Supporting Information

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Fig. S1. Photographs of Tern Pond (*Upper*) and Eider Pond (*Lower*).

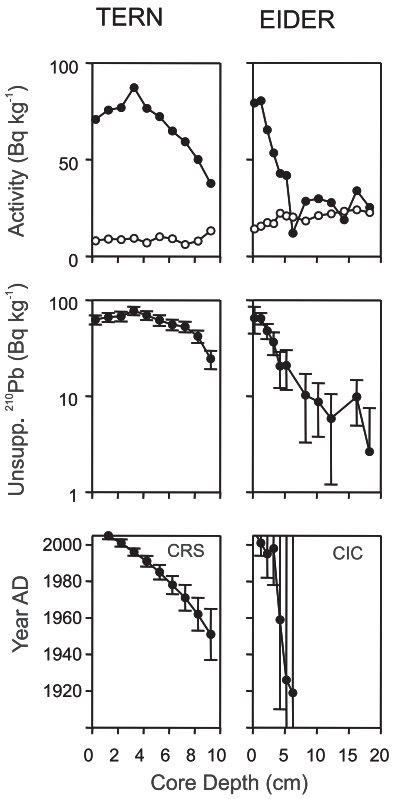

Fig. S2. Plots showing total and supported ^{210}Pb activity (as ^{226}Ra; *Upper*), unsupported ^{210}Pb activity (*Middle*), CRS- and CIC-derived age-depth profiles for Tern and Eider Ponds, respectively (*Bottom*). In Tern Pond, the profile of unsupported ^{210}Pb versus depth showed a nonmonotonic decline over time, necessitating the use of a CRS model to derive an age-depth profile. The ^{137}Cs profile (not shown) did not show a distinct subsurface peak likely because of Cs migration within the core, and thus could not be used to corroborate the CRS dates. The ^{137}Cs profile from the Eider Pond core (not shown) showed a distinct peak at 3.25 cm depth, denoting the year 1963, the time of its maximum atmospheric fallout from atomic weapons testing. The ^{137}Cs profile most closely matched ^{210}Pb dates derived from the CIC model, where 4 cm depth corresponded to the year 1967. Because the profile of unsupported ^{210}Pb versus depth did not show any major non-monotonic features before the supported/unsupported horizon at approximately 6 cm depth, the CIC model is permissible in this instance.

Table S1. Full suite of water chemistry variables measured on the Tern Island study ponds

Variable	Tern	Eider
pH	10.4	8.7
Temp, °C	9	6
Cond, μS cm^{-1}	366	206
TN, mg L^{-1}	4.82	0.845
TP, μg L^{-1}	97.3	33.3
TP (filt.), μg L^{-1}	57.3	18.8
Chl-a, μg L^{-1}	1.7	0.6
DIC, mg L^{-1}	11.8	18.9
DOC, mg L^{-1}	39	8.6
SiO_2, mg L^{-1}	2.11	0.33
NO_3NO_2, mg L^{-1}	0.011	0.008
NH_3, mg L^{-1}	0.181	0.035
Cl, mg L^{-1}	90.2	33.4
SO_4, mg L^{-1}	57	20
Ca, mg L^{-1}	50.9	39.8
Mg, mg L^{-1}	10.3	5
K, mg L^{-1}	5.23	1.5
Na, mg L^{-1}	46.9	14.6
NO_2, mg L^{-1}	0.002	0.001
POC, mg L^{-1}	2.52	0.792
PON, mg L^{-1}	0.415	0.107
SRP, mg L^{-1}	0.0081	0.0038
TKN, mg L^{-1}	4.2	0.885
Ag, μg L^{-1}	0.019	0.001
Al, μg L^{-1}	133	23.1
As, μg L^{-1}	2.79	0.84
B, μg L^{-1}	20	9.8
Ba, μg L^{-1}	9.51	36.4
Be, μg L^{-1}	0.006	0.003
Bi, μg L^{-1}	0.006	0.002
Cd, μg L^{-1}	0.046	0.012
Ce, μg L^{-1}	0.065	0.111
Co, μg L^{-1}	0.266	0.101
Cr, μg L^{-1}	0.617	0.12
Cs, μg L^{-1}	0.005	0.006
Cu, μg L^{-1}	3.18	0.67
Fe, μg L^{-1}	334	194
Ga, μg L^{-1}	0.042	0.013
La, μg L^{-1}	0.027	0.044
Li, μg L^{-1}	3.7	2.1
Mn, μg L^{-1}	5.36	6.74
Mo, μg L^{-1}	0.405	0.182
Nb, μg L^{-1}	0.003	0.002
Ni, μg L^{-1}	1.44	0.51
Pb, μg L^{-1}	0.515	0.276
Pt, μg L^{-1}	0.001	< 0.001
Rb, μg L^{-1}	1.31	0.36
Sb, μg L^{-1}	0.064	0.032
Se, μg L^{-1}	0.32	0.06
Sn, μg L^{-1}	0.033	0.017
Sr, μg L^{-1}	240	126
Tl, μg L^{-1}	0.006	0.01
U, μg L^{-1}	0.305	0.275
V, μg L^{-1}	1.58	0.209
W, μg L^{-1}	0.05	0.02
Y, μg L^{-1}	0.039	0.053
Zn, μg L^{-1}	2.59	1.01

Table S2. Geochemical data for the Tern Pond sediment core

	Sediment core depth (cm)									
Variable	0.25	1.25	2.25	3.25	4.25	5.25	6.25	7.25	8.25	9.25
$\delta^{13}C$, ‰*	−19.36	−19.05	−19.08	−18.60	−22.65	−22.28	−21.52	−19.26	−19.47	−19.58
$\delta^{15}N$, ‰*	10.23	10.23	10.22	10.15	10.24	10.16	10.11	10.21	10.21	10.12
%C,	37.87	47.67	28.83	50.38	30.09	30.94	30.93	48.22	47.16	41.26
%N,	4.13	4.05	4.19	4.00	4.19	3.49	3.04	3.78	2.87	2.03
C/N, atomic	10.70	13.73	8.03	14.69	8.38	10.33	11.87	14.88	19.17	23.71
Hg, ng/g	68.02	64.70	64.86	68.66	72.33	69.84	70.54	75.17	70.82	56.48
Ag, μg/g	0.25	0.27	0.27	0.28	0.29	0.27	0.26	0.28	0.24	0.22
As, μg/g	4.2	3.2	3.4	3.4	2.3	2.5	3.1	2.8	2.7	2.6
Be, μg/g	0.18	0.18	0.19	0.18	0.18	0.20	0.20	0.23	0.21	0.18
Cd, μg/g	4.6	4.6	4.7	4.6	3.6	4.2	4.2	4.4	3.9	3.6
Co, μg/g	1.6	1.3	1.3	1.3	1.1	1.3	1.3	1.3	1.4	1.3
Cr, μg/g	4.9	4.4	4.4	4.3	2.7	4.0	3.8	3.9	4.0	3.3
Se, μg/g	1.8	1.9	2.2	2.1	1.6	1.7	2.2	1.6	1.1	1.5
Sb, μg/g	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sn, μg/g	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	<0.5
Te, μg/g	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tl, μg/g	0.10	0.10	0.10	0.09	0.15	0.13	0.12	0.16	0.13	0.11
V, μg/g	5	5	5	5	4	5	5	5	5	5
W, μg/g	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Ba, μg/g	20	18	18	18	15	16	16	17	15	14
B, μg/g	25	24	24	24	16	21	20	21	19	17
Cu, μg/g	24	24	25	24	19	22	22	23	21	19
Mn, μg/g	95	88	96	92	66	100	96	95	140	120
Na, μg/g	440	390	390	410	490	370	360	360	290	250
Ni, μg/g	12	12	12	11	9.2	10	10	10	9.9	8.8
Sr, μg/g	142	131	130	138	160	132	131	126	131	123
Ti, μg/g	40	36	38	36	26	35	35	35	38	32
Zn, μg/g	100	100	98	100	100	98	97	99	88	80
Pb, μg/g	4.3	4.1	3.9	3.7	2.9	3.6	3.4	3.6	3.6	3.2
Al, μg/g	1,200	1,100	1,100	1,200	1,200	1,200	1,200	1,200	1,400	1,200
Ca, μg/g	68,000	65,000	65,000	68,000	75,000	69,000	67,000	65,000	73,000	65,000
Fe, μg/g	5,500	5,500	5,600	5,800	5,700	6,200	6,000	6,200	6,500	5,800
K, μg/g	4,700	4,100	3,800	4,000	3,500	3,300	3,200	2,900	2,100	1,700
Mg, μg/g	3,000	2,900	2,800	3,000	2,900	3,000	2,800	2,800	3,000	2,700
P, μg/g	6,400	6,100	5,800	6,100	5,600	5,500	5,500	5,200	4,000	3,800

*The data are reported in delta notation δ; the units are per mil (‰) and defined as d = ((Rx − Rstd)) / Rstd)*1,000, where R is the ratio of the abundance of the heavy to the light isotope, x denotes sample, and std is an abbreviation for standard. All $\delta^{15}N$ is reported as ‰ vs. AIR and normalized to internal standards calibrated to International standards IAEA-N1(+0.4‰), IAEA-N2(+20.3‰), USGS-40(−4.52‰) and USGS-41(47.57‰). All $\delta^{13}C$ is reported as ‰ vs. V-PDB and normalized to internal standards calibrated to International standards IAEA-CH-6(−10.4‰), NBS-22(−29.91‰), USGS-40(−26.24‰) and USGS-41(37.76‰). Please note that the PDB and V-PDB scales are identical and interchangeable.

Table S3. Geochemical data for the Eider Pond sediment core

	Sediment core depth (cm)												
Variable	0.25	1.25	2.25	3.25	4.25	5.25	6.25	8.25	10.25	12.25	14.25	16.25	18.25
δ^{13}C, ‰*	−22.0	−22.4	−22.7	−22.8	−22.6	−22.1	−21.5	−20.9	−20.7	−21.2	−21.9	−20.8	−21.1
δ^{15}N, ‰*	5.1	5.0	5.0	4.6	4.9	4.8	5.3	5.5	5.2	7.2	5.6	5.0	5.4
%C,	35.8	34.9	31.5	30.8	26.7	31.6	28.5	23.3	9.3	4.7	3.5	4.4	3.7
%N,	2.0	2.1	2.0	1.8	1.7	1.6	1.5	1.1	0.5	0.3	0.2	0.2	0.2
C/N, atomic	20.8	19.6	18.9	19.7	18.5	22.9	22.0	25.4	22.0	16.4	20.5	24.2	20.8
Hg, ng/g		38.6	43.0	45.3	45.1	48.4	37.7	29.7	18.1	13.8	12.0	13.9	13.8
Ag, μg/g	0.05	0.06	0.06	0.06	0.06	0.07	0.06	0.06	0.05	0.04	0.03	0.04	0.04
As, μg/g	2.3	2.2	2.5	3.2	3.5	3.3	3.1	3.2	7.4	5.6	6.2	6.3	8.6
Be, μg/g	0.33	0.36	0.39	0.54	0.47	0.49	0.38	0.4	0.65	0.76	0.76	0.78	0.7
Cd, μg/g	0.58	0.67	0.63	0.72	0.72	0.93	0.97	0.88	0.39	0.12	0.1	0.13	0.07
Co, μg/g	3	3.2	3.6	4.2	4.2	4.4	3.9	4	7.1	6.9	9	7.2	8
Cr, μg/g	7.1	7.2	7.7	9.7	8.9	9.2	7.4	7.4	11	13	13	13	12
Se, μg/g	1	1.4	1.2	1	1.1	0.8	1.3	0.8	0.7	0.7	0.7	0.7	0.7
Sb, μg/g	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Sn, μg/g	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Te, μg/g	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Tl, μg/g	0.09	0.1	0.11	0.12	0.12	0.13	0.12	0.12	0.12	0.14	0.16	0.15	0.14
V, μg/g	9	9	10	13	12	12	10	10	12	14	14	13	13
W, μg/g	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Ba, μg/g	100	70	62	68	65	66	61	57	44	35	30	32	32
B, μg/g	26	26	26	30	28	30	26	21	10	7	6	5	6
Cu, μg/g	10	13	12	14	14	15	13	12	16	18	17	18	17
Mn, μg/g	160	85	91	110	110	120	110	130	190	190	210	200	200
Na, μg/g	330	190	200	190	180	160	160	120	85	77	72	70	73
Ni, μg/g	12	13	13	16	15	16	13	13	21	21	22	18	22
Sr, μg/g	99	107	108	108	111	111	123	146	143	133	142	137	139
Ti, μg/g	65	69	68	75	71	64	57	59	58	66	71	65	69
Zn, μg/g	63	82	92	99	100	100	93	72	56	44	51	45	42
Pb, μg/g	14	16	18	21	21	22	18	14	14	14	13	26	14
Al, μg/g	2,600	3,300	3,700	3,900	4,100	3,700	3,300	3,200	4,700	5,800	5,700	5,600	5,700
Ca, μg/g	87,000	100,000	100,000	99,000	100,000	100,000	120,000	13,0000	111,810	9,7000	100,000	9,8000	98,000
Fe, μg/g	1,1000	11,000	14,000	16,000	19,000	21,000	22,000	22,000	19,000	20,000	22,000	22,000	22,000
K, μg/g	2,200	2,300	1,900	1,600	1,600	1,400	1,300	1,300	2,000	2,300	2,200	2,200	2,300
Mg, μg/g	2,300	2,800	3,000	3,100	3,100	3,000	2,800	3,200	4,800	5,400	5,600	5,300	5,400
P, μg/g	1,700	2,000	1,800	1,400	1,200	980	850	760	680	930	840	780	760

*The data are reported in Delta notation δ, the units are per mil (‰) and defined as d = ((Rx-Rstd)) / Rstd)*1,000 where R is the ratio of the abundance of the heavy to the light isotope, x denotes sample and std is an abbreviation for standard. All δ^{15}N is reported as ‰ vs. AIR and normalized to internal standards calibrated to International standards IAEA-N1(+0.4‰), IAEA-N2(+20.3‰), USGS-40(−4.52‰) and USGS-41(47.57‰). All δ^{13}C is reported as ‰ vs. V-PDB and normalized to internal standards calibrated to International standards IAEA-CH-6(−10.4‰), NBS-22(−29.91‰), USGS-40(−26.24‰) and USGS-41(37.76‰). Please note that the PDB and V-PDB scales are identical and interchangeable.