

### Supplementary materials

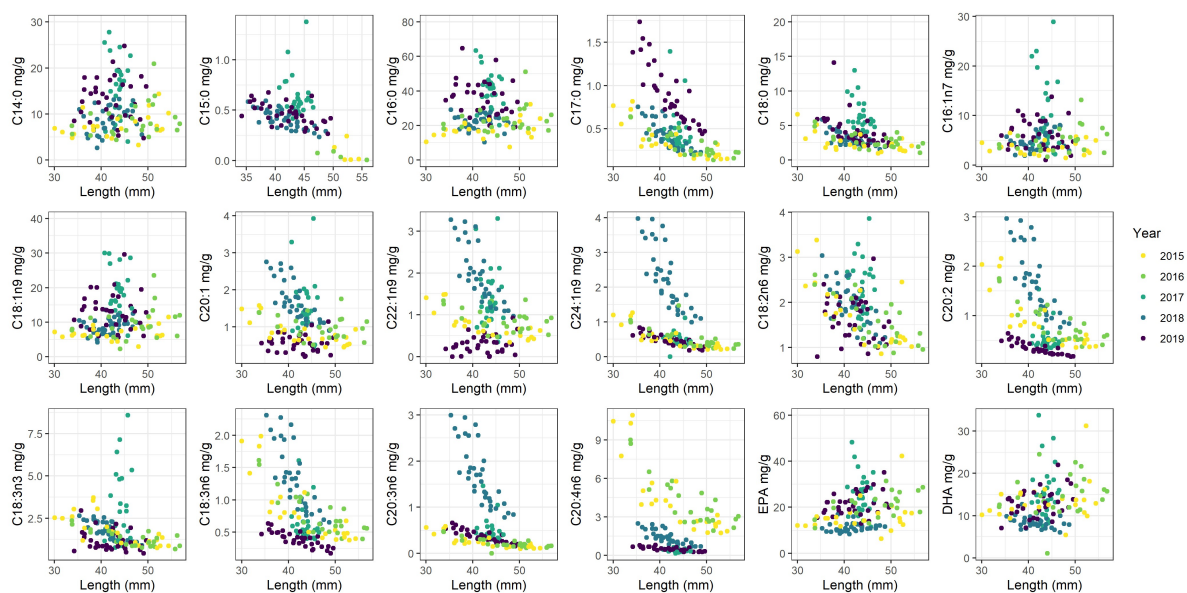


Fig. S1. Krill fatty acid content ( $\text{mg g}^{-1}$ ) at length

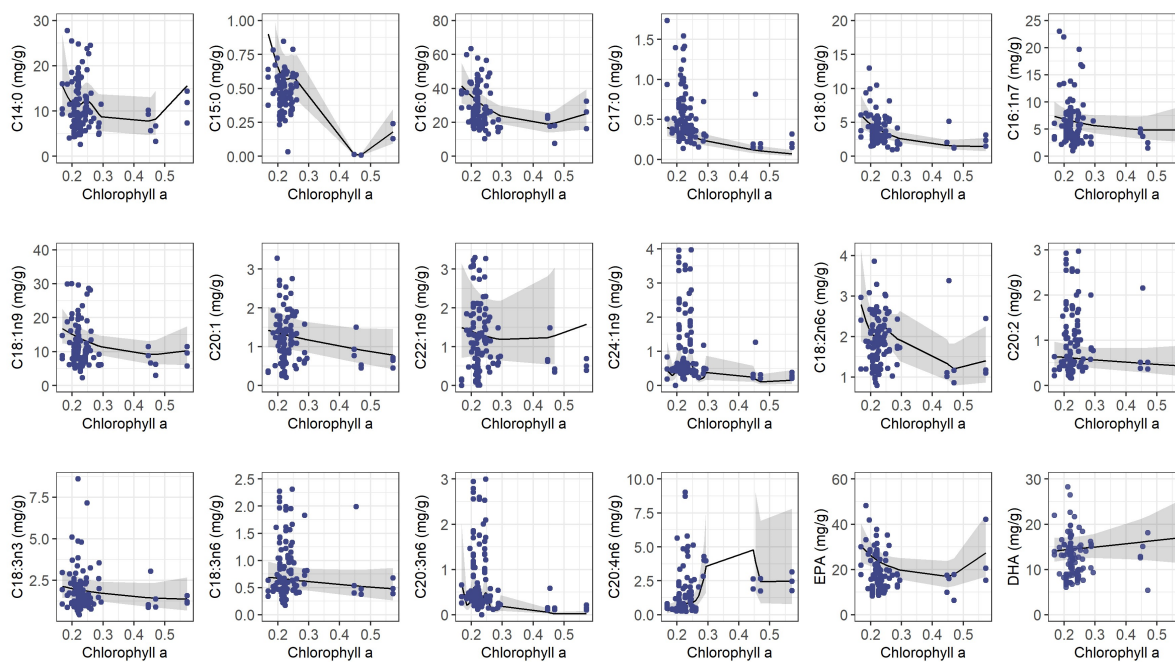


Fig. S2. Correlations between chlorophyll-a and fatty acids based on RenvGAM

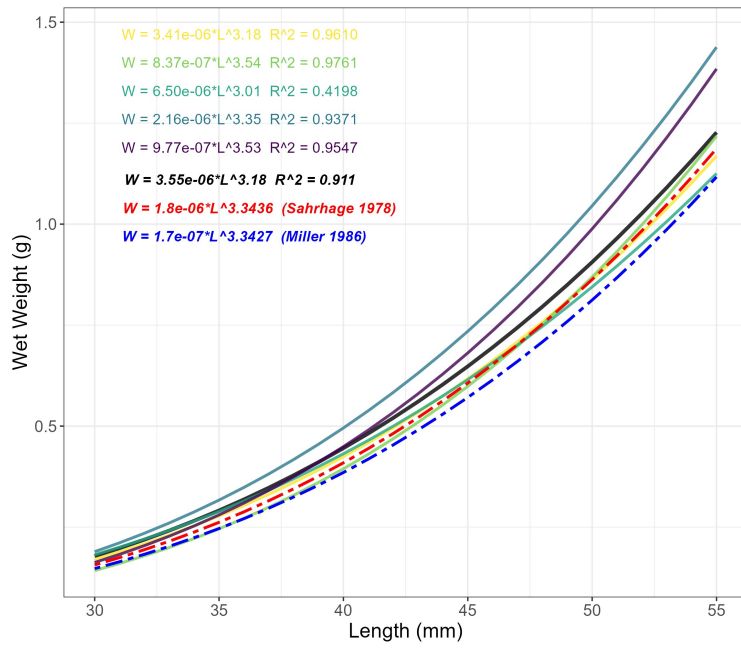


Fig. S3. LWR comparisons between the current study and others

Table S1. Summary of  $p$ -values and  $R^2$  from CenvGAM model with comprehensive habitat features. ‘SIE’ denotes the sampling distance to the sea ice edge, and ‘200 iso’ denotes the distance of sampling station to 200 m isobath

Fatty acid	year2016	year2017	year2018	year2019	SST	Chl a	SIE	200 iso	Date	Location	$R^2$
C14:0	0.117	0.000	0.104	0.000	0.021	0.030	0.560	0.468	0.659	0.870	0.300
C15:0	0.437	0.969	0.944	0.958	0.516	0.000	0.317	0.310	0.213	0.545	0.873
C16:0	0.007	0.000	0.346	0.000	0.000	0.005	0.608	0.853	0.000	0.006	0.518
C17:0	0.976	0.252	0.216	0.000	0.057	0.011	0.872	0.834	0.077	0.431	0.485
C18:0	0.108	0.000	0.079	0.000	0.284	0.598	0.682	0.212	0.298	0.368	0.474
C20:0	0.855	0.000	0.000	0.000	0.026	0.001	0.880	0.748	0.013	0.685	0.847
C21:0	0.208	0.000	0.000	0.000	0.012	0.000	0.673	0.473	0.047	0.500	0.735
C22:0	0.241	0.000	0.000	0.000	0.033	0.001	0.761	0.608	0.067	0.654	0.829
C23:0	0.186	0.013	0.000	0.000	0.012	0.000	0.602	0.470	0.048	0.545	0.760
C24:0	0.139	0.015	0.000	0.000	0.020	0.000	0.409	0.379	0.059	0.938	0.774
C16:1n7	0.007	0.000	0.639	0.079	0.067	0.311	0.146	0.714	0.492	0.987	0.275
C18:1n9	0.221	0.000	0.526	0.000	0.127	0.384	0.432	0.754	0.296	0.701	0.452
C20:1	0.095	0.186	0.001	0.000	0.024	0.039	0.629	0.162	0.004	0.362	0.606
C22:1n9	0.585	0.424	0.008	0.000	0.447	0.195	0.546	0.291	0.105	0.557	0.621
C24:1n9	0.537	0.135	0.000	0.095	0.015	0.001	0.768	0.157	0.024	0.947	0.754
C18:2n6	0.908	0.219	0.235	0.331	0.107	0.081	0.362	0.133	0.052	0.053	0.243
C20:2	0.694	0.000	0.001	0.000	0.132	0.004	0.876	0.999	0.047	0.264	0.704
C22:2n6	0.671	0.000	0.000	0.000	0.136	0.001	0.190	0.514	0.262	0.163	0.959
C18:3n3	0.024	0.016	0.000	0.341	0.957	0.212	0.001	0.010	0.283	0.432	0.309
C18:3n6	0.835	0.001	0.016	0.000	0.008	0.002	0.952	0.808	0.010	0.575	0.610
C20:3n3	0.000	0.066	0.000	0.000	0.044	0.158	0.290	0.234	0.969	0.749	0.675
C20:3n6	0.873	0.024	0.000	0.168	0.025	0.002	0.946	0.944	0.030	0.785	0.798
C20:4n6	0.937	0.000	0.000	0.000	0.010	0.001	0.727	0.792	0.008	0.245	0.847
C20:5n3 (EPA)	0.024	0.000	0.006	0.019	0.952	0.007	0.990	0.314	0.639	0.506	0.590
C22:6n3 (DHA)	0.900	0.154	0.769	0.085	0.444	0.161	0.016	0.013	0.159	0.744	0.338