4.5 Contaminants in Bird Eggs

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4.5.1 Introduction

Since 1998, the parameter 'Contaminants in Bird Eggs' has been implemented in the Trilateral Monitoring and Assessment Program (TMAP) (Becker *et al.* 2001). Each spring, eggs of the common tern and oystercatcher were sampled from a total of 13 breeding colonies in the Wadden Sea (Figure 4.5.1). In these eggs concentrations of mercury, polychlorinated biphenyls (PCBs) and a number of organochlorines, including pesticides, were determined. This contribution presents and evaluates the latest levels of contaminants in bird eggs from the Wadden Sea and their recent trends as reported in more detail in Becker and Muñoz Cifuentes (2004). We focus on the geographical variation of contamination from The Netherlands to Denmark in 2002, and on temporal trends for three periods, *viz.* 1998–2003, 1991–2003 and 1981–2003. For the first time, temporal trends of chlordane levels, which have been analyzed since 1998, are presented.

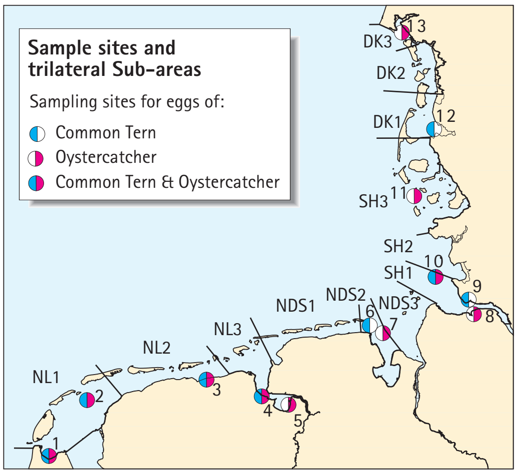

Figure 4.5.1: Sampling sites and geographical variation of the contaminants analyzed in common tern and oystercatcher eggs in the Wadden Sea in 2002. The Netherlands: 1 Balgzand, 2 Griend, 3 Julianapolder, 4 Delfzijl; Germany, Niedersachsen: 5 Dollart, 6 Minsener Oog, 7 Mellum (6 and 7 = Jade), 8 Hullen, 9 Neufelderkoog (8 and 9 = Elbe estuary); Germany, Schleswig Holstein: 10 Trischen, 11 Norderoog; Denmark: 12 Margrethekoog, 13 Langli. At sites 5, 7, 8, 11 and 13 only oystercatcher eggs, at sites 6, 9 and 12 only common tern eggs were taken; at all other sites eggs of both species were collected.

4.5.2 Geographical trends

The results presented in Figure 4.5.2 reveal that in 2002 the central part of the German Wadden Sea, and the Elbe estuary in particular, still are the hot spots for chemical contamination. The lowest residue levels in eggs of common tern and oystercatcher were recorded in the Danish Wadden Sea. Within the Dutch Wadden Sea, the concentrations of most chemicals (mercury, PCBs, DDT, and chlor-

Common tern breeding pair (Photo: Dietrich Frank)

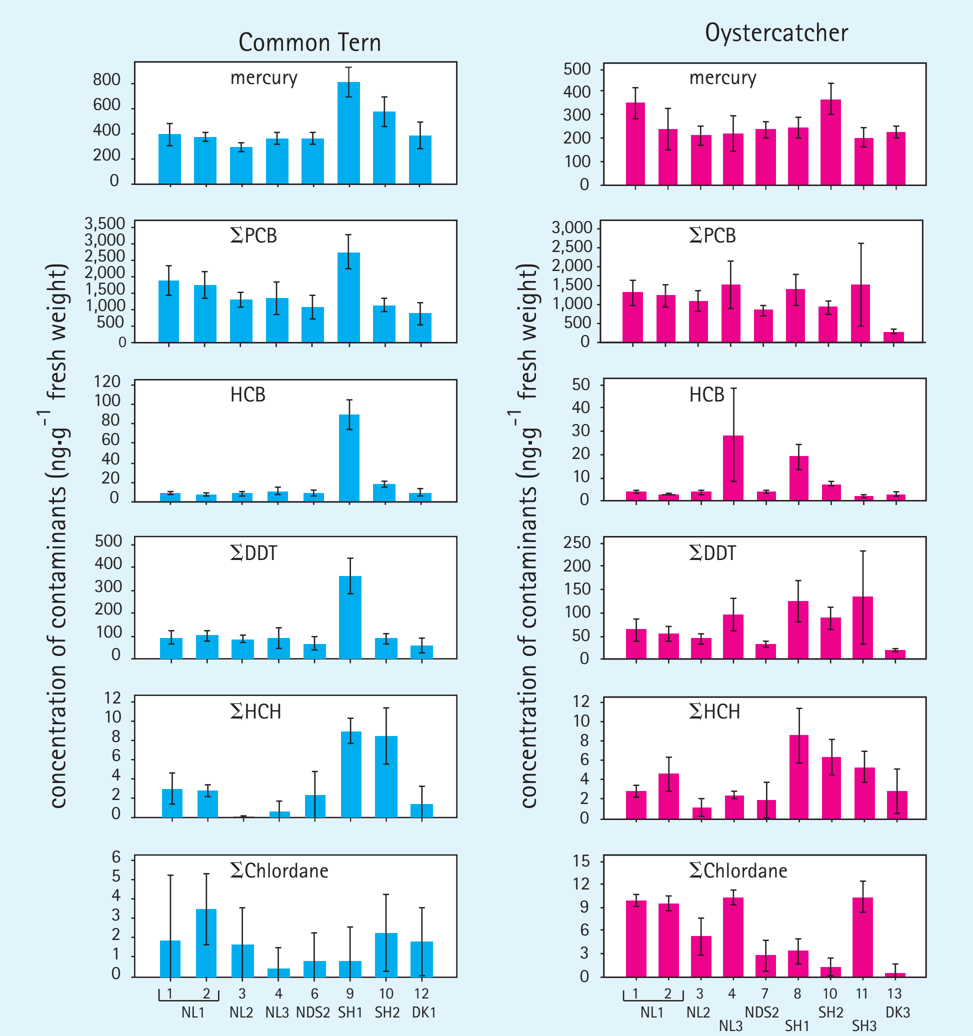

Figure 4.5.2: Geographical variation of the contaminants analyzed in common tern and oystercatcher eggs in the Wadden Sea in 2002. The Netherlands: 1 Balgzand, 2 Griend, 3 Julianapolder, 4 Delfzijl; Germany, Niedersachsen: 5 Dollart, 6 Minsener Oog, 7 Mellum (6 and 7 = Jade), 8 Hullen, 9 Neufelderkoog (8 and 9 = Elbe estuary); Germany, Schleswig Holstein: 10 Trischen, 11 Norderoog; Denmark: 12 Margrethekoog, 13 Langli. At sites 5, 7, 8, 11 and 13 only oystercatcher eggs, at sites 6, 9 and 12 only common tern eggs were taken; at all other sites eggs of both species were collected. Mean concentration (ng·g^{-1} fresh weight of egg content) and 95% confidence intervals are presented. At most sites, n=10 eggs per species were analyzed.

danes) decreased from west to east. For PCBs and chlordanes, this spatial trend continued towards the north-eastern Wadden Sea, indicating pollutants mainly originating from southwest sources (*e.g.* Rhine). In addition, the Ems estuary was recognized as a pathway discharging contaminants into the Wadden Sea, which was reflected by higher levels of HCB and chlordanes in oystercatcher eggs.

4.5.3 Temporal development

An overview of temporal trends as observed in the periods 1991-2003 and 1998-2003 is presented in Figure 4.5.3 and Table 4.5.1. When considering the data from 1981–2003 for the central German Wadden Sea, it is noted that residue levels in eggs of common cern and oystercatcher have decreased markedly since the beginning of the 1990s, especially regarding mercury, ΣPCB, HCB and ΣHCH (Figure 4.5.4). During the 1990s, these levels were roughly less than half of those observed in the previous decade. Since the mid 1990s, however, the decrease of egg concentrations seemed to have stagnated at levels still above the target concentrations. The data from 1998–2003 surprisingly reveals a recent increase of the concentration levels of some of the pollutants (Figure 4.5.3, Table 4.5.1; *e.g.* mercury: Balgzand, Jade, Trischen, Langli; ΣPCB: Dutch Wadden Sea, Jade; ΣDDT: Dutch Wadden Sea, Elbe). Chlordane concentrations in eggs of common tern and oystercatcher seem to show an overall increase at most sampling locations.

Concomitant with the overall decreasing concentration levels of contaminants in bird eggs, the strong inter-site and inter-specific differences as present during the 1980s have also decreased (Figure 4.5.5).

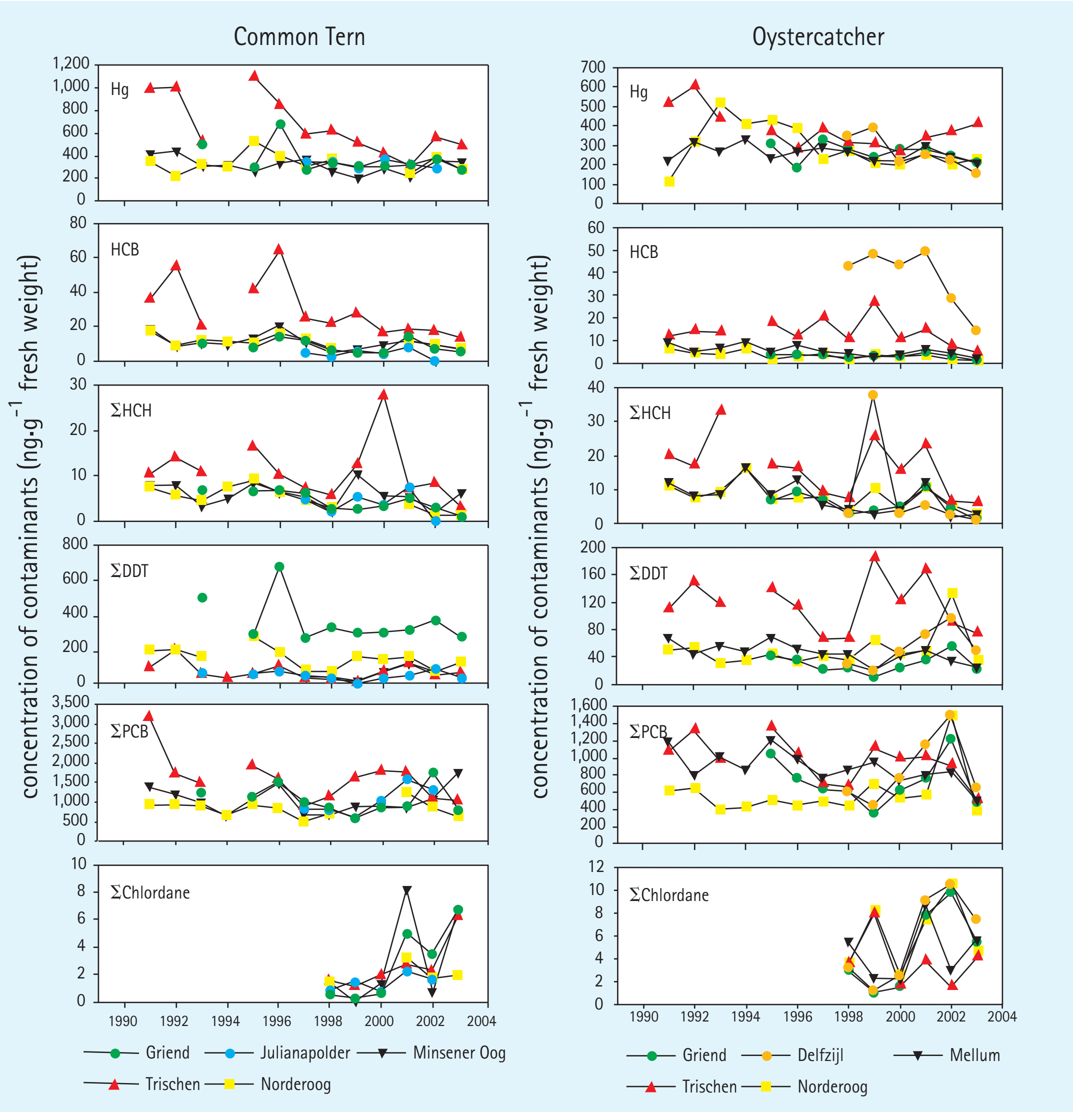

Figure 4.5.3: Temporal trends of mercury, HCB, sum of HCH-isomers (ΣHCH), sum of DDT and its metabolites (ΣDDT), sum of PCB congeners (ΣPCB), and sum of cis- and trans-chlordane, cis- and trans-nonachlor (ΣChlordane) concentrations in eggs of common tern (left) and oystercatcher (right) from selected sampling sites in 1991-2003. Arithmetric means ($ng \cdot g^{-1}$ fresh weight of egg content).

4.5.4 Ecotoxicological aspects

The current levels of contaminants in bird eggs were generally below the known critical concentrations for birds' reproduction. Hatching success of the common tern at relatively high and low contaminated sites at the German Wadden Sea coast did not differ (Thyen *et al.*, 1998; Becker *et al.*, 2003). More recently, Muñoz Cifuentes (2004) presented data from the mid 1990s suggesting that at the Elbe estuary reproductive success of the common tern, common gull and herring gull was affected by organochlorine contamination. Monitoring of birds' breeding success is not included in the TMAP Common Package of monitoring parameters.

4.5.5 Target evaluation

The available data on concentrations of contaminants in bird eggs indicates that the burden of pollutants in the Wadden Sea is slowly proceeding towards the Wadden Sea Plan Targets. On the other hand, the stagnation and, more recently, some increases, point to local problems from recent anthropogenic discharges. Among these are contaminants prohibited a long time ago, such as chlordanes.

The present concentrations of PCBs and DDT, especially in the eggs of common tern, are still very high in comparison with the proposed target levels, whereas for HCB and HCH the target may be reached fairly soon. In the case of mercury, the recent concentrations measured in eggs of oystercatcher and common tern, e.g. at the Elbe estuary, are still higher than target concentrations.

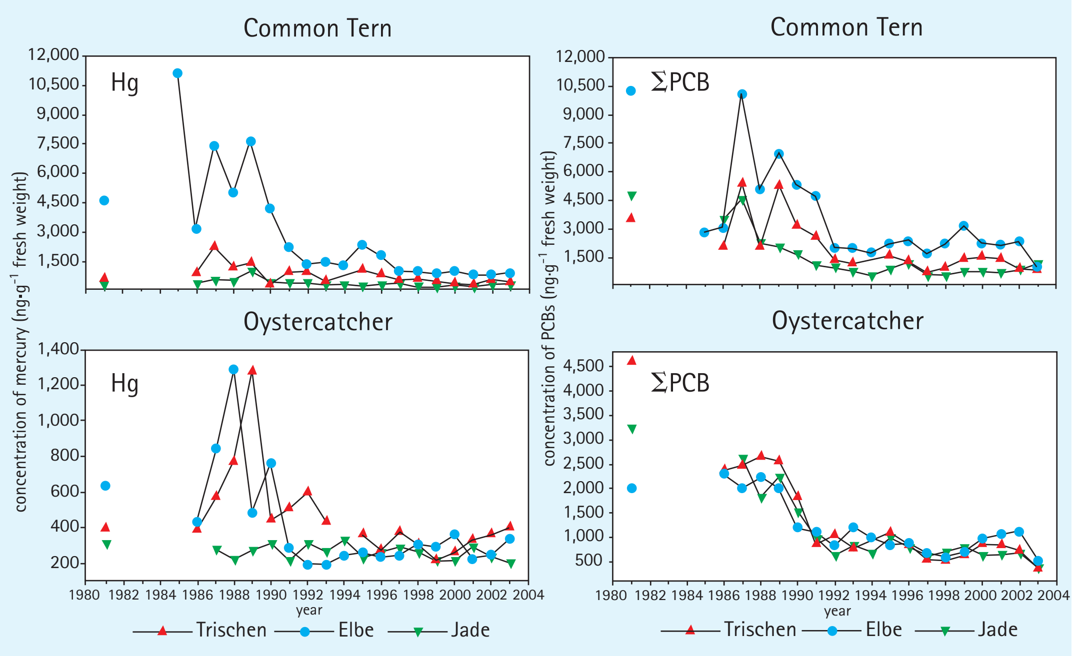

Figure 4.5.4: Temporal trends of concentrations of mercury (left) and PCB (right) (ΣPCB: sum of 32 PCB congeners; $ng \cdot g^{-1}$ fresh weight; arithmetic means) in eggs of common tern and oystercatcher from selected breeding sites in the central German Wadden Sea in 1981–2003. Data for 1981–1990 after Becker *et al.* (1991, 1992).

4.5.6 Conclusions

The monitoring of mercury and organochlorines in bird eggs in the TMAP has significantly contributed to the understanding of the dynamics and trends in levels of these hazardous chemicals in coastal birds in the Wadden Sea environment.

In 2002, the central part of the German Wadden Sea, and the Elbe estuary in particular, was still a hot spot for chemical contamination and supplementary inputs in the western part of the Wadden Sea were obvious.

Since the beginning of the 1990s, concentration levels of most contaminants decreased, leveling off in the mid-1990s. However, since 1998, the concentration levels of some chemicals have increased again, which may indicate new inputs or remobilization of these chemicals from sedimentary deposits.

Recent observations of coastal birds' reproductive success in the Elbe estuary underline the necessity of a continued effort to reduce anthropogenic inputs of hazardous chemicals into the Wadden Sea in order to avoid impacts on bird populations and the ecosystem.

4.5.7 Recommendations

Considering the current contamination status of bird eggs on the Wadden Sea coast and its recent development, we recommend:

- to continue the monitoring of the TMAP parameter 'Contaminants in Bird Eggs' in a long-term perspective, especially at the identified hot spots, in order to separate short term fluctuations from long-term trends and to use the parameter as an early warning of marine pollution by chemicals;
- to continue the monitoring of chemicals, such as chlordane and PCBs, which still remain in the environment although their use is prohibited by law;
- to supplement the geographical coverage of contaminant monitoring in bird eggs with an additional sampling site at the mouth of the Rhine; and
- to implement within the TMAP the parameter 'Breeding Success' providing a sensitive ecotoxicological indicator.

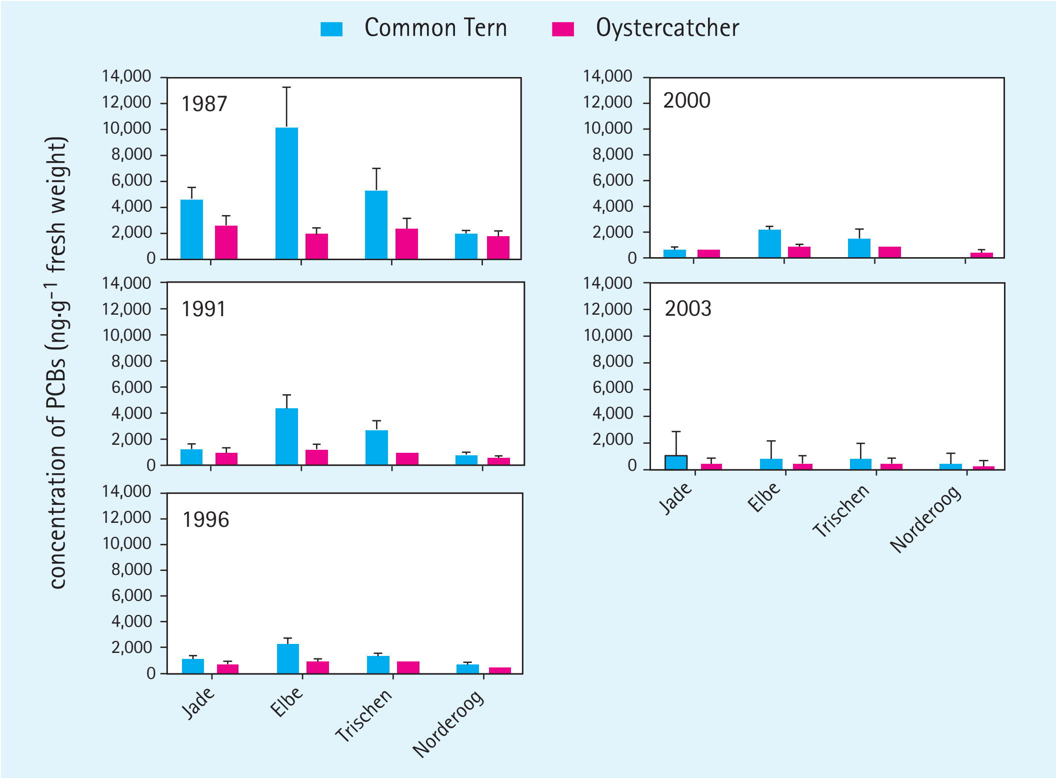

Figure 4.5.5: Temporal, spatial and interspecific variation in ΣPCB concentrations (sum of 32 congeners) in eggs of common tern and oystercatcher from selected breeding sites on the German Wadden Sea coast between 1987 and 2003. Mean concentration ($ng \cdot g^{-1}$ fresh weight of egg content) and 95% confidence intervals are presented.

Table 4.5.1:
Temporal trends in pollutant levels in Common Tern and Oystercatcher eggs for one or two time periods. Chlordanes studied since 1998. For significant trends, Spearman rank coefficients (rs) calculated on the basis of n eggs and p-values are presented. N.s.: not significant, *<0.05, **<0.01*<0.001. Positive trends are given in bold.**

		Hg	n	HCB	n	ΣPCB	n	ΣDDT	n	ΣHCH	n	ΣChlordane	n
Common Tern													
Balgzand	1998-2003	n.s.	60	n.s.	60	n.s.	60	0,278*	60	-0,528***	60	0,438***	60
Griend	1993-2003	-0,320**	100	-0,363***	100	n.s.	100	n.s.	100	-0,698***	100		
	1998-2003	n.s.	60	n.s.	60	0,282*	60	0,419**	60	n.s.	60	0,726***	60
Julianapolder	1998-2002	n.s.	33	n.s.	33	0,771***	33	0,647***	33	-0,653***	33	n.s.	33
Delfzijl	1998-2003	n.s.	60	-0,258*	60	n.s.	60	n.s.	60	-0,506***	60	0,318*	60
Minsener Oog	1991-2003	-0,251**	130	-0,334***	129	n.s.	130	-0,195*	130	-0,274**	130		
(Jade)	1998-2003	0,418**	60	0,291*	60	0,476***	60	0,418**	60	n.s.	60	0,418**	60
Elbe	1991-2003	-0,626***	135	-0,228**	135	-0,269**	135	n.s.	135	-0,250**	135		
	1998-2003	n.s.	60	-0,653***	60	-0,422**	60	n.s.	60	-0,601***	60	n.s.	60
Trischen	1991-2003	-0,548***	120	-0,448***	120	-0,387***	120	-0,352***	120	-0,355***	120		
	1998-2003	n.s.	60	-0,270*	60	n.s.	60	n.s.	60	-0,352**	60	0,382**	60
Norderoog	1991-2003	n.s.	109	-0,352***	110	-0,205*	110	-0,341***	110	-0,588***	110		
	1998-2003	n.s.	40	n.s.	40	-0,320*	40	n.s.	40	-0,478**	40	n.s.	40
Oystercatcher													
Balgzand	1998-2003	0,396**	60	-0,283*	60	n.s.	60	n.s.	60	-0,536***	60	0,654***	60
Griend	1994-2003	-0,278*	82	-0,315**	82	n.s.	82	n.s.	82	-0,389***	82		
	1998-2003	n.s.	60	n.s.	60	0,263*	60	0,408**	60	n.s.	60	0,620***	60
Julianapolder	1998-2003	-0,337*	58	-,448***	58	0,443***	58	0,533	58	-0,647***	58	0,634***	58
Delfzijl	1998-2003	-0,579***	60	-0,261*	60	0,460***	60	0,626***	60	-0,542***	60	0,682***	60
Dollart	1991-2003	n.s.	85	-0,322**	75	0,320**	75	n.s.	75	n.s.	75		
	1998-2003	-0,330*	36	0,600***	36	0,677***	36	0,716***	36	0,368*	36	0,414*	36
Mellum (Jade)	1991-2003	-0,276**	130	-0,562***	130	-0,359***	130	-0,494***	130	-0,625***	130		
	1998-2003	n.s.	60	n.s.	60	-0,381**	60	n.s.	60	-0,285*	60	n.s.	60
Elbe	1991-2003	0,334***	130	-0,424***	130	-0,218*	129	n.s.	130	-0,289**	130		
	1998-2003	n.s.	60	-0,286*	60	n.s.	60	0,403**	60	n.s.	60	0,510***	60
Trischen	1991-2003	-0,373***	118	-0,346***	118	-0,406***	118	n.s.	118	-0,503***	118		
	1998-2003	0,423**	58	-0,627***	58	n.s.	58	n.s.	58	-0,336*	58	n.s.	58
Norderoog	1991-2003	-0,276**	129	-0,512***	129	n.s.	129	n.s.	129	-0,490***	129		
	1998-2003	n.s.	59	-0,389**	59	n.s.	59	n.s.	59	n.s.	59	0,268*	59
Langli	1999-2002	0,453**	40	n.s.	40	n.s.	40	n.s.	40	-0,579***	40	n.s.	40

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