Text S1. Methods for compound specific stable isotope analysis

Collagen samples were analyzed for using 5 mg of purified collagen from approximately 50 mg of bone. Preliminary analyses were conducted to determine the highest rate of collagen return from bone sampled from different parts of the skull to minimize destruction (mandible, internal occipital shelf, temporal process). All produced similar stable isotope measurements. Samples were primarily taken from the internal occipital shelf at the back of the skull to maintain external integrity. Bone was decalcified using 0.2 M HCl for 24-72 hours depending on bone thickness, followed by centrifugation and nanopure water rinse. Removal of humic acids was conducted using 0.125 M NaOH for 20 hours. Samples were washed to a neutral pH, then solubilized in 0.01N HCl. Once solubilized, samples were dried under a stream of N_2 and freeze dried. Freeze dried collagen was analyzed for bulk isotopic composition of nitrogen by the UW IsoLab (isolab.ess.washington.edu) using a coupled elemental analyzer-isotope ratio mass spectrometer following the standard protocols of the laboratory. C:N ratios were available for most (n = 107) samples used as a measure of the quality for nitrogen analyses of bone collagen for stable isotope analysis (van Klinken 1999). No samples within this subset were outside the acceptable C:N range of 2.7-3.6 (by mass), indicating there was no substantial loss of glycine or addition of nitrogen due to microbial processing from mortality, decay, curation, and analysis. We therefore assumed samples without C:N data (n = 20) also were within the acceptable range as they were subject to the same storage and processing procedures at the same museum institution (University of Alaska Fairbanks, Museum of the North).

$\delta^{15}N$ of eleven amino acids (alanine, glycine, proline, aspartic acid, leucine, isoleucine, valine, threonine, serine, glutamic acid, phenylalanine, tyrosine) were measured in the UW Facility for Compound-Specific Isotope Analysis of Environmental Samples. The composition of amino acids in bone collagen is highly variable across amino acids (Gauza-Włodarczyk et al.

2017). Tyrosine, isoleucine, valine, and threonine are not abundant in bone collagen, whereas glycine is 20 times more abundant in bone collagen than most amino acids on a gram amino acid per 100 g of protein basis. Samples were prepared following the procedures developed by Chikaraishi et al. (2007) and protocols by Rachel Jeffrey's lab at University of Liverpool UK which are modifications of that published by Metges et al. (1996) and Popp et al. (2007). Briefly, proteins were hydrolyzed in 6N HCl and purified using a cation exchange column. Norleucine was added as an internal standard. Amino acids were esterified using isopropanol acetyl chloride, and derivatized via acylation with 4:1 toluene: pivaloyl chloride. Samples were brought up in ethyl acetate and analyzed using a coupled gas chromatography-combustion-isotope ratio mass spectrometer system (GC-C-irMA; Thermo Scientific Trace GC + GC IsoLink coupled to a Delta V irMS) in continuous flow mode monitoring masses (m/z) 28 and 29. A 30 m x 0.32 mm x 0.50 μm Agilent Technologies DB-35 capillary column with 35% Phenyl and 65% polysiloxane stationary phase and moderate polarity was used (Chikaraishi et al. 2010) with an inlet temperature of 260 C, column flow of 2 ml/min and oven ramp of 9 ˚C min^{-1}. Tyrosine and isoleucine for most samples were not discernable and thus were omitted from this analysis. Leucine and isoleucine also co-eluted for many samples and thus leucine stable isotope measurements were deemed unreliable and also omitted from this dataset. For each run, a 12 amino acid external standard with known isotopic composition was injected four times to condition the column followed by sample injections. Samples were injected in triplicate, with the 12 amino acid standard mixture injected every two samples (or six injections). A two-hour column oxidation was performed after 6 samples (25 injections) followed by a 30-minute backflush. $\delta^{15}N$ was measured as:

$$S1.\ \ \delta^{15}\mathrm{N}\ (\text{‰ vs. air}) = \left(\frac{(^{15}\mathrm{N}/^{14}\mathrm{N})_{\mathrm{Sample}}}{(^{15}\mathrm{N}/^{14}\mathrm{N})_{\mathrm{Air}}} - 1\right) * 1000$$

For each machine run, a linear model was fit for each individual amino acid using the following equation:

$$S2.\ \ \mathrm{Std_{aa}} = \mathrm{m_{aa}t} + \mathrm{b_{aa}}$$

Where *m* represents the slope of the precision drift, *t* represents the injection number since last column oxidation, and *Std* represents the δ^{15}N of an individual amino acid *aa* for a standard observation. The data was then corrected using the following equations:

$$S3.\ \ \mathrm{D_{aa,t}} = \mathrm{Std_{aa,t}} - \mathrm{True}_{aa}$$

Where $D_{aa,t}$ is the difference between an observed standard δ^{15}N ($Std_{aa,t}$) for a given amino acid (*aa*) at a given injection number (*t*) and the true δ^{15}N for that standard. Then:

$$\mathrm{S4.\ \ Sample_{corrected,aa,t}} = \mathrm{Sample_{obs,aa,t}} - \mathrm{D_{aa,t}}$$

Where the drift value, $D_{aa,t,}$ is subtracted from the sample value for a given amino acid and a given injection to correct the observed sample values for precision drift since last column oxidation. Mean sample corrected values for the triplicate injections were used for all analyses and trophic position calculations. Norleucine had lower precision in standards compared to phenyalanine, therefore no correction using the internal standard was applied. Mean precision for a given amino acid standard was calculated using the standard deviation of the external standard injections for a given run after drift correction and taking a mean of each run's standard deviation (Table S1). Conditioning injections were omitted from this calculation.

Table S1: Mean standard precision for amino acids calculated from the standard deviation of the external standard injections for a given run after drift correction and omitting conditioning injections. The mean of standard deviations for multiple runs was taken. * denotes amino acids used for this analysis.

Amino Acid	Mean Precision (‰)
Phenylalanine*	0.34
Glutamic Acid*	0.56
Alanine*	0.46
Proline*	0.48
Valine	0.38
Aspartic Acid*	0.83
Glycine	0.35
Serine	0.89
Threonine	0.37
Norleucine	0.40

Table S2: Catalogue number, collection year, sex, species, and $\delta 15N_x$ of individual amino acids from sampled museum pinniped specimens from University of Alaska Fairbanks Museum of the North (UAM). Region Codes: Southeast Gulf of Alaska harbor seals (SE), Northen Gulf of Alaska harbor seals (SC), Southeast Bristol Bay harbor seals (BB), Iliamna Lake harbor seals (IL), western stock of Steller sea lions (WG), and eastern stock of Steller sea lions (EG). Additional archived metadata associated with specimen catalogue numbers and institution codes is available through: http://vertnet.org/. NA indicates data was not available for a given amino acid for a given specimen, in most cases this was due to low concentration of an amino acid (valine, threonine) or co-elution (glycine).

Institution Code	Catalogue Number	Year	Region Code	Sex	Species	$\delta^{15}N_{Alanine}$ (‰)	$\delta^{15}N_{Valine}$ (‰)	$\delta^{15}N_{Aspartic\ Acid}$ (‰)	$\delta^{15}N_{Phenylalanine}$ (‰)	$\delta^{15}N_{Glutamic\ Acid}$ (‰)	$\delta^{15}N_{Threonine}$ (‰)	$\delta^{15}N_{Serine}$ (‰)	$\delta^{15}N_{Proline}$ (‰)	$\delta^{15}N_{Glycine}$ (‰)
UAM	110281	2008	WG	F	Sea Lion	26.31	NA	22.85	13.47	28.12	NA	9.69	32.61	22.01
UAM	110284	2010	WG	F	Sea Lion	23.62	NA	19.68	16.53	26.16	NA	13.09	31.97	23.74
UAM	110328	2008	IL	NA	Harbor Seal	21.48	NA	18.87	14.63	26.22	NA	14.25	29.07	23.76
UAM	11475	1962	SC	M	Harbor Seal	22.65	24.63	25.64	11.30	28.06	-24.99	15.09	27.39	10.07
UAM	11712	1972	SE	M	Harbor Seal	22.86	24.09	23.81	10.11	26.77	-32.35	16.16	26.35	7.26
UAM	11713	1965	SE	NA	Harbor Seal	24.18	24.32	23.74	11.36	27.19	-32.52	14.49	26.41	9.01
UAM	11738	1973	SC	F	Harbor Seal	22.79	25.03	23.43	8.29	25.33	-24.62	15.01	20.08	8.98
UAM	11740	1973	SC	F	Harbor Seal	22.06	23.92	23.14	9.31	26.69	-25.50	14.55	25.55	8.10
UAM	11742	1973	SC	F	Harbor Seal	21.69	24.75	23.71	10.13	25.80	-24.72	15.63	26.66	9.01
UAM	11743	1973	SC	M	Harbor Seal	21.54	23.36	23.96	21.50	24.46	-27.58	21.31	27.94	10.70
UAM	11747	1973	SC	F	Harbor Seal	21.73	22.53	22.61	13.49	26.40	-19.71	16.40	24.81	8.81
UAM	11770	1972	SC	M	Harbor Seal	22.61	24.69	18.92	13.01	27.09	-9.32	16.80	24.88	9.58
UAM	11771	1980	SC	F	Harbor Seal	23.25	21.52	24.24	13.37	28.32	-25.67	15.49	26.08	9.47
UAM	11774	1972	SC	F	Harbor Seal	22.89	25.23	25.19	9.24	26.78	-25.88	15.86	27.22	10.19
UAM	11777	1972	SE	F	Harbor Seal	24.94	27.90	26.47	10.86	28.88	-25.52	18.05	26.80	11.60

UAM	11778	1972	SE	F	Harbor Seal	21.85	24.69	24.46	9.12	22.92	-26.71	16.11	30.59	26.44
UAM	11779	1972	SE	F	Harbor Seal	22.47	23.82	23.60	8.83	23.40	-28.18	11.63	22.87	9.56
UAM	11816	1973	SC	F	Harbor Seal	23.14	25.34	22.80	9.62	25.96	-24.04	16.34	29.27	11.04
UAM	11817	1973	SC	F	Harbor Seal	21.19	25.17	22.84	10.92	24.72	-23.85	14.78	26.21	8.43
UAM	102605	2010	WG	NA	Sea Lion	23.86	26.48	18.00	13.48	28.78	-16.28	16.60	11.50	NA
UAM	11827	1975	BB	M	Harbor Seal	22.99	24.60	26.80	13.67	28.96	-24.41	15.79	27.40	9.96
UAM	11836	1973	SC	M	Harbor Seal	19.93	23.04	20.51	13.51	22.15	-19.78	14.80	21.64	9.54
UAM	11920	1975	SC	F	Harbor Seal	22.13	24.27	22.73	11.05	24.66	-31.29	14.78	26.74	7.42
UAM	11921	1972	SC	F	Harbor Seal	22.49	22.86	21.72	14.94	26.45	-25.17	16.21	31.36	9.57
UAM	134119	2016	EG	F	Sea Lion	24.66	22.83	23.46	12.18	23.78	-30.59	19.33	29.14	26.72
UAM	138278	2017	IL	NA	Harbor Seal	19.95	22.38	21.42	8.34	22.59	-18.00	19.73	26.83	25.11
UAM	19119	1972	SE	M	Harbor Seal	26.30	26.27	29.17	12.68	31.61	-31.23	19.05	28.96	9.57
UAM	19122	1972	SE	M	Harbor Seal	20.86	23.32	23.84	8.19	25.53	-29.55	16.36	24.72	7.05
UAM	19123	1972	SE	M	Harbor Seal	26.17	27.64	27.30	10.50	28.88	-28.73	18.10	32.02	11.74
UAM	19124	1972	SE	F	Harbor Seal	23.78	23.98	22.61	12.96	27.78	-33.23	19.61	29.82	10.65
UAM	19159	1981	BB	M	Harbor Seal	25.83	26.98	27.23	16.93	30.79	-22.27	19.51	31.42	13.86
UAM	19160	1981	BB	F	Harbor Seal	24.46	28.51	23.20	10.18	27.88	-25.23	17.08	32.57	28.34
UAM	19161	1981	BB	M	Harbor Seal	25.86	26.15	27.71	17.17	26.21	-27.49	19.22	24.80	10.59
UAM	19172	1981	BB	M	Harbor Seal	25.49	25.80	27.57	14.41	28.94	-30.74	20.04	29.62	12.53
UAM	19173	1981	BB	F	Harbor Seal	25.09	26.21	23.61	15.02	28.91	-13.94	19.08	28.93	12.71
UAM	19174	1981	BB	M	Harbor Seal	23.64	25.11	25.51	13.31	25.57	-23.91	15.50	24.71	11.36
UAM	19175	1981	BB	F	Harbor Seal	25.80	25.28	25.58	15.36	29.33	-24.52	16.81	29.32	12.09

UAM	21485	1965	SE	F	Harbor Seal	24.38	25.47	24.00	11.03	27.61	-30.75	13.94	27.44	9.37
UAM	28932	1965	SE	F	Harbor Seal	27.32	25.73	27.09	11.89	30.20	-37.04	20.15	30.69	11.88
UAM	28933	1965	SE	F	Harbor Seal	23.61	24.36	22.87	11.43	26.52	-30.01	10.66	27.21	8.53
UAM	28934	1966	BB	F	Harbor Seal	26.66	NA	24.28	13.19	29.60	NA	17.62	34.11	21.21
UAM	28935	1966	BB	M	Harbor Seal	24.53	23.19	26.14	14.86	28.82	-34.46	19.92	29.30	12.22
UAM	28936	1966	BB	F	Harbor Seal	26.27	28.10	27.69	18.89	28.56	-23.48	19.05	31.61	12.48
UAM	28937	1966	BB	F	Harbor Seal	25.26	25.81	28.01	18.39	29.02	-22.52	20.95	31.86	11.73
UAM	28938	1966	BB	F	Harbor Seal	25.33	28.09	27.28	12.42	30.06	-18.18	18.51	28.28	12.49
UAM	28939	1966	BB	F	Harbor Seal	27.44	28.13	25.92	17.49	29.96	-21.86	20.68	33.93	27.79
UAM	28940	1966	BB	F	Harbor Seal	26.05	23.45	26.56	14.89	29.97	-35.19	19.69	30.00	12.78
UAM	28941	1966	BB	M	Harbor Seal	25.32	24.09	23.17	14.39	29.77	-6.95	19.29	27.46	11.53
UAM	28942	1966	BB	F	Harbor Seal	26.55	25.89	26.01	16.88	29.70	-32.82	13.94	33.68	25.14
UAM	28943	1966	BB	NA	Harbor Seal	25.90	25.93	26.20	14.52	30.47	-29.78	20.35	29.42	13.45
UAM	28950	1980	SC	F	Harbor Seal	23.17	25.64	23.86	9.31	26.99	-26.81	14.37	27.22	9.20
UAM	31904	1995	WG	F	Sea Lion	24.73	28.01	20.18	11.77	26.09	-31.51	9.14	30.82	26.41
UAM	3409	1957	IL	NA	Harbor Seal	21.08	24.11	17.65	12.79	24.51	-29.38	10.35	22.89	20.29
UAM	35432	1995	SE	M	Harbor Seal	23.56	25.62	24.87	13.51	26.69	-24.45	16.56	27.64	11.24
UAM	35434	1996	SE	M	Harbor Seal	21.20	24.81	24.65	10.36	26.40	-19.40	13.55	25.20	10.04
UAM	35437	1996	SC	M	Harbor Seal	23.65	25.25	24.84	10.18	27.12	-28.38	16.53	27.84	9.59
UAM	35438	1996	SC	M	Harbor Seal	22.57	26.30	21.51	13.88	26.48	-22.51	16.08	24.71	10.01
UAM	35439	1996	SC	F	Harbor Seal	21.83	22.54	21.84	11.26	25.85	-30.18	21.24	30.62	8.53
UAM	35440	1996	SC	M	Harbor Seal	21.89	25.80	21.00	20.13	30.67	-19.24	18.22	26.47	11.10

UAM	35442	1996	SC	M	Harbor Seal	23.61	25.40	22.88	12.04	25.88	-31.72	15.70	27.98	8.81
UAM	35445	1996	SC	F	Harbor Seal	23.89	25.56	24.59	12.45	27.92	-30.06	16.76	26.90	9.75
UAM	35446	1996	SC	M	Harbor Seal	24.94	25.49	24.96	12.46	28.49	-21.04	16.75	28.99	11.01
UAM	35447	1996	SC	M	Harbor Seal	23.29	26.70	24.46	10.75	27.85	-29.09	15.34	28.10	14.46
UAM	35449	1996	SC	F	Harbor Seal	26.42	27.50	20.83	14.16	25.89	-21.99	15.29	27.60	9.51
UAM	35450	1996	SC	M	Harbor Seal	22.41	23.89	22.47	10.72	25.67	-27.84	15.88	25.79	7.95
UAM	36254	1965	SE	M	Harbor Seal	22.82	25.68	23.72	10.05	26.40	-24.84	14.33	26.48	10.58
UAM	36262	1965	SE	F	Harbor Seal	24.34	NA	20.59	12.39	27.45	NA	15.63	31.28	20.92
UAM	3702	1955	SC	F	Harbor Seal	24.01	27.08	23.69	12.02	27.39	-23.72	15.84	31.22	10.26
UAM	37032	1975	WG	F	Sea Lion	23.15	26.82	23.46	18.27	25.51	-8.00	13.09	34.15	25.47
UAM	3716	1880	IL	NA	Harbor Seal	21.63	20.54	21.55	9.22	24.33	-32.75	13.36	24.73	6.13
UAM	37972	1996	SE	M	Harbor Seal	22.69	27.11	25.19	11.95	28.15	-34.57	17.57	31.58	9.01
UAM	37973	1995	SE	F	Harbor Seal	22.63	24.84	23.53	10.04	26.34	-24.00	19.78	26.17	9.22
UAM	37974	1995	SE	M	Harbor Seal	23.90	25.53	23.53	9.78	26.77	-25.09	16.53	26.52	9.02
UAM	41613	1996	SE	M	Harbor Seal	24.46	22.47	24.88	9.46	28.02	-33.65	15.06	26.39	9.60
UAM	41615	1995	SE	F	Harbor Seal	22.36	23.66	22.20	9.75	22.04	-32.32	16.52	23.32	7.97
UAM	41616	1995	SE	F	Harbor Seal	22.99	20.62	22.30	8.88	26.52	-28.70	17.96	24.25	8.45
UAM	41617	1996	SE	M	Harbor Seal	24.73	NA	22.08	7.59	28.58	NA	13.82	31.12	22.45
UAM	42151	1996	BB	F	Harbor Seal	23.65	24.00	25.55	12.63	26.95	-30.26	19.30	26.72	9.35
UAM	42152	1996	BB	F	Harbor Seal	24.02	25.98	26.02	16.28	25.02	-20.68	21.15	29.13	12.11
UAM	4233	1956	WG	M	Sea Lion	25.53	26.13	25.81	16.06	28.30	-34.69	8.75	33.12	10.64
UAM	43044	1996	BB	F	Harbor Seal	25.38	26.81	25.73	16.65	26.44	-25.19	17.25	30.19	11.85

UAM	47510	1985	BB	M	Harbor Seal	26.57	25.31	25.98	16.89	31.33	-12.05	19.55	28.95	13.70
UAM	47511	1985	BB	M	Harbor Seal	24.23	27.18	27.57	14.16	30.31	-28.43	23.79	29.65	12.86
UAM	5011	1958	WG	NA	Sea Lion	24.81	19.72	23.68	13.46	27.90	1.64	11.86	31.30	17.75
UAM	52183	1997	BB	F	Harbor Seal	23.62	23.16	22.28	15.24	27.46	-2.86	19.11	25.80	9.43
UAM	52184	1997	BB	F	Harbor Seal	26.16	27.00	25.63	14.58	31.35	-20.69	20.27	29.41	11.83
UAM	5260	1952	SC	F	Harbor Seal	23.23	22.35	20.95	13.23	27.00	-6.19	16.64	30.47	17.91
UAM	62888	2001	WG	M	Sea Lion	25.80	24.76	23.39	20.61	26.30	-34.52	17.89	33.76	24.97
UAM	62889	2001	WG	M	Sea Lion	25.42	NA	20.73	21.21	25.46	NA	14.06	30.46	25.15
UAM	62890	2001	WG	F	Sea Lion	24.08	23.38	24.00	19.78	26.46	-26.12	19.68	37.44	26.49
UAM	62891	2001	WG	M	Sea Lion	26.98	25.69	23.71	17.75	29.24	-4.29	21.13	34.93	14.16
UAM	62892	2001	WG	F	Sea Lion	26.72	24.11	26.81	23.46	27.78	7.86	19.78	34.49	16.18
UAM	62893	2001	WG	F	Sea Lion	24.85	21.86	22.69	14.93	25.11	NA	17.23	NA	24.71
UAM	62894	2001	WG	M	Sea Lion	26.14	NA	24.15	14.72	28.33	NA	19.02	36.05	23.05
UAM	62896	2001	WG	M	Sea Lion	25.00	24.97	23.65	16.14	25.50	NA	11.01	32.40	22.53
UAM	84943	2002	SC	M	Harbor Seal	24.06	25.72	24.54	9.80	27.81	-28.76	15.19	27.69	9.60
UAM	84950	2002	SC	F	Harbor Seal	24.33	29.49	24.40	12.46	27.73	NA	19.03	30.76	11.04
UAM	84958	2002	SC	F	Harbor Seal	22.49	24.46	21.81	6.21	26.42	-28.76	15.60	27.93	7.01
UAM	84959	2002	SC	F	Harbor Seal	21.70	8.94	22.62	12.03	25.76	-28.41	15.27	27.83	29.30
UAM	85206	2006	SE	M	Harbor Seal	22.48	23.79	22.15	15.21	25.43	-28.42	23.88	29.55	11.85
UAM	85207	2006	SE	M	Harbor Seal	23.29	20.90	23.25	11.83	26.82	-33.89	12.67	28.13	10.37
UAM	85208	2006	SE	M	Harbor Seal	23.67	13.02	22.43	9.53	25.13	-28.17	15.08	27.17	9.90
UAM	85212	2005	SE	M	Harbor Seal	22.64	24.17	22.84	11.39	26.56	-28.57	10.77	26.10	8.01

UAM	86877	2006	EG	M	Sea Lion	25.85	21.88	26.13	18.08	28.17	2.18	15.05	32.37	28.60
UAM	86989	2006	WG	M	Sea Lion	25.18	24.32	23.19	13.41	28.72	9.75	13.51	33.30	NA
UAM	87032	2003	SC	F	Harbor Seal	23.39	25.48	22.72	11.44	28.02	-20.97	16.53	26.53	8.75
UAM	87054	2002	BB	M	Harbor Seal	26.46	24.92	27.58	14.06	30.14	-5.89	22.71	35.04	12.24
UAM	87056	2002	BB	F	Harbor Seal	28.14	NA	25.64	19.36	31.48	NA	19.26	34.89	29.33
UAM	92552	2000	WG	M	Sea Lion	25.27	25.63	24.24	16.69	26.69	-6.93	12.44	32.94	14.13
UAM	92554	2000	WG	F	Sea Lion	27.37	22.86	19.23	14.65	23.93	-19.09	13.86	35.30	NA
UAM	92555	2000	WG	M	Sea Lion	26.11	NA	23.03	14.56	27.65	NA	15.94	35.04	21.43
UAM	99535	2003	SE	F	Harbor Seal	22.48	25.77	23.27	13.50	26.31	-30.79	11.84	27.72	8.64
UAM	99536	2003	SE	NA	Harbor Seal	20.67	22.14	21.16	11.55	23.92	-29.33	15.88	22.39	8.77
UAM	99537	2003	SE	F	Harbor Seal	23.65	18.90	23.63	12.10	25.14	-32.58	14.95	27.61	8.40
UAM	99543	2003	SE	M	Harbor Seal	23.74	26.91	24.00	10.95	27.96	-35.93	10.83	27.00	7.63
UAM	99544	2003	SE	M	Harbor Seal	22.35	23.66	24.05	10.79	25.88	-27.66	12.34	26.50	10.21
UAM	99563	2003	SE	NA	Harbor Seal	22.16	22.68	23.65	9.91	26.16	-26.05	16.69	25.04	8.07
UAM	99566	2003	SE	NA	Harbor Seal	23.37	25.69	23.56	12.19	26.48	-27.83	17.32	23.45	10.41
UAM	99570	2003	SE	NA	Harbor Seal	23.36	22.03	23.94	11.84	27.06	-32.09	15.29	26.98	8.97
UAM	99572	2003	SE	NA	Harbor Seal	23.41	25.89	23.11	10.95	27.24	-31.52	13.83	28.04	8.24
UAM	99575	2005	SC	M	Harbor Seal	23.75	25.40	23.79	9.96	29.35	-23.41	16.79	27.96	9.58
UAM	99641	2004	SC	F	Harbor Seal	22.98	23.83	23.07	10.72	27.72	-26.53	15.03	26.24	8.76
UAM	99657	2004	SE	F	Harbor Seal	19.89	23.13	20.32	11.04	25.10	-28.62	19.76	23.71	6.99
UAM	99658	2004	SE	F	Harbor Seal	21.82	21.17	20.93	9.60	25.52	-34.40	10.62	23.54	8.95
UAM	99665	2006	SE	M	Harbor Seal	19.89	21.78	21.82	8.59	25.41	-30.56	14.66	24.99	6.04

UAM	99667	2005	SE	M	Harbor Seal	21.20	20.90	21.41	11.22	25.58	-17.01	16.64	24.31	11.25
UAM	99693	2003	SC	M	Harbor Seal	23.83	24.83	23.44	12.48	26.35	-25.29	17.94	29.05	9.68

Table S2: Model fitting sensitivity analysis omitting low sample size classifications. Candidate models for identifying spatial and temporal trophic structure of Alaskan pinnipeds based on decade and region-species classification. Interpretations define how the model describes trophic structure with regards to decade and classification. LOOIC (leave-one-out information criterion) describes the support of each candidate models where lower values indicate best model and the difference $elpd_{loo}$ was used to compare model predictive capacity relative to the best model (model 6, italicized). Region-species classifications with low sample size (eastern stock Steller sea lions, Iliamna Lake harbor seals) were omitted from this analysis which did not change the results.

	Fixed Effects	Random Effects	Interpretation	LOOIC (Standard error)	Difference $elpd_{loo}$ (Standard error)
1.	Decade	Trophic Amino Acid	Trophic position varies by decade but not classification	830.0 (45.3)	-42.3 (10.2)
2.	Classification	Trophic Amino Acid	Trophic position varies by classification but not decade	781.2 (51.6)	-17.9 (5.2)
3.	Classification, Decade	Trophic Amino Acid	Trophic position varies by both classification and decade	780.8 (48.1)	-17.7 (5.6)
4.	Classification*Decade	Trophic Amino Acid	Trophic position varies by classification and decade; decadal change is distinct for each classification	747.8 (48.7)	-1.2 (2.7)
5.	-	Classification, Decade, Trophic Amino Acid	Trophic position varies with classification and decade but common trends exist across classification and decade	782.5 (51.5)	-18.6 (4.8)
6.	-	*Classification*Decade, Trophic Amino Acid*	*Trophic position varies by classification and decade; decadal change is distinct for each classification. Common trends exist across classification and decade*	*745.4 (50.8)*	–

Figure S1: Model estimated posterior distributions for group-level effects of amino acid included as a random effect (k) in the best performing model (Model 6, Table 2). Distributions denote medians (black bold line) and 95% credible intervals (colored shaded region) in units of trophic position (x-axis).

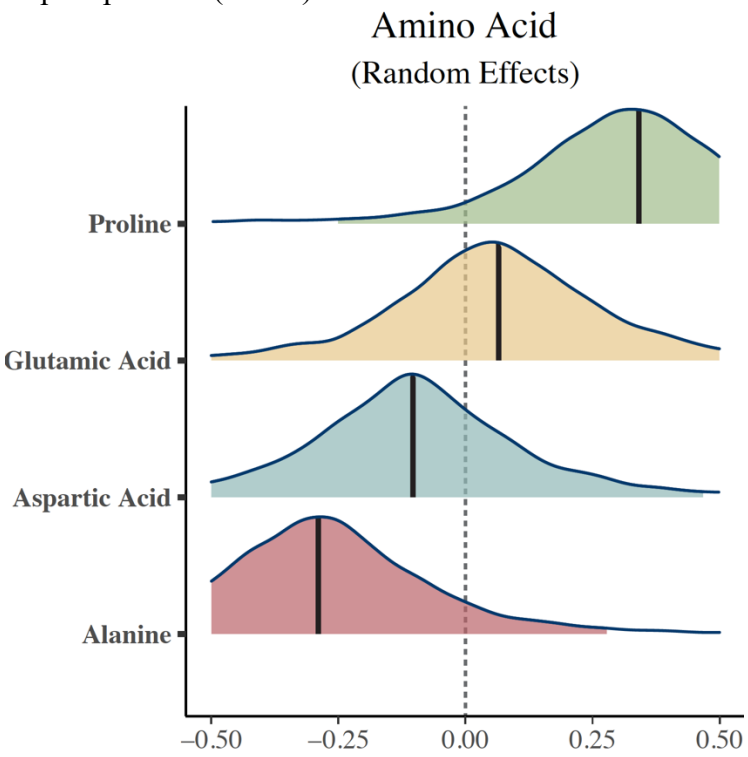


Figure S2: Model estimated pinniped trophic position for the combined effects of region-species classification, decade, and decade*classification interaction from the best performing model (Model 6, Table S2). Distributions denote median (circles), 80% credible interval (tails), and long-term mean (dashed line) for each pinniped classification (A-C & E). Region-species classifications with low sample size (eastern stock Steller sea lions, Iliamna Lake harbor seals) were omitted from this analysis. Unmodeled average trophic position estimates (square) are plotted for classifications with low sample size (B & F).

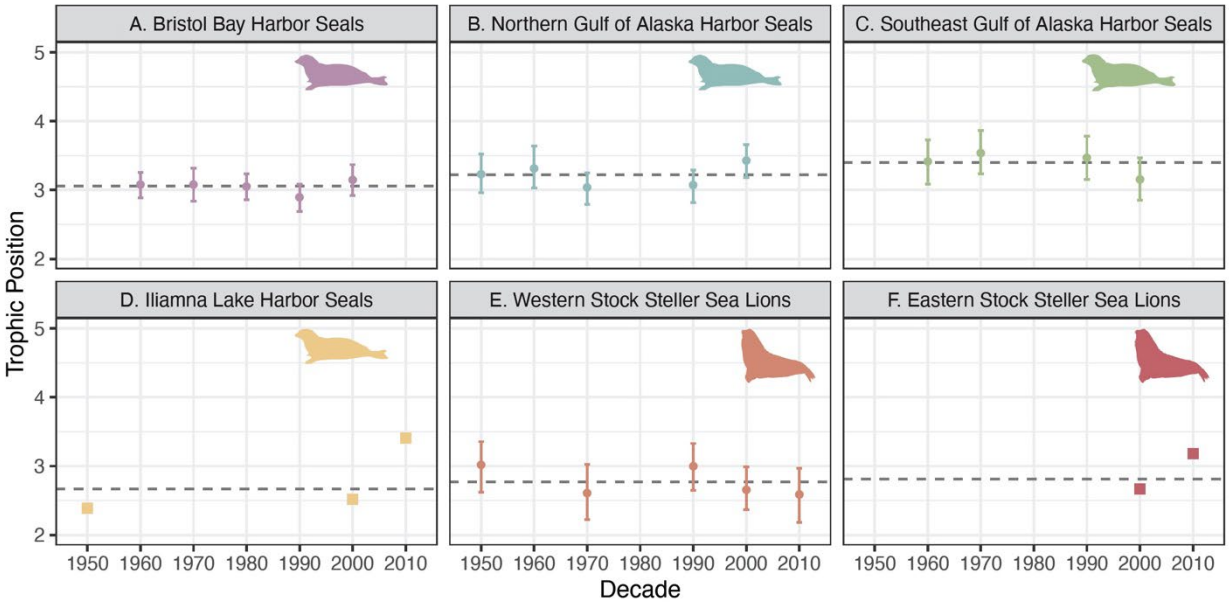


Figure S3: Time series of pinniped trophic position estimated using glutamic acid (trophic amino acid) and phenylalanine (source amino acid). Color corresponds to region-species classification for a) Bristol Bay harbor seals b) northern Gulf of Alaska harbor seals, c) southeast Gulf of Alaska harbor seals, d) Iliamna Lake harbor seals, e) western stock Steller sea lions and f) eastern stock Steller sea lions.

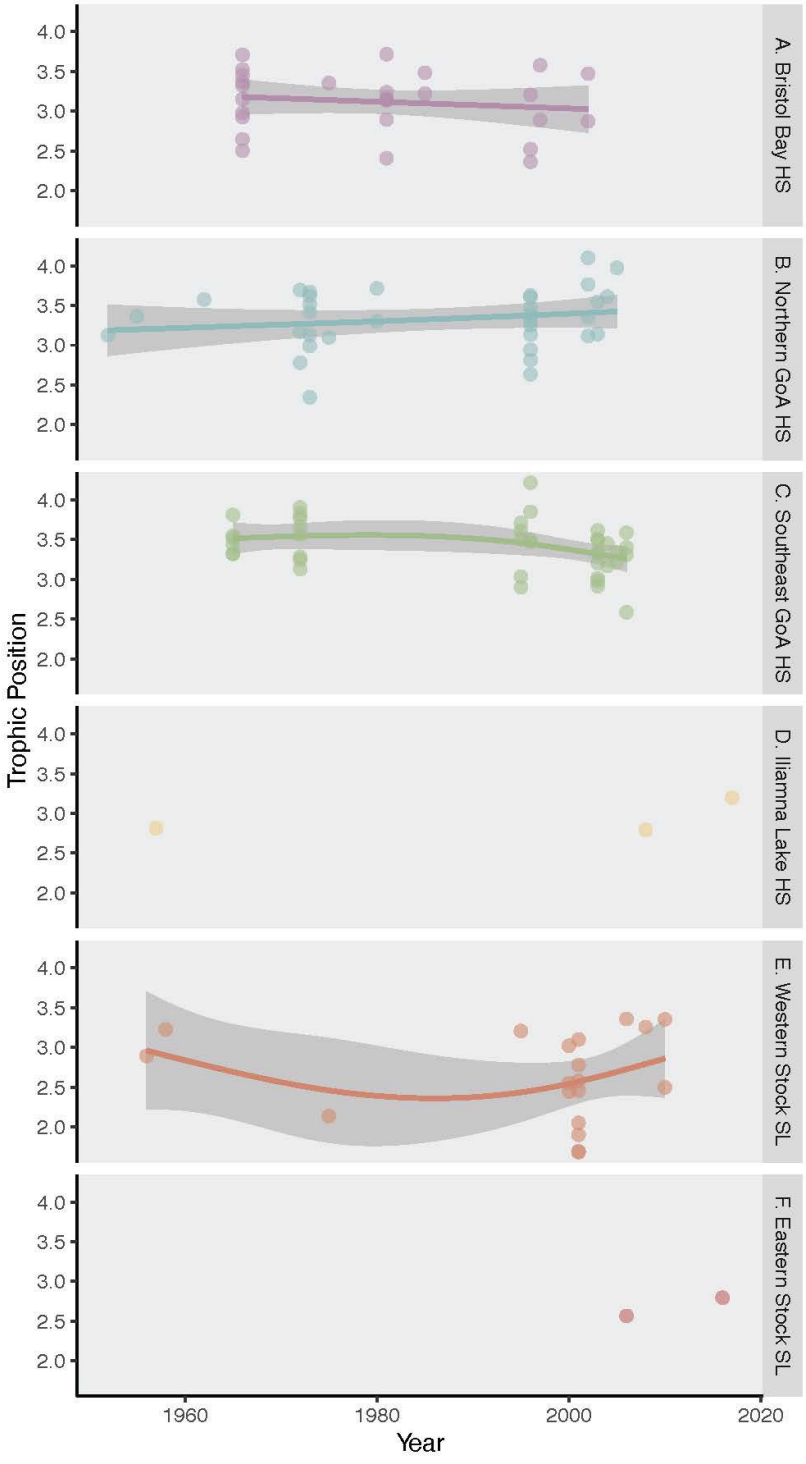
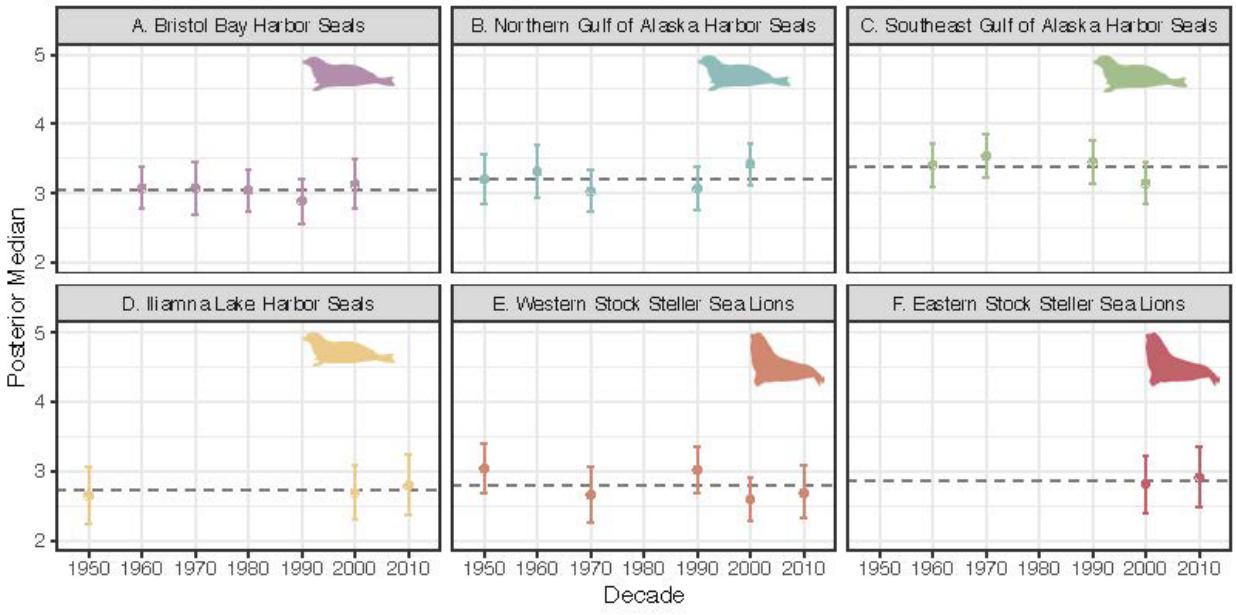


Figure S4: Model estimated pinniped trophic position for the combined effects of region-species classification, decade, and decade*classification interaction from the best performing model (Model 6, Table 2). Distributions denote median (circles), 80% credible interval (tails), and long-term mean (dashed line) for each pinniped classification (A- E). These results are the same as Figure 6 but include the posterior distributions for Iliamna Lake harbor seals (D) and eastern stock Steller sea lions (F).



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