



Extreme herding behavior in adult male sub-Antarctic fur seals

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Abstract

We re-analyzed unpublished data on herding behavior in adult male sub-Antarctic fur seals *Arctocephalus tropicalis* recorded at Gough Island during the 1975/76 austral summer breeding season. The results extend the study of competition and injury in adult males from the same population. Herding behavior is defined and shows that adult males in this population exhibit the most extreme herding behavior of the fur seal genus *Arctocephalus*. Extreme herding responses result from both human disturbance and in natural settings without human disturbance. Such information is needed for comparative studies about aggression and territorial behavior in otariids.

Keywords Aggression · Breeding season · Gough Island · Intersexual encounters · Otariids

Introduction

Sub-Antarctic fur seals (Otariidae: *Arctocephalus tropicalis* (Gray 1872; SAFS hereafter) breed on Gough Island (40°19' S, 9°57' W) in the South Atlantic Ocean (Hofmeyr and Bester 2018). SAFS are polygamous, colonial breeders with adult males defending territories during the austral summer (Bester 1981) on beaches where adult females gather, give birth and mate over a highly synchronized period of approximately 6 weeks (Bester 1995). Adult male numbers ashore peak in December (Bester 1981), when adult fur seal males of various species typically engage in highly ritualized aggressive interactions (Rand 1967; Peterson 1968; Stirling 1971; Miller 1971, 1975). Such aggressive interactions improve the adult male's reproductive advantage through territoriality and dominance hierarchies (Stirling et al. 1993) although alternative male reproductive strategies and female choice also play a part (Miller 2018).

Several categories of adult intersexual behavior are recognized for fur seals and sea lions (otariids), i.e., vocal and visual contact, copulation, herding/crowding and olfactory

investigation (Bartholomew and Hoel 1953; Paulian 1964; Rand 1967; Bonner 1968; Peterson 1968; Miller 1971), peacekeeping (Vaz-Ferreira 1956; Kenyon 1960; Peterson and Bartholomew 1967; Shusterman and Dawson 1968; Miller 1971), abduction (Campagna et al. 1988) and displacement (Miller 1971; Bester 1977). Here we report on extreme herding events in adult male SAFS which (a) extends a previous study on contest competition and injury in fur seal males (Bester et al. 2024) to (b) address the ways in which adult male fur seals promote their reproductive fitness during the breeding seasons. The study is intended to contribute to comparative studies about aggression and territorial behavior in otariids (Campagna 2018; Miller 2018).

Methods

Gough Island (40°19' S, 9°57' W) in the South Atlantic Ocean (Fig. 1) supports the largest population of SAFS anywhere (Hofmeyr and Bester 2018). We regularly (weekly) visited a number of beaches on the South East Coast of the island (Fig. 1) during the 1975/76 breeding season to (a) census the fur seal population (Bester 1981), (b) study adult male fighting tactics (Bester et al. 2024), (c) time budgeting and activity patterns (Bester and Rossouw 1994), and (d) territory sizes and tenure (Bester and Rossouw 2025).

We used criteria of Condry (1978) and Jones et al. (2019) to identify adult male and female SAFS. Adult male interactions with adult females were defined as 'herding' when a

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Fig. 1 Map of South Atlantic Ocean showing the location of Gough Island, and the study beaches on the South East Coast where all observations of ‘herding’ were recorded (taken from Bester et al. 2024)

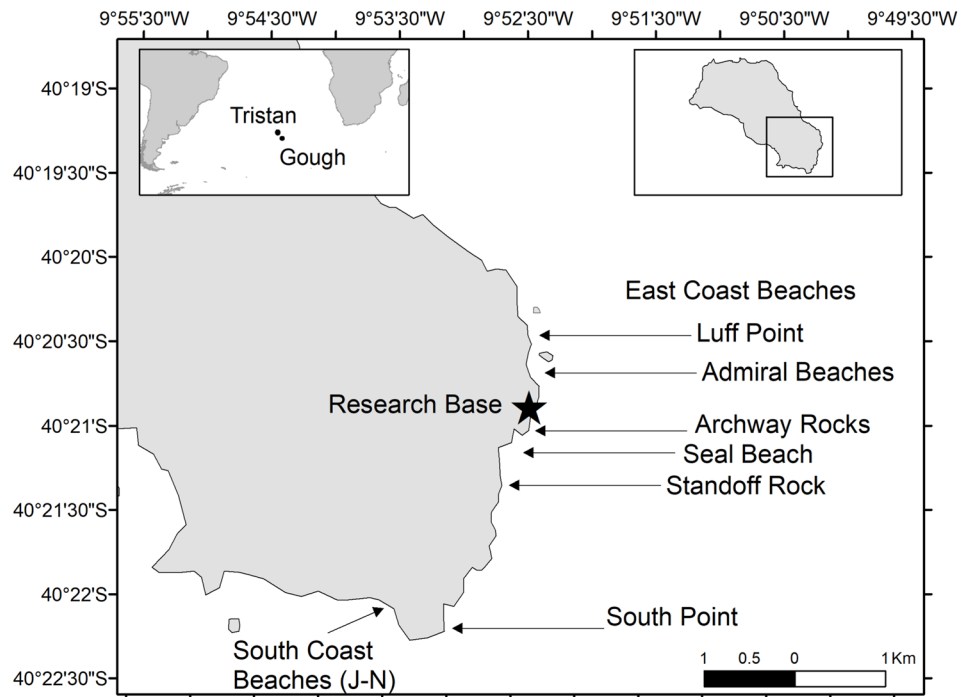


Table 1 Summary of social encounters between adult male and female *A. tropicalis* observed using focal animal sampling on 7 days between 5 December 1975 and 6 January 1976 at Gough Island

| Category | Social Number | Encounters Percentage |
|--------------------------|---------------|-----------------------|
| Herding | 55 | 20.3 |
| Crowding responses | 69 | 25.5 |
| Displacement | 5 | 1.9 |
| Olfactory investigation | 98 | 36.2 |
| Peacekeeping | 21 | 7.8 |
| Copulation | 3 | 1.1 |
| Vocal and visual contact | 20 | 7.4 |
| Total encounters | 271 | |

territorial male tried to prevent an adult female from leaving his territory, as opposed to ‘crowding’ which does not entail the female trying to move away from a territory. The ‘herding’ and ‘crowding’ encounters (see all categorizations in Table 1) were variously scored during focal animal sampling (Altmann 1974) and incidental observations (e.g., during ground censuses) usually spread over the period 08:00–16:00 (Bester and Rossouw 1994). The intersexual encounters in the different categories are variously described in Stirling (1971), Miller (1971, 1975), Bester (1977) and Campagna (2018). Stirling (1971), Stirling and Warneke (1971) and St. Clair Hill et al. (2001) described the accompanying airborne vocalizations. Although the categories of intersexual encounters are subjective and not mutually exclusive (one

type often merges into another type during the same interaction), ‘herding’ is usually executed with some aggression by the male, the female predictably responding with a submissive open-mouth display (Bester 1977).

Results and discussion

We categorized the intersexual social encounters ($n = 271$) of adult SAFS into seven behavioral types (Table 1). One of these was ‘herding’ at a frequency of 20.3% ($n = 55$) which was similar to the 16.2% recorded for *A. forsteri* (Miller 1971). Typically, herding is a mild response in which the male blocks the female’s path with his neck and chest while whickering incessantly with its whiskers erect. The male may place itself in an upright posture in front of the female and with rapid ‘head flicks’, i.e., rapid ventro-lateral movements of the head, try to stop her leaving. Through physical contact, with his head in upright alert posture with an oblique squint, he may force her back into his territory. He may also become increasingly aggressive, emitting high-pitched whickering intermittently interrupted by an open-mouth guttural challenge from a head held high and slightly oblique position, with intensifying head flicks (Bester 1977).

Extreme herding, however, goes beyond the usual adult male SAFS response of interposing its body between the female and her line of departure (see above). Beyond the aforementioned mild response, the most extreme herding behavior in other *Arctocephalus* fur seals entailed male *A. forsteri* pinning a female down by throwing itself on top of

her (Miller 1971). Such levels of higher aggression are similar to that reported for *Arctocephalus* species (e.g., Bonner 1968; Paulian 1964) including SAFS at Amsterdam Island. However, SAFS from Gough Island matches the extreme herding by the Northern fur seal, *Callorhinus ursinus* (Bartholomew 1953; Peterson 1968) and South American sea lions (*Otaria flavescens*) that abduct females from territories (Campagna et al. 1988). Male SAFS from Gough Island were observed to (a) bodily lift a female persistent in departing and carry her well back into its territory, (b) bite a female in her rump and drag her back even if she just crossed into a neighboring male's territory, and (c) chase after a female that has already fled his frontline territory into the sea.

In the latter situation, a male may chase a female along the shore and back onto the beach further along. In one instance, such a male was confronted by another territorial male at the new location and proceeded to chase the female back to his territory tracking back along the same route. Such movements are not uncommon as male fur seals are not rigidly tied to territories and territorial behavior, and may change locations and/or resort to the sea (Rand 1967; Carey 1991; Francis and Boness 1991; Bester and Rossouw 1994; Miller 2018). In a most extreme case, the male chased after a female that had fled into the sea after we disturbed her and while submerged he either forced her to turn back or caught her in his jaws approximately 8 m offshore. Both seals surfaced inshore with the male firmly clasp the female's rump in his jaws. He then proceeded to carry her up onto the beach (Fig. 2a) and upon releasing her, herded her back into his territory. When picked up by the male in this way, she may bite firmly into his back (Fig. 2b). However, her seemingly aggressive biting has submissive undertones and she may at any time resort to explicit submissive behavior to appease him (Bester 1977). Females on the breeding colony beaches occasionally have lacerations on the neck, back, rump and flanks, although rarely more than one at a time, which may be related to extreme herding behavior by the male (Bester 1977). Such wounds may be inflicted when the female is practically suspended by her full weight (between 28.0 and 46.0 kg—Bester 1987) from a single contact point with the male's jaws (Fig. 2a).

As in *C. ursinus*, extreme herding responses occurred as a result of human interference during e.g., ground censusing (Peterson 1968; Bester 1977). However, it also occurs under natural circumstances and may well be precipitated by females attempting to take to the sea during times of excessive heat loading (Bester and Rossouw 1994). Furthermore, the SAFS population at Gough Island was growing rapidly at the time and continued population growth depended on the ability of adult females to exploit less suitable east coast open beaches (Fig. 1) during the breeding season (Bester 1980). Access to adult SAFS females of

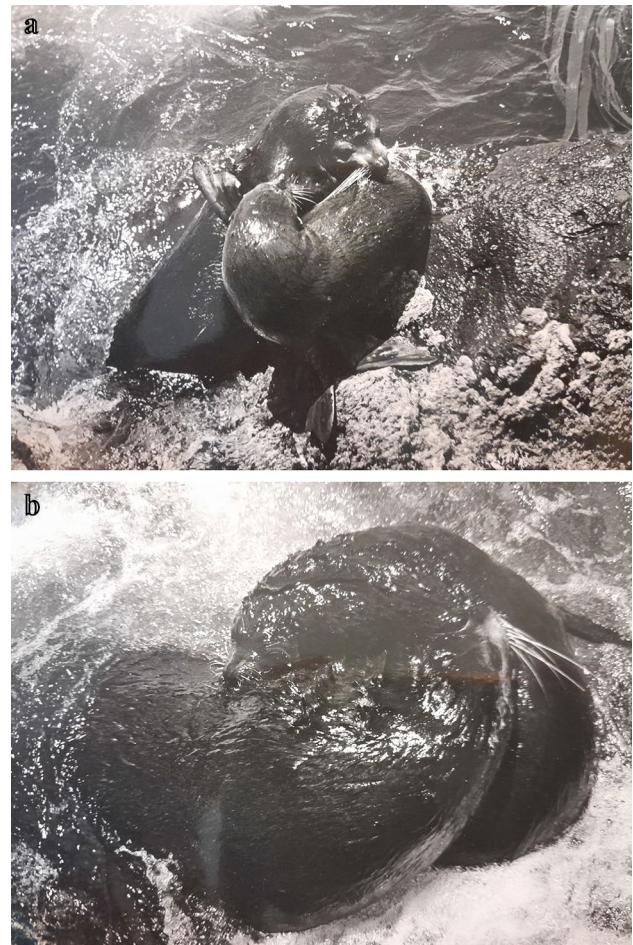


Fig. 2 **a** Adult male SAFS carrying an adult female back onto his frontline territory after catching her in inshore waters subsequent to her fleeing from his territory. **b** Adult female SAFS counteracting the male's effort to carry her back onto his territory by biting him firmly in the back

reproductive age (Bester 1995) in this area would therefore be hotly contested, perhaps resulting in the extreme herding behavior of the territorial SAFS males there.

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Author contributions MNB planned the study, and together with GJR, recorded all the observations. MNB sourced relevant scientific literature, drafted, read, edited, and approved the manuscript.

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Data availability The recorded intersexual encounters between adult males and females are shown in Table 1 taken from Bester (1977).

Declarations

Conflict of interest The authors declare that there is no conflict of interest.

Ethical approval Field procedures in 1975/76 were approved by the Director-General, South African Department of Transport, under advice from the South African Scientific Committee for Antarctic Research, pursuant to the provisions of the South African Sea Bird and Seals Protection Act, 1973 (Act 46 of 1973), and the Convention for the Conservation of Antarctic Seals of 1972. No formal animal ethics committee existed at the University of Pretoria in 1975. Data was gathered by observation with minimal disturbance to the fur seals during censuses and observation periods, and as such no ethical concerns are linked to the data gathering process.

Informed consent Informed consent not applicable.

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