Institut für Vogelforschung "Vogelwarte Helgoland", An der Vogelwarte 21, D-26386, Wilhelmshaven

Documentation of the TMAP Parameter "Pollutants in seabird eggs" in The Netherlands in 2011

1. Egg sampling

Eggs were sampling according to OSPAR (1997), Becker et al. (2001) and VDI (2009). In general, per year, species and site, 10 eggs were sampled (cf. Fig. 1.1 and Table 1.1).

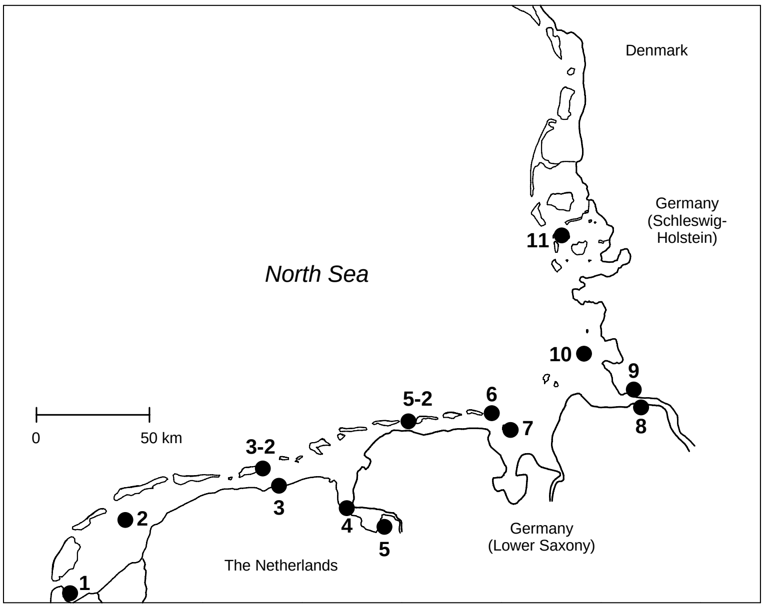

Fig. 1.1: Sampling sites of Oystercatcher and/or Common Tern eggs in the trilateral Wadden Sea. The Netherlands: 1 Balgzand, 2 Griend, 3 Julianapolder, 3-2 Schiermonnikoog, 4 Delfzijl; Germany, Lower Saxony: 5 Dollart, 5-2 Baltrum, 6 Minsener Oog, 7 Mellum (6 and 7 = Jade), 8 Hullen, 9 Neufelderkoog (8 and 9 = Elbe estuary); Germany, Schleswig Holstein: 10 Trischen, 11 Norderoog/Hallig Hooge.At sites 3, 5, 7 and 8 only Oystercatcher eggs, at sites 3-2, 6 and 9 only Common Tern eggs were taken.

Table 1.1: Number of Oystercatcher and Common Tern eggs sampled per site in 2011

	Species	
Site	Oystercatcher	Common Tern
Balgzand	10	10
Griend	10	10
Julianapolder	10	-
Schiermonnikoog	-	9
Delfzijl	10	4

2. Chemical analytics

The samples were analyzed as shortly described by OSPAR (1997), Sommer et al. (1997) and Becker et al. (2001). You can get a detailed description of methods on request.

3. Documentation of data, description of the EXCEL-file and of the variables

The data from The Netherlands in 2011 are documented in an EXCEL-file (already sent on disk). The variables in the EXCEL-file are explained in the file-head.

4. Assessment of the results

To present a short assessment of the data, we prepared and present statistics for the following most important chemicals or chemical groups:

ORGANOCHLORINES:

PCB sum	62 congeners
6PCBs	6 PCB-congeners (PCB28, PCB52, PCB101, PCB138, PCB153, PCB180)
HCB	
HCH sum	α-HCH, β-HCH, γ-HCH
DDT sum	p,p'-DDE, p,p'-DDT, p,p'-DDD
Chlordane sum	Sum of Chlordan and Nonachlor-compounds: trans-Chlordan, cis-Chlordan, trans-Nonachlor, cis-Nonachlor

To make the following text more readable, for "PCB sum" the simplifying term "PCB", for "DDT sum" the term "DDT", for "HCH sum" the term "HCH" and for "Chlordane sum" the term "Chlordanes" is used.

HEAVY METALS:

Hg (mercury)

All concentrations are given in $ng \cdot g^{-1}$ fresh weight of the eggs.

Statistics:

For analysing temporal trends for the years 2007 – 2011, Spearman rank correlations were calculated (two-tailed) for the years 2007 - 2011. To identify potential differences in pollutant concentrations between 2010 and 2011, Mann-Whitney-U-tests were conducted. In the figures, arithmetic means ± 95% confidence intervals are presented. If the confidence intervals do not overlap, significance of at least $p < 0.05$ is indicated.

5 Results

5.1 Spatial patterns of selected contaminants in the Wadden Sea in 2011

For the Oystercatcher, we identified areas with relatively high contaminations (in the order of mean contamination level, beginning with the highest):

Mercury:	Trischen, Halligen, Jade
PCB:	Elbe, Dollart, Trischen
HCB:	Delfzijl, Elbe, Dollart
DDT:	Elbe, Trischen, Dollart
HCH:	Trischen, Elbe, Halligen
Chlordanes:	Dollart, Jade

In the Common Tern, concentrations of Hg, PCB, HCB and DDT tended to be higher at most sites than in the Ostercatcher whereas Chlordane concentrations tended to be lower. In the following areas relatively high contaminations of Common Tern eggs were detected (given in the order of contamination level, beginning with the highest average level):

Mercury:	Elbe, Trischen
PCB:	Elbe
HCB:	Elbe, Delfzijl
DDT:	Elbe, Trischen
HCH:	Elbe, Jade, Balgzand
Chlordanes:	Schiermonnikoog, Jade, Halligen, Balgzand

In the **Oystercatcher**, the geographical pattern of Hg concentrations in 2011 was largely similar to that of 2010 (last report): Again Hg peaked at Trischen and more or less surrounding sites. A further peak at Balgzand detectable in 2010 had disappeared in 2011. For PCB, prominent concentration peaks were hardly recognizable in 2011 which was in contrast to 2010. This was mainly caused by increased concentrations in the western Wadden Sea. As in 2010, the clearly highest concentration of HCB was measured in 2011 at Delfzijl where it was even higher than in 2010. A second, much smaller peak was again recorded at the river Elbe. For DDT, the highest concentrations were again found at Elbe, Trischen and Dollart. For HCH, a very clear concentration peak was found at Trischen, as in 2010. However, at Jade, the site with the highest HCH concentrations in 2010, the values were comparatively low in 2011. Further concentration decreases in the western Wadden Sea have resulted in Elbe, Trischen and Halligen forming the clear core area of HCH contamination. For Chlordanes, peak values have been recorded again at Dollart, but increased concentrations in both the western and the eastern Wadden Sea have resulted in a stronger approximation of the values at a generally increased contamination level.

In the **Common Tern**, contamination patterns of Hg, PCB, HCB and DDT identified in 2011 were in general rather similar to those in 2010, showing peak values at Elbe and, in case of PCB, at Delfzijl. In contrast to 2010, a further PCB peak was recorded at Balgzand, indicating a potential influx of contaminants via the river Rhine. For the mentioned substances, the spatial contamination pattern had remained more similar than in the Oystercatcher. However, in HCB and DDT, concentrations measured in 2011 were clearly higher than in 2010 at many sites. In HCH, a prominent concentration peak was again recorded at the river Elbe whereas concentration values in the western Wadden Sea except Balgzand were clearly lower than in the previous year. After concentration increases in Chlordanes, peak values were recorded in 2011 at Schiermonnikoog, at Jade and Halligen, whereas concentrations had strongly approximated the detection limit in 2010.

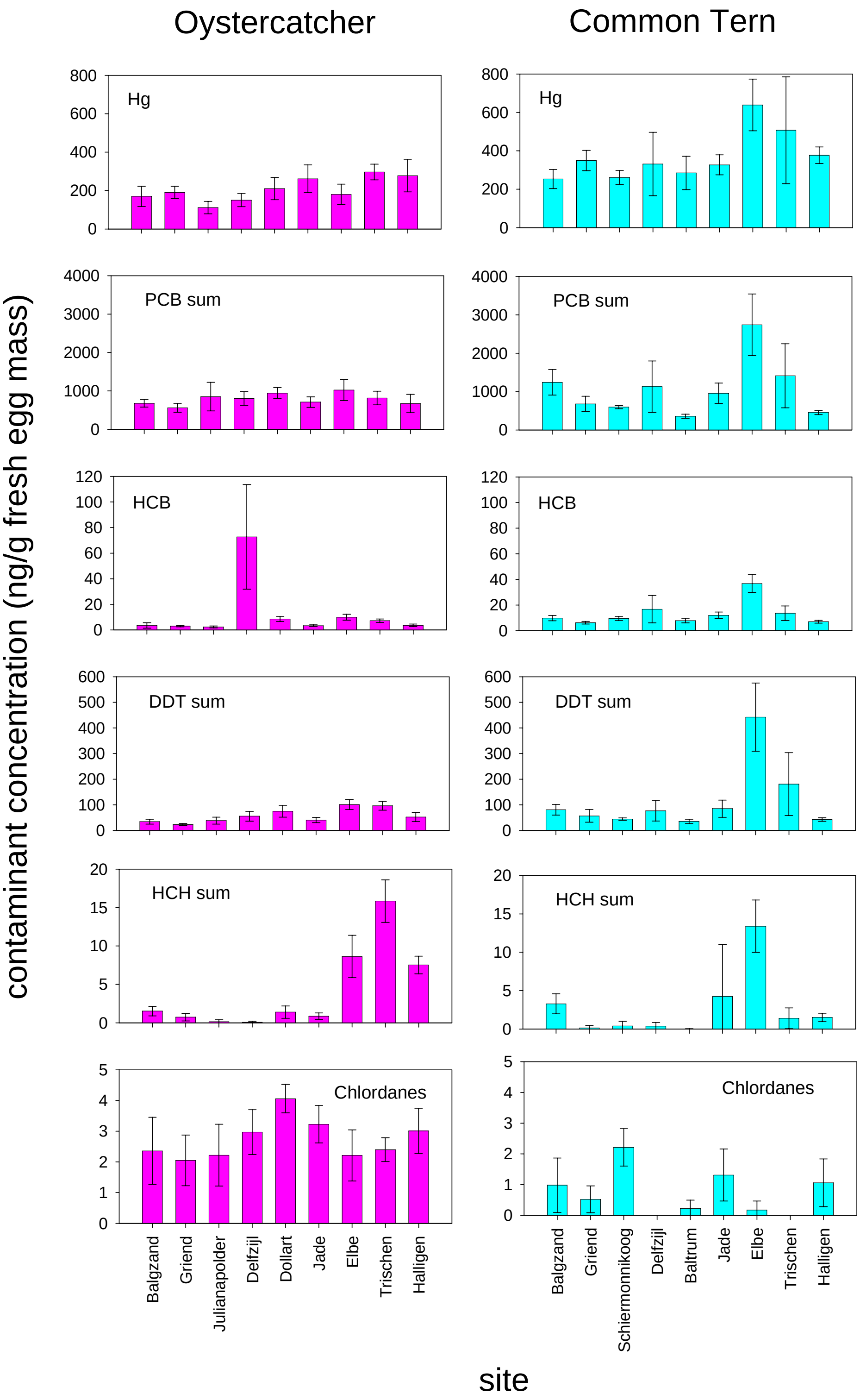

Fig. 5.1.1: Spatial patterns of pollutant concentrations in Oystercatcher and Common Tern eggs from the Wadden Sea in 2011

5.2 Annual variation in pollutant concentration in the period 2007-2011

Balgzand

Temporal Trends 2007-2011:

Oystercatcher	Significant **increases** were detected in HCH.
Common Tern	Significant **decreases** were detected in Hg, HCB and HCH.

In 2011, a significantly **lower** Hg level and **higher** levels of PCB, DDT, HCH and Chlordanes than in 2010 were found in Oystercatcher eggs. In Common Tern eggs, concentration of Hg was **lower**, concentrations of PCB, HCB, DDT and Chlordanes were **higher** in 2011 compared to 2010.

Griend

Temporal Trends 2007-2011:

Oystercatcher	Significant **decreases** were detected in Hg and Clordanes, a significant increase occurred in HCB.
Common Tern	Significant **decreases** were detected in PCB and Chlordanes, a significant increase was found in Hg.

Between 2010 and 2011, HCH concentrations **decreased**, Hg, PCB, DDT and Chlordane levels **increased** in Oystercatcher eggs. In Common Tern eggs, the levels of Hg and HCH **decreased** in that period.

Julianapolder/Schiermonnikoog

Temporal Trends 2007-2011:

Oystercatcher	Significant **decreases** in the concentrations of Hg and Chlordanes were identified at Julianapolder.
Common Tern	Significant **increases** in the concentrations of HCB and HCH were identified at Schiermonnikoog.

In Oystercatcher eggs from 2011 sampled at Julianapolder, the level of HCH was significantly lower, those of DDT and Chlordanes were significantly higher than in 2010. In Common Tern eggs from 2011 sampled at Schiermonnikoog, the concentrations of Hg and HCH were significantly lower than in 2010, those of HCB and Chlordanes were significantly higer.

Delfzijl

Temporal Trends 2007-2011:

Oystercatcher	HCB **increased**.
Common Tern	HCB **increased.**

Between 2010 and 2011, HCH decreased, HCB and Chlordanes increased in Oystercatcher eggs. Number of Common Tern eggs sampled in 2010 was below five, so no statistical comparison of the two years was possible.

Mean contamination values for the different substance groups in the period 2007-2011 are given in Figures 8.2.1-8.2.6 in the Appendix. A summarizing overview of short-term (2010-2011) and mid-term (2007-2011) temporal changes in the Dutch and German Wadden Sea is given in Tables 5.2.1 and 5.2.2.

Table 5.2.1: Overview over the development of selected pollutants in eggs of Oystercatcher and Common Tern in the Wadden Sea from 2007-2011, according to Spearman rank correlations. -: significant decline, +: significant increase.

	Oystercatcher									Common Tern								
	Balgzand	Griend	Julianapolder	Delfzijl	Dollart	Jade	Hullen	Trischen	Halligen	Balgzand	Griend	Schiermonnikoog	Delfzijl	Baltrum	Jade	Neufelderkoog	Trischen	Halligen
Hg		-	-		+		-			+	+			+	+		+	
PCB sum						+	+	+			-						+	
HCB		+		+	+	+		+	+	+		+	+	+	+		+	+
DDT sum						+	+	+	+						+		+	+
HCH sum	+					+	+	+	+	+		+					+	
Chlordane Nonachlor sum		-	-					-			-				+			

Table 5.2.2: Overview over the development of selected pollutants in eggs of Oystercatcher and Common Tern in the Wadden Sea from 2010-2011, according to Mann-Whitney-U-tests. -: significant decline, +: significant increase. Oystercatcher samples from Trischen and Common Tern samples from Delfzijl too low for statistical comparison in 2010.

	Oystercatcher								Common Tern							
	Balgzand	Griend	Julianapolder	Delfzijl	Dollart	Jade	Hullen	Halligen	Balgzand	Griend	Schiermonnikoog	Baltrum	Jade	Neufelderkoog	Trischen	Halligen
Hg	-	+						-	-	-	-		-		-	-
PCB sum	+	+						+	+			+				+
HCB				+	+		+	+	+		+	+		+	+	
DDT sum	+	+	+					+	+			+				+
HCH sum	+	-	-	-	-	-	+	+		-	-	+		-		+
Chlordane Nonachlor sum	+	+	+	+	+	+	+	+	+		+	+			+	+

6. General Assessment

In the Oystercatcher, the absolutely highest or second highest concentrations of five from six contaminant groups were found at Elbe or Trischen as in the previous year. But in contrast to 2010, these peaks were in many cases only marginally higher than at the further sites. This was mainly due to concentration increases at these other sites.
In the Common Tern, clearly prominent concentration peaks of all contaminants except Chlordanes were found again at Elbe. Consequently, a continuous decrease of pollution was recorded with increasing distance from the Elbe estuary which is in accordance to the observations from the previous years.

In general, the species-specific spatial contamination patterns remained similar to those recorded in 2010: The contamination pattern of the Common Tern showed again clear concentration peaks at the Elbe, that of the Oystercatcher indicated again a clear HCB peak at Delfzijl and a HCH peak at Trischen. The species-specific patterns may have been influenced by differences in the feeding ecology, with the Oystercatcher possibly foraging to a higher degree in terrestrial habitats at some sites. This might explain why in particular at the river Elbe, no maximum concentrations have been found in the Oystercatcer but in the Common Tern. Furthermore, for the benthic feeding Oystercatcher, contaminants bond to sediment particles which might have been transported previously are problably more important than for the pelagic feeding Common Tern. In addition, the partly whole-year presence of the Oystercatcher in the Wadden Sea might have affected the contamination patterns recorded. In general, the data underline the importance of the large rivers Elbe and Ems for the influx of several contaminants into the Wadden Sea. For Hg, PCB, HCB and DDT, contamination levels tended to be higher in the Common Tern than those in the Oystercatcher (except in HCB at Delfzijl), reflecting the slightly higher trophic level of the piscivorous Common Tern with an even more effective bioaccumulation of pollutants. However, for HCH at Trischen and Halligen, contamination was clearly higher in the Oystercatcher, the same was true for Chlordanes at most study sites.

During the five-year-period 2007-2011, contamination decreases were recorded only in single cases: In the Oystercatcher, Hg decreased at Griend, Julianapolder and Hullen, Chlordanes decreased at Griend, Julianapolder and Trischen. In the Common Tern, the only mid-term decreases were recorded in PCB and Chlordanes at Griend. In total, a clearly higher number of contaminant increases than of decreases was recorded: In the Oystercatcher, HCB increased at six, HCH at five, DDT at four, PCB at three and Hg at one of the nine sampled sites (in total 19 increases). In particular the sites in the eastern and north-eastern part of the Wadden Sea was affected by increasing contamination. Most increases (four of six substance groups) were recorded at Jade and Trischen. In the Common Tern, HCB increased at seven, Hg at five, DDT and HCH at three and PCB and Chlordanes at each one of the nine study sites (in total 20 increases). As in the Oystercatcher, increases were recorded most frequently at Jade (four substance groups) and at Trischen (five substance groups).
When comparing the year 2011 with 2010, again clearly more contamination increases (23) than decreases (7) were recorded: Chlordanes increased at all nine, HCB and DDT at four, PCB and HCH at three and Hg at one study site. Most increases were recorded at Halligen (five substance groups), at Balgzand and Gried (each four substance groups). In contrast, HCH decreased at five and Hg at two of the nine sites.
Also in the Common Tern, more contamination increases (18) than decreases (9) were recorded. HCB and Chlordanes increased at five, PCB and DDT at three and HCH at two study sites. These took mainly place at Baltrum (five substance groups), Balgzand and Halligen (each four substance groups). In contrast, Hg decreased at six, HCH at three of the eight study sites for which samples were sufficient to allow a statistical comparison of the two years.
The results indicate that both short-term and longer-term analyses are necessary to describe adequately the changes in environmental pollution of the Wadden Sea. Whereas the last report describes mainly significant mid-term decreases of most substance groups but indicates already contamination increases at many sites on the short-term, this study indicates that that those short-term increases have continued in 2011 in many cases. Future date might show if the short-term (2010-2011) and mid-term (2007-

2011) increases reported in this study indicate an undesired trend reversal or if this development represents contaminant fluctuations around an establishing level (cf. Becker & Dittmann 2009).

Summarizing, the actual results of the data from 2011 indicate similar species-specific spatial contamination patterns as in the previous years. Whereas the Elbe is again the most prominent site of contamination in the Common Tern, in the Oystercatcher particularly high concentrations of HCB and HCH have been found at Delfzijl and, respectively, at Trischen. In the Oystercatcher, the contamination peaks were less protruding than in the previous years, which was mainly caused by contamination increases in formerly comparatively low polluted areas. On the mid-term, contamination increases in the Oystercatcher were mainly found in the eastern and northeastern Wadden Sea. In the Common Tern, increases of several substance groups were found at many sites throughout the Wadden Sea. Also when comparing the year 2011 with the previous one, clearly more contamination increases than decreases were recorded. Both on the short- and mid-term, HCB has clearly increased in both species throughout the Wadden Sea. In this context, especially the continuous increase of HCB in the Oystercatcher at Delfzijl has to be mentioned where HCB has reached maximum values of HCB for many years and where HCB concentrations have increased by a factor of more than seven in the Oystercatcher between 2007 and 2011. A slowlier increase was also observed in the Common Tern. Also Chlordanes were increasing throughout the Wadden Sea in both study species on the short-term. In addition, at many sites, short and mid-term increases of DDT and HCH were recorded. In the Common Tern, Hg showed mid-term increases, even if at most sites, a short-term decrease was observed. Future data may show if the recent increases of many contaminants reflect an undesired reversal of the former, decreasing trend or if these developments still reflect fluctuations around an establishing level. This is also of interest on the background of the Environmental Quality Objectives (EcoQOs) defined by OSPAR in recent years for coastal bird eggs from the North Sea area (Dittmann et al. 2011).

7. Literature

Becker, P.H. & T. Dittmann (2010): "Contaminants in Bird Eggs" in the Wadden Sea: Trends and Perspectives. Proc. 12th Intern. Scientific Wadden Sea Symposium, Wilhelmshaven. Common Wadden Sea Secretariat, Wilhelmshaven, Germany.

Becker P.H. & T. Dittmann (2009): Contaminants in Bird Eggs. Thematic Report No. 5.2. In: Marencic, H. & Vlas, J. de (Eds.), 2009. Quality Status Report 2009. Wadden Sea Ecosystem No. 25. Common Wadden Sea Secretariat, Trilateral Monitoring and Assessment Group, Wilhelmshaven, Germany.

Becker, P.H., & J. Muñoz Cifuentes (2004): Contaminants in birds eggs: recent spatial and temporal trends. In: Wadden Sea Ecosystem No. 18, 5-25. Common Wadden Sea Secretariat, Wilhelmshaven.

Becker, P.H., J. Muñoz Cifuentes (2005): Contaminants in Birds Eggs. Chapter 4.5. In: Essink,K., Dettmann,C., Farke, H., Laursen, K., Lüerßen, G., Marencic, H., Wiersinga, W. (Eds.) Wadden Sea Quality Status Report 2004. Wadden Sea Ecosystem No. 19. Trilateral Monitoring and Assessment Group, Common Wadden Sea Secretariat, Wilhelmshaven, Germany: 123-128.

Becker, P.H., J. Muñoz Cifuentes, B. Behrends & K.R. Schmieder (2001): Contaminants in Bird Eggs in the Wadden Sea – Spatial and Temporal Trends 1991 – 2000. Wadden Sea Ecosystem 11. Common Wadden Sea Secretariat Wilhelmshaven: 68 pp.

Becker, P.H., S. Schuhmann & C. Koepff (1993): Hatching failure in Common Terns (*Sterna hirundo*) in relation to environmental chemicals. Environ. Pollut. 79: 207-213.

Dittmann, T., Becker, P.H., Bakker, J., Bignert, A., Nyberg, E., Pereira, M.G., Pijanowska, U., Shore, R., Stienen, E.W.M., Toft, G.O. & Marencis, H. 2011. The EcoQO on mercury and organohalogens in coastal bird eggs: report on the pilot study 2008-2010. (INBO.R.2011.43). Research Institute for Nature and Forest, Brussel: 74 S.

Muñoz Cifuentes, J. (2004): Seabirds at risk? Effects of environmental chemicals on reproductive success and mass growth of seabirds breeding at the Wadden Sea in the mid 1990s. Wadden Sea Ecosystem No. 18.

OSPAR, 1997. Oslo and Paris Conventions for the Prevention of Marine Pollution. Joint meeting of the Oslo and Paris Commissions, Brussels 2-5 September 1997. Summary record OSPAR 97/15/1

Sommer, U., K.R. Schmieder & P.H. Becker (1997): Untersuchung von Seevogeleiern auf chlorierte Pestizide, PCB's und Quecksilber. BIOforum 20 (3/97): 68-72.

Van den Berg, M., Birnbaum, L., Bosveld, A.T.C., Brunström, B., Cook, P., Feeley, M. Giesy, J.P., Hanberg, A., Hasegawa, R., Kennedy, S.W., Kubiak, T., Larsen, J.C., Rolaf van Leeuwen, F.X., Liem, A.K.D., Nolt, C., Peterson, R.E., Poellinger, L., Safe, S., Schrenk, D., Tillit, D., Tysklind, M., Younes, M., Waern, F. and Zacharewski, T., 1998. Toxic equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife. Environ. Health Perspect. 106(12): 775-792.

Verein Deutscher Ingenieure (VDI) (2009): VDI Richtlinien – Biological procedures to determine effects of air pollutants (bioindication). Biomonitoring with bird eggs as accumulative and reactive indicators. VDI 4230, Part 3. Verein Deutscher Ingenieure, Düsseldorf.

This report was compiled by Tobias Dittmann, Ursula Pijanowska and Peter H. Becker.

Wilhelmshaven, 06 February 2012

(Prof. Dr. Peter H. Becker)

8. Appendix

8.1 Concentrations of selected contaminants in eggs of Oystercatcher and Common Tern at different sites of the Dutch Wadden Sea 2011

Table 8.1.1: Concentrations of chemicals in Oystercatcher and Common Tern eggs sampled in The Netherlands in 2011. Mean concentrations in ng · g $^{-1}$ (fresh mass of egg content), standard deviations and number of samples are presented.

	Balgzand	Griend	Julianapolder	Delfzijl
Oystercatcher	**(N=10)**	**(N=10)**	**(N=10)**	**(N=10)**
Hg	169,8 ± 73,9	190,3 ± 45,1	111,2 ± 45,5	149,9 ± 47,4
6 PCB (law)	294,5 ± 68,2	261,8 ± 78,2	374,2 ± 230,0	365,9 ± 113,5
PCB sum	679,3 ± 139,9	561,4 ± 161,6	852,3 ± 520,4	804,5 ± 244,1
HCB	3,5 ± 2,9	3,0 ± 0,9	2,3 ± 1,0	72,7 ± 57,1
ppDDE	32,5 ± 13,0	21,6 ± 5,6	36,9 ± 19,0	52,4 ± 25,5
ppDDT	0,2 ± 0,5	0,0 ± 0,0	0,2 ± 0,5	1,3 ± 1,0
ppDDD	1,4 ± 0,2	1,1 ± 0,1	1,4 ± 0,1	1,8 ± 0,5
DDT sum	34,1 ± 12,9	22,7 ± 5,7	38,4 ± 19,0	55,6 ± 26,6
alpha-HCH	0,0 ± 0,0	0,3 ± 0,2	0,0 ± 0,0	0,1 ± 0,2
beta-HCH	1,5 ± 0,9	0,4 ± 0,6	0,2 ± 0,4	0,0 ± 0,0
gamma-HCH	0,0 ± 0,0	0,0 ± 0,1	0,0 ± 0,0	0,0 ± 0,0
HCH sum	1,5 ± 0,9	0,7 ± 0,7	0,2 ± 0,4	0,1 ± 0,2
Chlordane sum	2,4 ± 1,5	2,1 ± 1,2	2,2 ± 1,4	3,0 ± 1,0

	Balgzand	Griend	Schiermonnikoog	Delfzijl
Common Tern	**(N=10)**	**(N=10)**	**(N=9)**	**(N=4)**
Hg	252,9 ± 69,4	349,5 ± 74,0	261,0 ± 48,4	331,7 ± 103,7
6 PCB (law)	525,6 ± 198,1	296,2 ± 125,3	249,3 ± 22,8	518,7 ± 174,6
PCB sum	1241,1 ± 462,0	680,2 ± 278,2	596,4 ± 50,1	1128,7 ± 420,9
HCB	9,8 ± 2,9	6,2 ± 1,5	9,5 ± 2,2	16,8 ± 6,7
ppDDE	77,7 ± 27,9	54,6 ± 32,9	42,1 ± 5,6	74,2 ± 24,8
ppDDT	0,3 ± 0,6	0,4 ± 1,2	0,1 ± 0,2	0,0 ± 0,0
ppDDD	2,4 ± 1,6	1,7 ± 0,5	2,0 ± 0,7	2,1 ± 0,7
DDT sum	80,4 ± 29,2	56,7 ± 34,1	44,2 ± 5,9	76,3 ± 24,9
alpha-HCH	0,1 ± 0,2	0,0 ± 0,0	0,0 ± 0,0	0,4 ± 0,3
beta-HCH	3,1 ± 1,9	0,2 ± 0,5	0,4 ± 0,8	0,0 ± 0,0
gamma-HCH	0,1 ± 0,4	0,0 ± 0,0	0,0 ± 0,0	0,0 ± 0,0
HCH sum	3,3 ± 1,8	0,2 ± 0,5	0,4 ± 0,8	0,4 ± 0,3
Chlordane sum	1,0 ± 1,2	0,5 ± 0,6	2,2 ± 0,8	0,0 ± 0,0

8.2 Temporal trends of pollutant concentrations at different sites during 2007-2011

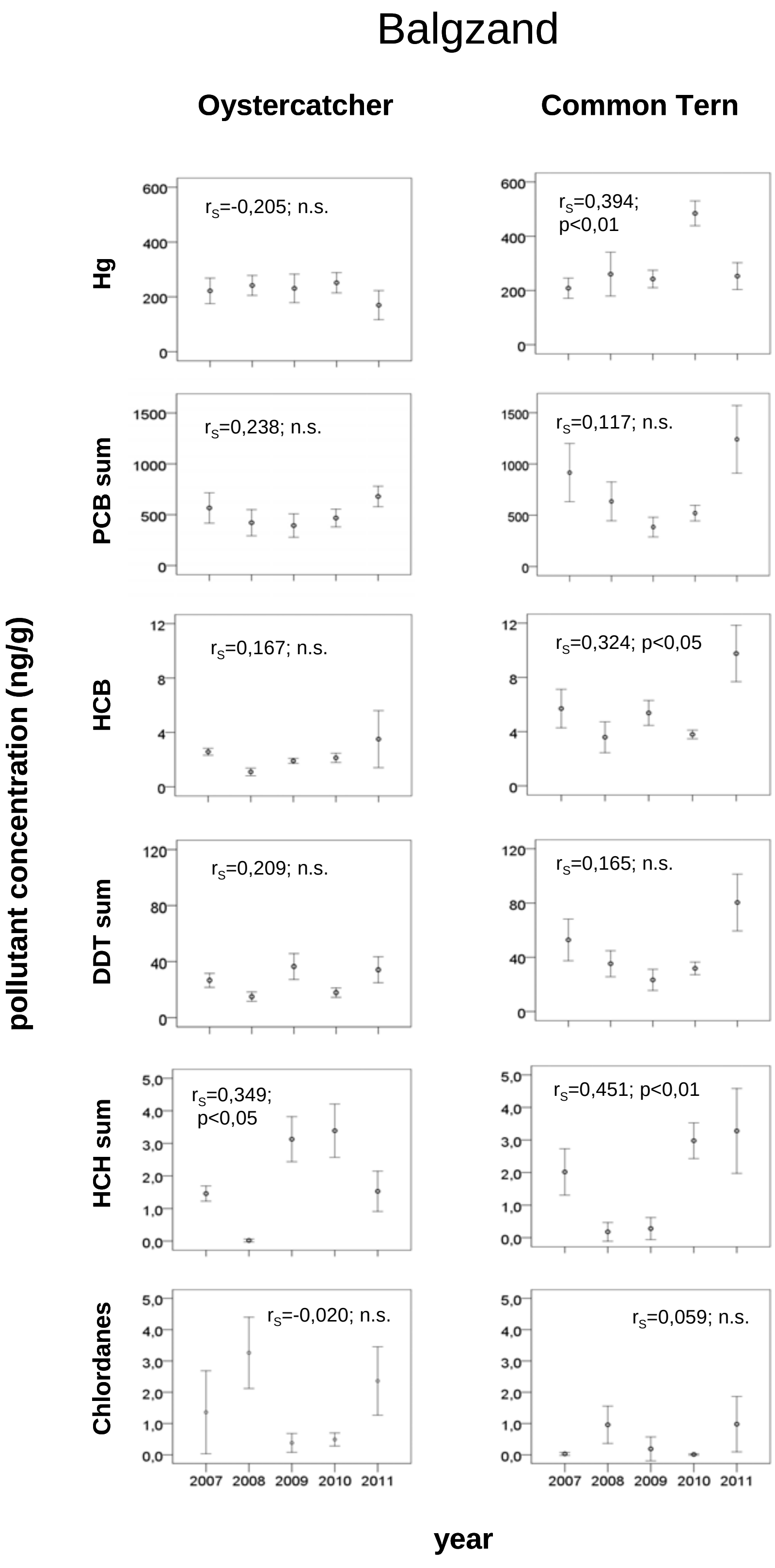

Fig. 8.2.1: Temporal development of pollutant concentrations in Oystercatcher and Common Tern eggs from Balgzand, NL, in the period 2007-2011. Arithmetic means are given with the 95% confidence interval.

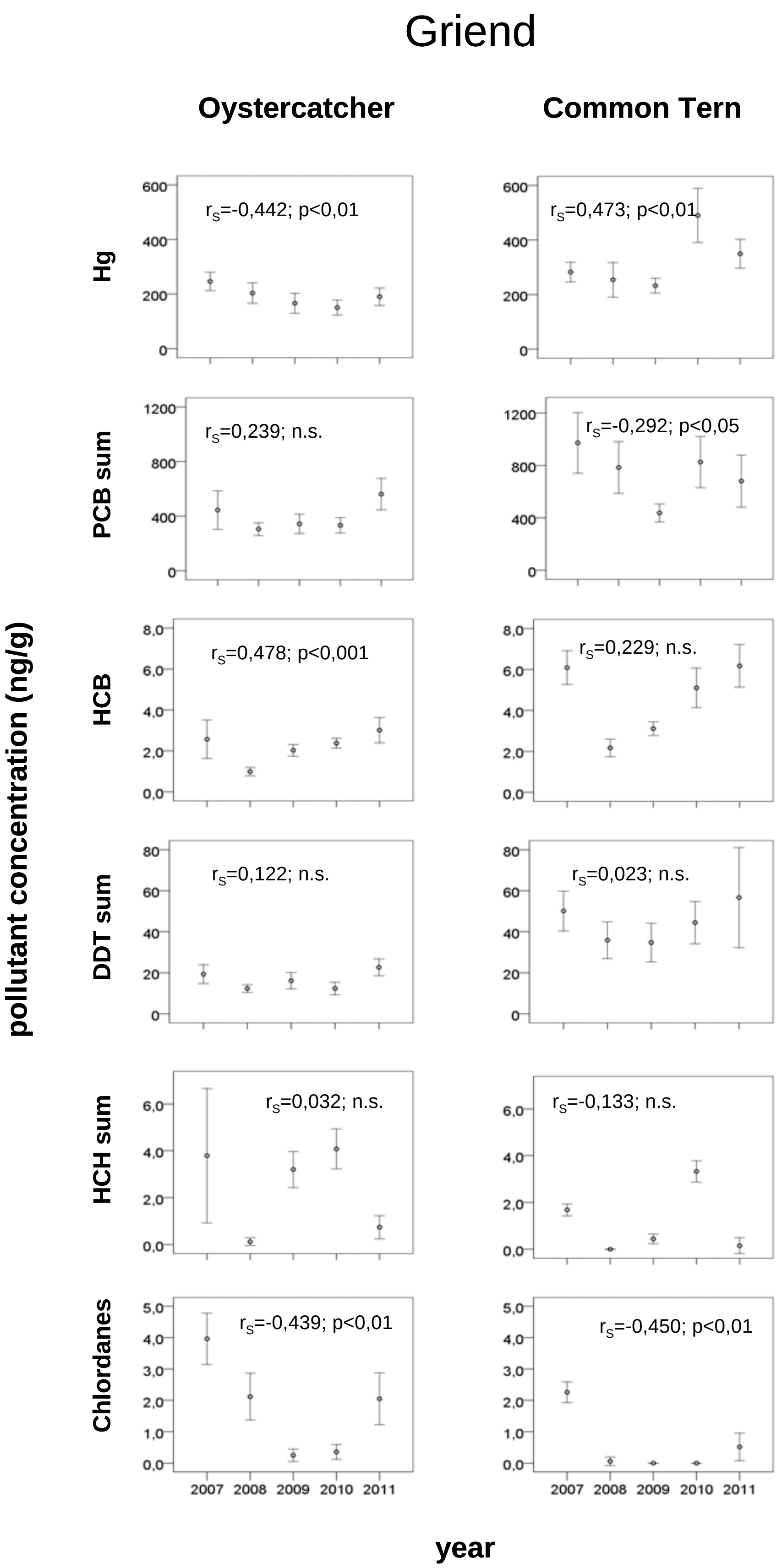

Fig. 8.2.2: Temporal development of pollutant concentrations in Oystercatcher and Common Tern eggs from Griend, NL, in the period 2007-2011. Arithmetic means are given with the 95% confidence interval.

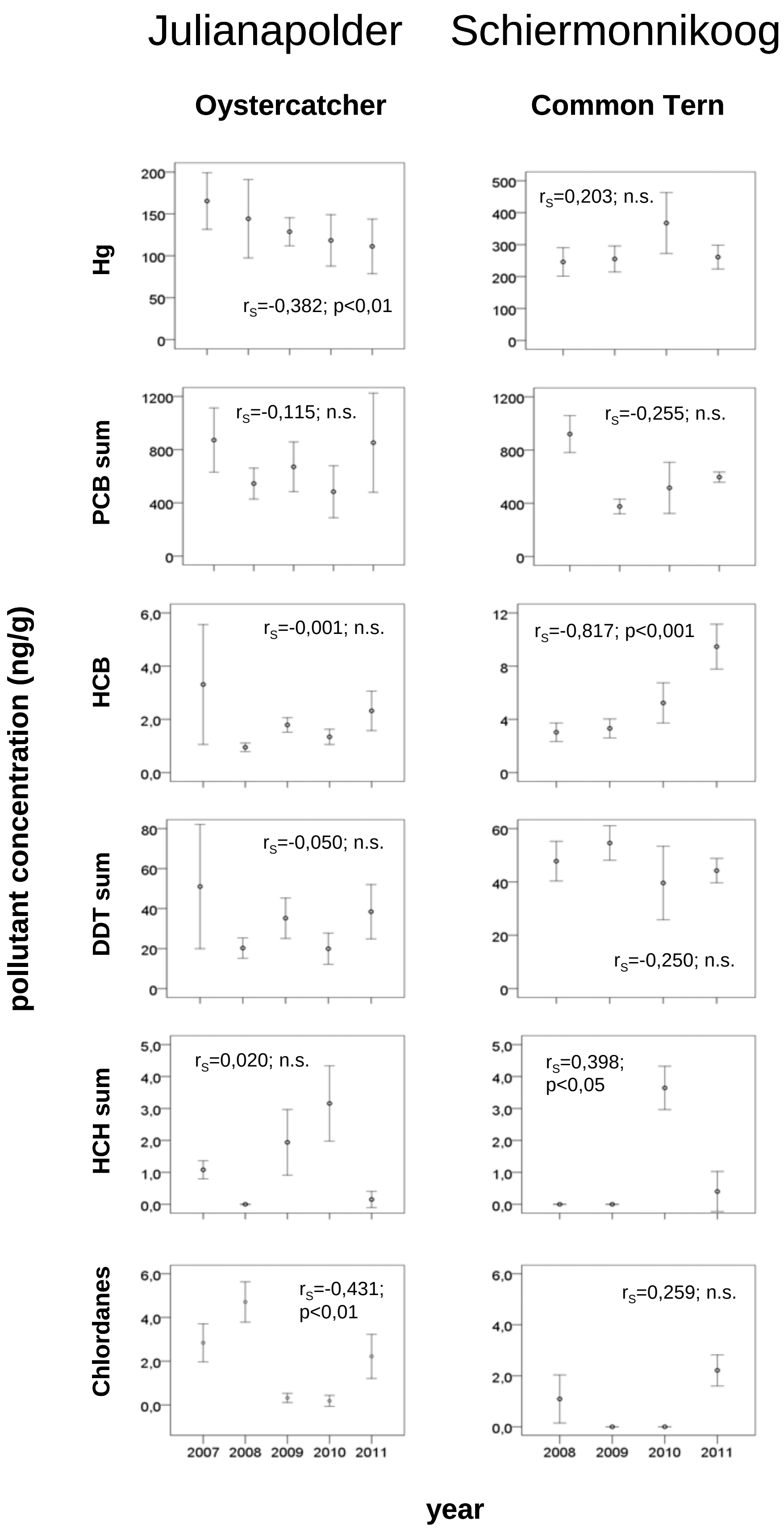

Fig. 8.2.3: Temporal development of pollutant concentrations in Oystercatcher eggs from Julianapolder and in Common Tern eggs from Schiermonnikoog, NL, in the period 2007-2011. Arithmetic means are given with the 95% confidence interval.

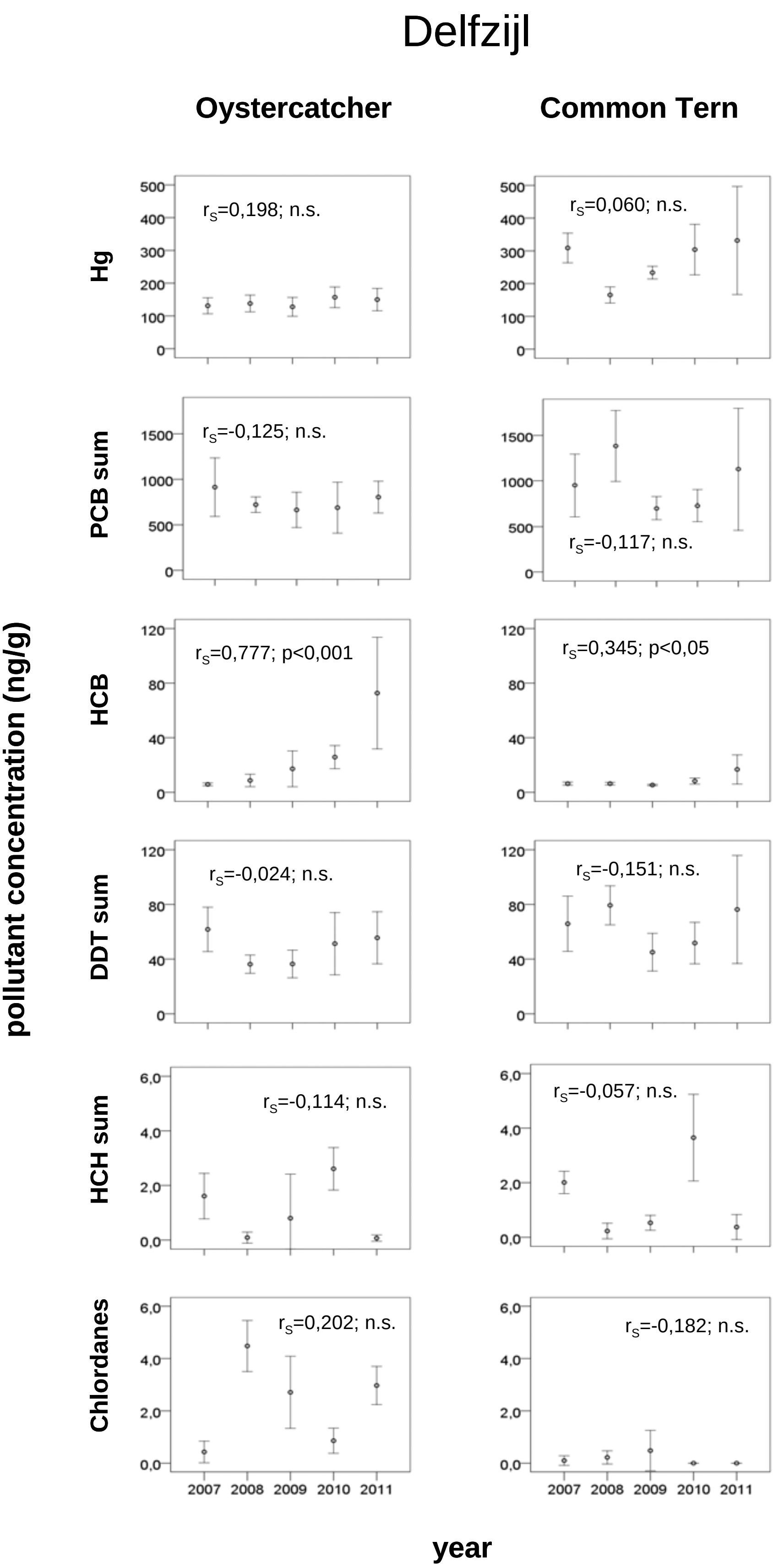

Fig. 8.2.4: Temporal development of pollutant concentrations in Oystercatcher and Common Tern eggs from Delfzijl, NL, in the period 2007-2011. Arithmetic means are given with the 95% confidence interval.