

Limited sexual segregation in depth use by southern elephant seals from Marion Island



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Background and Research Questions

- Spatial foraging segregation has been documented in various pinnipeds, including Antarctic fur seals, New Zealand fur seals, grey seals, northern elephant seals and southern elephant seals from Macquarie Island and South America;
- Segregation in seals is likely driven by forage selection, predator avoidance, activity budgets and/or social affinity (Staniland & Robinson 2008);
- General positive relationship between sexual size dimorphism and spatial segregation (Mysterud 2000);
- (1) Is there a difference in dive depths obtained between male and female southern elephant seals from Marion Island?
- (2) Do male southern elephant seals from Marion Island utilise different water depths, when compared to females (i.e. the depths where they spend most time)?

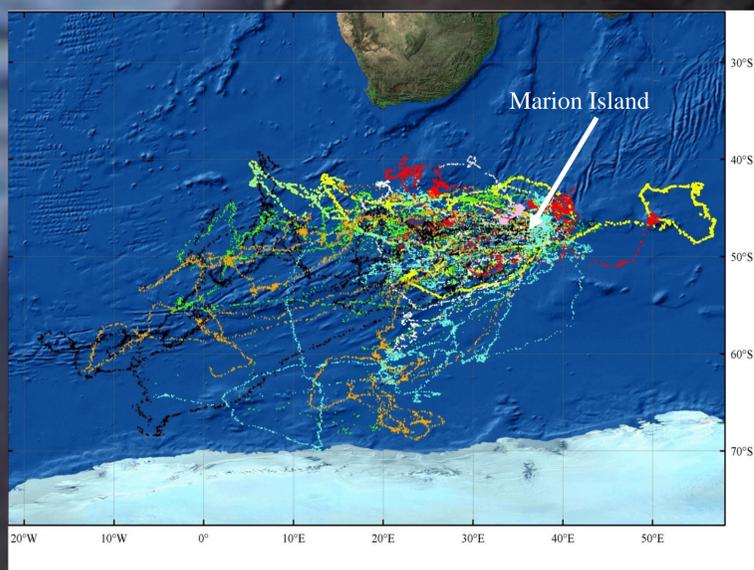


Figure 1: Map indicating spatial movements of southern elephant seals carrying satellite-relay data loggers in this investigation.

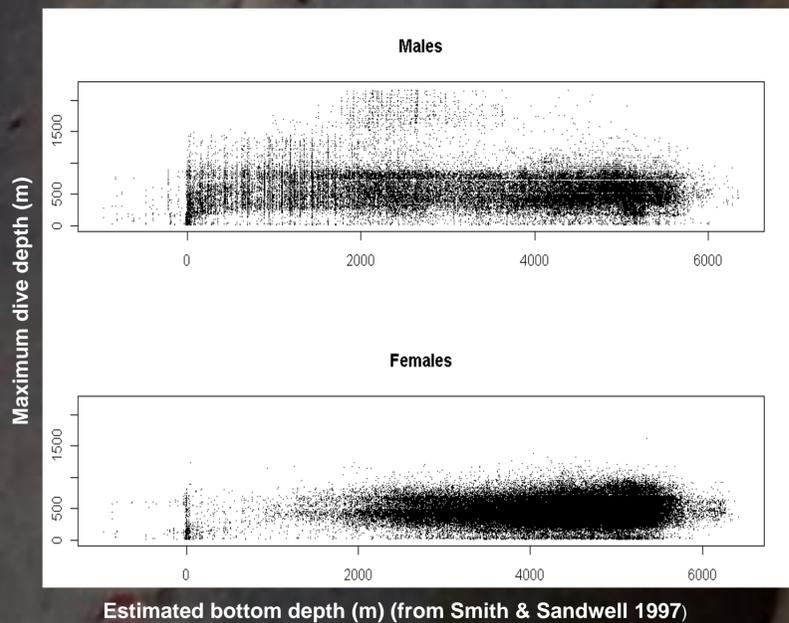


Figure 2: Maximum dive depths (in metres) in relation to estimated ocean bottom depths for the 182 882 dives analysed.

Results

- Male elephant seals dived deeper on average than females (mean maximum depth of $565.3 \pm 292\text{m}$ vs. $459.3 \pm 176.5\text{m}$; $T = -73.6$; $df = 63651$; $p < 0.0001$);
- Males occasionally performed benthic dives, up to depths of approximately 2000m, while females performed almost exclusively pelagic dives (Figure 2);
- Females spent more time in water depths between 200m and 500m, while males spent more time in depths between 600m and 1250m (Table 1 and Figure 3);
- Substantial overlap exists between the sexes in the number of dives to depths in the region of 500m, and also in the percentages of time spent by individuals between 500m and 600m.

References

- Mysterud, A. 2000. *Oecologia* 124, 40-54
 Smith, W.H.F. & Sandwell, D.T. 1997. *Science* 277, 1956-1962
 Staniland, I.J. & Robinson, S.L. 2008. *Anim. Behav.* 75, 1581-1590

Methods

- Fifty-five satellite-relay data loggers (SMRU) deployed between 2004 and 2008 on southern elephant seals hauled out on Marion Island. Forty-eight tracks provided useful dive data (track days ranged between 27 and 345 days);
- Only dive data obtained from adult and sub-adult animals (no juveniles) were used for this investigation;
- After removing incomplete profiles, we used 182 882 dive profiles for analyses;
- Dive profiles were binned in order to obtain actual time estimates spent by each animal in various depth categories (method described in McIntyre et al. in prep.).

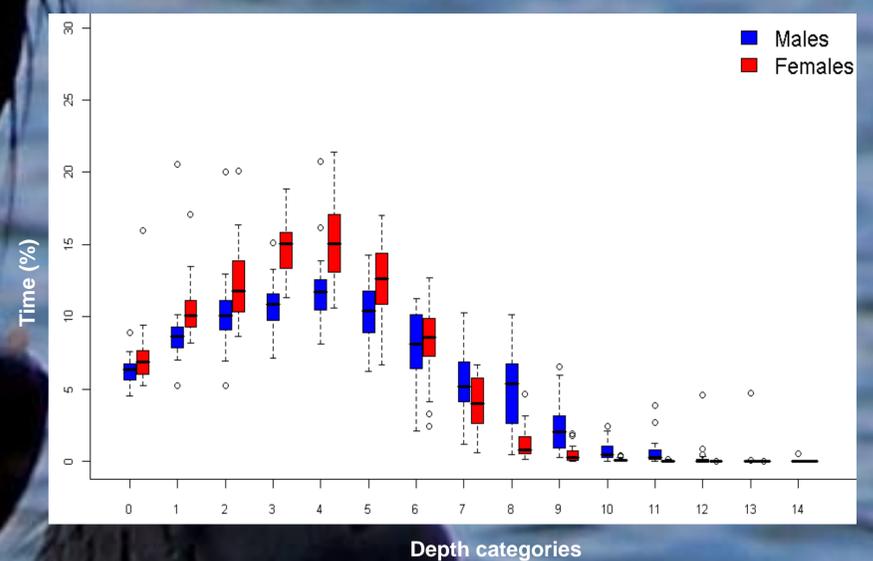


Figure 3: Depth use by southern elephant seals from Marion Island, displayed as percentages of time spent in depth categories. Depth categories present various water depth layers (0 = sea surface; 1 = 0-100m; 2 = 100-200m; 3 = 200-300m; 4 = 300-400m; 5 = 400-500m; 6 = 500-600m; 7 = 600-700m; 8 = 700-800m; 9 = 800-900m; 10 = 900-1000m; 11 = 1000-1250m; 12 = 1250-1500m; 13 = 1500-2000m; 14 = > 2000m)

Depth category	Males (n = 19)	Females (n = 27)	ANOVA		
	Mean time (%)	Mean time (%)	df	T	p
0-100m	12.00 ± 4.3	13.42 ± 2.8	28	1.2522	0.2209
100-200m	13.69 ± 4.3	15.35 ± 3.8	36	1.3657	0.1805
200-300m	14.26 ± 2.5	18.30 ± 2.6	40	5.3244	0.0000
300-400m	16.01 ± 3.8	19.39 ± 3.5	37	3.0761	0.0039
400-500m	13.71 ± 2.7	16.13 ± 2.8	40	2.9507	0.0053
500-600m	10.69 ± 3.1	10.58 ± 3.1	38	-0.1251	0.9011
600-700m	7.20 ± 2.7	4.73 ± 2.1	32	-3.2899	0.0024
700-800m	6.56 ± 3.7	1.37 ± 1.2	21	-5.8880	0.0000
800-900m	3.13 ± 2.4	0.55 ± 0.6	20	-4.6751	0.0001
900-1000m	0.96 ± 0.9	0.14 ± 0.2	19	-3.8377	0.0011
1000-1250m	0.91 ± 1.4	0.05 ± 0.1	18	-2.7444	0.0133
1250-1500m	0.49 ± 1.5	0.00	18	-1.4692	0.1590
1500-2000m	0.36 ± 1.5	0.00	18	-1.0488	0.3081
>2000m	0.04 ± 0.2	0.00	18	-1.0000	0.3306

Table 1: Analysis of Variance (ANOVA) test results indicating significant differences in mean percentages of time spent by animals of different sexes in different depth layers. Statistically significant p-values ($p < 0.05$) are highlighted.

Discussion

- Some segregation exists between sexes of southern elephant seals in the depth use patterns displayed by animals of either sex. Males tend to utilise deeper water depths more than females;
- Segregation between the sexes is not as extreme as was predicted, based on the extreme sexual dimorphism displayed by this species;
- We therefore suggest that the segregation in depth use exhibited in this species is a by-product of greater physical ability and physiological capabilities of males, and is not driven by forage selection, predator avoidance, activity budgets or social affinity.

Acknowledgements

Many thanks to all the field assistants involved in the Pinniped Monitoring Programme on Marion Island, specifically those involved in SRDL deployments between 2004 and 2008