Male harassment of breeding female New Zealand sea lions —a significant source of adult mortality

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Sexual dimorphism in NZ sea lions. Male, female and pup.

New Zealand sea lions *Phocarctos hookeri* are sexually dimorphic, polygamous pinnipeds. Breeding females interact with males that:

- Outweigh them.
- Possess dangerous weapons (large teeth).
- Aggressively pursue interactions/copulation.

Sexual aggression by males during breeding can lead to injury and death.

We investigated the injuries and number of deaths attributed to male harassment, and tested whether the arrival and departure behaviour of female NZ sea lions is adapted to reduce this.

Methods

The study was conducted at Sandy Bay, Enderby Island, Auckland Islands, December to January 2002/03 and 2003/04.

Data on female deaths by male harassment were collected from necropsy records; data on female injuries from bite wounds and scarring by canine teeth.

Behavioural observations were conducted four hours daily between 0800 to 2000.

Female arrivals and departures were observed within all observation periods.

Early harem development at Sandy Bay, 12 December 2002.

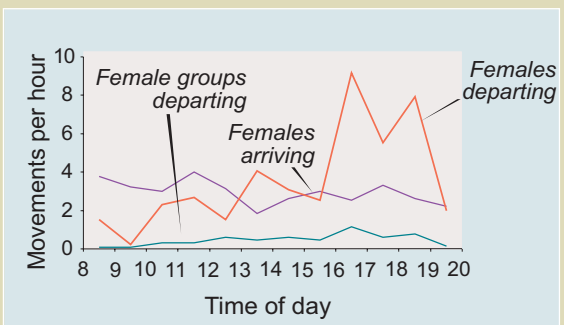
Results

- Harassment causes high mortality, 5 in every 1000 breeding females each year.
- Permanent scars from male bites observed on 84% of adult females.
- 208 hours of behavioural observations, 478 arrivals (single females), 76 departures (mean group size ± SE 7.5 ± 1.1, range 1 to 34).
- Harassment level varied with female arrival behaviour.
- No significant difference in frequency of ***arrivals*** to time of day; ***departures*** significantly more common during late afternoon and early evening.

Year	Pup mark re-capture estimate	Female deaths attributed to males	Calculated yearly mortality
2000/01	562	4	0.7%
2001/02	403	2	0.5%
2002/03	488	1	0.2%
2003/04	507	3	0.6%
Overall	1960	10	0.5%

	Numbers observed	Not harassed	Harassed	Captured
Arrival	478	55%	35%	10%
Departure	78	58%	28%	14%

Arrival behaviour (%)	Behaviour observed	Not harassed	Harassed	Captured
Straight in from the sea	87	63	29	8
Back and forth at breakers before coming ashore	14	43	43	14
Straight in and sit on water's edge >5 s	12	32	51	17
Back and forth at breakers and sit on water's edge >5 s	7	35	56	9



Major influences on harassment

During arrival: tide level. The higher the tide, the less beach distance females had to cross and the less likely harassment was.

During departure: female group size and the number of males between the departing group and the sea. Smaller group size of females and larger numbers of males both led to more harassment.

Capture, harassment, and mating attempt.

Discussion

- Male harassment of female NZ sea lions causes an appreciable level of mortality and injury.
- This mortality and visible injury rate only represents the direct impacts.
- Indirect impacts, such as the time and energy cost of avoidance, pup separation, pup injury and death, can have long-term effects that are just as significant.
- *Arrival behaviour* of females is orientated towards evasion of males on arrival rather than synchronisation of arrival times.
- *Departure behaviour* is adapted to the avoidance of harassment via departure at high water, departing in groups, and group departures when male numbers were low.

Conclusions

High level of male harassment and injury of females is common among pinnipeds.

Direct and indirect effects of male harassment influence female breeding behaviour and could affect overall reproductive success.

This naturally occurring mortality and injury level needs consideration in the modelling of the New Zealand sea lion population, and the corresponding management of anthropogenic impacts on the species.

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