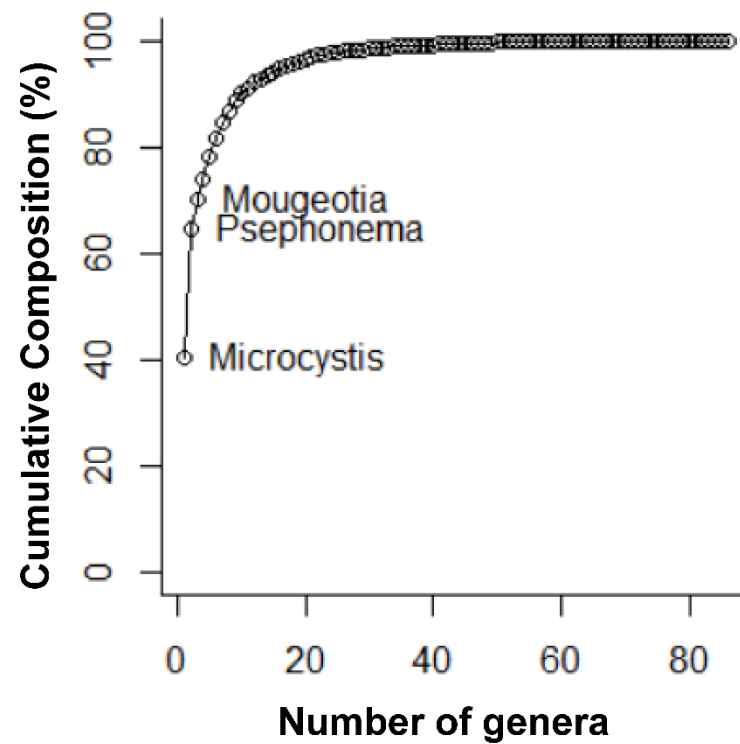**Supplementary information**

Figure S1. Accumulation curve of cell density of phytoplankton by all the genera. Genera are presented in descending order according to numbers of cells. Dominant genera, *Microcystis*, *Psephonema* and *Mougeotia* contributed more than 70% of the total numbers of cells.
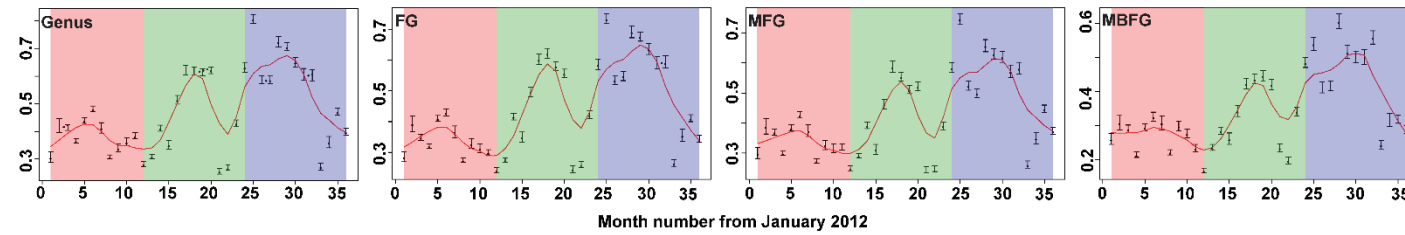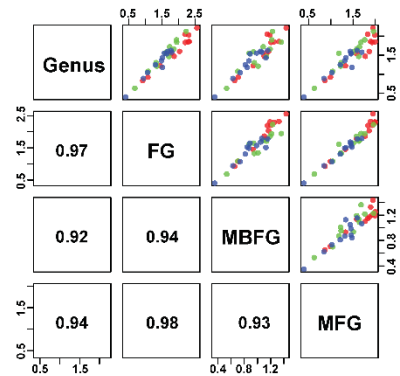
(a) Cell density ($\times 10^6$ cells L^{-1})

(b) α diversity

(c) β diversity

Month number from January 2012
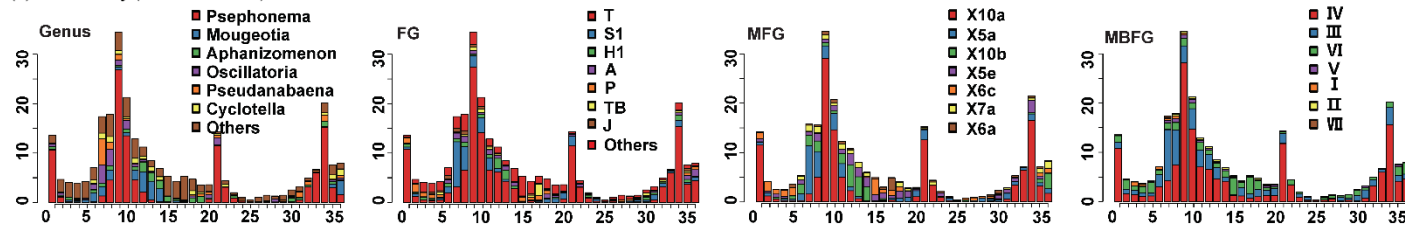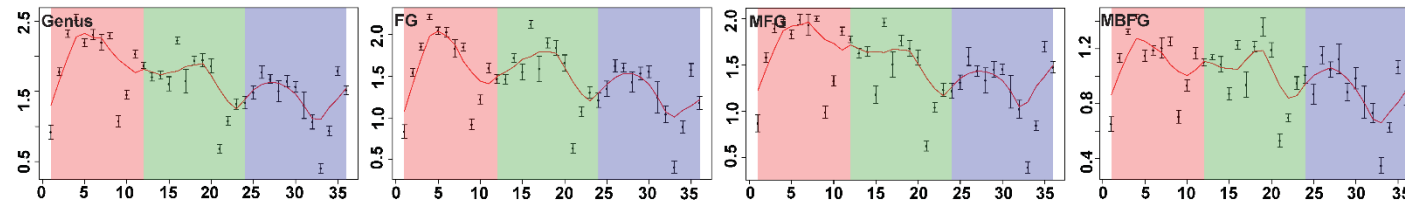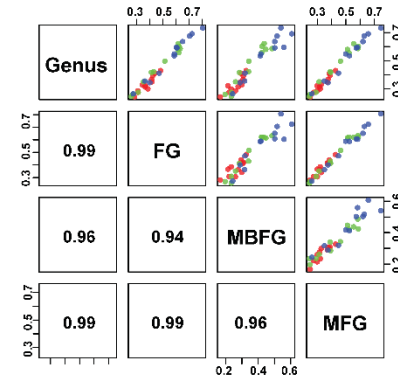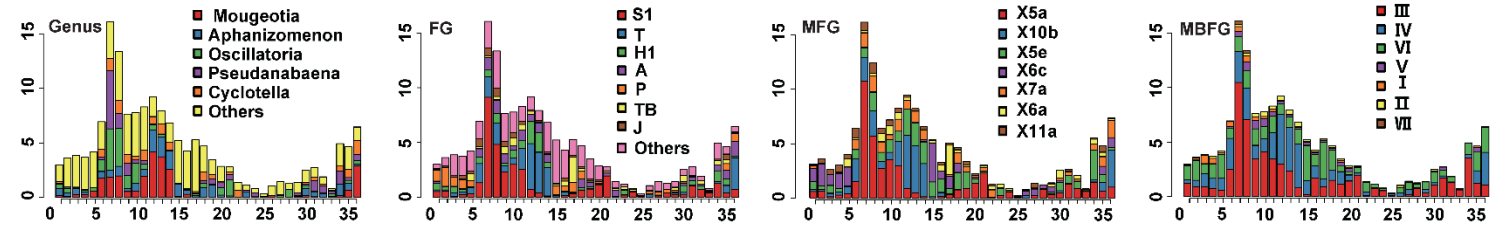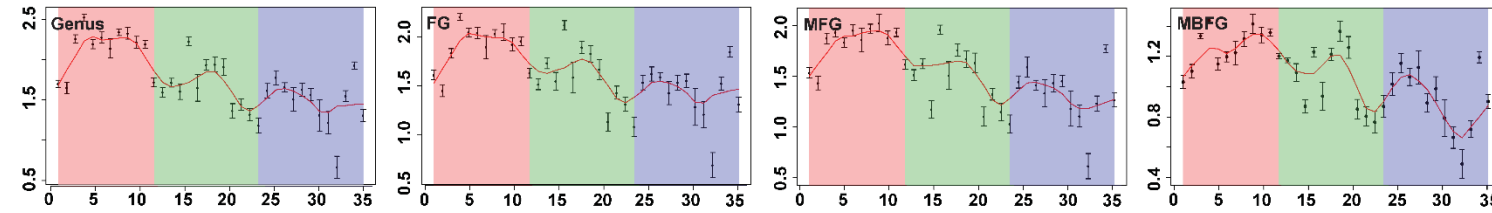
(d) α diversity

(e) β diversity

Figure S2. Seasonal composition and successions of phytoplankton in Lake Erhai from January 2012 to December 2014 according to taxonomic and 3 functional groupings, with removal of the dominant genus *Microcystis*. (a) Cell density and composition, (b) alpha diversity (Shannon-Wiener diversity) indices, (c) beta diversity (Bray-Curtis dissimilarity) indices, (d) pair plot for linear fitting of alpha and (e) beta diversity. The order from left to right is genus, functional groups (FG), morpho-functional groups (MFG) and morphology-based functional groups (MBFG). Numbers of cells are presented as the mean of the 15 sites for each month. Alpha and beta diversity values are presented as the mean ± standard deviation (SD) among the 15 sites for each month. The numbers in the lower left columns in (d) and (e) are correlation coefficients (R^2) ($p < 0.05$).

(a) Cell density (× 10⁶ cells L⁻¹)

Genus: Mougeotia, Aphanizomenon, Oscillatoria, Pseudanabaena, Cyclotella, Others

FG: S1, T, H1, A, P, TB, J, Others

MFG: X5a, X10b, X5e, X6c, X7a, X6a, X11a

MBFG: III, IV, VI, V, I, II, VII

(b) α diversity

(c) β diversity

Month number from January 2012

(d) α diversity

(e) β diversity

Figure S3. Seasonal composition and successions of phytoplankton in Lake Erhai from January 2012 to December 2014 according to taxonomic and 3 functional groupings, with removal of the dominant genera *Microcystis* and *Psephonema*. (a) Cell density and composition, (b) alpha diversity (Shannon-Wiener diversity) indices, (c) beta diversity (Bray-Curtis dissimilarity) indices, (d) pair plot for linear fitting of alpha and (e) beta diversity. The order from left to right is genus, functional groups (FG), morpho-functional groups (MFG) and morphology-based functional groups (MBFG). Numbers of cells are presented as the mean of the 15 sites for each month. Alpha and beta diversity values are presented as the mean ± standard deviation (SD) among the 15 sites for each month. The numbers in the lower left columns in (d) and (e) are correlation coefficients (R^2) ($p < 0.05$).

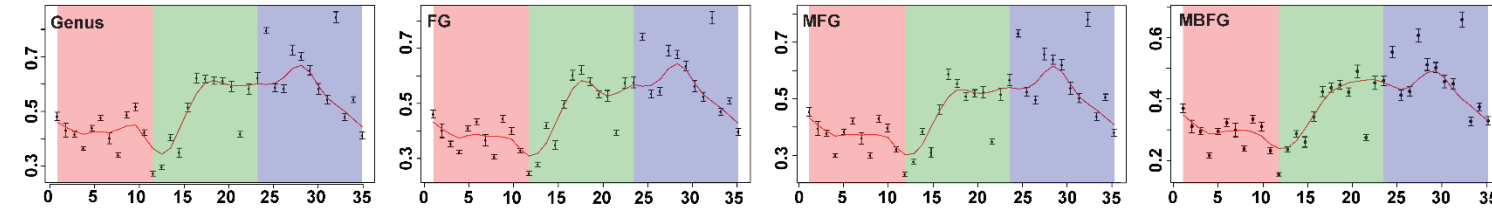(a) Cell density (× 10^6 cells L^{-1})

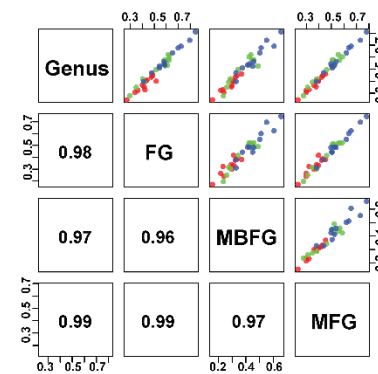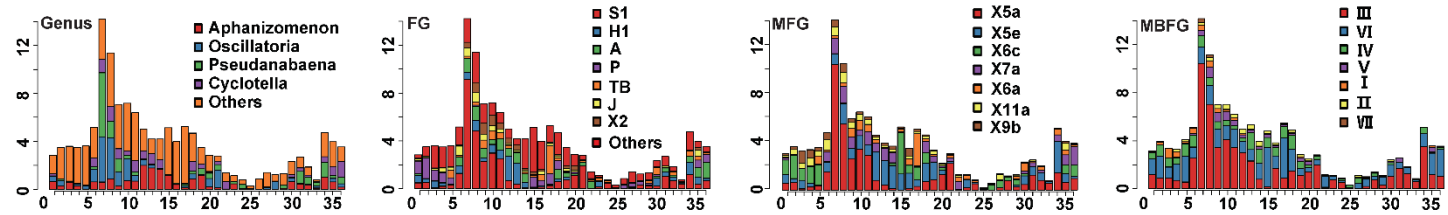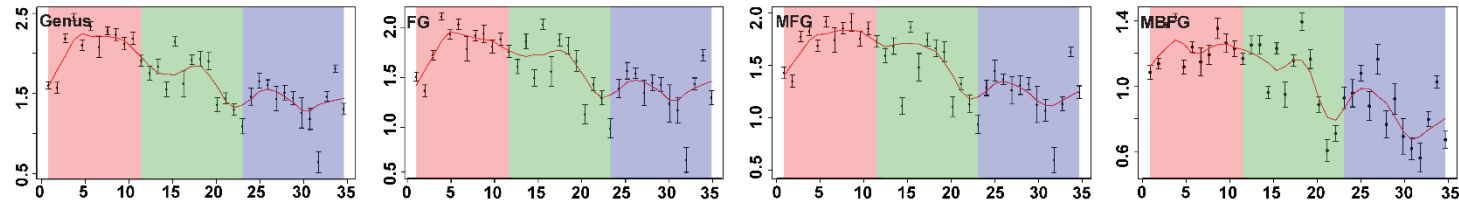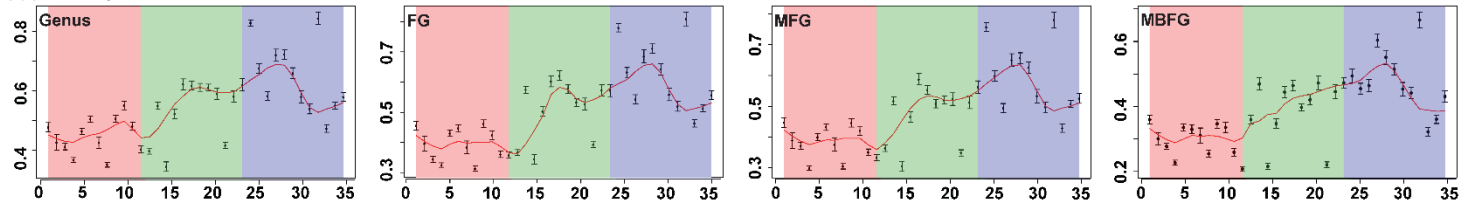**Genus** — Aphanizomenon, Oscillatoria, Pseudanabaena, Cyclotella, Others

FG — S1, H1, A, P, TB, J, X2, Others

MFG — X5a, X5e, X6c, X7a, X6a, X11a, X9b
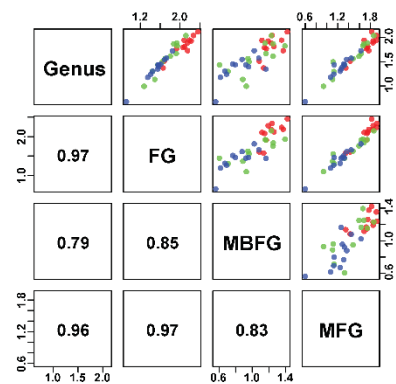
MBFG — III, VI, IV, V, I, II, VII

(b) α diversity

(c) β diversity

Month number from January 2012
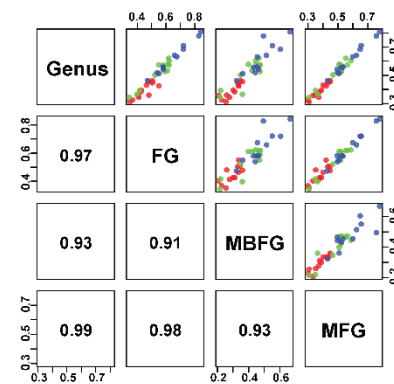
(d) α diversity

(e) β diversity

Figure S4. Seasonal composition and successions of phytoplankton in Lake Erhai from January 2012 to December 2014 according to taxonomic and 3 functional groupings, with removal of the dominant genera *Microcystis*, *Psephonema* and *Mougeotia*. (a) Cell density and composition, (b) alpha diversity (Shannon-Wiener diversity) indices, (c) beta diversity (Bray-Curtis dissimilarity) indices, (d) pair plot for linear fitting of alpha and (e) beta diversity. The order from left to right is genus, functional groups (FG), morpho-functional groups (MFG) and morphology-based functional groups (MBFG). Numbers of cells are presented as the mean of the 15 sites for each month. Alpha and beta diversity values are presented as the mean ± standard deviation (SD) among the 15 sites for each month. The numbers in the lower left columns in (d) and (e) are correlation coefficients (R^2) ($p < 0.05$).
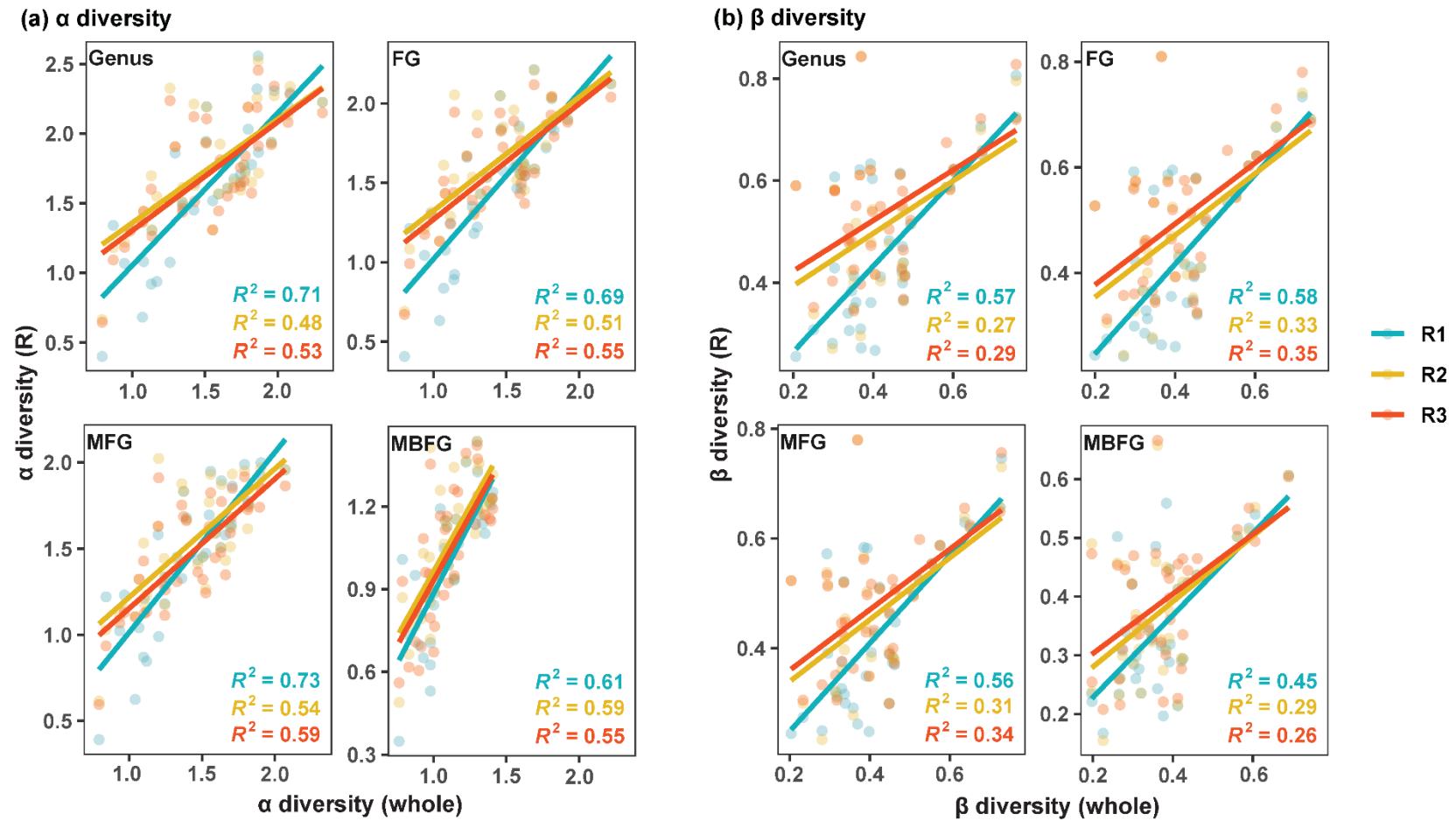
Figure S5. Correlation analyses presented as pair-wise scatter plots and linear regressions, for (a) α diversity (Shannon-Wiener) and (b) β diversity (Bray-Curtis) indices of genus between the whole community and the remaining community (R) after the dominant genera *Microcystis*,

Psephonema and *Mougeotia* were removed gradually. R1: removal of *Microcystis*, R2: removal of *Microcystis* and *Psephonema*, R3: removal of *Microcystis*, *Psephonema* and *Mougeotia*. The numbers in the lower right are correlation coefficients (R^2) ($p < 0.001$).