Electronic supplementary material 1 Warming drives phenological changes in coastal zooplankton

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Contenat list

Table S1. Results from the analysis with estimated annual cardinal dates as response (y; season Start, End, and Length) as explained by x; temporal trend (Trend), ice conditions (Ice) and temperature anomalies (Temp.). The model parameters (Par) are presented along with their estimated effects (Est.), standard errors (SE), as well as t- and p-values (t and p respectively). These include mean temperature anomaly for February to March (temp_fm), March to April (temp_ma), and April to May (temp_am), as well as summer temperature anomaly from July through September (temp_s), and the ice break-up day (ice_end). In addition, all models include year as a continuous variable accounting for the temporal partial trend (year_x), and a break point (periodsecond), when the net size and frequency of sampling changes, together with an interaction with year to increasing the flexibility of the model (interaction term year_x:periodsecond). Also R^2 and number of years included. Letters a and c in the titles indicate adults and copepodites, respectively. The trend for the second period was derived from refitting the linear model with the factor variable period in different order (periodfirst) and the estimates, standard errors, t and p-values are shown marked with *. Ice effects were only modelled until 2006. The table is available as a separate csv file.

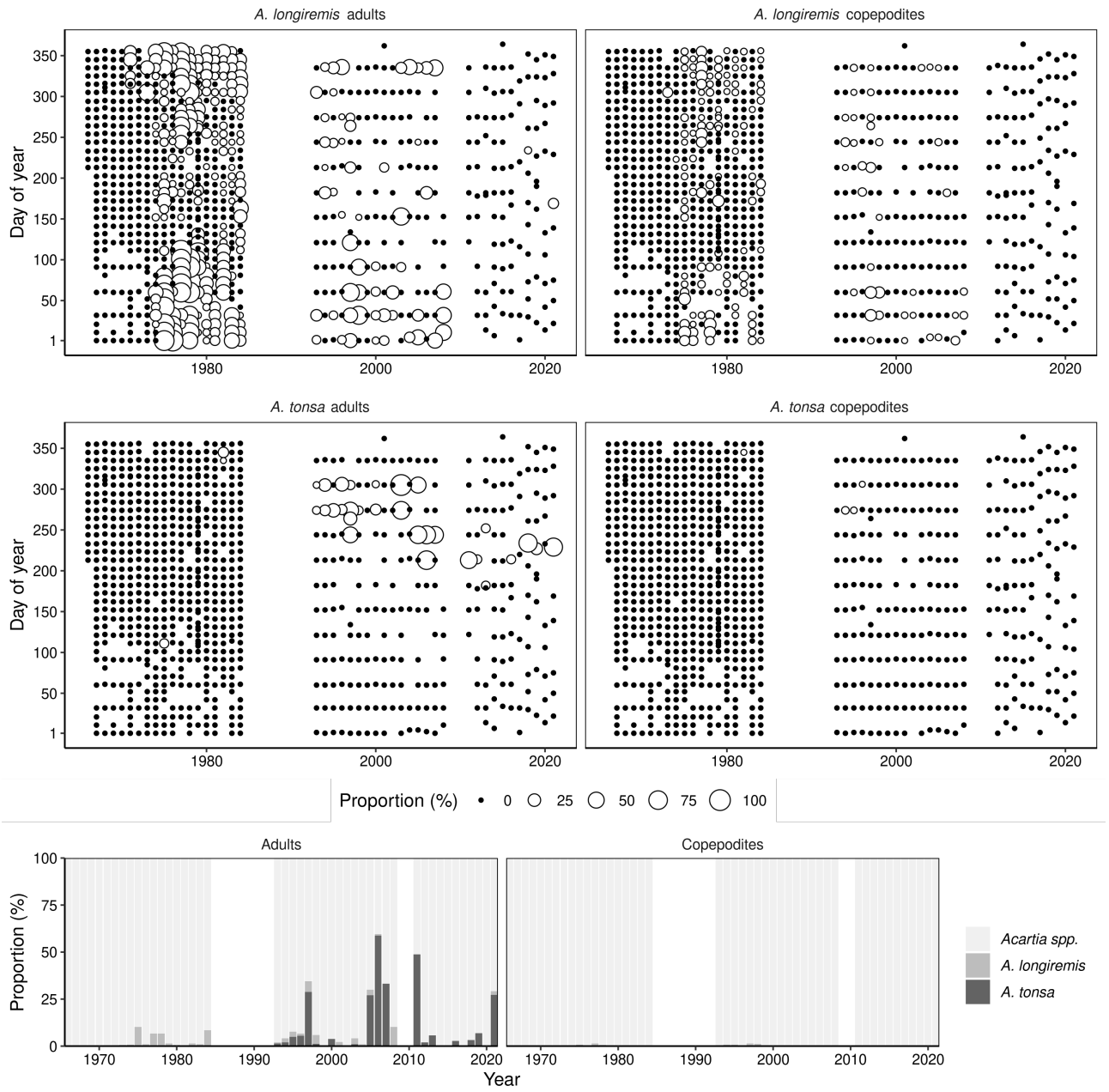


Figure S1. The two top rows show the proportion of adults and copepodite *A. longiremis* and *A. tonsa* out of the total abundance of *Acartia* adults and copepodites for each individual sampling location. The sizes of the circle indicates the proportion of each group from the total, and the ones where the species were not present at all are highlighted in black. The bottom panel shows the proportion of each species of the total annual abundance.

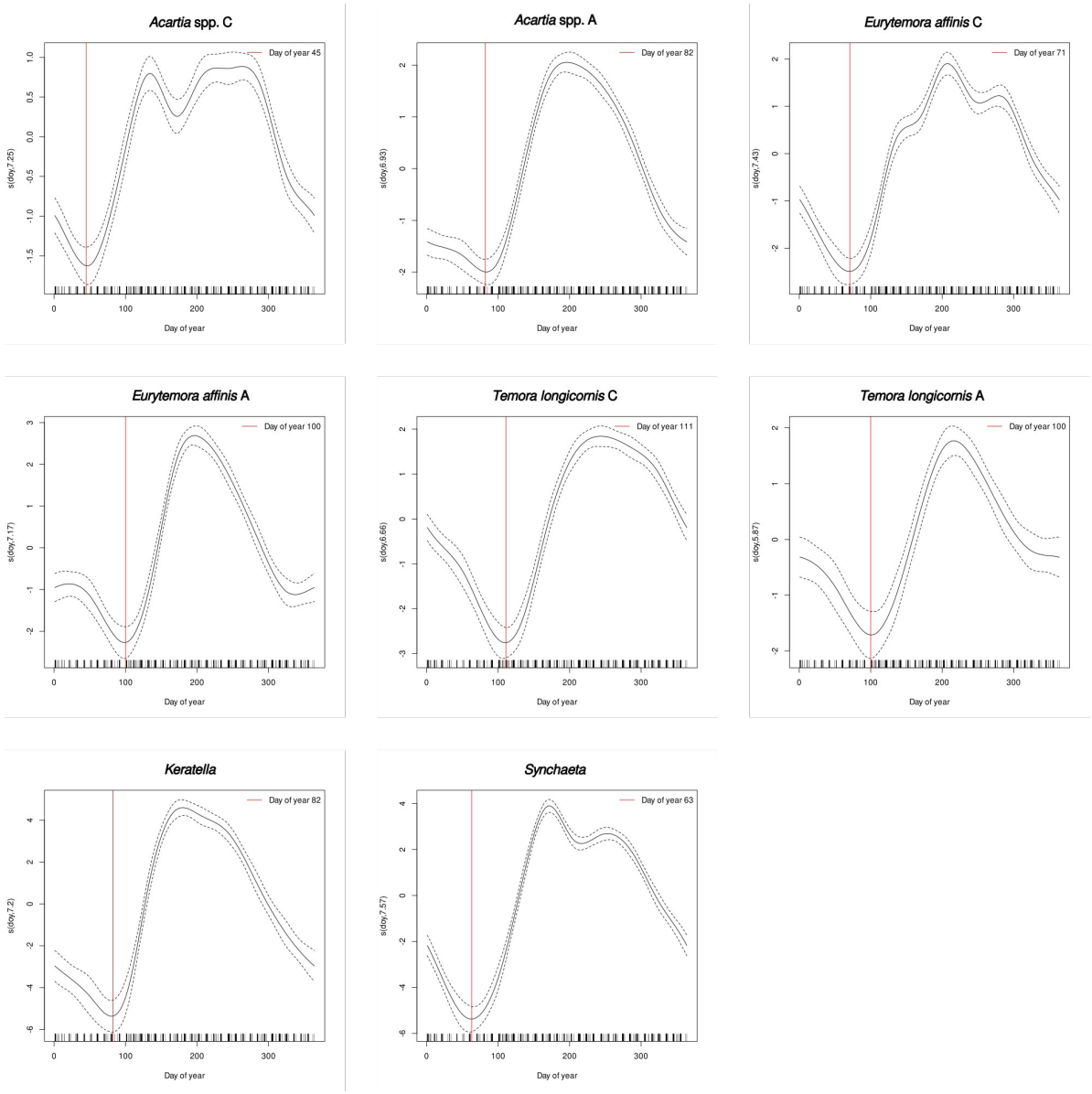


Figure S2. Mean seasonal pattern for the full time-series for each species. The cyclic smoothing functions illustrate the partial effects of day of year on the log scale. The vertical line marks the timing of lowest abundance for the species. Letters A and C in titles indicate adults and copepodites, respectively.

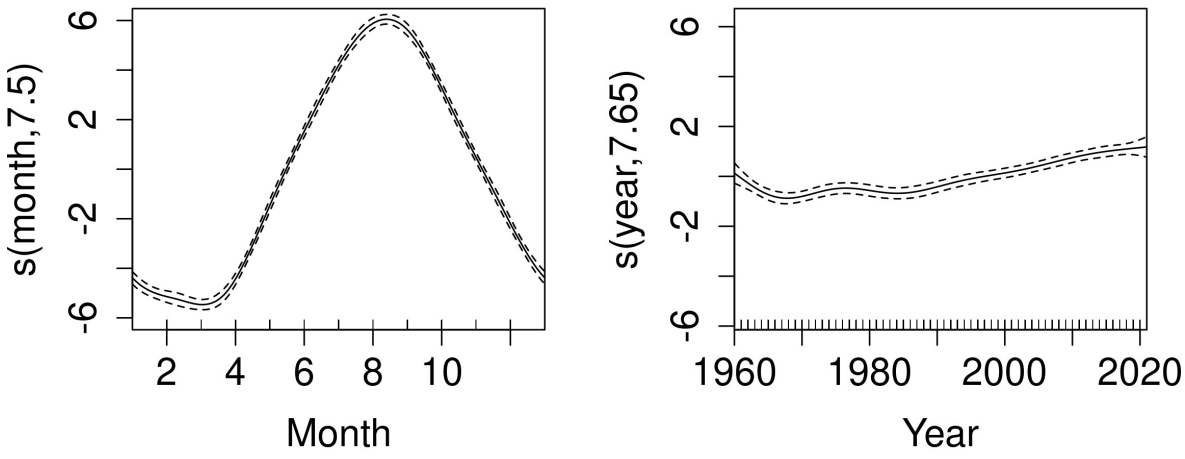


Figure S3. The left panel shows intra-annual smooth of the temperature (mean 0–30 m) and the right panel shows the temperature trend over the time-period using a GAM with a cyclic spline to account for within-year seasonality, and a thin plate spline to model the between-year trend.

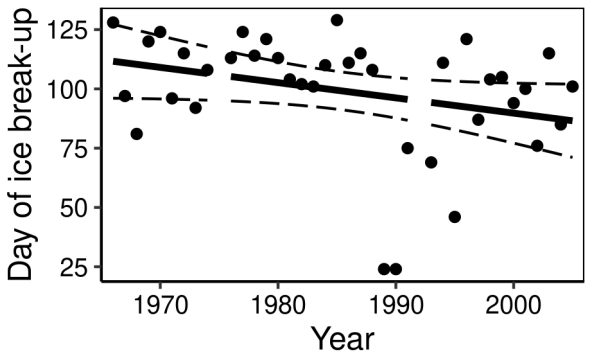
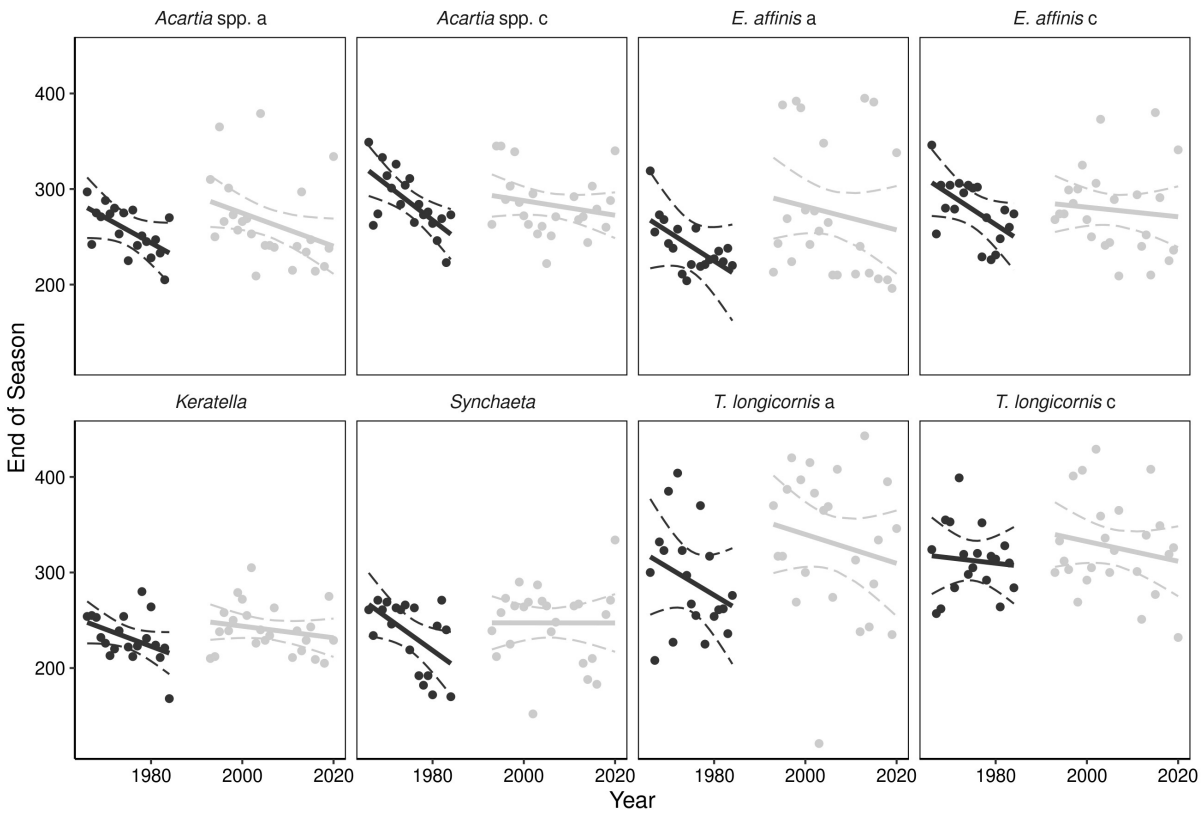


Figure S4. Ice break-up day for 1967–2006, shown together with linear regression results and 95% confidence intervals. Breaks in the lines indicate ice-free years.



S5. The temporal change in end of the season. Points indicate the time when cumulative abundance exceeds 85% of the annual abundance and lines are the model fit from the regression. Black dots indicate the first period (1967–1984) and grey dots the later period (1993–2020). Letters a and c in titles indicate adults and copepodites, respectively.