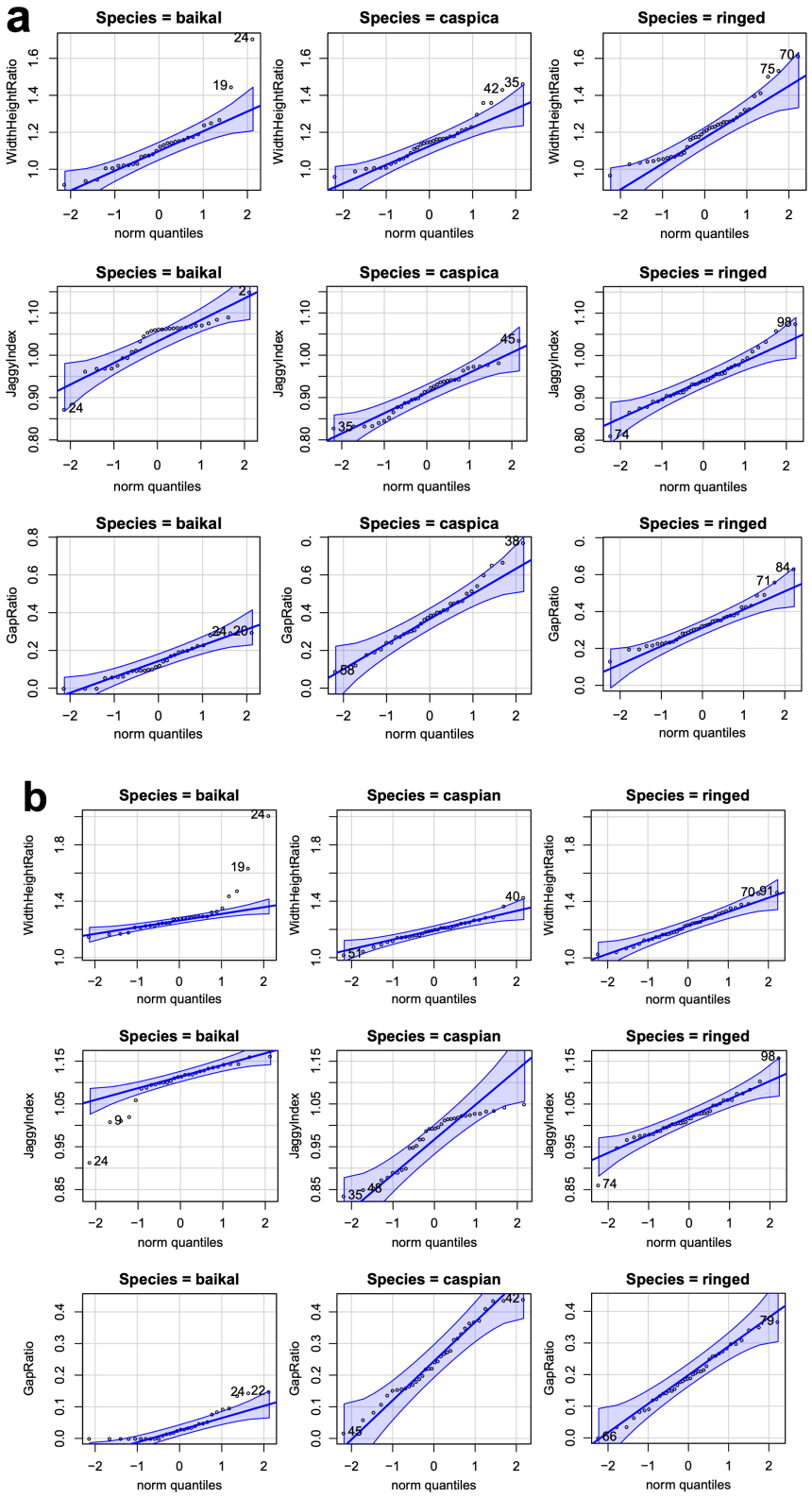

Fig. S1. Normal Q-Q plot of cusp index, gap ratio, width-height ratio of *Pusa* seals for (a) maxilla and (b) mandible.

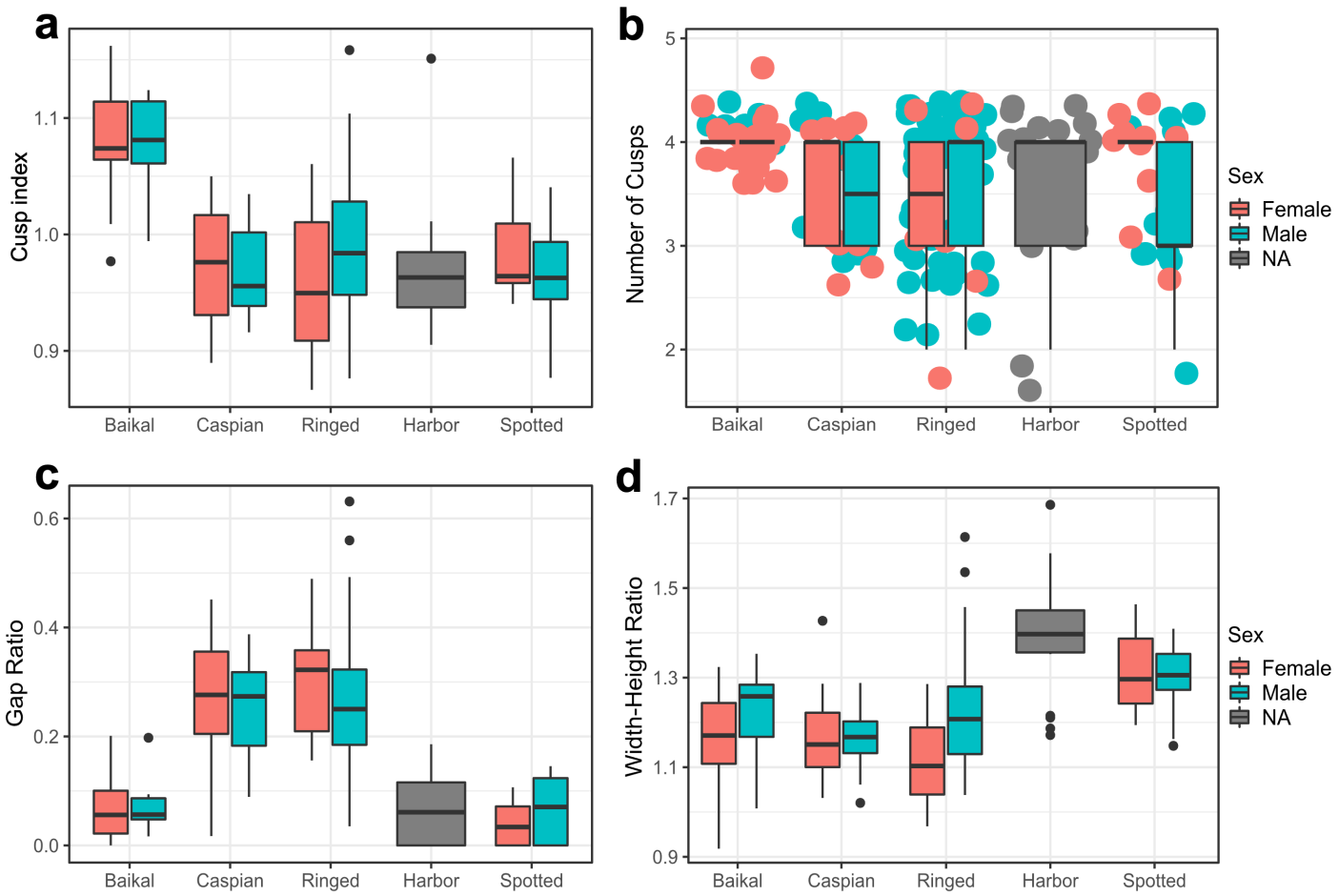

Fig. S2. Box plot and jitter plot comparing (a) cusp index, (b) number of cusps, (c) gap ratio, (d) width-height ratio according to sex in *Pusa* and *Phoca* species. No significant difference was seen between sex in both cusp index and number of cusps in all species.

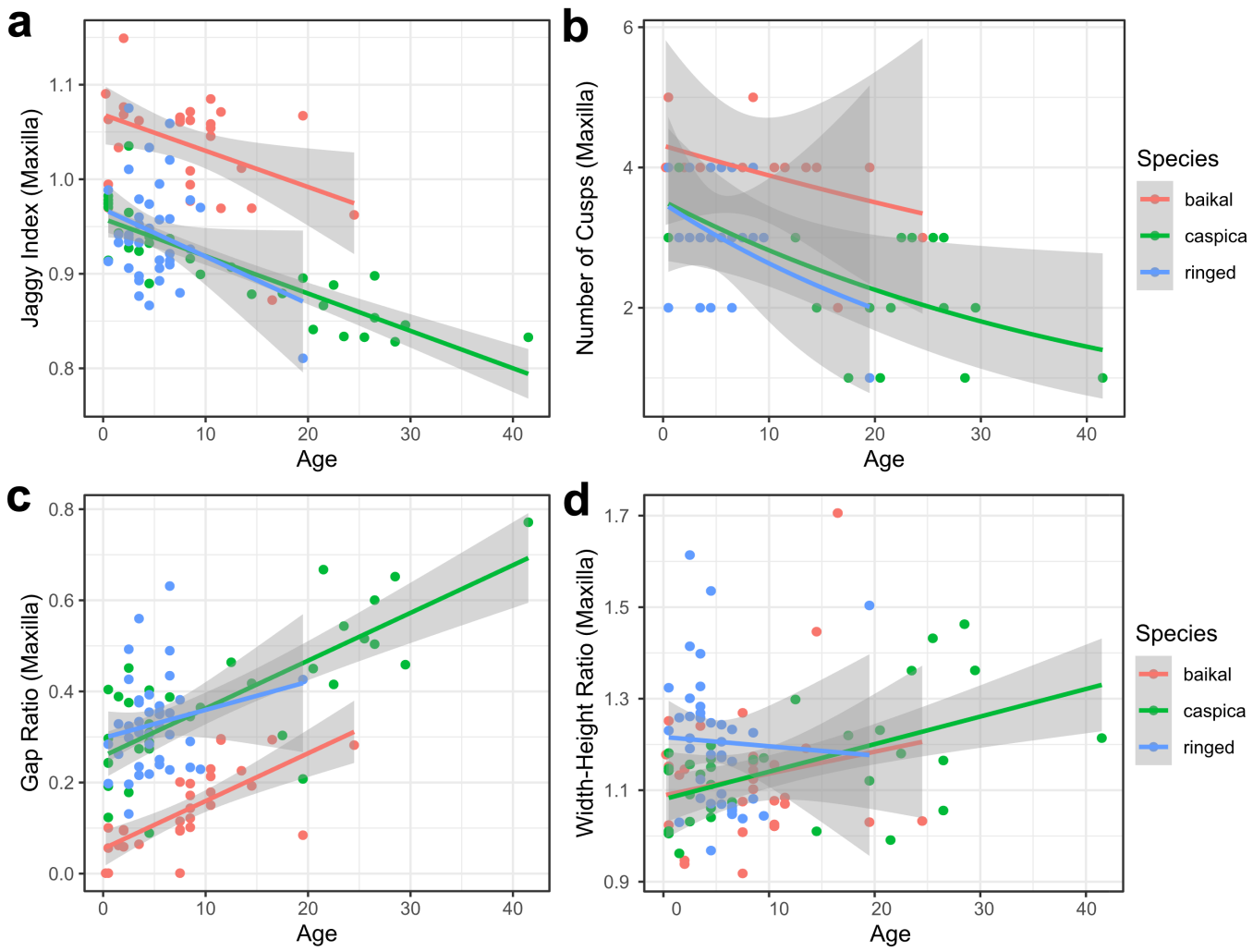

Fig. S3. Relationship between age and maxilla tooth morphologies. Effects of age on (a) cusp index, (b) number of cusps, (c) gap ratio, (d) width-height ratio. Red, green, blue lines represent regression of Baikal, Caspian, ringed seals respectively. Gray bands show 95% credible interval.

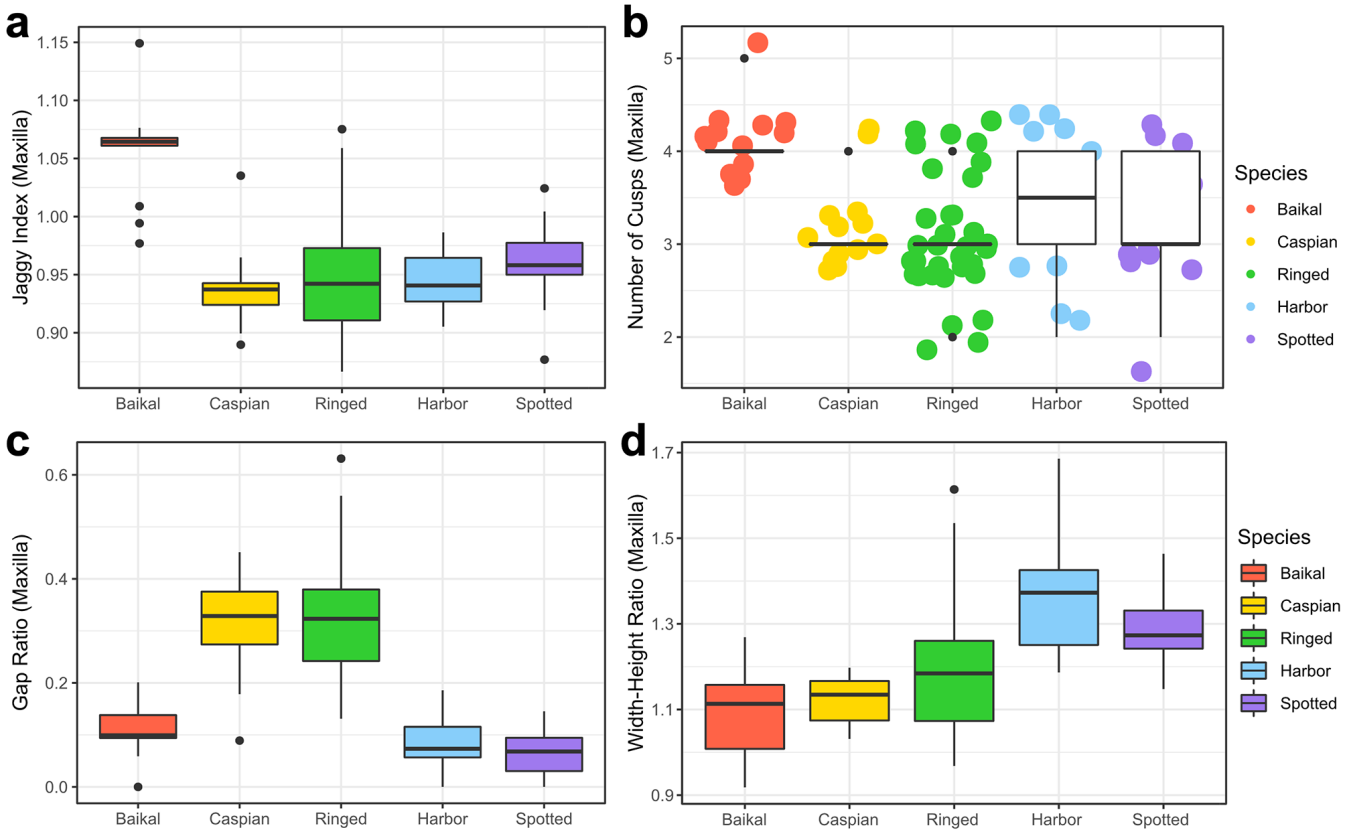

Fig. S4. Box plot of (a) cusp index, (b) number of cusps, (c) gap ratio, (d) width-height ratio of *Pusa* and *Phoca* seals. The box represents Inter-Quartile Range (IQR), while whisker illustrate data range by showing highest or lowest value of data. Outliers (data that are lower than $\boldsymbol{1st\ quartile - 1.5 \times IQR}$ or higher than $\boldsymbol{3rd\ quartile + 1.5 \times IQR}$) are shown in black dots. Since (b) *number of cusps* were similar in most specimens, data were presented by jitter plot, with each dot representing each specimen and black bold lines representing species' average.

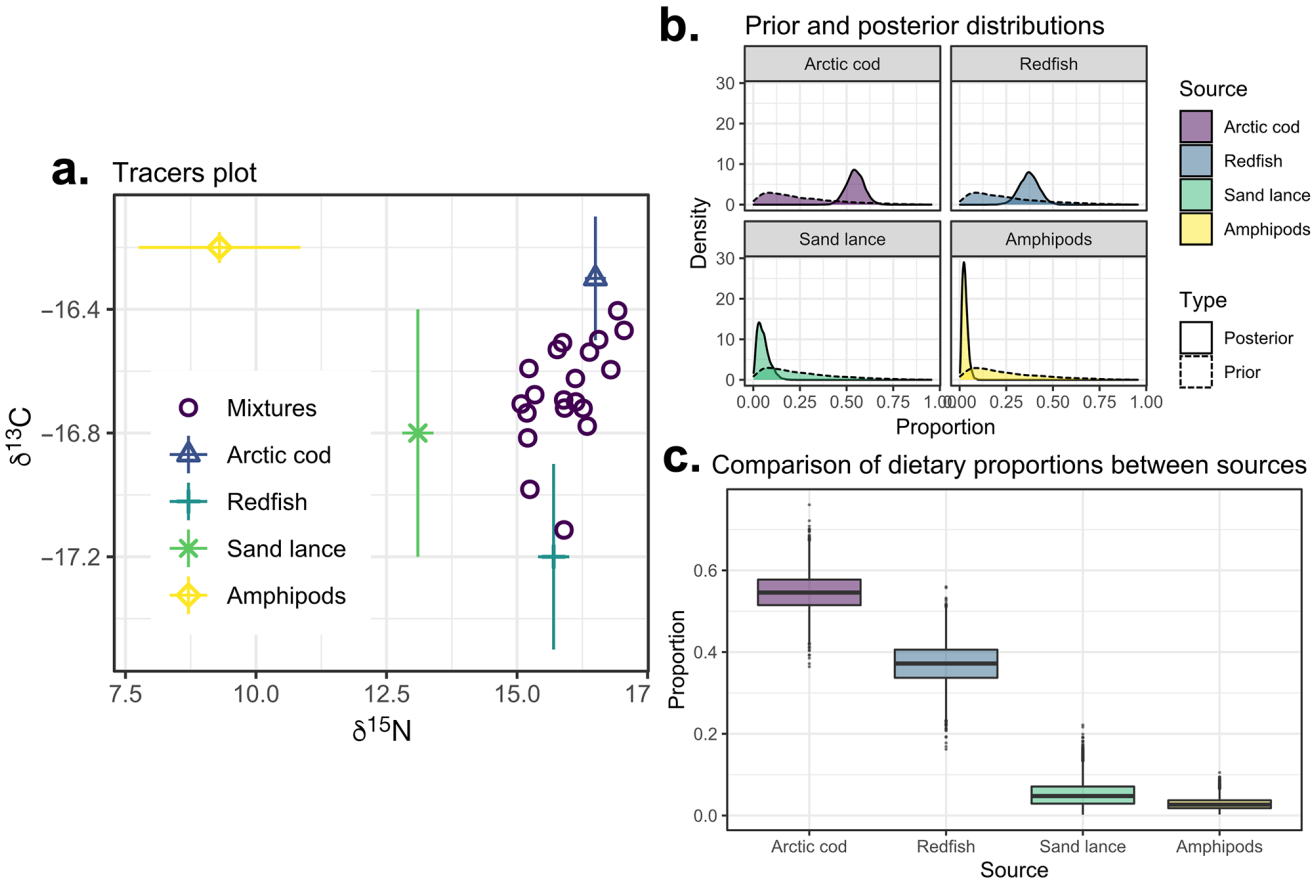

Fig. S5. Example results of diet proportion of harbor seal using Stable Isotope mixing model, *simmr*. (a) Tracers plot using top three frequently predated species and one better used zooplankton. Mixtures represents stable isotope data of harbor seals. (b) Prior and posterior distribution of four prey species. (c) Box plot of estimated proportion of each prey species in harbor seal diet.

Table S1. Result of model selection for number of cusps and tooth morphological indices of mandible. Statistical information of the best model selected are written in the table below. SE stands for Standard Error.

cusp index				
Coefficients:	Estimate	SE	*t* value	p-value
(Intercept)	1.138	0.009	126.226	< 0.001
Age	-0.004	0.000	-9.442	< 0.001
Caspian seal	-0.115	0.011	-10.211	< 0.001
Ringed seal	-0.098	0.010	-9.387	< 0.001
Residual SE = 0.045, df = 107				
Adjusted R-squared = 0.681				
F = 79.27 on 3 and 107 df, p < 0.001				

gap ratio				
Coefficients:	Estimate	SE	*t* value	p-value
(Intercept)	0.008	0.024	0.322	0.748
Age	0.004	0.002	1.601	0.112
Caspian seal	0.153	0.031	4.949	< 0.001
Ringed seal	0.181	0.029	6.293	< 0.001
Age:Caspian	0.003	0.003	1.213	0.228
Age:ringed	-0.003	0.003	-1.243	0.217
Residual SE = 0.076, df = 105				
Adjusted R-squared = 0.588				
F = 32.41 on 5 and 105 df, p < 0.001				

number of cusps				
Coefficients:	Estimate	SE	*z* value	p-value
(Intercept)	1.476	0.104	14.211	< 0.001
Age	-0.014	0.006	-2.357	0.018
Caspian seal	-0.101	0.132	-0.767	0.443
Ringed seal	-0.037	0.119	-0.308	0.758
Null deviance = 22.858, df = 110				
Residual deviance = 15.638, df = 107				
Family = Poisson distribution, log link function, AIC = 373.7				

Width Height Ratio				
Coefficients:	Estimate	SE	*t* value	p-value
(Intercept)	1.227	0.039	31.678	< 0.001
Age	0.010	0.004	2.524	0.013
Caspian seal	-0.016	0.049	-0.327	0.744
Ringed seal	-0.032	0.046	-0.705	0.482
Age:Caspian	-0.011	0.004	-2.566	0.012
Age:ringed	0.000	0.004	-0.091	0.928
Residual SE = 0.122, df = 105				
Adjusted R-squared = 0.255				
F = 8.536 on 5 and 105 df, p < 0.001				

Table S2. Results of inter-species comparison using Steel-Dwass test. Pairs with statistically significant difference are written in bold.

	Species		Cusp index			Number of cusps			Gap ratio			Width height ratio		
			Estimate	Statistics	p-value	Estimate	Statistics	p-value	Estimate	Statistics	p-value	Estimate	Statistics	p-value
Maxilla	Baikal	Caspian	0.016	-25.906	**< 0.0001**	0.071	-8.806	**< 0.0001**	0.929	6.931	**< 0.0001**	0.582	0.707	0.985
	Baikal	Harbor	0.014	-28.290	**< 0.0001**	0.232	-3.373	**0.041**	0.350	-1.218	0.801	0.957	12.564	**< 0.0001**
	Baikal	Ringed	0.059	-13.232	**< 0.0001**	0.109	-11.070	**< 0.0001**	0.987	44.228	**< 0.0001**	0.708	2.521	0.159
	Baikal	Spotted	0.036	-15.821	**< 0.0001**	0.193	-4.342	**0.009**	0.271	-2.179	0.267	0.946	11.470	**< 0.0001**
	Caspian	Harbor	0.585	0.672	0.990	0.588	0.687	0.964	0.038	-12.990	**< 0.0001**	0.992	45.255	**< 0.0001**
	Caspian	Ringed	0.557	0.644	0.992	0.491	-0.137	1.000	0.509	0.094	1.000	0.683	2.375	0.202
	Caspian	Spotted	0.731	2.015	0.341	0.596	0.944	0.882	0.019	-22.160	**< 0.0001**	0.955	11.011	**< 0.0001**
	Harbor	Ringed	0.488	-0.125	1.000	0.415	-0.748	0.949	0.994	69.892	**< 0.0001**	0.194	-4.178	**0.007**
	Harbor	Spotted	0.667	1.339	0.754	0.496	-0.034	1.000	0.433	-0.514	0.997	0.358	-1.068	0.891
	Ringed	Spotted	0.615	1.270	0.794	0.593	1.040	0.838	0.005	-83.745	**< 0.0001**	0.752	3.447	0.030
Mandible	Baikal	Caspian	0.038	-11.593	**< 0.0001**	0.462	-1.000	0.827	0.951	8.922	**< 0.0001**	0.324	-1.596	0.548
	Baikal	Harbor	0.093	-4.372	**0.012**	0.450	-1.000	0.828	0.593	0.685	0.983	0.907	4.726	**0.007**
	Baikal	Ringed	0.086	-8.735	**< 0.0001**	0.471	-1.436	0.588	0.977	27.838	**< 0.0001**	0.380	-1.466	0.623
	Baikal	Spotted	0.024	-20.916	**< 0.0001**	0.417	-1.483	0.562	0.512	0.093	1.000	0.756	2.421	0.194
	Caspian	Harbor	0.269	-1.968	0.372	0.488	-0.183	1.000	0.077	-7.583	**< 0.0001**	0.908	5.546	**0.002**
	Caspian	Ringed	0.620	1.366	0.703	0.509	0.208	0.999	0.434	-0.667	0.985	0.505	0.048	1.000
	Caspian	Spotted	0.385	-0.934	0.916	0.455	-0.659	0.953	0.051	-10.402	**< 0.0001**	0.801	3.172	**0.065**
	Harbor	Ringed	0.782	2.799	0.118	0.521	0.381	0.994	0.915	8.852	**< 0.0001**	0.088	-6.499	**0.001**
	Harbor	Spotted	0.542	0.319	1.000	0.467	-0.443	0.989	0.433	-0.538	0.996	0.208	-2.740	0.123
	Ringed	Spotted	0.287	-2.202	0.275	0.446	-0.902	0.872	0.066	-12.127	**< 0.0001**	0.794	3.906	**0.022**

Table S3. Results of mandible vs maxilla, and male vs female by Wilcoxon rank sum test. Pairs with statistically significant differences are written in bold.

		p-value			
		cusp index	number of cusps	gap ratio	Width Height Ratio
Maxilla vs Mandible	Baikal	**0.002**	0.353	**< 0.0001**	**< 0.0001**
	Ringed	**< 0.0001**	**< 0.0001**	**< 0.0001**	0.312
	Caspian	**< 0.0001**	**< 0.0001**	**0.007**	**< 0.0001**
	Harbor	**0.035**	0.055	0.235	0.353
	Spotted	0.128	**0.038**	0.299	0.347
Male vs Female	Baikal	0.682	0.663	0.801	0.259
	Ringed	0.242	0.517	0.300	**0.025**
	Caspian	0.940	0.743	0.527	0.860
	Harbor	NA	NA	NA	NA
	Spotted	0.266	**0.038**	0.202	0.799

Table S4. Principal component loadings of each variable.

variables	PC1	PC2	PC3	PC4	PC5	PC6	PC7
width	-0.443	0.321	0.130	-0.174	0.428	-0.202	0.655
height	-0.380	-0.105	0.611	-0.192	0.326	0.076	-0.567
cusp	-0.285	-0.470	-0.430	-0.708	-0.100	-0.026	-0.008
gap length	0.472	-0.060	-0.033	-0.231	0.543	0.637	0.135
cusp index	-0.283	-0.542	-0.299	0.596	0.426	-0.006	0.011
gap ratio	0.485	-0.074	-0.037	-0.152	0.408	-0.736	-0.163
width height ratio	-0.202	0.602	-0.577	0.001	0.239	0.068	-0.451

Table S5. Frequency of Occurrence (%) of each species collected from past studies.

Species	Prey	FO (%)	Location	Subject	Research Year	Reference
Baikal	***M. branickii (All age group)***	**35**	Ushkan Islands, Baikal lake	Intestine	1980	Egorova et al. 1992
	M. branickii (<1yr pup)	100				
	M. branickii (Juvenile)	67				
	M. branickii (Adult)	9				
Ringed	*Themisto libelluta*	17.2	Spitsbergen, Norway	Gastrointestinal tracts	2014~2017	Bengtsson et al. 2020
	Gammarus wilkitzkii	15.2				
	Amphipoda spp.	3.03				
	All Amphipods	**35.43**				
	Amphipoda	**38.5**	Alaska	Stomach	1996~2001	Dehn et al. 2007
	Parathemisto libellula	6.4	Spitsbergen, Norway	Gastrointestinal tracts	2002~2004	Labansen et al. 2007
	Gammarus wilkitzkii	1.9				
	Onisimus glacialis	0.4				
	Anonyx spp.	1.9				
	Stegocephalus inflatus	0.7				
	All Amphipods	**11.3**				
	All Amphipods	**54.49**	Alaska	Stomach	1961 ~ 1984	Quakenbush et al. 2011
	All Amphipods	**30.95**	Alaska	Stomach	1998 ~ 2009	
Harbor	***Crustacean***	**6.7**	Moray Firth, Scotland	Faeces	1988	Pierce et al. 1991
	Crustacean	**0**	Moray Firth, Scotland	Faeces	1989~1992	Tollit & Thompson 1996
	Crustacean	**0.08**	San Juan Island	Scats	2005 ~ 2008	Lance et al. 2012
Spotted	***Amphipoda***	**26.3**	Alaska	Stomach	1996 ~ 2001	Dehn et al. 2007
Hooded	*Parathemisto libellula*	3.6	drift ice east of Greenland	Stomach	2000	Haug et al. 2004
	Parathemisto sp.	10.7				
	Gammarus sp.	3.6				
	All Amphipods	**17.9**				
Harp	*Parathemisto libellula*	35	drift ice east of Greenland	Stomach	2000	Haug et al. 2004
	Parathemisto sp.	10				
	All Amphipods	**45**				
Bearded	***Amphipoda***	**63.9**	Alaska	Stomach	1996 ~ 2001	Dehn et al. 2007
	Gammarus setosus	3	Spitbergen, Norway	Gastrointestinal tracts	1989 ~ 1996	Hjelset et al., 1999
	Atylus carinatus	3				
	Gammarocanthus loricatus	3				
	Lysianassidae indet	3				
	All Amphipods	**12**				
	All Amphipods	**4.55**	Bering sea, Alaska	Stomach	1960s	L. T. Quakenbush et al. 2011
	All Amphipods	**31.66**			1970s	
	All Amphipods	**25.16**	Chukchi sea, Alaska		2000s	
	All Amphipods	**6.02**			1960s	
	All Amphipods	**29.5**			1970s	
	All Amphipods	**12.06**			2000s	
Crabeater	***Krill***	**100**	-	Stomach	-	Ballard et al. 2012
	Krill	**94**	Antarctic continental shelf	Stomach	-	Lowry et al. 1988

Leopard	***Krill***	**15.8**	Prydz Bay, Eastern Antarctica	Stomach	1999 ~ 2000	Hall-Aspland & Rogers 2004
	Krill	**2.6**			2000 ~ 2001	
	Krill	**5.9**			2001 ~ 2002	
	Waldeckia obesa	10.5			1999 ~ 2000	
	Chemiridon sp.	5.3				
	All Amphipods	**15.8**				
	Waldeckia obesa	5.3			2000 ~ 2001	
	Chemiridon sp.	10.5				
	All Amphipods	**15.8**				
	Waldeckia obesa	5.9			2001 ~ 2002	
	Chemiridon sp.	11.8				
	All Amphipods	**17.7**				
	Krill	**100**	Danco Coast, Antarctic Peninsula	Scats	2000	Casaux et al. 2009
	All Amphipods	**22.2**	Devis station, Antarctica	Faeces	1984	Green & Williams, 1986
	Krill	**100**	Biscoe Islands	Stomach	1985	Lowry et al. 1988
	Krill	**45**	Antarctic Peninsula	Stomach		Siniff & Stone 1985
	Krill	**58**		Stomach		Hall-Aspland & Rogers, 2004
Weddell	***Euphausia sp.***	**34.1**	Harmony Point, Nelson Island, Shetland Islands	Faeces	1996	Casaux et al. 1997
	Amphipods (Bovallia gigantea)	17.1				
	Euphausia superba	**5.7**	Danco Coast, Antarctic Peninsula	Scats	1998	Casaux et al. 2006
	Amphipods (Grammarids)	2.9				
	Euphausia superba	**18**			2000	
	Amphipods (Grammarids)	2.6				
	Krill	**0**	-	Stomach	-	Ballard et al. 2012
	Krill	**1**	-	Stomach	-	Øritsland, 1977

Table S6. $\delta^{13}C$ and $\delta^{15}N$ stable isotope values collected from past studies.

Species	Sampling location	Body part	*n*	$\delta^{15}N \pm SD$	$\delta^{13}C \pm SD$	Reference
Pinnipeds (Mixtures):						
Bearded seal (*Erignathus barbatus*)	Barrow, AK, USA	Muscle	55	16.8 ± 0.9	–17.1 ± 0.5	Dehn et al. 2007
Spotted seal (*Phoca largha*)	Little Diomede, Shishmaref, AK USA	Muscle	79	17.8 ± 1.0	–18.5 ± 0.9	Dehn et al. 2007
Ribbon seal (*Phoca fasciata*)	Little Diomede, AK, USA	Muscle	40	16.0 ± 1.2	–18.7 ± 0.1	Dehn et al. 2007
* Weddell seal (*Leptonychotes weddellii*)	Terra Nova Bay, Ross Sea	Skin	25	15.7 ± 0.6	−21.1 ± 0.6	Rumolo et al. 2020
Grey seal (*Halichoerus grypus*)	estuary of St Lawrence	Blood	5	15.6 ± 0.9	–17.6 ± 0.6	Lesage et al. 2001
Hooded seal (*Cystophora cristata*)	gulf of St Lawrence	Blood	9	15.5 ± 0.6	–17.1 ± 0.3	Lesage et al. 2001
Harbor seal (*Phoca vitulina*)	estuary of St Lawrence	Blood	13	16.0 ± 0.5	–16.7 ± 0.2	Lesage et al. 2001
Harp seal (*Pagophilus groenlandicus*)	estuary of St Lawrence	Muscle	2	13.5 ± 0.2	–17.6 ± 0.1	Lesage et al. 2001
Teleost Fish (Sources):	Sampling location		*n*	$\delta^{15}N \pm SD$	$\delta^{13}C \pm SD$	Reference
Arctic cod (*Boreogadus saida*)	Barrow, AK, USA		24	15.5 ± 1.0	–20.9 ± 0.4	Dehn et al. 2007
Pacific herring (*Clupea pallasii*)	Bering Strait		3	13.8 ± 0.9	–20.7 ± 1.7	Dehn et al. 2007
Walleye Pollock	Bering Strait		6	14.2 ± 2.0	–20.4 ± 2.5	Dehn et al. 2007
Rainbow Smelt	Barrow, AK, USA		10	14.8 ± 1.0	–21.2 ± 0.8	Dehn et al. 2007
Eelpout (*Lycodes sp.*)	eastern Beaufort Sea coast		2	14.3 ± 0.1	—20.1 ± 0.3	Dunton et al. 2012
Antarctic toothfish (*Dissostichus mawsoni*)	Victoria Land coast of the Ross Sea		9	13.5 ± 0.5	−23.6 ± 0.5	Goetz et al. 2017
Emerald rockcod (*Trematomus bernacchii*)	Victoria Land coast of the Ross Sea		26	11.0 ± 0.5	−22.3 ± 1.5	Goetz et al. 2017
Antarctic herring (*Pleuragramma antarctica*)	Victoria Land coast of the Ross Sea		3	9.4 ± 0.2	−24.3 ± 0.9	Goetz et al. 2017
Atlantic herring (*Clupea harengus*)	estuary of St Lawrence		10	13.1 ± 0.6	–18.8 ± 1.1	Lesage et al. 2001
Arctic Cod (*Boreogadus saida*)	estuary of St Lawrence		2	14.8 ± 0.2	–18.0 ± 0.2	Lesage et al. 2001
Cottidae	estuary of St Lawrence		2	14.4 ± 0.4	–16.7 ± 0.9	Lesage et al. 2001
Sand lance (*Ammodites americanus*)	estuary of St Lawrence		9	11.4 ± 0.3	–18.5 ± 0.4	Lesage et al. 2001
Winter flounder (*Pseudopleuronectes americanus*)	gulf of St Lawrence		6	13.0 ± 0.4	–18.9 ± 0.5	Lesage et al. 2001
White hake (*Urophycis tenuis*)	estuary of St Lawrence		3	16.7 ± 0.5	−17.8 ± 0.3	Lesage et al. 2001
Redfish (*Sebastes sp.*)	estuary of St Lawrence		6	14.0 ± 0.3	—18.9 ± 0.3	Lesage et al. 2001
Crustacea (Sources):						
Euphausiacea	East Chukchi		33	9.7 ± 1.72	–20.2 ± 1.15	Schell et al. 1998
Amphipoda (unsorted)	Bering Strait		40	7.9 ± 0.8	–19.9 ± 0.7	Dehn et al. 2007
Northern shrimp (*Pandalus borealis*)	Newfoundland		10	11.3 ± 0.2	—17.9 ± 0.3	Lawson & Hobson 2000
Sculptured Shrimp	Barrow, AK, USA		1	16.1	–19.8	Dehn et al. 2007

Ice Krill (*Euphausia crystallorophias*)	western Ross sea	11	6.12 ± 0.51	−24.52 ± 0.77	Hong et al. 2021
Antarctic krill (*Euphausia superba*)	western Ross sea	15	3.65 ± 0.58	−27.41 ± 0.57	Hong et al. 2021
Amphipoda	estuary of St Lawrence	2	7.6 ± 1.55	−17.9 ± 0.05	Lesage et al. 2001
Krill (*Thysanoessa inermis*)	estuary of St Lawrence	4	10.1 ± 1.5	−19.6 ± 1.1	Lesage et al. 2001
Mollusca (Sources):					
Greenland Cockle	Bering Strait	1	8.0	–19.2	Dehn et al. 2007
Octopus (*Octopus* spp.)	Bering Strait	1	9.9	−20	Dehn et al. 2007
Squid	Bering Strait	3	13.6 ±1.2	−19.9 ±1.3	Dehn et al. 2007
Squid *(Illex illecebrosus*)	gulf of St Lawrence	6	13.0 ± 0.4	−19.2 ± 0.3	Lesage et al. 2001

Table S7. Three prey species most likely to be preyed upon based on stomach content analysis in the same region where stable isotopes were obtained, and the well-consumed zooplankton (amphipods or krill) for that species with references.

	Species	Region	Used prey types for simmr	Reference
Species whose zooplankton proportion were calculated in this study using past studies' data by simmr	Bearded seal (*Erignathus barbatus*)	Alaska, USA	Eelpout, Sculptured Shrimp, Octo*Pusa*mphipods	Dehn et al. 2007
	Spotted seal (*Phoca largha*)	Alaska, USA	Pacific herring, Arctic cod, Rainbow smelt, Amphipods	Dehn et al. 2007
	Ribbon seal (*Phoca fasciata*)	Alaska, USA	Walleye Pollock, Northern shrimp, Squid, Amphipods	L. Quakenbush & Citta 2008
	* Weddell seal (*Leptonychotes weddellii*)	Terra Nova Bay, Ross Sea	Antarctic toothfish, Emerald rockcod, Antarctic herring, Krill	Casaux et al. 2006
	Grey seal (*Halichoerus grypus*)	St Lawrence	Sand lance, Winter flounder, White hake, Krill	Hammill et al. 2007
	Hooded seal (*Cystophora cristata*)	St Lawrence	Redfish, Squid, Capelin, Amphipods	Haug et al. 2007
	Harbor seal (*Phoca vitulina*)	St Lawrence	Arctic cod, Redfish, Sand lance, Amphipods	Hauksson & Bogason 1997
	Harp seal (*Pagophilus groenlandicus*)	St Lawrence	Atlantic herring, Arctic cod, Cottidae, Amphipods	Lindstrøm et al. 1998

Table S8. Proportion of zooplankton derived from stable isotope mixing model, *simmr* package of R.

	Prey Species	Mean (%)	SD (%)		Prey Species	Mean (%)	SD (%)
Bearded *Erignathus barbatus*	Eelpout	0.174	0.141	Grey *Halichoerus grypus*	Sand lance	0.084	0.061
	Sculptured	0.526	0.133		Winter flounder	0.334	0.191
	Squid	0.214	0.143		White hake	0.423	0.108
	Amphipods	0.087	0.043		Krill	0.159	0.096
Spotted *Phoca largha*	Pacific herring	0.085	0.063	Hooded *Cystophora cristata*	Redfish	0.903	0.050
	Arctic cod	0.774	0.109		Squid	0.027	0.019
	Rainbow smelt	0.108	0.097		Capelin	0.046	0.040
	Amphipods	0.033	0.018		Amphipods	0.024	0.014
Ribbon *HistrioPhoca fasciata*	Walleye pollock	0.203	0.088	Harbor *Phoca vitulina*	Arctic cod	0.545	0.070
	Northern shrimp	0.101	0.056		Redfish	0.392	0.074
	Squid	0.634	0.113		Sand lance	0.041	0.026
	Amphipods	0.063	0.038		Amphipods	0.022	0.012
Weddell *Leptonychotes weddellii*	Antarctic toothfish	0.939	0.027	Harp *Pagophilus groenlandicus*	Atlantic herring	0.544	0.048
	Emerald rockcod	0.025	0.019		Arctic cod	0.057	0.034
	Antarctic herring	0.022	0.016		Cottidae	0.032	0.019
	Antarctic krill	0.014	0.008		Amphipods	0.367	0.025

Table S9. Species whose zooplankton proportion were directly cited from past studies.

Species	Region	Proportion of zooplankton (%)	Reference
Baikal seal (*Pusa sibirica*)	Lake Baikal, Russia	46 ± 6	Yoshii et al. 1999
Ringed seal (*Pusa hispida*)	Nunavut, Canadian High Arctic	11 - 31	Matley et al. 2015
Crabeater seal (*Lobodon carcinophaga*)	western Antarctic Peninsula	87.9	Hückstädt et al. 2012
Leopard seal (*Hydrurga leptonyx*)	Livingston Island, Antarctic Peninsula	31.7 - 38.0	Krause et al. 2020

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