The following supplement accompanies the article

Temporal variation in western Hudson Bay ringed seal *Phoca hispida* diet in relation to environment

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Marine Ecology Progress Series 481:269–287 (2013)

Supplement. Equations to estimate fish body length and wet mass from otolith length; energy density of fish and invertebrates included in ringed seal (*Phoca hispida*) diet; and mean nitrogen and carbon stable isotope ratios for ringed seals and a collection of prey taxa

Table S1. *Phoca hispida*. Regression equations used to estimate body length (BL, cm) from otolith length (OL, mm) of fish recovered from ringed seal stomachs collected in Arviat, Nunavut, Canada, over the period 1991 to 2006

Prey taxon	Body length (cm)				
	Equation	r^2	n	[range OL]	Source
Ammodytidae					
Ammodytes spp.	*BL* = (76.454**OL*-13.547)/10	0.92	486	[1.04–3.07]	1
Clupeidae					
Clupea harengus	*BL* = (15.627+57.86**OL*)/10	0.98	477	[0.87–3.02]	1
Cottidae					
Unidentified spp.[a]	*BL* = 0.5445**OL*^2+1.1569**OL*+2.9606	0.91	33	[1.14–3.81]	2
Artediellus sp.	*BL* = -0.1261**OL*^2+2.9693**OL*	0.84	31	[1.98–4.93]	2
Gymnocanthus tricuspis[a]	*BL* = 0.5445**OL*^2+1.1569**OL*+2.9606	0.91	33	[1.14–3.81]	2

Myoxocephalus scorpioides[b]	*BL* = 2.2271**OL*^1.2493	0.83	19	[4.38–7]	2
Myoxocephalus scorpius	*BL* = 2.2271**OL*^1.2493	0.83	19	[4.38–7]	2
Myoxocephalus sp.[b]	*BL* = 2.2271**OL*^1.2493	0.83	19	[4.38–7]	2
Triglops murrayi	*BL* = 0.5445**OL*^2+1.1569**OL*+2.9606	0.91	33	[1.14–3.81]	2
Gadidae					
Unidentified spp.[c]	*BL* = 0.1001**OL*^2+0.9985**OL*+2.6473	0.95	330	[4.2–17.9]	2
Boreogadus saida	*BL* = (19.433+(18.612**OL*)+0.546*(*OL*)^2))/10	0.81	270	[1.08–11.55]	1
Gadus morhua	*BL* = 4.4986+0.1184**OL*+0.1997**OL*^2	0.96	502	[1.81–17.95]	3
Gadus ogac	*BL* = 0.1001**OL*^2+0.9985**OL*+2.6473	0.95	330	[4.2–17.9]	2
Liparidae					
Liparis sp.	*BL* = 5.7414**OL*^1.3634	0.83	43	[0.97–2.69]	2
Osmeridae					
Mallotus villosus	*BL* = ((215.741**OL*)-(176.657**OL*^2)+(71.062**OL*^3)-(9.449**OL*^4)-23.151)/10	0.98	407	[0.64–3.42]	1
Osmerus mordax	*BL* = 2.8571**OL*^1.131	0.88	57	[3.71–6.35]	2
Stichaeidae					
Eumesogrammus praecisus	*BL* = 3.4394**OL*^0.982	0.91	40	[2.2–6.39]	2
Lumpenus lampretaeformis[d]	*BL* = 9.2666**OL*^0.6212	0.87	62	[1.05–2.56]	2
Lumpenus fabricii[d]	*BL* = 9.2666**OL*^0.6212	0.87	62	[1.05–2.56]	2
Leptoclinus maculatus	*BL* = 9.2666**OL*^0.6212	0.87	62	[1.05–2.56]	2
Gasterosteidae					
Pungitius pungitius	*BL* = 7.21**OL*		35	[1.5–5.8]	4

[1]Lidster et al. (1994); [2]G. Stenson & D. McKinnon (unpubl. data); [3]B. Healey (unpubl. data); [4]Leopold et al. (1991)

[a]Equation from *Triglops murrayi*; [b]Equation from *Myoxocephalus scorpius*; [c]Equation from *Gadus morhua;* [d]Equation from *Leptoclinus maculatus*

Table S2. *Phoca hispida*. Energy density (kJ g^{-1} wet mass) and regression equations used to estimate wet mass (WM, g) from otolith length (OL, mm) or body length (BL, cm) of prey recovered from ringed seal stomachs collected in Arviat, Nunavut, Canada, 1991 to 2006

Prey taxon	Wet mass (g) Equation	r^2	n	Source	Energy (kJ g^{-1} WM)	Source
Fish						
Ammodytes spp.	*WM* = 2.26*(*BL*/10)^2.86	0.79	87	1	5.06	1
Clupea harengus	*WM* = 1.48*OL^3.08			2	7.18	6
Cottidae[a]	*WM* = 7.37*(*BL*/10)^2.57	0.87	252	1	4.57	7
Artediellus sp.[a]	*WM* = 7.37*(*BL*/10)^2.57	0.87	252	1	3.69	8
Gymnocanthus tricuspis	*WM* = 11.11*(*BL*/10)^4.03	0.92	17	1	4.57	7
Myoxocephalus scorpioides	*WM* = 9.54*(*BL*/10)^2.64	0.96	10	1	4.43	8
Myoxocephalus scorpius	*WM* = 9.54*(*BL*/10)^2.64	0.96	10	1	4.43	8
Myoxocephalus sp.	*WM* = 9.54*(*BL*/10)^2.64	0.96	10	1	4.43	8
Triglops murrayi	*WM* = 6.48*(*BL*/10)^2.96	0.81	113	1	4.33	1
Gadidae[b]	*WM* = (10^(-5.2106+3.0879*Log_{10}(*BL*)))*1000		502	4	4.7	8
Boreogadus saida	*WM* = 6.24*(*BL*/10)^2.98	0.86	354	1	4.7	1
Gadus morhua	*WM* = (10^(-5.2106+3.0879*Log_{10}(*BL*)))*1000		502	4	4.52	9
Gadus ogac	*WM* = 0.0101*OL^4.0995	0.96	239	3	4.7	8
Liparis sp.	*WM* = 0.0065*BL^3.1802	0.96	39	3	2.84[d]	8
Mallotus villosus	*WM* = 4.21*(*BL*/10)^3.74	0.85	187	1	4.9	1
Eumesogrammus praecisus	*WM* = 6.70*(*BL*/10)^3.29	0.96	109	1	3.22	1
Lumpenus lampretaeformis[c]	*WM* = 3.04*(*BL*/10)^2.16	0.87	70	1	5.57	11
Lumpenus fabricii[c]	*WM* = 3.04*(*BL*/10)^2.16	0.87	70	1	4.51	11
Leptoclinus maculatus	*WM* = 3.04*(*BL*/10)^2.16	0.87	70	1	4.97	1
Osmerus mordax	*WM* = 0.0026*BL^3.3001		59	3	4.2	11
Pungitius pungitius	*WM* = 1.54*OL^2.62		35	5	7.26	12
Invertebrates						
Copepoda					4.12	8
Cumacea					3.63[e]	13
Atylus carinatus					3.88	7
Onisimus litoralis					8.24	14

Hyperiidae	4.18	1
Themisto libellula	4.18	1
Gammaridae	3.88	7
Mysidae	3.63	13
Decapoda	3.48	1
Eualus fabricii	4.87	8
Lebbeus groenlandicus	4.81	8
Lebbeus polaris	5.46	8
Spirontocaris phippsi	4.37[f]	15
Dendrobranchiata	3.48	1
Mollusca	4[g]	10
Bivalvia	3.03[h]	10
Polychaeta	2.78	8
Echinoidea	1.33[i]	10

[1]Elliott & Gaston (2008); [2]Ross (1993); [3]G. Stenson & D. McKinnon (unpubl. data); [4]B. Healey (unpubl. data); [5]Leopold et al. (1991); [6]Mean of values from D. Chabot (unpubl. data; 5.61 kJ g^{-1}), Anthony et al. (2000), Lawson et al. (1998), Arrhenius & Hansson (1993), and Steimle & Terranova (1985); [7]Mean of values from D. Chabot (unpubl. data; 4.47 kJ g^{-1}) and Bradstreet & Finley (1983); [8]D. Chabot (unpubl. data); [9]Mean of values from D. Chabot (unpubl. data; 5.04kJ g^{-1}), Lawson et al. (1998), Steimle & Terranova (1985), and Holdway & Beamish (1984); [10]Steimle & Terranova (1985); [11]M. Hammill et al. (unpubl. data); [12]Mean of values from D. Chabot (unpubl. data; 9.71 kJ g^{-1}), and Ball et al. (2007); [13]Mean of values from D. Chabot (unpubl. data; *Boreomysis arctica*: 3.76 kJ g^{-1}, *Mysis mixta*: 3.14 kJ g^{-1}), Bradstreet & Finley (1983), and Tyler (1973); [14]Bradstreet & Finley (1983); [15] Tyler (1973)

[a]Equation from "all sculpins"; [b]Equation from *Gadus morhua*; [c]Equation from *Leptoclinus maculatus*; [d]Mean of 3 species; [e]Value from Mysidae; [f]Value from *Spirontocaris* sp.; [g]Mean of 21 species; [h]Mean of 11 species; [i]Mean of 4 species

Table S3. *Phoca hispida*. Mean nitrogen ($\delta^{15}N$) and carbon ($\delta^{13}C$) stable isotope ratios of ringed seal muscle tissue collected in spring and fall 1991 to 1992 and 2003 to 2006 in Arviat, Nunavut, Canada, and of fish and invertebrate species collected during the open water season in Hudson Bay over the period 2004 to 2007 in marine and riverine habitats. Carbon isotope ratios were corrected for the oceanic Suess effect and the presence of carbonates for invertebrates (C_{cor}). Mean ± standard deviation

Taxon		n	$d^{15}N$ (‰)	$d^{13}C_{cor}$ (‰)	Habitat
Seal					
Phocidae					
	Ringed seal *Phoca hispida*	217	15.31 ± 1.31	–19.60 ± 0.88	Marine
	1991–1992	52	16.38 ± 1.09	–19.28 ± 1.22	
	2003–2006	165	15.03 ± 1.27	–19.84 ± 0.69	
	Spring	33	14.74 ± 0.70	–19.16 ± 0.59	
	Fall	184	15.41 ± 1.37	–19.68 ± 0.90	
	Adult	94	15.36 ± 1.15	–19.32 ± 0.94	
	Juvenile	88	15.41 ± 1.39	–19.78 ± 0.79	
	Pup	33	14.91 ± 1.48	–19.91 ± 0.75	
Fish					
Gadidae					
	Arctic cod *Boreogadus saida*	27	14.66 ± 1.29	–19.19 ± 0.80	Marine
	Greenland cod *Gadus Ogac*	5	15.34 ± 0.36	–19.26 ± 0.48	Marine
Zoarcidae		11	15.12 ± 0.59	–18.13 ± 1.05	Marine
	Fish doctor *Gymnelus viridis*				
Pholidae		2	13.05 ± 1.03	–18.34 ± 0.11	Marine
	Banded gunnel *Pholis fasciata*				
Agonidae		7	15.30 ± 0.59	–18.17 ± 0.77	Marine
	Atlantic poacher *Leptagonus decagonus*				
Ammodytidae		35	12.80 ± 1.50	–20.71 ± 1.27	Marine
	Ammodytes spp.[a]				
Cottidae		24	14.27 ± 1.29	–18.78 ± 1.19	Marine
	Twohorn sculpin *Icelus bicornis*				
	Arctic sculpin *Myoxocephalus scorpioides*				
	Moustache sculpin *Triglops murrayi*				
	Ribbed sculpin *Triglops pingelii*				
	Triglops spp.				
	Unidentified sculpins				

Stichaeidae		24	14.00 ± 1.00	–18.29 ± 1.40	Marine
	Fourline snakeblenny *Eumesogrammus praecisus*				
	Daubed shanny *Leptoclinus maculatus*				
	Arctic shanny *Stichaeus punctatus*				
	Unidentified shannies				
Osmeridae					
	Capelin *Mallotus villosus*	34	13.83 ± 0.77	–19.32 ± 0.68	Marine
	Rainbow smelt *Osmerus mordax*	1	12.87	–26.00	River
Liparidae		3	13.29 ± 0.45	–20.45 ± 0.69	Marine
	Unidentified snailfish				
Gasterosteidae		1	13.95	–24.02	River
	Unidentified stickleback				
Invertebrates					
Actiniaria		1	15.52	–14.34	Marine
	Unidentified sea anemone				
Amphipoda					
	Unidentified amphipods	22	8.56 ± 3.69	–18.89 ± 1.10	Marine
	Gammaridae	3	9.73 ± 0.29	–17.98 ± 0.40	Marine
	Hyperiidae	90	11.39 ± 1.74	–20.70 ± 1.27	Marine
	Hyperoche medusarum				
	Parathemisto libellula				
	Unidentified hyperiids				
Asteroidea		13	9.30 ± 1.04	–18.36 ± 0.76	Marine
	Unidentified starfish				
Chaetognatha		1	13.87	–19.02	Marine
	Unidentified worm				
Copepoda		14	10.64 ± 1.00	–20.53 ± 0.30	Marine
	Calanus spp.				
Decapoda		19	13.52 ± 2.05	–18.44 ± 2.22	Marine
	Arctic argid *Argis dentata*				
	Arctic eualid *Eualus fabricii*				
	Circumpolar eualid *Eualus gaimardii*				
	Greenland shrimp *Eualus macilentus*				
	Spiny lebbeid *Lebbeus groenlandicus*				
	Polar lebbeid *Lebbeus polaris*				
	Lebbeus spp.				

	Striped shrimp *Pandalus montagui*				
	Pandalus spp.				
	Parrot shrimp *Spirontocaris spinus*				
	Unidentified shrimps				
Euphausiidae					
	Unidentified euphausiids	27	9.35 ± 1.27	–20.75 ± 0.36	Marine
	Unidentified euphausiids, small	10	10.21 ± 1.39	–22.73 ± 0.40	River
Gastropoda		1	14.17	–21.54	Marine
	Unidentified gastropod				
Mysidae		46	9.63 ± 1.70	–18.73 ± 1.07	Marine
	Unidentified mysids				
Mytilidae		8	8.07 ± 0.96	–19.78 ± 0.48	Marine
	Unidentified mussels				
Teuthida		4	13.41 ± 0.88	–18.01 ± 0.08	Marine
	Unidentified squids				

[a]*Ammodytes dubius* and *Ammodytes hexapterus* are found in Hudson Bay (Coad & Reist 2004)

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