Supporting information

Variation pattern of particulate organic carbon and nitrogen in oceans and inland waters

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Supporting information introduction: Supporting information includes six tables and two figures.

Table S1 Data information and sources for POC, PON and corresponding dissolved organic carbon (DOC), dissolved organic nitrogen (DON), chlorophyll-a and total suspended matter.

Ocean Database

Ocean datasets	location	Data link and description
Marine POM	Global Ocean	http://dx.doi.org/10.5061/dryad.d702p/3
Cruise NBP1302	Rose Sea	http://www.bco-dmo.org/dataset/658394
Cruise VDT0410	South East of New Zealand	http://www.bco-dmo.org/dataset/3329
Cruise KN199-04	N. Atlantic Ocean	http://www.bco-dmo.org/dataset/3851
Cruises LMG 0414- 0602	Southern Ocean	http://www.bco-dmo.org/dataset/3035
Cruise IronEx II	Pacific Ocean	http://www.bco-dmo.org/dataset/3152
Cruise RB-08-02	Southwest Atlantic	http://www.bco-dmo.org/dataset/3304
Cruise MV1008	Eastern Tropical Pacific Ocean	http://www.bco-dmo.org/dataset/516495
Cruises KY0103-01-02	Sub-Arctic Pacific Ocean	http://www.bco-dmo.org/dataset/2907

Cruise NH1008	Monterey Bay	http://www.bco-dmo.org/dataset/3725
Cruise 61TG_3052	Southern Ocean	http://www.bco-dmo.org/dataset/2866
Cruise M80/2	North Atlantic Ocean	https://doi.pangaea.de/10.1594/PANGAEA.843427
Cruise PS79	Atlantic Ocean	https://doi.pangaea.de/10.1594/PANGAEA.848818
Dünweber, 2010	Arctic Ocean	https://doi.pangaea.de/10.1594/PANGAEA.809471
Cruise PS69/001	Pacific and Atlantic Oceans	https://doi.pangaea.de/10.1594/PANGAEA.759667
Cruise SS2010v09	Pacific Oceans	https://doi.pangaea.de/10.1594/PANGAEA.843554
Cruise M97	Atlantic Ocean	https://doi.pangaea.de/10.1594/PANGAEA.863119
SBC LTER	Santa Barbara Coastal	https://pasta.lternet.edu/package/metadata/eml/knb-lter-sbc/10/21
Palmer Station Antarctica LTER	West Antarctica	https://pasta.lternet.edu/package/metadata/eml/knb-lter-sbc/215/01
Cruise CalCOFI	North Atlantic Ocean	https://pasta.lternet.edu/package/metadata/eml/knb-lter-cce/54/1
Cruise CCE Process	North Atlantic Ocean	https://pasta.lternet.edu/package/metadata/eml/knb-lter-cce/104/1
MCR LTER	North Atlantic Ocean	https://pasta.lternet.edu/package/metadata/eml/knb-lter-mcr/104/1
Cruise NBP01-02	Pacific and Atlantic Oceans	ftp://ftp.nodc.noaa.gov/nodc/archive/arc0060/0112164/
Cruise OC404	Atlantic Ocean	ftp://ftp.nodc.noaa.gov/nodc/archive/arc0037/0078011/
Cruise WB0508	Atlantic Ocean	ftp://ftp.nodc.noaa.gov/nodc/archive/arc0042/0086459/
Cruise WB0506	Atlantic Ocean	ftp://ftp.nodc.noaa.gov/nodc/archive/arc0042/0086459/
Cruise WB0409	Atlantic Ocean	ftp://ftp.nodc.noaa.gov/nodc/archive/arc0042/0086459/
Cruise WB0413	Atlantic Ocean	ftp://ftp.nodc.noaa.gov/nodc/archive/arc0042/0086459/
Cruise WCOA11	North Atlantic Ocean	ftp://ftp.nodc.noaa.gov/nodc/archive/arc0072/0123607/
Cruise WCOA2011	Pacific Ocean	https://www.nodc.noaa.gov/archive/arc0093/0155173/1.1/data/0-data/
Lecture data	Ocean and Coastal	Sterner et al., 2008
Lecture data	China sea	Cai, P.H. et al., 2015
Lecture data	northern Adriatic Sea	Salvi et al., 1998
Lecture data	Columbia River Estuary	Small and Prahl, 2004

Lake Database

Lake datasets	location	Data link and description
Lacustrine Communities	Lacustrine Central Group	https://pasta.lternet.edu/package/metadata/eml/knb-lter-cdr/579/5
NWT LTER	Green Lake	https://pasta.lternet.edu/package/metadata/eml/knb-lter-nwt/107/8
MCML LTER	McMurdo Dry Valleys Lakes	https://pasta.lternet.edu/package/metadata/eml/knb-lter-mcm/57/9
WPlum Island LTER	Ipawich and Parker river	https://pasta.lternet.edu/package/metadata/eml/knb-lter-sbc/108/6
NTL LTER	Great Lakes Group	https://pasta.lternet.edu/package/metadata/eml/knb-lter-ntl/278/6
Arctic LTER	Alaskan Lakes	https://pasta.lternet.edu/package/metadata/eml/knb-lter-arc/10090/3
Water/Soil Environment	Lake Kasumigaura	http://www.nies.go.jp/db/index-e.html
Lecture data	Northern American Lakes	Sterner et al., 2008

Lecture data	Norwegian Lakes	Sterner et al., 2008
Lecture data	Hokkaido Lakes	Sterner et al., 2008
Lecture data	Biwa Lake	Sterner et al., 2008
Lecture data	Hovsgol Lake	Sterner et al., 2008
Lecture data	Baikal Lake	Sterner et al., 2008
Lecture data	Skidaway River	Verity, 2002
Lecture data	Taihu Lake	This study

Table S2 Relationship between PON and POC for each latitudinal range. Three mathematical functions were used to fit the relationship between PON and POC. The parameters and determined coefficients of each function are listed in the table. The R^2 with * marked is the best regression function for the POC and PON.

Items	$POC=A_0\times PON+C_0$			$POC=A_1\times PON$		$POC=A_2\times PON^{B2}$			POC/PON	N
	A_0	C_0	R^2	A_1	R^2	A_2	B_2	R^2		
80-90	8.828	0.080	0.772	9.294	0.767	6.211	0.835	0.832*	12.2±7.5	958
70-80	7.081	0.221	0.932*	7.149	0.931	6.573	0.866	0.896	9.4±6.4	2321
60-70	11.961	6.833	0.915	11.436	0.907	7.131	1.105	0.961*	7.6±2.7	211
50-60	8.289	-0.142	0.835	8.262	0.835	7.547	1.016	0.937*	8.3±5.0	776
40-50	5.929	1.486	0.850	6.401	0.836	7.547	0.872	0.875*	8.7±4.5	4913
30-40	6.800	-1.126	0.881	6.582	0.879	6.399	0.948	0.911*	6.7±2.7	23441
20-30	5.197	0.340	0.959*	5.336	0.956	5.528	0.903	0.870	6.6±2.8	2776
10-20	6.920	2.496	0.876	7.038	0.876	7.488	0.974	0.953*	7.9±4.0	4335
0-10	5.900	0.460	0.905*	6.448	0.890	6.379	0.897	0.853	7.5±2.6	1004
0-10	7.607	0.345	0.836*	8.100	0.831	7.617	0.905	0.792	8.7±3.0	898
10-20	6.190	0.961	0.895*	7.016	0.869	7.216	0.826	0.864	8.5±3.2	749
20-30	5.521	1.120	0.896	5.994	0.883	6.823	0.830	0.936*	7.4±2.2	494
30-40	6.621	0.362	0.951*	6.834	0.948	6.610	0.749	0.887	8.7±4.1	283
40-50	14.909	-5.115	0.881	13.967	0.860	7.646	0.918	0.941*	8.7±3.6	1191
50-60	6.133	0.577	0.898	6.585	0.888	6.945	0.910	0.965*	8.3±3.5	973
60-70	5.984	1.424	0.930	6.025	0.930	7.349	0.889	0.939*	7.6±3.9	16002
70-80	8.395	-5.181	0.928	7.849	0.917	7.961	0.868	0.973*	8.0±3.4	1858
mean	7.545	0.302	0.891	7.666	0.882	6.998	0.901	0.905		
STDEV	**2.498**	**2.658**	**0.047**	**2.169**	**0.048**	**0.645**	**0.081**	**0.052**		

Table S3 Relationship between PON and POC for each depth interval in the southern and northern hemispheres. Three mathematical functions were used to fit the relationship between PON and POC. The parameters and determined coefficients of each function are listed in the table.

Northern	$POC=A_0\times PON+C_0$	$POC=A_1\times PON$	$POC=A_2\times PON^{B2}$	POC/PON	N

	A_0	C_0	R^2	A_1	R^2	A_2	B_2	R^2		
0-5m	5.534	3.078	0.898	5.867	0.889	7.493	0.897	0.941*	6.9±2.3	6476
5-10m	5.762	3.276	0.884*	6.268	0.871	8.664	0.801	0.868	6.7±2.1	3689
10-20m	6.347	0.438	0.936	6.411	0.935	7.208	0.878	0.948*	7.0±2.8	3754
20-80m	8.003	-3.386	0.914	7.650	0.908	7.602	0.902	0.959*	7.1±3.4	11511
>80m	7.173	-0.610	0.967	7.086	0.966	7.690	0.856	0.969*	8.4±6.5	15384
mean	7.110	0.646	0.898	7.002	0.897	6.675	0.956	0.934		
STDEV	**0.358**	**0.986**	**0.020**	**0.293**	**0.021**	**0.106**	**0.035**	**0.011**		

Southern	**$POC=A_0\times PON+C_0$**			**$POC=A_1\times PON$**		**$POC=A_2\times PON^{B2}$**			**POC/PON**	**N**
	A_0	C_0	R^2	A_1	R^2	A_2	B_2	R^2		
0-5m	7.027	0.681	0.877	6.966	0.876	7.533	0.883	0.944*	7.9±4.4	5274
5-10m	6.410	0.377	0.903	6.440	0.902	7.482	0.877	0.938*	7.8±4.5	2329
10-20m	5.516	3.142	0.865	5.670	0.861	7.560	0.882	0.942*	7.9±5.0	3198
20-80m	6.366	0.480	0.953*	6.379	0.953	7.356	0.888	0.945	7.8±4.4	6758
>80m	5.274	2.534	0.909	5.335	0.907	7.200	0.891	0.947*	8.1±4.9	4940
mean	6.119	1.443	0.901	6.158	0.900	7.426	0.884	0.943		
STDEV	**0.716**	**1.296**	**0.034**	**0.651**	**0.035**	**0.149**	**0.005**	**0.004**		

Table S4 Relationship between PON and POC and offshore distance in the southern and northern hemispheres. Three mathematical functions were used to fit the relationship between PON and POC. The parameters and determined coefficients of each function are listed in the table.

Northern	**$POC=A_0\times PON+C_0$**			**$POC=A_1\times PON$**		**$POC=A_2\times PON^{B2}$**			**POC/PON**	**N**
	A_0	C_0	R^2	A_1	R^2	A_2	B_2	R^2		
5 km	7.059	-1.326	0.937	6.852	0.935	6.471	1.003	0.957*	6.6±1.4	3131
5-10 km	8.059	2.586	0.887	7.750	0.883	6.684	0.979	0.958*	6.8±2.0	1385
10-15 km	8.424	-5.191	0.926	7.815	0.914	7.056	0.955	0.962*	7.0±2.1	1093
15-20 km	6.839	-0.701	0.942	6.696	0.941	6.658	0.951	0.945*	6.7±2.0	1146
20-30 km	6.866	-0.772	0.932	6.723	0.931	6.993	0.879	0.934*	7.3±3.2	2480
30-40 km	6.594	-0.182	0.932*	6.555	0.932	6.796	0.903	0.924	6.9±2.9	1880
40-50 km	7.096	0.915	0.882	7.143	0.882	7.358	0.963	0.953*	7.7±3.8	3766
50-75 km	8.520	-1.832	0.820	8.127	0.813	6.994	0.874	0.944*	8.6±5.1	1610
75-100 km	6.275	0.333	0.846	6.357	0.845	6.592	0.928	0.941*	7.4±3.7	1020
100-125 km	6.530	0.005	0.935	6.530	0.935	6.695	0.864	0.936*	8.1±4.4	966
125-150 km	6.189	0.762	0.931*	6.395	0.927	6.967	0.935	0.930	7.9±4.6	582

150-200 km	8.367	2.994	0.966*	8.146	0.962	6.535	0.939	0.936	7.1±3.2	1001
200-300 km	6.280	0.067	0.933*	6.271	0.933	6.451	0.893	0.919	7.5±4.4	1776
300-500 km	7.869	0.574	0.821	7.784	0.821	7.068	0.893	0.898*	8.7±5.6	3317
500-800 km	7.454	0.741	0.841	7.522	0.841	7.760	0.924	0.939*	8.9±4.9	2112
800-1100 km	6.220	1.857	0.908	6.326	0.906	7.183	0.998	0.945*	7.7±3.3	857
>1100 km	5.826	0.493	0.855	5.918	0.854	6.243	0.929	0.900*	6.9±3.6	13184
North	7.103	0.881	0.893	7.004	0.892	6.656	0.955	0.932*	7.5±4.6	41297
mean	7.086	0.078	0.900	6.995	0.897	6.853	0.930	0.937		
STDEV	**0.877**	**1.851**	**0.047**	**0.719**	**0.047**	**0.376**	**0.042**	**0.018**		

Southern	**$POC=A_0\times PON+C_0$**			**$POC=A_1\times PON$**		**$POC=A_2\times PON^{B2}$**			**POC/PON**	**N**
	A_0	C_0	R^2	A_1	R^2	A_2	B_2	R^2		
5 km	5.534	3.078	0.898	5.867	0.889	7.493	0.897	0.941*	8.3±10.1	4536
5-10 km	5.762	3.276	0.884*	6.268	0.871	8.664	0.801	0.868	7.6±3.1	598
10-15 km	5.634	2.570	0.952*	5.912	0.945	7.485	0.878	0.928	7.6±3.8	1196
15-20 km	5.156	4.301	0.853	5.530	0.838	7.699	0.854	0.912*	8.2±5.5	1378
20-30 km	7.687	-2.723	0.965*	7.645	0.965	7.165	0.875	0.945	7.6±4.0	1794
30-40 km	6.721	0.793	0.825	6.686	0.825	7.261	0.878	0.939*	7.5±3.5	1222
40-50 km	6.772	2.072	0.969*	6.756	0.969	7.501	0.870	0.951	8.3±4.8	733
50-75 km	6.200	0.915	0.919	6.323	0.918	7.409	0.853	0.932*	8.0±4.4	814
75-100 km	3.614	8.133	0.701	4.027	0.648	7.479	0.877	0.946*	7.9±4.3	910
100-125 km	5.471	2.559	0.948*	5.488	0.947	7.018	0.896	0.937	7.7±4.9	726
125-150 km	5.665	1.567	0.975*	5.698	0.975	6.957	0.899	0.947	7.4±3.6	511
150-200 km	4.416	4.793	0.918	4.609	0.903	6.996	0.890	0.964*	7.7±4.2	316
200-300 km	6.062	1.003	0.903	6.195	0.902	7.065	0.889	0.925*	7.4±4.2	541
300-500 km	6.347	0.438	0.936	6.411	0.935	7.208	0.878	0.948*	7.4±3.8	280
500-800 km	8.003	-3.386	0.914	7.650	0.908	7.602	0.902	0.959*	7.9±3.8	2207
800-1100 km	7.173	-0.610	0.967	7.086	0.966	7.690	0.856	0.969*	8.6±3.7	3985
>1100 km	5.719	1.092	0.840	6.010	0.831	7.142	0.895	0.939*	8.2±3.5	164
South	5.974	1.528	0.913	6.033	0.912	7.373	0.890	0.948*	7.8±3.8	21911
mean	5.996	1.757	0.904	6.127	0.896	7.402	0.876	0.938		
STDEV	**1.098**	**2.720**	**0.070**	**0.942**	**0.080**	**0.406**	**0.025**	**0.023**		

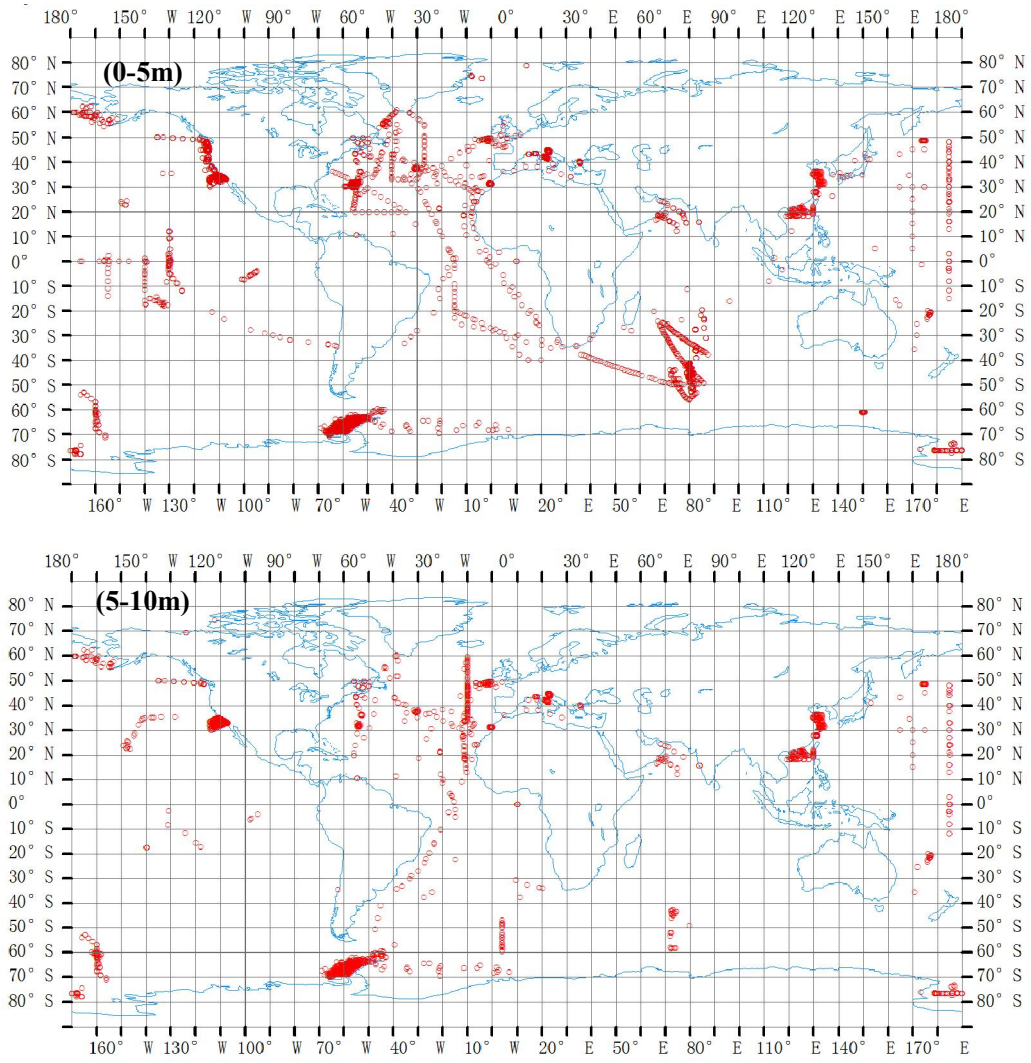
Table S5 Relationship between PON and POC for different lakes. Three mathematical functions were used to fit the relationship between PON and POC. The parameters and determined coefficients of each function are listed in the table. Table S5 list the lake names and their abbreviations.

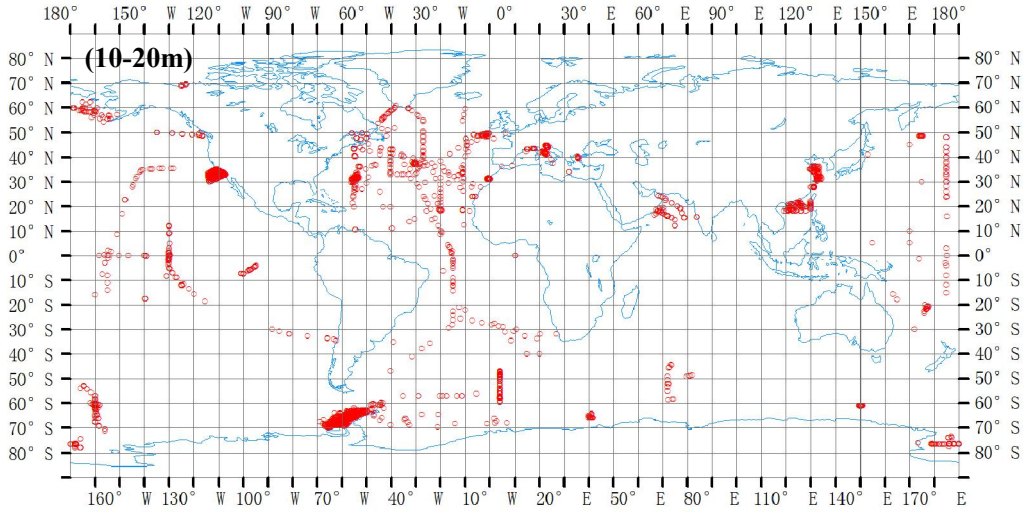
Items	$POC=A_0\times PON+C_0$			$POC=A_1\times PON$		$POC=A_2\times PON^{B2}$			POC/PON	N
	A_0	C_0	R^2	A_1	R^2	A_2	B_2	R^2		
MDV	7.689	9.426	0.717*	9.686	0.623	16.217	0.599	0.611	14.7±10.1	3024
ALa	8.418	4.139	0.766	9.157	0.755	11.490	0.858	0.921*	11.6±6.8	2037
NL	7.345	15.668	0.940*	7.913	0.924	13.340	0.842	0.935	10.4±2.8	119
NA	7.700	18.412	0.925	7.966	0.921	12.963	0.871	0.926*	10.0±2.9	133
HkL	7.499	3.009	0.941*	7.566	0.941*	8.384	0.966	0.925	8.6±3.9	21
LCG	12.869	-1.856	0.946*	12.826	0.946*	13.473	0.971	0.920	12.8±3.1	93
KkL	6.435	24.082	0.889	6.818	0.884	9.582	0.916	0.917*	7.1±1.5	4678
BwL	7.048	7.449	0.868*	8.202	0.839	11.606	0.811	0.844	8.8±1.6	79
HL	10.101	-0.468	0.797*	9.691	0.796	9.448	0.843	0.731	9.7±2.2	28
BkL	7.912	-0.412	0.963*	7.765	0.963	7.812	0.979	0.954	7.8±0.9	64
GL	7.800	11.132	0.933	7.967	0.931	10.745	0.932	0.949*	9.6±2.7	175
ThL	7.274	-103.900	0.805*	5.757	0.742	1.278	1.220	0.492	4.0±4.0	82
GLG	1.606	3.994	0.190	2.612	0.066	4.615	0.247	0.089	5.1±7.7	163
SkR	7.498	2.433	0.863*	7.700	0.863*	8.326	0.967	0.855	7.7±0.7	956
IPPR	5.773	107.960	0.391	7.310	0.151	34.735	0.731	0.518*	28.7±18.6	223
Mean	7.531	6.738	0.796*	7.929	0.756	11.601	0.850	0.772		
STDEV	**2.328**	**40.756**	**0.221**	**2.181**	**0.280**	**7.393**	**0.215**	**0.247**		

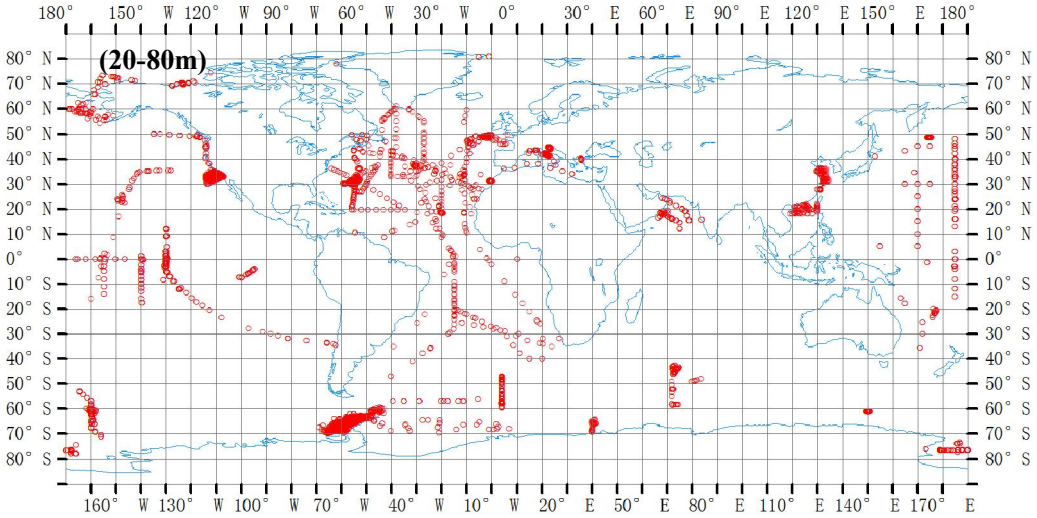
Table S6 Parallel table of lake names and their abbreviations.

Name	Full name	Nation	Latitude
ALa	Alaskan Lakes	USA	68.59
GLG	Great Lakes Group	USA	45.52
SkR	Skidaway River	USA	32.43
NA	Northern American Lakes	USA	43.81
LCG	Lacustrine Central Group	USA	45.42
IPPR	Ipswich and Parker rivers	USA	42.61
HkL	Hokkaido Lakes	Japan	43.54
KkL	Lake Kasumigaura	Japan	36.15
BwL	Lake Biwa	Japan	35.33
NL	Norwegian Lakes	Norway	60.69
MDV	McMurdo Dry Valleys Lakes	Antarctica	-77.09
HL	Lake Hovsgol	Mongolia	51.12
BkL	Lake Baikal	Russia	53.99
GL	Green Lake	Canada	39.99
ThL	Lake Taihu	China	31.18

Figure S1 Global distribution of paired samples of POC and PON for each depth interval, the original map data of world vector downloaded from http://www.naturalearthdata.com/.




(10-20m)
180° 150° W 120° W 90° W 60° W 30° W 0° 30° E 60° E 90° E 120° E 150° E 180°
80° N 70° N 60° N 50° N 40° N 30° N 20° N 10° N 0° 10° S 20° S 30° S 40° S 50° S 60° S 70° S 80° S
160° W 130° W 100° W 70° W 40° W 10° W 20° E 50° E 80° E 110° E 140° E 170° E


(20-80m)
180° 150° W 120° W 90° W 60° W 30° W 0° 30° E 60° E 90° E 120° E 150° E 180°
80° N 70° N 60° N 50° N 40° N 30° N 20° N 10° N 0° 10° S 20° S 30° S 40° S 50° S 60° S 70° S 80° S
160° W 130° W 100° W 70° W 40° W 10° W 20° E 50° E 80° E 110° E 140° E 170° E

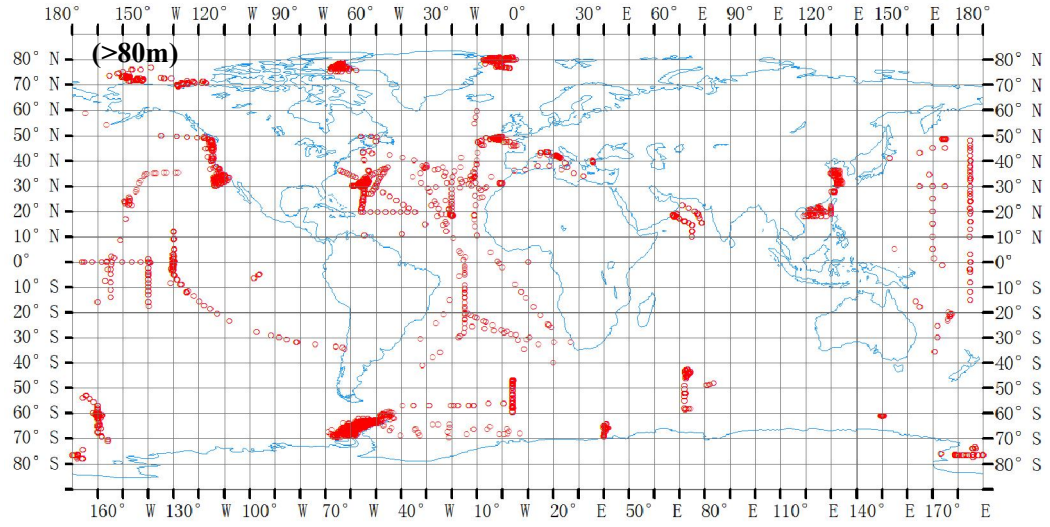


Figure S2 The variation of POC/PON with the distance from the shore to open ocean. The relationships between POC/PON and distance are POC/PON=0.0024*D+7.1764 (R^2=0.519, North hemisphere) and POC/PON=0.0004*D+7.7346 (R^2=0.118, South hemisphere).