The following supplement accompanies the article

Feather mercury concentration in streaked shearwaters wintering in separate areas of southeast Asia

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Table S1. Selection of models explaining tail-feather [Hg] (log-transformed) by Δ AIC for all birds. Best model is in **bold**. The number of parameters (df) and Akaike weight (wi) are shown also. Generalized Linear Mixed Models were used; potential factors were colony (CO), non-breeding area (NB), sex (SX), δ^{15}N of the tail-feather (N), and interaction term (NB*N). Sampling year was treated as a random factor and reflected as intercept (~1).

Model	df	AIC	ΔAIC	wi
~1 + NB + SX	**7**	**-32.3**	**0.00**	**0.84**
~1 + CO + NB + SX	9	-28.0	4.34	0.10
~1 + NB + N + SX	8	-27.2	5.08	0.07
~1 + CO + NB + N + SX	10	-20.8	11.50	0.00
~1 + NB + N + SX + NB*N	11	-17.9	14.39	0.00
~1 + CO + NB + N + SX + NB*N	13	-10.9	21.47	0.00
~1 + NB	6	-10.3	21.98	0.00
~1 + NB + N	7	-8.0	24.34	0.00
~1 + CO + NB	8	-5.4	26.95	0.00
~1 + NB + N + NB*N	10	-1.1	31.26	0.00
~1 + CO + NB + N	9	-0.6	31.70	0.00
~1 + CO + NB + N + N*NB	12	7.0	39.32	0.00
~1 + CO + SX	6	28.8	61.13	0.00
~1 + CO + N + SX	7	36.6	68.90	0.00
~1 + CO	5	37.8	70.17	0.00
~1 + SX	4	41.3	73.64	0.00
~1 + CO + N	6	44.2	76.49	0.00
~1	3	46.9	79.25	0.00
~1 + N + SX	5	47.1	79.47	0.00
~1 + N	4	51.0	83.37	0.00

Table S2. Selection of models explaining tail-feather [Hg] (log-transformed) by Δ AIC for males and females separately. Best model is in **bold**. The number of parameters (df) and Akaike weight (wi) are shown also. Generalized Linear Mixed Models were used; potential factors were colony (CO), non-breeding area (NB), δ^{15}N of the tail-feather (N), and interaction term (NB*N). Sampling year was treated as a random factor and reflected as intercept (~1).

Males

Model	df	AIC	Δ AIC	wi
~1 + NB	**5**	**-14.3**	**0.00**	**0.98**
~1 + NB + N	6	-5.8	8.51	0.01
~1 + CO + NB	7	-4.1	10.23	0.01
~1 + NB + N + N*B	8	3.2	17.52	0.00
~1 + CO + NB + N	8	4.2	18.53	0.00
~1 + CO + NB + N + NB*N	10	13.5	27.76	0.00
~1	3	28.8	43.11	0.00
~1 + CO	5	32.8	47.10	0.00
~1 + N	4	35.9	50.22	0.00
~1 + CO + N	6	40.1	54.36	0.00

Females

Model	df	AIC	Δ AIC	wi
~1 + CO + NB	8	-8.9	0.00	0.73
~1 + CO + NB + N	9	-5.5	3.35	0.14
~1 + NB	6	-3.7	5.20	0.05
~1 + NB + N	7	-3.4	5.48	0.05
~1 + CO	5	-2.7	6.18	0.03
~1 + CO + NB + N + NB*N	12	1.9	10.79	0.00
~1 + CO + N	6	4.5	13.41	0.00
~1 + NB + N + NB*N	10	6.6	15.53	0.00
~1	3	15.5	24.41	0.00
~1 + N	4	20.5	29.41	0.00

Table S3. Selection of models explaining presence (1) or absence (0) of eggs or chicks by ΔAIC. Adequate models (ΔAIC<2.00) are in **bold**. The number of parameters (df) and Akaike weight (wi) are shown also. Generalized Linear Mixed Models were used; potantial factors were colony (CO), non-breeding area (NB), and tail-feather [Hg] (log transformed, HG). Sampling year was treated as a random effect and reflected as intercept (~1).

Effects on the presence of egg

Model	df	AIC	ΔAIC	wi
~ 1 + CO + NB	7	**119.8**	**0.00**	**0.38**
~ 1 + CO	4	**120.1**	**0.33**	**0.32**
~ 1 + CO + HG	5	**121.6**	**1.76**	**0.16**
~ 1 + CO + NB + HG	8	**121.8**	**1.94**	**0.14**
~ 1 + NB	5	129.1	9.23	0.00
~ 1	2	130.4	10.59	0.00
~ 1 + NB + HG	6	130.8	11.03	0.00
~ 1 + HG	3	132.4	12.59	0.00

Effects on the presence of chick

Model	df	AIC	ΔAIC	wi
~ 1 + CO	4	**129.8**	**0.00**	**0.37**
~ 1 + CO + HG	5	**130.5**	**0.65**	**0.27**
~ 1	2	**131.6**	**1.75**	**0.16**
~ 1 + CO + NB	6	133.0	3.22	0.07
~ 1 + HG	3	133.6	3.74	0.06
~ 1 + CO + NB + HG	7	134.4	4.60	0.04
~ 1 + NB	4	135.5	5.66	0.02
~ 1 + NB + HG	5	137.4	7.57	0.01

Table S4. δ^{15}N values of seawater, sea bottom surface sediment, and zooplankton in marginal seas in southeast Asia and the central to north west North Pacific. Values are average ± SD (stated or calculated from data given) with ranges of values of each sample in parenthesis, range of average values of subsamples, or approximate values read from the figures in the literature. Multiple average values are given where different values are reported for subsamples (seasons, locations or sampling years).

Area and year of sampling	Material	δ^{15}N values (‰)	References
North Western Pacific (Oyashio), 2007	Suspended POM[a)] (10, 20, 30 m depth)	4.4 ± 1.7	Chiba et al. 2012
North Western Pacific (Oyashio), 2001–2003	Suspended PN[a)] (<10 m depth)	5.2 ± 1.7 (4.0–6.0)	calculated from Usui et al. 2006
East China Sea (NE of Taiwan, Kuroshio), 1994	DON[a)]	4.6 ± 0.9 (60–80 m depth) 3.3 ± 0.4 (100–300 m depth) 4.7 ± 0.2 (300–400 m depth) 5.7 ± 0.1 (> 500 m depth)	Liu et al. 1996
East China Sea (Kuroshio), 2000	Suspended POM[a)] (<150 m)	5.6 –7.8 (range of average values of stations) (0.7–9.5)	Wu et al. 2003
East China Sea, 2008–2010	Phytoplankton (<50 µm, net sample)	3.6 ± 1.1 (1.7–5.1)	calculated from Chang et al. 2014
South China Sea off Vietnam, 2003–2004	Suspended PON[a)] (<100 m depth)	2.9 ± 0.5 (SWM 2003)[b)] 2.8 ± 1.0 (SpIM 2004)[b)] 4.2 ± 0.8 (SWM 2004)[b)]	Loick et al. 2007
South China Sea, 2004–2007	Suspended PN[a)]	4.2 ± 1.0 (<100 m depth) 5.2 ± 1.1 (3.3–6.6) (374 m depth) 5.5 ± 1.3 (4.0–7.6) (447 m depth)	Kao et al. 2012
South China Sea, 1987–2007	Sinking POM[a)] (600–3750 m depth)	2.7–4.5 (range of average values of stations)	Gaye et al. 2009
Indian Ocean, west and south Indonesia, 2005	Suface sediment (0–60 cm)	5.1 ± 0.8 (3.7–7.1)	calculated from Baumgart et al. 2010
South China Sea, 1987–2007	Surface sediment (0–1 cm)	(3.4–6.6)	Gaye et al. 2009
Gulf of Thailand, 1995	Surface sediment (0–2 cm)	2.1 ± 0.9 (middle gulf) 3.2 ± 0.7 (lower gulf)	Meksumpun et al. 2005
North Western Pacific (Oyashio), 2002–2003	Surface sediment (0–3 cm)	5.7 ± 0.5 (4.0–6.6)	calculated from Usui et al. 2006
North Pacific (Oyashio and off Vancouver), 1960–2002	Zooplankton (*Neocalanus* spp.)	7–10 (range of average values of stations)	Chiba et al. 2012
Central North Pacific (180°, 39.5°N–46°N), 1979–1997	Zooplankton (*Neocalanus* spp.)	2–4 (range of average values of stations)	Chiba et al. 2012
Central South Pacific, 2002–2004, 2011	Zooplankton	3.8 ± 0.5 (east of New Caledonia) 5.6 ± 0.3 (west of New Caledonia)	Hunt et al. 2015
East China Sea, 2008–2010	Zooplankton	5.5 (grand average) (1.6–8.3)	calculated from Chang et al. 2014
South China Sea off Vietnam, 2003	Zooplankton (>2500 µm)	4.5–5.8 (SWM 2003)[b)] 5.2–5.5 (SpIM 2004)[b)] 5.5–6.1 (SWM 2004)[b)]	Approximate value read from Loick et al. 2007

a)POM, particulate organic matter; PON, particulate organic nitrogen; PN, particulate nitrogen; DON, dissolved organic nitrogen.

b)SWM, south west monsoon season; SpIM, spring intermonsoon season

Table S5. Reported Hg concentration in various materials collected in the North Western Pacific, Central North Pacific, and surrounding areas, including marginal seas of south east Asia (Yellow Sea, East China Sea, South China Sea) and the sea around Australia. Values are concentrations of total gaseous Hg (TGM) or atmospheric gaseous elemental Hg (GEM) in air, dissolved gaseous elemental Hg (DGM) or total Hg in seawater, total Hg in surface sediment, total Hg in muscle of marine fish and tuna[a)], or Hg in red meat of toothed whales[a)] (units were converted by from mg kg^{-1} to μg g^{-1}, from ng l^{-1} to 10^3 pg l^{-1}, and from fM to 10^{-3} pM. Marine fish of several species were collected from fish markets. Hg concentrations are average ± SD (range of sample values in parentheses) or maximum value. Two average values are given where different values are reported for subsamples (seasons, locations or sampling years).

Area and year of sampling	Material	Hg concentration	unit	References
The Sea of Japan, 2001	Air (TGM)	~3 (maximum)	ng m^{-3}	Friedli et al. 2004
North Pacific (including volcano plume), 2001	Air (TGM)	~3 (maximum)	ng m^{-3}	Friedli et al. 2004
East China Sea, 2001	Air (TGM)	~6.3 (maximum)	ng m^{-3}	Friedli et al. 2004
Central South Pacific (1°–15°S), 2011	Air (GEM)	1.15 ± 0.05	ng m^{-3}	Soerensen et al. 2014
Central North Pacific (14°–20°N), 2001	Air (GEM)	1.32 ± 0.005	ng m^{-3}	Soerensen et al. 2014
Central Equator Pacific (1°S–15°N), 2001	Air (GEM)	1.18 ± 0.005	ng m^{-3}	Soerensen et al. 2014
Intertropical convergence zone of Central Pacific, 2001	Air (GEM)	1.27 ± 0.10	ng m^{-3}	Soerensen et al. 2014
Yellow Sea, 2010	Air (GEM)	2.61 ± 0.50 (summer)	ng m^{-3}	Ci et al. 2011
Yellow Sea, 2012	Air (GEM)	1.86 ± 0.40 (spring), 1.84 ± 0.50 (fall)	ng m^{-3}	Ci et al. 2015
South China Sea, 2007	Air (GEM)	2.62(1.04–6.75)	ng m^{-3}	Fu et al. 2010
Southeast Asia and South China Sea, 2010	Air (GEM)	2.49 ± 1.00	ng m^{-3}	Sheu et al. 2013
Central South Pacific (1°–15°S), 2011	Surface water (aquatic gaseous elemental Hg)	0.0470 ± 0.0133	pM	Soerensen et al. 2014
Central North Pacific (14°–20°N), 2001	Surface water (aquatic gaseous elemental Hg)	0.0513 ± 0.0041	pM	Soerensen et al. 2014
Central Equator Pacific (1°S–15°N), 2001	Surface water (aquatic gaseous elemental Hg)	0.0530 ± 0.0103	pM	Soerensen et al. 2014
Intertropical convergence zone of Central Pacific, 2001	Surface water (aquatic gaseous elemental Hg)	0.1047 ± 0.0199	pM	Soerensen et al. 2014
Central North Pacific, 2006	Upper layer seawater (Total Hg)	0.99 ± 0.32	pM	Sunderland et al. 2009
Central Pacific, 2002	Surface water(Total Hg)	0.34–1.94	pM	Laurier et al. 2004
NW Pacific (Japanese coastal water), 2002	Surface water (Total Hg)	0.49–4.43	pM	Laurier et al. 2004
Yellow Sea 2010	Surface water(Total Hg)	1690 ± 350 (summer)	pg l^{-1}	Ci et al. 2011
South China Sea, 2007	Surface water(Total Hg)	1200 ± 300	pg l^{-1}	Fu et al. 2010
Yellow Sea, 2010	Surface water(DGM)	63.9 ± 13.7(summer)	pg l^{-1}	Ci et al. 2011
Yellow Sea, 2012	Surface water(DGM)	27.0 ± 6.8 (spring) 28.2 ± 9.0 (fall)	pg l^{-1}	Ci et al. 2015
South China Sea, 2007	Surface water(DGM)	36.5 ± 14.9	pg l^{-1}	Fu et al. 2010

Area and year of sampling	Material	Hg concentration	unit	References
NE Australian coast, 2001-2002	Sediment	0.01 ± 0.01	μg g^{-1} dry	Jones et al. 2005
Yellow Sea, 2006	Surface sediment	0.024 ± 0.015 (0.006–0.069)	μg g^{-1} dry	calculated from Yuan et al. 2012
Yellow Sea, 2011-2012	Surface sediment	0.0242 (0.0070–0.0474)	μg g^{-1} dry	Meng et al. 2014
East China Sea (inner shelf), 1997, 1999	Surface sediment	0.0358 ± 0.0072 (0.0265–0.0476)	μg g^{-1} dry	calculated from Fang and Chen 2010
East China Sea (middle shelf), 1997, 1999	Surface sediment	0.0078 ± 0.0027 (0.0041–0.0139)	μg g^{-1} dry	calculated from Fang and Chen 2010
East China Sea, 2011-2012	Surface sediment	0.0328 (0.0082–0.0843)	μg g^{-1} dry	Meng et al. 2014
South China Sea, 2011-2012	Surface sediment	0.1661 (0.0154–0.398)	μg g^{-1} dry	Meng et al. 2014
East China Sea (Zheijang), 1998	Marine fish	0.09(0.06–0.13)[c)]	μg g^{-1} dry	calculated from Pan and Wang 2012
South China Sea (Malaysia), 1995-1999	Marine fish	0.22 ± 0.21 (<0.05–0.67)[b)]	μg g^{-1} dry	calculated from Agusa et al. 2007
South China Sea (Hainan Island and Yongxing Island), 2012, 2013	Marine fish	0.154 ± 0.113 (0.04–0.42)	μg g^{-1} dry	calculated from Liu et al. 2014
South China Sea (Peal River Estuary), 2004-2012	Estuary prey fish	0.145 (0.062–0.303)	μg g^{-1} dry	Gui et al. 2014
South China Sea (Hong Kong), 2004	Marine fish	1.98 (0.35–3.57)[c)]	μg g^{-1} dry	calculated from Pan and Wang 2012
Gulf of Thailand (Thailand and Cambodia), 1995-1999	Marine fish	0.23 (<0.05–1.4)[b)c)]	μg g^{-1} dry	calculated from Agusa et al. 2007
Java Sea (Malaysia), 1995-1999	Marine fish	0.24 (<0.05–0.68)[b)c)]	μg g^{-1} dry	calculated from Agusa et al. 2007
Straits of Malacca (Thailand and Malaysia), 1995-1999	Marine fish	0.10 (<0.05–0.31)[b)c)]	μg g^{-1} dry	calculated from Agusa et al. 2007
Central North Pacific	Albacore tuna[a)]	0.27[d)]	μg g^{-1} wet	Ferriss and Essington 2014
Central North Pacific, 2006	Albacore tuna[a)]	0.50 ± 0.24	μg g^{-1} wet	Kaneko and Ralston 2007
North Pacific, 2001, 2005-2006	Albacore tuna[a)]	0.444 ± 0.148	μg g^{-1} wet	Chen et al. 2014
NW Pacific (Oyashio and Japan Sea), 2003, 2007	Albacore tuna[a)]	0.39 ± 0.11(Shizuoka), 0.42 ± 0.14(Wakayama)	μg g^{-1} wet	Hisamichi et al. 2010
East China Sea, 2003, 2007	Albacore tuna[a)]	0.43 ± 0.10	μg g^{-1} wet	Hisamichi et al. 2010
North Pacific, 2001, 2005-2006	Bigeye tuna[a)]	0.929 ± 0.668	μg g^{-1} wet	Chen et al. 2014
Central North Pacific	Bigeye tuna[a)]	0.36[d)]	μg g^{-1} wet	Ferriss and Essington 2014
Central North Pacific, 2006	Bigeye tuna[a)]	0.60 ± 0.25	μg g^{-1} wet	Kaneko and Ralston 2007
NW Pacific (Oyashio and the Sea of Japan), 2003, 2007	Bluefin tuna[a)]	1.01 ± 0.42	μg g^{-1} wet	Hisamichi et al. 2010

Area and year of sampling	Material	Hg concentration	unit	References
NW Pacific, (Oyashio-Kuroshio Transition) 2003, 2007	Bluefin tuna[a)]	1.10 ± 0.86	μg g^{-1} wet	Hisamichi et al. 2010
East China Sea, 2003, 2007	Bluefin tuna[a)]	1.71 ± 0.34 (Taipei), 1.85 ± 0.54 (Okinawa)	μg g^{-1} wet	Hisamichi et al. 2010
Central North Pacific, 1971-2008	Yellowfin tuna[a)]	0.218 ± 0.008 (1998), 0.336 ± 0.023 (2008)	μg g^{-1} wet	Drevnick et al. 2015
Central North Pacific	Yellowfin tuna[a)]	0.22[d)]	μg g^{-1} wet	Ferriss and Essington 2014
Central North Pacific, 2006	Yellowfin tuna[a)]	0.30 ± 0.18	μg g^{-1} wet	Kaneko and Ralston 2007
NW Pacific (Oyashio and the Sea of Japan), 2003, 2007	Yellowfin tuna[a)]	0.30 ± 0.09 (Wakayama), 0.31 ± 0.26 (Shizuoka)	μg g^{-1} wet	Hisamichi et al. 2010
East China Sea, 2003, 2007	Yellowfin tuna[a)]	0.35 ± 0.22	μg g^{-1} wet	Hisamichi et al. 2010
NW Pacific (Oyashio), 2000-2004	Baird's beaked whale[a)]	0.62 ± 0.30 (Abashiri), 1.03 ± 0.29 (Hakodate)	μg g^{-1} wet	Endo et al. 2010
NW Pacific (Oyashio-Kuroshio Transition), 2000-2004	Baird's beaked whale[a)]	1.98 ± 0.43	μg g^{-1} wet	Endo et al. 2010
NW Pacific (Oyashio-Kuroshio Transition) 2000-2004	Short-finned pilot whale[a)]	1.30 ± 0.41	μg g^{-1} wet	Endo et al. 2010
NW Pacific (Kuroshio), 2000-2004	Short-finned pilot whale[a)]	10.81 ± 4.47	μg g^{-1} wet	Endo et al. 2010
East China Sea, 2000-2004	Short-finned pilot whale[a)]	12.71 ± 11.20	μg g^{-1} wet	Endo et al. 2010
NW Pacific (Kuroshio), 2000-2004	Striped dolphin[a)]	5.20 ± 5.27	μg g^{-1} wet	Endo et al. 2010
East China Sea, 2000-2004	Striped dolphin[a)]	6.76 ± 2.22	μg g^{-1} wet	Endo et al. 2010
NW Pacific and Taiwan Strait, 1994-1995	Spotted dolphin[a)]	3.64 ± 2.21	μg g^{-1} wet	Chen et al. 2002
Australian water	Spotted dolphin[a)]	(0.82–1.01)	μg g^{-1} wet	Kemper et al. 1994
NW Pacific and Taiwan Strait, 1994-1996	Spotted dolphin[a)]	1.39 ± 0.30	μg g^{-1} wet	Chen et al. 2002
NW Pacific and Taiwan strait. 1994-1997	Risso's dolphin[a)]	3.17 ± 4.36	μg g^{-1} wet	Chen et al. 2002
NW Pacific and Taiwan strait, 1994-1998	Bottlenose dolphin[a)]	1.44 ± 0.53	μg g^{-1} wet	Chen et al. 2002
The Australian waters except Northern Territory	Bottlenose dolphin[a)]	0.22–0.77	μg g^{-1} wet	Kemper et al. 1994

[a)] Albacore tuna, *Thunnus alalunga*; Bigeye tuna, *T. obesus;* Bluefin tuna*, T. thynnus;* Yellowfin tuna*, T. albacares;* Baird's beaked whale, *Berardius bairdii*; Short-finned pilot whale, *Globicephala macrorhynchus*; Striped dolphin, *Stenella coeruleoalba*; Spotted dolphin, *S. attenuata*; Spinner dolphin, *S. longirostris*; Risso's dolphin, *Grampus griseus*; Bottlenose dolphin, *Turiops truncatus*.

[b)] In calculation of average values, <0.005μg g^{-1} dry was treated as 0.005μg g^{-1} dry.

[c)] Grand aveage across species-average values.

[d)] No description of samples.

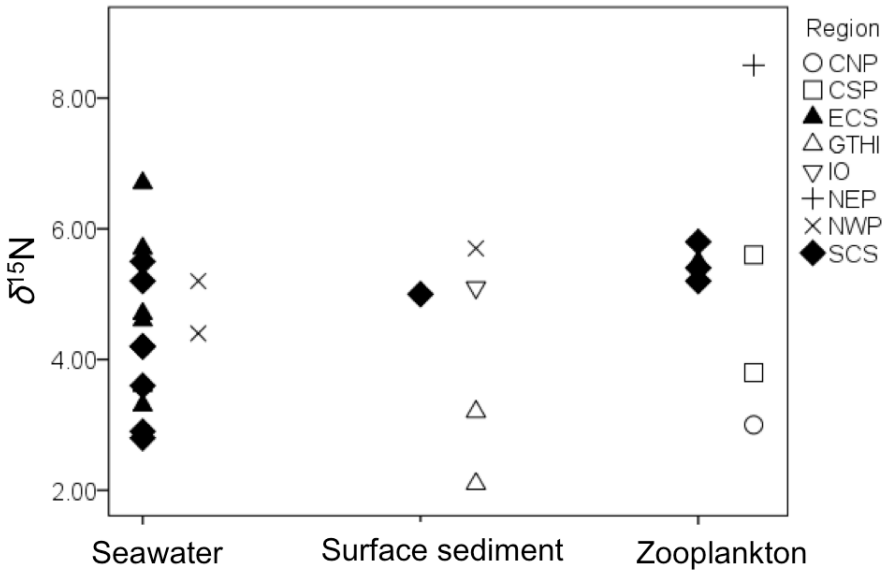

Fig. S1. Reported average $\delta^{15}N$ values of samples or subsamples of seawater (POM, DON, PON, or PN), surface sediment, or zooplankton sampled in the Central North Pacific (CNP), Central South Pacific (CSP), East China Sea (ECS), Gulf of Thailand (GTHI), Indian Ocean (IO), North Eastern Pacific (NEP), North Western Pacific (NWP), or South China Sea (SCS). For studies in which only ranges of sample values are reported, the middle values are shown. See Table S4.

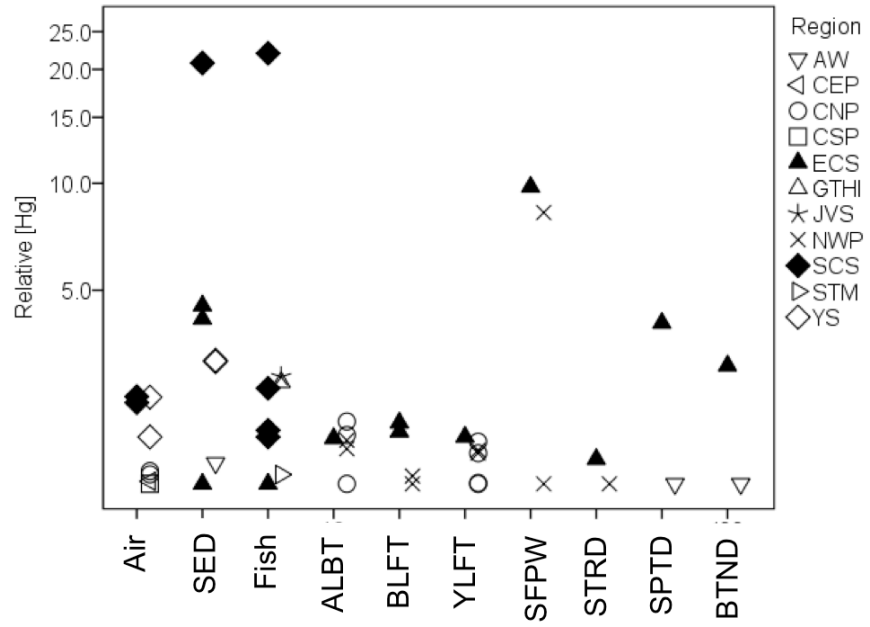

Fig. S2. Reported average Hg concentrations in air (Air, measured as gaseous elemental Hg), surface sediment (SED), muscle of marine fish sampled in the market (Fish), muscle of tuna species (ALBT, Albacore; BLFT, Bluefin; YLFT, Yellowfin), or red meat of whales or dolphins (SFPW, short-finned pilot whale; STRD, striped dolphin; SPTD, spotted dolphin; BTND, bottlenose dolphin) sampled in Australian waters (AW), Central Equatorial Pacific (CEP), Central North Pacific (CNP), Central South Pacific (CSP), East China Sea (ECS), Gulf of Thailand (GTHI), Java Sea (JVS), North Western Pacific (NWP), South China Sea (SCS), Straits of Malacca (STM), and Yellow Sea (YS). Hg concentrations are shown relative to the smallest average value reported in each material in Table S5. For studies in which two average values or only ranges of sample values are reported, the middle values are shown. See Table S5.

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