Deriving Site-Specific 2,2-bis (chlorophenyl)- 1,1-dichloroethylene (p,p'-DDE) Quality Criteria of Water and Sediment for Protection of Common Tern Populations

Wei AN, Jian-ying HU*, Yi WAN, Lihui AN, and Zhaobin ZHANG

College of Environmental Science, Peking University, Beijing, 100871 China

Tables	3
Figures	2
Words	121

Instrumental conditions of GC-MS analysis. GC-MS analysis was performed with a Hewlett-Packard 5890 gas chromatography connected to a Hewlett-Packard 5971 mass spectrometer. The mass spectrometer was operated in the electron impact ionization mode with an ionizing energy of 70 eV. The injector temperature was maintained at 250°C, and the detector source temperature was kept at 280°C. An HP-5MS capillary column (30 m × 0.25 mm i.d. with a film thickness of 0.25 μm) used for analysis was programmed to increase from 50 °C (2 min) to 186°C at a rate of 10 °C/min (2 min), and then to 235 °C at 5 °C/min, which was held for 2 min. The injection volume was 2 μL, and the splitless mode was used.

SUPPORTING INFORMATION **Table 1.** Life-cycle demographic parameters for common tern population.

Parameters	Default Value	Parameters	Default Value
Pairing probability (ε_2)	0.12	Neonatal female ratio(σ)	0.5
Paring probability ($\varepsilon_{3,4}$)	0.77	Sub-adult survival ($s_{1\text{-}2}$)	0.55
Paring probability (ε_5)	0.89	Sub-adult survival ($s_{2\text{-}3}$)	0.74
Paring probability ($\varepsilon_{>5}$)	1	Sub-adult survival ($s_{3\text{-}4}$)	0.76
Nest success (θ_i)	0.97	Adult survival ($s_{>4}$)	0.91
Young survival (δ_i)	0.71	Cluster size (c_i)	2.77

SUPPORTING INFORMATION Table 2. Exposure/effect relationship for a specific concentration of dichlorodiphenyltrichloroethane (DDE) on the survival of young and predicted intrinsic rate of natural increase (r) of common tern. The r at specific concentration was estimated by age-structured model incorporating effects of DDE on survival of young into life history parameter F_i based on Eq.1 and 2.

Species	Ce	δ_i	r	n	References
Common tern	*0	71	0.09	103	(27)
	3980	28	0.02	456	
	4520	25	0.01	452	(26)
	7570	5	-0.07	68	

* Reduction of young is assumed to be zero under null exposure. Ce: Concentration of DDE in eggs (ng/g wet weight); δ_i: Fledged young (%); r: Intrinsic rate of natural increase(r); n: Number of measured eggs.

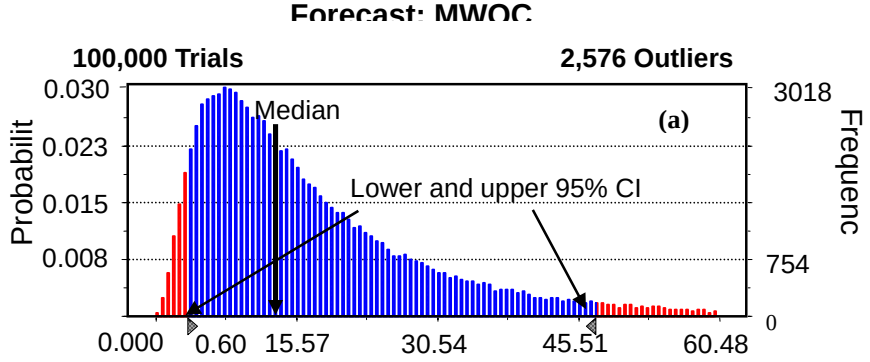
SUPPORTING INFORMATION Table 3. Concentrations (ng/g wet weight) of dichlorodiphenyltrichloroethanes (DDT) -related chemicals in common tern eggs.

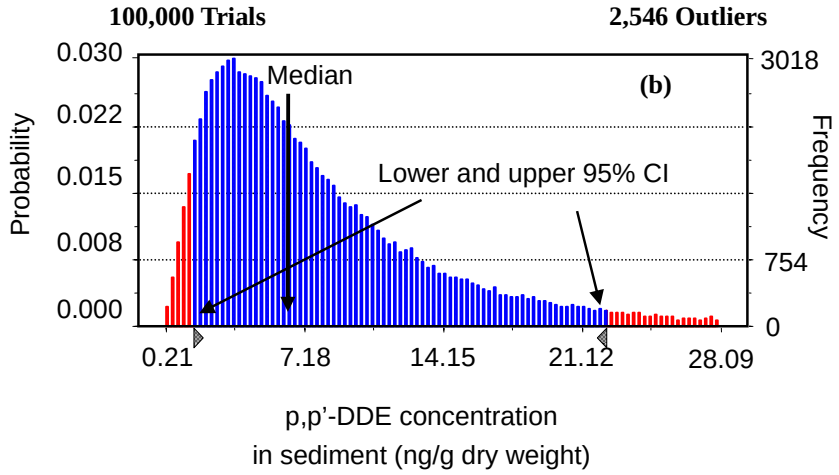
No.	Fat (%)	p,p'-DDMU	p,p'-DDE	No.	Fat (%)	p,p'-DDMU	p,p'-DDE
1	11.26	0.63	19.16	19	11.03	2.58	71.28
2	16.72	1.61	47.99	20	10.86	0.42	35.66
3	10.52	0.48	19.37	21	16.37	1.47	15.57
4	12.07	1.03	34.24	22	14.44	4.51	28.29
5	12.54	0.43	87.09	23	11.28	2.28	38.08
6	12.33	0.43	38.48	24	12.86	4.86	144.93
7	14.43	6.53	326.60	25	8.45	0.10	13.54
8	10.73	0.99	51.31	26	10.52	3.45	140.01
9	8.72	0.33	16.92	27	12.20	1.33	45.53
10	11.81	0.40	13.14	28	9.27	4.54	146.89
11	12.73	0.97	39.86	29	9.17	0.58	28.39
12	10.95	4.83	101.04	30	7.78	1.47	30.35
13	20.94	1.53	64.12	31	8.94	1.50	29.54
14	10.62	3.14	55.45	32	11.46	1.89	62.74
15	13.17	1.22	41.14	33	10.23	0.98	26.46
16	11.26	0.38	53.71	34	18.35	0.96	40.90
17	13.11	1.23	40.18	35	15.67	2.96	80.03
18	19.68	0.53	29.51				

p,p'-DDMU: 1-chloro-2,2-bis(p-chlorophenyl)ethylene;

p,p'-DDE: 2,2-bis(chlorophenyl)- 1,1-dichloroethylene

SUPPORTING INFORMATION **Figure 1.** Frequency charts of a Monte-Carlo simulation for a lognormal distribution of MWQC (a) and MSQC (b) and their median and 95% confidence boundaries. p,p'-DDE: 2,2-bis(chlorophenyl)-1,1-dichloroethylene; MWQC: marine water quality criteria; MSQC: marine sediment quality criteria.





SUPPORTING INFORMATION **Figure 2.** Frequency chart of a Monte-Carlo simulation for a probability distribution of predicted p,p'-DDE residues in common tern eggs based on MWQS and BAF probability distribution and the risk of common tern population shrinkage. p,p'-DDE: 2,2-bis(chlorophenyl)-1,1-dichloroethylene; MWQS: marine water quality standard in China; BAF: bioaccumulation factor. The concentration of 4467 ng/g in eggs is the threshold of common tern population shrinkage due to p,p'-DDE exposure