The following supplement accompanies the article

Trophic niche of the invasive red king crab *Paralithodes camtschaticus* in a benthic food web

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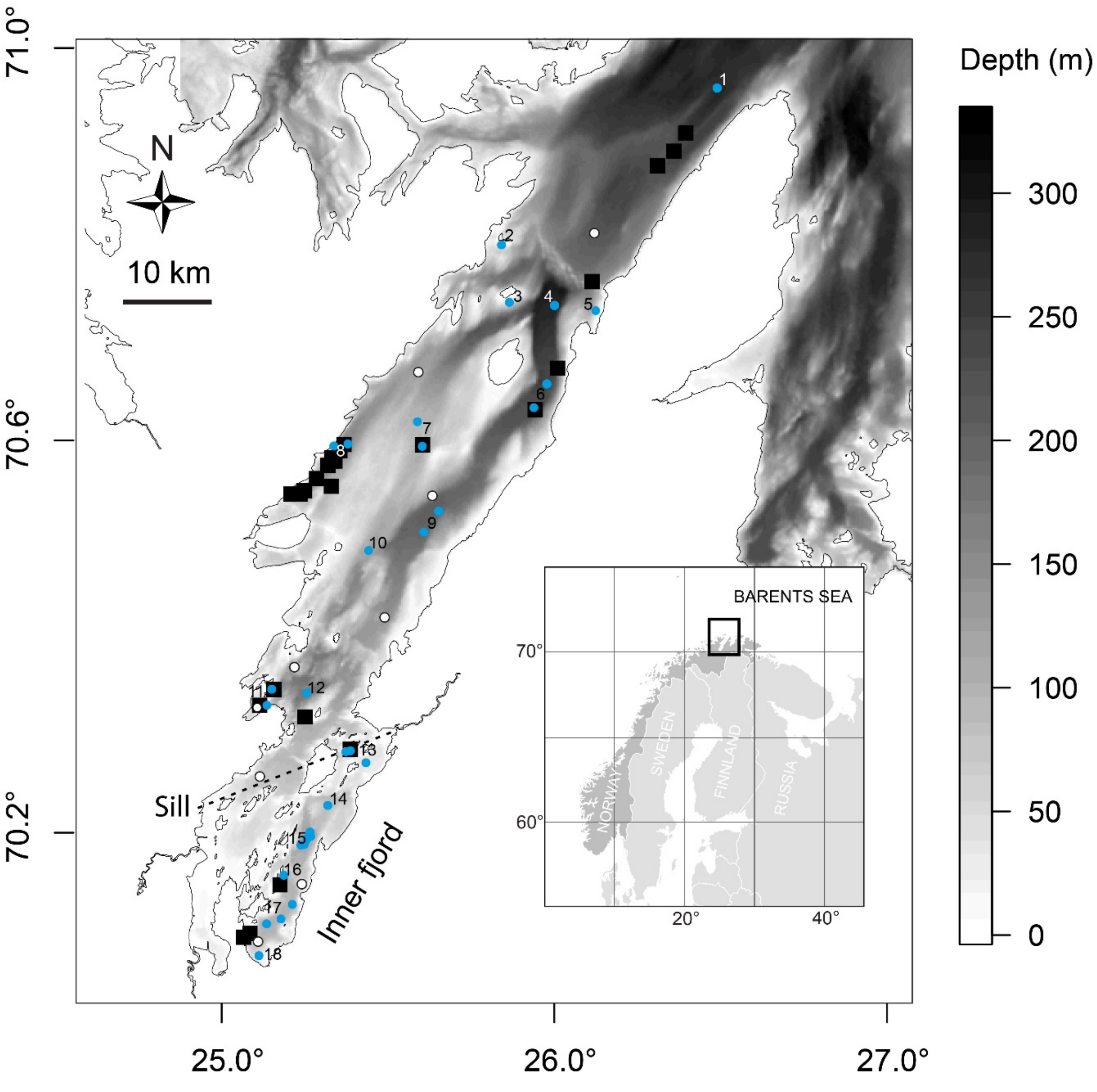

Fig. S1. Sampling stations of red king crab (■), sediments (o) and other species (●) for stable isotope analysis. See Table S1 for species at sampling stations.

Table S1. Mean (±SD) carbon and nitrogen stable isotope signatures of species analyzed

Species	Replicate no.	δ13C Mean	δ13C SD	δ15N Mean	δ15N SD	Sampling stn(s) in Fig. S1
Actinaria indet.	1	–17.78	–	11.97	–	13
Amblyraja radiata	2	–17.15	0.77	13.41	0.07	9
Ampharetidae	1	–19.57	–	10.48	–	8
Ascidiacea indet.	3	–20.60	0.41	11.38	1.04	14
Astarte sp.	5	–18.67	0.49	10.51	2.02	2, 5, 18
Asterias rubens	4	–17.21	1.14	10.28	1.13	3, 13, 18
Bathyarca sp.	4	–18.63	0.10	11.83	0.09	15
Buccinum undatum	3	–17.64	0.61	12.18	1.05	17
Chlamys islandica	6	–19.13	0.32	7.45	0.63	11, 13
Cirripedia	3	–19.98	0.44	6.54	0.29	2
Clinocardium ciliatum	2	–19.93	0.32	7.94	0.81	14, 16
Ctenodiscus crispatus	4	–17.38	0.38	13.04	1.10	14, 15, 17
Edwardsiidae	2	–20.35	0.13	10.93	0.33	7
Eunice norvegica	2	–19.13	0.09	9.69	0.41	2
Eunicidae	3	–19.46	1.57	9.84	0.50	5
Gadiculus thori	4	–20.17	0.14	10.95	0.22	6
Gadus morhua	12	–19.38	0.59	13.70	1.03	1, 6
Glypthocephalus cynoglossus	4	–17.26	0.37	14.69	0.36	6
Gorgonocephalus sp.	2	–19.70	0.85	12.46	0.32	15
Henricia sp.	1	–17.67	–	10.37	–	13
Hiatella arctica	3	–19.70	0.73	6.78	0.10	11
Hippoglossoides platessoides	4	–18.06	0.52	13.44	1.03	6
Hippoglossus hippoglossus	4	–18.66	0.40	12.94	0.70	6
Hormatia digitata	6	–18.94	0.54	10.79	0.22	2, 3
Hyas sp.	2	–17.32	0.46	11.27	1.38	13
Lithodes maja	5	–17.07	0.54	11.22	0.33	8
Lumbrineridae	1	–19.88	–	10.51	–	8
Lunatia tenistriata	3	–18.10	0.08	11.29	0.03	15
Maldanidae	8	–18.97	0.70	11.56	0.71	6, 7, 9, 15
Margarites sp.	1	–18.56	–	8.73	–	11
Melanogrammus aeglefinus	4	–19.20	0.37	12.66	0.51	6
Modiolus modiolus	1	–19.30	–	8.52	–	11
Nemertea	5	–19.60	0.75	12.07	0.60	5, 8
Nephtyidae	4	–17.69	0.71	11.51	0.43	7, 15
Neptunea despecta	4	–17.26	0.56	10.84	0.74	2, 3, 13
Nereis sp.	2	–25.28	0.38	9.40	0.46	5
Nuculana minuta	1	–18.13	–	6.55	–	11
Nucula sp.	2	–19.15	0.18	8.47	0.83	3, 15, 17
Ophiopholis aculeata	4	–19.23	0.36	6.21	0.24	11, 13
Ophiura sarsi	3	–15.54	0.55	12.83	0.11	17
Owenia fusiformis	1	–19.36	–	8.49	–	7
Pagurus sp.	3	–17.91	0.55	11.44	0.45	2, 15
Pandalus borealis	4	–17.39	0.28	12.10	0.38	6
Parvicardium minimum	1	–19.68	–	9.28	–	6
Pectinaria sp.	1	–19.04	–	9.90	–	7
Pleuronectes platessa	4	–17.77	1.45	12.65	0.74	6
Polymastia sp.	2	–19.82	0.09	10.05	0.07	2
Polyplacophora indet.	1	–19.82	–	8.96	–	11
Pontophilus norvegicus	1	–17.94	–	10.73	–	5
Paralithodes camtschaticus (Red king crab)	160	–17.48	0.53	10.88	0.65	
Sabinea septemcarinata	4	–17.08	0.29	15.02	0.40	14, 17

Species	Replicate no.	$\delta^{13}C$ Mean	$\delta^{13}C$ SD	$\delta^{15}N$ Mean	$\delta^{15}N$ SD	Sampling stn(s) in Fig. S1
Sclerocrangon boreas	10	–16.15	0.45	14.14	0.67	14, 15, 17
Sebastes sp.	4	–20.01	0.59	12.13	1.20	1
Spiochaetopterus typicus	2	–19.85	0.32	10.39	0.04	15
Strongylocentrotus droebachiensis	7	–18.29	1.00	8.10	1.46	11, 13, 16
Terebellidae	1	–20.41	–	7.69	–	5
Trichobranchidae	2	–20.34	0.08	8.73	0.16	7
Yoldia hyperborea	9	–18.10	0.45	7.46	0.46	14, 15, 17
Yoldiella sp.	1	–19.24	–	9.51	–	15
Zooplankton	5	–21.05	0.76	8.90	0.56	10, 12, 15

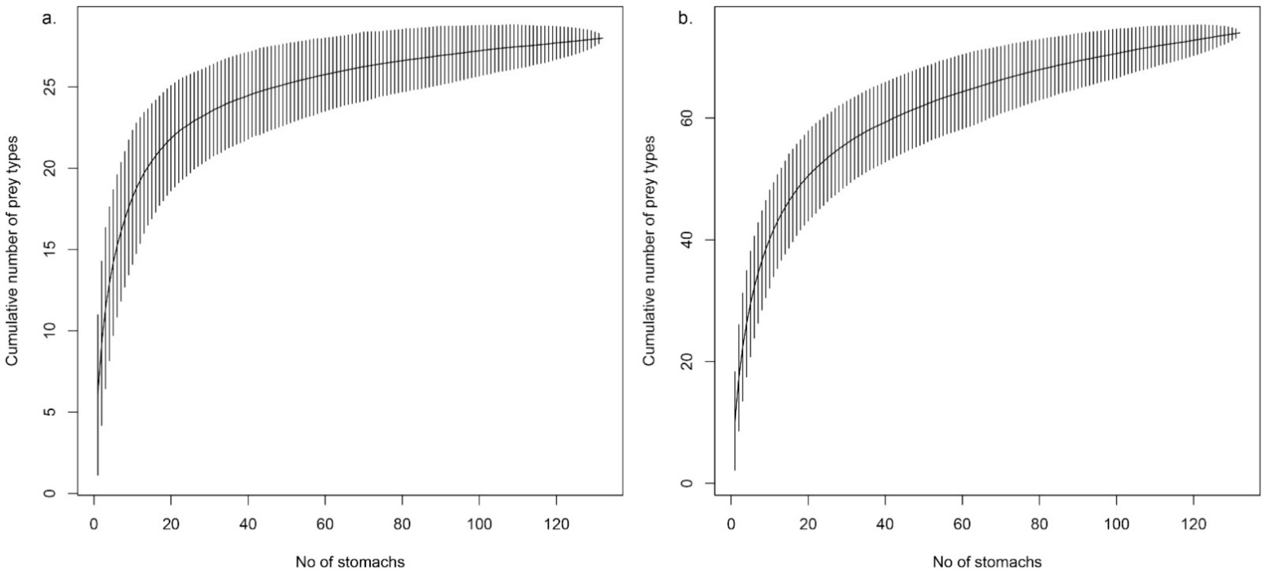

Fig. S2. Cumulative prey curves for red king crab stomachs. Level of identification: (a) Major taxonomic groups (n = 32) and (b) lowest possible level (n = 70). Lower taxonomic identification of prey items resulted in a higher number of stomachs needed for accurate description of the diet. Data are means ± SD from 999 permutations.

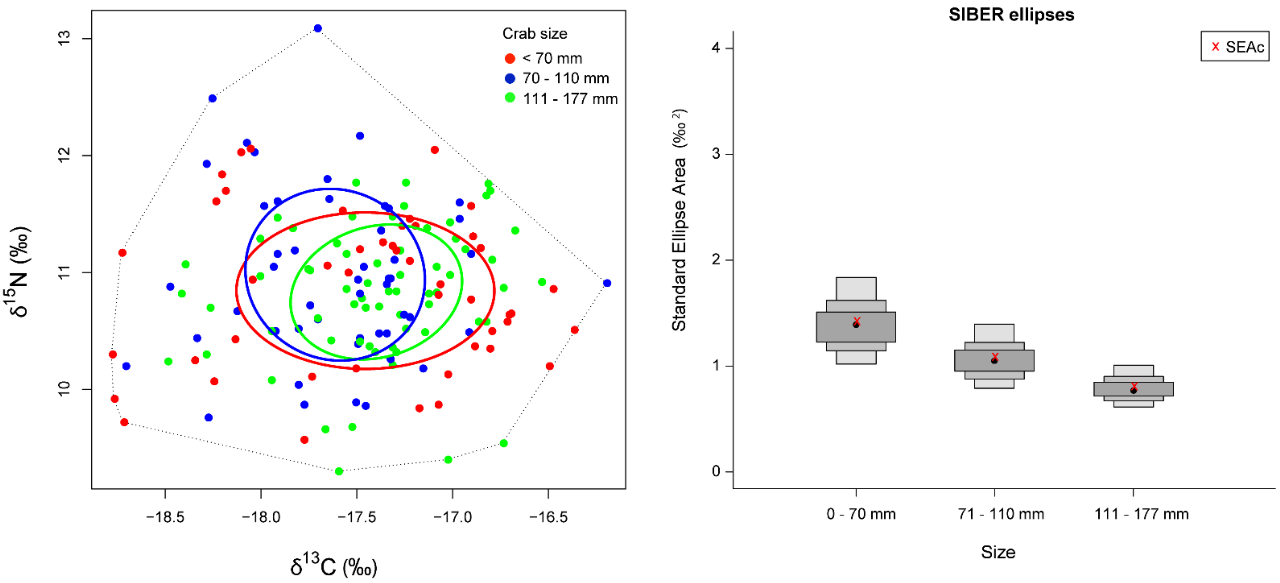

Fig. S3. Isotopic niche of red king crab size classes. Ellipses are sample size corrected standard ellipses (SEA_c) after Jackson et al. (2011). Estimated posterior distributions of Bayesian standard ellipses with 95%, 75% and 50% credible intervals for each crab size class, obtained from 10^4 solutions.

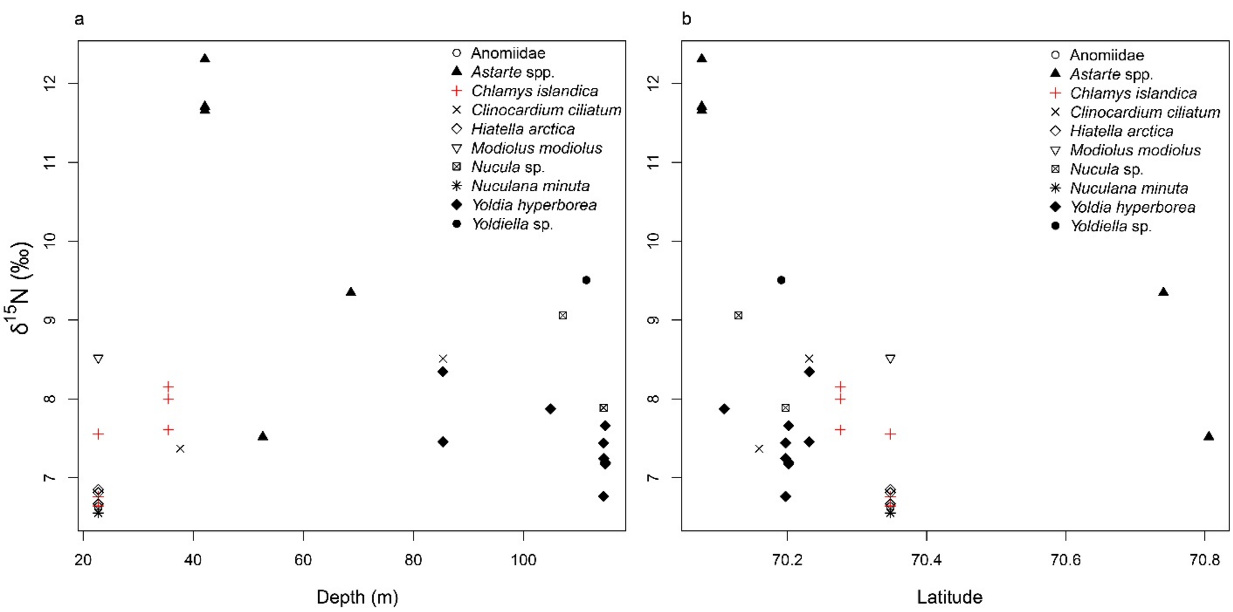

Fig. S4. Stable nitrogen isotope signatures of filter feeding bivalve species analyzed in the current study versus (a) depth and (b) latitude (from the inner to the outer fjord) of sampling stations. *Chlamys islandica* was used as a baseline for trophic level calculation of red king crabs.

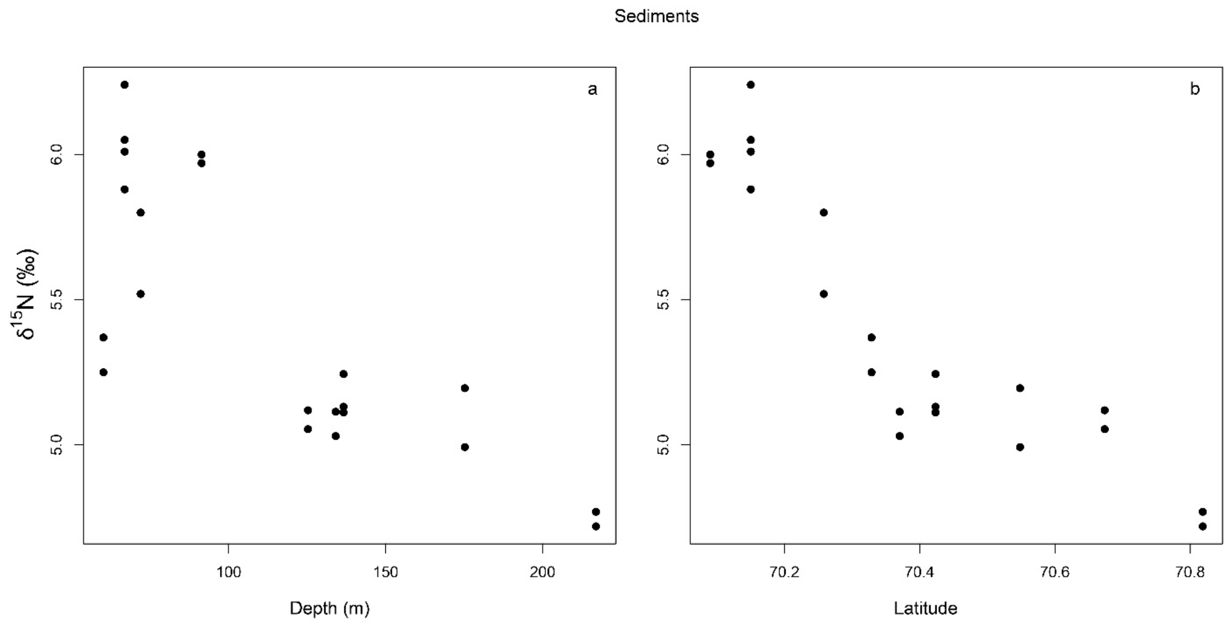

Fig. S5. Stable nitrogen isotope signatures of sediment samples analyzed in the current study versus (a) depth and (b) latitude (from the inner to the outer fjord) of 9 sampling stations.

Table S2. Results from Moran's *I* analysis for stable carbon and nitrogen signatures of red king crabs with utm coordinates of sampling stations as locations in space. Different numbers of nearest neighbors (*k*) were used in the calculation of the weights. See documentation in R for the function moranI (package *lctools*; Kalogirou 2015) for further details and references.

ID	*k*	Moran's *I*	*Z* resampling	P-value resampling	*Z* randomization	*P*-value randomization
$\delta^{15}N$						
1	3	0.522	9.143	6.08E-20	9.149	5.74E-20
2	4	0.516	9.931	3.05E-23	9.938	2.85E-23
3	6	0.489	11.789	4.46E-32	11.797	4.05E-32
4	9	0.452	13.519	1.21E-41	13.528	1.06E-41
5	12	0.445	15.540	1.85E-54	15.551	1.57E-54
6	18	0.331	14.658	1.20E-48	14.668	1.03E-48
7	24	0.241	12.738	3.63E-37	12.747	3.25E-37
$\delta^{13}C$						
1	3	0.295	5.216	1.82E-07	5.214	1.85E-07
2	4	0.278	5.415	6.11E-08	5.413	6.21E-08
3	6	0.250	6.095	1.09E-09	6.092	1.11E-09
4	9	0.247	7.468	8.15E-14	7.464	8.40E-14
5	12	0.215	7.626	2.41E-14	7.622	2.49E-14
6	18	0.153	6.923	4.44E-12	6.919	4.55E-12
7	24	0.102	5.556	2.76E-08	5.553	2.81E-08

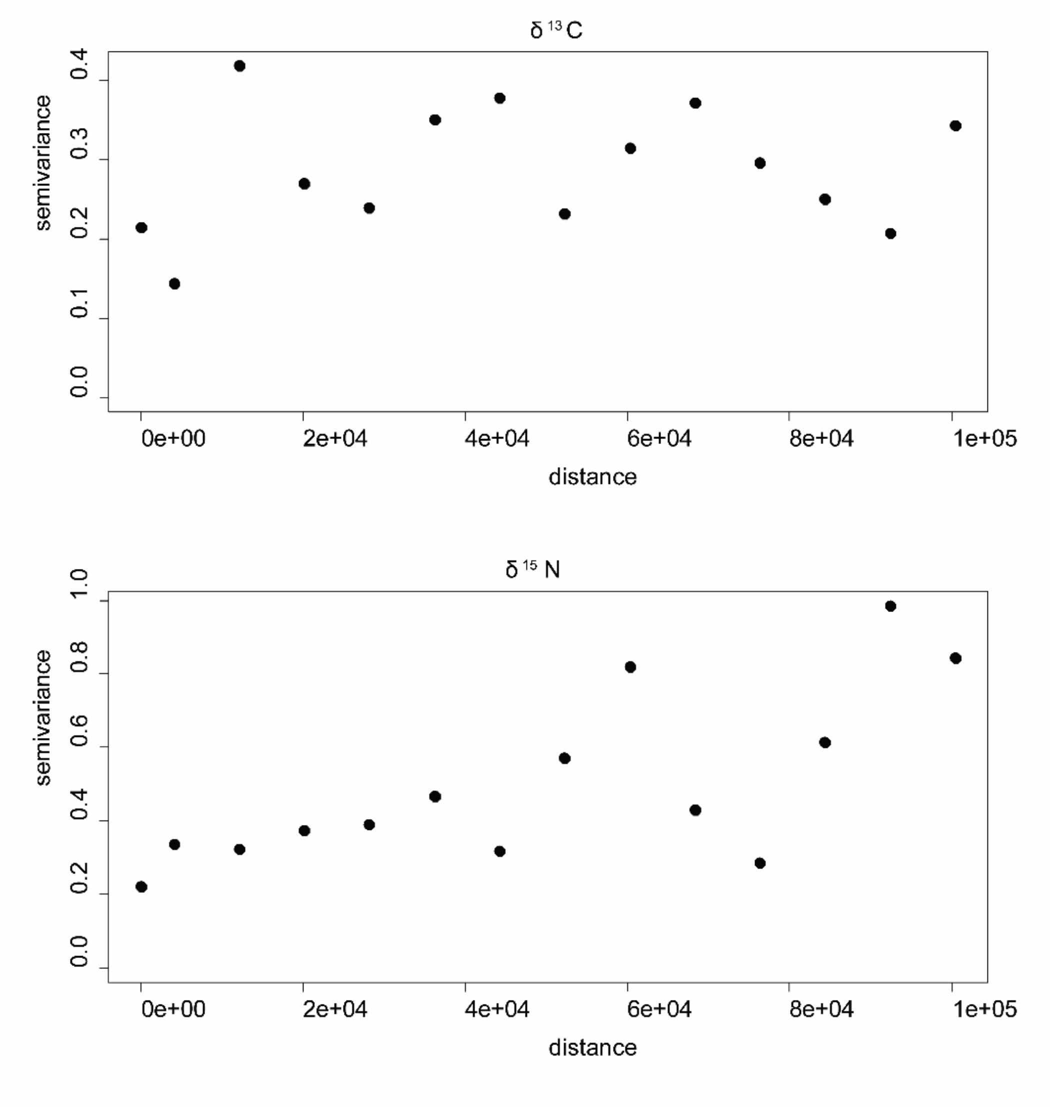

Fig. S6. Semivariogram for stable carbon and nitrogen signatures of red king crabs. Distances are given in meters. See documentation in R for the function variog (package *geoR*; Ribeiro & Diggle 2015) for further details.

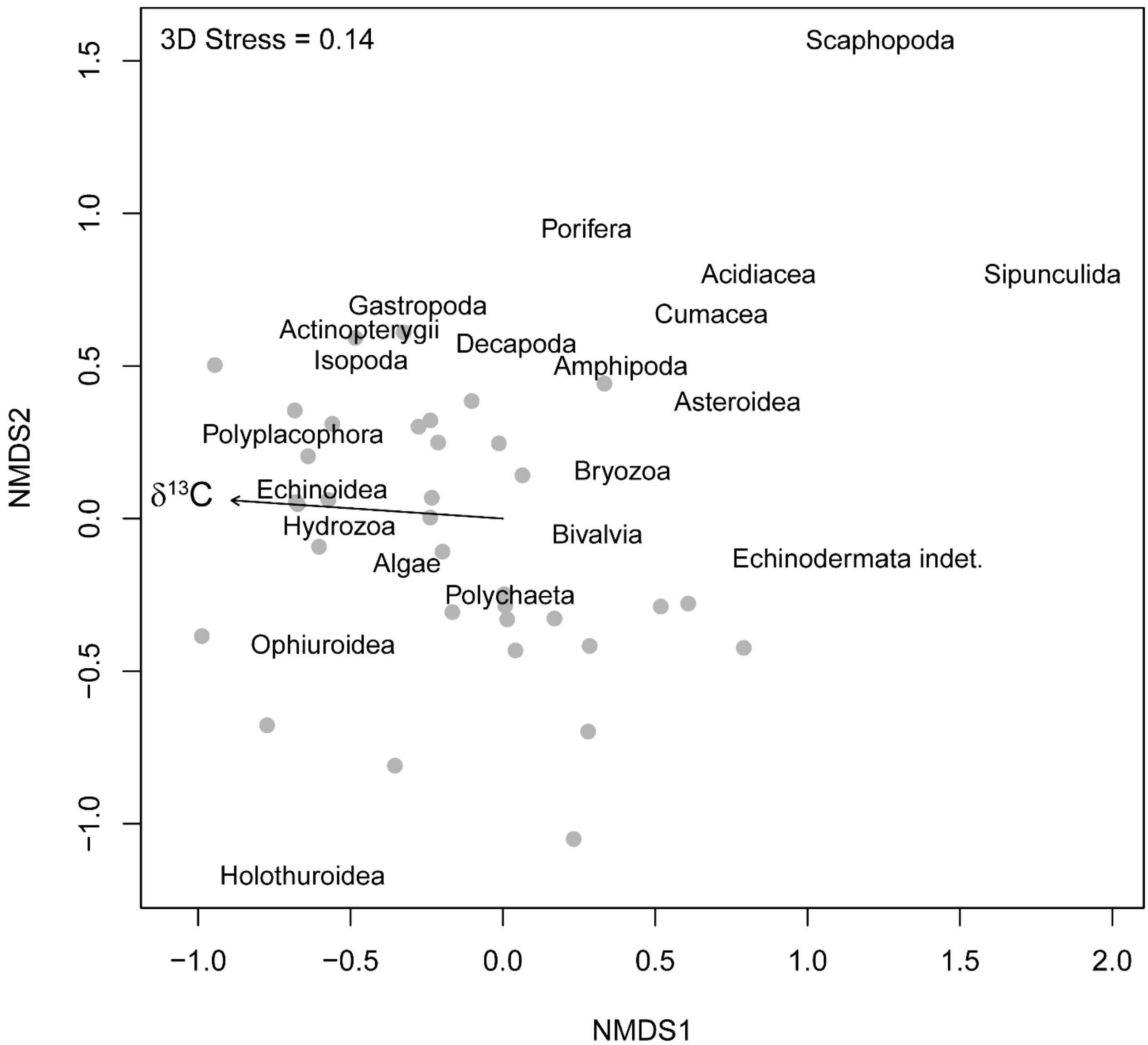

Fig. S7. Non-metrical MDS (axes 1 and 2) of diet composition in red king crabs from stomach-content analysis (n = 57, excluding 3 empty stomachs). Carbon and nitrogen stable isotope signatures were fitted to the ordination (envfit procedure in R package vegan) and its significance was assessed by permutation tests (10000). Significant correlation was obtained for $\delta^{13}C$ and is indicated by the vector.

Table S3. SIBER overlap in isotopic niche with red king crab.

No. in Fig. S9	Species	SIBER overlap in SEA_c with red king crab (‰ ^{2})
1	*Asterias rubens*	1.00
2	*Buccinum undatum*	0.01
3	*Gadiculus argenteus thori*	0.00
4	*Gadus morhua*	0.00
5	*Glypthocephalus cynoglossus*	0.00
6	*Hippoglossoides platessoides*	0.00
7	*Hippoglossus hippoglossus*	0.00
8	*Lithodes maja*	0.37
9	*Lunatia tenistriata*	0.00
10	*Melanogrammus aeglefinus*	0.00
11	*Neptunea despecta*	0.21
12	*Pagurus* sp.	0.35
13	*Pandalus borealis*	0.00
14	*Pleuronectes platessa*	0.00
15	Red king crab	–
16	*Sabinea septemcarinata*	0.00
17	*Sclerocrangon boreas*	0.00
18	*Sebastes* sp.	0.00

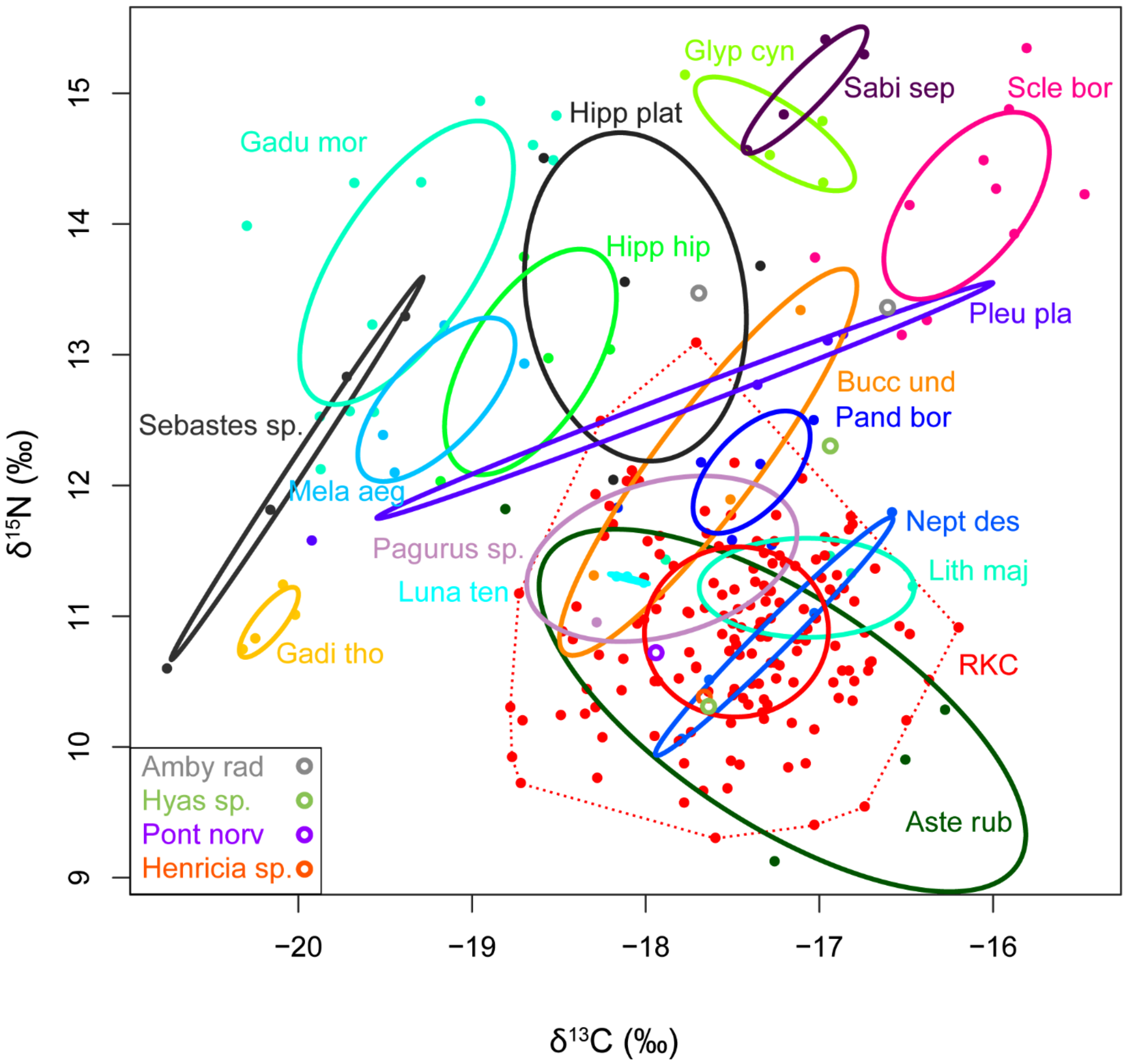

Fig. S8. Isotopic niche of red king crab and possible competitors in the benthic food web of Porsangerfjord. Data are represented by sample size corrected standard ellipses (SEAc), after Jackson et al. (2011). Red king crab convex hull is, in addition, depicted by the dotted line. Single data points are represented by dots. *Amby rad* = *Amblyraja radiata* (thorny skate), *Aste rub* = *Asterias rubens*, *Bucc und* = *Buccinum undatum*, *Gadi tho* = *Gadiculus thori* (silvery cod), *Gadu mor* = *Gadus morhua* (cod) , *Glyp cyn* = *Glyptocephalus cynoglossus* (witch flounder), *Henricia sp*., *Hipp pla* = *Hippoglossoides platessoides* (long rough dab), *Hipp hip* = *Hippoglossus hippoglossus* (halibut) , *Hyas sp*. (crab), RCK = *Paralithodes camtschaticus* (red king crab), *Lith maj* = *Lithodes maja* (stone crab), *Luna ten* = *Lunatia tenistriata*, *Mela aeg* = *Melanogrammus aeglefinus* (Haddock), *Nept des* = *Neptunea despecta*, *Pagurus sp*., *Pand bor* = *Pandalus borealis*, *Pleu plat* = *Pleuronectes platessa* (European plaice), *Pont norv* = *Pontophilus norvegicus*, *Sab sep* = *Sabinea septemcarinata*, *Scle bor* = *Sclerocrangon boreas*, *Sebastes sp*. (redfish).

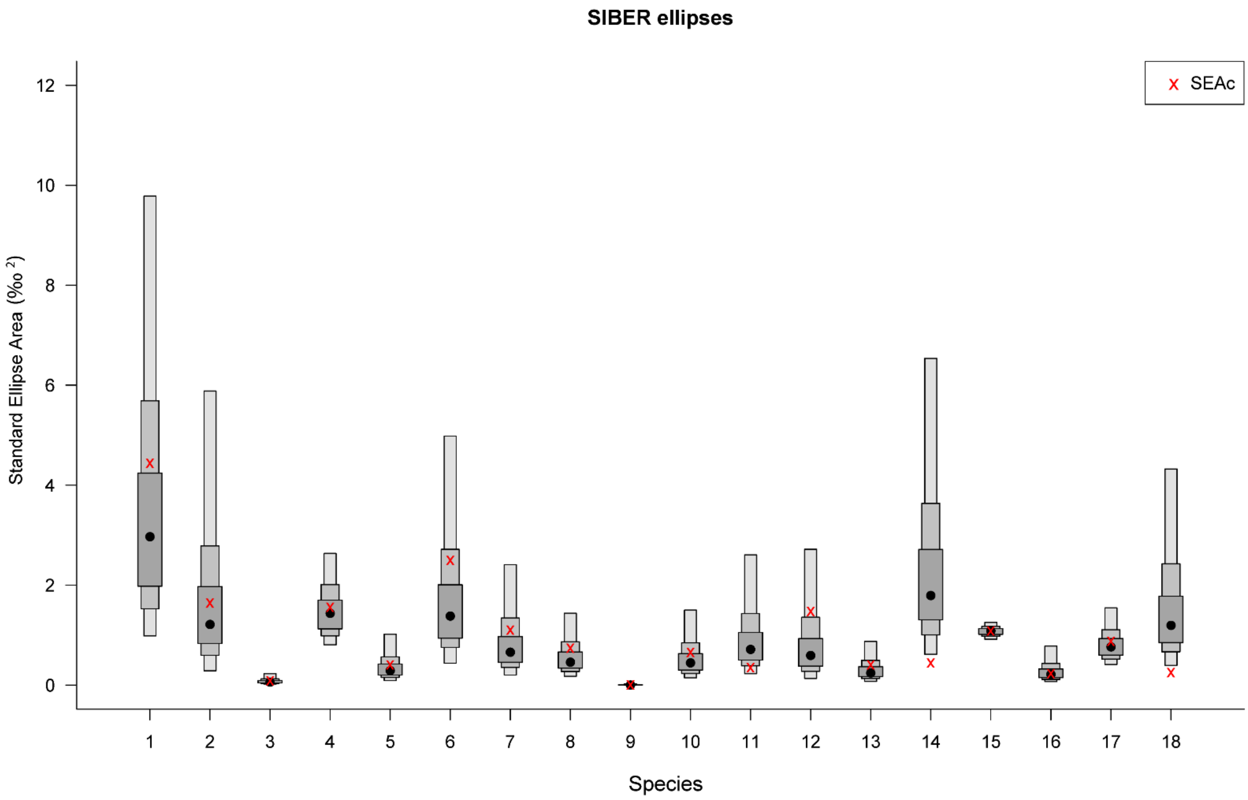

Fig. S9. Estimated posterior distributions of Bayesian standard ellipses with 95%, 75% and 50% credible intervals for each species, obtained from 10^4 solutions. For species names, see Table S3. Values of small sample-size corrected standard ellipses (SEAc) are displayed in red (x).

LITERATURE CITED

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