



The cephalopod prey of southern elephant seals (*Mirounga leonina*) from Stranger Point, King George Island, Antarctica

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Introduction. Southern elephant seals (*Mirounga leonina* L.), the largest of all seals, are distributed throughout the Southern Ocean with a current total population size of ca. 750000 specimens (Laws, 1984). Males attain a total length of 6 m and a total weight of up to 5000 kg. Females are considerably smaller reaching 3 m in length and a weight of 800 kg. They are highly polygynous and gregarious in their breeding behaviour, and may also form large aggregations at other times. There are three major breeding populations centred in South Georgia, the Kerguelen Islands and the Macquarie Islands in the Atlantic, Indian and Pacific sector, respectively. Southern elephant seals are deep-diving predators which can dive for 120 minutes to depths exceeding 1200 m. Hence, analysis of their food provides useful information about distribution, abundance and biology of their preferred prey which consists mainly of cephalopods (75%) and fish (25%), and which is difficult to sample by more conventional means, such as research cruises or commercial fisheries catches.

Material and methods. Studies were carried out in the southernmost breeding colony of southern elephant seals (ca. 600 females) in Stranger Point, King George Island, Antarctic Peninsula (62°14'S, 58°30'W) during austral summers of 1992 and 1993 (see map). In total, 59 seals were anaesthetised by injection of Ketamine-Hydro-chloride (13 females and 9 juvenile males in 1992, and 17 males and 20 juveniles in 1993). Selections were made at random from individuals recently hauled out. Standard length and girth were recorded and body weight was estimated using allometric functions. Stomach lavages were made adapting the technique described by Antonelis et al. (1987). Cephalopod beaks were sampled from the stomach contents and stored in 70% ethanol. Lower beaks were identified by comparison with reference collections and by reference to Clarke (1986). Lower rostral length (LRL) was measured with digital callipers to an accuracy of 0.1 mm. Allometric equations were used from the literature to relate LRL to dorsal mantle length (ML in mm) and wet mass (in grammes).

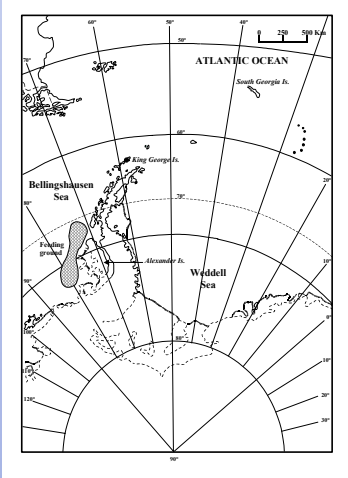


Table 1. Estimated number, mass, and frequency of occurrence of cephalopods in the stomach contents of 36 southern elephant seals (61% of n=59) sampled in 1992 and in 1993 in Stranger Point, King George Island, Antarctica.

Species	n	(%)	Mass (g)	(%)	% Occurrence
Teuthoidea					
<i>Psychroteuthis glacialis</i>	188	(83.9)	27 750	(77.4)	97
<i>Alluroteuthis antarcticus</i>	12	(5.3)	3 467	(9.7)	22
<i>Kondakovia longimana</i>	3	(1.3)	2 141	(6.0)	8
<i>Galiteuthis glacialis</i>	9	(4.0)	389	(1.1)	19
<i>Gonatus antarcticus</i>	2	(0.9)	161	(0.4)	6
<i>Brachioteuthis ?picta</i>	8	(3.6)	75	(0.2)	17
Octopoda					
<i>Grimpoteuthis glacialis</i>	1	(0.5)	1 800	(5.0)	3
<i>Pareledone charcoti</i>	1	(0.5)	58	(0.2)	3
Total	224	(100.0)	35 841	(100.0)	

Table 2. Summary of lower rostral length (LRL for Teuthoidea) and lower hood length (LHL for Octopoda), estimated mantle length (DML) and mass of cephalopods eaten by southern elephant seals in Stranger Point, King George Island, Antarctica.

Species	n	LRL or LHL (mm)		DML (mm)		Mass (g)	
		Mean	Range	Mean	Range	Mean	Range
Teuthoidea							
<i>Psychroteuthis glacialis</i>	188	4.8	1.9 - 7.9	168	64 - 389	148	6 - 826
<i>Alluroteuthis antarcticus</i>	12	4.3	2.0 - 5.8	146	66 - 199	289	26 - 604
<i>Galiteuthis glacialis</i>	9	3.4	1.2 - 5.0	150	61 - 216	43	3 - 90
<i>Brachioteuthis ?picta</i>	8	3.3	3.1 - 3.8	83	79 - 93	9	9 - 11
<i>Kondakovia longimana</i>	3	8.9	8.3 - 9.8	310	287 - 343	714	562 - 949
<i>Gonatus antarcticus</i>	2	4.6	4.5 - 4.6	152	150 - 154	80	77 - 83
Octopoda							
<i>Grimpoteuthis glacialis</i>	1	8.2		110		1800	
<i>Pareledone charcoti</i>	1	3.4		38		58	

Results. Thirty-six (61%) stomachs contained a total of 224 lower cephalopod beaks. Other prey were fish (in 10% of investigated stomachs), Euphausiacea (9%), bivalves (1%), and isopods (1%). The cephalopod prey represented a total wet mass of 35.8 kg (Table 1). Six species of squid and 2 octopod species occurred (Table 2). The glacial squid *Psychroteuthis glacialis* was most abundant numerically (83.9%) as well as in terms of biomass (77.4%); its LRL size frequency distribution is shown in Fig. 1. All other species were much lower in abundance with *Alluroteuthis antarcticus* being the second most important (9.7% estimated biomass), followed by *Kondakovia longimana* (6.0%) and the cirrate octopod *Grimpoteuthis glacialis* (5.0%). The remaining four species, *Galiteuthis glacialis*, *Gonatus antarcticus*, *Brachioteuthis ?picta* and *Pareledone charcoti* accounted for less than 2% of the total cephalopod biomass estimated from the seals' diet. Relative abundance and species number of cephalopods in the diet increased with the size of the seals, but did not differ between sexes and sampling years.

Conclusions. The present study gives the first information on the cephalopod diet of southern elephant seals of the Antarctic Peninsula region. The data suggest that the seals are preying upon a cephalopod community that is typical for the high-Antarctic seas south of the Antarctic Polar Front such as the southern Bellingshausen Sea. That area has been suggested to be a major feeding ground for southern elephant seals of the Antarctic Peninsula region (Bornemann et al., 1999). It differs considerably from that found in southern elephant seal diet studies from more northern breeding sites in the Southern Ocean such as South Georgia (Rodhouse et al., 1992) or Heard and Macquarie Island (Green & Burton, 1993; Slip, 1995), where the cephalopod community preyed upon by the seals is more diverse.

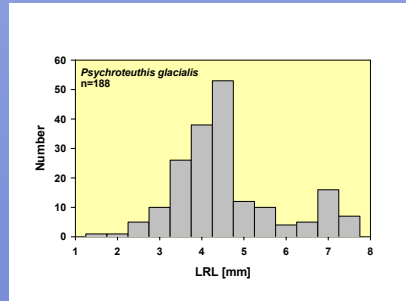


Fig. 1. *Psychroteuthis glacialis*: LRL size frequency distribution.

References.

Antonelis, G.A., Lowry, M.S., DeMaster, D.P., Fiscus, C.H. (1987). Assessing northern elephant seal feeding habits by stomach lavage. *Mar. Mammal Sci.* 3:308-322.
 Bornemann, H., Pütz, J., Ramdohr, S., Kreyser, M., Carlini, A., Sellmann, L. (1999). Southern elephant seal migration and Antarctic sea ice. EASIS Symposium, *Ecology of the Antarctic Sea Ice Zone*, Bremerhaven, 22-25 June 1999, poster presentation.
 Clarke, M.R. (1986). A handbook for the identification of cephalopod beaks. Clarendon Press, Oxford.
 Green, K., Burton, H.R. (1993). Comparison of the stomach contents of southern elephant seals, *Mirounga leonina*, at Macquarie and Heard Islands. *Mar. Mammal Sci.* 9:10-22.
 Laws, R.M. (1984). Seals. In: Laws, R.M. (ed.) *Antarctic ecology*. Vol. 2. Academic Press, London, pp. 621-715.
 Rodhouse, P.G., Arnborn, T.R., Fedak, M.A., Yeatman, J., Murray, A.W.A. (1992). Cephalopod prey of the southern elephant seal, *Mirounga leonina* L. *Can. J. Zool.* 70:1007-1015.
 Slip, D.J. (1995). The diet of southern elephant seals (*Mirounga leonina*) from Heard Island. *Can. J. Zool.* 73:1519-1528.