

PCDF/PCDDs, dioxin like PCBs, PCNs and Toxaphene in the edible crab (*Cancer pagurus*) from reference localities in Norway 1996

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Introduction

The present study is part of registrations of micropollutants in seafood organisms in order to enable the Norwegian Food Control Authority (SNT) to assess the exposure of the general population to persistent organochlorines, in particular dioxin like compounds.

The hepatopancreas (digestive gland) of edible crabs is also used as indicator medium of contamination levels in the quality classification system of the Norwegian Pollution Control Authority (SFT). Thus the second aim of the study was to establish reference values (= assumed high background from merely diffuse loading and limit of Class I in this system (1)).

Material and Methods

10-20 male crabs have been sampled September-November 1996 at 11 localities several km from urban or industrial sources and also representative of commercial fishing sites (Figure 1). The pooled samples were homogenized with a food processor and split in aliquots for the three laboratories. Hepatopancreas and rest carapace content were weighed in each individual and the sums for each pooled sample calculated. Mean weights of hepatopancreas in all individuals were 22.3 g (19-30 g); which constituted about 55 (47-60) % of the total brown meat.

Analysis of dioxins and non-/mono-ortho PCBs were performed in all hepatopancreas samples and in rest carapace content from 5 of the 11 localities. The exploratory analyses of PCNs (polychlorinated naphthalenes) and four Toxaphene congeners (Tox 26, 32, 50, 62) were limited to samples from two localities.

Analysis of PCDF/PCDDs and non-ortho PCBs was performed at the National Institute for Public Health by an analytical procedure described in (2). For these variables six parallel samples were analysed by NILU according to a method found in (3). The results from the two laboratories were in good accordance (cf. Table 1 with note), the difference mostly being less than 10 %. NILU also analysed Toxaphene and PCN, the methods being described in (4,5)

Data for mono-ortho PCBs are from the analyses at the College of veterinary Medicine. The analytical procedure is described in (6).

Calculation of toxic equivalents (TEQs) is according to the international model (7) and Ahlborg et al. (8), respectively for PCDF/PCDDs and coplanar PCBs (IUPAC nos. 77, 105, 118,126, 156, 157, 169, 189). For PCNs the tentative toxic equivalency factors (TEFs) are from (9).

Results and discussion

The TEQ results for PCDF/PCDDs, non- and mono-ortho PCBs in crab hepatopancreas are presented in Table 1 (wet weight basis) and Figure 1 (fat weight basis). The fat content varied between 10 and 20 %, mainly in the interval 12-15 %.

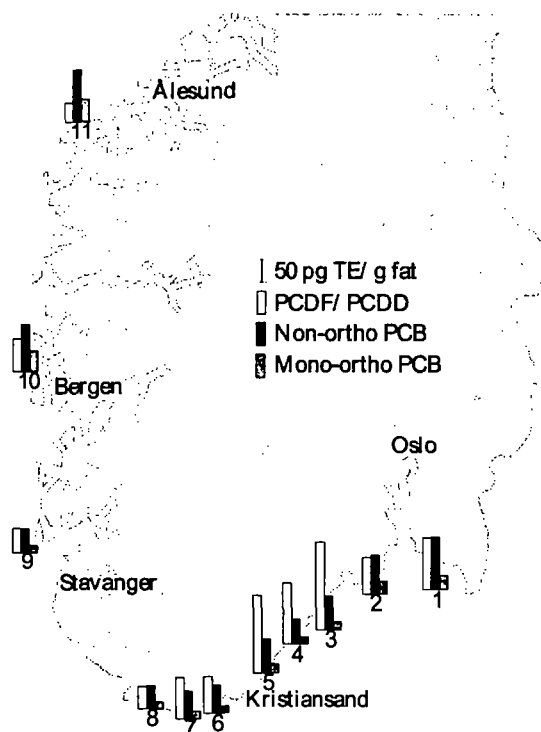


Figure 1. TEQs from PCDF/PCCDs, non- and mono-ortho PCBs in hepatopancreas of the edible crab (*Cancer pagurus*) from 11 reference stations in Norway, pg/g lipid.

Sum TEQs mostly varied in the interval 10-25 pg/g w.w. Consequently, to fill up the recommended upper limit of 35 pg/kg body weight life-long weekly intake it will suffice with about 100-200 g per week from this source alone.

The deviating high TEQ_{PCDF/PCDD} at St. 3 probably still shows the influence of the heavily contaminated Frierfjord (35 km north), notwithstanding that the direct discharge to the fjord was reduced from 300-500 g TEQs per year in 1989-90 to below 10 g/year in 1991-92 (10), and to less than 2-3 g per year in 1993-1996. Possibly this contamination of the coastal current along the Skagerrak is even traced as far as the localities 4-5 (Figure 1). This subject is treated elsewhere (11).

Table 1. Toxic equivalents from PCDF/PCDDs, non- and mono-ortho PCBs in hepatopancreas of the edible crab (*Cancer pagurus*) from reference localities in Norway 1996 (Fig. 1), pg TEQs/g w.w.

Localities	PCDF/ PCDD	non-ortho PCB	mono-ortho PCB	sum TEQs
1. Tisler	10.10	10.37	2.84	23.3
2. Rauerbåen	9.74	10.30	3.54	23.6
3. Skaddene/Risør	25.81 ¹⁾	9.98 ¹⁾	2.51	38.3
4. Dalsgr./Flostad	15.57	6.44	1.73	23.7
5. Torsken/Fevik	16.31	7.17	1.87	25.4
6. Ny Hellesund	8.08 ¹⁾	5.76 ¹⁾	1.54	15.4
7. Skjemøy/Mandal	8.71	5.76	1.72	16.2
8. S. Katland/Farsund	3.18	3.60	1.09	7.9
9. Åmøy/Stavanger	5.00	4.64	1.33	11.0
10. Solsvik/Sotra	5.57	8.65	3.97	18.2
11. Runde	4.43 ¹⁾	11.37 ¹⁾	4.67	20.5

¹⁾ Parallels at Norwegian Institute for Air Research in the given order: 24.4/11.1; 8.37/5.33 and 4.66/12.73.

Assuming that the localities 3-5 still are affected by the previous discharges to the Frierfjord, it appears from Table 1 that the other results confirm the validity of the present limit of class I in SFT's classification system of 10 pg TEQ_{PCDF/PCDD}/g w.w. in crab hepatopancreas. Due to former lack of data there is as yet no classification scheme for TEQ_{PCB}. The figures in Table 1 suggest a high background level from merely diffuse loading of 10-15 pg/g.

Excepting loc. 3 the total fat weight based sum TEQ did not vary more than about 2 times (Figure 1), against about 3 times on wet weight basis. One may note, however, that the TEQ profile differed between the sites. The comparatively high TEQ_{PCB} from St. 9 may reflect a marginal influence from the wide PCB contamination in the Bergen fjord areas. It is more difficult to explain the even more expressed PCB occurrence at the remote St. 11. As Runde has a large population of nesting seabirds one may speculate about the possibility of secondary contamination via guano.

Based on the (not presented) results from analysis of the low fat (1.4-2.9 %) residual carapace content (excluding hepatopancreas) the sum TEQs concentration in the total brown meat of five samples was calculated to 52-63 % of the level in hepatopancreas (Table 1).

Results from the two samples analysed for PCNs and Toxaphene are seen in Table 2. The PCN values were low, and with an insignificant contribution to sum TEQs (compare Table 1). Sum Toxaphene was about 1-3 % of sum PCBs in the same samples (these PCB data are not included here). It is worth noticing that crabs from St. 11 Runde had about the double Toxaphene content compared with crabs from the Skagerrak coast (cf. above remark on neighbouring bird cliffs at St. 11).

Table 2. Sum PCNs (tetra to hepta congeners), TEQ_{PCN} and Toxaphene, in hepatopancreas of crabs (*Cancer pagurus*) from two reference sites in Norway (cf. Figure 1), pg/g w.w.

Loc.no	ΣPCN	TEQ _{PCN} ¹⁾	Tox 26	Tox 32	Tox 50	Tox 62	SumTox ²⁾
3	180	0.15	924	<86	633	<510	1855
11	78	0.03	2173	<53	899	411	3509

¹⁾ Applied the tentative TEFs in (9), i.e. 0.002 for 123567/123467-HxCN and 0.003 for 1234567-HpPCN

²⁾ Used half detection level for calculation.

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