 12h45
Kowie River mouth	33°36′04″	26°54′02″	5 May: 17h05–17h45
Kasouga River mouth	33°39′15″	26°44′10″	10 Apr: unrecorded
Kasouga to Kariega Point	33°40′02″	26°43′00″	12 Apr: 15h15–17h45
Kariega River (Kenton-on-Sea)	33°40′40″	26°40′50″	13 Apr: 09h45
Boesmans River (Kenton-on-Sea)	33°41′10″	26°39′40″	13 Apr: 10h30–11h30
Kwaaihoek	33°42′12″	26°38′42″	13 Apr: 12h00–12h35
Boknesstrand	33°43′30″	26°35′00″	13 Apr: 15h00–15h30
Cannon Rocks	33°45′10″	26°30′50″	13 Apr: 15h55–16h50
Cannon Trail	33°45′30″	26°23′25″	13 Apr: 17h30
Bird Island	33°50′27″	26°17′10″	25 May: 09h40–11h40
Black Rocks	33°50′15″	26°15′52″	17 Mar: 10h30
Seal Island	33°50′00″	26°16′37″	17 Mar: 09h25–10h20
Stag Island	33°50′00″	26°17′00″	17 Mar: 08h30–09h10
Lake Eric to Springs	33°43′20″	26°10′09″	24 May: 11h20–12h10
Sundays River mouth	33°43′06″	25°50′57″	1 Jun: 12h55–14h25
Tankatara saltpans	33°42′20″	25°46′20″	8 Jun: 09h05–11h20
Coega saltworks	33°47′00″	25°40′50″	29 Apr: 13h50–15h20
Ngqura Port	33°47′52″	25°41′43″	26 Mar: 13h50–14h30
St Croix Island	33°48′00″	25°46′02″	16 Mar: 06h50–07h45
Jahleel Island	33°48′12″	25°42′14″	15 Mar: 09h35–10h30
Brenton Island	33°49′04″	25°45′54″	15 Mar: 10h50–11h15
Sand pumping site	33°48′00″	25°41′37″	29 Apr: 13h15–13h30
Joorst Park	33°48′40″	25°40′32″	29 Apr: 12h35–13h00
St George's Beach	33°49′26″	25°39′36″	29 Apr: 12h10
Bluewater Bay Lifesaving Club	33°50′13″	25°39′00″	29 Apr: 11h50
Bluewater Bay beach	33°51′30″	25°38′07″	29 Apr: 11h25
Redhouse saltpan	33°50′17″	25°35′09″	7 May: 14h30–15h35
Bar None saltpans	33°49′40″	25°33′33″	7 May: 16h55–17h40
Chatty saltpans	33°51′20″	25°35′00″	4 Apr: 09h00–10h20
Swartkops Estuary	33°51′18″	25°36′08″	7 May: 09h25–14h10
John Tallant Road to Swartkops mouth	33°52′58″	25°37′42″	29 Apr: 10h50
Fishwater Flats sewage works	33°53′00″	25°37′13″	29 Apr: 16h20–17h25
Port Elizabeth harbour	33°57′47″	25°38′17″	28 Apr: 14h05–16h45
King's Beach	33°58′08″	25°38′35″	28 Apr: 17h05–17h25
Shark Rock	33°58′45″	25°39′33″	26 Apr: 17h00

Locality	Geographic coordinates[a]		Date and time visited
	Latitude (S)	Longitude (E)	
Pollock Beach	33°59′20″	25°40′30″	26 Apr: 16h45
Pollock Beach to Flat Rock	33°59′37″	25°40′45″	26 Apr: 16h25–16h45
Arlington waste disposal site	34°00′30″	25°34′30″	30 Apr: 16h05–16h30
Flat Rock to Cape Recife Lighthouse	34°01′03″	25°41′38″	26 Apr: 07h15–09h25
Cape Recife point	34°01′55″	25°41′59″	26 Apr: 13h45–13h55
The Pati	34°01′40″	25°40′00″	26 Apr: 14h50–15h10
Beaches north of The Pati	34°01′45″	25°39′12″	30 Apr: 11h35
Schoenmakerskop to Noordhoek	34°02′53″	25°35′28″	30 Apr: 11h05–15h25
Seaview	34°00′00″	25°19′12″	19 Apr: 11h10–11h30
Beachview	34°00′10″	25°19′27″	19 Apr: 12h20–12h45
Maitlands River mouth	33°59′15″	25°17′29″	19 Apr: 13h05–13h25
Maitlands to Blue Horizon Bay	33°58′48″	25°16′12″	27 Apr: 12h05–13h20
Blue Horizon Bay	33°58′40″	25°15′06″	27 Apr: 12h05
Blue Horizon Bay to Van Stadens	33°58′12″	25°14′24″	27 Apr: 14h05–15h00
Van Stadens River mouth	33°58′15″	25°13′23″	27 Apr: 15h00–15h30
Beach west of Van Stadens	33°58′12″	25°12′36″	27 Apr: 15h30–16h40
Dunes east of Gamtoos Reserve	33°57′43″	25°03′36″	9 May: 15h15–15h55
Gamtoos “dead arm”	33°57′40″	25°02′25″	9 May: 16h55–17h25
Gamtoos campsite to mouth	33°58′08″	25°02′40″	9 May: 14h35–15h15
Gamtoos River mouth	33°58′15″	25°01′55″	9 May: 11h45–12h30
Dunes west of Gamtoos mouth	33°58′17″	25°01′18″	9 May: 12h30–13h50
Gamtoos Ferry to mouth	33°56′40″	25°00′23″	9 May: 10h45–11h45
Kabeljous to Gamtoos	33°59′10″	24°58′20″	5 May: unrecorded
Kabeljous River mouth	34°00′20″	24°56′00″	23 Apr: 18h00
Wavecrest to JB ski boat club	34°03′10″	24°55′38″	23 Apr: 17h00–17h50
JB ski boat club to Die Waalskipper	34°04′10″	24°55′27″	23 Apr: 15h30–16h00
Marina Martinique area	34°04′10″	24°54′26″	23 Apr: 16h35
Seekoi River mouth	34°05′12″	24°54′34″	23 Apr: 13h50–14h40
Paradise Beach	34°04′48″	24°54′00″	23 Apr: 15h15
Krom River mouth	34°08′32″	24°50′40″	22 Apr: 06h45–07h45
St Francis Bay Harbour	34°10′20″	24°50′05″	22 Apr: 09h30–10h15
Seal Point Nature Reserve	34°12′45″	24°50′18″	22 Apr: 12h45–13h30
Cape St Francis	34°11′50″	24°50′31″	22 Apr: 11h30–12h45
Thysbaai	34°11′10″	24°43′44″	23 Apr: 11h15–12h30
Oyster Bay	34°10′20″	24°37′57″	22 Apr: 16h20–17h45
Huisklip (Tsitsikamma River mouth)	34°08′05″	24°26′13″	? Apr: unrecorded
Storms River mouth	34°01′32″	23°53′50″	21 Apr: 16h30–18h00
Nature’s Valley (Groot River mouth)	33°58′12″	23°34′30″	21 Apr: 13h55–14h25
Nature’s Valley beach	33°59′00″	23°33′12″	21 Apr: 14h50–15h10
Matjies River	34°00′07″	23°28′13″	20 Apr: 17h40–18h00

Locality	Geographic coordinates[a]		Date and time visited
	Latitude (S)	Longitude (E)	
Rafiki's to Matjie's River	34°00′00″	23°27′47″	20 Apr: 17h25–17h40
Kettle Beach	34°00′15″	23°27′37″	20 Apr: 17h20
Lubner's Beach/The Waves	34°00′20″	23°27′05″	20 Apr: 17h15
Dune Beach Resort	34°00′53″	23°25′12″	20 Apr: 17h00
Bitou River	34°00′26″	23°22′57″	21 Apr: 11h00
Keurbooms Lagoon and sandspit	34°02′00″	23°23′36″	21 Apr: 09h05–10h40
Keurbooms (above road bridge)	33°59′36″	23°24′00″	21 Apr: 10h55
Central Beach (Plettenberg Bay)	34°03′40″	23°22′49″	20 Apr: 14h40–15h25
Robberg Beach	34°05′32″	23°22′32″	20 Apr: 13h35–13h45
Robberg rubbish tip	34°05′10″	23°21′26″	20 Apr: 13h10–13h25
Robberg Nature Reserve	34°06′20″	23°23′30″	20 Apr: 10h40–12h55

[a] Central point of each site.