

METHODS OF REDUCING MORTALITY OF SEABIRDS CAUSED
BY UNDERWATER BLASTING

J. COOPER

Received 3 February 1983, accepted 28 February 1983

INTRODUCTION

Underwater blasting causes severe shock waves which can kill birds in the water (Cooper 1976). Blasting can also kill large numbers of fish which attract seabirds (Hockey 1976). A series of blasts spaced out over a period of time can therefore result in enhanced mortality of seabirds, since birds attracted to dead prey from the first blast are themselves killed by subsequent ones (Fig.1).

The necessity for redredging the approach channel to the iron-ore loading jetty in Saldanha Bay, southwestern Cape, South Africa, in 1977 so that very large ore-carriers could be accepted, resulted in a series of underwater blasts to break up limestone capping on the seabed in the bay (Anon 1978).

It became apparent that these series of blasts were killing seabirds when I collected 182 freshly dead Jackass Penguins *Spheniscus demersus* on the beach on 5 April 1977 in Saldanha Bay, after receiving reports from the public. Enquiry revealed that two underwater blasts a day were taking place in the vicinity of Marcus Island within Saldanha Bay. At a meeting with the officials responsible for the blasting, it was decided to reduce the number of blasts to one a day at midday when fewer Jackass Penguins were likely to be in the water near the island. Plans were also made to test underwater acoustics as a scaring technique.

METHODS

The following bird scaring techniques were used : underwater playback of Killer Whale *Orcinus orca* vocalizations and electronic noises (Shaughnessy *et al.* 1981); and firing guns over the water. Both methods were tried in the blast area just prior to a blast. After each blast, the sea in the area was searched and floating corpses of seabirds were collected and counted. Corpses of penguins were cut open to obtain stomach contents (Cooper in press).

RESULTS

Over the period March - August 1977 a total of 91 blasts was conducted and a minimum total of 1 099 seabirds of three species was killed (Table 1). Cape Cormorants *Phalacrocorax capensis* and Jackass Penguins constituted all but five of the total killed.

TABLE 1

MINIMUM NUMBER OF SEABIRDS KILLED BY UNDERWATER BLASTING
NEAR MARCUS ISLAND, SALDANHA BAY,
MARCH - AUGUST 1977

Species	No.	%
Jackass Penguin <i>Spheniscus demersus</i>	454	41,3
Cape Cormorant <i>Phalacrocorax capensis</i>	640	58,2
Kelp Gull <i>Larus dominicanus</i>	5	0,5
Total	1 099	



Figure 1
Jackass Penguins killed by underwater blasting
in Saldanha Bay, April 1977

A break-down of the "kill rate" of Jackass Penguins is given in Table 2 in relation to the scaring technique employed. The highest kill rate (9,4 penguins/blast) occurred when there were two blasts per day, one early in the morning and one late in the afternoon (blasts 1 - 32) with no scaring techniques employed. This was halved when only one blast a day was carried out at midday (numbers 33 - 39) also without the use of scaring techniques.

On 20 and 23 April 1977 J.C. Sinclair observed the effect of underwater acoustics prior to three blasts (numbers 41 - 43) (Table 2). No penguins were killed. However, the second blast on 23 April (No. 43) killed c. 500 Cape Cormorants. On 25 April gunfire plus underwater acoustics proved successful in frightening cormorants out of the blast area and few were killed subsequently.

Later blasts (numbers 46 - 70, Table 2) at the rate of two a day resulted in a kill rate of 3,3 penguins/blast when underwater acoustics and gunfire were used together as scaring techniques. The final series of blasts (numbers 71 - 91, Table 2) utilized gunfire only as a scaring technique but only one blast per day was undertaken. In this series the kill rate was further reduced to 2,5 penguins/blast.

The overall kill rate for 454 Jackass Penguins was 5,0 birds/blast.

Most penguins collected after blasts had full stomachs showing that they were returning to Marcus Island after foraging at sea.

DISCUSSION

Although the scaring techniques employed were successful in reducing the kill rate of both Jackass Penguins and Cape Cormorants, it is difficult to evaluate them since time of day and number of blasts a day also had an effect which cannot be easily separated from the effect of the scaring techniques.

Frost *et al.* (1975) found that Jackass Penguins at sea responded to Killer Whale vocalizations by fleeing from the area. However, on a number of occasions J.C. Sinclair observed that penguins took no notice of underwater acoustics, either of Killer Whale vocalizations or electronic noise. Underwater acoustics had no effect on scaring Cape Cormorants (J.C. Sinclair, pers.comm.), and also had equivocal effects on Cape Fur Seals *Arctocephalus pusillus* (Shaughnessy *et al.* 1981). The reduction in the kill rate may have been as much due to the boat moving in the area as it played the underwater acoustics and to gunfire, as to the acoustics themselves.

This was not a neatly designed experiment. It was a set of observations made during a commercial operation with a number of *ad hoc* decisions being made to change the number of blasts/day and the scaring technique employed. Nevertheless, the following recommendations can be made which may hopefully lead to a reduction in the kill rate of seabirds, especially penguins, in similar operations :

TABLE 2

THE EFFECT OF SCARING TECHNIQUES AND NUMBER OF UNDERWATER BLASTS
 PER DAY ON THE "KILL RATE" OF JACKASS PENGUINS *SPHENISCUS DEMERSUS*, SALDANHA BAY,
 MARCH - AUGUST 1977

Blast Nos	No. of blasts	No. of blasts per day	Scaring technique	No. Jackass Penguins killed	Mean No. Jackass Penguins killed per blast
1-32	32	2	Nil	c. 300*	9,4
33-39	7	1	Nil	29	4,1
41	1	1	Underwater acoustics	0	0,0
42-45	4	2	Underwater acoustics	0	0,0
46-70	25	2	Underwater acoustics	76	3,3
71-91	21	1	Gunfire only	49	2,5
Total	91	-	-	454	5,0

*D. Zwemmer, Lievense Consultants, pers. comm.
 (No details are available for blast no. 40)

1. Schedule underwater blasts at a time when few birds are in the vicinity.
2. Attempt to undertake only one blast a day, but at least avoid blasts spaced a few hours apart.
3. Prior to the blast, a boat should patrol the area and gunfire should be utilized to scare away birds.
4. Use of underwater acoustics does not seem to be an efficient scaring technique.

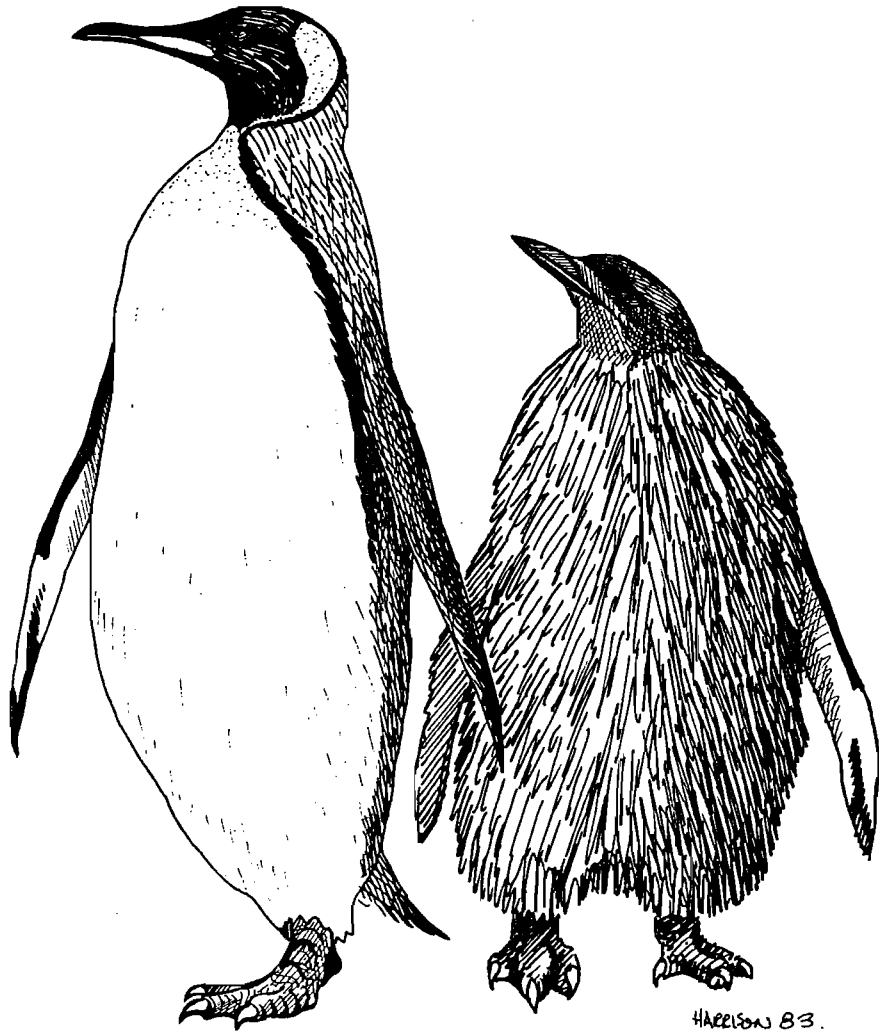
ACKNOWLEDGEMENTS

I thank Mr D. Zwemmer, Lievense Consultants, and the staff of South African Diving Services, Saldanha, for their willing co-operation during the period blasting took place, Dr A. Semmelink, Central Acoustics Laboratory, University of Cape Town, for the loan of equipment and J.C. Sinclair for his observations. The research was sponsored by the Advisory Committee for Ecological Studies in the Langebaan-Saldanha Area.

REFERENCES

- ANON. 1978. Marcus Island, killers hit the seabirds. *Afr. Wildlife* 32(2): 24-26.
- COOPER, J. 1976. (Editorial comment). *Cormorant* 1: 6.
- COOPER, J. in press. Changes in resource division among four breeding seabirds in the Benguela upwelling system, 1953-1978. In: LEDGER, J.A. (Ed.). Proceedings of the Fifth Pan-African Ornithological Congress.
- FROST, P.G.H., SHAUGHNESSY, P.D., SEMMELINK, A., SKETCH, M. & SIEGFRIED, W.R. 1975. Responses of Jackass Penguins to Killer Whale vocalizations. *S. Afr. J. Sci.* 71: 157-158.
- HOCKEY, P.A.R. 1976. Reactions of seabirds to an underwater explosion in Saldanha Bay. *Cormorant* 1: 6.
- SHAUGHNESSY, P.D., SEMMELINK, A., COOPER, J. & FROST, P.G.H. 1981. Attempts to develop acoustic methods of keeping Cape Fur Seals *Arctocephalus pusillus* from fishing nets. *Biol. Conserv.* 21: 141-158.

J. Cooper, Percy FitzPatrick Institute of African Ornithology, University of Cape Town, Private Bag, Rondebosch 7700, South Africa.



King Penguins

HARRISON 83.