THE CONTRIBUTION MADE BY CLEANING OILED AFRICAN PENGUINS *SPHENISCUS DEMERSUS* TO POPULATION DYNAMICS AND CONSERVATION OF THE SPECIES

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SUMMARY

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Since 1968, the Southern African Foundation for the Conservation of Coastal Birds (SANCCOB) based in Cape Town has cleaned, on average, between 200 and 2000 African Penguins *Spheniscus demersus* per year. Most of these were banded prior to release, so that the success of the cleaning procedures could be monitored. Survival of cleaned and non-oiled African Penguins was compared from an analysis of recoveries of banded individuals. Over a period of 10 years, time elapsed between banding and recovery did not differ significantly between cleaned and non-oiled penguins, as shown by a randomisation test. Results from this study were compared with banding recovery data for certain North American seabirds. Some rehabilitated African Penguins were shown to be amongst the oldest known individuals of this species in the wild. Cleaning oiled African Penguins is considered to make a worthwhile contribution to the conservation of a vulnerable, endemic species.

INTRODUCTION

Pollution of the marine environment by oil is an ever present threat to coastal and marine flora and fauna. Oil spills can result from marine accidents, such as vessels colliding or running aground, and the illegal but seemingly frequent practice of ships cleaning their bilge tanks at sea (Frost *et al*. 1976). The first documented oiling incident to affect penguins off southern Africa occurred in 1948, when an American tanker *Esso Wheeling* was wrecked near Dyer Island (Green 1950). Another incident occurred in 1952 (Rand 1952), but it was the closure of the Suez Canal in 1967, forcing ships from the Persian Gulf to take the long route around southern Africa to Europe, that heralded the beginning of more frequent oiling incidents (Underhill *et al*. 1999). Of the bird species affected by such pollution in southern Africa, the African or Jackass Penguin *Spheniscus demersus* is particularly vulnerable, being flightless and foraging within a relatively short distance of its inshore and coastal breeding localities. This species is endemic to southern Africa, breeding mainly on islands off the coasts of Namibia and South Africa. Numbers have declined by some 70% since the start of the 20th Century and have continued to decrease in the 1990s to a total of about 179 000 (Crawford *et al*. 1995). The species was listed as 'vulnerable' in the South African Red Data Book for Birds (Brooke 1984) and under the most recent IUCN valuation technique update.

Since 1968, attempts have been made to clean and rehabilitate oiled seabirds, particularly penguins, at the Southern African National Foundation for the Conservation of Coastal Birds (SANCCOB), a voluntary organisation supported by public donations, in Cape Town. Large-scale spills in 1968, 1971, 1972 and 1994 resulted in 1700, 1216, 4000 and 10 000 oiled birds being collected, respectively (Underhill *et al*. 1999). The 1994 spill was the result of the sinking of a bulk ore carrier, the *Apollo Sea*, near Dassen Island (33°25'S, 18°05'E). The 10 000 African Penguins oiled represented about 5% of the world population at that time. A total of 5213 birds was released after cleaning and successful treatment by SANCCOB. Between 1970 and 1991, at least 11 300 African Penguins are known to have been victims of oil spills (Morant *et al.* 1981, Adams 1994). Although this is an underestimate of the actual numbers involved, it illustrates the impact that a single spill, such as that of the *Apollo Sea* incident, can have when it happens close to a large penguin colony.

Oiled penguins received at SANCCOB were washed with Light Duty Concentrate and warm water. When all traces of oil had been removed, the birds were rinsed by a jet of water under high pressure. Cleaned birds were fed twice a day, usually with Sardine *Sardinops sagax* (Hodges 1995). When the plumage had regained its waterproofing qualities and the penguins were fit and well they were released, usually at Robben Island in Table Bay, some 11 km to the north of Cape Town (Randall *et al*. 1980). Most were fitted with metal flipper bands bearing a unique number, allowing the success of the cleaning operation to be monitored (Adams 1994). A programme of banding 'wild', i.e. non-oiled, birds at breeding colonies began in the early 1970s.

In contrast to many other attempts to rescue oiled seabirds around the world (Sharp 1996), SANCCOB has attained a high degree of success in rehabilitating African Penguins into the wild (Randall *et al*. 1980). This paper shows that flipper-banding of cleaned birds has provided an insight into the survival of these birds after release, allowing us to assess the contribution made by cleaning oiled African Penguins to the population dynamics and conservation of this vulnerable species.

METHODS

Survival of cleaned, released penguins was compared to that of non-oiled ones, by considering the elapsed times between banding or release and recovery of the band at the time of death. Banding and recovery details are kept by the South African Bird Ringing Unit (SAFRING) at the Avian Demography Unit, University of Cape Town. Only birds in adult plumage and juveniles, which had completed their first moult and gone to sea, were included in the analysis. Nestlings were excluded because they are not directly at risk from oil contamination at sea and, therefore, none was treated at SANCCOB. There were also very few nestlings banded in the early years. A separate analysis was performed on adult birds, excluding those still in immature plumage at banding. Adult plumage is attained between 12 and 22 months of age (Randall 1989).

The analysis included recoveries within a period of 10 years from the date at which each penguin was banded (or released). This simulated a situation such that all the birds were banded on day one and the situation reviewed 10 years later. Birds banded after 1985 were excluded, because for these birds, 10 years had not elapsed by the time of this analysis. A period of 15 years was also investigated but sample sizes were reduced. A randomisation test was performed on the data to test the null hypothesis that time elapsed from banding to death was the same for both cleaned and non-oiled penguins. The randomisation test did not require survival rates to conform to a parametric model. It allowed various percentiles of time elapsed between ringing and death to be tested. The 95% confidence limits for each percentile were computed by bootstrapping. For details of the randomisation tests and their applicability to this kind of data see Manly (1991) and Oatley & Underhill (in press).

RESULTS

Totals of 147 cleaned and 163 non-oiled African Penguins were recovered dead within a 10-year period from banding between 1971 and 1996. The totals banded which could have potentially been recovered were 5620 for cleaned, released penguins and 8470 for non-oiled penguins. The median time elapsed between release of a cleaned, full-grown penguin and it being recovered dead was 18 months whereas for a non-oiled bird it was 21 months (Table 1). The median time elapsed for birds banded in adult plumage was 23 months for both rehabilitated and non-oiled birds. Rehabilitated adults lived for eight months longer at the 90th percentile, but all other comparisons differed by a maximum of three months. There was no significant difference between the times elapsed at each percentile for cleaned and non-oiled birds.

DISCUSSION

The results imply that oiled African Penguins which were cleaned and released had as good a chance of long-term survival as those which had not been oiled. This result is different to that experienced in the Northern Hemisphere. North American banding data indicate that post-release survival of oiled seabirds is low (Sharp 1996). Cleaning and release of oiled birds in the U.K. has also met with little success, with probably 'less than 10%' of released birds surviving beyond one month (C.J. Mead as quoted by Sharp 1996). In the Southern Hemisphere, rehabilitation of Magellanic Penguins *Spheniscus magellanicus* has been stated to be of 'little use' (Sharp 1996). Of 360 Magellanic Penguins cleaned in 1991, less than 60 were released. None of these was seen alive more than a few days after release, although several were found dead in

TABLE 1

Time elapsed (months) between banding and death of African Penguins truncated to 10 years

Full-grown birds

	Non-oiled (n = 163)		Cleaned (n = 147)		
Percentile	**Months elapsed**	**Confidence intervals**	**Months elapsed**	**Confidence intervals**	**Test for difference**
50	21	(15,25)	18	(7,24)	n.s. $P = 0.45$
75	53	(36,65)	50	(40,62)	n.s. $P = 0.86$
90	89	(76,99)	91	(70,100)	n.s. $P = 0.83$
95	108	(92,113)	106	(93,112)	n.s. $P = 0.89$

Adult birds

	Non-oiled (n = 137)		Cleaned (n = 124)		
Percentile	**Months elapsed**	**Confidence intervals**	**Months elapsed**	**Confidence intervals**	**Test for difference**
50	23	(17,28)	23	(11,30)	n.s. $P = 0.93$
75	55	(37,67)	57	(43,69)	n.s. $P = 0.84$
90	88	(75,102)	96	(78,104)	n.s. $P = 0.57$
95	111	(91,117)	109	(96,114)	n.s. $P = 0.79$

bushes near to the release point. Washing was made difficult due to lack of water and water pressure in an area of desert (P.D. Boersma *in litt.*).

Sharp (1996) considered the results of banding recovery data for three species of marine birds in North America (Table 2). The median period elapsed between banding and recovery of cleaned individuals of these species ranged from 0.2 to 0.4 months. These elapsed times were exceeded by non-oiled birds by ratios of between 1:36 and 1:52 (Table 2). In comparison, elapsed times for full-grown and adult African Penguins which had not been oiled were 21 and 23 months, respectively, whereas those for rehabilitated birds were 18 and 23 months (Tables 1, 2). This gives ratios of 1:1.2 and 1:1 for full-grown and adult penguins, respectively. This indicates that the rehabilitation of African Penguins has been a successful exercise not just in the short-term survival of birds, but also over the period of a decade.

Of 23 banded penguins known to be at least 20 years old, five were rehabilitated, including two of the three oldest (Table 3). Both had reached 26 years of age before death. Twenty-one of these penguins were fitted with 'P' series bands, used between 1972 and 1979. SAFRING schedules show that 9865 of these bands were fitted on African Penguins, of which 2209 (22.4%) were birds treated by SANCCOB. The proportion of the oldest birds which had been rehabilitated is five out of 21 (23.8%) which is very similar to the proportion ringed. This provides further evidence that rehabilitation efforts do not adversely affect long term survival prospects of African Penguins in the wild.

TABLE 2

Median months survived by oiled and non-oiled seabirds in North America, based on banding recoveries (after Sharp 1996), as compared with African Penguins (this study)

Species	n	Oiled	n	Non-oiled	Non-oiled : oiled ratio
Western Grebe *Aechmophorus occidentalis*	10	0.4	37	20.8	52
Velvet Scoter *Melanitta fusca*	10	0.3	22	15.5	51.7
Guillemot *Uria aalge*	78	0.2	641	7.2	36
African Penguin *Spheniscus demersus* (full-grown)	147	18	163	21	1.2
African Penguin *Spheniscus demersus* (adult)	124	23	137	23	1

TABLE 3

African Penguins aged 20 years or more

Band number	Age at banding	Cleaned at SANCCOB	Date banded	Date resighted	Age at resighting (years)
P6593	Adult	No	30 November 1972	28 March 1999	27+ (dead)
P4240	Immature	Yes	13 September 1972	25 September 1998	26–27(dead)
P4364	Immature	Yes	10 August 1973	04 January 1999	*c.* 26 (dead)
P3264	Adult	No	06 October 1974	13 March 1999	>25 (alive)
P3741	Adult	Yes	26 September 1972	03 October 1995	>24 (alive)
P4234	Immature	Yes	13 September 1972	01 January 1996	>24 (dead)
P7347	Immature	No	02 December 1972	17 August 1995	*c.* 23 (nest)
P3351	Immature	No	11 December1976	27 March 1999	*c.* 23 (alive)
P6101	Immature	No	16 March 1977	27 March 1999	22–23 (+ chicks)
P9631	Immature	No	23 April 1977	27 March 1999	22–23 (+ chick)
P9759	Adult	No	18 August 1977	27 March 1999	>22 (alive)
P4302	Immature	Yes	08 December 1972	06 June 1994	*c.* 22 (alive)
P3254	Adult	No	06 October 1974	13 November 1995	>22 (alive)
P9482	Immature	No	17 December 1977	27 March 1999	*c.* 22 (alive)
P3222	Adult	No	03 October 1974	18 August 1994	>21 (alive)
P8778	Adult	No	01 July 1976	27 August 1996	>21 (alive)
P9447	Chick	No	06 March 1978	27 March 1999	21 (+ chicks)
P9449	Chick	No	06 March 1978	27 March 1999	21 (on eggs)
T1050	Chick	No	24 May 1978	27 March 1999	20.8 (alive)
P4470	Chick	No	29 April 1975	13 November 1995	20.5 (alive)
P4432	Chick	No	24 September 1975	10 February 1996	20.3 (dead)
P4777	Chick	No	10 November 1977	05 February 1998	20.25 (dead)
Z1028	Chick	No	21 January 1979	27 March 1999	20 (alive)

The evidence presented thus suggests that cleaning of oiled African Penguins is more than an exercise in humanitarianism. Cleaned birds are likely to survive as long as non-oiled birds and thus reduce the number lost to oiling incidents. At least 65 African Penguins have now been oiled twice and subsequently cleaned and released by SANCCOB. Of these, 27 have been resighted alive following their second release, 12 of them breeding. Unfortunately, four birds had their bands removed prior to their second release, preventing further monitoring of those individuals.

Cleaned penguins are also known to have bred successfully and can thus be fully restored to the population (Morant *et al*. 1981, pers. obs.). In 1995, at a study site on Dassen Island off the west coast of South Africa, the post-hatching success of African Penguins cleaned and released after the *Apollo Sea* oiling incident in 1994, was 55.2% as compared to 53.7% for non-oiled penguins (D.C. Nel pers. comm.). However, there were seasonal differences between the two groups, the oiled birds being less successful during times of low food availability. Disruption of pair bonds as a result of oiling may lead to a reduction in breeding success of oiled birds. There is also evidence that the moult cycle of African Penguins can be disrupted as a result of oiling (A.C. Wolfaardt pers. comm.). Further studies are needed to compare the frequency of breeding attempts by penguins restored to the wild population with those of non-rehabilitated birds.

As far as African Penguins are concerned, cleaning of oiled individuals can make an important contribution to the conservation of this declining species, endemic to southern Africa. However, it should be stressed that measures preventing marine pollution, accidental or by negligence, are still urgently required, and are more cost effective than trying to clean up the mess afterwards.

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