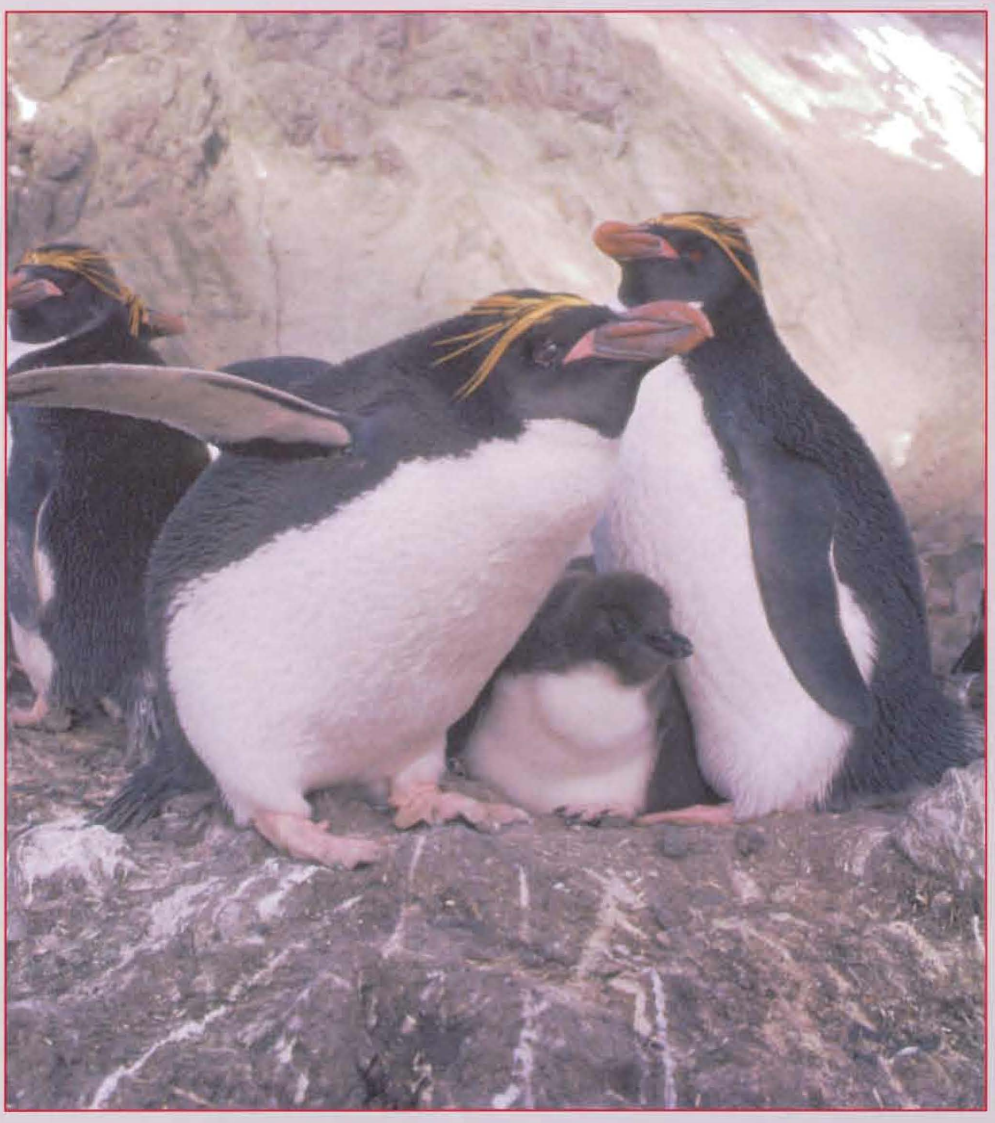
Kjell Isaksen, Onno Huyser, Steve Kirkman,
Ross Wanless & Wendy Wilson

Studies of seabirds and seals on Bouvetøya 1998/99



Norsk Polarinstitutt
INTERNRAPPORT

No. 2 - Tromsø 2000

Internrapport nr. 2

Kjell Isaksen, Onno Huyser, Steve Kirkman,
Ross Wanless & Wendy Wilson

Studies of seabirds and seals on Bouvetøya 1998/99

The Norwegian Polar Institute is Norway's main institution for research and topographic mapping in Norwegian polar regions. The Institute also advises Norwegian authorities on matters concerning polar environmental management.

Norsk Polarinstitutt 2000

Addresses:

Kjell Isaksen

Norwegian Polar Institute
Polar Environmental Centre
N-9296 Tromsø
Norway

Onno Huyser, Ross Wanless & Wendy Wilson

Percy FitzPatrick Institute of African Ornithology
University of Cape Town
Rondebosch 7701
South Africa

Steve Kirkman

Department of Zoology and Entomology
University of Pretoria
Pretoria 0002
South Africa

Technical editor: Gunn Sissel Jaklin
Layout: Audun Igesund
Cover photo: Macaroni Penguins *Eudyptes chrysolophus* with chick at Nyrøysa, Bouvetøya. (Kjell Isaksen)
Printed: Norsk Polarinstitutt, March 2000
ISBN: 82-7666-171-8

INTRODUCTION

Bouvetøya (54°25'S, 3°20'E) is a small island situated in an isolated part of the South Atlantic. Although large numbers of seabirds and seals aggregate on the island to breed during summer, the dynamics of these populations have been little studied to date. To obtain more information about the populations of penguins and fur seals and to better assess the potential impacts of possible krill fisheries around the island, a suite of monitoring programmes was initiated during the NARE 1996/97 field season. These programmes are part of the *CCAMLR Ecosystem Monitoring Programme* (CEMP), following standard monitoring procedures agreed upon within the framework of the *Convention on the Conservation of Antarctic Marine Living Resources* (*CCAMLR*). Monitoring following the standard methods is carried out at a number of other sites in the Antarctic (see Agnew 1997). The Norwegian Polar Institute is responsible for carrying out the monitoring on Bouvetøya, in cooperation with the FitzPatrick Institute of African Ornithology of the University of Cape Town and the University of Pretoria.

A more detailed description of the study site and the monitoring programme has been given by Isaksen et al. (1997a, b). Preliminary results from the 1996/97 field season have been presented by Hofmeyr et al. (1997), Huyser et al. (1997), Isaksen et al. (1997a, c), and Mehlum et al. (1998).

The main objective for the 1998/99 expedition to Bouvetøya was to continue the CEMP-monitoring work initiated in 1996/97. The species monitored were Chinstrap Penguin (*Pygoscelis antarctica*), Macaroni Penguin (*Eudyptes chrysolophus*) and Antarctic Fur Seal (*Arctocephalus gazella*). In addition to the CEMP-work, other work on seabirds and seals was carried out.

The South African expedition vessel MV *SA Agulhas* arrived on Bouvetøya on 8 December 1998. Due to strong winds helicopter flights to the island were delayed until the morning of 9 December. The five members of the Bouvetøya team were then flown to Nyrøysa, situated on the western side of the island, in a South African Air Force Oryx helicopter. The helicopter flights were stopped before all the field equipment had been transferred to the island due to increasing winds at the ship's position at the eastern side of the island. The rest of the equipment was transferred the following day when the ship moved to the western side of the island.

The expedition team stayed at the field station at Nyrøysa which was erected during the 1996/97 expedition (see Isaksen et al. 1997a, b). Additional space for sleeping and storage of food and equipment was provided by the use of tents and South African Department of Environmental Affairs and Tourism (DEAT) storage containers. The MV *SA Agulhas* returned to Bouvetøya on 27 February 1999. The transfer of expedition members and equipment from Bouvetøya to the ship was carried out without delay the same day.

FIELD WORK AND PRELIMINARY RESULTS

Monitoring of penguins

The monitoring of Chinstrap and Macaroni Penguins at Nyrøysa follows the standard methods that have been developed for the CEMP (CCAMLR 1997). Six different biological parameters are monitored.

Breeding population size (CEMP Standard Method A3)

The monitoring includes all breeding penguins at Nyrøysa, but none nesting elsewhere on the island. The number of incubated nests and the number of occupied (but not incubated) nests were counted separately at least three times on 17 December 1998. Following the CEMP procedure, birds that appeared to be incubating were not disturbed to verify the nest contents.

For Macaroni Penguins the number of incubated nests counted in 1998/99 (1344) was higher than the number from 1996/97 (1047), whereas the number of incubated Chinstrap Penguin nests was lower in 1998/99 (192 compared to 205).

According to the CEMP Standard Methods the censuses are to be performed one week after peak egg-laying. This was not possible in 1996/97 or 1998/99 because of the expedition team's arrival on the island, well after peak egg-laying. Censuses performed late in the season will give lower numbers of incubated nests than censuses performed early in the season as the number of incubated nests will decline as the season progresses. This trend will be particularly pronounced at Nyrøysa as interactions with seals result in a substantial number of failures during incubation. The census in 1996/97 was made about nine days later than in 1998/99. It is therefore likely that some of the increase in the number of incubated Macaroni Penguin nests is a consequence of the different census dates. Similarly, the decline in the number of incubated Chinstrap Penguin nests between the two seasons may be larger than indicated by the survey data. A census of the number of incubated Chinstrap Penguin nests on 30 December 1998 gave approximately 159 nest, a decline of 17% over the 13 days from 17 December.

There are often difficulties classifying nests into the three categories of incubated nests, occupied nests and unoccupied nests. The distinction between the two latter especially becomes increasingly difficult and subjective as the breeding season progresses. The number of occupied nests probably also varies considerably with time during the day and over the course of the season. These factors are likely to account for a large difference between the 1996/97 and 1998/99 census in the number of occupied Macaroni Penguin nests.

The penguin breeding colonies at Nyrøysa are situated on slopes leading up from the large Antarctic Fur Seal colony, bordering the sea. From 6 to 9 metres of the cliff area upon which the colonies are situated have been washed away by the sea since 1996/97 (measured at three points assumed to be representative for the colony). The trend of penguins being displaced by fur seals, especially at the periphery of the breeding colonies, has also continued since 1996/97. Several sub-colonies have fewer breeding pairs, have disappeared altogether, or are becoming progressively fragmented through male fur seals holding breeding territories in the more accessible, flatter parts. In some places little affected by seals, the Chinstrap Penguins (and to a lesser degree also Macaroni Penguins) have expanded their breeding area inland or settled in new areas.

Age-specific annual survival and recruitment (A4)

A relatively small number of penguins was banded with S-series flipper bands (Lambournes Ltd.) in 1996/97 for a long-term study of individual survival. In total, 104 Chinstrap Penguins (54 adults and 50 chicks) and 150 Macaroni Penguins (100 adults and 50 chicks) were banded. The low number of individuals banded was due to uncertainty about the suitability of the flipper bands. Observations in 1996/97 and 1998/99 indicated that an unacceptably high proportion of these bands had opened somewhat on the flipper and/or caused feather abrasion to the birds wearing them. An unknown proportion of the banded birds had lost their bands (one band was found on the ground in the Macaroni Penguin colony).

Lambournes now produces flipper bands made of stronger metal and with improved design. Bands of this type (A-series) were used to band 99 adult and 100 young Macaroni Penguins in 1998/99. Based on experience with banding African Penguins (*Spheniscus demersus*) in South Africa, it is hoped that the A-series bands will not have a significant impact on penguin survival, and that they will have improved longevity compared to the previous S-series bands.

Duration of foraging trips (A5)

VHF radio transmitters (Advanced Telemetry Systems) were attached to both females and males in 19 Macaroni Penguin pairs with chicks. Similarly, both members of 19 Chinstrap Penguin pairs and one additional male were instrumented. Fast-setting epoxy was used to attach the instruments to the lower backs of the Macaroni Penguins, whereas Tesa tape was used on the Chinstrap Penguins. The tape attachments were made using a modified version of Method 3 described by Wilson et al. (1997), without using glue. The Tesa tape functioned equally well or in some respects even better than the epoxy over the 36-50 days the tape attachments lasted. The presence of the instrumented penguins in the breeding colony at Nyrøysa was monitored by a VHF-receiver/data-logger system (RX-900, Televilt Int.) during most of January and February 1999 at 10-minute intervals. One of the instrumented Macaroni Penguin females was killed by a fur seal. Another was seen seriously wounded from a bite and probably died later as a result of the injuries. One Macaroni Penguin female lost its transmitter and was subsequently refitted with a new instrument. Of the 39 instruments attached to Macaroni Penguins, 37 were retrieved at the end of the season. Thirty of 39 Chinstrap Penguin instruments were retrieved.

Breeding success (A6)

The number of penguin chicks at Nyrøysa was counted on 7-8 February 1999. The number of Macaroni Penguin chicks in 1998/99 was similar to that in 1996/97 (824 compared to 812). Chinstrap Penguins produced fewer chicks in 1998/99 than in 1996/97 (157 compared to 247). A considerable portion of the area occupied by breeding Chinstrap Penguins in 1996/97 was eroded by the sea by 1998/99, and some of the new areas that the penguins had started to use were quite steep. This has probably resulted in a higher rate of loss of eggs and young chicks. It may also have made them more susceptible to disturbances from human activities (e.g. helicopter flights and research activity).

Counts of chicks do not have the same sources of error as described above for counts of adults/nests. These numbers are therefore easier to compare between seasons. Chick production is, however, influenced not only by the number of breeding pairs, but also by food availability, mortality from predation etc.

Chick diet (A8)

Food samples from two Chinstrap and five Macaroni Penguin adults were collected every five days during the chick rearing period (10 January - 19 February). The number of Chinstrap Penguins sampled was low because the breeding population at Nyrøysa was small. Diet samples were collected by stomach pumping (Wilson 1984) adults of both sexes when they arrived at the colony from the sea to feed their chicks. The birds were weighed before sampling, and measured. All samples were

collected between ca. 18h30 and 21h30 local time (GMT+1). Samples were preserved in alcohol (Chinstrap Penguins) or frozen (Macaroni Penguins).

Chinstrap Penguins took exclusively crustacean prey items, with Antarctic Krill (*Euphausia superba*) forming the bulk. Macaroni Penguins on the other hand fed mostly on fish, with *E. superba* constituting an important part of the diet in some periods.

Breeding chronology (A9)

Forty Chinstrap Penguin and 101 Macaroni Penguin nests were checked every other day from before hatching until creching. The presence of eggs or young was noted for each nest, as well as whether or not the chicks were guarded by an adult. The mean hatching date (of the first egg) was 31 December for both Chinstrap (range 22 December - 8 January) and Macaroni Penguins (range 20 December - 13 January). This is three days later for Chinstrap Penguins and one day later for Macaroni Penguins compared to the 1996/97 season.

Macaroni Penguin chicks were guarded by at least one of the parents for a mean period of 25 days after hatching (range 18-34 days). The first chick not being guarded was seen on 22 January, and by 3 February all the monitored chicks had been seen unguarded one or more times. The mean date for the cessation of brooding was 25 January. There was no marked termination of the brooding period for Chinstrap Penguins. The chicks seemed to be guarded more by the adults and were left unattended less regularly than Macaroni Penguin chicks.

MONITORING OF ANTARCTIC FUR SEALS

The monitoring programme for Antarctic Fur Seals at Nyrøysa follows the CEMP standard methods (CCAMLR 1997). Two biological parameters are monitored.

Duration of adult female foraging/ attendance cycles (C1)

Forty VHF radio transmitters (Advanced Telemetry Systems) were attached with quick setting epoxy, midway between the shoulders of lactating Antarctic Fur Seal females that were captured with a hoop net. The females were tagged in each foreflipper, and their pups were weighed and marked (with a bleach mark and a single tag). The pups were re-weighed throughout the season, and their growth was compared to control pups, the mothers of which were not fitted with transmitters. An attempt was made to record the first foraging trip of as many females as possible, but as capture and deployment occurred well after the peak of the breeding season (6 December for the South Georgia population), and older and heavier females are known to give birth earlier in the season (Boyd et al. 1990), it is likely that the results of this experiment are not representative of the population as a whole. It is also not as easy to gauge the health of newborn pups as it is for older pups. The newborn pups of 12 instrumented mothers out of 24 died before or during the first foraging trip, and another died some weeks later. All transmitters were retrieved from failed deployments, and redeployed as soon as possible on females whose pups were by that stage more established. Thus, in total, 54 females carried transmitters during the season.

The presence of the instrumented females on shore was recorded by the automatic VHF-receiver/ data-logger system (RX-900, Televilt Int.) from 16 December to 26 February. The system searched for each frequency at 10 minute intervals. Thirty of the 40 transmitters were retrieved at the end of the season, and 31 females that had carried transmitters were weighed upon retrieval, in order to investigate the effects of maternal mass on foraging trip length and pup growth.

One female never returned after deployment, but the other 39 transmitters rendered good data. However, one transmitter picked up interference from an old transmitter that had been moulted off in the region of the VHF tower after the 1996/97 expedition, a problem which was only solved in the middle of the season, while another transmitter had been mistakenly deactivated, and only functioned for the last month.

Pup growth (C2)

Two methods were used: (1) pups were caught, marked (with a bleach mark and a single tag) and weighed at birth, and opportunistically recaptured and re-weighed throughout the season. Eighty-two newborn pups were initially captured, but 24 of these were of VHF mothers. Of the remainder, mortality and tag-loss further reduced the sample size. (2) Random samples of 100 pups each were weighed at 30, 60 and 74 days after the estimated mean pupping date. Mean weights for each sex were calculated using both methods.

Procedure 1 is usually the more accurate of the two as it requires repeated sampling of individual pups, whereas procedure 2 does not. In the case of the Bouvetøya study, however, the accuracy of procedure 1 was compromised (a) because the sampled pups were born near the end of the season, and (b) because sampling of newborns was of necessity biased toward the perimeter of the colony. Temporal and spatial prejudices do not have such an effect on procedure 2, which is also far less disturbing.

ADDITIONAL PROJECTS

In addition to the monitoring programme other work on seabirds and seals was carried out during the stay on the island. Some of this work is listed below.

General registration of the wildlife on the island

Records were kept of sightings of less common birds and mammals. A Gentoo Penguin (*Pygoscelis papua ellsworthi*) was observed on the island for the first time. Several Adélie Penguins (*Pygoscelis adeliae*) and one adult male Subantarctic Fur Seal (*Arctocephalus tropicalis*) were also observed. Several King Penguins (*Aptenodytes patagonicus*) stayed at Nyrøysa to moult. Humpback Whales (*Megaptera novaeangliae*) were seen less regularly and in smaller numbers than in the 1996/97 season.

Breeding biology of seabirds

Investigations of breeding biology of Southern Fulmars (*Fulmarus glacialoides*), Cape Petrels (*Daption capense*), Black-bellied Storm-petrels (*Fregetta tropica*) and Brown Skuas (*Catharacta antarctica*) were carried out. For all species nests were monitored and hatching dates, breeding success and causes of failure were recorded. Growth of skua and storm-petrel chicks was also recorded in 1998/99.

Seabird and fur seal diets

Stomach samples were collected from breeding Antarctic Prions (*Pachyptila desolata*) and Black-bellied Storm-petrels for analysis of prey composition. In 1998/99 few diets from Antarctic Prions and Black-bellied Storm-petrels were obtained from birds caught in mist nets, compared to 1996/97.

Pellets from Brown Skuas were collected for analysis of predation rates on Black-bellied Storm-petrels, and for analysis of ingestion of plastic particles by the storm-petrels.

One hundred and twenty three scat samples and 90 regurgitation samples of Antarctic Fur Seals were collected. Most of the scats and regurgitants consisted almost exclusively of krill, although remains of fish and squid were found in a few samples. The samples have yet to be sorted and analysed. A number of scats containing penguin feathers were found, especially on the beach on the southern part of Nyrøysa (Sørstrand), which is predominantly populated by sub-adult and adult male fur seals. The presence of penguin feathers in fur seal scats strongly suggests predation by fur seals on penguins at sea. Thus there are three known impacts on Bouvetøya of fur seals on penguins, the other two being interference competition for nest sites, and incidental mortality and injuries from bites incurred during competition for breeding territories. Ten fur seal carcasses were dissected shortly after death, in order to search for gut parasites and food remains. No food remains were found in any of the stomachs, but nematodes and larval cestodes were found in two stomachs, and adult cestodes were found in several scats.

Diving behaviour of penguins

Two types of devices were used to study the diving behaviour of penguins. Wildlife Computers Mk5-type microprocessor-controlled TDRs were fitted to six Chinstrap (both members of two pairs and one female and one male from two other pairs) and seven Macaroni Penguins (two males during their first long foraging trip and five females) rearing chicks. The instruments weighed 50 g and were glued onto the lower back of the penguins with fast-setting epoxy. Depth was sampled every two or five seconds. Temperature and light were sampled at four or six seconds intervals on some deployments. The instruments were removed from the penguins to download the data after 5 to 19 days (most deployments lasted 5 to 9 days).

Data-logger time-depth-recorders (TDRs) manufactured by Driesen and Kern (Kiel, Germany) were fitted to both Chinstrap and Macaroni Penguins. The data loggers are designed to record water/air temperature, light intensity, depth, swim speed and three-dimensional compass readings with 16-bit resolution every five seconds for up to 10 days. However, sensor failure sabotaged device deployments, and little compass and swim speed data was eventually collected. The loggers were deployed on seven female and seven male Chinstrap Penguins, and on 15 female Macaroni Penguins during the early part of chick rearing.

Ringing and tagging

Antarctic Prions and Black-bellied Storm-petrels were trapped in mist nets at night and ringed at 10-day intervals between 19 December 1998 and 17 February 1999, as well as during some additional trapping sessions. Breeding and non-breeding Brown Skuas at Nyrøysa were ringed with a standard steel metal ring and a yellow plastic alphanumeric colour ring. Retrapped birds from the 1996/97 season were also colour-ringed. All skua chicks fledged at Nyrøysa were ringed with a standard steel metal ring and a red plastic alphanumeric colour ring. This study investigates survival and recruitment rates of Brown Skuas at Nyrøysa. Southern Fulmars and Cape Petrels were ringed as part of breeding biology studies started in 1996/97. Some Cape Petrels were ringed with a red plastic alphanumeric colour ring in addition to the metal ring. The number of each species ringed is summarised in Table 1.

Table 1.

Birds ringed at Nyrøysa in 1998/99. Numbers in parentheses are number of colour-ringed birds

Species	Juv.	Adults	Total
Macaroni Penguin *Eudyptes chrysolophus*	100	99	199
Southern Fulmar *Fulmarus glacialoides*	0	8	8
Cape Petrel *Daption capense*	0	70 (19)	70 (19)
Antarctic Prion *Pachyptila desolata*	0	84	84
Wilson's Storm-petrel *Oceanites oceanicus*	0	1	1
Black-bellied Storm-petrel *Fregetta tropica*	0	67	67
Brown Skua *Catharacta antarctica*	21 (21)	33 (47)	54 (68)

One colour-ringed Northern Giant Petrel (*Macronectes halli*) was observed at Nyrøysa on 2 February. The bird (a male) was ringed as a chick on Marion Island (Prince Edward Islands) on 29 January 1991. It bred in 1998/99 and was last seen at the breeding site on Marion Island with a fledging chick on 12 January 1999 (D. Nel, pers. comm.). The bird was thus on its post-breeding migration. One Southern Giant Petrel (*Macronectes giganteus*) with a metal ring was also observed at Nyrøysa in February 1999, but was not identified. No giant petrels have ever been ringed on Bouvetøya. These birds are the first records from Bouvetøya of birds of any species ringed elsewhere.

A total of 67 adult female Antarctic Fur Seals were double-tagged, and 144 pups were tagged with only a single tag to minimize the chance of infection. As single-tagged animals have little value in long-term monitoring studies, most of these tags were removed at the end of the study. No foreign tags or brands were observed on fur seals or Southern Elephant Seals (*Mirounga leonina*).

Morphometric data

Morphological measurements were taken from a sample of the birds captured for ringing.

Approximately 60 Antarctic Fur Seal skulls were collected for morphometric analysis, 30 for Marthan Bester, University of Pretoria, and 30 for Øystein Wiig, Zoological Museum in Oslo. About 2/3 of the skulls were from intact carcasses of animals that had died recently. The skulls are in storage at Marine and Coastal Management (previously known as Sea Fisheries Research Institute) in Cape Town. A total of 25 fur seal baculi were collected, together with teeth for ageing them, for Marthan Bester, University of Pretoria.

Collection of material for analysis of genetics and pollutants

Samples of muscle and liver for analysis of contaminants were taken from three Chinstrap and 14 Macaroni Penguins killed by a landslide. Blood samples were taken from 16 Antarctic Prions for genetic analyses.

Estimation of pup production

A mark-recapture experiment was conducted to determine the number of Antarctic Fur Seal pups at Nyrøysa. A total of 1800 pups distributed evenly throughout the colony at the northern beach at Nyrøysa (Nordstrand) was marked with a bleach spot on the head between 5 and 8 January. The proportion of marked and unmarked pups was subsequently recorded during eight replicate counts in the colony from 12 to 15 January. The total estimate for Nordstrand was 12 645 ± 523 (S.E.). Four separate replicate counts were done along the narrow beach south of Nordstrand, giving an estimate of 366 ± 9.8 (S.E.). The total estimate of live pups at this time was thus 13 010, very similar to the figure arrived at two years ago of 12 528. An effort was also made to count dead pups throughout Nyrøysa, in the period 18-20 January. The count was facilitated by marking counted pup carcasses or groups of counted pup carcasses. A total of 2655 dead pups was counted. This count is very much an underestimate, considering the numbers of carcasses which were likely washed away or buried beneath rubble. Adding the two totals gives a figure of 15 665 (a minimum estimate of total pup production) of which 16.9% were dead (a minimum estimate of mortality) by mid-January.

Counts of Southern Elephant Seals

Weekly counts of Southern Elephant Seals were completed. The maximum number counted was 383 individuals on 6/7 January, including 217 adult females, 151 subadults, 14 yearlings and 1 weaned pup. Some 88 weaned pups were counted during the first census after arrival (11 December). Slide photographs were taken of some pups. The highest number of adult females (241) was counted on 14 January.

Recordings of plumage and vocalisations

In addition to recording morphological and plumage characteristics from individuals of the very variable population of Antarctic Prions breeding at Nyrøysa, recordings of vocalisations were made.

Marine debris

Surveys of beached marine debris were conducted according to guidelines approved by CCAMLR. In addition, records were kept of seals entangled in man-made material (such as nets and straps). Out of 27 sightings of entangled seals, all Antarctic Fur Seals, entangling material was removed from 24 seals. Thirteen cases were adjudged to be severe or very severe.

Focal attendance patterns

Eighteen Antarctic Fur Seal mother-pup pairs, as well as additional pups, were marked at a small isolated rookery ("the Rope") on the narrow beach in the middle part of Nyrøysa. Focal studies of attendance were done twice daily for over a month, with opportunistic re-weighing of pups. The aim was to compare pup growth and shore visit duration (using the VHF-based study recordings that coincided with the focals) between this small colony and the large Nordstrand colony, to see whether colony size and density affected attendance patterns.

CONCLUSION

The planned work on the monitoring project on penguins and fur seals was completed successfully. Because of the late and cold season storm-petrels and prions bred late and probably a large proportion of the population (compared to 1996/97) skipped breeding. Some of the planned work on these species therefore had to be cancelled.

The field station and the logistics at the station functioned very well.

ACKNOWLEDGEMENTS

The project is headed by the Norwegian Polar Institute in collaboration with the FitzPatrick Institute of African Ornithology, University of Cape Town, South Africa. We would like to thank V. Bakken, M. N. Bester, J. Cooper, I. Gjertz, F. Mehlum and P. Ryan for their support and help in planning the field work. We would also like to thank the South African Department of Environmental Affairs and Tourism (DEAT), especially Sam Oosthuizen and Jan Joubert, and the crew at MV *SA Agulhas* for transport and logistical support.

REFERENCES

Agnew, D. J. 1997. The Antarctic CCAMLR Ecosystem Monitoring Programme. *Antarctic Science 9*: 235-242.

Boyd, I. L., Lunn, N. J., Rothery, P. & Croxall, J. P. 1990. Age distribution of breeding female Antarctic fur seals in relation to changes in population growth rate. *Can. J. Zool. 68*: 2209-2213.

CCAMLR. 1997. *CCAMLR Ecosystem Monitoring Programme: Standard methods*. CCAMLR, Hobart, Australia.

Hofmeyr, G. J. G., Isaksen, K., Gjertz, I. & Bester, M. N. 1997. Attendance behaviour and pup growth of Antarctic fur seals at Bouvetøya. *Zoology and human welfare. Symposium of the Zoological Society of Southern Africa, Cape Town 7-11 July 1997.* (Abstract).

Huyser, O., Dyer, B. M., Isaksen, K., Ryan, P. & Cooper, J. 1997. Breeding biology and diet of Pintado Petrels Daption capense at Bouvetøya during the summer of 1996/97. *CCAMLR Working Group Paper WG-EMM-97/56.* CCAMLR, Hobart, Australia. 13 pp.

Isaksen, K., Hofmeyr, G., Dyer, B. M., Huyser, O. & Næstvold, A. 1997a. Studies of seabirds and seals at Bouvetøya 1996/97. Pp. 21-29 in Winther, J.-G. (ed.): Report of the Norwegian Antarctic Research Expedition 1996/97. *Norsk Polarinst. Medd. 148.*

Isaksen, K., Bakken, V., Gjertz, I. & Mehlum, F. 1997b. Establishment of a CEMP-monitoring program at Bouvetøya. *CCAMLR Working Group Paper WG-EMM-97/19.* CCAMLR, Hobart, Australia. 9 pp.

Isaksen, K., Hofmeyr, G. J. G., Dyer, B. M., Næstvold, A., Mehlum, F., Gjertz, I., Bakken, V. & Huyser, O. 1997c. Preliminary results from CEMP-monitoring of Antarctic Fur Seals, Chinstrap Penguins and Macaroni Penguins at Bouvetøya 1996/97. *CCAMLR Working Group Paper WG-EMM-97/20.* CCAMLR, Hobart, Australia. 26 pp.

Mehlum, F., Isaksen, K. & Bakken, V. 1998. Foraging trip duration in male and female Macaroni Penguins at Bouvetøya. *CCAMLR Working Group Paper WG-EMM-98/28.* CCAMLR, Hobart, Australia. 12 pp.

Wilson, R. P. 1984. An improved stomach pump for penguins and other seabirds. *J. Field Ornithol.* 55: 109-112.

Wilson, R. P., Pütz, K., Peters, G., Culik, B., Scolaro, J. A., Charrassin, J.-B. & Ropert-Coudert, Y. 1997. Long-term attachment of transmitting and recording devices to penguins and other seabirds. *Wildlife Soc. Bull. 25*: 101-106.


NANSEN AMUNDSEN SVERDRUP