

Photoperiod-driven rhythms reveal multi-decadal stability of phytoplankton communities in a highly fluctuating coastal environment

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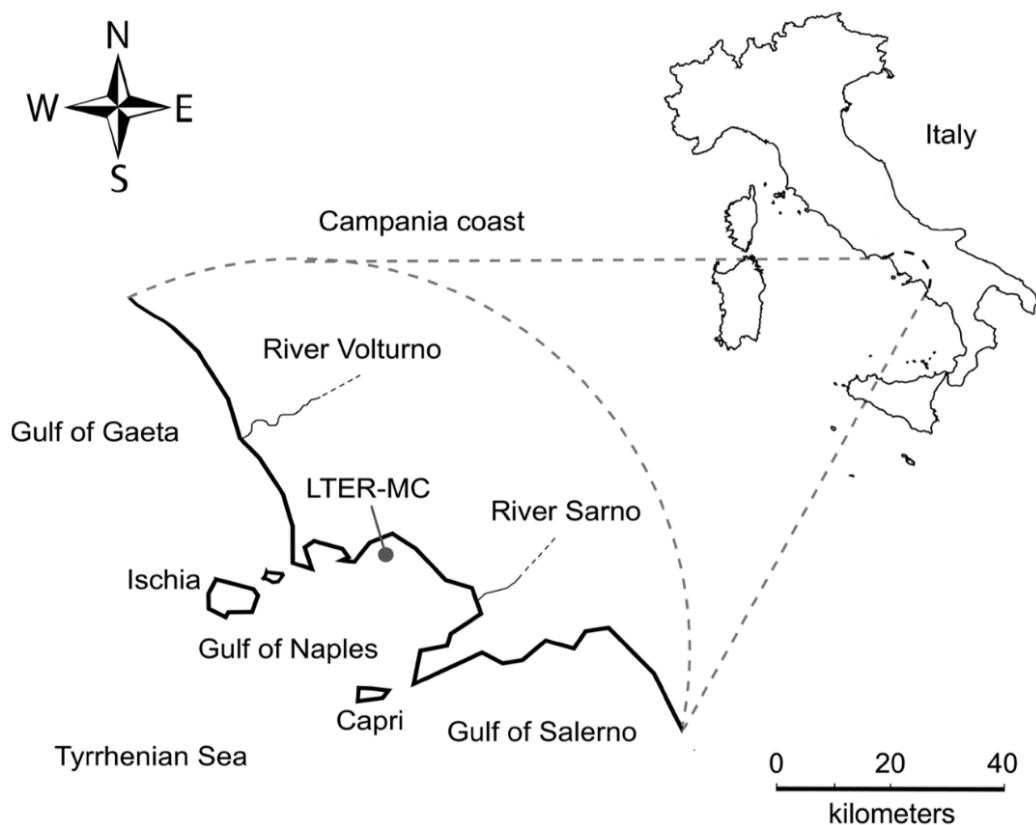


Figure S1. Map of the Gulf of Naples with the location of LTER-MC sampling station. Taken from Zingone et al. (2019).

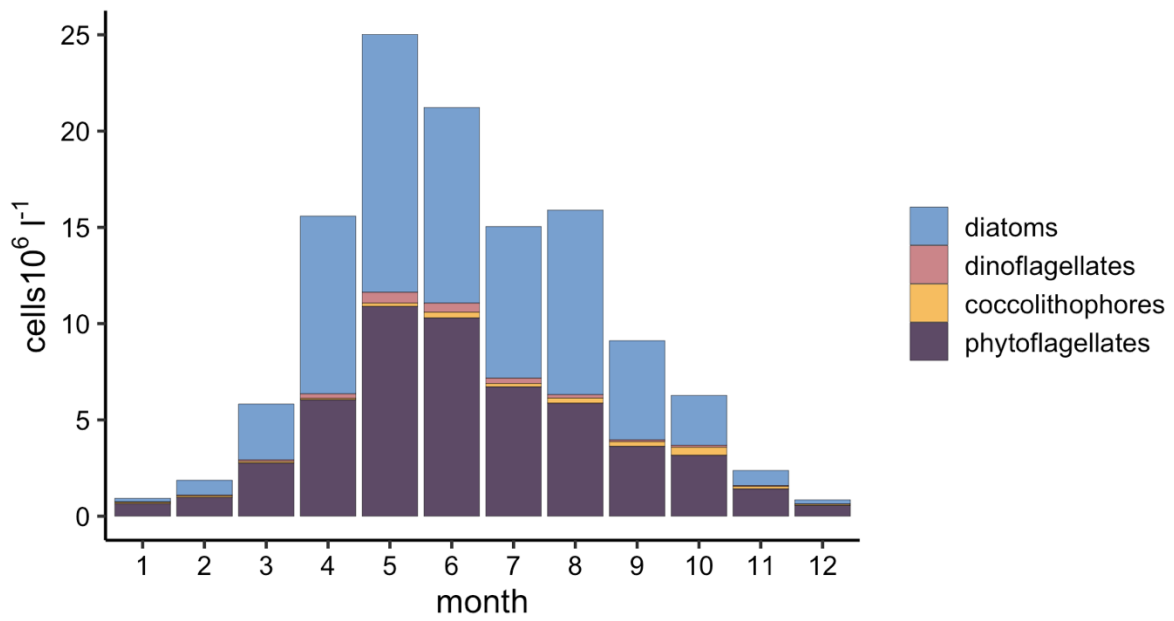


Figure S2. Monthly average abundance of surface phytoplankton functional groups (diatoms, phytoflagellates, dinoflagellates and coccolithophores) at LTER-MC during 1984-2015.

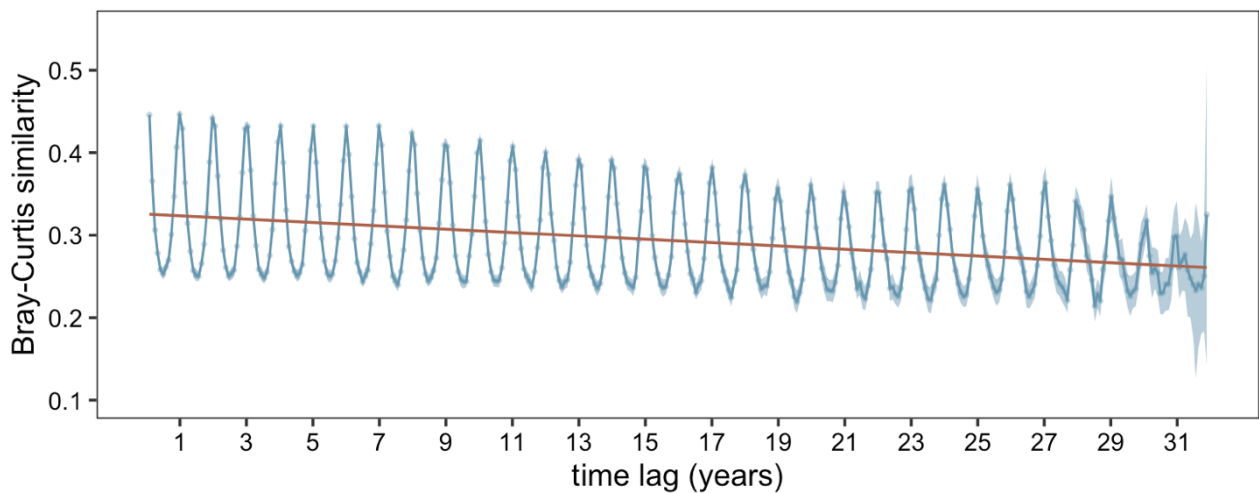


Figure S3. Interannual recurrence of phytoplankton communities shown by average Bray–Curtis similarities (0: completely different communities; 1: identical communities; shaded area: 95% confidence interval) between all pairs of weekly samples separated by a given number of months of the series (time lag, x axis) during 1984–2015. The first point of the series represents the average and 95% confidence interval of the Bray–Curtis similarity values among communities sampled 30 ± 4 days apart in the time interval considered. Similarly, the second point represents the average Bray–Curtis similarity among all the communities sampled 60 ± 4 days apart, the point at 1 year is the average similarity among all the communities sampled at 360 ± 4 days apart, and so on. The decay of maximum and minimum average similarity values over time is probably influenced by the lower number of samples to compare for time lags of many years.

Table S1. Main statistics and results of periodicity' significance test of phytoplankton species during 1984-2015. The relative frequency and the average abundance are the proportion of the number of species' presences and the mean cell counts calculated over all samples respectively.

Taxa	Functional group	Phylum	Class	Lomb-Scargle' significance test	Relative frequency (%)	Average abundance (cells mL ⁻¹)	SD average abundance (cells mL ⁻¹)
<i>Emiliania huxleyi</i>	coccolithophores	Haptophyta	Prymnesiophyceae	periodic	81.11	99.841	444.918
<i>Chaetoceros tenuissimus</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	80.24	833.686	2667.684
<i>Leptocylindrus danicus</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	75.56	516.291	1459.909
<i>Ollicola vangoorii</i>	phytoflagellates	Ochrophyta	Chrysophyceae	periodic	74.09	49.375	108.720
<i>Cylindrotheca closterium</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	72.53	134.461	1061.541
<i>Chaetoceros socialis</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	58.23	361.161	1484.519
<i>Paulinella ovalis</i>	phytoflagellates	Cercozoa	Imbricatea	periodic	52.60	15.579	38.642
<i>Skeletonema pseudocostatum</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	51.91	724.356	3079.788
<i>Pseudo-nitzschia delicatissima</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	50.87	178.832	572.108
<i>Pseudo-nitzschia galaxiae</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	50.17	172.925	750.267
<i>Leucocryptos marina</i>	phytoflagellates	Cryptophyta	Cryptophyta incertae sedis	periodic	49.57	20.412	54.265
<i>Pseudoscurfieldia marina</i>	phytoflagellates	Chlorophyta	Pyramimonadophyceae	periodic	48.96	34.543	88.768
<i>Cerataulina pelagica</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	43.93	45.160	295.119
<i>Skeletonema menzeli</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	40.04	166.955	929.201
<i>Pseudo-nitzschia pseudodelicatissima</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	35.88	36.893	154.966
<i>Bacteriastrium parallelum</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	28.68	133.224	1193.967
<i>Dactyliosolen fragillissimus</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	28.25	12.162	52.529
<i>Chaetoceros curvisetus</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	27.56	25.021	92.875
<i>Dinobryon faculiferum</i>	phytoflagellates	Ochrophyta	Chrysophyceae	periodic	25.65	11.094	31.375
<i>Pseudo-nitzschia galaxiae "small morphotype"</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	25.30	11.971	51.865
<i>Calciopappus caudatus</i>	coccolithophores	Haptophyta	Prymnesiophyceae	periodic	25.22	9.122	30.542
<i>Chaetoceros simplex</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	22.53	35.496	166.768
<i>Meringosphaera mediterranea</i>	phytoflagellates	Ochrophyta	Xanthophyceae	periodic	22.36	2.729	10.984
<i>Syracosphaera pulchra</i>	coccolithophores	Haptophyta	Prymnesiophyceae	periodic	22.27	4.616	22.351
<i>Thalassionema nitzschioides</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	22.10	10.662	50.545
<i>Chaetoceros "curvi-curvi"</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	22.01	44.504	187.802
<i>Minidiscus comicus</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	20.54	87.400	831.800
<i>Oxytoxum variabile</i>	dinoflagellates	Myzozoa	Dinophyceae	periodic	18.63	1.532	6.508
<i>Dactyliosolen blayuanus</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	18.20	5.434	27.295
<i>Pseudo-nitzschia multistriata</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	17.24	9.069	44.712
<i>Tenuicylindrus belgicus</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	15.95	20.343	137.977
<i>Thalassiosira rotula</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	15.77	8.415	49.317
<i>Syracosphaera molischii</i>	coccolithophores	Haptophyta	Prymnesiophyceae	periodic	14.82	1.478	7.630
<i>Prorocentrum triestinum</i>	dinoflagellates	Myzozoa	Dinophyceae	periodic	14.56	7.427	40.292
<i>Chaetoceros minimus</i>	diatoms	Ochrophyta	Bacillariophyceae	nonperiodic	14.39	18.118	147.183
<i>Calciolenia brasiliensis</i>	coccolithophores	Haptophyta	Prymnesiophyceae	nonperiodic	14.39	1.510	6.379
<i>Ophiaster spp.</i>	coccolithophores	Haptophyta	Prymnesiophyceae	periodic	14.04	0.555	2.595
<i>Acanthoica quattrosipina</i>	coccolithophores	Haptophyta	Prymnesiophyceae	periodic	13.43	0.703	3.509
<i>Dictyocha fibula</i>	phytoflagellates	Ochrophyta	Dictyochophyceae	periodic	12.57	0.330	1.508
<i>Asterionellopsis glacialis</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	12.48	9.622	51.439
<i>Rhabdosphaera clavigera</i>	coccolithophores	Haptophyta	Prymnesiophyceae	nonperiodic	12.22	1.016	4.160
<i>Thalassionema bacillare/frauenfeldii</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	12.13	2.142	10.770
<i>Lessardia elongata</i>	dinoflagellates	Myzozoa	Dinophyceae	periodic	11.87	2.251	9.883
<i>Eutreptiella spp.</i>	phytoflagellates	Euglenozoa	Euglenoidea	periodic	11.79	9.968	230.784
<i>Chaetoceros affinis</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	11.79	7.621	39.183
<i>Proboscia alata</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	11.79	1.716	8.360
<i>Dactyliosolen phuketensis</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	11.44	2.740	20.593
<i>Guinardia striata</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	10.66	2.199	13.753
<i>Apedinella radians</i>	phytoflagellates	Ochrophyta	Dictyochophyceae	periodic	10.23	1.725	9.830
<i>Thalassiosira mediterranea</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	9.62	12.108	144.521
<i>Chaetoceros diadema</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	9.10	11.441	68.375
<i>Chaetoceros thomsonii</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	8.93	38.160	378.091
<i>Chaetoceros contortus</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	8.93	17.016	102.922
<i>Lauderia annulata</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	8.93	2.193	11.314
<i>Heterocapsa niei</i>	dinoflagellates	Myzozoa	Dinophyceae	periodic	8.67	2.746	14.841
<i>Chaetoceros protuberans</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	8.06	3.544	21.745
<i>Diplostaureon cf. elegans</i>	phytoflagellates	Chlorophyta	Chlorophyceae	periodic	7.89	3.082	19.276
<i>Solenicola setigera</i>	phytoflagellates	unassigned	unassigned	periodic	6.85	4.202	36.203
<i>Chaetoceros peruvianus</i>	diatoms	Ochrophyta	Bacillariophyceae	nonperiodic	6.85	0.480	3.168
<i>Leptocylindrus mediterraneus</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	6.67	0.496	3.802
<i>Chaetoceros costatus</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	6.59	4.551	27.828
<i>Chaetoceros pseudocurvisetus</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	6.41	3.851	29.346
<i>Chaetoceros decipiens</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	6.41	1.711	13.331
<i>Leptocylindrus convexus</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	6.33	8.755	63.990
<i>Lithodesmium cf. variabile</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	6.33	2.395	23.235
<i>Dinobryon coalescens</i>	phytoflagellates	Ochrophyta	Chrysophyceae	periodic	6.15	7.670	71.109
<i>Chaetoceros anastomosans</i>	diatoms	Ochrophyta	Bacillariophyceae	nonperiodic	6.15	3.651	31.924
<i>Algirosphaera robusta</i>	coccolithophores	Haptophyta	Prymnesiophyceae	periodic	6.15	0.150	1.247
<i>Coronosphaera mediterranea</i>	coccolithophores	Haptophyta	Prymnesiophyceae	periodic	5.98	0.118	0.803
<i>Pratoperidinium bipes</i>	dinoflagellates	Myzozoa	Dinophyceae	periodic	5.89	0.744	4.436
<i>Chaetoceros wighamii</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	5.46	17.945	163.828
<i>Minutocellus polymorphus</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	5.37	31.354	476.638
<i>Pseudo-nitzschia fraudulenta/subfraudulenta</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	5.29	1.945	14.986
<i>Chaetoceros single sp.1</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	5.11	82.167	1139.217
<i>Chaetoceros diversus</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	5.11	10.012	161.038
<i>Eucampia zodiacus f. cylindricornis</i>	diatoms	Ochrophyta	Bacillariophyceae	nonperiodic	5.11	0.858	6.935
<i>Sphaerocalypta quadridentata</i>	coccolithophores	Haptophyta	Prymnesiophyceae	periodic	5.03	0.985	7.016
<i>Bacteriastrium furcatum</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	4.68	2.951	49.851
<i>Skeletonema tropicum</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	4.51	3.840	28.257
<i>Lialoma sp.</i>	diatoms	Ochrophyta	Bacillariophyceae	periodic	4.51	0.500	3.661
<i>Umbilicosphaera sibogae</i>	coccolithophores	Haptophyta	Prymnesiophyceae	periodic	3.21	0.050	0.365