

Supplementary file for: Solheim S.A., Sagerup K., Huber S., Byrkjedal I. & Gabrielsen G.W. 2016. The black-legged kittiwake preen gland – an overlooked organ for depuration of fat soluble contaminants? *Polar Research* 35. Correspondence: Kjetil Sagerup, Akvaplan-niva AS, Fram Centre, PO Box 6606 Langnes, NO-9296 Tromsø, Norway. E-mail: kjetil.sagerup@akvaplan.niva.no

Abbreviations in this supplementary file

DDE: Dichlorodiphenyldichloroethylene

DDT: dichlorodiphenyltrichloroethane

EI: electron ionization

GPC: gel permeation chromatography

HCB: hexachlorobenzene

lme: fitted linear mixed effect

LOD: limit of detection

NCI: negative chemical ionization

PCB: polychlorinated biphenyls

POP: persistent organic pollutant

SPE: solid phase extraction

TPE: thermoplastic elastomer

During storage of the extracts occurred an unfortunate contamination between GPC and SPE clean-up. A TPE-polymer leaked from the septum of the screw cap and contaminated the extracts. This type of septa and screw caps has been tested successfully earlier during method development. A product change on the polymer used in the septa (not announced by the distributor) included a TPE susceptible for organic solvents. The TPE-polymer was observed in the samples during the initial phase of SPE. Accordingly, a second clean-up on the GPC was necessary in order to remove the polymer. Same GPC parameters were applied as in the previous GPC-clean-up. Fractionation on the GPC was adjusted according to the TPE and the extract collection started after the main amount of the polymer was eluted from the column. A total removal of TPE was not possible without a loss of the analytes of interest, i.e., a small amount of TPE remained in the extracts after the second GPC clean-up. Accordingly, gas chromatography with mass-spectrometry analysis of PCBs had to be run in NCI-mode due to the TPE residues causing increased noise in EI-mode (Supplementary Table S1).

Supplementary Table S1. Masses applied for detection of the PCBs and *p,p'*-DDE in NCI-mode.

	Analyte	Quantifier ion	Qualifier ion
Internal standards	¹³ C-Pentachlorobiphenyls	338	336
	¹³ C-Hexachlorobiphenyls	372	370
	¹³ C-Heptachlorobiphenyls	406	404
	¹³ C- <i>p,p'</i> -DDE	330	330
Native compounds	Pentachlorobiphenyls	326	324
	Hexachlorobiphenyls	359.8	361.8
	Heptachlorobiphenyls	393.8	395.8
	Octachlorobiphenyls	428	430
	<i>p,p'</i> -DDE	318	246

The removal of the polymer resulted in a loss of the lowest chlorinated PCBs and some DDT derivatives, which were co-eluting with the main TPE-polymer peak. Therefore, this study does not present the whole spectre of PCBs and pesticides presented in the kittiwakes. However, since the lower chlorinated PCBs only represent a small amount of the \sum PCBs, the loss from each congener is calculated to vary from 0 to 2.4 % of the \sum PCBs, summed up to account for 7 % of the \sum PCBs. The congeners that could not be analysed were PCB-28, -31, -47, -52, -56, -66, -74 and -87. The calculated loss portion was made from a comparable data set on kittiwake liver (Borgå et al. 2005).

Reference

Borgå K., Wolkers H., Skaare J.U., Hop H., Muir D.C.G. & Gabrielsen G.W. 2005. Bioaccumulation of PCBs in Arctic seabirds: influence of dietary exposure and congener biotransformation. *Environmental Pollution* 134, 397-409.

Supplementary Table S2. Concentrations of POPs (ng/g wet weight (wt)) and lipid content (%) in black-legged kittiwake feathers, livers and preen glands presented as sample size (n > LOD/n [total]), mean ± SD, median and range.

Analyte	Feathers (ng/g wet wt)				Livers (ng/g wet wt)				Preen glands (ng/g wet wt)			
	n	Mean ± SD	Median	Range	n	Mean ± SD	Median	Range	n	Mean ± SD	Median	Range
Lipid content (%)	nd ^a	nd	nd	nd	24/24	5.78 ± 1.42	5.56	3.90 - 9.32	24/24	33.8 ± 9.25	32.8	24.6 - 68.8
α-HCH	2/24	nd	nd	nd	3/24	nd	nd	nd	11/24	nd	nd	nd
β-HCH	19/24	1.15 ± 0.60	0.93	0.54 - 2.83	19/24	2.45 ± 1.42	2.25	0.45 - 5.62	23/24	30.2 ± 15.4	29	6.07 - 60.5
γ-HCH	13/24	0.11 ± 0.04	0.10	0.04 - 0.17	0/24	nd	nd	nd	8/24	nd	nd	nd
∑HCH	19/24	1.20 ± 0.64	1.00	0.54 - 2.93	19/24	2.46 ± 1.43	2.25	0.45 - 5.67	24/24	29.2 ± 16.2	28.2	0.89 - 60.9
HCB	24/24	0.97 ± 0.95	0.73	0.29 - 4.83	24/24	17.0 ± 5.67	17.7	7.09 - 26.6	24/24	57.0 ± 16.8	55.0	35.7 - 117
Heptachlor	3/24	nd	nd	nd	24/24	8.06 ± 3.86	7.34	2.33 - 17.5	24/24	7.42 ± 3.87	6.33	2.98 - 20.2
<i>trans</i> -chlordane	13/24	0.05 ± 0.06	0.03	0.01 - 0.23	0/24	nd	nd	nd	0/24	nd	nd	nd
<i>cis</i> -chlordane	10/24	nd	nd	nd	19/24	0.06 ± 0.05	0.05	0.01 - 0.20	22/24	0.54 ± 0.24	0.46	0.20 - 1.06
oxy-chlordane	24/24	3.31 ± 2.25	2.30	1.12 - 8.42	24/24	24.6 ± 16.1	23.1	4.69 - 58.7	24/24	158 ± 67.4	141	43.7 - 304
<i>trans</i> -nonachlor	24/24	0.39 ± 0.41	0.26	0.07 - 2.01	24/24	0.83 ± 0.69	0.67	0.15 - 3.42	24/24	6.27 ± 4.45	5.23	1.66 - 19.3
<i>cis</i> -nonachlor	24/24	0.34 ± 0.27	0.27	0.08 - 1.35	24/24	0.95 ± 0.52	0.78	0.28 - 1.80	24/24	6.64 ± 3.96	6.08	2.87 - 19.5
∑chlordanes	24/24	4.09 ± 2.76	2.74	1.49 - 10.7	24/24	26.4 ± 16.8	25.5	5.77 - 61.7	24/24	172 ± 69.1	155	56.7 - 320
<i>p,p'</i> -DDE	24/24	11.0 ± 12.9	6.61	0.88 - 62.4	24/24	50.7 ± 45.7	34.0	6.32 - 185	24/24	273 ± 200	229	48.3 - 746
Mirex	2/24	nd	nd	nd	24/24	13.9 ± 10.0	13.8	0.97 - 32.5	24/24	32.4 ± 12.1	31.8	8.55 - 57.6
PCB 99	23/24	4.19 ± 2.59	3.07	1.59 - 10.6	23/24	27.0 ± 15.4	30.0	4.54 - 54.9	24/24	124 ± 55.5	118	45.4 - 252
PCB 101	5/24	nd	nd	nd	8/24	nd	nd	nd	0/24	nd	nd	nd
PCB 105	23/24	1.92 ± 1.27	1.35	0.69 - 4.81	24/24	11.0 ± 6.89	11.1	2.03 - 27.9	24/24	50.7 ± 21.1	51.2	19.5 - 105
PCB 118	24/24	5.75 ± 3.97	4.59	1.36 - 16.5	24/24	39.7 ± 24.9	38.2	7.53 - 91.6	24/24	179 ± 70.8	163	75.5 - 334
PCB123	1/24	nd	nd	nd	12/24	4.47 ± 3.65	3.54	0.76 - 10.4	4/24	nd	nd	nd
PCB 128	23/24	0.96 ± 0.72	0.77	0.18 - 3.01	23/24	6.75 ± 4.33	6.09	1.08 - 17.3	24/24	28.2 ± 14.0	27.0	12.2 - 75.0
PCB 138	23/24	14.0 ± 8.26	11.1	4.76 - 34.8	24/24	107 ± 65.9	110	16.8 - 217	24/24	427 ± 196	399	160 - 1029
PCB 141	7/24	nd	nd	nd	19/24	0.32 ± 1.19	0.05	0.01 - 5.23	19/24	0.26 ± 0.12	0.24	0.05 - 0.49

PCB 149	0/24	nd	nd	nd	24/24	6.65 ± 4.15	7.16	1.19 - 14.0	24/24	26.5 ± 9.81	25.8	10.5 - 47.1
PCB 153	23/24	20.9 ± 11.9	17.7	6.96 - 50.9	24/24	189 ± 134	176	27.5 - 473	24/24	729 ± 428	653	249 - 2285
PCB 156	24/24	1.15 ± 1.86	0.68	0.29 - 9.67	24/24	7.37 ± 4.98	7.21	1.09 - 15.6	24/24	27.6 ± 14.7	25.7	8.72 - 72.5
PCB 157	24/24	0.21 ± 0.11	0.19	0.07 - 0.46	22/24	1.54 ± 1.01	1.63	0.25 - 3.57	24/24	9.99 ± 19.0	5.33	2.01 - 97.8
PCB 167	24/24	0.56 ± 0.32	0.49	0.08 - 1.33	24/24	5.93 ± 4.10	5.09	0.83 - 14.6	24/24	24.44 ± 19.1	18.6	7.91 - 82.2
PCB 170	24/24	2.16 ± 1.18	1.97	0.23 - 4.94	23/24	30.3 ± 23.0	25.2	3.64 - 78.8	24/24	93.8 ± 66.3	75.5	31.8 - 343
PCB 180	24/24	6.55 ± 3.29	5.76	1.06 - 14.6	24/24	99.3 ± 75.1	80.8	11.6 - 239	22/24	294 ± 186	240	104 - 912
PCB 183	24/24	1.47 ± 0.78	1.15	0.49 - 3.46	24/24	16.9 ± 12.1	15.1	2.15 - 39.7	24/24	51.7 ± 29.4	43.3	18.7 - 148
PCB187	24/24	2.70 ± 1.58	2.26	0.76 - 6.83	24/24	28.8 ± 19.0	27.7	4.30 - 62.7	24/24	93.8 ± 50.0	81.7	43.5 - 269
PCB189	24/24	0.13 ± 0.31	0.06	0.03 - 1.58	24/24	1.22 ± 1.03	0.90	0.13 - 3.70	24/24	3.30 ± 3.32	2.29	0.94 - 17.6
PCB 194	23/24	0.51 ± 0.26	0.41	0.23 - 1.17	24/24	12.7 ± 11.3	8.97	1.03 - 43.6	24/24	28.5 ± 26.8	20.4	9.35 - 140
ΣPCBs	24/24	62.1 ± 34.9	53.8	22.0 - 147	24/24	591 ± 402	557	86.9 - 1285	24/24	2168 ± 1150	1923	806 - 6083
ΣPOPs	24/24	79.3 ± 47.9	69.4	28.9 - 225	24/24	709 ± 458	667	117 - 1489	24/24	2739 ± 1260	2384	1070 - 6625

^a Not detected.

Supplementary Table S3. Concentrations of POPs (ng/g lipid weight (wt)) and lipid content (%) in black-legged kittiwake feathers, livers and preen glands presented as sample size (n > LOD/n [total]), mean ± SD, median and range.

Analyte	Livers (ng/g lipid wt)				Preen glands (ng/g lipid wt)			
	n	Mean ± SD	Median	Range	n	Mean ± SD	Median	Range
Lipid content (%)	24/24	5.78 ± 1.42	5.56	3.90 - 9.32	24/24	33.8 ± 9.25	32.8	24.6 - 68.8
α-HCH	3/24	nd ^a	nd	nd	11/24	nd	nd	nd
β-HCH	19/24	44.7 ± 20.7	43.6	11.5 - 91.5	23/24	98.7 ± 57.8	103	15.5 - 206
γ-HCH	0/24	nd	nd	nd	8/24	nd	nd	nd
ΣHCH	19/24	44.8 ± 20.8	43.6	11.5 - 91.9	24/24	95.4 ± 59.8	89.5	2.11 - 207
HCB	24/24	309 ± 100	314	135 - 500	24/24	179 ± 64.4	174	84.6 - 302
Heptachlor	24/24	153 ± 83.7	142	34.0 - 347	24/24	22.8 ± 10.7	21.3	5.67 - 48.1
<i>trans</i> -chlordane	0/24	nd	nd	nd	0/24	nd	nd	nd
<i>cis</i> -chlordane	15/24	3.15 ± 7.08	1.08	0.62 - 28.5	22/24	1.61 ± 0.70	58.2	0.51 - 3.03

oxy-chlordane	24/24	445 ± 271	352	89.1 - 951	24/24	514 ± 279	428	112 - 1072
<i>trans</i> -nonachlor	24/24	13.4 ± 9.12	11.4	3.25 - 42.1	23/24	19.3 ± 12.5	16.0	6.73 - 51.1
<i>cis</i> -nonachlor	24/24	16.6 ± 7.95	15.7	5.59 - 30.2	23/24	21.2 ± 11.1	19.2	8.79 - 50.6
∑chlordanes	24/24	477 ± 279	401	113 - 1001	24/24	554 ± 286	468	145 - 1093
<i>p,p'</i> -DDE	24/24	795 ± 645	630	46.9 - 2480	24/24	807 ± 551	620	187 - 2096
Mirex	24/24	247 ± 159	246	25.0 - 490	24/24	103 ± 46.5	101	22.8 - 206
PCB 99	23/24	450 ± 278	330	40.1 - 888	24/24	403 ± 242	383	116 - 862
PCB 101	8/24	nd	nd	nd	0/24	nd	nd	nd
PCB 105	24/24	186 ± 133	178	13.4 - 607	24/24	161 ± 77.1	144	49.8 - 302
PCB 118	24/24	659 ± 426	573	53.7 - 1486	24/24	573 ± 279	556	189 - 1135
PCB123	12/24	81.2 ± 71.6	57.6	17.4 - 241	4/24	nd	nd	nd
PCB 128	23/24	111 ± 71.4	98.8	8.11 - 232	24/24	89.7 ± 53.0	78.6	31.1 - 257
PCB 138	24/24	1802 ± 1195	1499	143 - 3874	24/24	1372 ± 749	1315	409 - 3520
PCB 141	18/24	7.11 ± 26.6	0.79	0.25 - 114	19/24	0.77 ± 0.37	0.80	0.20 - 1.35
PCB 149	24/24	111 ± 74.3	92.0	9.54 - 228	24/24	84.8 ± 39.9	81.1	26.9 - 161
PCB 153	24/24	3190 ± 2458	2422	237 - 9038	24/24	2357 ± 1583	2071	637 - 7816
PCB 156	24/24	124 ± 90.5	101	9.59 - 292	24/24	88.9 ± 54.0	83.5	21.8 - 248
PCB 157	22/24	26.9 ± 20.1	21.5	2.14 - 68.2	24/24	29.3 ± 47.5	18.0	5.14 - 245
PCB 167	24/24	100 ± 75.7	78.2	7.39 - 279	24/24	78.3 ± 63.5	60.4	20.2 - 281
PCB 170	23/24	506 ± 417	351	32.5 - 1507	24/24	301 ± 235	248	81.1 - 1174
PCB 180	24/24	1680 ± 1348	1379	108 - 4573	22/24	942 ± 671	753	265 - 3120
PCB 183	24/24	285 ± 217	242	19.2 - 689	24/24	165 ± 106	139	47.8 - 505
PCB187	24/24	487 ± 351	476	35.4 - 1198	24/24	299 ± 183	265	111 - 919
PCB189	24/24	20.5 ± 17.6	15.6	1.13 - 70.8	24/24	10.7 ± 11.6	7.91	2.41 - 60.1
PCB 194	24/24	214 ± 198	168	12.4 - 834	24/24	92.2 ± 94.5	63.3	23.9 - 478
∑PCBs	24/24	9960 ± 7260	7781	733 - 24570	24/24	6971 ± 4273	6303	2058 - 20803
∑POPs	24/24	11977 ± 8142	9896	1777 - 26782	24/24	8731 ± 4734	8218	2733 - 22655

^aNot detected.

Supplementary Table S4. The sample size (n), mean \pm SD and the range for the contribution of lipid classes (%) to the total lipid content in black-legged kittiwake livers and preen glands.

Lipid class	Livers			Preen glands		
	n	Mean \pm SD	Range	n	Mean \pm SD	Range
Cholesteryl ester	0/12	nd ^a	nd	0/11	nd	nd
Wax ester	12/12	14.9 \pm 6.3	6.5 - 24.0	11/11	70.1 \pm 15.3	46.8 - 88.2
Triacylglycerol	12/12	26.7 \pm 12.1	15.2 - 54.5	11/11	27.5 \pm 15.8	9.0 - 51.5
Fatty alcohol	0/12	nd	nd	0/11	nd	nd
Cholesterol	12/12	9.9 \pm 2.1	6.2 - 12.3	0/11	nd	nd
Diacylglycerol	10/12	1.3 \pm 0.5	0.7 - 2.0	0/11	nd	nd
Free fatty acid	0/12	nd	nd	0/11	nd	nd
Monoacylglycerol	0/12	nd	nd	0/11	nd	nd
Galactocerebroside	5/12	1.7 \pm 0.2	1.4 - 2.0	0/11	nd	nd
Cardiolipin	0/12	nd	nd	0/11	nd	nd
Phosphatidylglycerol	12/12	0.9 \pm 0.4	0.4 - 1.5	0/11	nd	nd
Phosphatidylethanolamine	12/12	7.6 \pm 3.9	1.7 - 14.2	0/11	nd	nd
Phosphatidylinositol	12/12	3.9 \pm 1.9	1.4 - 7.4	0/11	nd	nd
Phosphatidic acid	0/12	nd	nd	0/11	nd	nd
Phosphatidylserine	12/12	3.9 \pm 1.8	1.4 - 6.9	0/11	nd	nd
Phosphatidylcholines	12/12	26.6 \pm 8.9	11.3 - 37.2	11/11	2.3 \pm 0.7	1.6 - 3.6
Sphingomyelin	12/12	2.9 \pm 0.9	1.4 - 4.2	0/11	nd	nd
Lysophosphatidylcholine	12/12	0.9 \pm 0.7	0.2 - 2.3	0/11	nd	nd

^aNot detected.

Supplementary Table S5. Summary of the linear mixed effect model for β -HCH in black-legged kittiwakes. Interpretation: in each contrast analysis, the first combination of predictor levels (first line) is basis for the interpretation of the three next lines. For example, in contrast analysis 1, the first combination is tissue feather and sampling period 1. The second line gives the lme values for period 2 compared with period 1, still for the organ feather. The interactions (two last lines) are compared to the second line.

	Value	SE	Df	t-value	<i>P</i> value
Contrast analysis 1					
Feather, period 1	- 0.21	0.33	44	- 0.63	0.53
Period 2	- 0.54	0.47	22	- 1.17	0.25
Liver	1.90	0.37	44	5.20	<0.001
Preen gland	3.69	0.37	44	10.01	<0.001
Period 2: liver	2.85	0.52	44	5.50	<0.001
Period 2: preen gland	1.92	0.52	44	3.72	<0.001
Contrast analysis 2					
Preen gland, period 1	3.48	0.33	44	10.55	<0.001
Period 2	1.38	0.47	22	2.96	<0.01
Liver	- 1.79	0.37	44	- 4.88	<0.001
Feather	- 3.69	0.37	44	- 10.08	<0.001
Period 2: liver	0.92	0.52	44	1.78	0.08
Period 2: feather	- 1.93	0.52	44	- 3.72	<0.001
Contrast analysis 3					
Liver, period 1	1.69	0.33	44	5.14	<0.001
Period 2	2.31	0.47	22	4.94	<0.001
Preen gland	1.79	0.37	44	4.88	<0.001
Feather	- 1.90	0.37	44	- 5.20	<0.001
Period 2: preen gland	- 0.92	0.52	44	- 1.78	0.08
Period 2: feather	- 2.85	0.52	44	- 5.50	<0.001
Contrast analysis 4					
Feather, period 2	- 0.75	0.33	44	-2.28	0.03
Period 1	0.54	0.47	22	1.17	0.26
Liver	4.75	0.37	44	12.98	<0.001
Preen gland	5.62	0.37	44	15.34	<0.001
Period 1: liver	- 2.85	0.52	44	- 5.50	<0.001
Period 1: preen gland	- 1.93	0.52	44	- 3.72	<0.001
Contrast analysis 5					
Preen gland, period 2	4.86	0.33	44	14.74	<0.001
Period 1	- 1.38	0.47	22	- 2.96	<0.01
Liver	- 0.86	0.37	44	- 2.36	0.02
Feather	- 5.62	0.37	44	- 15.34	<0.001
Period 1: liver	- 0.92	0.52	44	- 1.78	0.08
Period 1: feather	1.93	0.52	44	3.72	<0.001

Supplementary Table S6. Summary of the linear mixed effect model for HCB in black-legged kittiwakes. Interpretation: in each contrast analysis, the first combination of predictor levels (first line) is basis for the interpretation of the three next lines. For example, in contrast analysis 1, the first combination is tissue feather and sampling period 1. The second line gives the lme values for period 2 compared with period 1, still for the organ feather. The interactions (two last lines) are compared to the second line.

	Value	SE	Df	t-value	<i>P</i> value
Contrast analysis 1					
Feather, period 1	0.11	0.11	44	1.02	0.31
Period 2	- 0.79	0.15	22	- 5.21	0.07
Liver	5.27	0.14	44	38.20	<0.001
Preen gland	4.77	0.14	44	34.54	<0.001
Period 2: liver	1.39	0.20	44	7.09	<0.001
Period 2: preen gland	1.28	0.20	44	6.55	<0.001
Contrast analysis 2					
Preen gland, period 1	4.88	0.11	44	45.28	<0.001
Period 2	0.49	0.15	22	3.19	<0.01
Liver	0.51	0.14	44	3.66	<0.001
Feather	- 4.77	0.14	44	- 34.54	<0.001
Period 2: liver	0.11	0.20	44	0.54	0.59
Period 2: feather	- 1.28	0.20	44	- 6.55	<0.001
Contrast analysis 3					
Liver, period 1	5.38	0.11	44	49.97	<0.001
Period 2	0.59	0.15	22	3.88	<0.001
Preen gland	- 0.51	0.14	44	- 3.66	<0.001
Feather	- 5.27	0.14	44	- 38.20	<0.001
Period 2: preen gland	- 0.11	0.20	44	- 0.54	0.59
Period 2: feather	- 1.38	0.20	44	- 7.09	<0.001
Contrast analysis 4					
Feather, period 2	- 0.68	0.11	44	- 6.35	<0.001
Period 1	0.79	0.15	22	5.21	<0.001
Liver	6.66	0.14	44	48.23	<0.001
Preen gland	6.05	0.14	44	43.81	<0.001
Period 1: liver	- 1.38	0.20	44	- 7.01	<0.001
Period 1: preen gland	- 1.28	0.20	44	- 6.55	<0.001
Contrast analysis 5					
Preen gland, period 2	5.36	0.11	44	49.79	<0.001
Period 1	- 0.49	0.15	22	- 3.19	<0.01
Liver	0.61	0.14	44	4.42	<0.001
Feather	- 6.05	0.14	44	- 43.81	<0.001
Period 1: liver	- 0.11	0.20	44	- 0.54	0.59
Period 1: feather	1.28	0.20	44	6.55	<0.001

Supplementary Table S7. Summary of the linear mixed effect model for *oxy*-chlordanes in black-legged kittiwakes. Interpretation: in each contrast analysis, the first combination of predictor levels (first line) is basis for the interpretation of the three next lines. For example, in contrast analysis 1, the first combination is tissue feather and sampling period 1. The second line gives the lme values for period 2 compared with period 1, still for the organ feather. The interactions (two last lines) are compared to the second line.

	Value	SE	Df	t-value	P value
Contrast analysis 1					
Feather, period 1	1.23	0.14	44	8.67	<0.001
Period 2	- 0.50	0.20	22	- 2.47	0.02
Liver	4.06	0.16	44	25.32	<0.001
Preen gland	4.44	0.16	44	27.68	<0.001
Period 2: liver	1.68	0.23	44	7.39	<0.001
Period 2: preen gland	1.31	0.23	44	5.80	<0.001
Contrast analysis 2					
Preen gland, period 1	5.67	0.14	44	39.76	<0.001
Period 2	0.82	0.20	22	4.05	<0.001
Liver	- 0.38	0.16	44	- 2.36	0.02
Feather	- 4.44	0.16	44	- 27.68	<0.001
Period 2: liver	0.36	0.23	44	1.60	0.12
Period 2: feather	- 1.31	0.23	44	- 5.80	<0.001
Contrast analysis 3					
Liver, period 1	5.29	0.14	44	37.11	<0.001
Period 2	1.18	0.20	22	5.84	<0.001
Preen gland	0.38	0.16	44	2.36	0.02
Feather	- 4.06	0.16	44	- 25.32	<0.001
Period 2: preen gland	- 0.36	0.23	44	- 1.59	0.12
Period 2: feather	- 1.68	0.23	44	- 7.39	<0.001
Contrast analysis 4					
Feather, period 2	0.74	0.14	44	5.18	<0.001
Period 1	0.50	0.20	22	2.47	0.02
Liver	5.73	0.16	44	35.78	<0.001
Preen gland	5.75	0.16	44	35.88	<0.001
Period 1: liver	- 1.68	0.23	44	- 7.39	<0.001
Period 1: preen gland	- 1.31	0.23	44	- 5.80	<0.001
Contrast analysis 5					
Preen gland, period 2	6.49	0.14	44	45.49	<0.001
Period 1	- 0.82	0.20	22	- 4.05	<0.001
Liver	- 0.02	0.16	44	- 0.10	0.92
Feather	- 5.75	0.16	44	- 35.88	<0.001
Period 1: liver	- 0.36	0.23	44	- 1.60	0.12
Period 1: feather	1.31	0.23	44	5.80	<0.001

Supplementary Table S8. Summary of the linear mixed effect model for mirex in black-legged kittiwakes. Interpretation: in each contrast analysis, the first combination of predictor levels (first line) is basis for the interpretation of the three next lines. For example, in contrast analysis 1, the first combination is tissue feather and sampling period 1. The second line gives the lme values for period 2 compared with period 1, still for the organ feather. The interactions (two last lines) are compared to the second line.

	Value	SE	Df	t-value	<i>P</i> value
Contrast analysis 1					
Mirex not detected in feather					
Contrast analysis 2					
Male, liver, period 1	4.75	0.16	22	29.93	<0.001
Period 2	1.39	0.19	21	7.27	<0.001
Preen gland	- 0.24	0.13	22	- 1.82	0.08
Female	- 0.48	0.17	21	- 2.88	<0.01
Period 2: preen gland	- 0.91	0.18	22	- 4.91	<0.001
Contrast analysis 3					
Female, liver, period 1	4.27	0.16	22	26.90	<0.001
Period 2	1.39	0.19	21	7.27	<0.001
Preen gland	- 0.24	0.13	22	- 1.82	0.08
Male	0.48	0.17	21	2.89	<0.01
Period 2: preen gland	- 0.91	0.18	22	- 4.91	<0.001
Contrast analysis 4					
Female, liver, period 2	5.66	0.16	22	35.65	<0.001
Period 1	- 1.39	0.19	21	- 7.27	<0.001
Preen gland	- 1.14	0.13	22	- 8.77	<0.001
Male	0.48	0.17	21	2.88	<0.001
Period 1: preen gland	0.91	0.18	22	4.91	<0.001
Contrast analysis 5					
Male, liver, period 2	6.14	0.16	22	38.68	<0.001
Period 1	- 1.39	0.19	21	- 7.27	<0.01
Preen gland	- 1.15	0.13	22	- 8.77	<0.001
Female	- 0.48	0.17	21	- 2.88	<0.001
Period 1: preen gland	0.91	0.19	22	4.91	<0.001
Contrast analysis 6					
Female preen gland, period 1	4.03	0.16	22	25.41	<0.001
Period 2	0.48	0.19	21	2.52	0.02
Liver	0.24	0.13	22	1.82	0.08
Male	0.48	0.17	21	2.88	<0.01
Period 2: liver	0.91	0.19	22	4.91	<0.001
Contrast analysis 7					
Male, preen gland, period 1	4.51	0.16	22	28.44	<0.001
Period 2	0.48	0.19	21	2.52	0.02
Liver	0.24	0.13	22	1.82	0.08
Female	- 0.48	0.17	21	-2.88	<0.01
Period 2: liver	0.91	0.19	22	4.91	<0.001

Contrast analysis 8					
Male, preen gland, period 2	4.99	0.16	22	31.47	<0.001
Period 1	- 0.48	0.19	21	-2.52	0.02
Liver	1.15	0.13	22	8.77	<0.001
Female	- 0.48	0.17	21	-2.88	<0.01
Period 1: liver	- 0.91	0.19	22	- 4.91	<0.001

Supplementary Table S9. Summary of the linear mixed effect model for p,p' -DDE in black-legged kittiwakes. Interpretation: in each contrast analysis, the first combination of predictor levels (first line) is basis for the interpretation of the three next lines. For example, in contrast analysis 1, the first combination is tissue feather and sampling period 1. The second line gives the lme values for period 2 compared with period 1, still for the organ feather. The interactions (two last lines) are compared to the second line.

	Value	SE	Df	t-value	<i>P</i> value
Contrast analysis 1					
Feather, period 1	2.39	0.23	44	10.19	<0.001
Period 2	- 0.86	0.33	22	- 2.60	0.02
Liver	3.55	0.15	44	23.49	<0.001
Preen gland	3.99	0.15	44	26.38	<0.001
Period 2: liver	1.59	0.21	44	7.44	<0.001
Period 2: preen gland	1.07	0.21	44	5.01	<0.001
Contrast analysis 2					
Preen gland, period 1	6.39	0.24	44	27.20	<0.001
Period 2	0.21	0.33	22	0.63	0.54
Liver	- 0.44	0.15	44	- 2.88	<0.01
Feather	- 3.99	0.15	44	- 26.38	<0.001
Period 2: liver	0.52	0.21	44	2.43	0.02
Period 2: feather	- 1.07	0.21	44	- 5.01	<0.001
Contrast analysis 3					
Liver, period 1	5.95	0.24	44	25.34	<0.001
Period 2	0.73	0.33	22	2.20	0.04
Preen gland	0.43	0.15	44	2.88	0.01
Feather	- 3.56	0.15	44	- 23.49	<0.001
Period 2: preen gland	- 0.52	0.21	44	- 2.43	0.02
Period 2: feather	- 1.59	0.21	44	- 7.44	<0.001
Contrast analysis 4					
Feather, period 2	1.53	0.24	44	6.51	<0.001
Period 1	0.86	0.33	22	2.60	0.02
Liver	5.15	0.15	44	34.02	<0.001
Preen gland	5.07	0.15	44	33.47	<0.001
Period 1: liver	- 1.59	0.21	44	- 7.44	<0.001
Period 1: preen gland	- 1.07	0.21	44	- 5.01	<0.001
Contrast analysis 5					

Preen gland, period 2	6.60	0.24	44	28.10	<0.001
Period 1	- 0.21	0.33	22	- 0.63	0.54
Liver	0.08	0.15	44	0.55	0.59
Feather	- 5.07	0.15	44	- 33.47	<0.001
Period 1: liver	- 0.52	0.21	44	- 2.43	0.02
Period 1: feather	1.07	0.21	44	5.01	<0.001

Supplementary Table S10. Summary of the linear mixed effect model for penta-PCBs in black-legged kittiwakes. Interpretation: in each contrast analysis, the first combination of predictor levels (first line) is basis for the interpretation of the three next lines. For example, in contrast analysis 1, the first combination is tissue feather and sampling period 1. The second line gives the lme values for period 2 compared with period 1, still for the organ feather. The interactions (two last lines) are compared to the second line.

	Value	SE	Df	t-value	P value
Contrast analysis 1					
Feather, period 1	2.42	0.16	44	14.82	<0.001
Period 2	- 0.33	0.23	22	- 1.42	0.17
Liver	3.75	0.17	44	22.13	<0.001
Preen gland	4.11	0.17	44	24.27	<0.001
Period 2: liver	1.68	0.24	44	6.99	<0.001
Period 2: preen gland	1.06	0.24	44	4.43	<0.001
Contrast analysis 2					
Preen gland, period 1	6.54	0.16	44	40.00	<0.001
Period 2	0.74	0.23	22	3.18	<0.01
Liver	- 0.36	0.17	44	- 2.14	0.04
Feather	- 4.12	0.17	44	- 24.27	<0.001
Period 2: liver	0.61	0.24	44	2.56	0.01
Period 2: feather	- 1.06	0.24	44	- 4.43	<0.001
Contrast analysis 3					
Liver, period 1	6.18	0.16	44	37.79	<0.001
Period 2	1.35	0.23	22	5.83	<0.001
Preen gland	0.36	0.17	44	2.14	0.04
Feather	- 3.75	0.17	44	- 22.13	<0.001
Period 2: preen gland	- 0.61	0.24	44	- 2.56	0.01
Period 2: feather	- 1.68	0.24	44	- 6.99	<0.001
Contrast analysis 4					
Feather, period 2	2.09	0.16	44	12.81	<0.001
Period 1	0.33	0.23	22	1.42	0.17
Liver	5.43	0.17	44	32.02	<0.001
Preen gland	5.18	0.17	44	30.54	<0.001
Period 1: liver	- 1.68	0.24	44	- 6.99	<0.001
Period 1: preen gland	- 1.06	0.24	44	- 4.43	<0.001
Contrast analysis 5					

Preen gland, period 2	7.27	0.16	44	44.50	<0.001
Period 1	- 0.74	0.23	22	- 3.18	<0.01
Liver	0.25	0.17	44	1.48	0.15
Feather	- 5.18	0.17	44	- 30.54	<0.001
Period 1: liver	- 0.61	0.24	44	- 2.56	0.01
Period 1: feather	1.06	0.24	44	4.43	<0.001

Supplementary Table S11. Summary of the linear mixed effect model for hexa-PCBs in black-legged kittiwakes. Interpretation: in each contrast analysis, the first combination of predictor levels (first line) is basis for the interpretation of the three next lines. For example, in contrast analysis 1, the first combination is tissue feather and sampling period 1. The second line gives the lme values for period 2 compared with period 1, still for the organ feather. The interactions (two last lines) are compared to the second line.

	Value	SE	Df	t-value	P value
Contrast analysis 1					
Feather, period 1	3.57	0.16	44	21.95	<0.001
Period 2	- 0.26	0.23	22	- 1.11	0.28
Liver	3.93	0.16	44	23.90	<0.001
Preen gland	4.22	0.16	44	25.66	<0.001
Period 2: liver	1.75	0.23	44	7.54	<0.001
Period 2: preen gland	0.99	0.23	44	4.27	<0.001
Contrast analysis 2					
Preen gland, period 1	7.78	0.16	44	47.88	<0.001
Period 2	0.74	0.23	22	3.20	<0.01
Liver	- 0.29	0.16	44	- 1.76	0.09
Feather	- 4.22	0.16	44	- 25.66	<0.001
Period 2: liver	0.76	0.23	44	3.27	<0.01
Period 2: feather	- 0.99	0.23	44	- 4.27	<0.001
Contrast analysis 3					
Liver, period 1	7.49	0.16	44	46.10	<0.001
Period 2	1.50	0.23	22	6.50	<0.001
Preen gland	0.29	0.16	44	1.76	0.09
Feather	- 3.93	0.16	44	- 23.90	<0.001
Period 2: preen gland	- 0.76	0.23	44	- 3.27	<0.01
Period 2: feather	- 1.75	0.23	44	- 7.53	<0.001
Contrast analysis 4					
Feather, period 2	3.31	0.16	44	20.37	<0.001
Period 1	0.26	0.23	22	1.11	0.29
Liver	5.68	0.16	44	34.55	<0.001
Preen gland	5.21	0.16	44	31.69	<0.001
Period 1: liver	- 1.75	0.23	44	- 7.53	<0.001
Period 1: preen gland	- 0.99	0.23	44	- 4.27	<0.001
Contrast analysis 5					

Preen gland, period 2	8.52	0.16	44	52.40	<0.001
Period 1	- 0.74	0.23	22	- 3.20	<0.01
Liver	0.47	0.16	44	2.87	<0.01
Feather	- 5.21	0.16	44	- 31.69	<0.001
Period 1: liver	- 0.76	0.23	44	- 3.27	<0.01
Period 1: feather	0.99	0.23	44	4.27	<0.001

Supplementary Table S12. Summary of the linear mixed effect model for hepta-PCBs in black-legged kittiwakes. Interpretation: in each contrast analysis, the first combination of predictor levels (first line) is basis for the interpretation of the three next lines. For example, in contrast analysis 1, the first combination is tissue feather and sampling period 1. The second line gives the lme values for period 2 compared with period 1, still for the organ feather. The interactions (two last lines) are compared to the second line.

	Value	SE	Df	t-value	P value
Feather, period 1	2.55	0.17	44	15.14	<0.001
Period 2	- 0.18	0.24	22	- 0.74	0.47
Liver	4.19	0.17	44	24.44	<0.001
Preen gland	4.30	0.17	44	25.09	<0.001
Period 2: liver	1.82	0.24	44	7.52	<0.001
Period 2: preen gland	0.85	0.24	44	3.52	<0.001
Contrast analysis 2					
Preen gland, period 1	6.85	0.17	44	40.68	<0.001
Period 2	0.68	0.24	22	2.85	<0.01
Liver	- 0.11	0.17	44	- 0.65	0.52
Feather	- 4.30	0.17	44	- 25.09	<0.001
Period 2: liver	0.97	0.24	44	4.00	<0.001
Period 2: feather	- 0.85	0.24	44	- 3.52	0.001
Contrast analysis 3					
Liver, period 1	6.74	0.17	44	40.01	<0.001
Period 2	1.65	0.24	22	6.92	<0.001
Preen gland	0.11	0.17	44	0.65	0.52
Feather	- 4.19	0.17	44	- 24.44	<0.001
Period 2: preen gland	- 0.97	0.24	44	- 4.00	<0.001
Period 2: feather	- 1.82	0.24	44	- 7.52	<0.001
Contrast analysis 4					
Feather, period 2	2.37	0.17	44	14.10	<0.001
Period 1	0.18	0.24	22	0.74	0.47
Liver	6.01	0.17	44	35.07	<0.001
Preen gland	5.15	0.17	44	30.07	<0.001
Period 1: liver	- 1.82	0.24	44	- 7.52	<0.001
Period 1: preen gland	- 0.85	0.24	44	- 3.52	0.001
Contrast analysis 5					
Preen gland, period 2	7.53	0.17	44	44.71	<0.001

Period 1	- 0.68	0.24	22	- 2.85	<0.01
Liver	0.86	0.17	44	5.00	<0.001
Feather	- 5.15	0.17	44	- 30.07	<0.001
Period 1: liver	- 0.97	0.24	44	- 4.00	<0.001
Period 1: feather	0.85	0.24	44	3.52	0.001

Supplementary Table S13. Summary of the linear mixed effect model for PCB-194 (octa-PCB) in black-legged kittiwakes. Interpretation: in each contrast analysis, the first combination of predictor levels (first line) is basis for the interpretation of the three next lines. For example, in contrast analysis 1, the first combination is tissue feather and sampling period 1. The second line gives the lme values for period 2 compared with period 1, still for the organ feather. The interactions (two last lines) are compared to the second line.

	Value	SE	Df	t-value	P value
Contrast analysis 1					
Feather, period 1	- 0.89	0.20	44	- 4.45	<0.001
Period 2	0.03	0.28	22	0.11	0.91
Liver	4.84	0.20	44	24.48	<0.001
Preen gland	4.75	0.20	44	24.03	<0.001
Period 2: liver	1.74	0.28	44	6.22	<0.001
Period 2: preen gland	0.72	0.28	44	2.56	0.01
Contrast analysis 2					
Preen gland, period 1	3.86	0.20	44	19.22	<0.001
Period 2	0.75	0.28	22	2.63	0.02
Liver	0.09	0.20	44	0.45	0.66
Feather	- 4.75	0.20	44	- 24.03	<0.001
Period 2: liver	1.03	0.28	44	3.66	<0.001
Period 2: feather	- 0.72	0.28	44	-2.56	0.01
Contrast analysis 3					
Liver, period 1	3.95	0.20	44	19.67	<0.001
Period 2	1.77	0.28	22	6.24	<0.001
Preen gland	- 0.08	0.20	44	- 0.45	0.66
Feather	- 4.84	0.20	44	- 24.48	<0.001
Period 2: preen gland	- 1.03	0.28	44	- 3.66	<0.001
Period 2: feather	- 1.74	0.28	44	- 6.22	<0.001
Contrast analysis 4					
Feather, period 2	- 0.86	0.20	44	- 4.28	<0.001
Period 1	- 0.03	0.28	22	- 0.11	0.91
Liver	6.58	0.20	44	33.28	<0.001
Preen gland	5.47	0.20	44	27.65	<0.001
Period 1: liver	- 1.74	0.28	44	- 6.22	<0.001
Period 1: preen gland	- 0.72	0.28	44	- 2.56	0.01
Contrast analysis 5					
Preen gland, period 2	4.61	0.20	44	22.95	<0.001

Period 1	- 0.75	0.28	22	- 2.63	0.02
Liver	1.11	0.20	44	5.63	<0.001
Feather	- 5.47	0.20	44	- 27.65	<0.001
Period 1: liver	- 1.02	0.28	44	- 3.66	<0.001
Period 1: feather	0.72	0.28	44	2.56	0.01