

**POPULATION STRUCTURE OF A NON-BREEDING COLONY
OF THE CAPE FUR SEAL *ARCTOCEPHALUS PUSILLUS PUSILLUS*
AT CAPE FRIO, NAMIBIA**

D. J. DE VILLIERS*, W. H. OOSTHUIZEN†, J.-P. ROUX‡ and P. G. H. KOTZE†

The age and sex composition at a large non-breeding colony of the Cape fur seal *Arctocephalus pusillus pusillus* at Cape Frio, Namibia, are described. A ground estimate indicated that there were approximately 20 000 seals of all age groups and of both sexes at the colony during September 1989, around two months before the pupping season. The sex ratio of seals sampled was 1.61 : 1 ($n = 107$, 61.7% male). Most of the males were immature, 2- and 3-year-olds, although some older, mature bulls were present at the colony. In contrast, only 9.8% of females were sexually immature and 80.5% were older than 13 years. None of the young females was reproductively active and older females had reduced reproductive rates. Reproductive status of females differed from that of seals at other breeding colonies.

Along the Namibian coast, 15 breeding and four non-breeding Cape fur seal *Arctocephalus pusillus pusillus* colonies have been described by Rand (1972), Shaughnessy (1982, 1984), Oosthuizen and David (1988) and Crawford *et al.* (1989). Non-breeding colonies are defined by the absence of pups during the breeding season, or by their erratic and minimal pup production (Oosthuizen and David 1988). The northernmost non-breeding colony in southern Africa is situated on the mainland at Cape Frio (18°25'S, 12°00'E). The nearest breeding colony to Cape Frio is at Cape Cross (21°47'S, 13°57'E), approximately 370 km to the south.

The colony at Cape Frio was first discovered in 1964 (Shaughnessy 1987, Oosthuizen and David 1988). Since then, irregular ground and aerial estimates of the number of seals at the colony have been made. Numbers varied between 0 and 17 000 animals (Oosthuizen and David 1988). In this study, the age, sex composition and reproductive status of fur seals at the Cape Frio colony are determined.

MATERIAL AND METHODS

Independent ground estimates (to the nearest thousand) of the number of seals present at the Cape Frio colony were made on 19 September 1989 by three observers. During the following two days, seals were shot randomly with a high velocity rifle and a total of 107 individuals, including six seals entangled in fishing gear, were collected. To achieve a random sample, seals from the line of animals nearest to the marks-

man were shot; one animal from close to the water, middle and top of each line were collected. After the last shot, the marksman moved closer, thereby encouraging a number of seals to move into the water, and the next seals could then be shot. These lines were approximately 10 m apart and the entire length of the colony was covered. Data on size distribution and reproductive status of adult females were collected at the breeding colony at Cape Cross during a commercial harvest between 19 and 23 September 1988 ($n = 185$).

The age of the seals collected at Cape Frio was determined by counting growth layer groups in the dentine of a canine, as described by Oosthuizen (1997). Seals aged 13 years and older were grouped into one age-class, because 13 years is the maximum age that can be reliably estimated using this method (Oosthuizen 1997). The median birthdate was taken to be 1 December (Shaughnessy 1979). The thickness of the blubber (without skin) was measured mid-ventrally over the sternum to the nearest millimetre.

Testes were removed from each seal and tissue samples for histological examination were excised from the mid-portion and preserved in 10% formalin. Samples were embedded in paraffin wax and sectioned for examination of spermatogenesis (Bester 1990). Ovaries were inspected for the presence of follicles, corpora lutea and corpora albicantia (Rand 1955, Tedman 1991, Bester 1995). Reproductive status was assessed from evidence of pregnancy, placental scars and from back-calculation on the presence of corpora albicantia (Rand 1955, Boyd 1984, 1985, Bester 1995). Routine standard morphometric measurements, following Laws (1993), were taken for all seals collected.

* Formerly Ministry of Fisheries and Marine Resources, P.O. Box 394, Lüderitz, Namibia

† Sea Fisheries Research Institute, Private Bag X2, Rogge Bay 8012, Cape Town, South Africa: to whom all correspondence should be sent.

E-mail: oosthuiz@sfri.wcape.gov.za

‡ Ministry of Fisheries and Marine Resources, P.O. Box 394, Lüderitz, Namibia. E-mail: desert@idz.nam.lia.net

RESULTS

Approximately 20 000 seals of all age groups, excluding pups, were present at Cape Frio on 19 September 1989. They were crowded together in dense groups on the beach, covering a distance of about 1 km. The sex ratio of the sample studied ($n = 107$) was 1.61 : 1.0, consisting of 66 males and 41 females. This was not significantly different ($\chi^2 = 1.34$, $p > 0.05$) from the sex ratio of harvested seals at breeding colonies (Oosthuizen 1991). Most of the males were immature, with 43.8% aged two years and younger (mean age = 4.3 ± 3.0 years, $n = 64$), and only one male was older than 10 years (Fig. 1). The age structure of the females differed significantly from the males (t -test, $p < 0.001$). Of the total of 41 females, 37 were mature (mean age = 11.3 ± 3.6 years), of which 33 (80.5%) were older than 13 years and four (9.8%) were sexually immature and younger than four years (Fig. 1).

Active spermatogenesis was found in 91.7% ($n = 24$) of males older than three years. The only 2-year-old examined was immature, with no evidence of spermatogenesis. The pregnancy rate of the mature females at Cape Frio was 32.4% ($n = 37$), which was significantly lower ($\chi^2 = 59.3$, $p < 0.001$) than the pregnancy rate (85%, $n = 185$) at the breeding colony at Cape Cross (Fig. 2). At Cape Frio, two females were in their first pregnancy and six (16.2%) had aborted (Fig. 2). Back-calculation of the reproductive status of females older than 13 years showed that 57.1% had not been reproductively active for the previous two years, whereas only 14.3% had been active for two successive years (Fig. 2b). Seven females had active mammary glands, indicating that they were still nursing or had recently nursed pups.

Most of the seals collected were in good physical condition, with a mean blubber thickness of 21.6 ± 7.8 mm ($n = 63$) for males and 13.3 ± 6.3 mm ($n = 39$) for females. Of the nine females that had blubber < 10 mm thick, none was pregnant and four had aborted, as indicated by a large placental scar in the uterine horn, ipsilateral to the ovary with the corpus luteum.

Four tagged males were recovered and two were resighted, which were tagged as pups in 1986. Of these, three were from Van Reenen Bay breeding colony ($27^{\circ}24'S$, $15^{\circ}21'E$) and three from Cape Cross.

DISCUSSION

The estimate of 20 000 seals at Cape Frio in

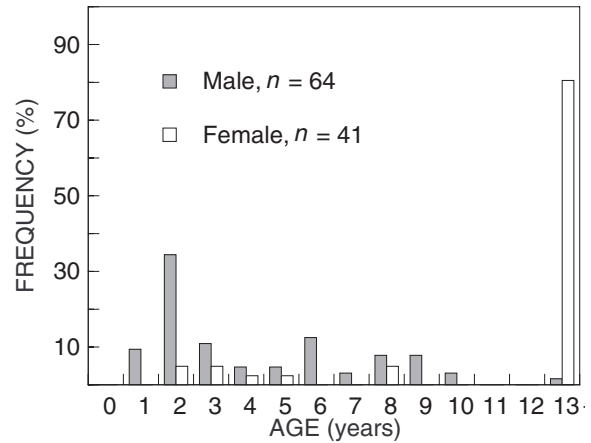


Fig. 1: The age structure of *Arctocephalus pusillus pusillus* at Cape Frio, estimated from counting dentinal growth layer groups of the canine tooth

September 1989 was higher than any previous estimate for that colony (Oosthuizen and David 1988). A study in March 1983 and January 1986 showed that most seals at the colony were immature, with only a few adult females and very few adult bulls (Oosthuizen and David 1988). Those authors concluded that immature seals congregate at non-breeding colonies such as Cape Frio before attaining sexual maturity. The composition of the Cape Frio colony is similar to those of the non-breeding subantarctic fur seal *A. tropicalis* (Bester 1981, 1982, Roux and Hes 1984) and the New Zealand fur seal *A. forsteri* colonies (Csordas and Ingham 1965), where mainly young males and only occasionally adult females are present. However, the age composition of the seals under study differed from that reported earlier for Cape Frio (Oosthuizen and David 1988), because of the presence of a large number of older, mostly reproductively inactive females, during the current study. It is possible that the age composition changes seasonally and that the present results are only representative of the spring population.

Most males older than three years of age at Cape Frio were sexually mature. However, based on the assumption that the age of social maturity (when the males are able to compete for a territory) for the Cape fur seal is similar to that of the Australian fur seal *A. p. doriferus*, which ranges between 8 and 13 years (Warneke and Shaughnessy 1985), only 13 of the sampled males at Cape Frio may have been socially mature. It is likely that intramale aggression

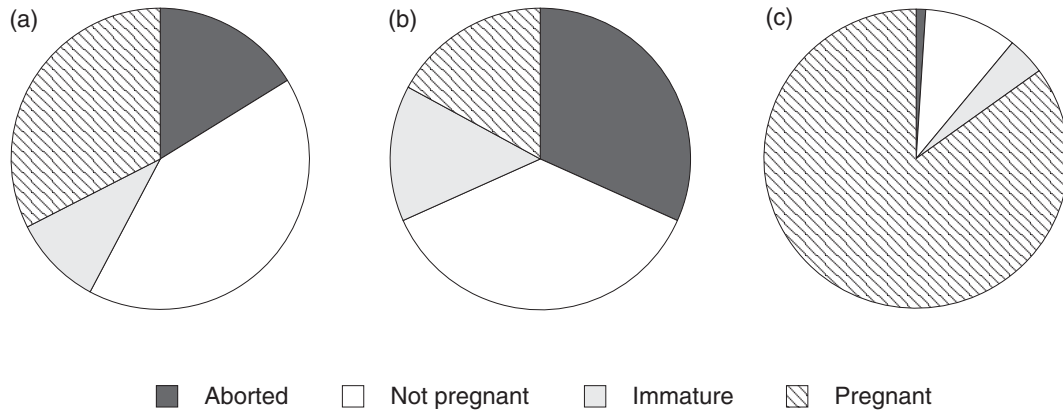


Fig. 2: Reproductive status of female *Arctocephalus pusillus pusillus* at Cape Frio; (a) their present status, (b) back-calculated for the previous year and (c) present status of females at Cape Cross

causes young males to reside at non-breeding colonies, as reported for the New Zealand fur seal (Csordas and Ingham 1965) and the subantarctic fur seal (Bester 1981, 1982).

Two-thirds of the sexually mature females at Cape Frio were reproductively inactive. This may be a result of intraspecific competition for food between lactating females which, being more restricted to the breeding colonies, may influence non-reproductive females to range farther from their natal colony and to use non-breeding colonies as a temporary or permanent haul-out. Also, some of the older females may have been post-reproductive, as found in subantarctic fur seals (Bester 1995) and northern fur seals *Callorhinus ursinus* (York 1987). However, seven females at Cape Frio had active mammary glands, indicating that some reproductive females were using the area as a temporary haul-out while feeding, or that they had recently lost their pups or had already weaned their pups successfully. Weaning takes place between August and October (Rand 1959), and the females may no longer have been restricted to their breeding colony.

Males tagged at breeding colonies >1 000 km to the south (e.g. Van Reenen Bay) were resighted at Cape Frio, suggesting that, because of the considerable distances travelled, that region may be a preferred feeding site (Oosthuizen 1991). As most of the males at Cape Frio were socially immature and the females were not reproductively active, it is unlikely that Cape Frio could develop into a breeding colony without an influx of breeding animals. However, regular surveys should be conducted to

monitor trends in the number of seals ashore and the number of pups born at Cape Frio.

ACKNOWLEDGEMENTS

We thank the Directorate of Nature Conservation and Recreation Resorts, Namibia, especially Mr R. Braby for assistance and Mr P. Brehan for his help at the Skeleton Coast Park. Mr D. Kotze (Sea Fisheries Research Institute [SFRI]) and Messrs A. Hendricks and A. Beukes (Ministry of Fisheries and Marine Resources, Namibia) rendered capable technical assistance. Dr J. H. M. David (SFRI) is thanked for his critical reading of the manuscript.

LITERATURE CITED

- BESTER, M. N. 1981 — Seasonal changes in the population composition of the fur seal *Arctocephalus tropicalis* at Gough Island. *S. Afr. J. Wildl. Res.* **11**: 49–55.
 BESTER, M. N. 1982 — Distribution, habitat selection and colony types of the Amsterdam Island fur seal *Arctocephalus tropicalis* at Gough Island. *J. Zool., Lond.* **196**: 217–231.
 BESTER, M. N. 1990 — Reproduction in the male sub-Antarctic fur seal *Arctocephalus tropicalis*. *J. Zool., Lond.* **222**: 177–185.
 BESTER, M. N. 1995 — Reproduction in the female subantarctic fur seal, *Arctocephalus tropicalis*. *Mar. Mamm. Sci.* **11**(3): 362–375.
 BOYD, I. L. 1984 — Development and regression of the corpus luteum in grey seal (*Halichoerus grypus*) ovaries and its use

- in determining fertility rates. *Can. J. Zool.* **62**: 1095–1100.
- BOYD, I. L. 1985 — Pregnancy and ovulation rates in Grey seals (*Halichoerus grypus*) on the British coast. *J. Zool., Lond.* **205**: 265–272.
- CRAWFORD, R. J. M., DAVID, J. H. M., WILLIAMS, A. J. and B. M. DYER 1989 — Competition for space: recolonising seals displace endangered, endemic seabirds off Namibia. *Biol. Conserv.* **48**: 59–72.
- CSORDAS, S. E. and S. E. INGHAM 1965 — The New Zealand fur seal, *Arctocephalus forsteri* (Lesson), at Macquarie Island, 1949–64. *CSIRO Wildl. Res.* **10**: 83–99.
- LAWS, R. W. 1993 — *Antarctic Seals: Research Methods and Techniques*. Cambridge; University Press: 390 pp.
- OOSTHUIZEN, W. H. 1991 — General movements of South African (Cape) fur seals *Arctocephalus pusillus pusillus* from analysis of recoveries of tagged animals. *S. Afr. J. mar. Sci.* **11**: 21–29.
- OOSTHUIZEN, W. H. 1997 — Evaluation of an effective method to estimate age of Cape fur seals using ground tooth sections. *Mar. Mamm. Sci.* **13**(4): 683–693.
- OOSTHUIZEN, W. H. and J. H. M. DAVID 1988 — Non-breeding colonies of the South African (Cape) fur seal *Arctocephalus pusillus pusillus* in southern Africa. *Investl Rep. Sea Fish. Res. Inst. S. Afr.* **132**: 17 pp.
- RAND, R. W. 1955 — Reproduction in the female Cape fur seal, *Arctocephalus pusillus* (Schreber). *Proc. zool. Soc. Lond.* **124**(4): 717–740.
- RAND, R. W. 1959 — The Cape fur seal (*Arctocephalus pusillus*). Distribution, abundance and feeding habits off the south western coast of the Cape Province. *Investl Rep. Div. Fish. S. Afr.* **34**: 75 pp.
- RAND, R. W. 1972 — The Cape fur-seal *Arctocephalus pusillus*. 4. Estimates of population size. *Investl Rep. Div. Sea Fish. S. Afr.* **89**: 28 pp.
- ROUX, J-P. and A. D. HES 1984 — The seasonal haul-out cycle of the fur seal *Arctocephalus tropicalis* (Gray, 1872) on Amsterdam Island. *Mammalia* **48**: 377–389.
- SHAUGHNESSY, P. D. 1979 — Cape (South African) fur seal. In *Mammals in the Seas. F.A.O. Fish. Ser.* **52**: 37–40.
- SHAUGHNESSY, P. D. 1982 — The status of seals in South Africa and Namibia. In *Mammals in the Seas. F.A.O. Fish. Ser.* **54**: 383–410.
- SHAUGHNESSY, P. D. 1984 — Historical population levels of seals and seabirds on islands off southern Africa, with special reference to Seal Island, False Bay. *Investl Rep. Sea Fish. Res. Inst. S. Afr.* **127**: 61 pp.
- SHAUGHNESSY, P. D. 1987 — Population size of the Cape fur seal *Arctocephalus pusillus*. 1. From aerial photography. *Investl Rep. Sea Fish. Res. Inst. S. Afr.* **130**: 56 pp.
- TEDMAN, R. A. 1991 — The female reproductive tract of the Australian sea lion, *Neophoca cinerea* (Peron 1816) (Carnivora: Otariidae). *Aust. J. Zool.* **39**: 351–372.
- WARNEKE, R. M. and P. D. SHAUGHNESSY 1985 — *Arctocephalus pusillus*, the South African and Australian fur seal: taxonomy, evolution, biogeography, and life history. In: *Studies of Sea Mammals in South Latitudes*. Ling, J. K. and M. M. Bryden (Eds). Adelaide; South Australian Museum: 53–77.
- YORK, A. E. 1987 — Northern fur seal, *Callorhinus ursinus*, Eastern Pacific population (Pribilof Islands, Alaska, and San Miguel Island, California). *NOAA tech. Rep. NMFS* **51**: 9–21.