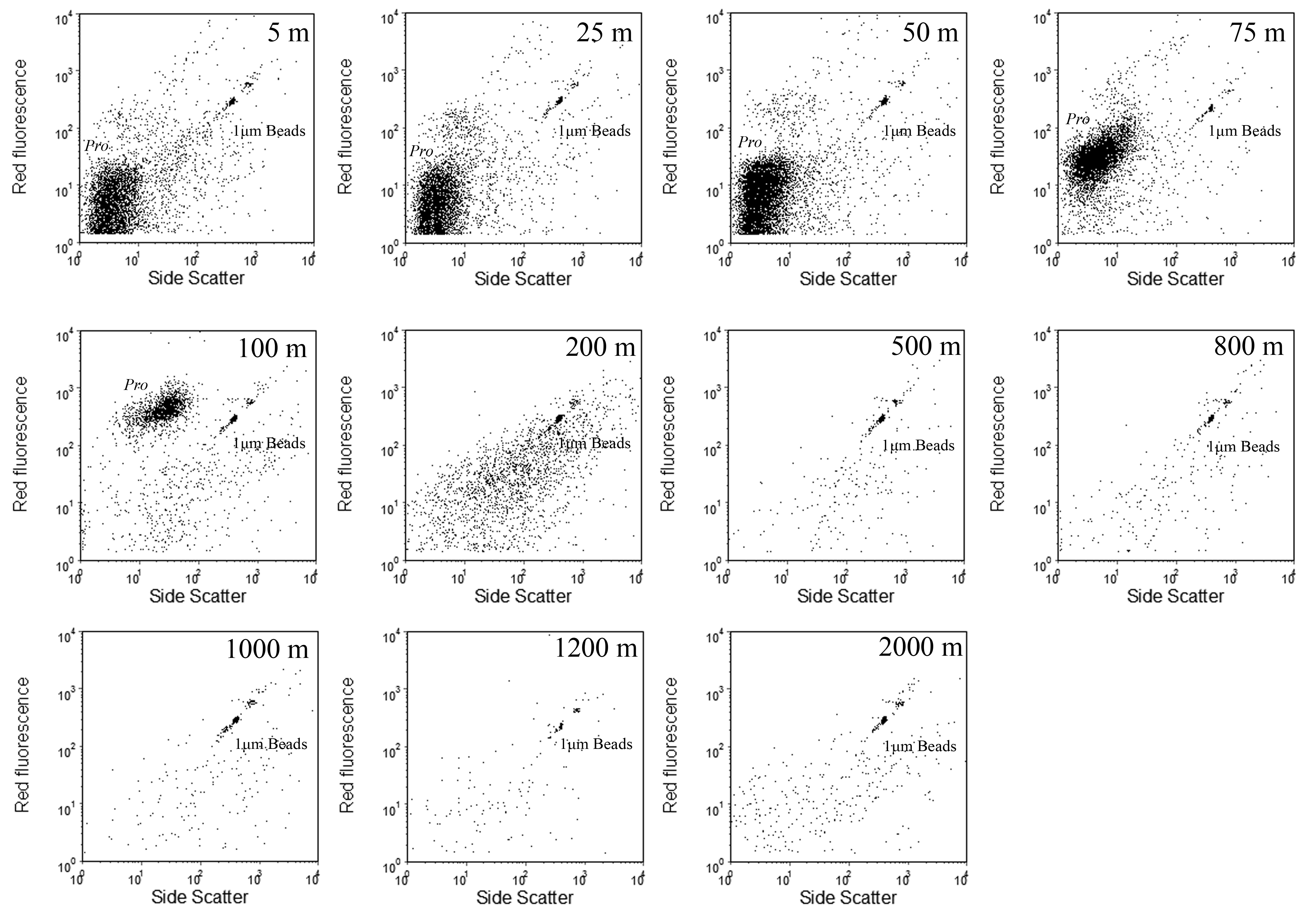
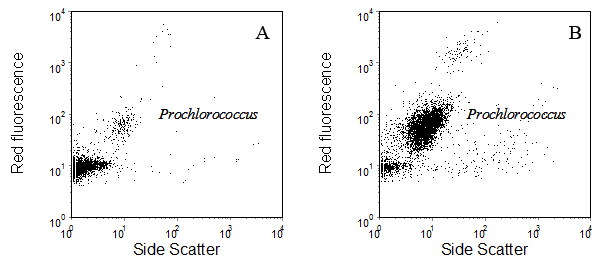
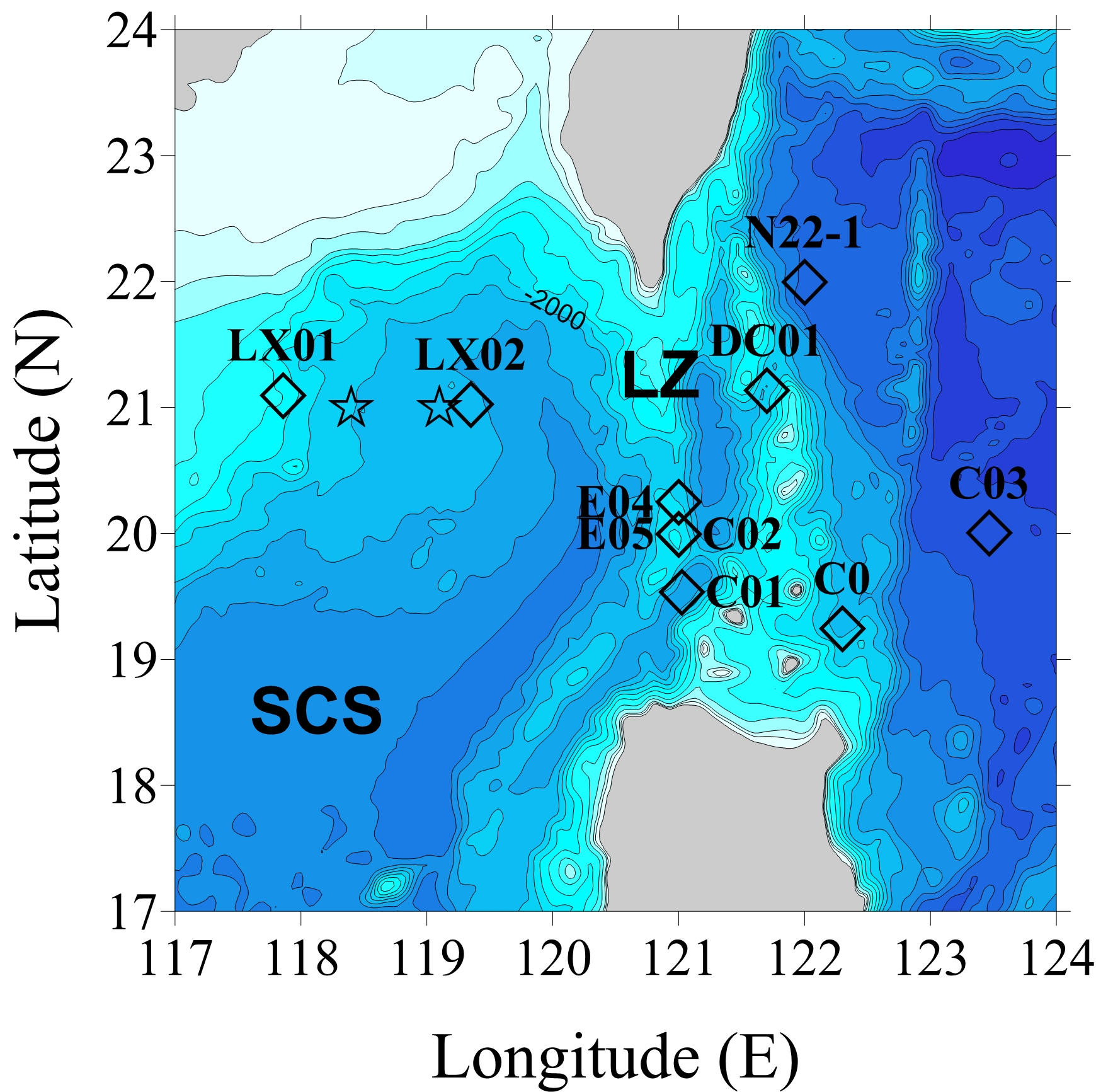
**Supplementary material**



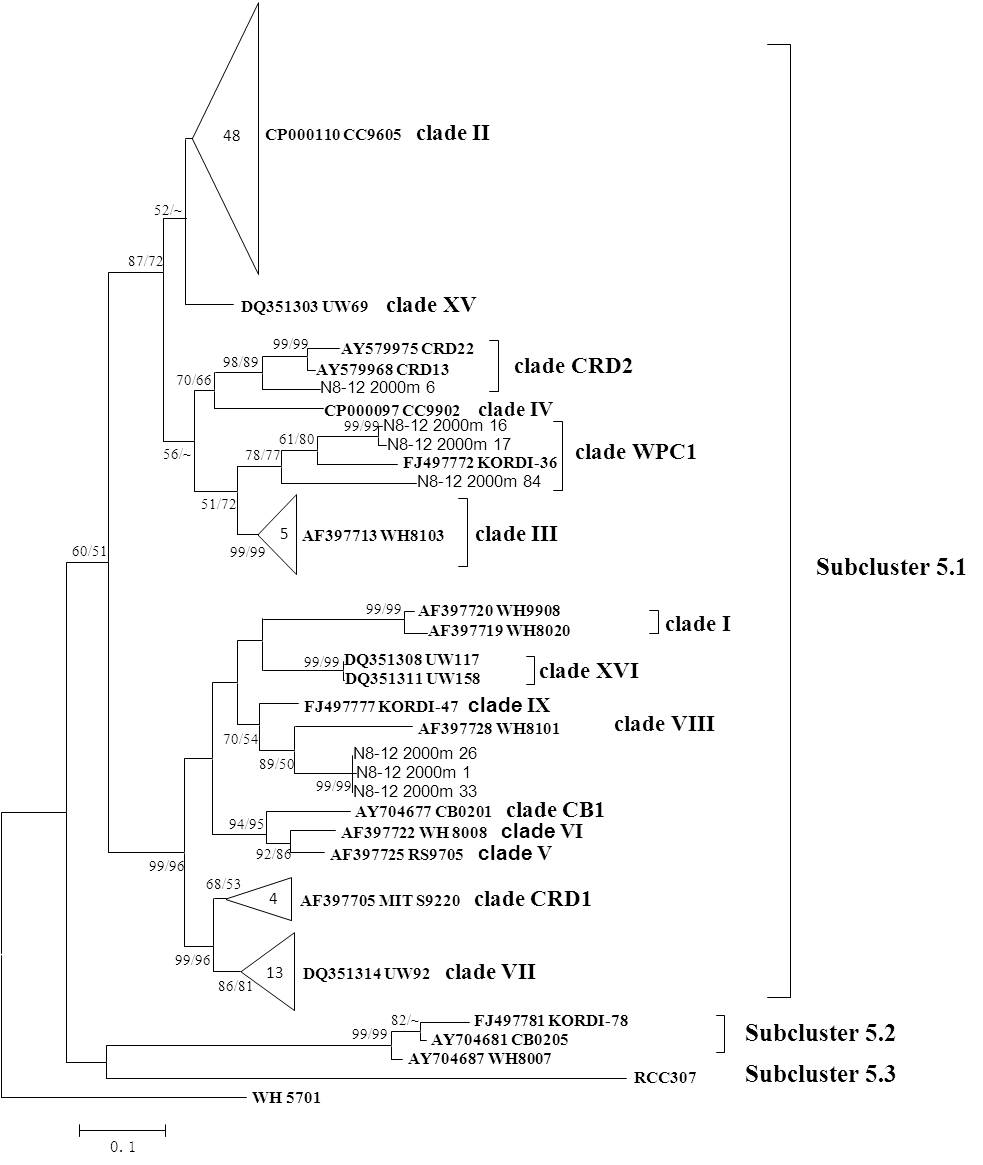
**Figure S1.** A depth profile of FCM plots at a reference site (N18-5) out of the Luzon Strait (as a field negative control)



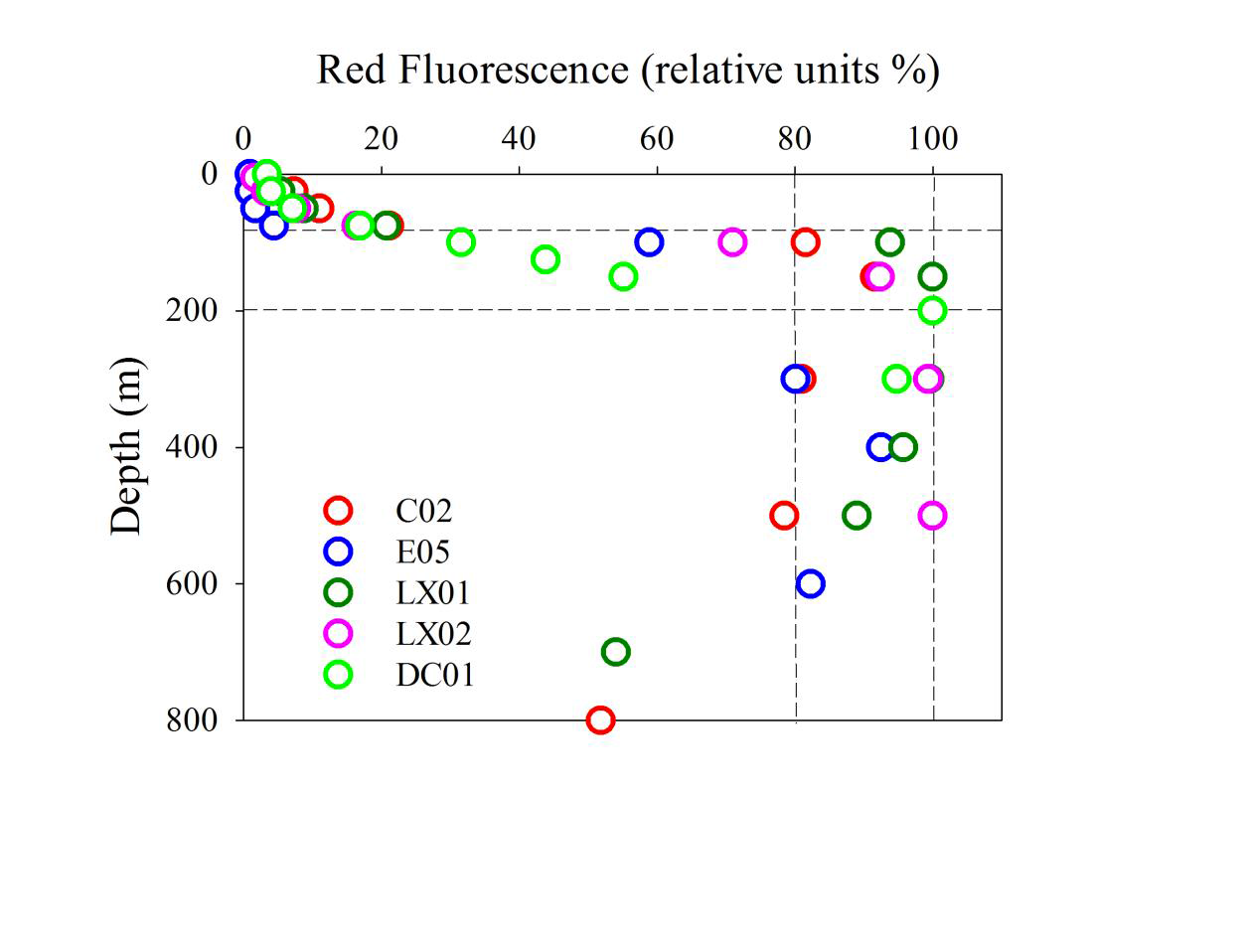
**Figure S2.** Comparison between FCM plots of a normal sample (A) and a 50 X condensed sample (B) from 800m of St. N8-12

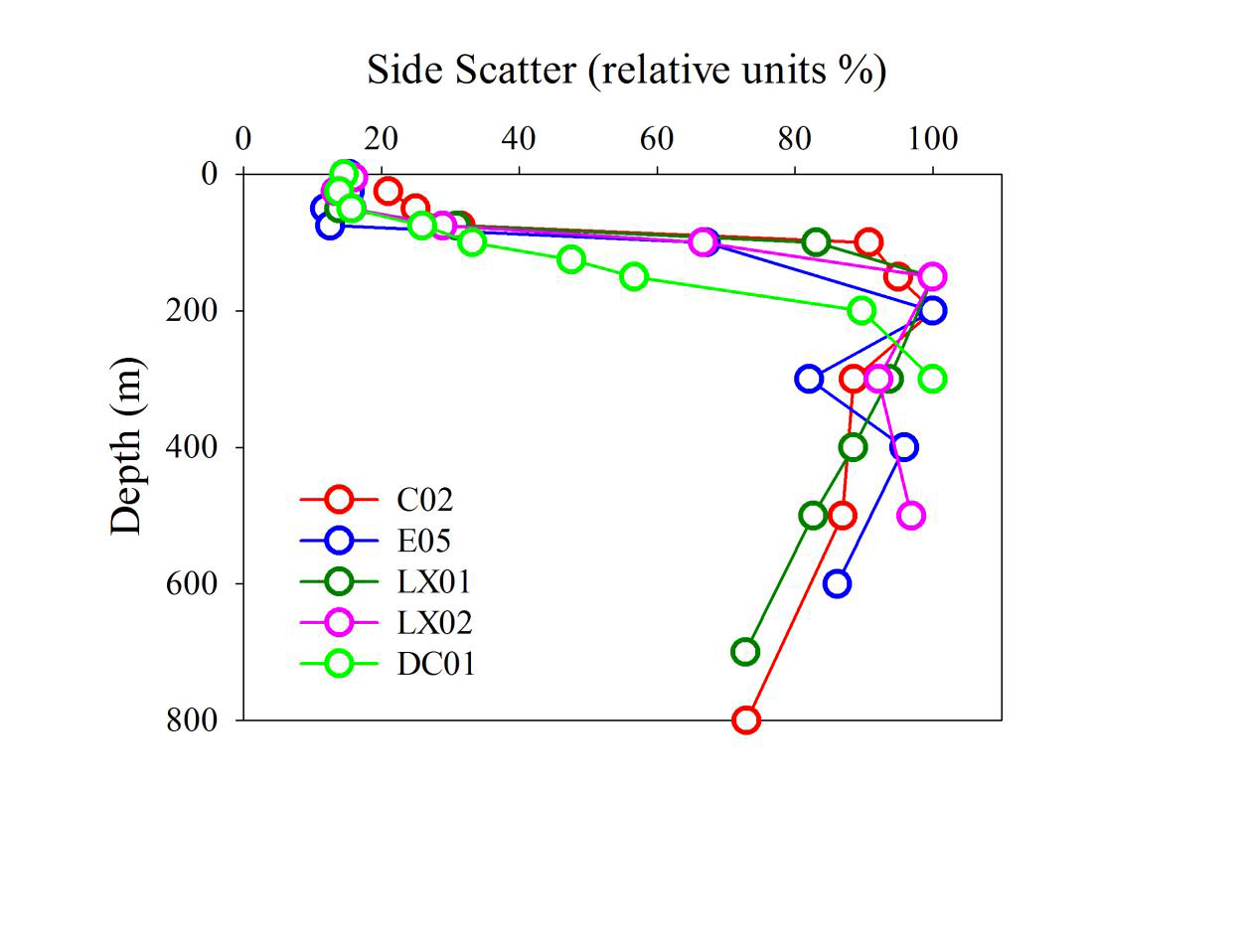
****

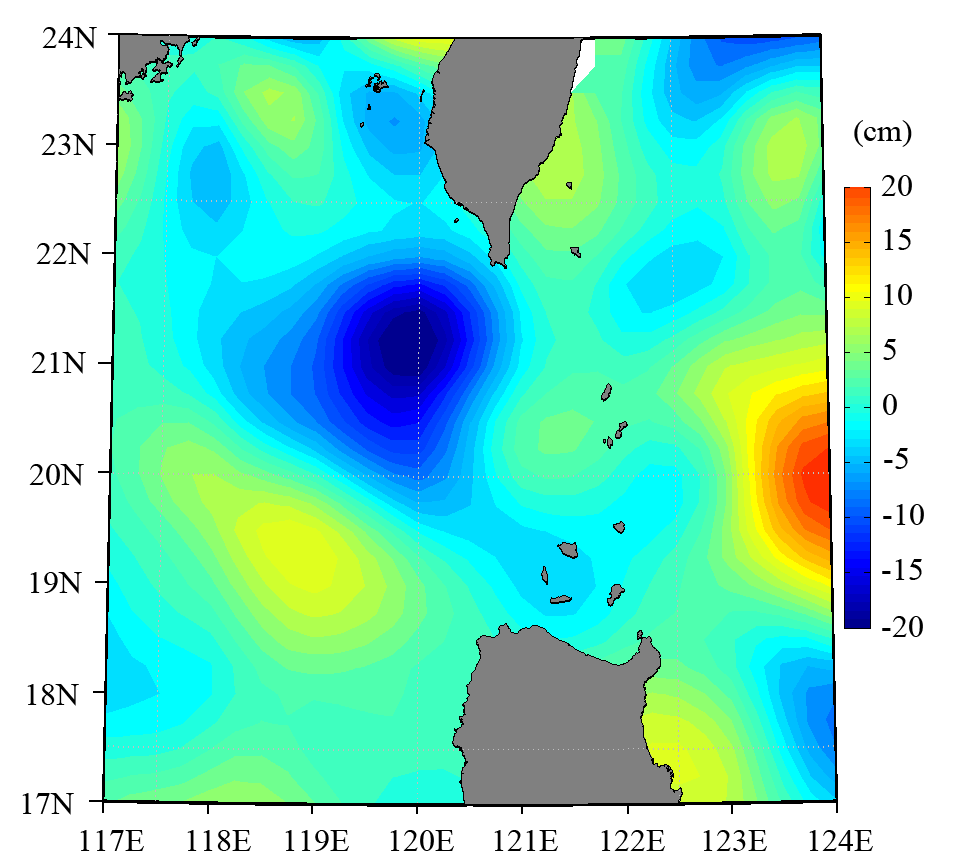
**Figure S3.** Topographic map of the Luzon Strait (LZ) and the South China Sea (SCS) areas with locations where *Prochlorococcus* were observed in the mesopelagic waters (Square) and the locations where solitary waves were monitored year round (Star). Refer to Table 1 for detailed information of the stations.

****

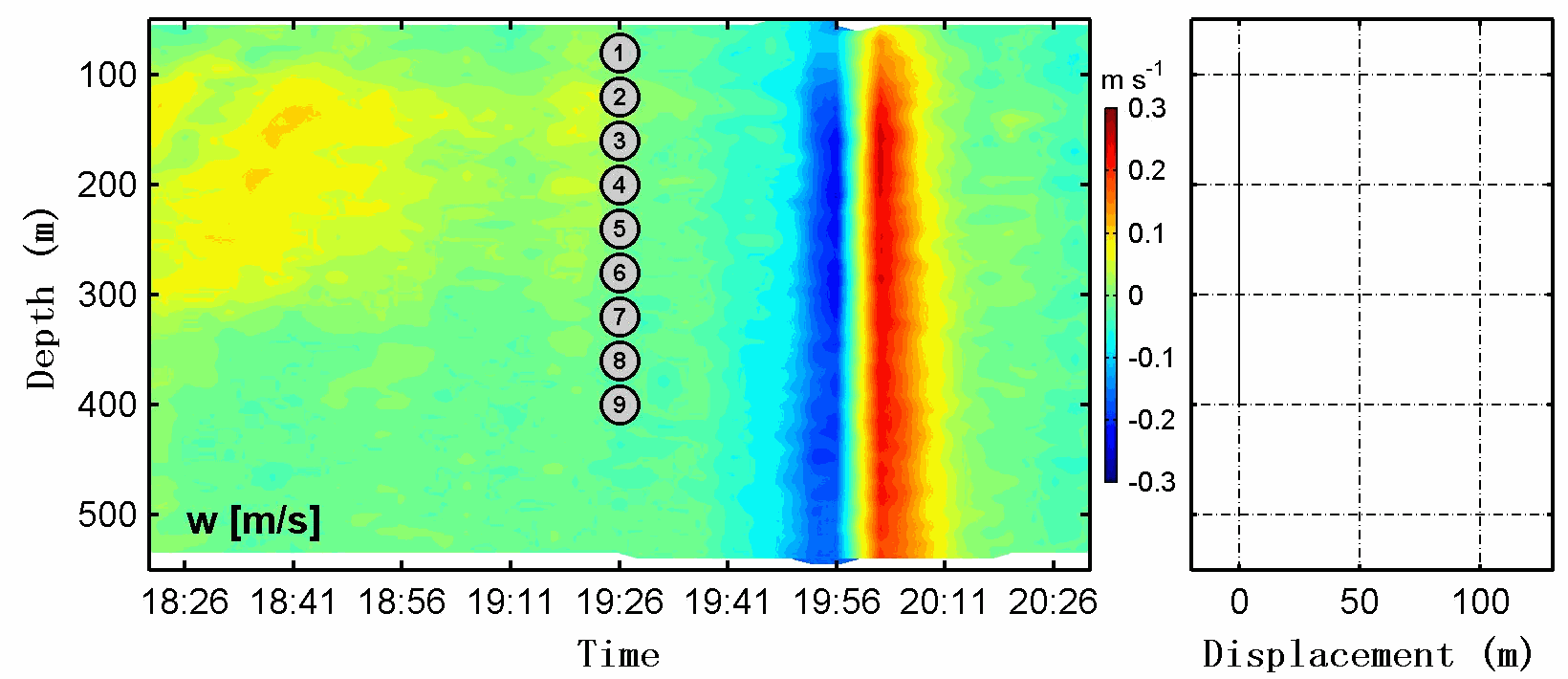
**Figure S4.** Phylogenetic tree based on *Synechococcus* ITS sequences (without two tRNAs) from the Western Pacific Ocean (St. N8-12). Support values, with 1000/100 replicates for NJ and ML analyses, were shown in the order of NJ/ML at nodes (Values lower than 50% are not shown). The numbers of environmental sequences recovered in this research were shown in the triangles. Cultivated strains were shown in bold. Scale bar indicates 0.01 nucleotide substitutions per site.

**Figure S5.** Flow cytometry cellular fluorescence of *Prochlorococcus* from different depths in the Luzon Strait area (dash lines as reference for comparison).

**Figure S6.** Depth profiles of flow cytometric side light scatter of *Prochlorococcus* in the Luzon Strait area, indicating the declining of cell sizes and cellular contents of *Prochlorococcus* cells in the aphotic waters (below 200m).



**Figure S7.** The sea level anomalies observed by satellite altimeters on April 21, 2010 showing a typical case of meso-scale eddies occurring year-round in the Luzon Strait areas.



**(Please right click your mouse on the photo and press Play button)**

**Figure S8.** Demonstration (cartoon movie) of the vertical transport process of material particles driven by the soliton of March 31, 2010 at the Luzon Strait area (21°00'N, 119°00'E), which is computed as  where z is the time-varied depth of water particle at starting depth Z0, obtained by integrating the vertical velocity w from the initial time to time T. In this model, material particles in the water column from 100 m to 400 m are indicated by a series numbers of 1 to 9 to show the displacements by the soliton.