Interactions between a male elephant seal *Mirounga leonina* and Cape fur seals *Arctocephalus pusillus*

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A male elephant seal *Mirounga leonina* at Van Reenen Bay, South West Africa/Namibia, was observed catching, killing and attempting copulation with female fur seals *Arctocephalus pusillus*, as well as catching and occasionally killing fur seal pups and participating in territorial disputes with fur seal bulls. Previous and subsequent records of a similar-sized elephant seal in the same vicinity suggest that an individual male has adapted its annual reproductive haul-out to coincide with the fur seals' breeding season.

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By Van Reenenbaai, Suidwes-Afrika/Namibië, is waarnemings gedoen van 'n see-olifantbul *Mirounga leonina* terwyl hy pelsrobkoeie *Arctocephalus pusillus* vang, doodmaak en met hulle probeer paar, asook pelsrobwelpies vang en af en toe doodmaak, en deelneem aan territoriale botsings met pelsrobbulle. Vorige en latere rekords van 'n see-olifant van dieselfde grootte in dieselfde omgewing dui daarop dat 'n bepaalde bul sy jaarlikse landverblyf (vir voortplanting) aangepas het om met die pelsrob se teelseisoen saam te val.

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The Sea Fisheries Institute has a field station for studying behaviour of the Cape fur seal *Arctocephalus pusillus pusillus* at Van Reenen Bay, South West Africa/Namibia (27°24′S, 15°22′E), where the seals breed both on a sandy beach and on a small island adjacent to it. On 30 October 1977, at the start of observations during the 1977/78 breeding season, an adult male elephant seal *Mirounga leonina* was seen on the beach amongst the fur seals. On 31 October it was measured (as between 4 and 5 m long) and tagged in the hindflippers with two numbered monel metal tags (A 16157, A 16158). At the time the elephant seal had its head resting on a freshly-dead fur seal cow, and a second freshly-dead female lay nearby. The next day the same elephant seal was seen on the beach, again with its head resting on a dead female fur seal, and five more dead seals were found nearby. All proved to be sexually mature females, four of which were in advanced pregnancy and one neither pregnant nor lactating.

Thereafter until 5 December the elephant seal was seen on 15 days during periodic visits to the beach. On six occasions one or more dead fur seals were seen in his vicinity and on another occasion a live seal was seen escaping from beneath him. All these fur seals were judged to be cows or yearling/subadult individuals from size and appearance. During this period the elephant seal was also seen on seven occasions involved in disputes with fur seal bulls, who were establishing or had established territories at the water's edge.

This paper presents further details of this elephant seal's behaviour, both during the 1977/78 and 1979/80 breeding seasons at Van Reenen Bay (the seal was absent during the 1978/79 season).

Methods

From 5 December 1977 systematic observations of fur seal behaviour began from 17 m up a cliff at one end of the beach and these continued on 29 days for a total of approximately 320 h, ending on 5 January 1978. During this period more details of the elephant seal's behavioural patterns became apparent, as he was present on 27 of the days on which observations were made. Resightings of the tags at periodic intervals confirmed that only one bull was involved. Observations were either made by eye or using 7 × 35 binoculars. Some behavioural sequences were photographed on still (35 mm) or cine (super 8 mm) film. Events were timed using the second hand of a wrist

watch.

Further observations were made during the 1979/80 breeding season, when the station was manned from 21 November to 13 December 1979, for a total of approximately 220 h of observations on 21 days, during 19 of which the elephant seal was present, and recognised by the presence of one of the tags.

Results

Interactions with females

On 5 December 1977 the elephant seal was clearly seen for the first time attempting copulation with a dead fur seal cow, and on 9 December he was seen catching and killing a fur seal cow before attempting copulation. Thereafter the elephant seal was seen to make numerous attempts to catch fur seals (mostly cows) on nearly every day on which he was in sight on the beach. On 54 occasions during 1977/78 and 1979/80 these attempts resulted in physical contact with the fur seal: in 36 of these the fur seal was eventually killed, in all but three of which the elephant seal immediately attempted copulation with the dead or dying seal. Of the three exceptions, one involved a very small seal, and in a second the elephant seal was disturbed by having stones thrown at it.

Five fur seals managed to escape after being caught by the elephant seal, and we rescued another seven by lobbing stones at the elephant seal from the top of the cliff until he released the seal. The elephant seal appeared to release six seals spontaneously: four of these were judged to be yearlings of unknown sex (Fig. 1A – C), a fifth was judged to be a small female and the sixth was a subadult male. All were released apparently unharmed. All the seals killed were judged to be mature females. This was confirmed by the examination of five carcases on 1 November 1977 and (after the elephant seal's departure) seven carcases on 2 February 1978, all of which were assumed to have been killed by the elephant seal.

The method of capture was principally one of taking the fur seals by surprise as they lay asleep on the beach. In most cases the elephant seal seemed to select a particular victim (nearly always lying with its back towards him) and then made a series of short dashes towards it, the last usually not exceeding 5 m. When the elephant seal reached its victim he struck down, usually aiming for the neck or shoulders of the recumbent seal and pinned it to the ground with his head and neck (Fig. 2A and B). From there on the pattern of behaviour varied according to circumstances. On six occasions the elephant seal struck down again (up to five times) with his head and neck at the seal after the initial capture, apparently in an effort to subdue the fur seal further. Sometimes (three of 11 occasions), after a brief pause the elephant seal rolled forward over the seal until the victim's head and thorax lay under his lower chest about level with the anterior insertion of the foreflippers, with the fur seal's hindquarters projecting out sideways. Alternatively (nine of 12 occasions), the elephant seal lifted his victim off the ground, swung it slightly in the air and brought it down heavily to the ground under the weight of his head and neck (Fig. 2D and E). In order to be able to do this the elephant seal had to take the fur seal's head or neck in his mouth, and in the process the left flipper was sometimes employed to restrain the seal's body while the grip was shifted from neck to mouth (Fig. 2C). On six occasions the victim was lifted once and on three occasions twice. This lifting and lowering behaviour could have served either to subdue the victim further or to reposition the victim's body into a more favourable position for copulation (see below). After lifting and lowering, the elephant seal invariably rolled forward on the carcase until it was in the position described above (Fig. 2F). On three out of nine occasions the elephant seal had to roll forward twice in order to restrain the victim securely, the fur seal being either lifted and lowered again or struck down at in the intervening period.

The force of these blows can be judged from the fact that on one occasion (when the elephant seal was being harrassed by stones lobbed from the top of the cliff) a section of the cow's intestines were eventually forced out of the ano-genital region.

Once the victim had been secured beneath the lower chest of the elephant seal there was a pause in activity, apparently while the fur seal succumbed to the elephant seal's mass, for copulation was not usually attempted until the struggles of the fur seal had ceased. The period between capture and the first attempt at copulation was timed on nine occasions, varying from 3,5 to 11,0 min (mean 8,2 min).

Prior to the copulation attempt, the elephant seal reached forward with his foreflipper and pulled the hindquarters of the fur seal back and towards his side (Fig. 2G). The elephant seal invariably used his right flipper for this purpose in the 24 attempted copulations for which such observations were made. Because of this stereotyped behaviour it is postulated that the lifting and lowering described above was intended to reposition the victim's body until it lay at right angles to the elephant seal with its head to the left, so that on occasions when the cow was lying in this position before capture no such manipulation was necessary. Unfortunately no specific notes were taken of the orientation of the victim's body prior to capture. However Laws (1956) noted no constant tendency of male elephant seals to lie on one particular side when pairing.

After pulling the fur seal back towards his right side, the elephant seal held it partly beneath his body with the foreflipper. To attempt intromission, the elephant seal flexed his body so that the hindquarters were brought up and to the right, the penial orifice then being in rough approximation to the rump of the fur seal. The penis was then everted and rubbed across the rump and hindflippers of the fur seal: successful intromission was never observed (Fig. 2H). Pelvic thrusts followed, and were timed on three occasions over periods from 12 to 60 s, giving rates of 20 to 24,8 thrusts per minute. Possible ejaculation was seen only once, when a dark-coloured liquid was observed running down the flanks of the cow and immediately soaking into the sand without staining it.

After ceasing pelvic thrusts, the elephant seal lay quietly in the same position for some time before swinging his hindquarters back and straightening his body. The elephant seal would then dismount (or resume a copulation attempt) some time later. The duration of the copulation attempt, defined as the period from the flexing of the body to its straightening again, was timed on 12

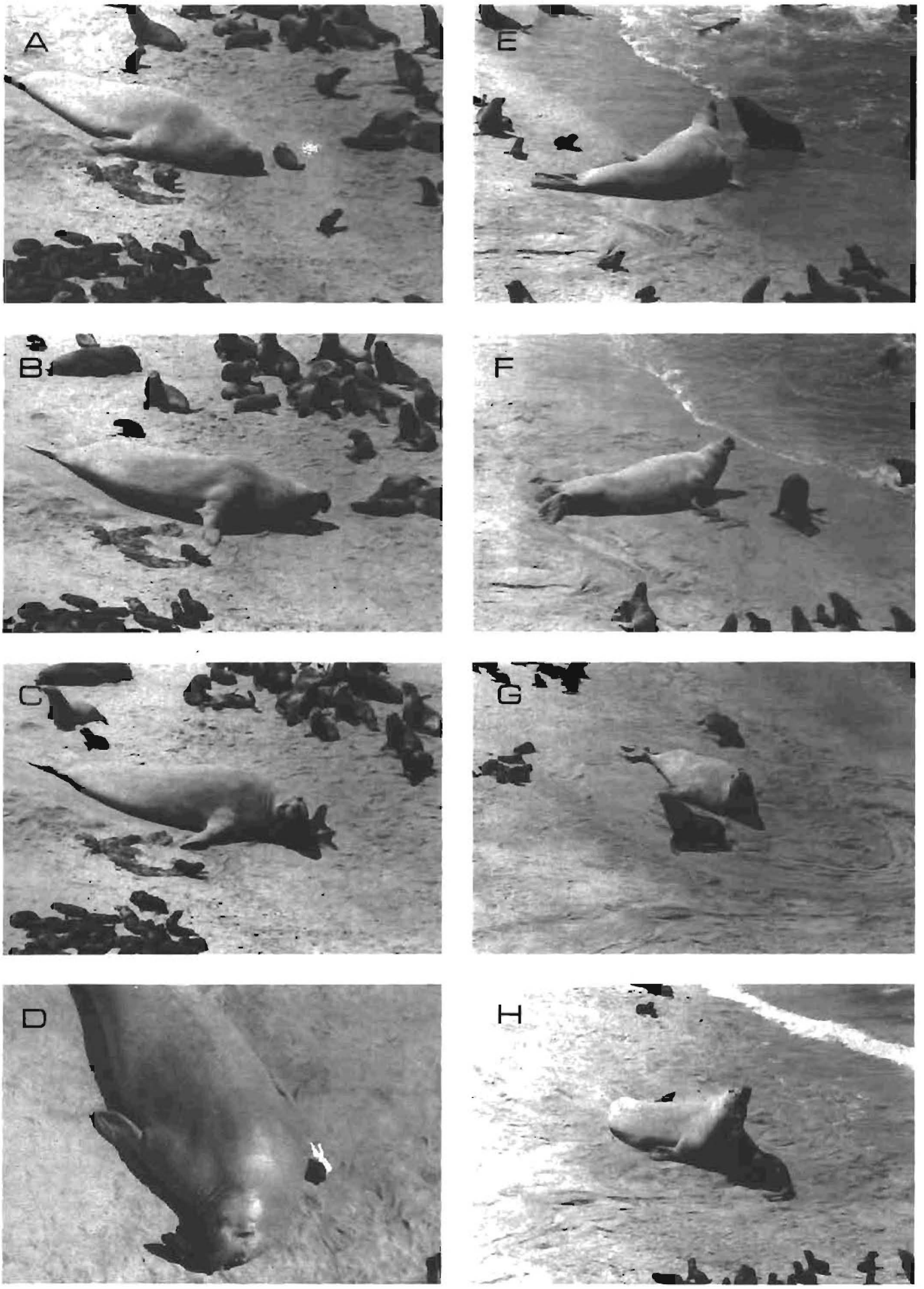

Fig. 1 A – C Capture and release of juvenile fur seal by male elephant seal. D Fur seal pup held by elephant seal in mouth. E – H Interaction between male elephant seal and fur seal bull.

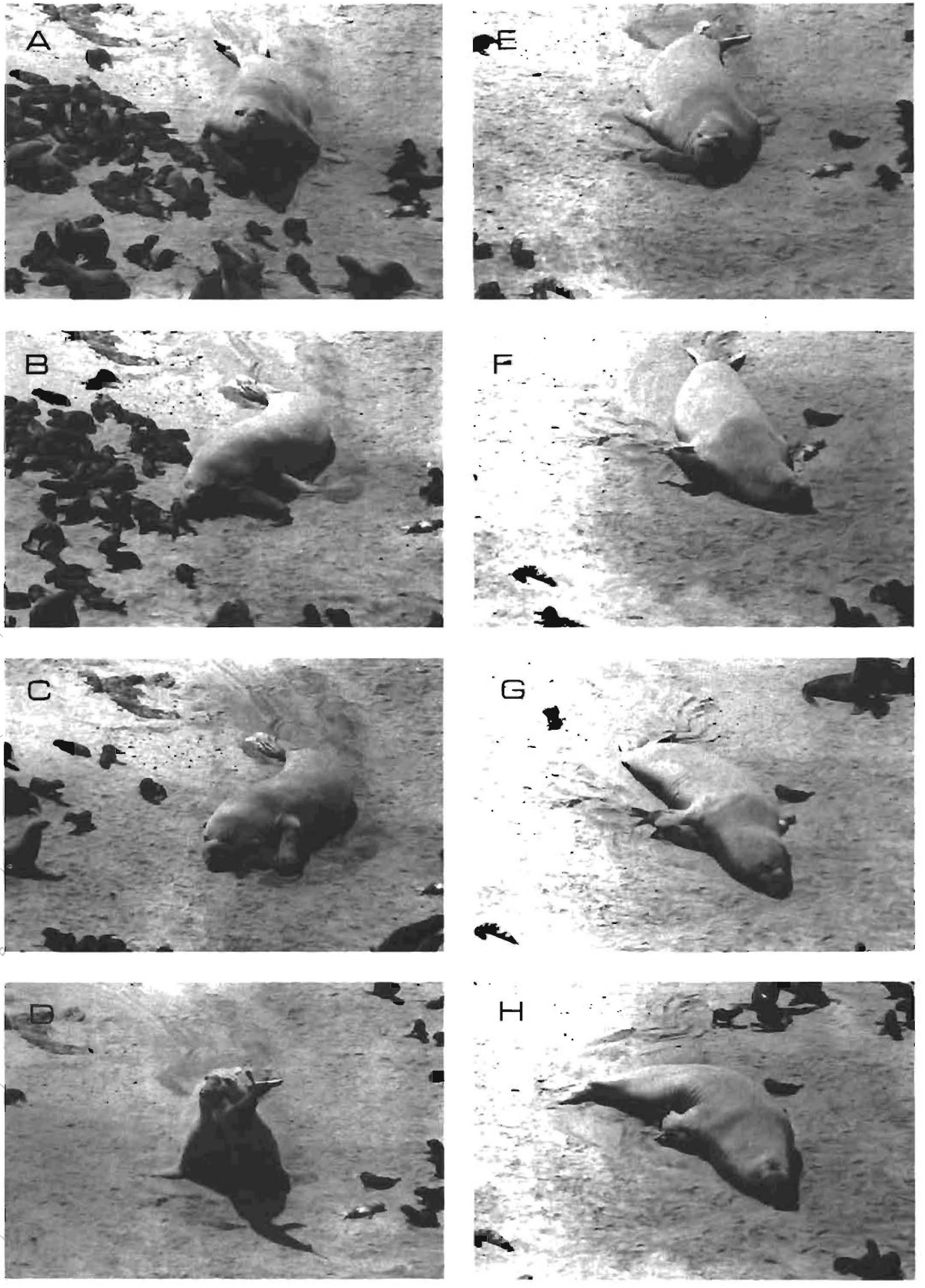

Fig. 2 A – H Sequence of capture, suffocation and attempted copulation of female fur seal by male elephant seal.

occasions, lasting from 4 to 16 min with a mean of 8 min.

The whole process involved in capturing female fur seals closely resembled published descriptions of intraspecific copulation in the elephant seal (Bartholomew 1952, Laws 1956, Le Boeuf 1972). The duration of normal copulation is also similar to that observed at Van Reenen Bay (3 to 7 min, Bartholomew 1952; about 5 min, Le Boeuf 1972; 10 min declining to 3 to 4 min at the height of the season, Laws 1956). The elephant seal bull at Van Reenen Bay seems to have made only minor adjustments to the normal pattern of copulatory behaviour in his attempts to copulate with fur seal cows, the principal ones being the rolling over the cows to subdue them, and the lifting and lowering of cows in certain instances: the latter behaviour might well have been facilitated by the smaller size of *A. p. pusillus* cows (averaging 70 kg as compared to 309 kg for *M. leonina* cows over six years of age — Bryden 1972).

The elephant seal frequently attempted to copulate more than once with dead fur seals. For 17 fur seals seen killed, the number of copulation attempts seen varied from none (once) to six, with a mean of 1,8. On 39 occasions when the elephant seal was seen attempting to copulate with fur seal carcases whose capture had not been witnessed, such copulations were attempted once on 27 occasions and twice on 12 occasions. As it was difficult to identify carcases from one day to the next, such observations only refer to the number of copulation attempts made in any one day. Consequently it is probable that most fur seal carcases were utilized several times in this way, and attempted copulations were seen with carcases that were clearly in an advanced state of decomposition (with visible hair loss or, in one instance, a carcase whose hindquarters had been partly eaten away by jackals). Altogether 87 attempted copulations with dead or moribund fur seals were seen, giving a frequency of attempted copulation of one every 6,2 h of observations. Le Boeuf (1972) considered an inter-copulation interval of 5 – 30 min to be not unusual for alpha-male elephant seals.

The clinical cause of death of the fur seals was not determined. A gross post-mortem examination of five carcases on 1 November 1977 failed to reveal any fracture of the skull, and neither did an examination of seven skulls from decomposing carcases on 2 February 1978. The fact that some seals escaped after being caught (and even rolled on), while many others were seen to struggle after being caught, suggests that trauma was not the main cause of death. One fur seal cow that had been rescued after lying for some time under the chest of the elephant seal immediately sat up and 'panted' with open mouth for several seconds before moving off. The seals may have died from suffocation caused by the great weight of the elephant seal on their head and thorax inhibiting respiration.

On three occasions the elephant seal was seen either taking a dead fur seal to sea in his mouth or landing with it in his mouth. In one of these instances the elephant seal took a cow that he had just killed to sea when stones were thrown at him from the top of the cliff, but lost the carcase in the surf while attempting to land about 100 m farther along the beach. On a second occasion the elephant seal reacted to stoning by moving towards the observer, seizing the carcase of a fur seal, throwing it away from the observer, and then following it. As the sea threatened to take the carcase away, the elephant seal lay on the carcase and at one stage charged after it as it rolled out to sea. Three minutes later he carried the carcase to sea in his mouth and swam about 500 m along the beach, where he landed 7 min later (still carrying the carcase) and proceeded to attempt to copulate with it in the surf. On the third occasion the elephant seal was seen landing with a dead fur seal, having carried it about 750 m along the coast. He almost lost the carcase when landing but brought his head down hard on it (as in a normal capture attempt) while it lay drifting in the shallows. Once again copulation was attempted close to the water's edge immediately after landing.

The elephant seal was seen on five occasions interrupting copulating fur seals (once on 11 December 1979, three times on 24 December 1977 and once on 3 January 1978). On each occasion the elephant seal approached in short rushes, and in every case the bull and cow fur seal continued copulation until the last possible moment. Neither was ever caught, although once the elephant seal's head struck the ground between the parting pair, and on another occasion the elephant seal actually came down on top of them. In one instance the same pair of fur seals resumed mating shortly after being disturbed by the elephant seal, and at some distance from their original position. The elephant seal then approached for a second time and interrupted the copulation. Disruption of copulations by other males is a feature of elephant seal behaviour (Le Boeuf 1972), and these instances may not represent attempts to catch the fur seal cow.

Interactions with pups

On most occasions fur seal pups merely moved out of the way as the elephant seal approached and were accordingly ignored or (if the approach was rapid) were trapped in its path and simply 'run over'. On 35 occasions, however, the elephant seal was observed deliberately catching a pup, usually by trapping it under his neck or holding it in his mouth (Fig. 1D). In the majority (22) of cases these captures were associated with attempts to capture adult cows. Pups were caught most frequently (17 times) immediately after an unsuccesful attempt on a cow or group of cows, and less frequently (five times) just preceding such an attack. The pup, once caught, would often be 'played with' or 'bullied'. This included whipping the pup from side to side (twice), lifting the pup off the ground (six times) and waving it around (three times), or rearing right up with the pup in its mouth (twice). Three times after dropping or releasing the pup the elephant seal caught it again by bringing his head down on it, and on one occasion the left flipper was used to restrain the pup as it struggled in the seal's mouth, similar to the technique used for securing cows. On six occasions cows attempted to retrieve their pups from the elephant seal, thrice successfully. On two of these occasions the elephant seal then chased the cow as far as the edge of the sea.

Five pups were killed as a result of the handling they received, one was considered 'half-dead' and another was so badly injured that it was killed by a jackal soon after being released by the elephant seal. All other pups were

released apparently unharmed. No attempt to copulate with pups was seen (unlike many elephant seal bull-pup interactions - Le Boeuf 1972).

Interactions with bulls

Detailed notes of the interactions between the elephant seal and fur seal bulls were not made because of their complex nature and the speed of the component actions. Most appeared to be initiated by the elephant seal, which would deliberately approach a group of fur seals (either from the sea or along the beach) and apparently select a particular bull for his attentions. The elephant seal would threaten this bull by lifting his head up high, inflating the proboscis and uttering a rattling 'roar' (as described by Laws 1956) in its direction (Fig. 1E). If this produced no effect, the elephant seal would move closer and repeat the threat. Normally the fur seal bull would eventually give way before the elephant seal's approach (although continually barking), and would either flee towards the sea (with the elephant seal in pursuit), or would try to dodge the attacker by circling round to one side of and sometimes behind the elephant seal, presumably in an effort to remain within or in the vicinity of its territory (Fig. 1F and G). The elephant seal tended to persist with these threats, and almost invariably the fur seal bull was eventually forced to leave the vicinity of its territory and either go to sea or move inland. Only twice was a fur seal bull seen to threaten the elephant seal in return. On these occasions the behaviour patterns used were much the same as used against conspecifics; i.e. a boundary type display with open-mouth threat and attempts to aim bites at the neck or the base of the flippers (Fig. 1H). The elephant seal would retract his proboscis and strike down with open mouth at the neck or forequarters of the fur seal, but the elephant seal's reactions were generally too slow for the strike to be successful. However the elephant seal managed to make contact with the fur seal bull on four occasions. One of these was a glancing blow that might have struck the fur seal's back. On a second occasion the fur seal bull went flying onto its back, defecated and was struck twice again before escaping to the top of the beach, from where the elephant seal chased it out to sea. On a third occasion the fur seal bull reacted to being struck by biting the elephant seal on the side of the head. The elephant seal then raised its head so that the fur seal was lifted clear of the ground: the fur seal then dropped off and fled to sea. On the last occasion, after being pinned to the ground by the elephant seal, the fur seal bull bit the elephant seal on the left foreflipper, causing it to let go. After chasing the fur seal to sea, the elephant seal returned to shore with its foreflipper bleeding quite badly.

Apart from the latter occasion, the elephant seal was seen to be bleeding from fresh wounds on six occasions: five of these wounds were situated on the side or back of the neck or on the side of the face, and two at the base of the foreflipper. As these corresponded to the areas most frequently bitten during inter-male disputes of *A. p. pusillus* (Rand 1967, p. 20), it can be assumed that the wounds were caused by interactions with male fur seals. (A bull was actually seen to bite the elephant seal on its hindflippers during one interaction.) These occurrences declined markedly as the season progressed: during 1977/78 five of them were seen prior to 30 November but only one thereafter (on 15 December). The incidence of all interactions between the elephant seal and fur seal bulls also seemed to decline with time. Of a total of 24 interactions recorded from 30 October 1977, seven took place before systematic observations began (on 5 December), 10 occurred in the period 5 to 15 December, and only seven in the period from 16 December to 5 January 1978 (when observations ceased). This decline was probably linked with the gradual departure of fur seal cows to sea and the associated breakdown in male territoriality as the breeding season of *A. p. pusillus* progressed: it was not linked with a decline in copulation attempts by the elephant seal.

Discussion

The field station was vacated from 6 to 29 January, and reoccupied from 30 January to 10 February 1978. During the latter period the elephant seal was never seen, despite visits to the colony on five days. It was therefore present at the colony during the 1977/78 season over a total interval of at least 67 days, and was never observed to be absent for more than one day at a time. During the 1979/80 season the same seal was present at Van Reenen Bay on all but two days of observations during the period 21 November to 13 December 1979 (a total interval of 23 days), but was absent from 26 January to 1 February 1980. No evidence of defecation was seen in either season, and it is assumed that the seal was resident at or near the colony throughout both periods and did not go to sea to feed.

The breeding season for southern elephant seals usually extends from August to November, with a peak number of cows ashore in mid-October (Condy 1979). Adult males come ashore from the first week of August onwards, reach their maximum numbers around the end of September and depart for sea in late October and November (Carrick, Csordas, Ingham & Keith 1962). Individual bulls may remain ashore (without feeding) for up to 65 days (Laws 1956, p. 69). The only other period of the annual cycle during which prolonged fasting of adults takes place is the moult: most adult bulls come ashore to moult in the period from late January to the end of April. In subadult bulls the moult can take as long as 43 days (Carrick *et al.* 1962).

It is not known exactly when the elephant seal at Van Reenen Bay first came ashore in either 1977/78 or 1979/80. If the animal did arrive in August, as in a normal elephant seal breeding season, its stay ashore must have been extended much longer than normal. Alternatively, the elephant seal could have changed the time of its haul-out to coincide more closely with the fur seals' breeding season. The physiological stimulus for the seal's presence ashore was clearly a sexual one, and no signs of moult were detected while the seal was under observation in either 1977/78 or 1979/80. An elephant seal (or seals) of a similar size has been recorded on this stretch of coastline for several years (Table 1). A large male elephant seal was in fact present at the Lions Head or Van Reenen Bay seal colonies during at least part of six breeding seasons, 1973/74, 1975/76, 1976/77, 1977/78, 1978/79 and 1979/80, during the last three of which it was identified as the same individual from the presence of tags and/or its unusual behaviour. It is possible, therefore, that an in-

dividual male elephant seal has adapted its annual reproductive haul-out to coincide with that of the only other pinniped breeding on the South West African coast, the Cape fur seal.

Table 1 Sightings of a large male elephant seal in fur seal rookeries, SWA coast

Dates seen	Locality	Remarks
7.11.73	Lions Head (27°40'S, 15°32'E)	Length assessed as 4,88 m from marks left in sand. Seen and photographed by diamond security officers.
–.3.74	Lions Head	Seen by CDM security staff: had disappeared by 3.4.74.
16.12.75	Lions Head	J.H. Coetzer, *pers. comm.*, to P.D. Shaughnessy, 6.2.76.
17.3–2.5.76	Lions Head	Seen regularly by 2 geophysicists. Absent 2.5.–23.5, when they left the area.
13–15.12.76	Lions Head	P.G.H. Frost, *pers. comm.*, 1.10.79.
17.12.76	Lions Head	Seen in aerial photographs of fur seal colony: est. 4–5 m from comparison with fur seal bulls.
30.10.77–5.1.78	Van Reenen Bay (27°24'S, 15°22'E)	Seen regularly (this paper). Tagged in hind-flippers.
10.11.78	Lions Head	S.A. Police, *pers. comm.*, to P.D. Shaughnessy, 11.10.78. Interactions with fur seal cows reported.
21.11.–13.12.79	Van Reenen Bay	Seen regularly by Sea Fisheries Institute staff. One tag present. Similar behaviour seen as in 1977/78 (this paper).

Undoubtedly more fur seals were caught and killed by the elephant seal than were actually observed, judging by the number of dead seals that were seen in its vicinity and which could not be attributed to any capture attempt witnessed. It was impossible to calculate the actual number killed because of losses due to tides and scavengers — such as jackals *Canis mesomelas* and brown hyaenas *Hyaena brunnea* — and confusion arising from the elephant seal's habit of moving carcases some distance from their point of capture. However, in 540 h of observations 43 cows were seen being killed (or were rescued from being killed), an average of 1 cow every 12,7 h. Assuming similar behaviour continued at night (as has been assumed for intraspecific sexual activity by the northern elephant seal - Le Boeuf 1972), it can be estimated that in the time span of 67 days during which the elephant seal was known to be present in 1977/78, $\frac{67 \times 24}{12,7}$ or 127, minus 7 known to be rescued = 120 cows were killed. It seems reasonable to assume (from the number of carcases seen) that there was at least one other seal killed for every two witnessed, in which case the total mortality in 1977/78 would have been about 180 cows.

Pup production at Van Reenen Bay in 1976 was estimated (from serial photographs of the colony) as 3 227 (Shaughnessy, *in press*). If this is adjusted for pups missed on the photographs (× 1,33 — Shaughnessy, *in press*), and a pregnancy rate of 80% assumed, the total mature female population can be estimated as 5 365. Thus the mortality rate inflicted by the elephant seal would be 2,2–3,4%, depending on assumptions regarding the proportion of kills not seen. This compares with a model-derived natural mortality rate for mature females of 8,7% (Shaughnessy & Best, *in press*), and indicates the deleterious nature of such interspecific behaviour.

Interspecific reproductive behaviour in wild pinnipeds is in fact quite rare. In general, when different species haul out in the same geographical area, breeding activities tend to be separated either temporally or spatially or both (e.g. Bonner 1968, Ling 1969, Orr 1965). At San Miguel island off California, however, individual male Steller's sea lions *Eumetopias jubatus* have been seen copulating with female Californian sea lions *Zalophus californianus*, and male Californian sea lions attempting copulation with female northern fur seals *Callorhinus ursinus*. One particular male Steller's sea lion was seen copulating on 34 occasions with female Californian sea lions, of which only 38% survived: in three years at least 75 females were killed by this male (De Long 1975). Successful interspecific copulation in the wild is also inferred from the apparent *Arctocephalus tropicalis/A. gazella* hybrids recorded from Marion Island (Condy 1978). On an intraspecific basis, elephant seals appear to be particularly sexually indiscriminate, and males have been seen attempting to mate with newborn pups, weaned pups, other males, non-oestrous and even dead females (Le Boeuf 1972; *in litt.* 14 January 1980). In the case of newly weaned pups the results were sometimes fatal for them. The male elephant seal's sexual behaviour is also characterised by mounting without any preliminaries, and in the case of females, regardless of their oestrous condition. It is therefore perhaps not surprising that this example of interspecific reproductive behaviour should involve an elephant seal as the active partner.

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