Multiple occurrences of king penguin (*Aptenodytes patagonicus)* sexual harassment by Antarctic fur seals (*Arctocephalus gazella)*

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List of figures, tables and online resources

Figure 1a-c (photos)

Figure 2 (black and white map)

Table 1 (To be in landscape orientation)

Online supplementary material - video clips (7 December 2012).

Clip 1: Seal's penis visible while coercing penguin.

Clip 2: Penguin tries to resist sexual coercion by seal.

Clip 3: Antarctic fur seal sexually coerces king penguin.

Abstract

Sexual coercion is the use of force to achieve mating, while reproductive interference encompasses many forms of interspecific interactions during mating. We describe three new occurrences of the sexual coercion of king penguins (*Aptenodytes patagonicus***) by Antarctic fur seals (***Arctocephalus gazella***) on sub-Antarctic Marion Island. These recurrent observations follow a common pattern where the seal chases, captures and mounts the penguin, followed by copulation attempts. These observations are similar to a previously published observation from the same island and we suggest that this may be an emergent behaviour. Two hypotheses directed at possible drivers for these coercive actions are examined: it may be learned behaviour associated with some sort of reward or it may be an extreme case of reproductive interference that can be explained by the 'mate deprivation hypothesis', resulting from the continued growth of the *A. gazella* population on the island. Reporting of similar occurrences from a range of species may allow more robust inference towards the ultimate drivers of the behaviour.**

Introduction

Sexual coercion is defined as the use of force to achieve mating with a member of the opposite sex, usually performed by males on females (Smuts and Smuts 1993). This behaviour has been widely reported among vertebrates (e.g. Smuts and Smuts 1993; Clutton-Brock and Parker 1995), but is not well understood. Sexual dimorphism is pronounced in many pinniped species (King 1983) and, with their polygynous and gregarious breeding habits, physical competition between males for reproductive access to females is pronounced (McCann 1980). Sexual coercion may thus be an energetically efficient reproductive strategy that is often used by males of sexually dimorphic species (Clutton-Brock and Parker 1995). Reproductive interference can be defined as an interspecific interaction during mating that has negative effects on the fitness of at least one of the species involved and is often the result of incomplete species recognition (Gröning and Hochkirch 2008). Such cases have been reported in many animal taxa (Gröning and Hochkirch 2008). For pinnipeds, cases of reproductive interference include hybridizations between closely related species (e.g. Wynen et al. 2000) and between different genera (e.g. Kovacs et al. 1997). Only a single case is known where pinniped sexual advances bridged the gap of vertebrate class – de Bruyn, Tosh & Bester (2008) reported the sexual coercion of an adult king penguin (*Aptenodytes patagonicus*) by a young adult male Antarctic fur seal (*Arctocephalus gazella*). Here we report three new cases of pinniped-penguin interactions from the same island – sub-Antarctic Marion Island (46°52'S, 37°51'E) – and explore possible drivers for the observed behaviour.

Observations

Three new opportunistically observed cases are summarised with comparison to de Bruyn et al. (2008) in Table 1. In all four instances, young adult male Antarctic fur seals (AFS) in good condition sexually coerced seemingly healthy adult king penguins (KP) of

Table 1 Comparison of four observations of the sexual coercion of a king penguin (*Aptenodytes patagonicus*) by an Antarctic fur seal (*Arctocephalus gazella*) on sub-Antarctic Marion Island

Date	Duration	Beach			Seal		Penguin		Intromission	Description of actions
		Name	Seal status	Age class	Condition	Sex	Condition	Sex		
2006/12/21	45 min	Trypot	Small breeding colony	Young adult	Good	Male	Good at start but exhausted after interaction	?	No	See De Bruyn et al. (2008)
2008/11/30	10 min (8:07–8:17)	Goodhope Bay	Bachelors only	Young adult	Good	Male	Good at start, exhausted and presumably internally injured after interaction	?	Very likely	The seal ran up to the penguin and bumped it down. It lay on top of the penguin and started thrusting its hips in a copulatory fashion. The seal's erect penis was clearly visible (Fig. 1a). Two bouts of thrusting in a copulatory fashion was intermitted by a break during which the seal kept the penguin pinned to the ground with its flipper, but did not seem interested in it. Eventually, the seal got off the penguin, and the bird was able to get up and join a group of fellow king penguins on the beach
2011/01/06	83 min (13:37–15:00)	Funk	Small breeding colony	Young adult	Good	Male	Good at start and energetically opposing seal's actions throughout. Killed and eaten	?	Unsure	Twenty-nine minutes of play and chase actions by the seal before pinning the penguin down in a similar fashion as described in De Bruyn et al. (2008). Pelvic thrusting and copulatory attempts lasted for 26 min, in an intermittent fashion as described for above observation. By 14:32, the seal's behaviour towards the penguin suddenly changed and it started ripping the bird apart. It spent at least 15 min consuming large parts of the penguin. Two predation events on king penguins were witnessed in the break water earlier that morning by two different individual seals
2012/12/07	>23 min (<14:03–14:30)	Goodhope Bay	Bachelors only	Young adult	Good	Male	Good at start, bleeding from cloaca after interaction	?	Yes	When the observers arrived, the penguin was already pinned by the seal. Pelvic thrusting (ranging from slow to vigorous) was of an intermittent fashion as described for above observations, but none continued for longer than 3 min. The seal's penis did penetrate the penguin's cloaca during some of the attempts, but not all. Occasionally, the seal would sniff the penguin and press its snout against the face of the bird (Fig. 1b). Eventually, the seal dismounted and moved several metres along the beach where it remained resting until observations ceased some 15 min later. After the event, the penguin was strong enough to get up and defend itself against giant petrels and sheathbills until joining a group of its kin. These opportunistic predators were attracted to the visibly bloody cloaca of the penguin (Fig. 1c). See Online resources 1–3 for video material of this interaction

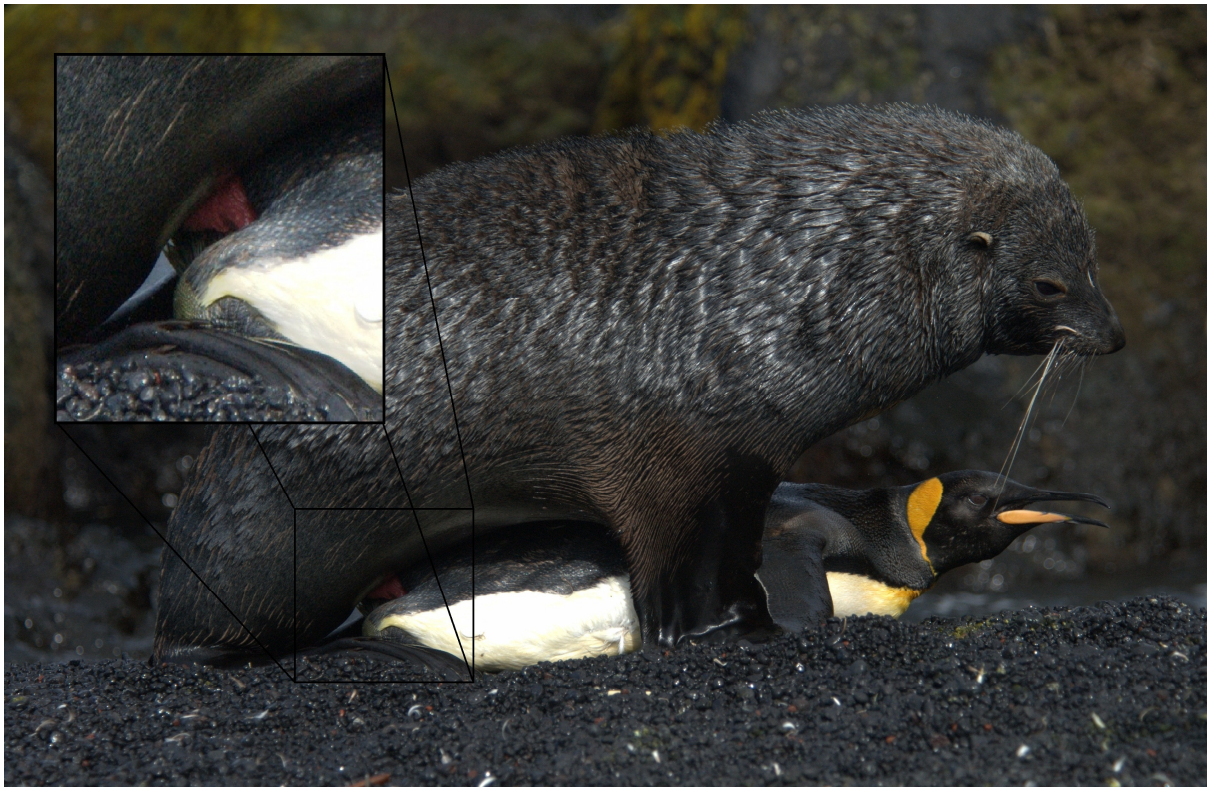

Fig. 1a The erect penis of an Antarctic fur seal (*Arctocephalus gazella*) clearly visible while attempting to copulate with a king penguin (*Aptenodytes patagonicus*). (R.R. Reisinger)

Fig. 1b Antarctic fur seal (*Arctocephalus gazella*) between copulation-attempt bouts while sexually coercing a king penguin (*Aptenodytes patagonicus*). (F.W. Fourie)

Fig. 1c Blood clearly visible between the legs of a king penguin (*Aptenodytes patagonicus*) after being released by the Antarctic fur seal (*Arctocephalus gazella*) that sexually coerced it. (W.A. Haddad)

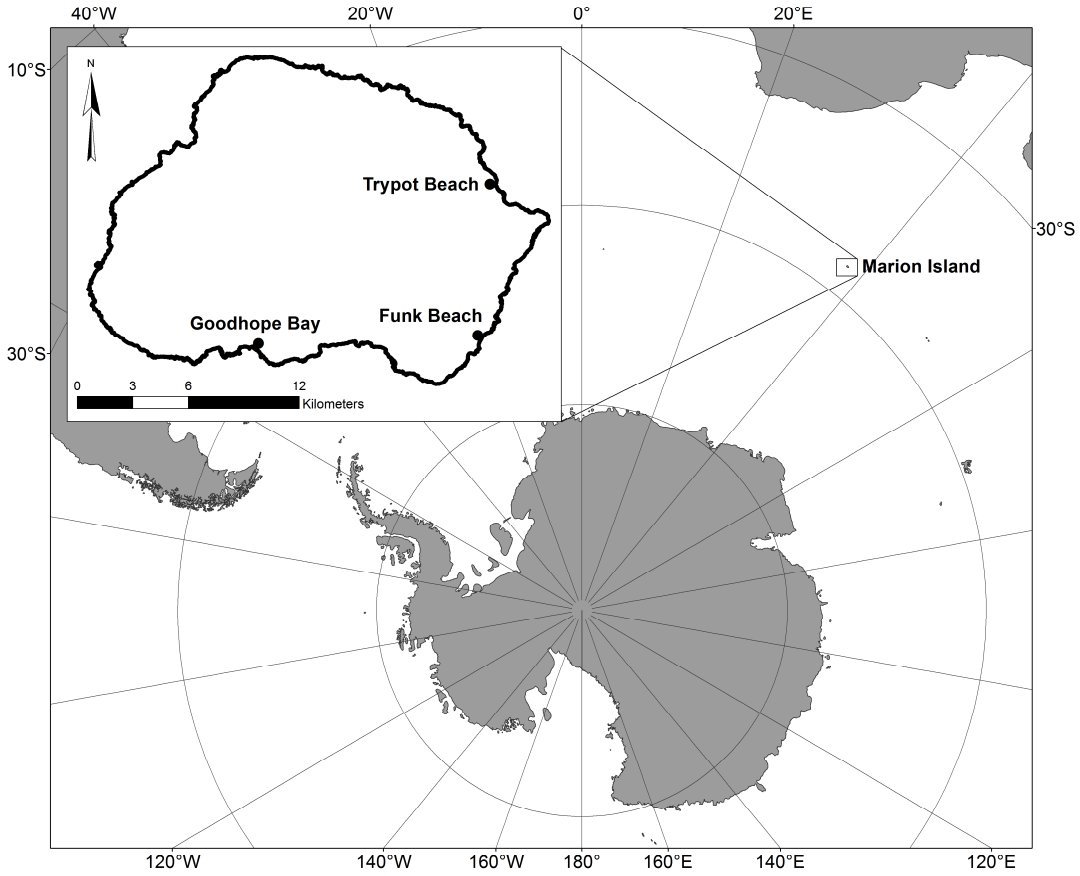

Fig. 2 The locations on Marion Island where sexual coercion of king penguins (*Aptenodytes patagonicus*) by Antarctic fur seals (*Arctocephalus gazella*) was observed between 2006 and 2012.

unknown sex (Table 1). All these events occurred during the AFS breeding season on the island – late November to early January (Kerley 1983) – mainly along the southern and eastern aspects of the island (Fig. 2) corresponding to the areas of highest AFS density (Hofmeyr et al. 2006). Funk and Trypot beaches are small AFS breeding colonies (<100 pups born annually), while Goodhope Bay is a bachelors beach with young and sub-adult males only. Goodhope Bay and Funk beaches have small (<900 breeding pairs) and very small (<150 breeding pairs) KP colonies respectively (Crawford et al. 2003), while Trypot beach is home to a small colony of moulting and resting birds.

The four observations of sexual coercion follow a common pattern where the seal chases, captures and mounts the penguin. The seal then attempts copulation several times with periods of rest in between. The typical duration of copulation for the species is two-and-a-half to six minutes (Bonner 1968). In the three observations described here, the seal seemed to repeat copulation attempts of approximately five minutes long, interspersed with rest periods of similar length while the penguin remained pinned down during rest periods. In two of the three new cases, actual penetration of the bird's cloaca by the seal's penis could not be confirmed but was likely. In the most recent case (7 December 2012) penetration was seen at least once and blood was evident between the bird's legs immediately after the interaction (see Online resources 1-3 for video material). Finally, in three of these four cases the AFS simply released the KP after the coercive interaction, while in one case the seal killed and ate parts of the penguin's neck and chest after attempting copulation.

Discussion

Antarctic fur seals prey opportunistically on king penguins (Makhado et al. 2007; Charbonnier et al. 2010), but the hunting of KPs by AFS males on shore has been described only on Marion Island (Hofmeyr and Bester 1993). Considering the extraordinarily high

observer effort of marine mammal field personnel at Marion Island over the past three-and-a-half decades (Bester et al. 2011), the observation reported by de Bruyn et al. (2008) was considered unique and out of the ordinary. Hunting of king penguins by AFSs was first observed on Marion Island in 1986 (Hofmeyr and Bester 1993), but sexual coercion only in 2006 (de Bruyn et al. 2008). Over the subsequent six years, sexual coercion of KPs by AFSs has been witnessed three more times (Table 1) – it thus appears to be a newly emerging behaviour among Marion Island's AFS males. The four observations discussed here were of AFS males in the same age class (young adult) and were recorded opportunistically over a period of six years. It is unlikely that a single individual AFS is responsible for all four occurrences of sexual coercion. Male AFS may live up to 15 years (de Magalhaes and Costa 2009) and a single animal maintaining the appearance of a young adult for nearly half of its life is thus improbable. Comparison of the photos taken during each event does not aid in individual identification.

Determining the drivers of the unusual behaviour described here is nearly impossible. However, we pose a couple of questions that may be tested in future and speculate as to what may have ultimately led to the sexual coercion of individuals from these very different species. De Bruyn et al. (2008) hypothesized that the sexual coercion event they witnessed was a result of the seal's predatory behaviour towards the penguin being redirected into sexual arousal. But in the 2011 observation the seal actually killed and ate the KP *after* sexually coercing it. In the light of new evidence, this hypothesis seems less plausible. We postulate two possible drivers for the described accounts of sexual coercion. Our observations may constitute a case of learned behaviour in pinnipeds, or may be cases of reproductive interference.

Individual pinnipeds display the ability to learn (Rawls et al. 1985; Shapiro et al. 2004; Schusterman 2008) and the group is considered highly adaptable to novel

circumstances and display behavioural plasticity when faced with environmental pressures (*e.g*. Staniland and Boyd 2003; Holcomb, Young & Gerber 2009; Kovacs et al. 2012). Otariids are capable of exploiting new feeding strategies as exemplified by a New Zealand sea lion that preyed on nesting southern royal albatrosses (Moore et al. 2008), Cape fur seals preying on nesting gannets (Crawford and Cooper 1996), ambushing of yellow-eyed penguins at their landing site by a Hooker's sea lion (Moore and Moffat 1992) and the taking of king penguins on land by AFSs (Hofmeyr and Bester 1993). A comprehensive review by Kirkman (2009) discusses seal-seabird interactions in southern-Africa.

The temporal distribution of coercion events suggests that it may be a learned behaviour. There is a fair amount of literature on animal learning behaviour in a foraging or predator avoidance context, but little regarding sexual behaviour (Shettleworth 2001). Learning behaviour is usually associated with a reward or threat (Shettleworth 2001) – what would the value of this learned behaviour be to the seal? Is it an opportunity for the seal to practice courtship and copulation behaviour prior to defending its own harem for the first time in the next breeding season? It seems unlikely that all four seals would independently have learned to sexually coerce a penguin in the same geographic locality, but no AFSs at other locations, or indeed any species of otariid, have been witnessed displaying similar behaviour.

Alternatively, the described events may be extreme cases of reproductive interference, particularly the type called 'heterospecific mating attempts' by Gröning and Hochkirch (2008), which involves mating attempts without any preceeding courtship behaviour. Like interspecific competition, this type of reproductive interference can be considered density dependant (Gröning and Hochkirch 2008). With the continued growth of the AFS population at Marion Island (Hofmeyr et al. 1997; Hofmeyr et al. 2006) the population might be reaching levels where there exists increasing competition for access to females. The observed

behaviour may then be explained by the 'mate deprivation hypothesis' (Thornhill and Thornhill 1983; Thornhill and Thornhill 1992) which states that males with limited access to females are more likely to sexually coerce. The events took place on an AFS bachelor's beach or on beaches with very small AFS rookeries. Can the observed behaviour be a result of young male-biased AFS populations on these beaches? Further, reproductive interference is usually associated with failed mate recognition (Gröning and Hochkirch 2008), but it seems very unlikely that these animals that are so adept at identifying other animate and inanimate objects (Schusterman 1981), such as specific prey and predator species, are not able to recognise a bird as an unsuitable partner. If the behaviour can not be attributed to failed mate recognition, or at least mate mis-recognition, it must be considered intentional – supporting the learned behaviour hypothesis.

The apparent increase in these occurances, the nature of the interactions and the potential consequences for the species involved prompt speculation, but the driving mechanisms for this behaviour are illusive. We suggest that reporting of such occurences from a range of species may allow for more robust inference related to the ultimate drivers of the behaviour.

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References

Bester MN, De Bruyn PJN, Oosthuizen WC, Tosh CA, McIntyre T, Reisinger RR, Postma M, van der Merwe DS, Wege M (2011) The marine mammal programme at the Prince Edward islands: 38 years of research. African J Mar Sci 33:511–521

Bonner WN (1968) The fur seal of South Georgia. Sci Rep Br Antarct Surv 56:1-81

Charbonnier Y, Delord K, Thiebot J-B (2010) King-size fast food for Antarctic fur seals. Polar Biol 33:721–724

Clutton-Brock TH, Parker GA (1995) Sexual coercion in animal societies. Anim Behav 49:1345–1365

Crawford RJM, Cooper J (1996) Cape fur seal *Arctochephalus pusillus* catches Cape gannet *Morus capensis* ashore at Malgas Island. Marine Ornithology 24:53–54

Crawford RJM, Cooper J, Dyer BM, et al. (2003) Populations of surface-nesting seabirds at Marion Island, 1994/95–2002/03. African J Mar Sci 25:427–440

De Bruyn PJN, Tosh CA, Bester MN (2008) Sexual harassment of a king penguin by an Antarctic fur seal. J Ethol 26:295–297

De Magalhaes JP, Costa J (2009) A database of vertebrate longevity records and their relation to other life-history traits. J Evol Biol 22:1770–1774

Gröning J, Hochkirch A (2008) Reproductive interference between animal species. Q Rev Biol 83:257–82

Hofmeyr GJG, Bester MN (1993) Predation on king penguins by Antarctic fur seals. S Afr J Antarct Res 23:71–74

Hofmeyr GJG, Bester MN, Jonker FC (1997) Changes in population sizes and distribution of fur seals at Marion Island. Polar Biol 17:150–158

Hofmeyr GJG, Bester MN, Makhado AB, Pistorius PA (2006) Population changes in Subantarctic and Antarctic fur seals at Marion Island. S Afr J Wildl Res 36:55–68

Holcomb K, Young JK, Gerber LR (2009) The influence of human disturbance on California sea lions during the breeding season. Anim Conserv 12:592–598

Kerley GIH (1983) Comparison of seasonal haul-out patterns of fur seals *Arctocephalus tropicalis* and *A. gazella* on subantarctic Marion Island. S Afr J Antact Res 71–77

King JE (1983) Seals of the world. Oxford university press, Oxford

Kirkman SP (2009) Evaluating seal–seabird interactions in southern Africa: a critical review. African J Mar Sci 31:1–18

Kovacs KM, Aguilar A, Aurioles D, et al. (2012) Global threats to pinnipeds. Mar Mammal Sci 28:414–436

Kovacs KM, Lydersen C, Hammill MO, et al. (1997) A harp seal x hooded seal hybrid. Mar Mammal Sci 13:460–468

Makhado AB, Bester MN, Kirkman SP, Pistorius PA, Ferguson JWH, Klages NTW (2007) Prey of the Antarctic fur seal Arctocephalus gazella at Marion Island. Polar Biol 31:575–581

McCann TS (1980) Territoriality and breeding behaviour of adult male Antarctic fur seal, *Arctocephalus gazella*. J Zool 192:295–310

Moore PJ, Charteris M, Larsen EJ (2008) Notes on New Zealand mammals 8. Predation on nesting southern royal albatrosses *Diomedea epomophora* by a New Zealand sea lion *Phocarctos hookeri*. New Zeal J Zool 35:201–204

Moore PJ, Moffat RD (1992) Predation of yellow-eyed penguin by Hooker's sea lion. Notornis 68–69

Rawls K, Fiorelli P, Gish S (1985) Vocalizations and vocal mimicry in captive harbor seals, *Phoca vitulina*. Can J Zool 63:1050–1056

Schusterman RJ (2008) Vocal Learning in Mammals with Special Emphasis on Pinnipeds. In: Oller D, Gribel U (eds) The evolution of communicative flexibility: complexity, creativity and adaptability in human and animal communication. MIT Press, Cambridge, pp 41–69

Schusterman RJ (1981) Behavioral capabilities of seals and sea lions: a review of their hearing, visual, learning and diving skills. Psychol Rec 31:125–143

Shapiro AD, Slater PIB, Janik VM (2004) Call usage learning in gray seals (*Halichoerus grypus*). J Comp Psychol 118:447– 454

Shettleworth SJ (2001) Animal cognition and animal behaviour. Anim Behav 61:277–286

Smuts BB, Smuts RW (1993) Male aggression and sexual coercion of females in nonhuman primates and other mammals: evidence and theoretical implications. Adv Study Behav 22:1–63

Staniland IJ, Boyd IL (2003) Variation in the foraging location of Antarctic fur seals (*Arctocephalus gazella*) and the effects on diving behavior. Mar Mammal Sci 19:331–343

Thornhill R, Thornhill NW (1983) Human rape: an evolutionary analysis. Ethol Sociobiol 4:137–173

Thornhill R, Thornhill NW (1992) The evolutionary psychology of men's coercive sexuality. Behav Brain Sci 15:363–421

Wynen LP, Goldsworthy SD, Guinet C, Bester MN, Boyd IL, Gjertz I, Hofmeyr GJG, White RWG, Slade R (2000) Postsealing genetic variation and population structure of two species of fur seal (*Arctocephalus gazella* and *A.tropicalis*). Mol Ecol 9:299–314