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Supplementary Materials for

Arctic mid-winter phytoplankton growth revealed by autonomous profilers

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This PDF file includes:

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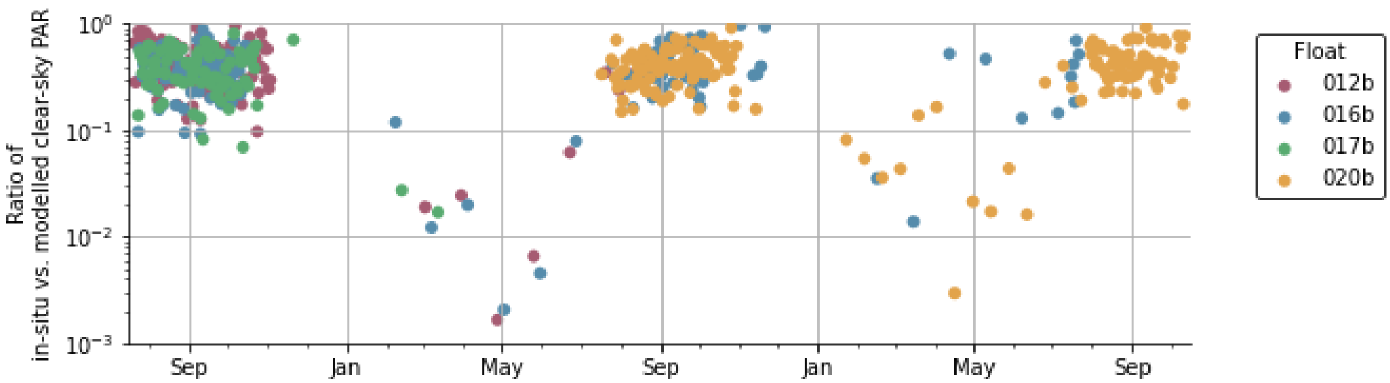

Figure S1: **Average ratio between the irradiance in modelled and theoretical clear-sky PAR profiles.**

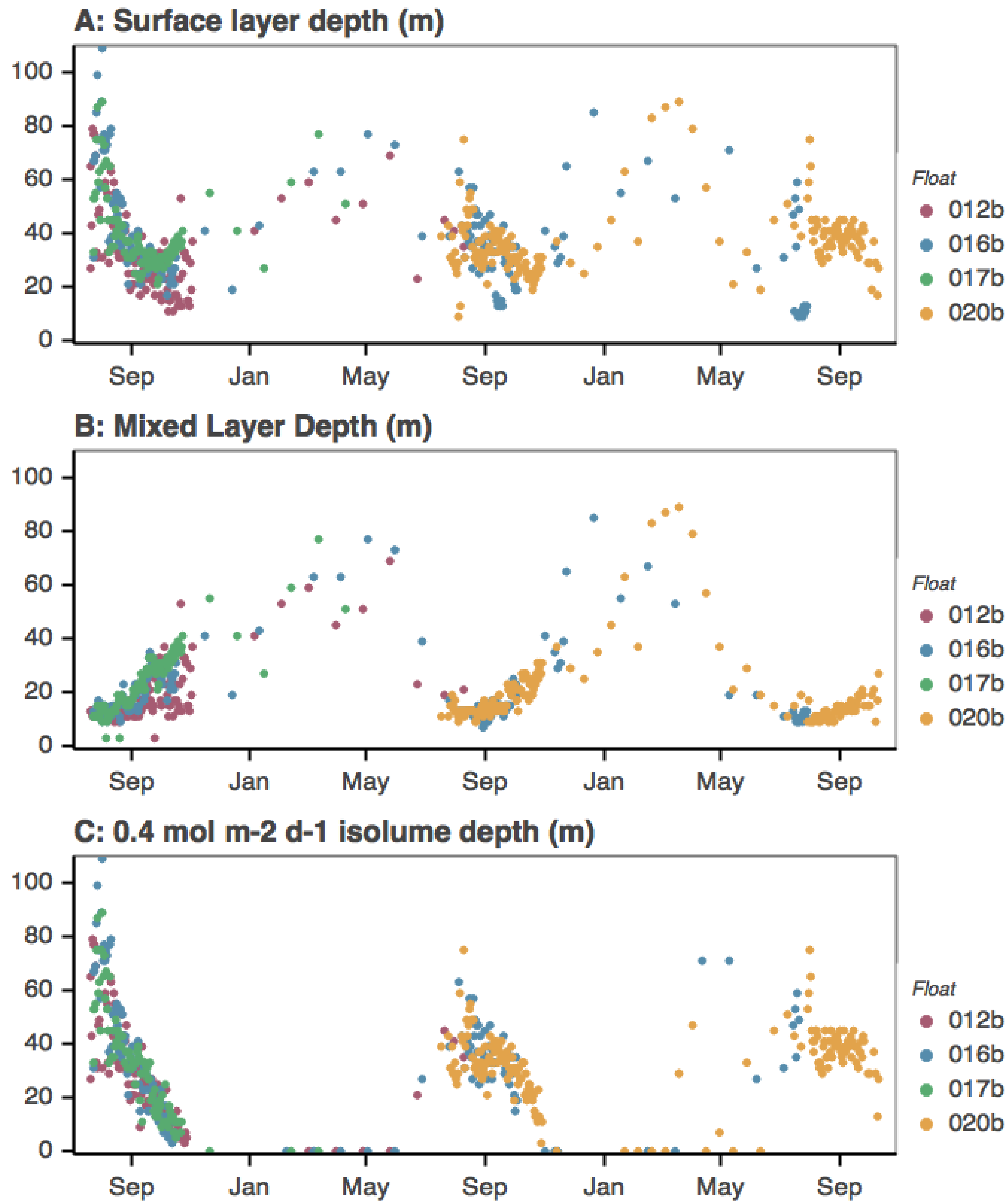

Figure S2: **Surface layer extent.** The depth of the surface layer was defined, for each profile, as either the depth of the mixed layer or the depth of the 0.4 isolume, whichever was deeper.

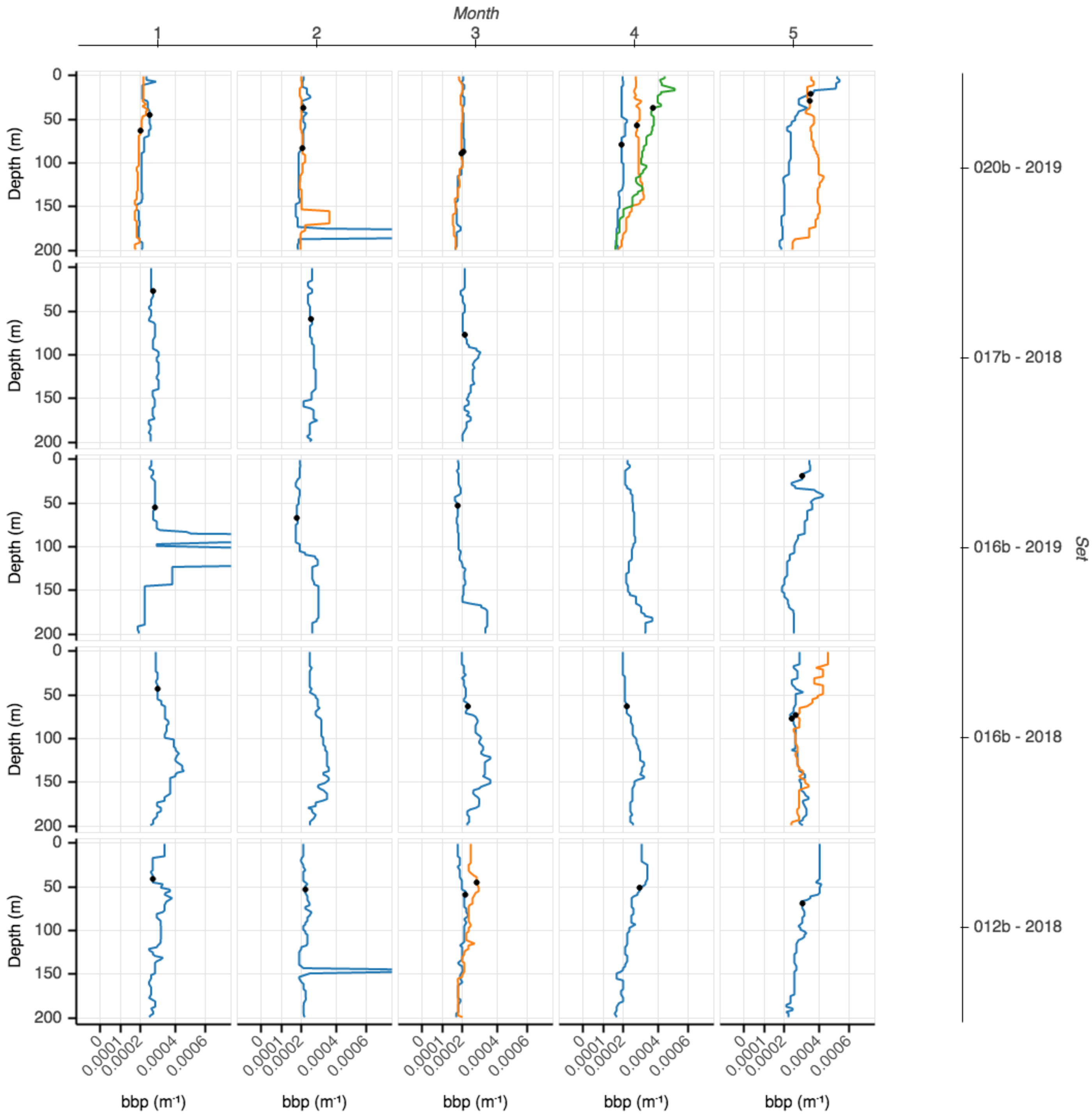

Figure S3: **Vertical backscattering profiles during winter.** Columns correspond to months January (1) through May (5), rows to one float and one year. The black dots indicate mixed layer depth for each profile. Also see the supplementary html files that allow interactively browsing all vertical profiles in all months for all floats.

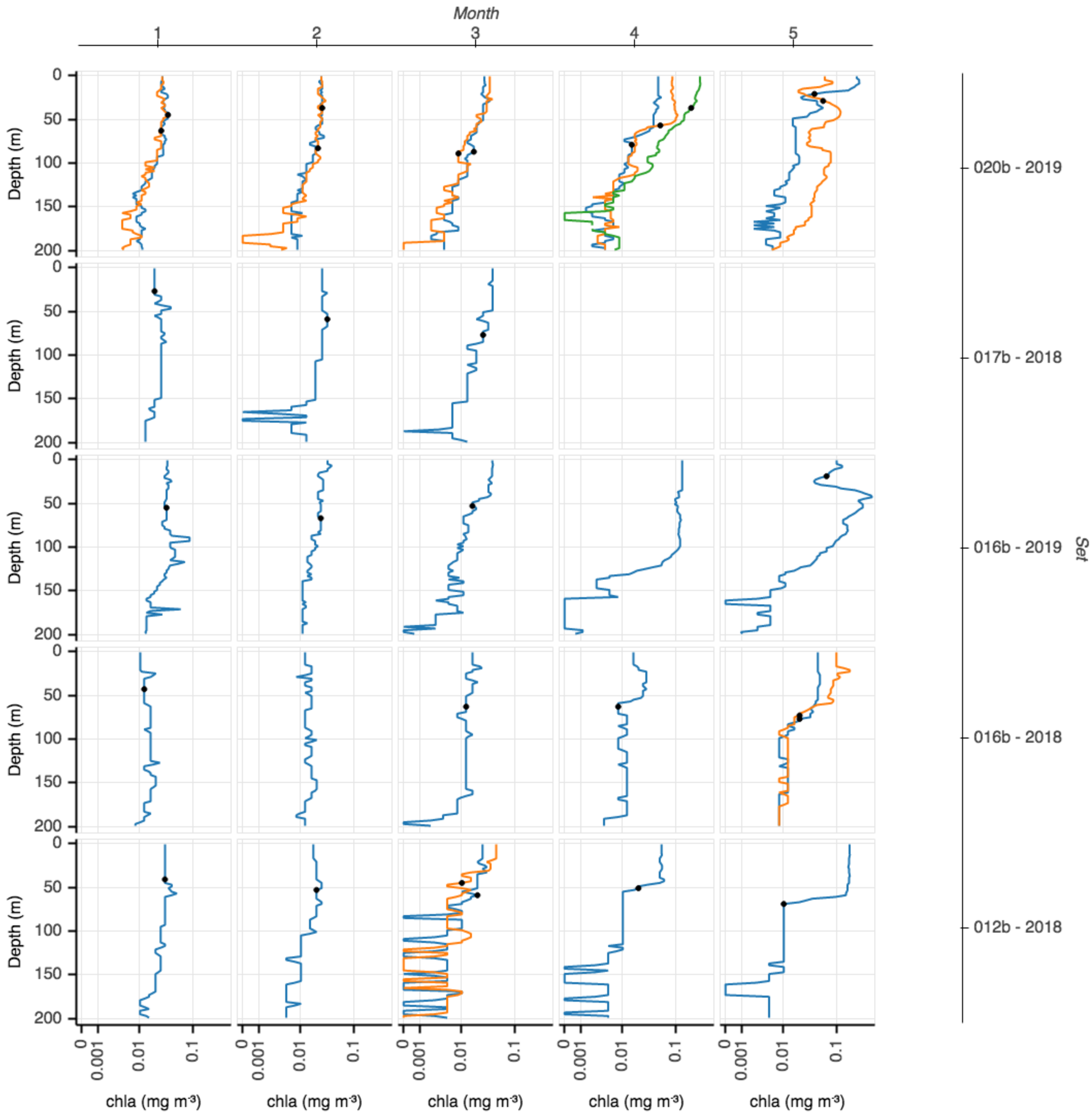

Figure S4: **Vertical chlorophyll *a* fluorescence profiles during winter.** Columns correspond to months January (1) through May (5), rows to one float and one year. The black dots indicate mixed layer depth for each profile. Also see the supplementary html files that allow interactively browsing all vertical profiles in all months for all floats.

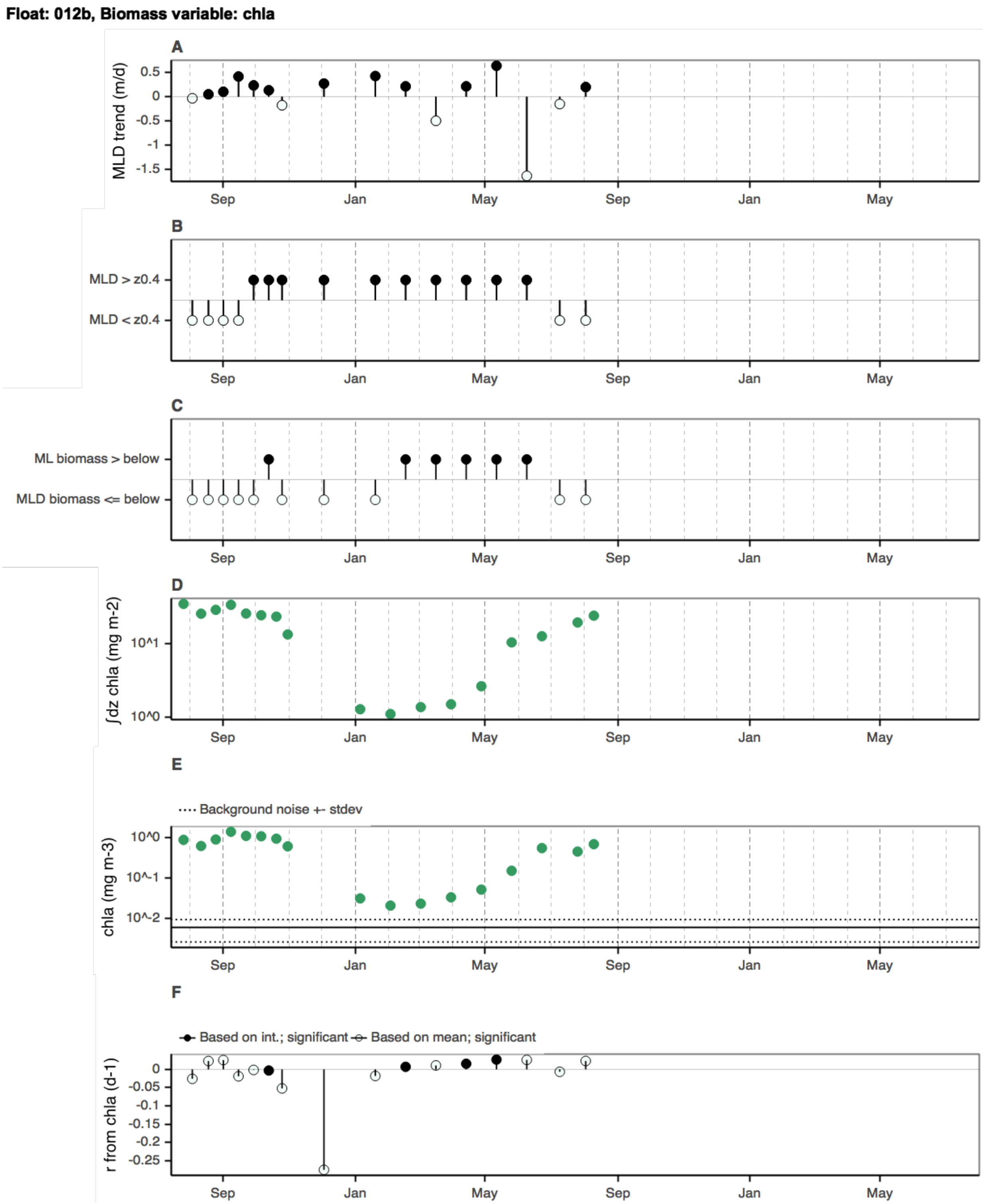

Figure S5: **Computation of net biomass accumulation rate r for float 012b from chlorophyll *a* fluorescence.** (A) Deepening (positive values) and shoaling (negative values) of the surface mixed layer. (B) Whether the mixed layer was deeper or shallower than the 0.4 mol m^{-2} d^{-1} isolume. (C) Whether mixed layer chl-a was significantly larger than chl-a in the layer down to 15 m below. (D) chl-a integrated over the surface layer depth. (E) chl-a averaged over the surface layer depth. (F) Specific biomass change calculated from surface layer chl-a. Wherever all the conditions in panels A-C are all fulfilled, the growth rate (panel F) is calculated from integrated values (panel D), where it is not, from averaged values (panel E). When two successive average chl-a values indicate that both are not different from the background noise signal (marked in panel E), the corresponding growth rate is not considered significant (triangles in panel F). All time series here shown based on values averaged in 14-day bins.

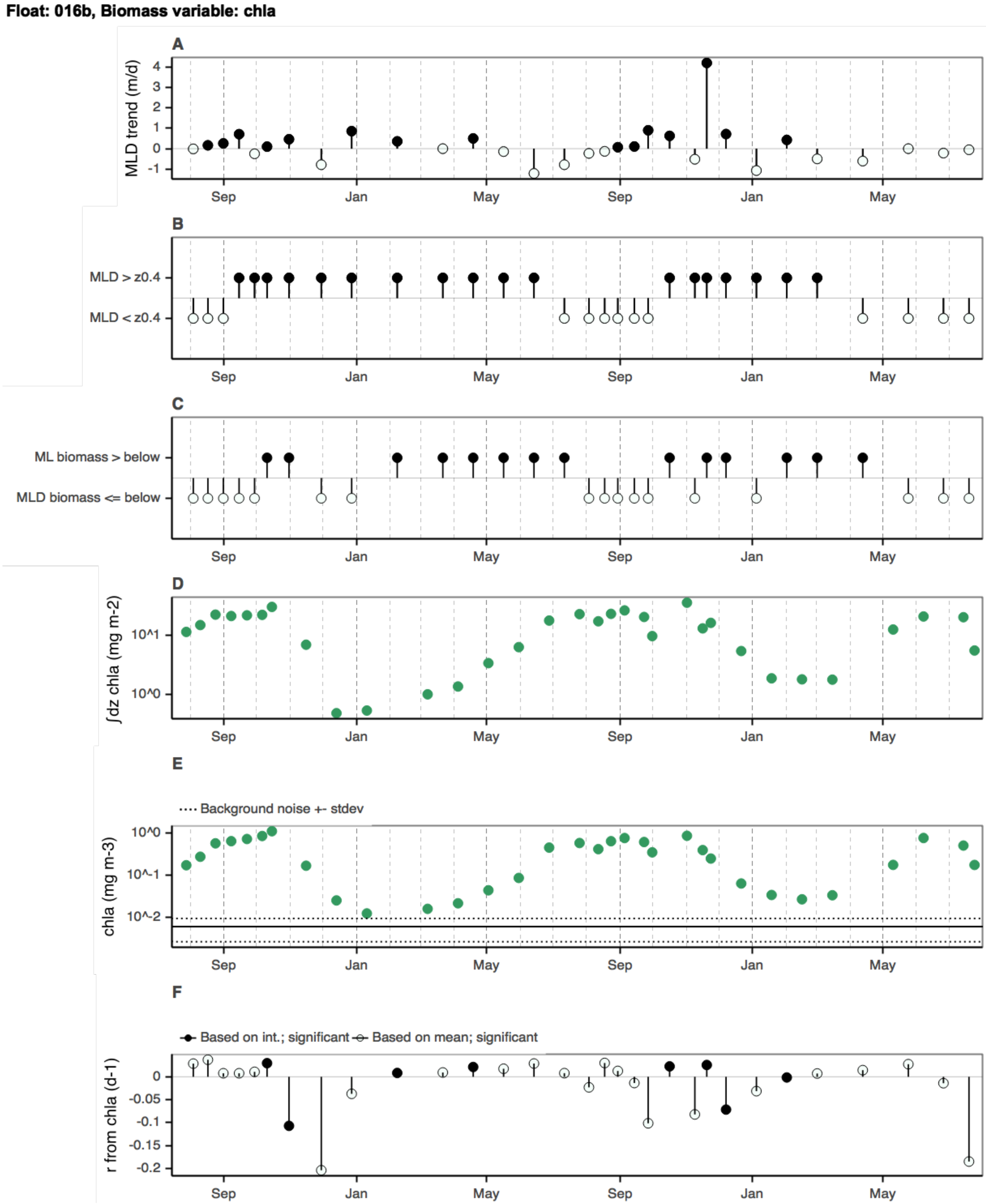

Figure S6: **Like Fig. S5 but for float 016b.**

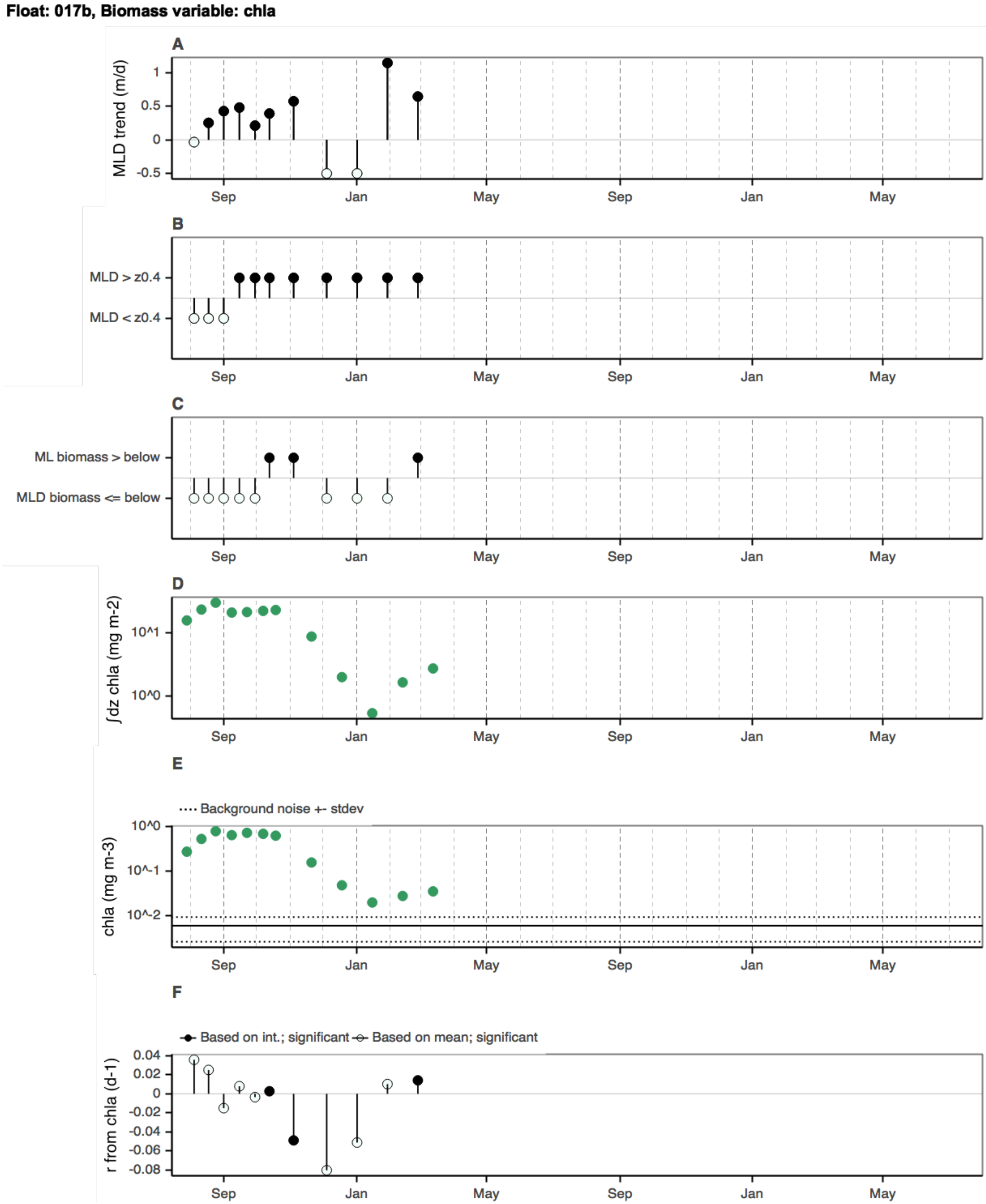

Figure S7: **Like Fig. S5 but for float 017b.**

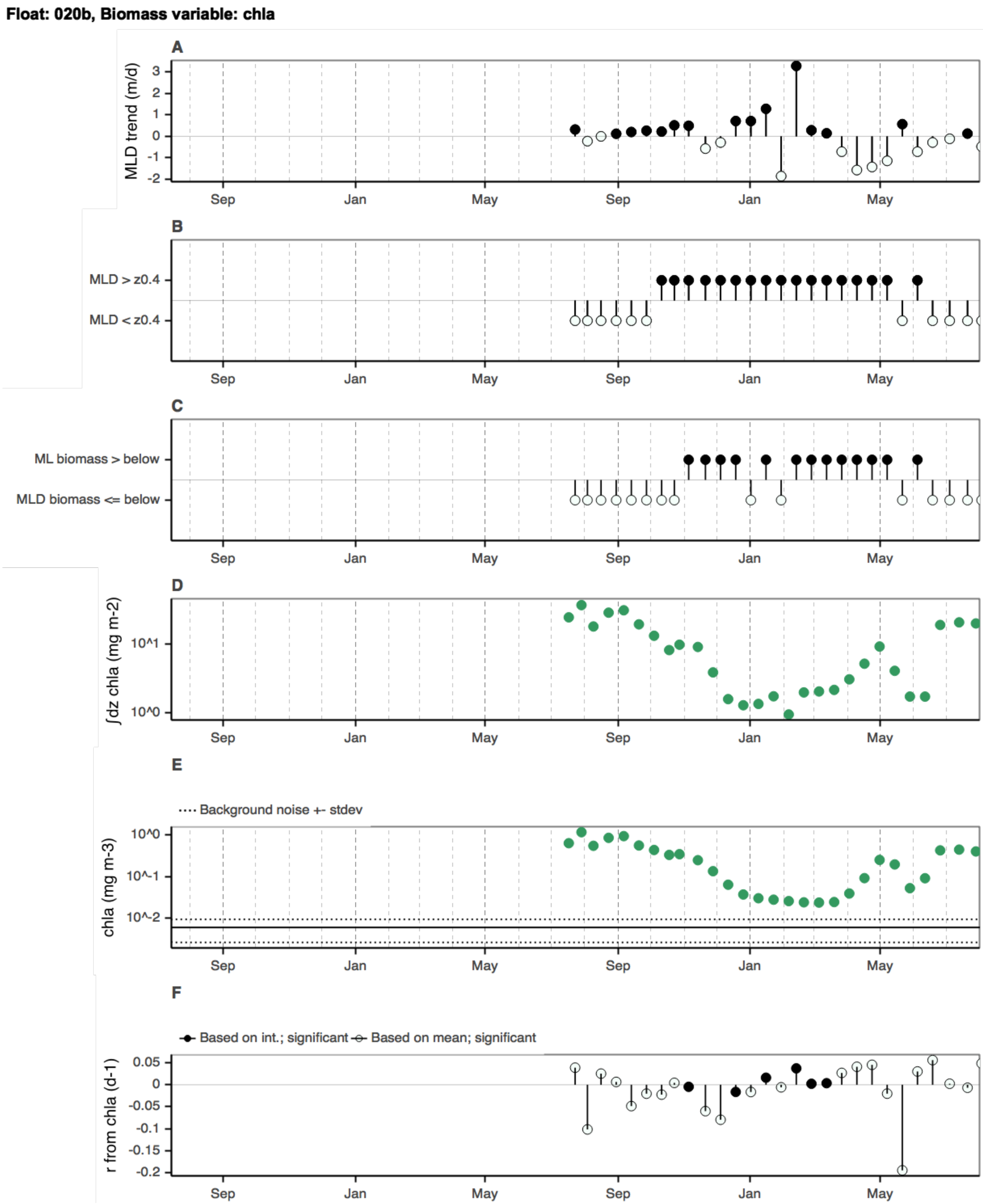

Figure S8: **Like Fig. S5 but for float 020b.**

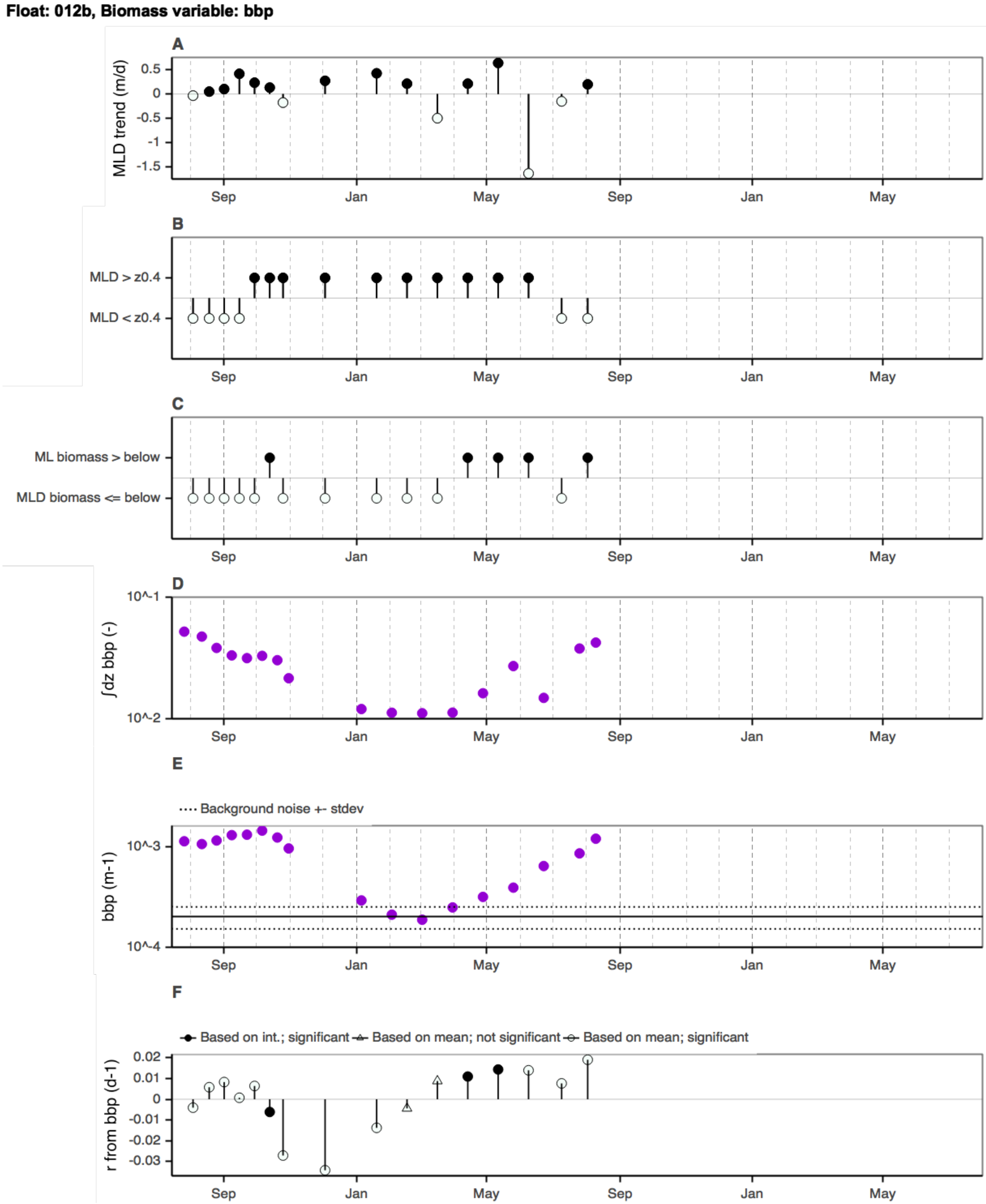

Figure S9: **Like Fig. S5 but based on backscattering (bbp) instead of chlorophyll *a* fluorescence.**

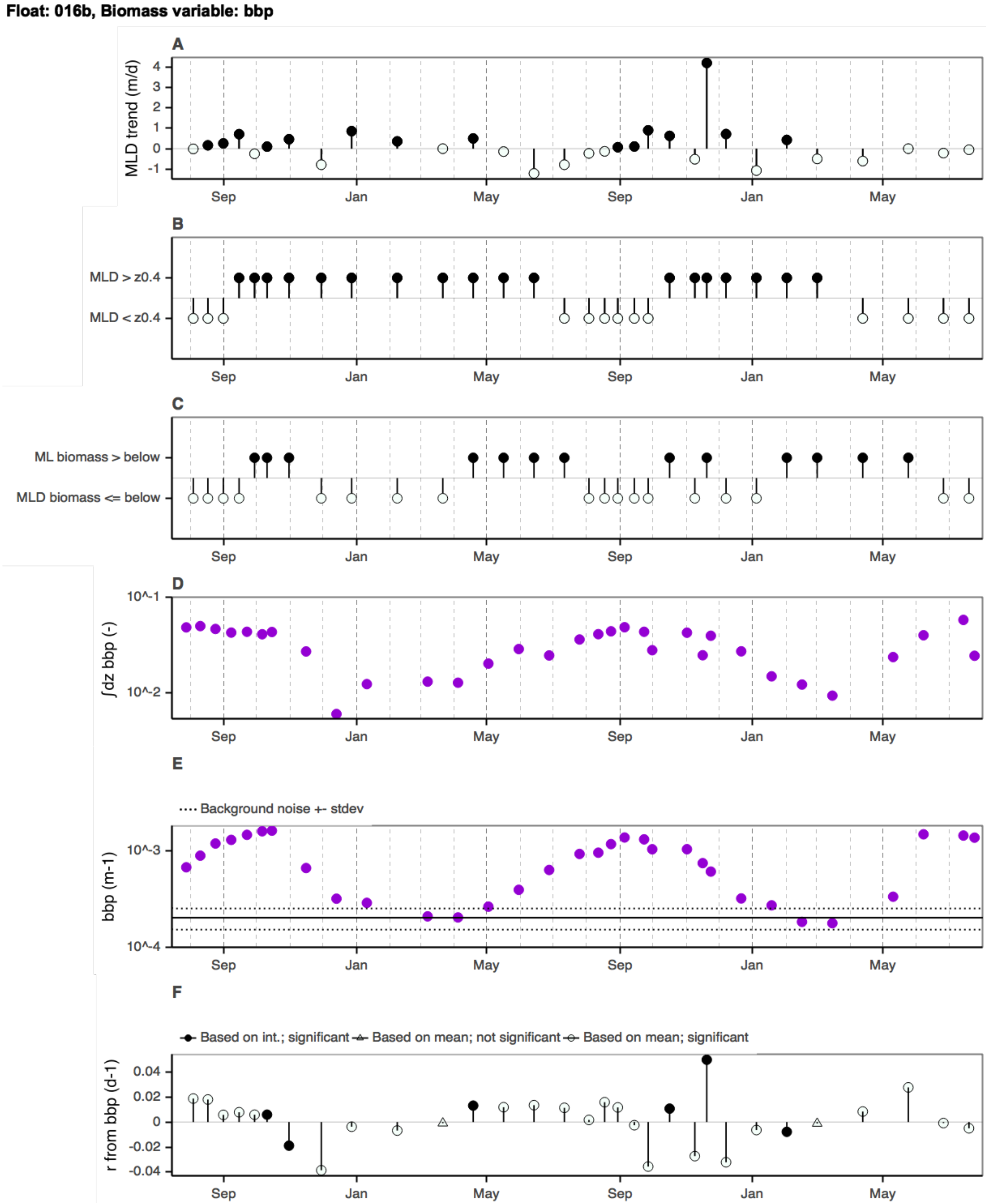

Figure S10: **Like Fig. S9 but for float 016b.**

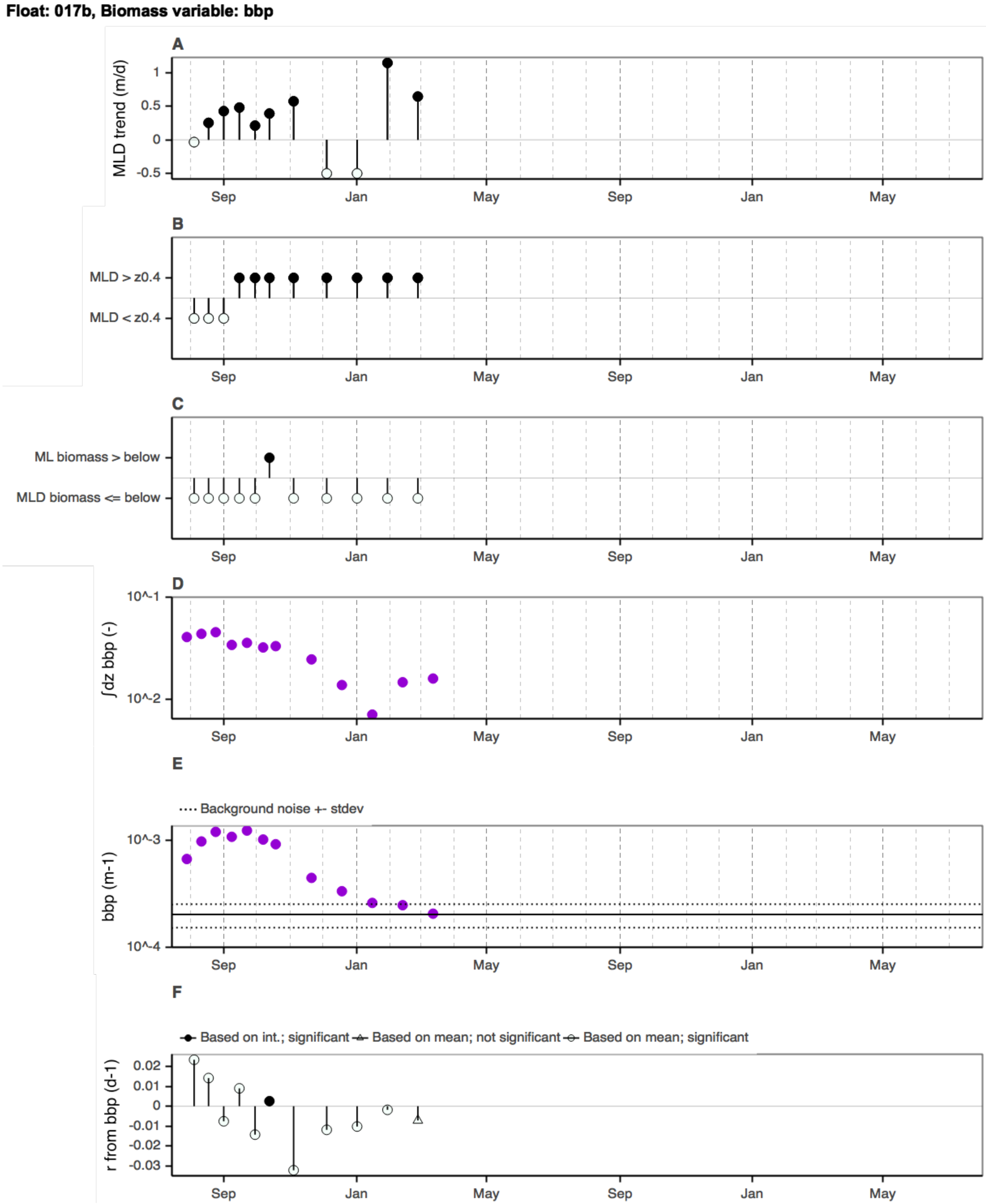

Figure S11: **Like Fig. S9 but for float 017b.**

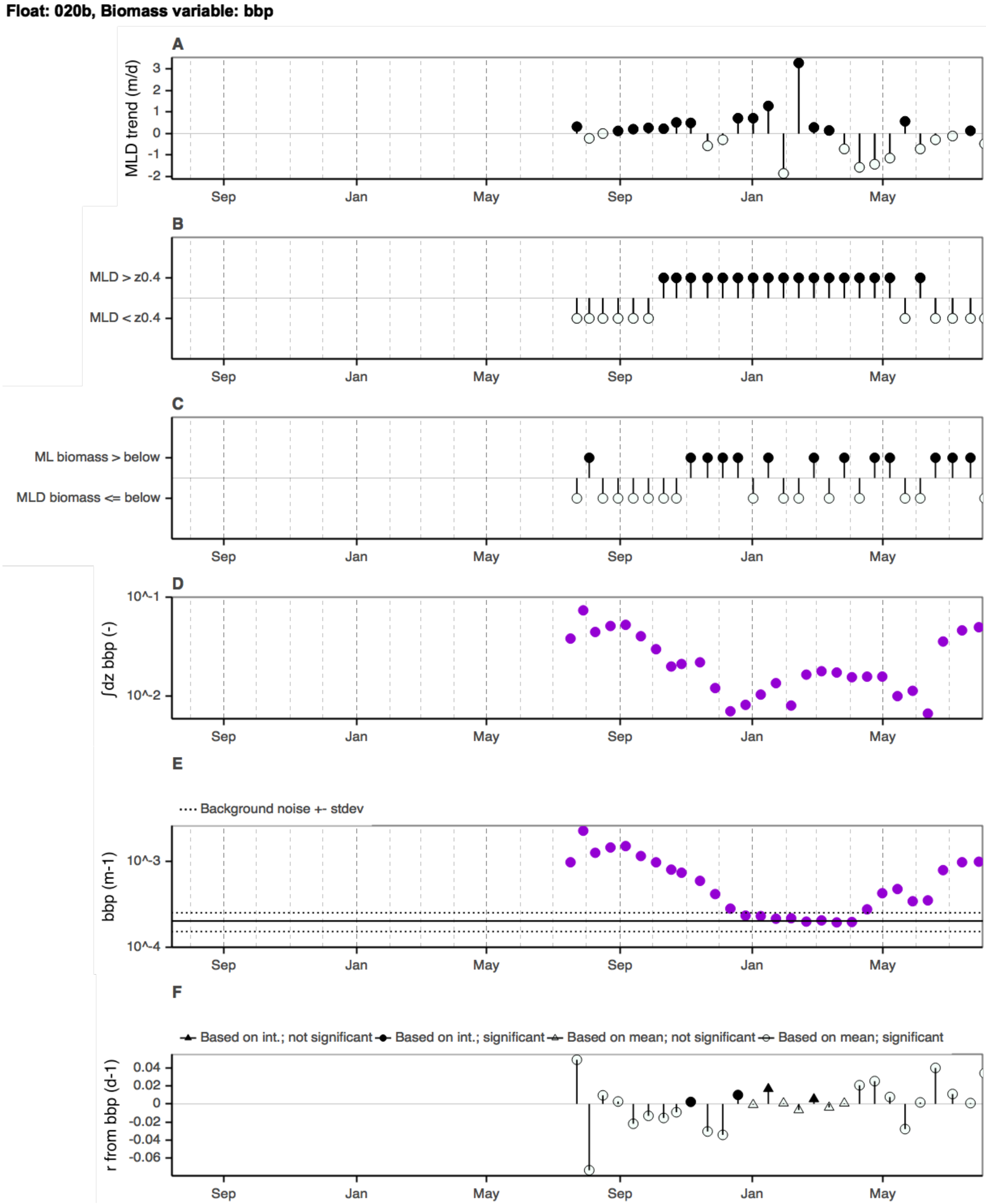

Figure S12: **Like Fig. S9 but for float 020b.**

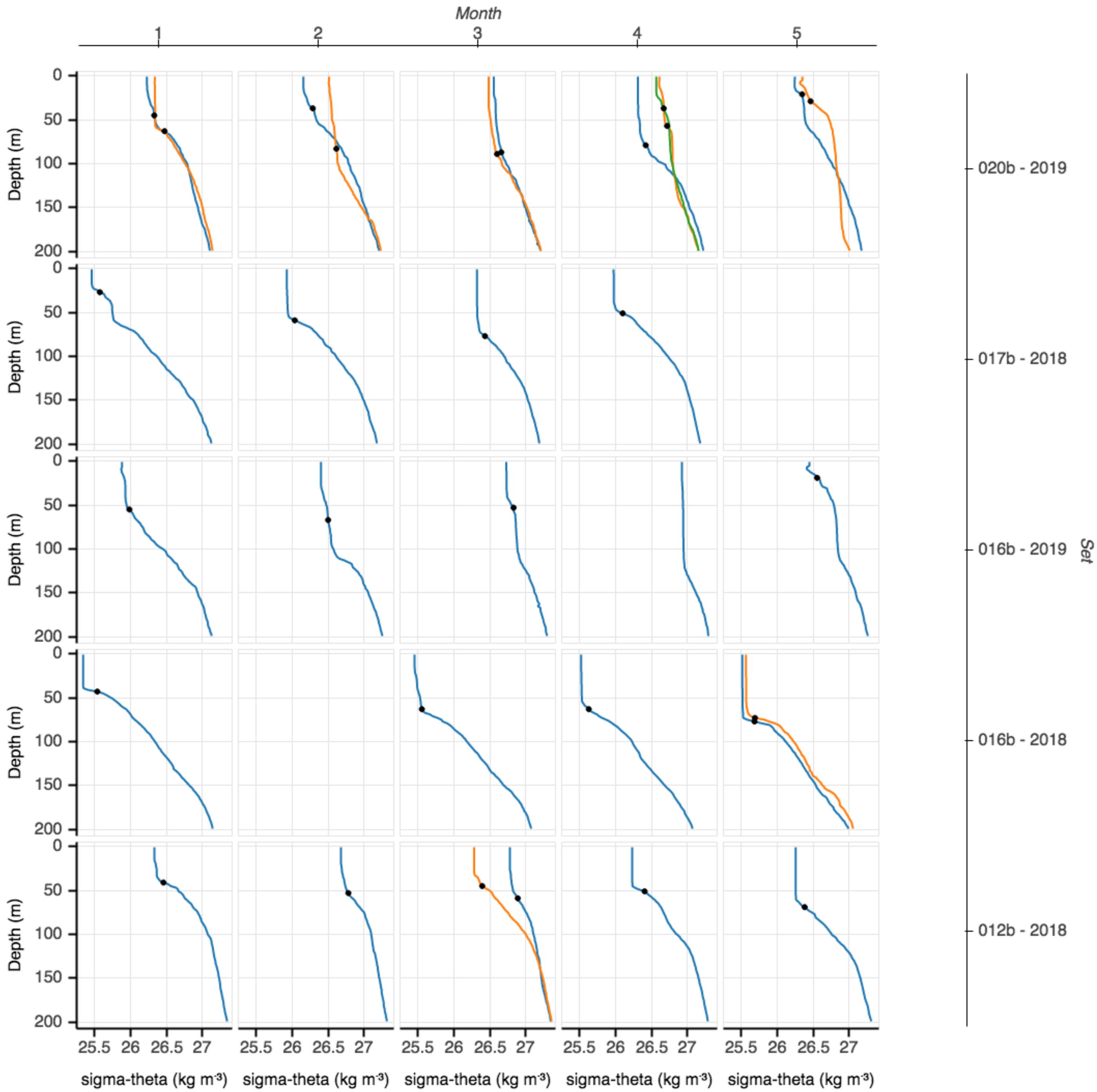

Figure S13: **Vertical density profiles during winter.** Columns correspond to months January (1) through May (5), rows to one float and one year. The black dots indicate mixed layer depth for each profile. Also see the supplementary html files that allow interactively browsing all vertical profiles in all months for all floats.

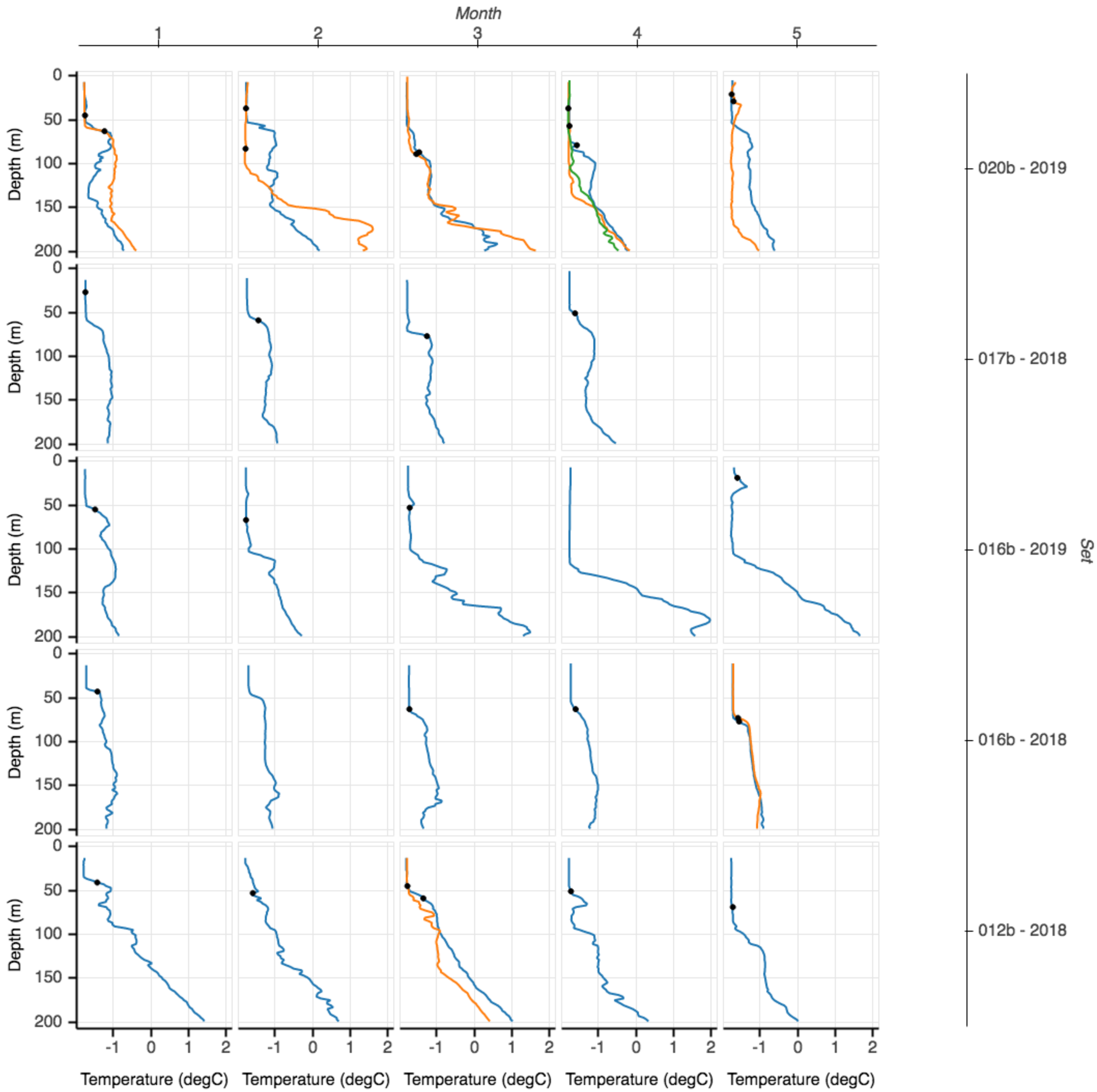

Figure S14: **Vertical temperature profiles during winter.** Columns correspond to months January (1) through May (5), rows to one float and one year. The black dots indicate mixed layer depth for each profile. Also see the supplementary html files that allow interactively browsing all vertical profiles in all months for all floats.

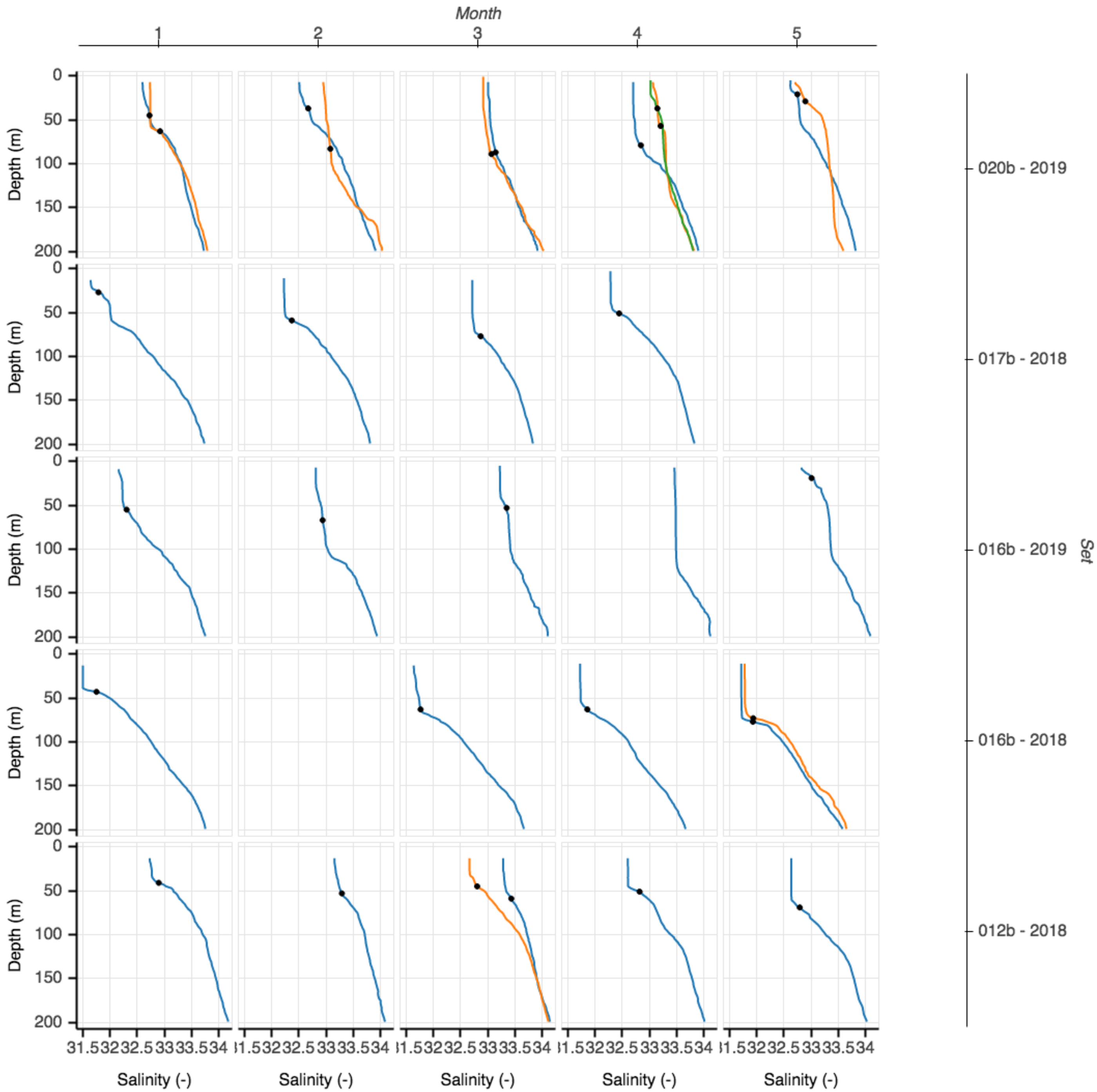

Figure S15: **Vertical salinity profiles during winter.** Columns correspond to months January (1) through May (5), rows to one float and one year. The black dots indicate mixed layer depth for each profile. Also see the supplementary html files that allow interactively browsing all vertical profiles in all months for all floats.

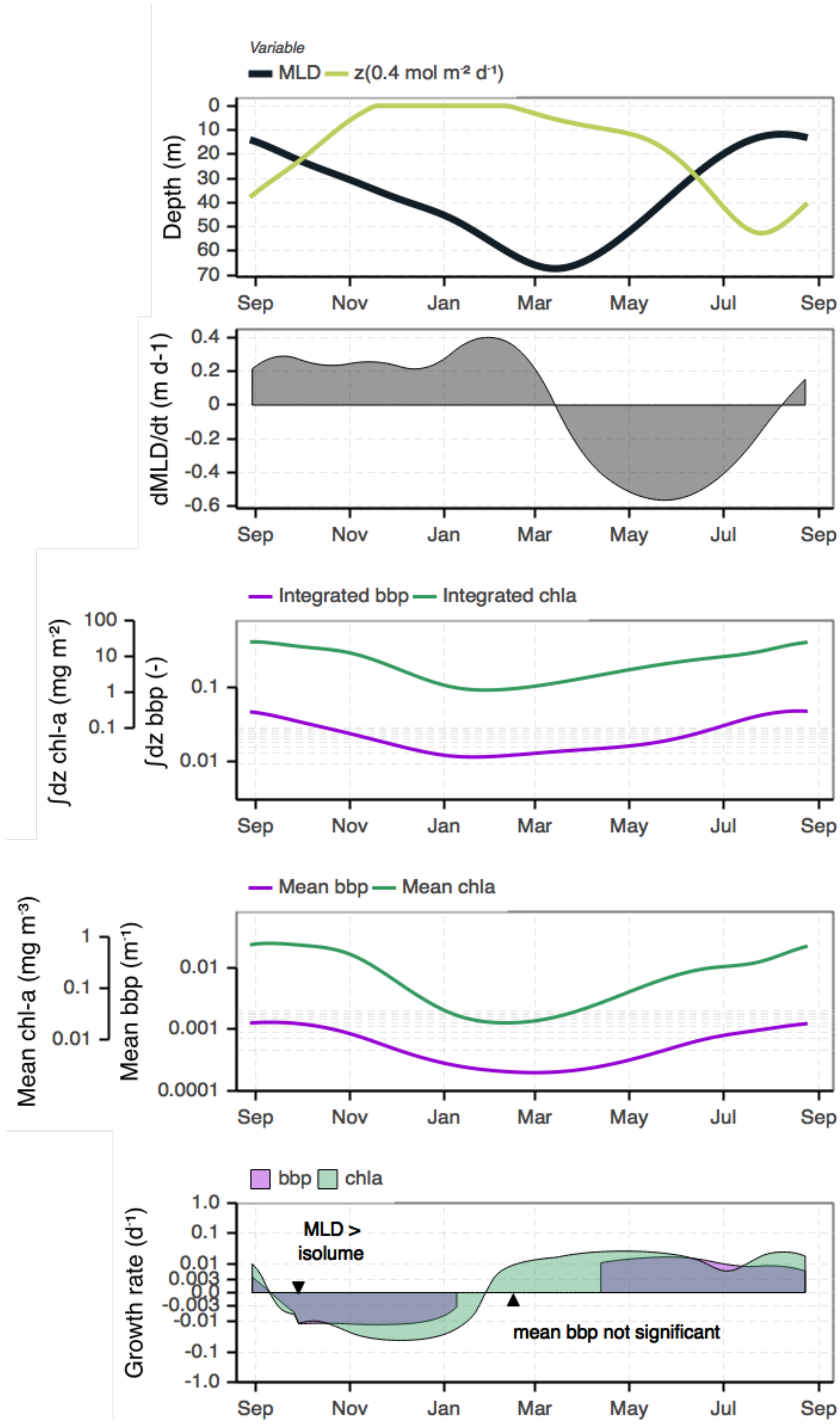

Figure S16: **Calculating growth rates from smoothed annual cycles.** Quantities relevant for calculation of growth rates, here shown using a Generalized Additive Model with 12 cubic splines over the annual cycle. The jumps in growth rates are at times when the criteria changed to calculate growth rate from either mean or integrated biomasses. E.g. in late September, the mixed layer deepened below the 0.4 isolume depth. From late January to early May, overall smoothed bbp-based biomass was not significantly larger than the noise level; therefore, no growth rates were computed during that time from the smoothed time series.

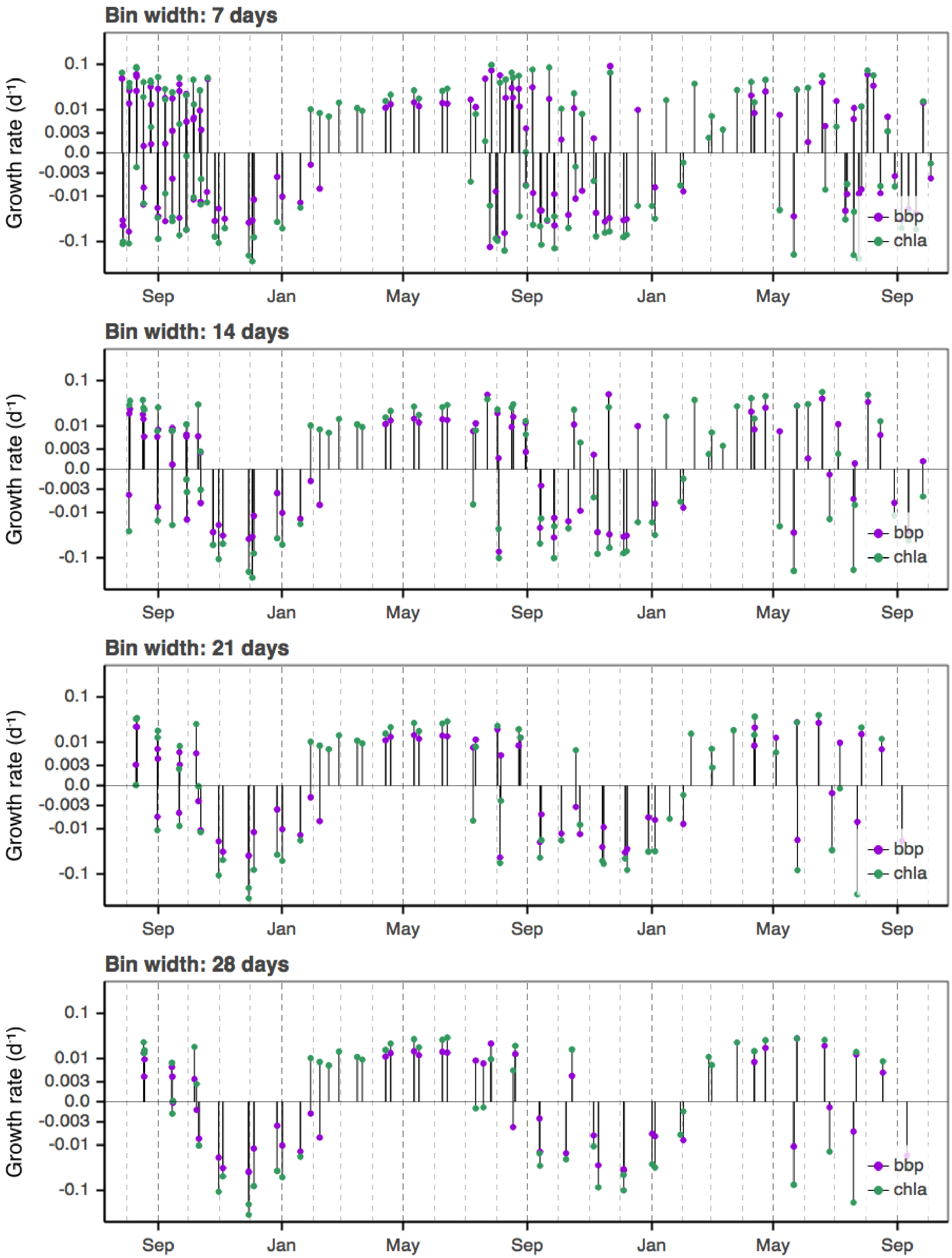

Figure S17: **Net biomass accumulation rate r for different bin widths.** Computed specific net growth rates from each of the four floats for four selected bin widths.

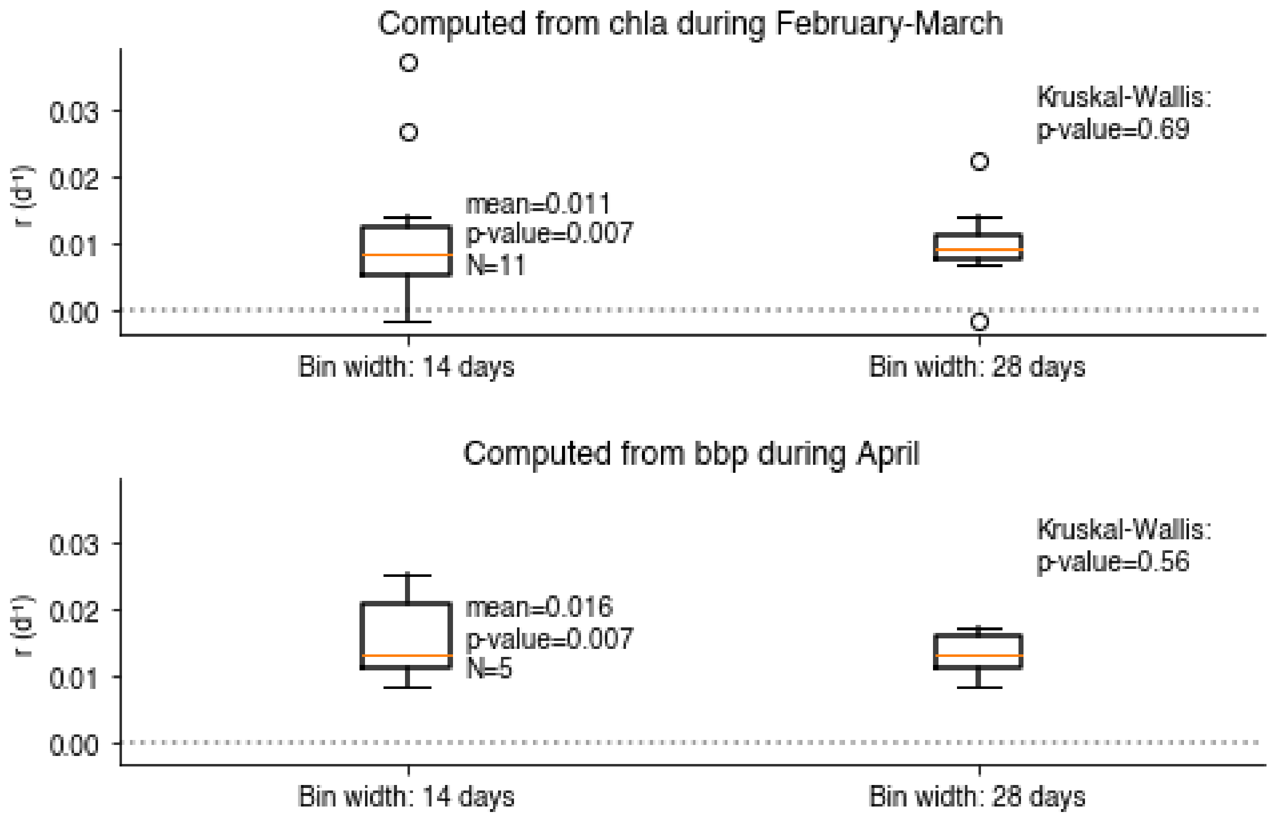

Figure S18: **Bin width does not significantly affect computation of net biomass accumulation rate r during winter.** Two selected winter periods corresponding to those reported in the main paper show no significant differences between two bin widths; we hence choose 14 days. Upper right corner: A Kruskal-Wallis test returned non-significant differences between the two groups.

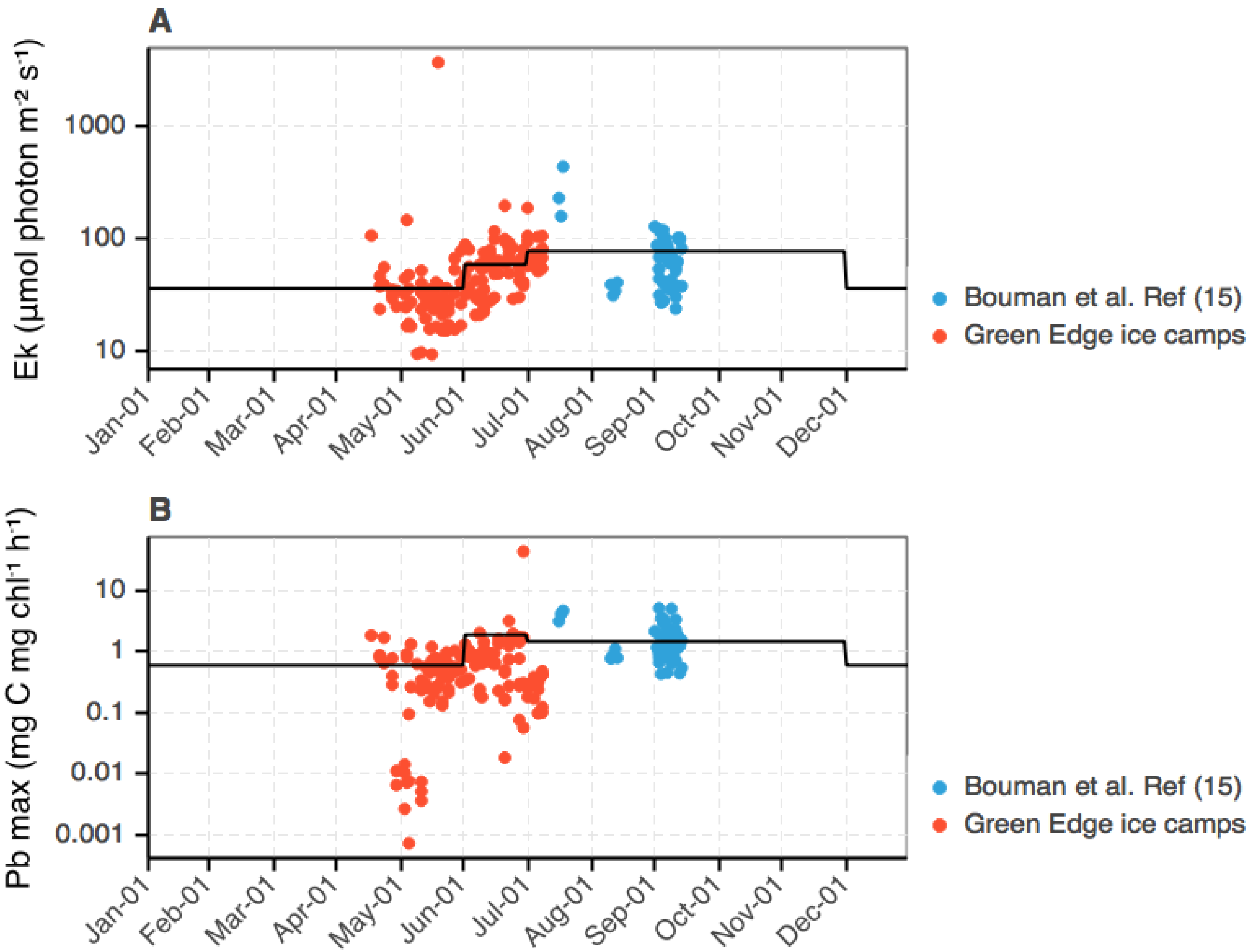

Figure S19: **Photosynthetic parameters in Baffin Bay.** (A) E_k, the light saturation parameter for photosynthesis, and (B) $P_{b,max}$, the chlorophyll *a* specific light saturated growth rate. The black line marks averaged values as used for modelling cell division rates.

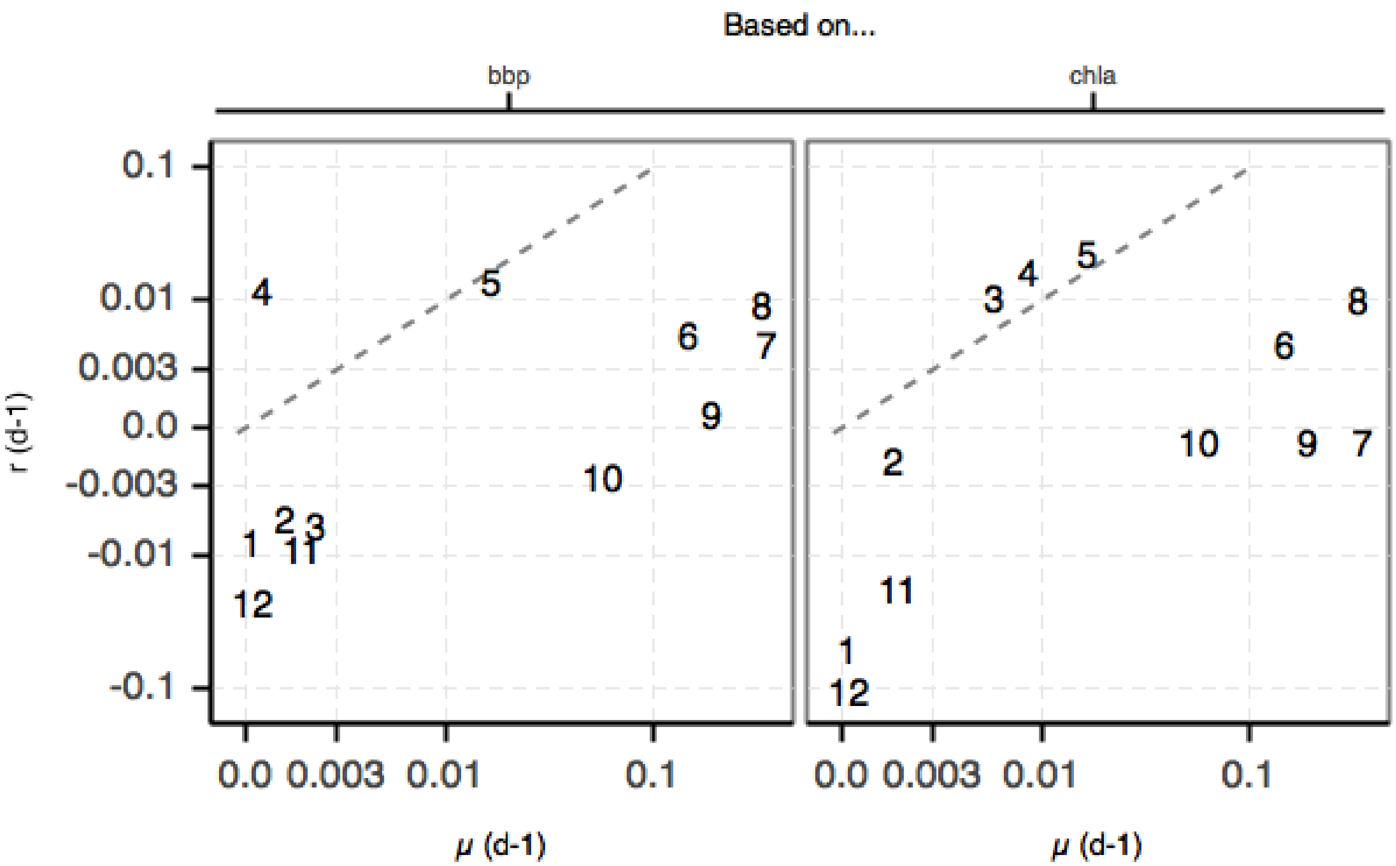

Figure S20: **Net growth rates approximately match modelled cell division rates in late winter and early spring.** The data represent monthly averages averaged over all floats; each number indicates the month of the year.

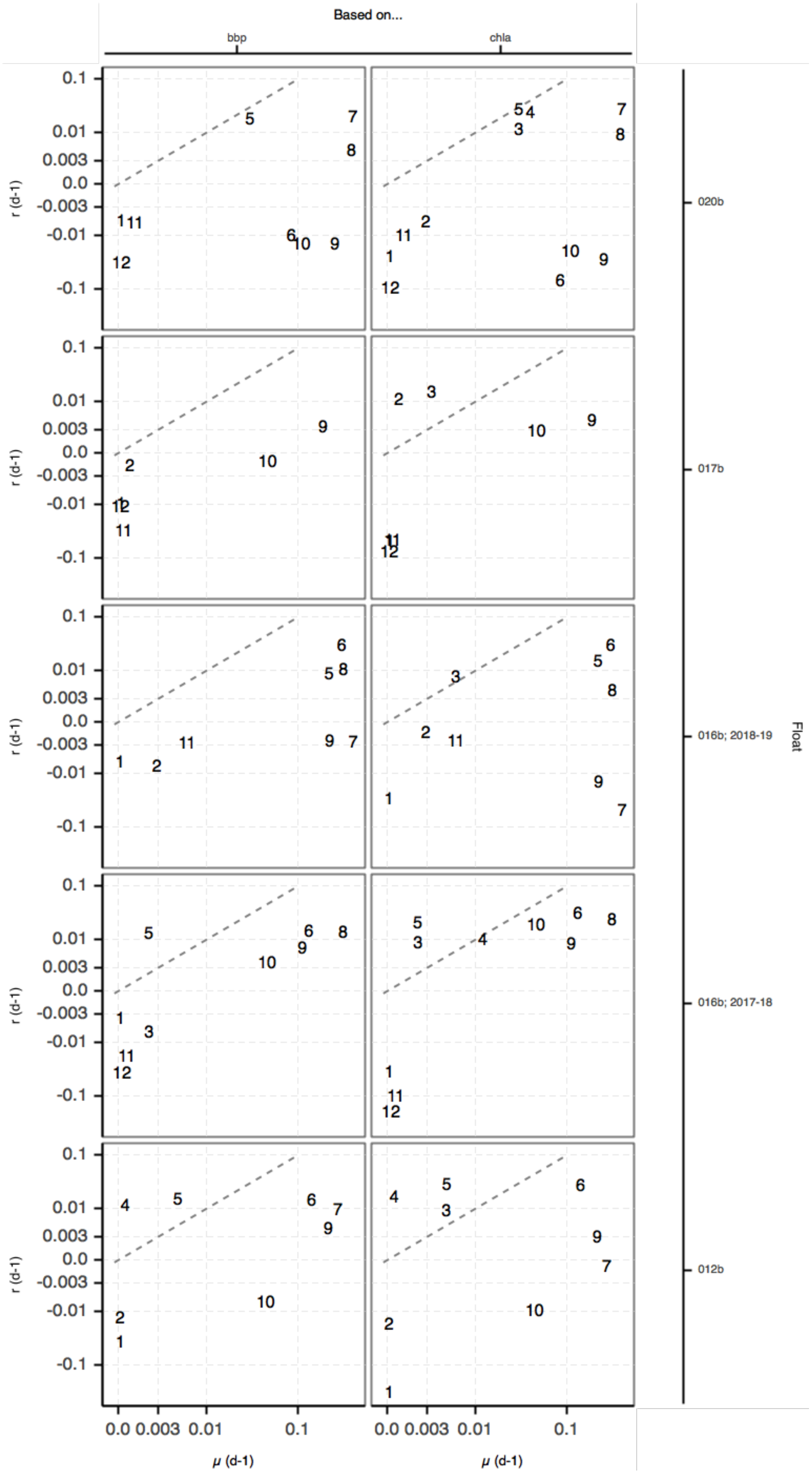

Figure S21: **Net growth rates approximately match modelled cell division rates in late winter and early spring.** The data represent monthly averages averaged for each of the 4 floats; each number indicates the month of the year.

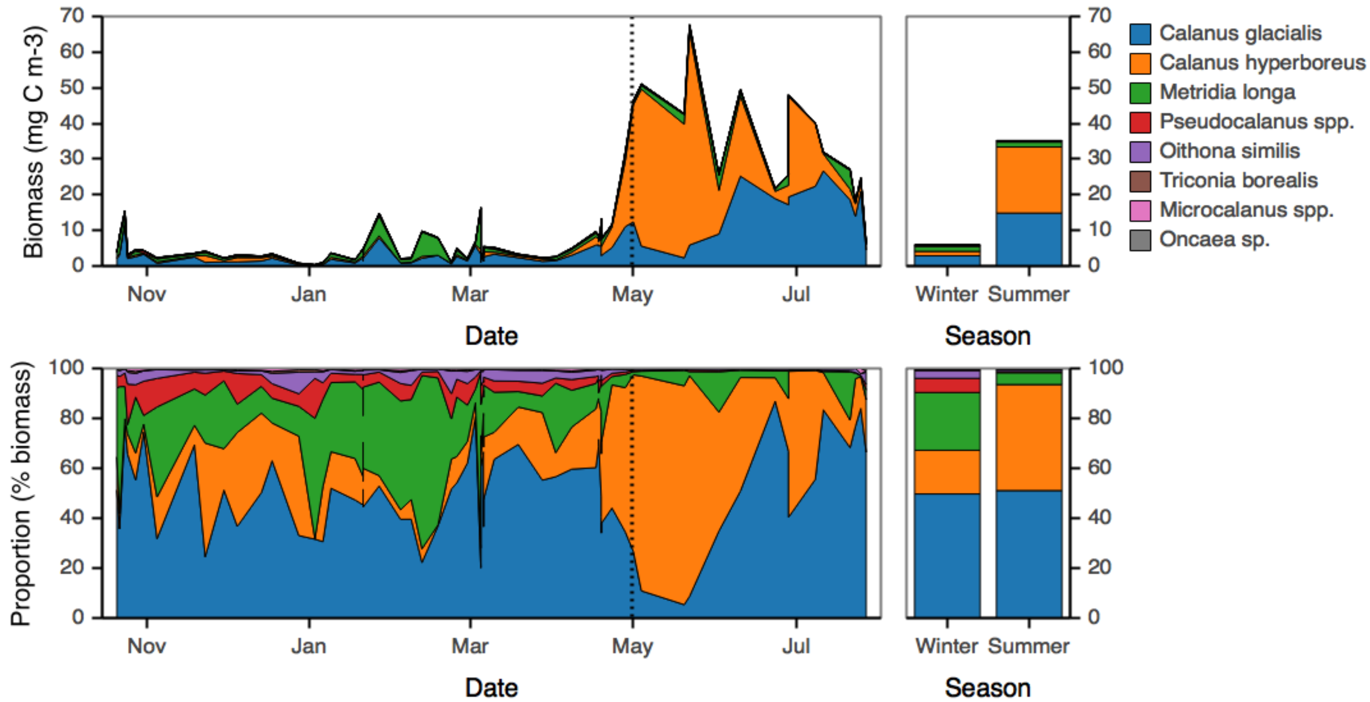

Figure S22: Mesozooplankton biomass integrated over the upper 60 m of the water column in the Amundsen Gulf, southwestern Beaufort Sea. The dotted line denotes the split between winter and summer in the bar plot averages.

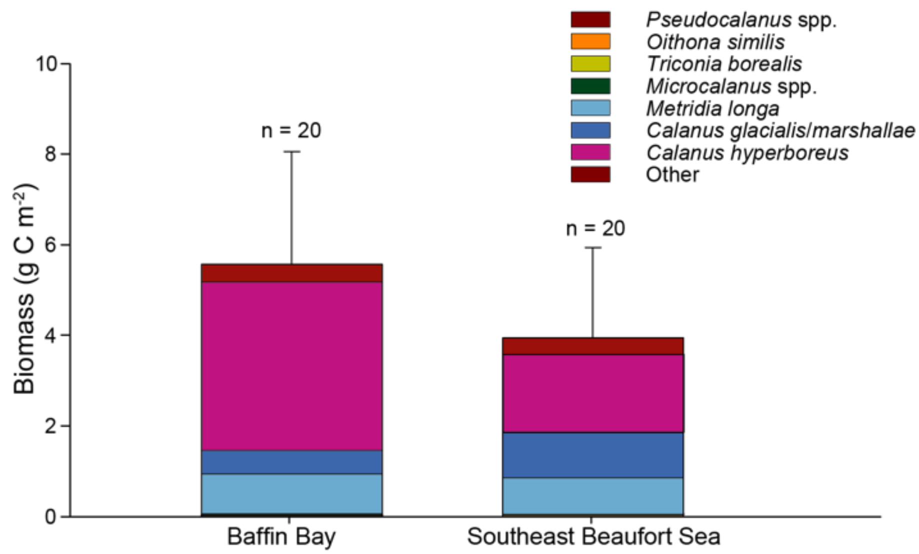

Figure S23: Mesozooplankton mean biomass integrated over the water column of 20 sampling stations in Baffin Bay and Southeast Beaufort Sea in summer 2016 and 2008, respectively.

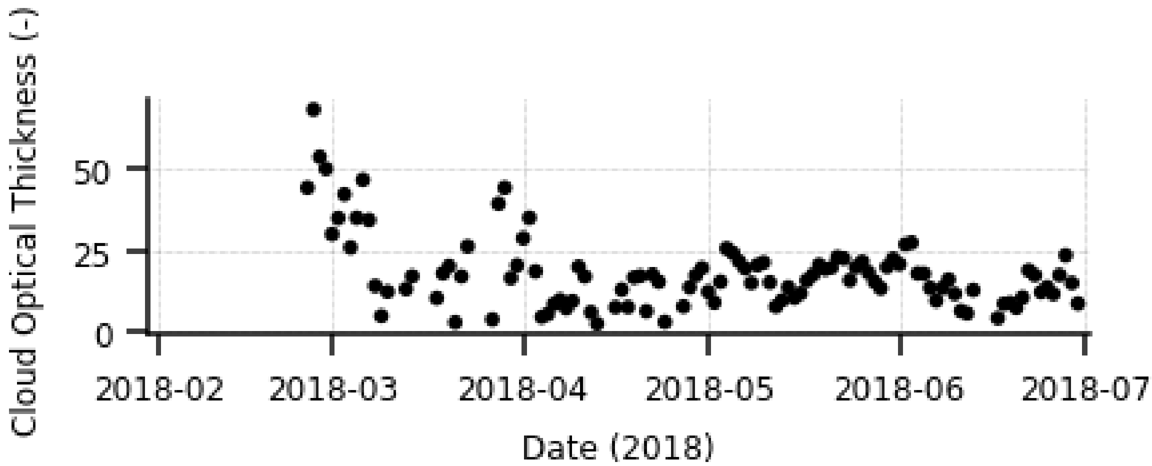

Figure S24: Cloud cover during the winter-spring transition in Baffin Bay.

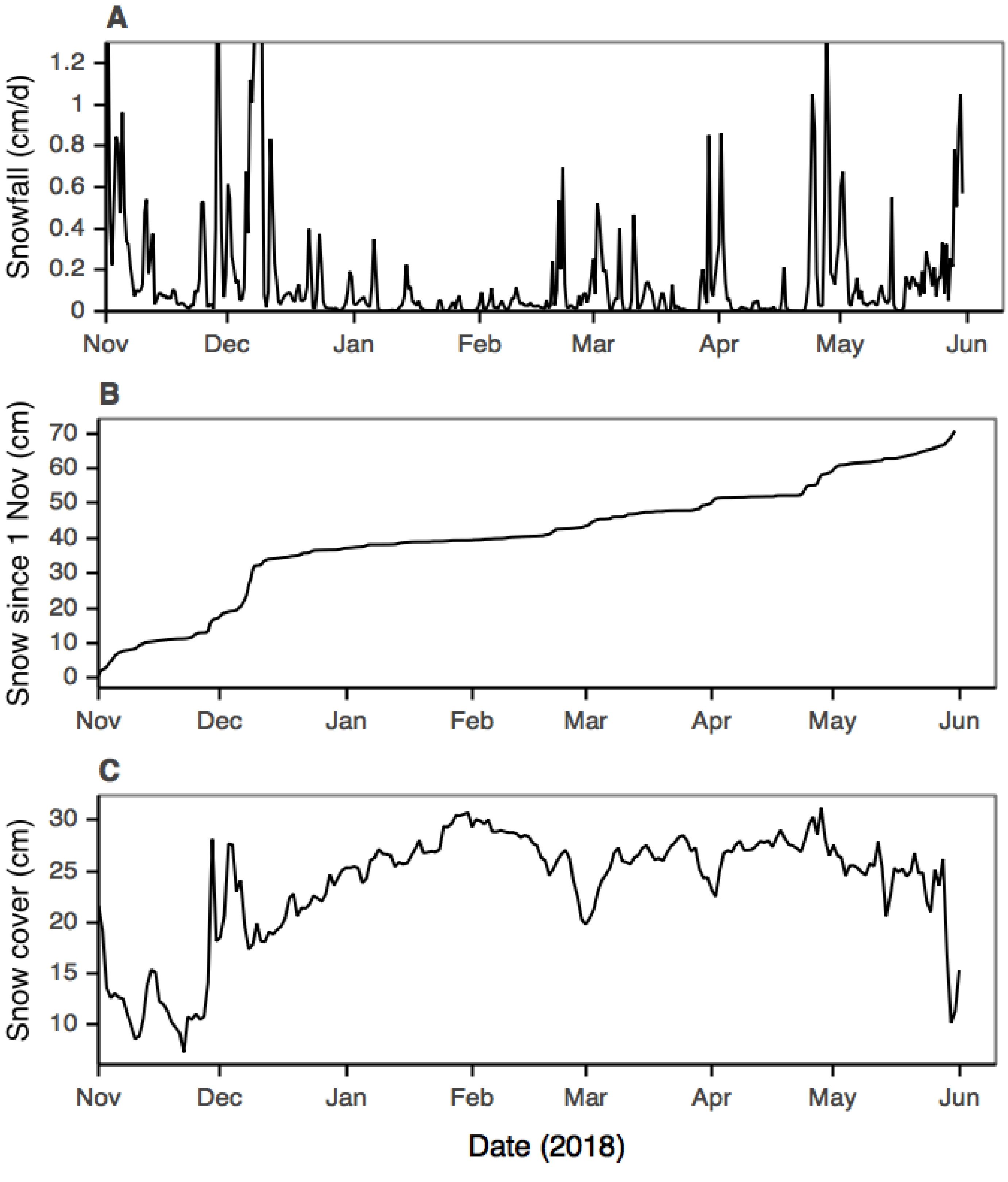

Figure S25: **Snow cover and snowfall on sea ice during winter and spring 2018 in Baffin Bay.** A, B: ERA-Interim precipitation converted to snowfall using a theoretical snow density of 200 kg m^{-3}. C: Snow cover observed by satellite.

Tables S1 to S3

Table S1: Floats deployed in 2017 and 2018.

Season	WMO number	Float name	Fate
2017-2018			
	4901804	takapm006b	Lost immediately after deployment
	6902666	takapm007b	Lost in fall 2017
	6902669	takapm008b	Lost during winter
	4901805	takapm012b	Survived winter; recovered during ISP 2018
	6902670	takapm015b	Lost during winter
	6902671	takapm016b	Survived two winters; changed WMO after firmware update
	6902829	takapm017b	Stopped sampling in April 2018; recovered in July 2018 from the CCGS Amundsen
2018-2019			
	6902896	takapm011b	Survived winter but emerged south of Davis Strait in summer 2019
	6902953	takapm016b	From 2018-11-1 (changed WMO number after firmware update); survived second winter
	6902897	takapm020b	Survived winter

Table S2: Sampling schedule of the floats. *Depending on ice cover. ** 14 days for float takapm020b

	16 November through June	July	August-October	1 to 15 November*
Sampling interval (days)	28**	10	1	1 or 28**
Profiles up to	10 m	10 m	surface	surface or 10 m

Table S3: All sensor correction parameters in this study. *New WMO number after firmware update

Float Name	WMO	Optode slope	FChla Dark	FChla F-factor
takapm012b	4901805	1.1009	0.036	0.6598
takapm016b	6902071	1.1375	0.0511	0.4886
takapm016b	6902953*	1.1479	0.0438	0.756
takapm017b	6902829	1.1508	0.0511	0.6601
takapm020b	6902897	1.0454	0.0365	0.603