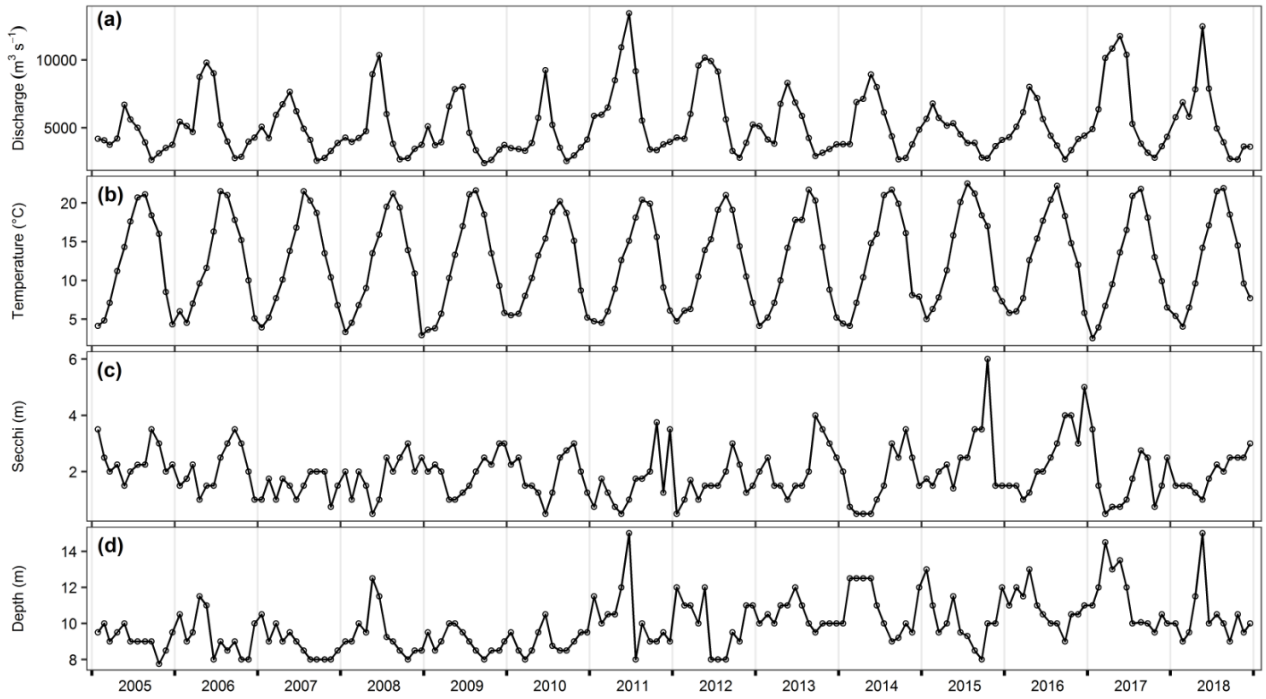

Figure S1: Abiotic variables measured monthly from January 2005 through December 2018 from the Columbia River at Vancouver, WA, including (**a**) mean monthly discharge (m^3 s^{-1}), (**b**) water temperature (˚C), (**c**) Secchi disk depth (m), and (**d**) river water depth (m) at the sampling site. Discharge data taken from Columbia River Data Access in Real Time (http://www.cbr.washington.edu/dart) from the Bonneville Dam, 66 river km upstream of Vancouver

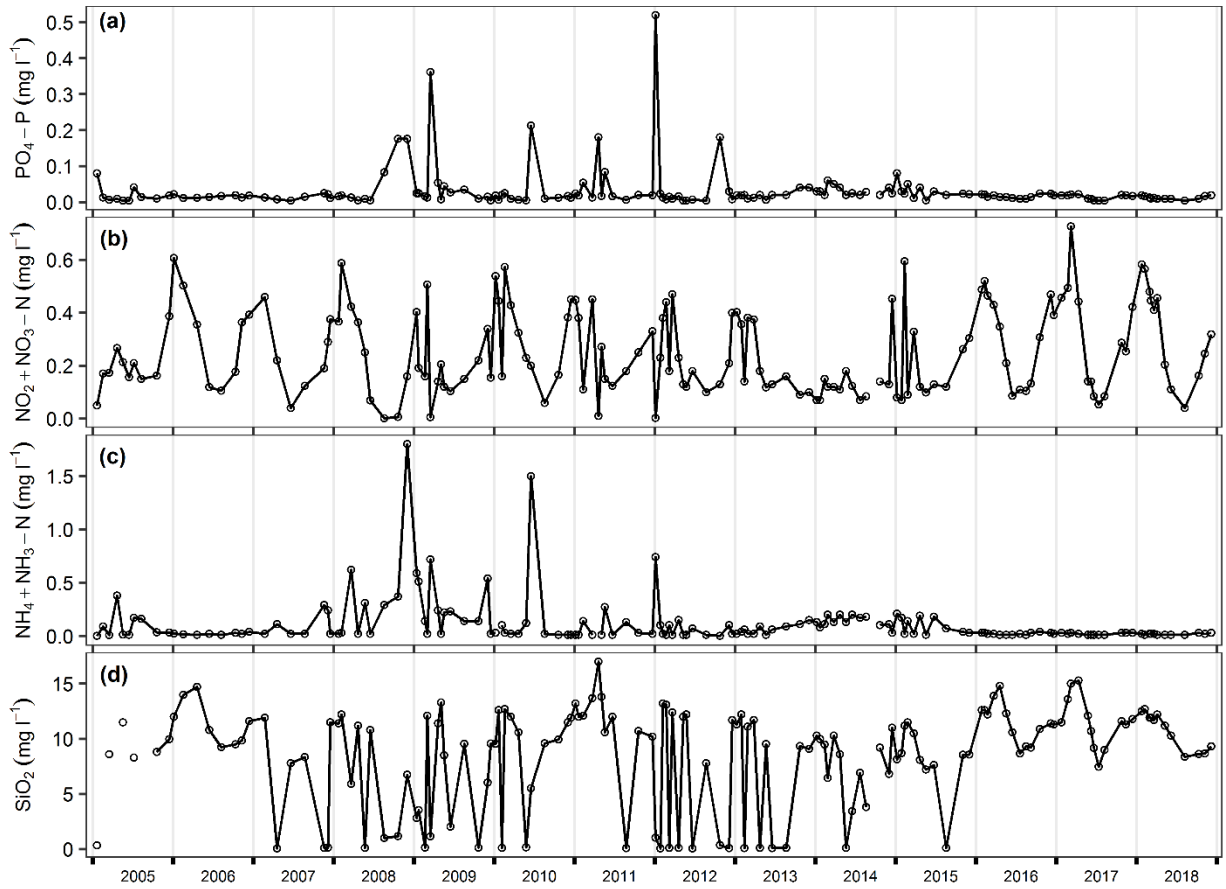

Figure S2: Nutrient concentrations, including (**a**) phosphate (mg l^{-1}), (**b**) nitrite plus nitrate (mg l^{-1}), (**c**) total ammonia nitrogen (mg l^{-1}), (**d**) and silica (mg l^{-1}). Data collected between January 2005 – December 2018 at Port Westward, OR (formerly Beaver Army Terminal), 82 km downstream from our sampling site at Vancouver, WA (USGS, unpublished data)

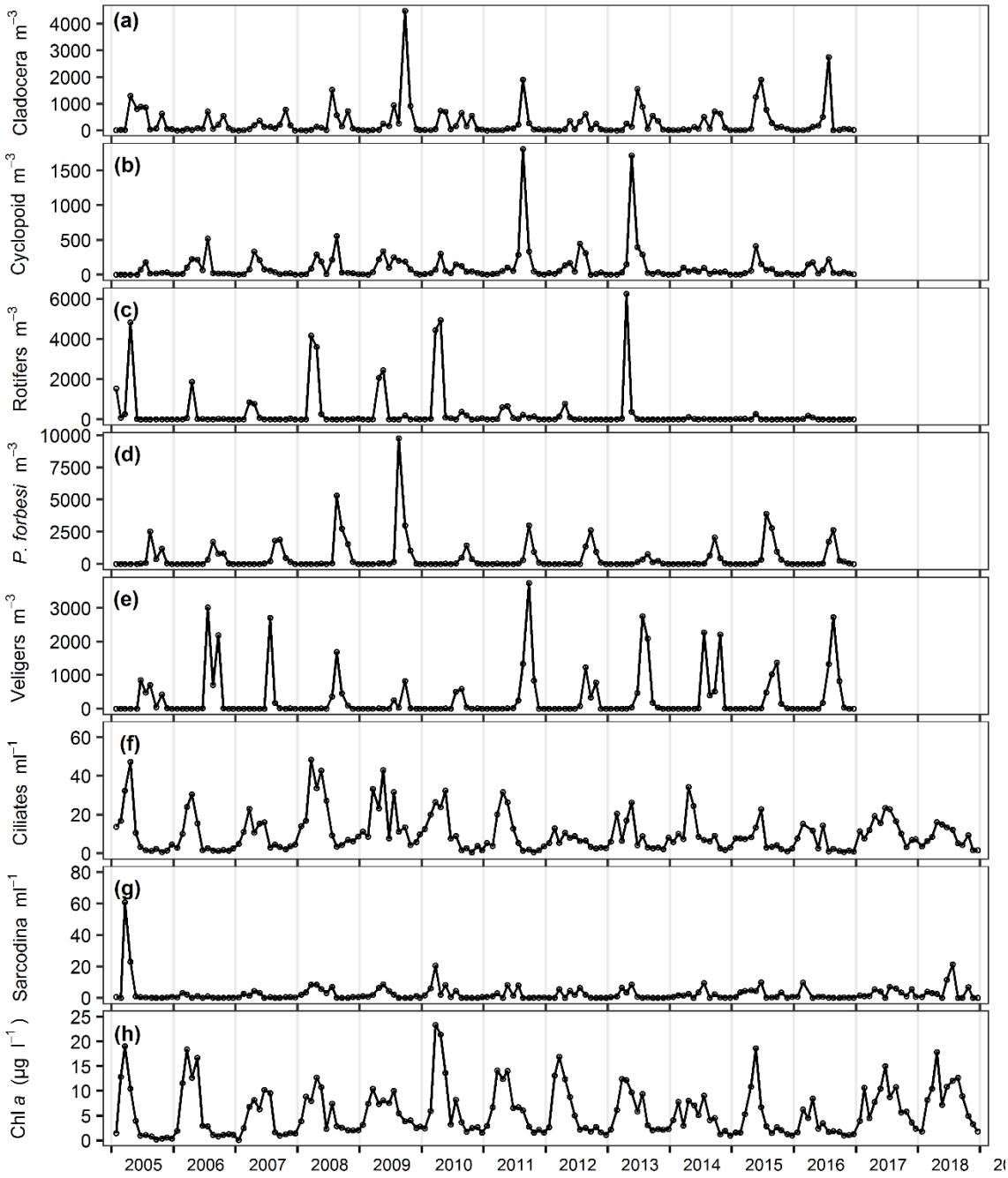

Figure S3: Densities of biotic factors included in BIOENV analyses, including, (**a**)Cladocera m^{-3}, (**b**) cyclopoid copepoda m^{-3}, (**c**) rotifers m^{-3}, (**d**) *P. forbesi* m^{-3}, and (**e**) *C. fluminea* veligers m^{-3}, (**f**) ciliates (ml^{-1}), (**g**) Sarcodina (ml^{-1}), and (**h**) chlorophyll *a* concentration (µg l^{-1}). Mesozooplankton taxa data (**a - e**) from Dexter et al. unpubl. data

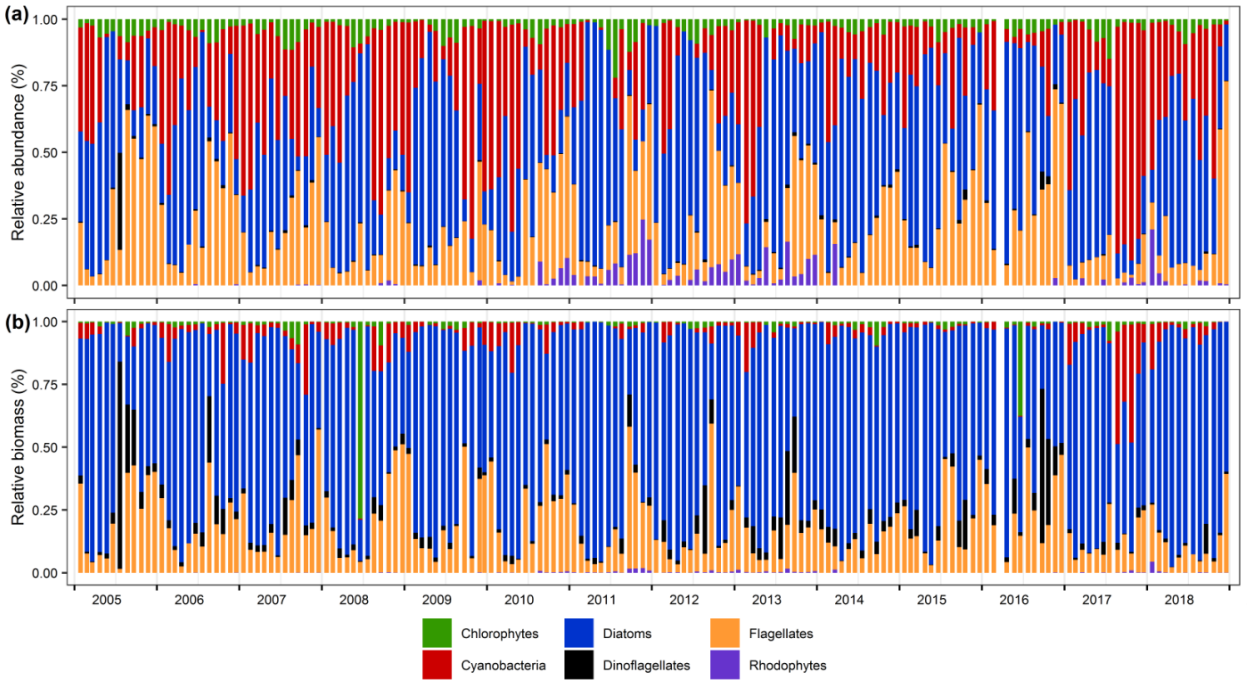

Figure S4: (**a**) Relative abundance (cells ml^{-1}) and (**b**) biomass (µg C l^{-1}) of six major taxonomic categories of Columbia River phytoplankton collected from Vancouver, WA from January 2005 through December 2018

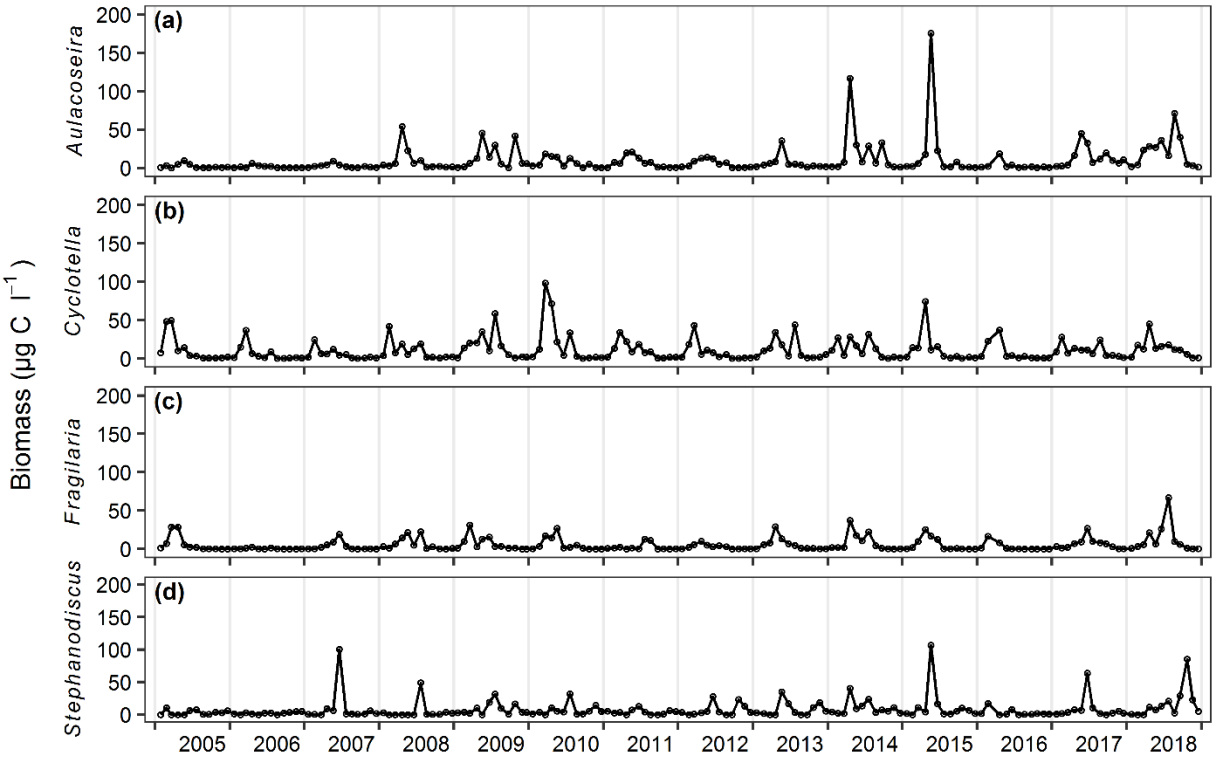

Figure S5: Biomass (µg C l^{-1}) of (**a**) *Aulacoseira* spp., (**b**) *Cyclotella* spp., (**c**) *Fragilaria crotonensis*, and (**d**) *Stephanodiscus* spp. collected near Vancouver, WA from 2005-2018

Table S1. Results of BIOENV non-metric correlation procedure for all external abiotic and biotic factors included from 2005 through 2018, listed with all models tested and Spearman's rank correlation coefficients. Best fit model listed in bold.

Parameters included in model	**Correlation coefficient**
Ciliates	0.4655
Temperature, Ciliates	0.4834
Temperature, Chl *a*, Ciliates	0.5061
Temperature, Secchi, Chl *a*, Ciliates	**0.5188**
Temperature, Secchi, Chl *a*, Ciliates, Sarcodina	0.5182
Temperature, Secchi, Chl *a*, Discharge, Ciliates, Sarcodina	0.5130
Temperature, Depth, Secchi, Chl *a*, Discharge, Ciliates, Sarcodina	0.4725
Salinity, Temperature, Depth, Secchi, Chl *a*, Discharge, Ciliates, Sarcodina	0.4282

Table S2. Results of BIOENV non-metric correlation procedure for external abiotic and biotic factors included from 2005 through 2016 and acquired from Dexter et al. (Submitted a), listed with all models tested and Spearman's rank correlation coefficients. Best fit model listed in bold.

Parameters included in model	**Correlation coefficient**
Ciliates	0.4670
Ciliates, *P. forbesi*	0.5227
Chl a, Ciliates, P. forbesi	0.5236
Secchi, Chl a, Ciliates, *P. forbesi*	0.5260
Chl a, Discharge, Ciliates, *P. forbesi*, *C. fluminea* veligers	0.5256
Secchi, Chl a, Ciliates, Sarcodina, *P. forbesi*, *C. fluminea* veligers	0.5299
Secchi, Chl a, Discharge, Ciliates, Sarcodina, *P. forbesi*, *C. fluminea* veligers	**0.5357**
Temperature, Secchi, Chl a, Discharge, Ciliates, Sarcodina, *P forbesi*, *C. fluminea* veligers	0.5280
Temperature, Secchi, Chl a, Discharge, Ciliates, Sarcodina, *P. forbesi*, Rotifers, *C. fluminea* veligers	0.5158
Temperature, Secchi, Chl a, Discharge, Ciliates, Sarcodina, Cyclopoids, *P. forbesi*, Rotifers, *C. fluminea* veligers	0.5011
Temperature, Depth, Secchi, Chl a, Discharge, Ciliates, Sarcodina, Cyclopoids, *P. forbesi*, Rotifer, *C. fluminea* veligers	0.4876
Temperature, Depth, Secchi, Chl a, Discharge, Ciliates, Sarcodina, Cladocera, Cyclopoids, *P. forbesi*, Rotifers, *C. fluminea* veligers	0.4696
Salinity, Temperature, Depth, Secchi, Chl a, Discharge, Ciliates, Sarcodina, Cladocera, Cyclopoids, *P. forbesi*, Rotifers, *C. fluminea* veligers	0.4365

Table S3. Results of BIOENV non-metric correlation procedure for abiotic and biotic factors included from 2005 through 2016, including mesozooplankton data acquired from Dexter et al. (Submitted), and nutrient data acquired from USGS, listed with all models tested and Spearman's rank correlation coefficients. Best fit model in bold.

Parameters included in model	Correlation coefficient
Ciliates	0.4694
P. forbesi, Ciliates	0.5161
P. forbesi, Chl a, Ciliates	0.5267
P. forbesi, Secchi, Chl a, Ciliates	0.5342
P. forbesi, Temperature, Secchi, Chl a, Ciliates	**0.5431**
P. forbesi, Temperature, Secchi, Chl a, Ciliates, Sarcodina	0.5408
P. forbesi, *C. fluminea* veligers, Secchi, Chl a, Discharge, Ciliates, Sarcodina	0.5419
P. forbesi, *C. fluminea* veligers, Temperature, Secchi, Chl a, Discharge, Ciliates, Sarcodina	0.5401
Cyclopoids, P. forbesi, *C. fluminea* veligers, Temperature, Secchi, Chl a, Discharge, Ciliates, Sarcodina	0.5330
Cyclopoid, P. forbesi, *C. fluminea* veligers, Temperature, Depth, Secchi, Chl a, Discharge, Ciliates, Sarcodina	0.5202
Rotifers, Cyclopoids, P. forbesi, *C. fluminea* veligers, Temperature, Depth, Secchi, Chl a, Discharge, Ciliates, Sarcodina	0.5079
Rotifers, Cyclopoids, P. forbesi, *C. fluminea* veligers, Salinity, Temperature, Depth, Secchi, Chl a, Discharge, Ciliates, Sarcodina	0.4994
Cladocera, Rotifers, Cyclopoids, P. forbesi, *C. fluminea* veligers, Salinity, Temperature, Depth, Secchi, Chl a, Discharge, Ciliates, Sarcodina	0.4872
Silica, Cladocera, Rotifers, Cyclopoids, P. forbesi, *C. fluminea* veligers, Salinity, Temperature, Depth, Secchi, Chl a, Discharge, Ciliates, Sarcodina	0.4745
NO_3+NO_2-N, Silica, Cladocera, Rotifers, Cyclopoids, P. forbesi, *C. fluminea* veligers, Salinity, Temperature, Depth, Secchi, Chl a, Discharge, Ciliates, Sarcodina	0.4592
NO_3+NO_2-N, PO_4-P, Silica, Cladocera, Rotifers, Cyclopoids, P. forbesi, *C. fluminea* veligers, Salinity, Temperature, Depth, Secchi, Chl a, Discharge, Ciliates, Sarcodina	0.4387
NH_3+NH_4-N, NO_3+NO_2-N, PO_4-P, Silica, Cladocera, Rotifers, Cyclopoids, P. forbesi, *C. fluminea* veligers, Salinity, Temperature, Depth, Secchi, Chl a, Discharge, Ciliates, Sarcodina	0.3993

Table S4. Results of post-hoc Dunn's Comparisons (adjusted using the false discovery rate method) of cyanobacteria abundance by year. Significant p-values ($\alpha < 0.05$) are shown in bold.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
2006	0.918	-	-	-	-	-	-	-	-	-	-	-	-
2007	0.400	0.441	-	-	-	-	-	-	-	-	-	-	-
2008	0.154	0.180	0.629	-	-	-	-	-	-	-	-	-	-
2009	0.132	0.154	0.569	0.919	-	-	-	-	-	-	-	-	-
2010	0.180	0.218	0.696	0.918	0.860	-	-	-	-	-	-	-	-
2011	0.635	0.569	0.154	0.054	**0.042**	0.067	-	-	-	-	-	-	-
2012	0.860	0.796	0.306	0.113	0.093	0.132	0.765	-	-	-	-	-	-
2013	0.696	0.765	0.649	0.357	0.303	0.400	0.400	0.569	-	-	-	-	-
2014	0.498	0.569	0.860	0.498	0.443	0.569	0.218	0.403	0.790	-	-	-	-
2015	0.993	0.918	0.400	0.154	0.132	0.180	0.635	0.860	0.696	0.498	-	-	-
2016	0.438	0.400	0.089	**0.023**	**0.021**	**0.029**	0.765	0.544	0.216	0.132	0.438	-	-
2017	**0.021**	**0.023**	0.159	0.417	0.450	0.377	**0.005**	**0.016**	0.060	0.117	**0.021**	**0.002**	-
2018	0.089	0.113	0.441	0.790	0.860	0.718	**0.023**	0.060	0.190	0.357	0.089	**0.016**	0.577