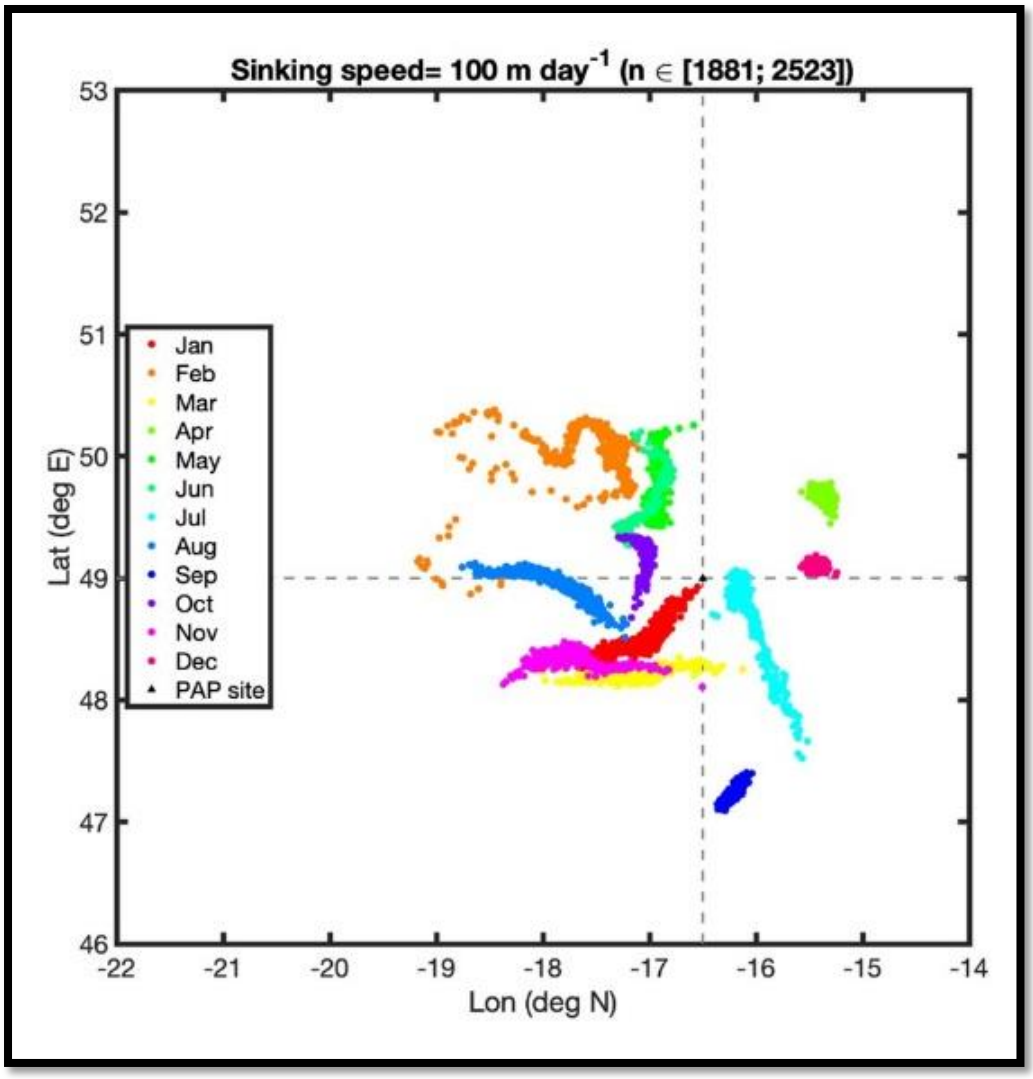
Supplementary data

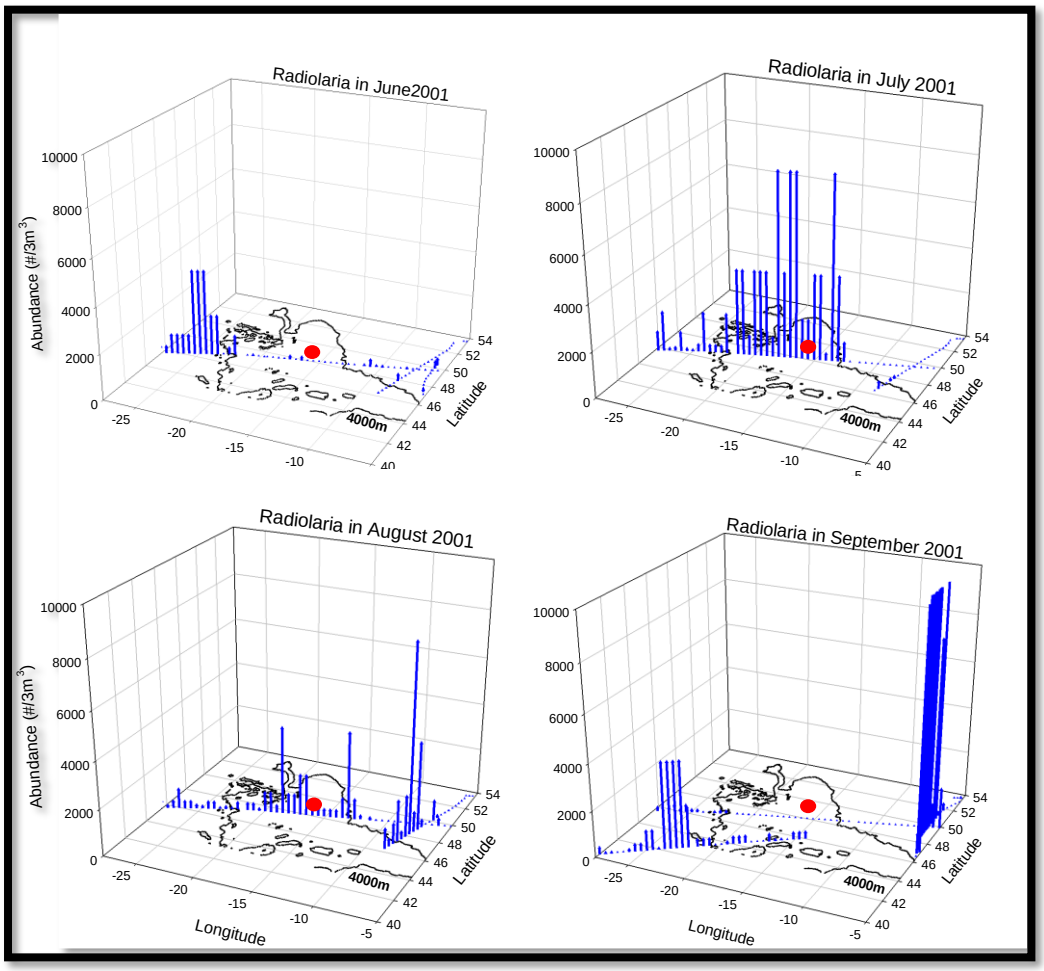


Supplementary figure 1: Output of particle tracking model for 2018 based on the Copernicus 1/12-degree model. This shows the origin at the base of the upper mixed layer of the particle reaching 3000m depth.

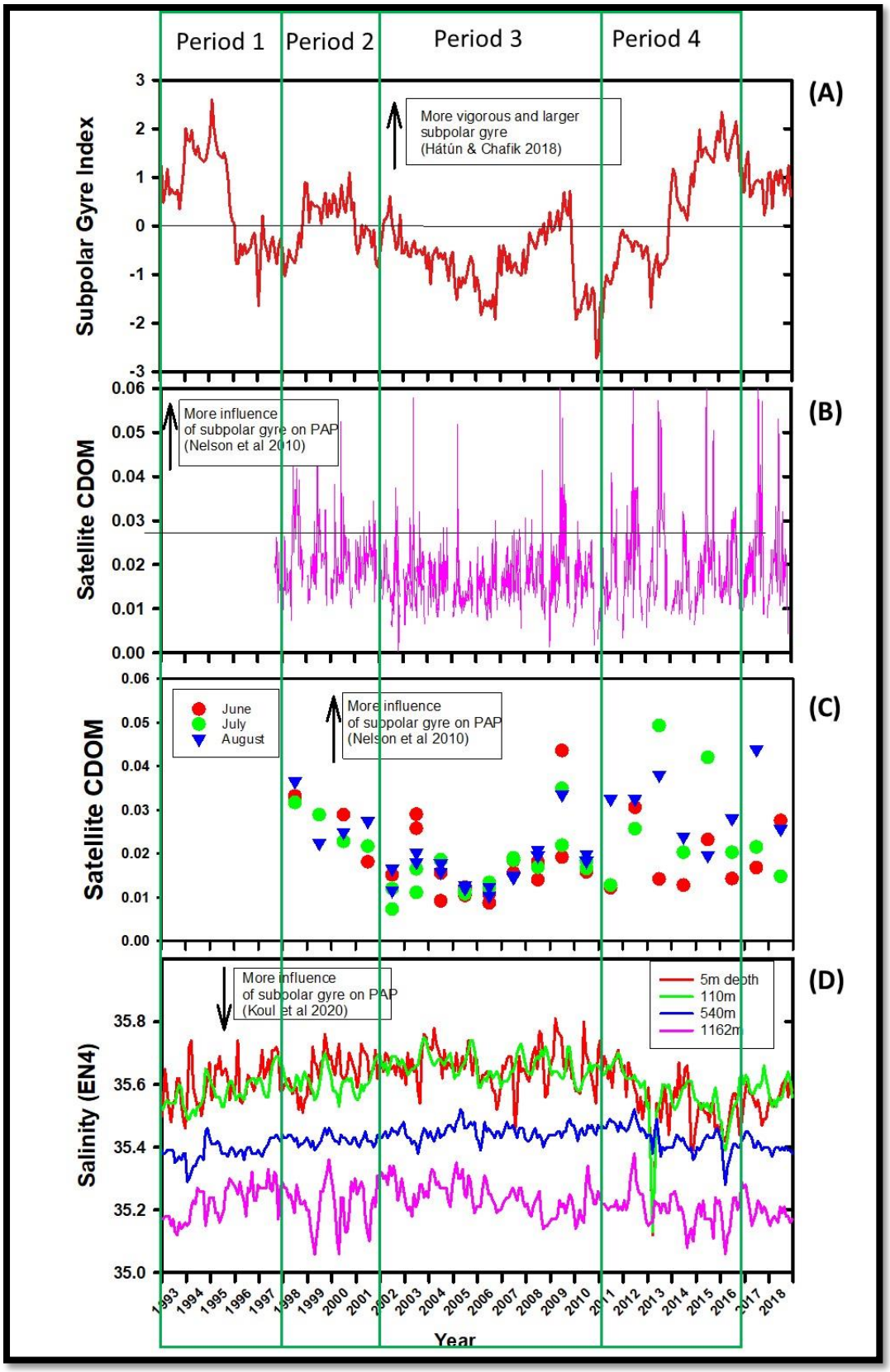
Large area distribution of Radiolaria

The distribution of faunal groups in the CPR dataset is determined by the routes taken by commercial ships towing the device at 7m depth. Although this provides better spatial and temporal coverage than is possible by any other means, at times the data are limited in both space and time. In the region of PAP-SO one of the regular shipping routes usually passes close to the site extending from the continental shelf at about 50°N past PAP-SO at 49°N and over the mid-Atlantic ridge at about 46°N. This is repeated monthly providing a highly relevant data set for PAP-SO. Analyses of the Radiolaria collected reveal the surprising observation that the abundance of this faunal group is often distinct in three regions, these being over the mid-Atlantic ridge (<4000m depth), over the abyssal plain (>4000m depth) and over the continental slope and shelf (<4000m depth). Another surprising observation is that temporally enhanced abundance in these three regions progresses from west to east. A good example of this trend is found for the year 2001.

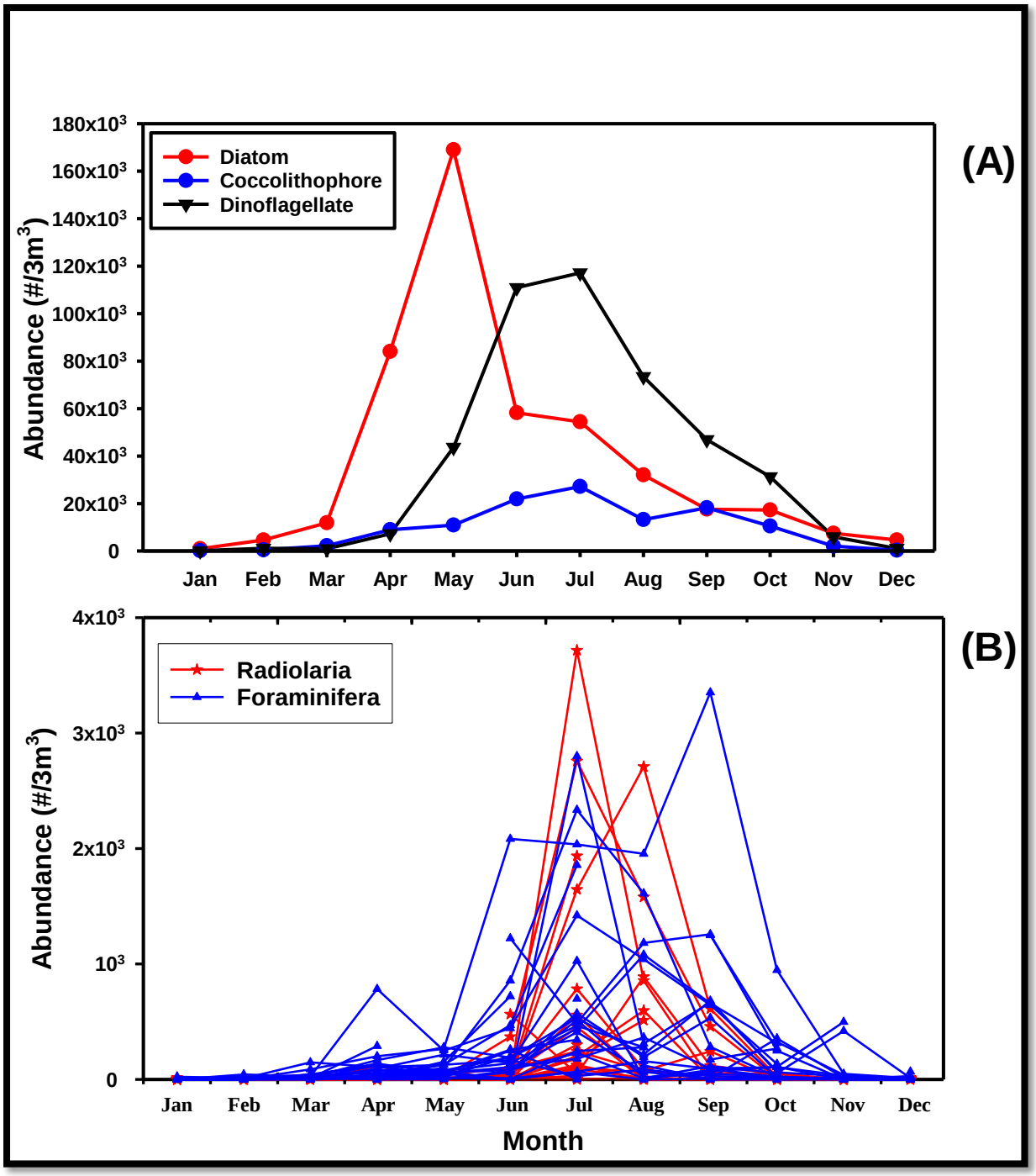
The conclusion from this analysis is that the area of ocean relevant to PAP-SO should exclude water depths shallower than 4000m but that extending the area north of PAP-SO has little effect on the results as there were very few samples taken in this area.



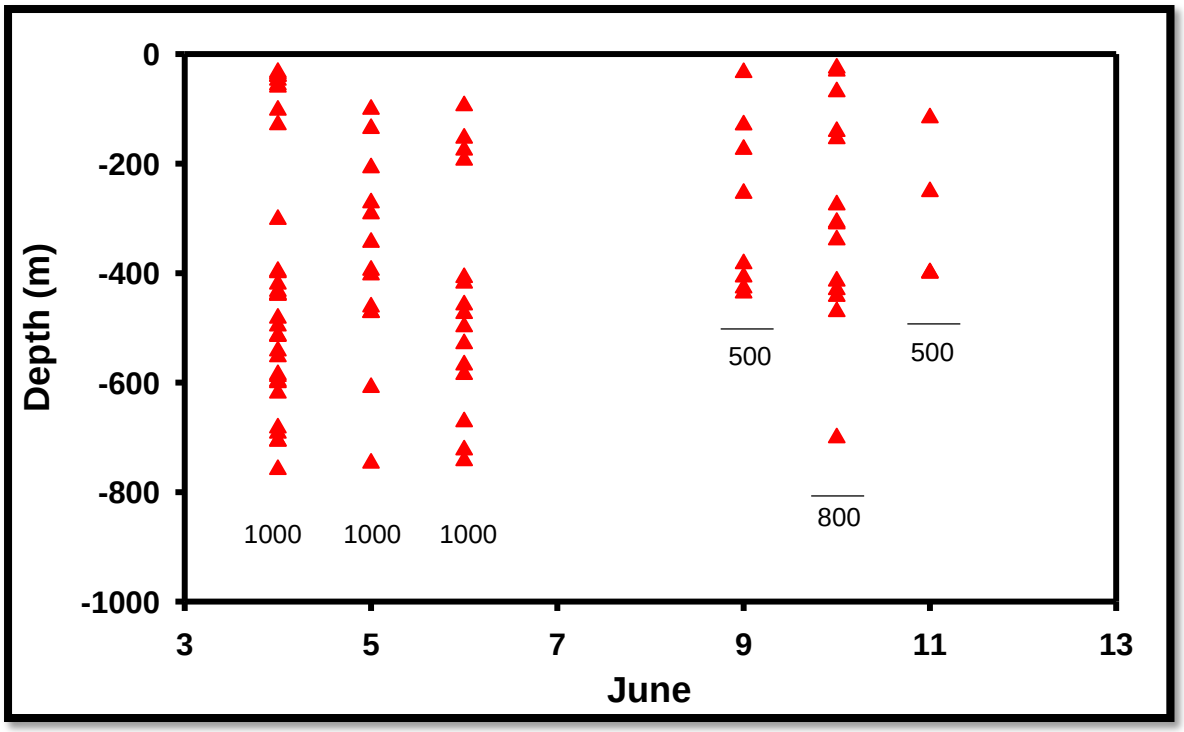
Supplementary figure 2: Abundance of Radiolaria in the broad region around PAP-SO (red dot). The 4000m contour interval is also shown.



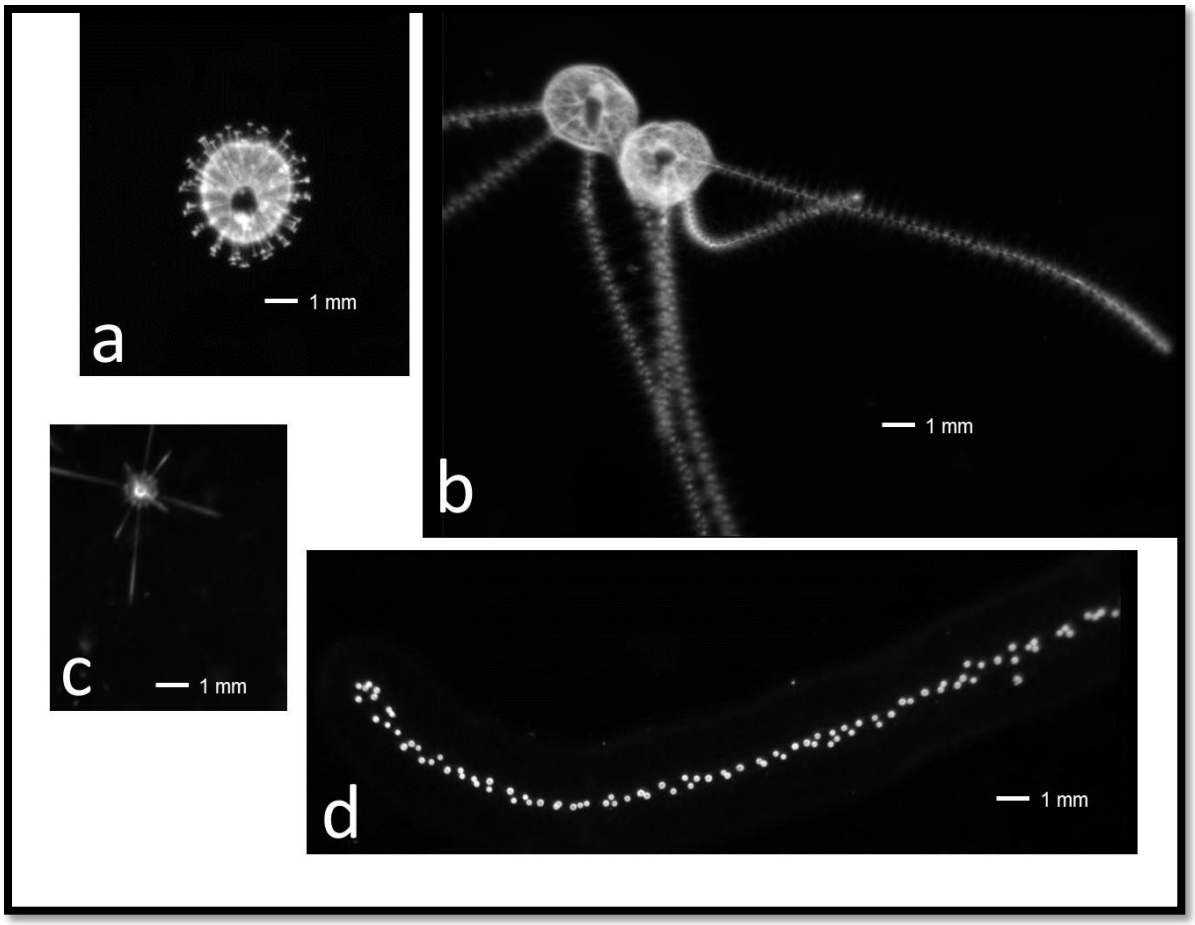
Supplementary figure 3: Time series of (A) the subpolar gyre index (Chafik L (2019) (North Atlantic subpolar gyre index. Dataset version 2. Bolin Centre Database). https://doi.org/10.17043/chafik-2019-gyre-2, (B) satellite-derived Coloured Dissolved Organic Matter (CDOM) at PAP (C) CDOM in the months of June, July and August at PAP-SO and (D) Salinity at PAP at different depths extracted from EN4.



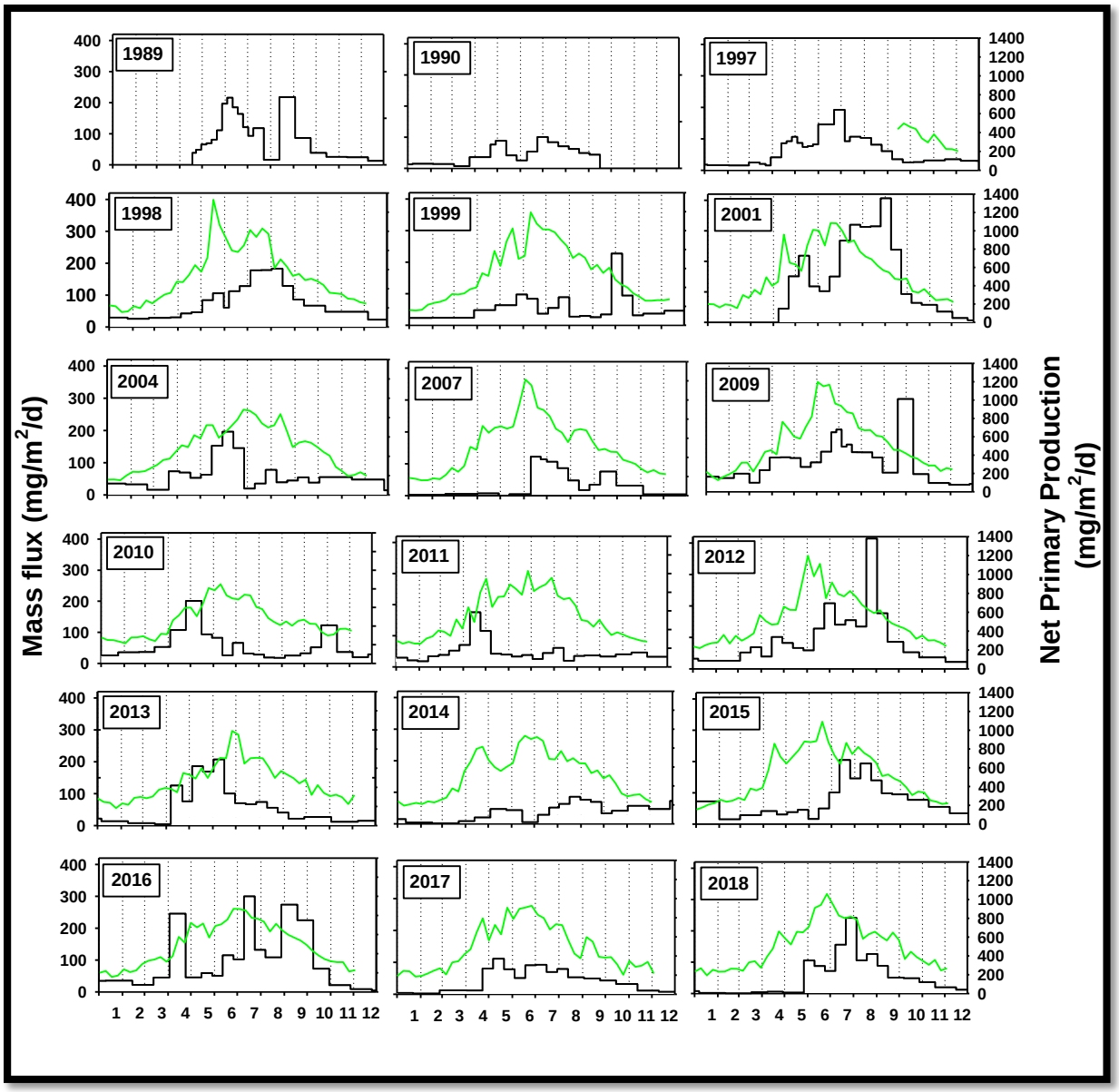
Supplementary figure 4: Monthly log abundance of (A) phytoplankton groups (average of all years 1958-2019) and (B) Rhizaria (Radiolaria and Foraminifera) in the CPR trapezium around PAP-SO. The abundances are expressed per sample which has a volume of $3M^3$.



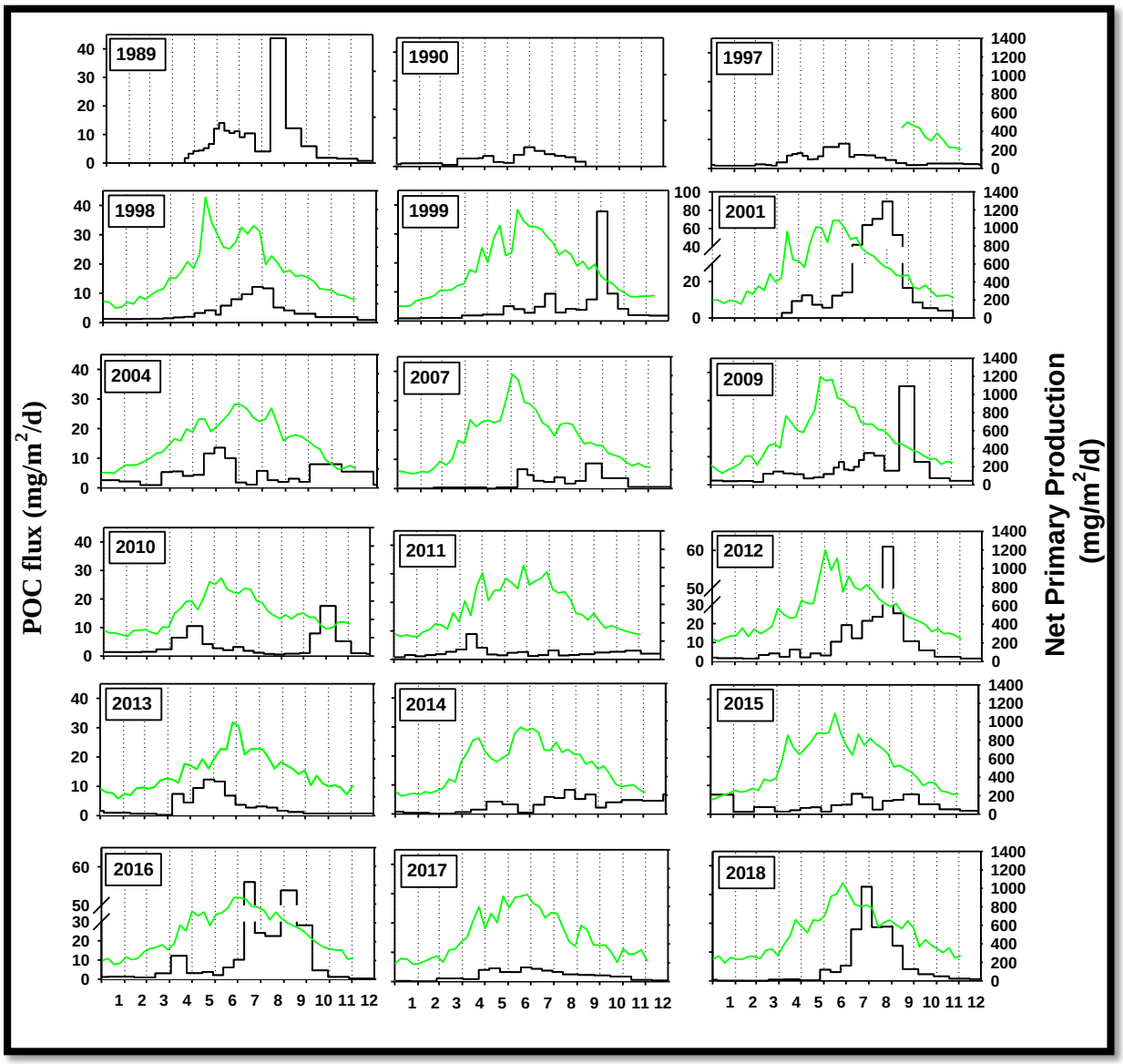
Supplementary figure 5: *Occurrence of Rhizaria at PAP-SO on various dates in June 2013 which was a year with low abundance (Figure 5A). Each triangle represents an image containing a specimen. The horizontal lines indicate the maximum depth of sampling by the VPR where this was less than the 1000m target.*



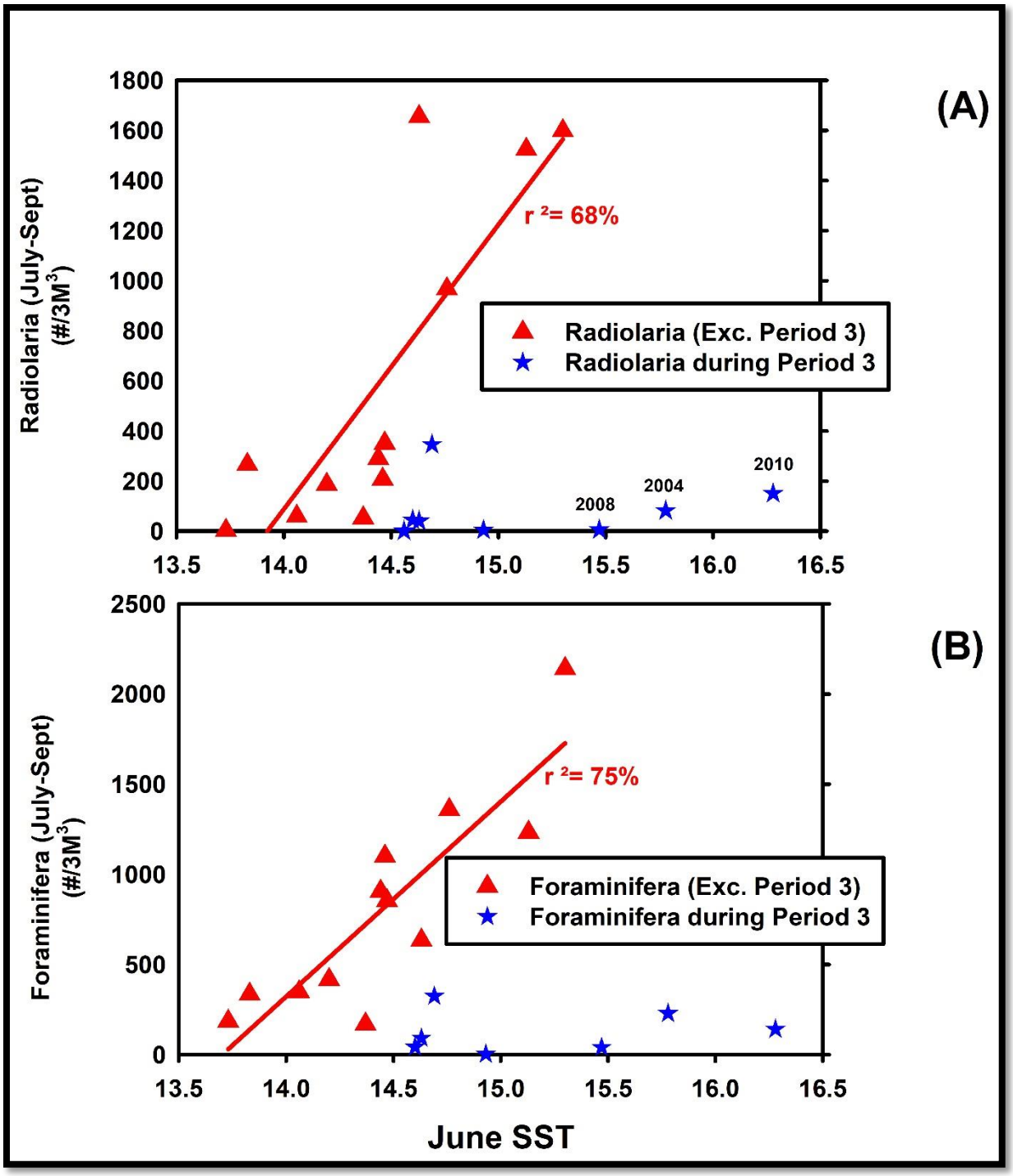
Supplementary figure 6: Examples of images from the VPR showing (A) a larger Rhizaria: ph Cercozoa, subcl. Phaeodaria, cf fam Aulacanthidae (B) Rhizaria: ph. Cercozoa, subcl. Phaeodaria, cf. fam. Coelodendridae (C) smaller Radiozoa; cl Acantharia or cl. Polycystina) (D) Rhizaria: Colonies of subord. Collodaria.



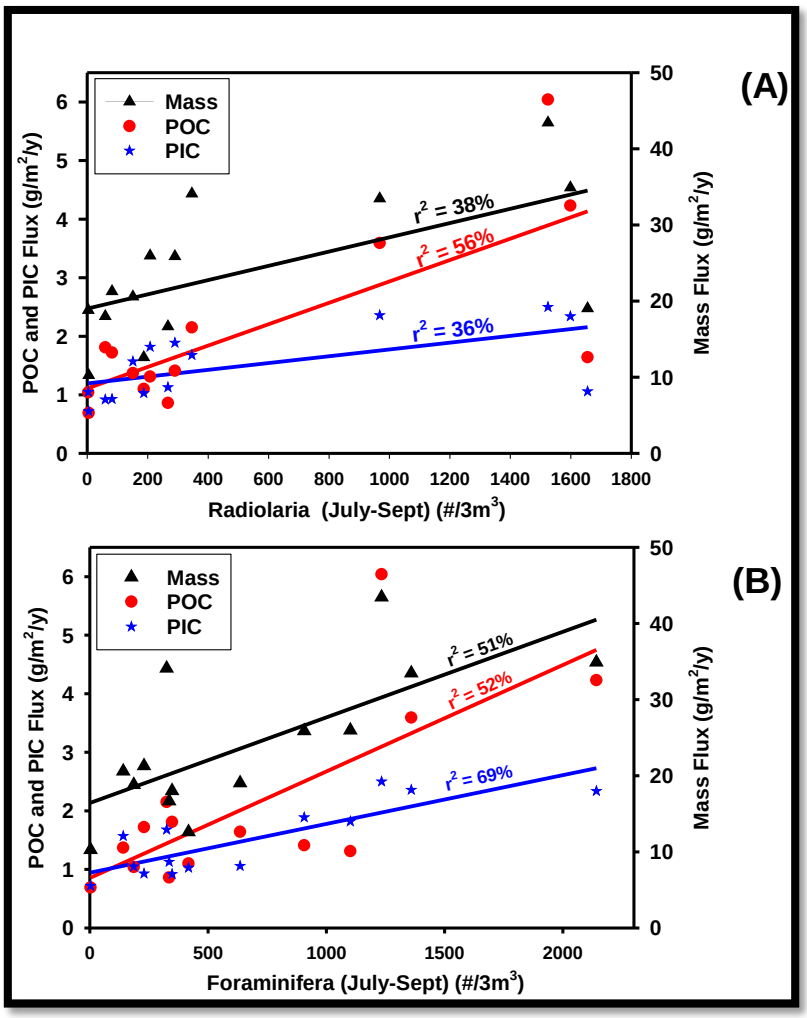
Supplementary figure 7: Particle flux at 3000m in terms of Total Mass of material for each of the 18 good years of measurement since 1989. Also shown on these graphs is the estimate of NPP using the merged CAFE model (green line).



Supplementary figure 8: Particle flux at 3000m in terms of Particulate Organic Carbon of material for each of the 18 good years of measurement since 1989. Also shown on these graphs is the estimate of NPP using the merged CAFE model (green line).



Supplementary figure 9: Relationship between SST in June (From EN4 database) and the abundance of (A) Radiolaria and (B) Foraminifera during the period following from July to September (inclusive). Data for Period 3 (2003-2010 inclusive) (Blue stars) during which PAP is likely to have more influence of the subtropical gyre are shown as distinct from data during other periods (Red triangles). It was possible to examine this relationship using a larger number of years than are available for the comparison with sediment trap data due to the fact that no sediment trap data were available in some years.



Supplementary figure 10: Relationship between the abundance of Rhizaria in July-September and annual integrated sequestration flux as POC, PIC and DW for (A) Radiolaria as defined by the CPR and (B) Foraminifera.