Chemical contaminants

Food monitoring, 1998-2003. Part 1.

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Food monitoring, 1998-2003,
consists of four sub-reports:

Part 1: Chemical contaminants
Part 2: Pesticides
Part 3: Food additives
Part 4: Microbial contaminants

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The Danish Veterinary and Food Administration is part of the Ministry of Family and Consumer Affairs. The Danish Veterinary and Food Administration is responsible for the administration and control within food and veterinary areas "from farm to fork", as well as practical matters relating to animal protection (otherwise under the Ministry of Justice).

Making of regulations, co-ordination and development, take place in the Administrations center in Moerkhoej. The 10 Regional Authorities handle the practical inspection of food and veterinary matters, including import/export etc.

The central administration of The Danish Veterinary and Food Administration employ a staff of approx. 250 full-time employees, whilst the 10 regional authorities employ a further approx.1500 full-time employees.

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1 Preface

The monitoring programme for foods was established in 1983. Results are reported for periods of five or six years; thus, the present report covers the fourth period, 1998-2003.

The fourth period report of the monitoring programme consists of the following sub-reports:

Part 1: Chemical contaminants
Part 2: Pesticides
Part 3: Food additives
Part 4: Microbial contaminants

The Danish Veterinary and Food Administration coordinates the studies in collaboration with the Danish Institute for Food and Veterinary Research. The regional laboratories in Copenhagen, Odense (until 1999), Ringsted, Aalborg (until 1999), and Århus carried out the analyses of chemical contaminants. The only exception is dioxin analyses, which for most parts where carried out by Danish Institute for Food and Veterinary Research. Most samples were taken by the regional veterinary and food control authorities; while samples of fish from Danish waters were taken by the Fisheries Inspections under the Danish Directorate of Fisheries. The reporting of chemical contaminants was coordinated by Arvid Fromberg, Danish Institute for Food and Veterinary Research.

April 2005

2 Sammenfatning og konklusion

I det danske overvågningsprogram for fødevarer har indholdet af kemiske forureninger været fulgt gennem 21 år. De fleste af de stoffer der er undersøgt i denne delrapport har været undersøgt siden overvågningsprogrammets start i 1983.

Nærværende rapport beskriver resultaterne af udvalgte fødevarers indhold af sporelementer, nitrat, organiske miljøforureninger og svampetoksiner i den 4. overvågningsperiode 1998-2003. Udviklingstendenser i koncentrationsniveauerne er undersøgt gennem perioden og er sammenlignet med tilsvarende data fra de tidligere overvågningsperioder.

Indtaget af forureningerne via kosten er blevet estimeret ud fra indholdsdata for de kemiske forureninger i fødevarer samt danskernes kostindtag. Kostindtagene er beregnet for voksne og for nogle af stofferne er indtaget også beregnet for børn. Der er foretaget en sundhedsmæssig vurdering på basis af de estimerede indtag i forhold til enten Acceptabel daglig indtagelse (ADI), Tolerabel daglig indtagelse (TDI), Tolerabel ugentlig indtagelse (TWI) eller Provisorisk tolerabelt ugentligt indtag (PTWI). ADI/TDI/TWI/PTWI angiver ikke faregrænser, men den mængde mennesker kan indtage dagligt hele livet igennem uden at det betyder en risiko for sundhedsskade. Indtag over ADI/TDI/TWI/PTWI gennem kortere eller længere perioder forventes ikke at føre til en forhøjet risiko så længe det livslange gennemsnitlige indtag er på den sikre side.

Sporelementer

Overvågningsprogrammet inkluderer de toksiske sporelementer bly, cadmium, nikkel, kviksølv og arsen samt det essentielle sporelement selen. I alt 7585 prøver fordelt på 96 forskellige fødevaretyper fra det danske marked er blevet udtaget og analyseret.

De fem toksiske sporelementer blev inkluderet i overvågningsprogrammet fordi tidligere overvågningsperioder har vist at indtaget af disse sporelementer var signifikant, uden dog at overskride det tolerable indtag. Selen blev inkluderet på grund af dets betydning som antioxidant.

Resultaterne fra overvågningsprogrammet 1998-2003 viser at indholdet af bly, cadmium og kviksølv i fødevarer fra det danske marked er forblevet på et konstant koncentrationsniveau sammenlignet med tidligere overvågningsperioder. Forekomsten af disse tre sporelementer i fødevarerne skyldes hovedsagelig atmosfærisk nedfald eller ved optag gennem rødderne fra opdyrket jord. I kontrast til dette kan naturlige biogeokemiske processer i det terrestriske eller marine miljø forklare tilstedeværelsen af nikkel, arsen og selen i fødevarer.

Indholdet af bly i bladgrønsager som f.eks. grønkål og i indmad som f.eks. oksenyrer, der blev benyttet som markør-fødevarer, har vist en nedgang over tid sammenlignet med data fra tidligere overvågningsperioder. En mindre, men signifikant nedgang, blev fundet for cadmium i gulerødder og kartofler. Ingen signifikante ændringer blev fundet for kviksølv, nikkel og arsen.

For bly, cadmium og nikkel var brød og cerealier, grøntsager og drikkevarer de største kilder til indtaget. Drikkevarer inkluderer drikkevand (postevand), som generelt har en lav koncentration af disse sporelementer, selvom afsmitning fra visse vand-installationer kan forårsage en markant stigning i indholdet. Det høje indtag af vand forklarer hvorfor vand er en vigtig kilde for indtaget sporelementer. For arsen og kviksølv er fisk den vigtigste fødevaregruppe. For selen er kød, brød, cerealier samt fisk de vigtigste kilder til indtaget.

Indtaget af kviksølv og cadmium er for voksne henholdsvis 41% og 24% af PTWI værdien (provisorisk tolerabelt ugentligt indtag). For børn i aldersgruppen 4-6 år, er de samme værdier henholdsvis 45% og 57% af PTWI. Eftersom PTWI værdierne indikerer et indtag hvor skadelige effekter kan forekomme i de mest sensitive individer, er indtaget for kviksølv og cadmium blevet vurderet som højt, dog uden at medføre sundhedsfare. Det estimerede indtag af bly, nikkel og arsen er relativt lavt og medfører ingen sundhedsfare. Indtaget af selen er tilstrækkeligt og overholder de nordiske anbefalinger.

Nitrat

Grøntsager udgør stadig det største bidrag til det humane indtag af nitrat i Danmark. I nærværende overvågningsperiode er nitratindholdet bestemt i kartofler, hovedsalat, icebergsalat, spinat, børnemad samt i en række andre grøntsager som rødbede, selleri og rucola salat.

Nitratindholdet i hovedsalat og i icebergsalat er lavere i denne overvågningsperiode sammenlignet med den foregående periode fra 1993 til 1996, men højere i forhold til perioden fra 1984 til 1988. Ligesom for de to foregående overvågningsperioder er nitratindholdet højere i dansk produceret salat sammenlignet med udenlandsk salat, mens indholdet af nitrat i danske kartofler stadigvæk generelt er lavere end i udenlandske kartofler. De højeste nitratindhold blev fundet i rucolasalat med gennemsnitsindhold højere end 5200 mg/kg, mens det laveste indhold var i børnemad med gennemsnitsindhold på 9 mg/kg og 34 mg/kg for henholdsvis 2002 og 2003.

Salat og kartofler udgør stadig de største bidragsydere til indtaget af nitrat i Danmark, men i modsætning til de tidligere overvågningsperioder er nitratindtaget nu højere for salat end for kartofler. Således er nitratindtaget for indeværende overvågningsperiode bestemt til cirka 19 mg/dag for salat og 12 mg/dag for kartofler. Indtaget af salat er steget fra cirka 4 g/dag for perioderne 1984 – 1988 og 1993 – 1996 til cirka 9 g/dag i indeværende overvågningsperiode, samtidig med at indtaget af kartofler er faldet fra henholdsvis cirka 166 g/dag (1984 – 1988) og 124 g/dag (1993 - 1996) til cirka 100 g/dag i indeværende overvågningsperiode. Disse forhold kan forklare, at indtaget af nitrat nu er højere for salat end for kartofler.

Det gennemsnitlige indtag af nitrat fra kosten, inklusiv drikkevand, for en voksen person på 70 kg er beregnet til cirka 61 mg/dag, hvilket er lavt i forhold til den fastlagte ADI værdi for nitrat på 257 mg/dag. Indholdet af nitrat i børnemad for indeværende overvågningsperiode er lav i forhold til EU grænseværdien på 200 mg/kg, hvilket viser at nitratindholdet i denne typer af produkter ikke er et sundhedsmæssigt problem.

Organiske miljøforureninger

De organiske forureninger, der er undersøgt i overvågningsprogrammet, inkluderer en række chlorpesticider og deres omdannelsesprodukter, samt polychlorerede biphenyler (PCB). Senest er også dioxin og dioxin-lignende PCB blevet tilføjet til overvågningsprogrammet. Alle disse stoffer er langsomt nedbrydelige og findes derfor i miljøet og dermed også i vore fødevarer. Det karakteristiske ved stofferne er, at de akkumuleres i fedtvæv hos dyr og mennesker.

Mange af de undersøgte chlororganiske forbindelser kan forårsage kræft hos dyr og mennesker. Endvidere har nogle af de chlororganiske forbindelser i reagensglasforsøg vist potentiale til at påvirke hormonsystemet. For dioxiner er de mest følsomme effekter på forplantningsevnen, immunforsvaret og centralnervesystemet.

Tilstedeværelsen af de organiske miljøforureninger er blevet undersøgt i kød, fisk og mejeriprodukter. I mange af prøverne er der ikke påvist indhold af de undersøgte chlorpesticider og indikator-PCB over detektionsgrænsen. De højeste gennemsnitlige indhold er fundet i torskelever og fed fisk.

Udviklingen over tid for indholdene af chlorpesticider og indikator-PCB i fisk er fulgt i denne samt de tre tidligere overvågningsperioder. Der er observeret et generelt fald i indholdene i de forgående tre perioder, hvorimod der i den fjerde periode ikke har kunne konstateres et fald. For produkter af animalsk oprindelse kan der ikke ses nogen klar udvikling i koncentrationsniveauerne.

Den danske befolknings gennemsnitlige daglige indtag er estimeret til at være mellem 0,03 og 0,3 µg/dag for hver af chlorpesticiderne og 0,9 µg/dag for summen af indikator-PCB. Estimatet for personer der har et relativt højt indtag af stofferne (0,95-fraktilen) viser, at de konsumerer cirka dobbelt så meget som gennemsnitsdanskeren. Personer med specielle indtagsmønstre, f.eks. personer med betydelig konsumering af torskelever eller torskeleverolie forventes dog at have et endnu højere indtag. Det højeste bidrag til indtaget af chlororganiske forbindelser er fra fisk, kød og mejeriprodukter, hvor børn har et højere indtag fra mælk og mælkeprodukter og et lavere fra fisk end voksne.

Det kan konkluderes, ud fra en sammenligning af de estimerede indtag med ADI eller TDI for de respektive stoffer, at de fundne indhold ikke giver anledning til sundhedsmæssige betænkeligheder. Det højeste forhold mellem det estimerede indtag og TDI er for børns indtag af PCB, hvor det gennemsnitlige indtag udgør 25% af TDI og for voksne hvor det udgør 13% af TDI. Beskyttelsesniveauet for PCB er derfor signifikant lavere end for chlorpesticiderne.

For dioxin og dioxin-lignende PCB er det gennemsnitlige indtag for voksne ca. 50% af TWI (tolerabel ugentlig indtag). Personer med et højt kostindtag af dioxin og dioxin-lignende PCB (f.eks. 95-percentilen) er tæt ved at overskride TWI-værdien, afhængig af oprindelse, forureningsniveauet og hvor meget fed fisk de indtager. Børns indtag af dioxin og dioxin-lignende PCB fra andre fødevarer end fisk er i gennemsnit 2-3 gange større end for voksne. For disse fødevarer er mælk og andre mejeriprodukter den dominerende kilde til indtaget. Der er flere børn end voksne, der forventes at overskride TWI. Ved risikovurdering af voksnes og børns eksponering for dioxin og dioxin-lignende PCB vurderes et indtag over TWI i kortere tidsrum ikke at have betydning for risikoen. Forbrugeren er indenfor sikkerhedsmargenen, så længe man følger de anbefalede kostråd, specielt hvad angår indtag af fede fisk.

I denne overvågningsperiode har man, for at få et billede af den integrerede eksponering for organiske miljøforureninger, som noget nyt undersøgt modermælk for organiske chlorforbindelser, PCB og dioxin. Tidligere undersøgelser har vist et fald i indholdene i modermælk fra danske kvinder og resultaterne i denne rapport viser en fortsættelse af denne tendens. Ved sammenligning med data fra 8-9 år siden er der for dioxin og dioxin-lignende PCB sket et fald på 46% , for PCB et fald på 57% og for chlorpesticider et fald på mellem 50-60%.

Mykotoksiner (ochratoksin A)

Ochratoksin A er blevet karakteriseret som et muligt humant kræftfremkaldende stof. Siden 1986 har ochratoksin A i kornprodukter været en del af det danske overvågningssystem. Indholdet af ochratoksin A i danske kornprodukter er faldet betragteligt i de senere år. Økologisk dyrkede kornprodukter har generelt indeholdt mere ochratoksin A end konventionelt dyrkede kornprodukter, men denne forskel synes dog at være mindsket i de seneste år. Forskellen mellem økologisk og konventionelt dyrkede kornprodukter har sandsynligvis været relateret til forhold omkring tørring af korn og opbevaringsforhold.

Kornprodukter er den vigtigste kilde til den danske befolknings indtag af ochratoksin A. Estimerede indtag baseret på data fra denne 4. overvågningsperiode viser, at personer, der har et højt indtag af ochratoksin A (95% fraktil) nu har et indtag under TDI værdien på 5 ng/kg legemsvægt/dag. Det gælder både personer, der konsumerer udelukkende konventionelle eller udelukkende økologiske kornprodukter. Omkring halvdelen af indtaget af ochratoksin A kommer fra kornprodukter og rugbrød er den vigtigste kilde.

3 Summary and conclusion

Chemical contaminants in foods has been a part of the monitoring programme for foods since its start in 1983; thus, some of the chemical contaminants dealt with in this sub-report have now been followed through a period of 21 years.

The report covers results from analyses of contents of trace elements, nitrate, organic environmental contaminants and mycotoxins in selected foods during the 4th monitoring period 1998-2003 as well as comparisons with corresponding data on contents from previous monitoring periods.

Results from the chemical analyses are combined with data on the consumption of the concerned foods items in calculations of the adult Danish population's intake of the substances. For some of the substances, intake calculations are also made for children. On basis of the calculated intakes of chemical contaminations combined with the substances Acceptable daily intake (ADI), Tolerable daily intake (TDI), Tolerable weekly intake (TWI) or Provisional tolerable weekly intake (PTWI), a safety assessment has been made. ADI/TDI/TWI/PTWI do not indicate any danger limit, but the daily or weekly intake on a life-long basis, which may take place with a high degree of safety, where intakes above the ADI/TDI/TWI/PTWI through shorter or longer periods of time are not considered to involve any increased risk as long as the long-term average intake is kept on the safe side.

Trace elements

The monitoring programme includes the toxic trace elements lead, cadmium, nickel, mercury and arsenic as well as the essential element selenium. A total of 7585 samples of 96 foods most frequently consumed by the Danes were sampled on the Danish market and analysed.

The five toxic trace elements were included in the monitoring programme, because the former monitoring periods have shown that the dietary intake was noticeable but not exceeding the tolerable intake. Selenium was included because of its importance as an antioxidant.

The results of the monitoring programme 1998-2003 show that the contents of lead, cadmium and mercury in foods marketed in Denmark remain at a stable concentration level in comparison with the previous monitoring period. The occurrence of these three contaminants in foods is mainly caused by atmospheric deposition or by root uptake from arable soil. In contrast, natural biogeochemical processes in the terrestrial or marine environments mainly explain the contents of nickel, arsenic and selenium in food.

The content of lead in leafy vegetables such as curly kale and in offal such as ox kidney, which were used as marker foods, has shown a long-term decrease in concentration. A smaller but significant decrease was shown for cadmium in carrots and potatoes. No marked changes over time have occurred for mercury, nickel and arsenic.

For lead, cadmium and nickel, the highest contributors to the dietary intake are bread and cereals, vegetables and beverages. Beverages include drinking water (tap water), which generally has a low concentration of these trace elements, although migration from some water installations may cause this content to increase markedly. The high consumption explains why water is of importance for the trace element intake. For the intake of arsenic and mercury, fish is the most important food group. For selenium, meats, bread and cereals as well as fish are the most important contributors to the intake.

The adult dietary intake of mercury and cadmium is up to 41 % and 24 % of the provisional tolerable intake values (PTWI), respectively. For children from 4-6 years of age, the same values amount to 45 % and 57 % of the PTWI values. Because the PTWI values indicate an intake where adverse effects may occur in the most sensitive individuals, the estimated mercury and cadmium intakes are evaluated as being high but not causing any health concerns. The estimated dietary intake of lead, nickel and arsenic is evaluated a relatively low and safe. The selenium intake is sufficient and coincides with the Nordic recommendations.

Nitrate

Vegetables are the main contributor to the intake of nitrate in the human diet, generally providing approximately 80 % of the total daily intake. The acute toxicity of nitrate is low, but in food and in the gastrointestinal tract the nitrate ion can be reduced to nitrite, which has higher acute toxicity. However, the health problem with nitrite is the contribution to the formation of nitrosamines, which have been found to be a potent carcinogenic in animal experiments. In addition, several of the nitrosamines are also considered to be carcinogenic to humans.

In the present monitoring period, nitrate content was determined in potatoes, head and iceberg lettuce, spinach, baby food and several other vegetables, such as beetroot, celery and rucola lettuce.

The average content of nitrate in both head lettuce and iceberg lettuce of Danish origin showed a small decrease compared to the period from 1993 – 1996, but an increase compared to the period (1984 – 1988). The contents of nitrate were generally lower in foreign than in Danish lettuce. However, the average nitrate content for all the samples of Danish and foreign lettuce was very similar for the three investigated monitoring periods, corresponding to approximately 2000 mg/kg. In the present monitoring period, the content of nitrate in Danish potatoes was found to be very similar from year to year with an average content of approximately 100 mg/kg. As in the previous two monitoring periods, higher nitrate contents were found in foreign than in Danish potatoes. Very high nitrate contents were found in samples of rucola lettuce with mean values above 5200 mg/kg, whereas the lowest contents were obtained in samples of baby food with mean values not exceeding 34 mg/kg.

Lettuce and potatoes are still the main contributor to intake of nitrate by the Danish population. However, contrary to the two foregoing monitoring periods, the nitrate intake is now considerably higher for lettuce than for potatoes. Thus, the mean intake of nitrate in the present monitoring period was estimated to be approximately 19 mg/day for lettuce and 12 mg/day for potatoes. The intake of lettuce has increased from approximately 4 g/day during the periods from 1984 - 1988 and 1993 – 1996 to about 9 g/day in the present period. These differences explain why lettuce is now a more important contributor to the intake of nitrate than potatoes. The nitrate intake for a person weighing 70 kg was determined using the data from the present monitoring period to be approximately 60 mg/day, which is fairly low compared to the ADI value for nitrate (257 mg/day). The mean content of nitrate found in baby food in the present monitoring period is low compared to EU maximum limit for these products (200 mg/kg), indicating that nitrate in baby food does not represent a food safety problem.

Organic environmental contaminants

The organochlorine substances included in the monitoring programme are a number of organochlorine pesticides, including metabolites and indicator PCB. Most recently dioxins and dioxin-like PCB have been added to the program. These substances are slowly degradable and therefore persist for long periods in the environment, where they accumulate in the fatty tissues of animals and humans.

Many of the organochlorine compounds included in the monitoring programme causes development of cancer in the liver of animals. Some of these organochlorine compounds have also shown a potential to affect hormone systems *in vitro*. For dioxins the most sensitive effects in animal studies are on the reproductive, immune and central nervous system.

The contents of organochlorine environmental contaminants have been analysed in meat, fish, and dairy products. In a large number of samples, the contents of the organochlorine pesticides and indicator PCB under study were not detected, being below the limit of detection. The highest average contents are found in cod liver and fatty fish.

The contents of organochlorine pesticides and indicator PCB in fish during the present and the three previous monitoring periods have been compared, and a general downward tendency in concentrations were observed for the previously periods but the tendency of the fourth period seems to be at steady state condition. The development in contents in products of animal origin is not so clear.

The Danish population's average daily intake has been estimated at between 0.03 and 0.3 µg/day for the individual organochlorine pesticides and 0.9 µg/day for indicator PCB-sum. Persons having a relatively high intake of the substances (the 0.95 quantile) are estimated to consume approximately twice as much, whereas persons with special intake patterns, e.g. a substantial consumption of cod liver or cod liver oil, may have even higher intakes. The highest contributions to the intake of the organochlorine environmental contaminants are from fish, meat and dairy products, where children have higher intake from milk and milk products and lower intake from fish, than adults.

When the estimated intakes and the ADI/TDI values are compared, the found quantities of the organochlorine pesticides and indicator PCB measured is not considered to give occasion for health concerns. The highest ratio is found for the intake of PCB for children where the average intake make up 25% of TDI and for adults the PCB intake make up 13% of TDI. The protection level for PCB is therefore significantly lower than for the organochlorine pesticides measured.

For dioxins and dioxin-like PCB the average estimated intake for adults constitutes approximately 50% of the TWI. Persons with high dietary intake of dioxin and dioxin-like PCB (e.g. the 0.95 quantile) are close to or exceed the TWI, depending on the origin and the contamination level in especially the fatty fish they consume. For children the intake of dioxins and dioxin-like PCB from food, excluding fish, is two to three times the intake estimated for adults. Milk and milk products are the dominant contributors to the intake. A larger proportion of children are likely to exceed the TWI than compared to adults. However, the overall risk assessment for the life time exposure of dioxin and dioxin-like PCB by adults and children does not find short time intake above TWI critical. The consumer is within a safe margin for dioxin exposure as long as the general dietary advises is followed, especially concerning intake of fatty fish.

Human milk has been included in the monitoring program in the recent period in order to follow the integrated human exposure to organic environmental contaminants. The samples have been analysed for organochlorine pesticides, PCB and dioxins. Previous surveys of Danish human milk have shown a decrease in contents by the dominating compounds, and the new data continues the trend. Compared to the levels 8-9 years ago dioxins and dioxin-like PCB have decreased by 46%, PCB by 57% and many organochlorine pesticides by 50% to 60%.

Mycotoxins (ochratoxin A)

Ochratoxin A has been classified as a possible human carcinogen. Since 1986 measurement of ochratoxin A in cereals has been a part of the Danish monitoring system. The content of ochratoxin A in Danish cereals has decreased in recent years. Organically grown cereals have generally contained more ochratoxin A than conventionally grown cereals. The difference has, however, tended to diminish in recent years. The difference between organic and conventional cereals can presumably be explained in terms of grain drying and storage conditions.

Cereals are the most important source to the Danish population's intake of ochratoxin A. The intake estimates based on data from the 4th monitoring period show that persons having a high intake of ochratoxin A (the 0.95 quantile) have intakes below the TDI value of 5 ng/kg bw/day, based both on the consumption of exclusively conventional or organic cereals. Around half of the intake of ochratoxin A comes from cereals. Rye bread is the main source.

4 Monitoring programme for foods

The subjects of the monitoring programme have changed over time. For the first two periods (1983-1992) the monitoring programme covered nutrients and chemical contaminants, while in the third period (1993-1997) new subjects were included under the monitoring concept: Pesticides, veterinary drugs, food additives and microbial contaminants.

The monitoring programme for nutrients has been reduced during the fourth period, and purpose of the analyses of veterinary drugs is food control rather than monitoring. Thus these two subjects are not reported for the fourth period. However, dioxin, dioxin-like PCB and selenium are included in the present monitoring period.

While each of the first two monitoring periods (1983-1987 and 1988-1992) was reported as a whole [1, 2], the reporting of the third period was divided into sub-reports according to subject [3, 4, 5, 6, 7]. The fourth period is reported in four sub-reports covering, chemical contaminants, pesticides, food additives and microbial contaminants.

The objectives of the monitoring programme are, by means of systematic studies of foods and the dietary habits of the Danish population,

- to ascertain whether our foods are subject to any long-term changes in terms of the contents of desirable and undesirable substances and/or microorganisms,
- to assess the health significance of any such changes in relation to major changes in dietary habits,
- to disclose potential problems within the area and to provide background material as well as a basis for decisions to remedy any problems which might have arisen.

The material provided may also serve as a documentation of the health quality of Danish foods, and be used for updating the Danish food composition databank. Monitoring results are used also in other connections; e.g., microbiological results are reported to the Danish Zoonosis Centre, and results concerning residues of pesticides are reported to the EU.

Work with the monitoring programme consists of the following:

- to monitor, by means of analyses, the contents of desirable and undesirable substances/ microorganisms in specific foods,
- to investigate the dietary habits of the Danish population,
- to carry out intake estimates (wherever relevant) by combining contents in foods and data on the population's diet.

Subsequently, a nutritional and/or toxicological assessment can be made. Such an assessment will be particularly important whenever changes are found.

Since changes in the contents of foods and changes in our dietary habits usually develop slowly, the studies cover a considerable number of years. Every five or six years, the results are reviewed, and the analytical results for the foods are compared with the dietary habits over the period. This permits an assessment of whether the intake of desirable substances is adequate, and whether the intake of undesirable substances or microorganisms is acceptably low.

Content findings and intake estimates are compared with earlier results, thus permitting an assessment of the development of contents and intakes over time.

Results are evaluated continuously during the monitoring period, enabling reactions to violations of existing limits or other noteworthy observations.

The monitoring programme gives information on the immediate situation concerning Danish foods, the health significance for Danish consumers, and the direction in which matters are likely to develop. In this respect, the monitoring programme can provide background material and a basis for decisions on actions in the form of national or international regulations.

5 Introduction

Since the beginning of the monitoring system in 1983, chemical contaminants have been included in the monitoring system for foods [8,10,13]. Trends for some of the chemical contaminants has therefore been studied within a time period of more than two decades. In Table 1, the total number of food categories and number of analyses for each substance monitored are displayed, and further details are found in the following individual chapters and their corresponding appendixes.

Table 1. *Number of food categories, samples and number of analytes during the 4th period of the monitoring (1998-2003).*

Substance	Number of food categories	Number of samples	Number of analytes
Lead	96	1313	1
Cadmium	96	1313	1
Nickel	96	1312	1
Mercury	81	1167	1
Selenium	96	1313	1
Arsenic	81	1167	1
Nitrate	6	1447	1
Organochlorine pesticides	36	3552	19
Indicator PCB	36	3552	10
Dioxin and PCB	16	228	37
Ochratoxin A	2	649	1

The listed chemical compounds prioritised for inclusion in the monitoring system are all potentially health hazardous compounds found in food. In the 4th monitoring period, selenium as well as dioxin and dioxin-like PCB congeners were included in the monitoring system. In addition to the food samples, human samples were also included in the 4th monitoring period (Table 2).

Table 2. *Number of human samples and number of analytes analysed during the 4th period of the monitoring (1998-2003).*

Human milk	Number of samples	Number of analytes
Organochlorine pesticides	38	19
Indicator PCB	38	10
Dioxin and PCB	38	37

Analyses of chemical compounds in human milk can be used as an indicator for the intake of the compounds, making it possible to look at development in their levels over time.

5.1 Data on contents

Quality of analyses

Analyses of the compounds were carried out at the regional laboratories, which were accredited according to EN45000 or ISO17025 during the monitoring period. Most of the dioxin analyses were carried out by Danish Institute for Food and Veterinary Research, which is accredited according to ISO17025. Various procedures for quality assurance are undertaken in connection with the analyses of the various contaminants. Generally, recovery tests are carried out within each series of analyses, reference materials are continuously being analysed, and laboratories participate regularly in proficiency tests.

5.2 Intake calculations

The intake estimates are based on the dietary intake data collected in the Danish nationwide food consumption survey 2000-2002 [9]. The food consumption data were sampled throughout the 3 years in order to take into account any possible seasonal variation in dietary habits. The representative sample of Danes included a total of 4120 respondents (2167 female and 1953 male) aged 4-75 yr. The Danish nationwide food consumption survey used a seven-day prospective food record with a pre-coded (semi-closed) questionnaire that included answering categories for the most commonly eaten foods and dishes in the Danish diet. The questionnaire was organised according to a normal daily meal pattern. For food items not found in the pre-coded categories, it was allowed for the participant to manually fill in the missing food. The food amounts eaten were given in household measures, e.g. pieces, glasses, cups, spoons, etc. Standard portion sizes were used in the conversion of the reported amounts to weight (grams). Composite foods (e.g. dishes) were split up into ingredients by means of standard recipes. Due to the simplified design of the questionnaire, the total diet could be represented by the intake of 333 food items with Food Identification numbers (FoodId). The final result of these conversions was then recalculated and expressed as the daily mean intake for the seven-day food register of each participant in the survey.

Based upon the individual’s data, it was possible to describe the intake distribution of both foods and chemical contaminations for the population divided into children (4-14 years of age) and adults (15-75 years of age). For calculations of the intake of contaminants in this report, the individual-level consumption of each of the food items was multiplied by a qualified estimate of the contaminant content in that particular food item. The result of this is a distribution of the contaminant intake among adults or children. The intake distribution within the population has been described using an average as well as the 90%-quantile for high intakes. The bodyweight of the individual respondents was used in those cases where the result of the intake calculation is stated as intake per kg bodyweight.

In the following chapters, the results for the chemical contaminants included in the 4th monitoring period are described in detail and they are compared with the results from previous monitoring periods. When comparing intake calculations, it should be noted that the dietary data used of the calculations in the different periods are not identical. The calculated intakes in the present report shall be seen as the best intake estimate that can be given today using the available methods.

5.3 Safety assessments

Assessments of chemical substances in foods are usually based on the concept of ADI/TDI (Acceptable/Tolerable Daily Intake for humans), which indicates the quantity which humans may ingest daily for an entire lifetime with no recognizable health risk. ADI is used for substances that are approved for use in the production of foods, such as food additives and pesticides, while TDI is used for substances that occur as unintentional contaminants.

On the basis of existing toxicological, epidemiological, and other studies, the NOAEL (No Observed Adverse Effect Level) is established, which is the daily dose, expressed in mg/kg bodyweight that has shown no adverse effects in the most sensitive, relevant study. Usually, results from animal studies are used, since relevant and sufficiently sensitive studies in humans are rarely available. When establishing the ADI/TDI, this dose is reduced by an uncertainty factor that allows for the extrapolation of results from animals to humans and the variations in the sensitivity and habits of humans, as well as the uncertainty inherent in the evaluation of the study itself. It must be pointed out that the ADI/TDI is no danger line. Intakes above the ADI/TDI over shorter periods of time (weeks, months) constitute no risk, as long as the average long-term intake does not exceed the ADI/TDI.

6 Trace elements

6.1 Introduction

The content and dietary intake of trace elements in foodstuffs sold on the Danish market has been repeatedly investigated in the Danish Food Monitoring Programme since its initiation in 1983 [10]. In this report the fourth monitoring period comprising 1998-2003 is reported, and the results are compared with earlier monitoring periods. The 20 years of continued monitoring of the toxic trace elements in food, lead, cadmium, mercury, nickel and arsenic, has generated results of great importance for the assessment and handling of risks associated with consumption of food sold on the Danish market. The data obtained represents a comprehensive benchmark of the concentration levels and distribution of the five toxic trace elements in commercially available foods. Based on this knowledge, specific cases of geographically localised food contamination caused by environmental contamination of soil or ambient air can be evaluated [11]. Finally, the monitoring data obtained for Danish foods provides a scientifically sound background for establishing legislation on the European as well as the national level.

The samples taken of each of the food items included in the monitoring programme were analysed individually, which provided detailed information on the variation of trace elements in foods eaten by the Danes. The results were combined with food consumption data [9] in order to estimate the Danes' dietary intake of trace elements. In each 5-year period the same food items were sampled to allow for a comparison of the trace element contents over time. The Danes' food consumption pattern was surveyed independently but overlapping in time with the repeated monitoring cycles. This allowed an estimation of the Danes' current dietary intake of trace elements.

The aims of the food monitoring programme 1998-2003 were (i) to monitor the content and changes over time of trace elements in food sold on the Danish market, and (ii) to estimate the intake of trace elements with the entire diet, and also to evaluate if any associated health consequences were likely to occur.

6.2 Methods of sampling, analysis and quality assurance

The samples taken during 1998-2003 and the chemical analyses were organised in 8 surveys, each covering food items from the same main food category as shown in Appendix 1. The number of samples taken of each food item was first of all dimensioned on the basis of the cost of the laboratory work. Secondly, the number of samples was decided on the basis of earlier experience regarding variation in trace element content, the expected rate of changes in contents over time and the expected contribution of the food item to the total trace element intake. The Public Food Inspection Services in various parts of Denmark were in charge of the nationwide sampling. The types and numbers of foodstuffs included are given in Appendix 1.

Chemical analyses and quality assurance

The content of cadmium, lead, nickel, mercury, selenium and arsenic was analysed by the regional laboratories in Århus and in Odense (until 1999). The samples were prepared according to common household practice, but none of the foods were cooked prior to analysis. Only edible parts of the foods were used and adhered soil was removed by brushing under clean water. The methods of analysis involved isolation of the relevant tissue or part of the sample by utensils, which did not contaminate the samples. The homogenised food sample was dissolved by microwave-assisted wet-ashing in quartz vessels (Multiwave, Anton Paar, Austria) with nitric acid. Following this process the trace element content was determined by inductively coupled plasma- mass spectrometry using an Agilent 7500 ICP-MS instrument (Agilent Technologies, Waldbronn, Germany). A summary of the analytical settings used is given in Table 1. The analytical work was organised and run in batches comprising 15-20 unknown samples, one blank, one double determination for each 10 unknown samples and one certified reference material. The limit of detection (LOD), precision and accuracy were estimated from these controls for each of the 8 surveys. In case of deviations from a set of criteria for tolerable variation of blanks, for values obtained for CRMs (x-charts) and for double determinations (R-charts), all the analyses in that batch were repeated. The LODs, which were calculated according to the three-sigma criterion, were estimated from the variance of the analytical blank values. Results indicated by ”less than” in Appendix 1 were below the LOD value for the analytical survey in which the result was produced. The repeatability has been summarised for each trace element in Table 1. The values correspond to the within-day random error for the analysis of trace element concentrations above 10 times the LOD.

***Table 3** Summary of the ICP-MS method of analysis and figures of merit*

Method performance	Unit	Cadmium	Lead	Nickel	Mercury	Selenium	Arsenic
Mean blank concentration[A]	ng/l in solution	0.30	6.20	7.1	3.2	1.8	1.3
Limit of detection[B]	µg/kg w.w.	0.05	0.92	1.1	0.48	0.27	0.2
Relative standard deviation, s_r[C]	%	3.0	3.4	3.9	2.3	2.9	1.6
Recovery[D]	%	103	101	101	97	107	100
Analytical method							
Isotopes detected	amu	114	208	60	202	82	75
Integration time per mass	ms	300	300	300	300	300	300
Repetitions		3	3	3	3	3	3
Internal standard		Rh	Bi	Ge	Rh	Te	Te

[A] Expressed as element concentration in solution

[B] Expressed for 2 g (wet weight) sample intake and 100 ml final volume following the three sigma criterion

[C] Mean value calculated from double determinations of element concentrations > 10 * LOD

[D] Mean value for standard added to sample digest diluted to 100 ml volume

Handling of low results and data analysis

Analytical results close to the limit of detection (LOD) are associated with a larger relative standard deviation than those given in Table 1, and for values below the LOD, the confidence interval exceeds 100 % of the value. For those trace elements that were present at low concentrations, the obtained values were anyhow collated. Their mean value was the best approximation to the true concentration and was therefore used for the estimation of the total dietary trace element intake, as described in the following section. In contrast, using zero or the LOD value for these low concentrations would lead to an under or overestimation, respectively, of the trace element intake.

Estimation of dietary trace element intake

The dietary trace element intake was estimated as outlined in section 5.2. Since the monitoring system provided data for the trace element content in 96 food items, additional data were gathered from other surveys of trace elements in food sold in Denmark. Furthermore, for food items that were not included in the analytical surveys, concentration data from similar foods were used. This was particularly the case for several dairy products and types of bread. No corrections for losses and gains during food preparation were applied, as the current knowledge about these processes is insufficient. The mean values for trace element contents in the foods were used, because they were assumed to reflect the consumer's average exposure to a trace element in marketed foods. Individuals who mainly consume food originating from geographically localised areas, such as home-grown products, are not included in the intake estimations. For the purpose of comparing the intake estimates (µg/day) with the Provisional Tolerable Daily Intake (PTWI) as µg/body weight/week (WHO), the intake was expressed as µg/person/day by dividing with the reported body mass for each respondent.

6.3 Data on contents and developments over time

The 7585 results for the contents of cadmium, lead, nickel, mercury, selenium and arsenic in 96 food items sampled during 1998-2003 are summarised in Appendix 1. The ICP-MS analytical method used during 1998-2003 has limits of detection, which for lead and mercury are about a factor of 10 lower in comparison with the methods based on atomic absorption spectrometry used in the former monitoring period 1993-1997 [12]. This improved detection capability has provided a better analytical accuracy for trace elements present in the low µg/kg concentration range. Since the concentration of particularly lead and mercury is very low in many food items, the calculated contributions from such foods to the total trace element intake have become more accurate. Furthermore, a new set of results for trace elements in drinking water, which is an important source of trace element intake, has been generated in 2004 (unpublished results).

Table 4. *The content (µg/L) of four trace elements in drinking water sampled in Denmark in the spring 2004. LOD signifies the limit of detection of the ICP-MS analytical method used.*

	N	Mean	Minimum	Maximum	LOD
Cadmium	208	0.11	<0.01	1.91	0.01
Lead	208	0.87	0.03	9.76	0.01
Nickel	208	2.21	0.35	21.3	0.04
Mercury	208	<0.01	<0.01	<0.01	0.01

Although not originally planned as a part of the monitoring system, these data have provided an improved and updated knowledge on the significance of drinking water as a contributor to the total trace element intake. In summary, the change in the method of analysis and the availability of newly generated data for trace element contents in certain food groups have made a more comprehensive intake estimation of the six trace elements possible.

Cadmium

The data for cadmium presents many modestly lower mean concentration values in the fourth period as compared with the third. The cadmium concentration in potatoes and in carrots, have been followed since the beginning of the monitoring system in 1983. The results for these ”marker foods” have been shown in Figure 1 A) – B). The mean cadmium content has been reduced over the 20-year monitoring period by approximately a factor of 2-2.5 in these vegetables. The interpretation of this reduction is, however, not straightforward. The results for cadmium in slaughter animals’ kidneys, which is another marker organ, is lower in comparison with the 3rd monitoring period. Both sets of results for these marker foods of vegetable and animal origin indicate a reduced burden by cadmium.

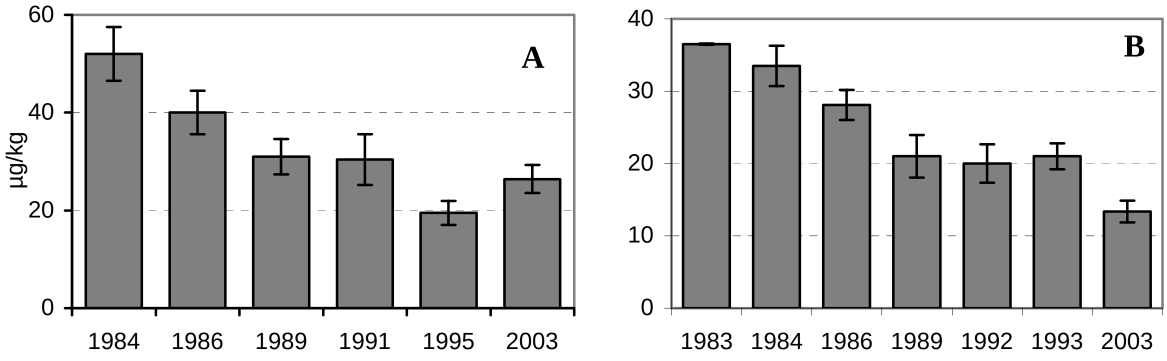

Figure 1. *The mean concentration of cadmium in marker-foods 1984-2003, A) carrots and B) potatoes*

Lead

The lead concentration in curly kale, a marker-food for atmospheric deposition of lead, has decreased by a factor of approximately eight in 2003 in comparison with the 1980s [10]. The reduction of the lead contents found in kale as well as in spinach (not shown) follows the time course of reductions in lead emissions from the combustion of leaded petrol in Denmark and other European countries. The still detectable contamination of leafy vegetables by lead is likely originates from a combination of atmospheric deposition from a variety of emission sources and from lead-contaminated dust. The direct root uptake from contaminated soil is, however, very modest [11].

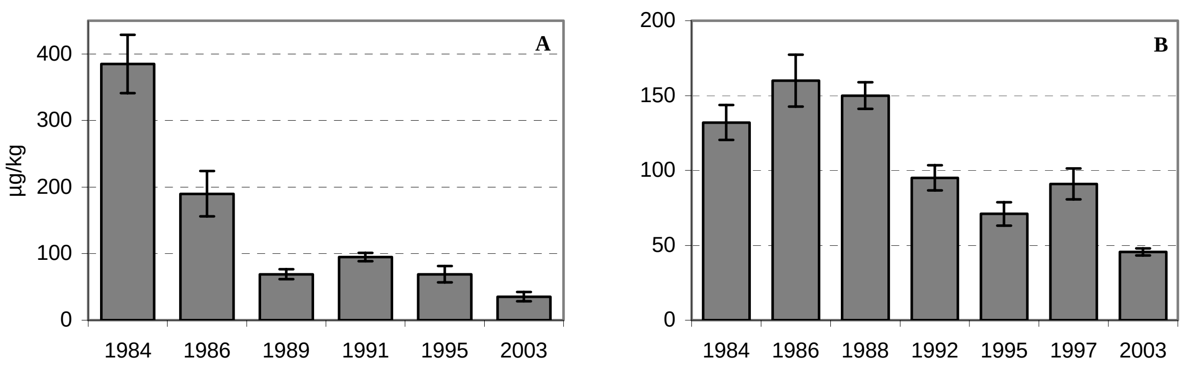

Figure 2. *The mean concentration of lead in marker-foods 1984-2003. A) curly kale and B) Ox kidneys*

As with cadmium, lead is taken up by the animals' kidneys, which may be used to monitor the exposure of the animal to lead via its fodder. A marked decline by approximately a factor of 3 in mean lead contents has occurred for ox kidney, as shown Figure 2 B), but in pig's kidney the lead concentration has not changed from the 3rd to the 4th monitoring period (data not shown).

Nickel

In general, the contents of nickel in the food items in Appendix 1 show a large variability within the 4th monitoring period as well as between periods [4]. The wide range of the results prevents the finding of any significant changes in nickel content, and the nickel content in rye bread, which was tested as a marker food for nickel [13], has not changed relative to the 3rd monitoring period. As with cadmium in drinking water, newly generated data by ICP-MS analyses (unpublished data) has provided updated knowledge on the occurrence of nickel in drinking water.

Mercury

The content of mercury in fish, contributing substantially to the dietary intake of this element, is present at a stable concentration level in comparison with the 3rd monitoring period. Using plaice and cod as marker foods, the concentration of mercury in these fish species has remained stable over the four monitoring periods. In geographically localised areas of the Danish seas, mercury emissions from chlorine-alkali and other chemical industries have previously led to highly elevated contents of this element in marine biota, particularly in fish from The Sound [14]. The sources of the emissions have been stopped, and for over a decade the mercury contents in locally caught fish have decreased [15].

Selenium

The selenium content in food has been generally stable over the years, but large differences exist between foods of animal and plant origin. This can be explained by the conventional farming practice of supplementing the animals' fodder with selenium. In contrast, the selenium content of arable soil is not fortified by selenium, and consequently the content in cereals and vegetables is low and reflects the low natural selenium content in Danish arable soil. The content of selenium in cabbage species such as curly kale, Brussels sprouts and cauliflower, which naturally concentrates selenium (and sulphur), is the highest among the vegetables.

Arsenic

Arsenic is mainly found in marine foods and occurs due to natural processes in the sea. The contents found in fish greatly vary for the same fish species. Part of the variation in the arsenic content found in flounder, herring and cod could be explained by salinity differences between the seas where the fish was caught [16]. In general, the arsenic contents were high in fish caught in waters with a high salinity (The North Sea and The Kattegat) and low in more brackish waters (The Belt Sea and The Baltic).

6.4 Intake calculations and safety assessment

The high degree of detail in the available consumption information (section 5.2) had to be matched by correspondingly detailed data on the trace element content in order to generate a complete estimate of the dietary intake of trace elements. Because only 96 individual food items were analysed in the 1998-2003 monitoring period, a number of assumptions regarding the trace element content of the remaining food items had to be made based on the actual data collected for similar food items. Given these limitations, the calculated dietary intake of cadmium, lead, nickel, mercury, selenium and arsenic is given in Table 5 for Danes between 15-75 years of age.

In general, the estimated intakes of cadmium, lead, nickel and mercury for the 4th monitoring period have decreased in comparison with the previous three monitoring periods. These changes may be caused by different eating habits reflected in the 2000-2002 national dietary survey and by reduced trace element contents of the food items investigated, or both factors at the same time.

***Table 5**. Estimated intake for adults (15-75 years) of six trace elements from the Danish diet during four 5-year monitoring periods covering 1983-2003. The intakes are given as the mean and 95th percentile values or, for selenium, as the mean and 5th percentile values. The Provisional Tolerable Weekly Intake (PTWI) and the Nordic Nutrition Recommendations (NNR) indicate upper tolerable and target intakes, respectively. For nickel neither recommended intake nor PTWI value exists.*

Monitoring period		Cadmium		Lead		Nickel	Mercury		Selenium		Arsenic	
		µg/day	% PTWI	µg/day	% PTWI	µg/day	µg/day	% PTWI	µg/day	% NNR	µg/day	% PTWI [A]
1998-2003	Mean	10	14%	19	7%	109	1.9	12% [C]	43	87%	62 [B]	< 2 %
	95th percentile	17	24%	31	13%	197	4.1	41% [C]			227 [B]	
	5th percentile								23			
1993-1997	Mean	16	22%	18	7%	167	3.5	7%	48	96%		
	95th percentile	24	33%	28	11%	278	5.8	11%				
	5th percentile								27			
1988-1992	Mean	17	24%	27	11%	157	5.0	10%	49	98%		
	95th percentile	28	40%	46	18%	281	9.0	18%				
	5th percentile								25			
1983-1987	Mean	20	29%	42	17%	199	7.0	14%	51	102%	118	< 4%
	95th percentile	32	46%	76	30%	252	15	30%				
	5th percentile								28			

[A] The assumption has been made that less than 5 % of the total content in seafood is inorganic arsenic [17] for which a PTWI value has been set.
[B] The estimated intake of arsenic is based on data for vegetables, meats, poultry, fish and beverages.
[C] The PTWI value used, which is 1,6 µg/kg b.w./week, is for methyl mercury [18]. It is assumed that the mercury contained in fish is MeHg only, and that mercury contained in all other food items is present as inorganic mercury.

The dietary intake of the toxic trace elements by infants is listed in Table 6. Young children ingest more food relative to their body weight than adults, and the associated dietary intake of trace elements per kg of body weight therefore amounts to higher values.

***Table 6**. Estimated intake of lead, cadmium and mercury by infants of 4-6 years using consumption data from the Danish dietary survey 2000-2002 [9].*

	N	Cadmium		Lead		Mercury	
		µg/day	% PTWI	µg/day	% PTWI	µg/day	% PTWI
Mean	230	7.7	36%	9.7	13%	1.3	16%
95th percentile		11,9	57%	15.4	20%	2.9	45%

Cadmium

Cadmium may accumulate in the body, primarily in kidneys and liver, and has a half-life of several decades. The toxic effect occurs in the kidneys and may lead to proteinuria. The PTWI value has been established at 7 µg/kg body weight [19] equivalent to 72 µg/person/day. Cadmium has been classified as a carcinogen when inhaled, but such an effect was neither substantiated nor declined [20] for oral exposure. The mean and 95th percentile of cadmium intakes (Table 5), which have been estimated at 10 µg/day and 16 µg/day for 1998-2003, are equivalent to 14 and 22 % of the PTWI value, respectively. The median cadmium intake of 9.6 µg/day is in good accordance with the mean value. The food groups that contribute the most to the intake are bread and cereals followed by vegetables, as shown in Figure 3. The decrease in cadmium intake in comparison with the previous monitoring period [12] mainly occurs for bread and cereals, vegetables and for beverages including drinking water.

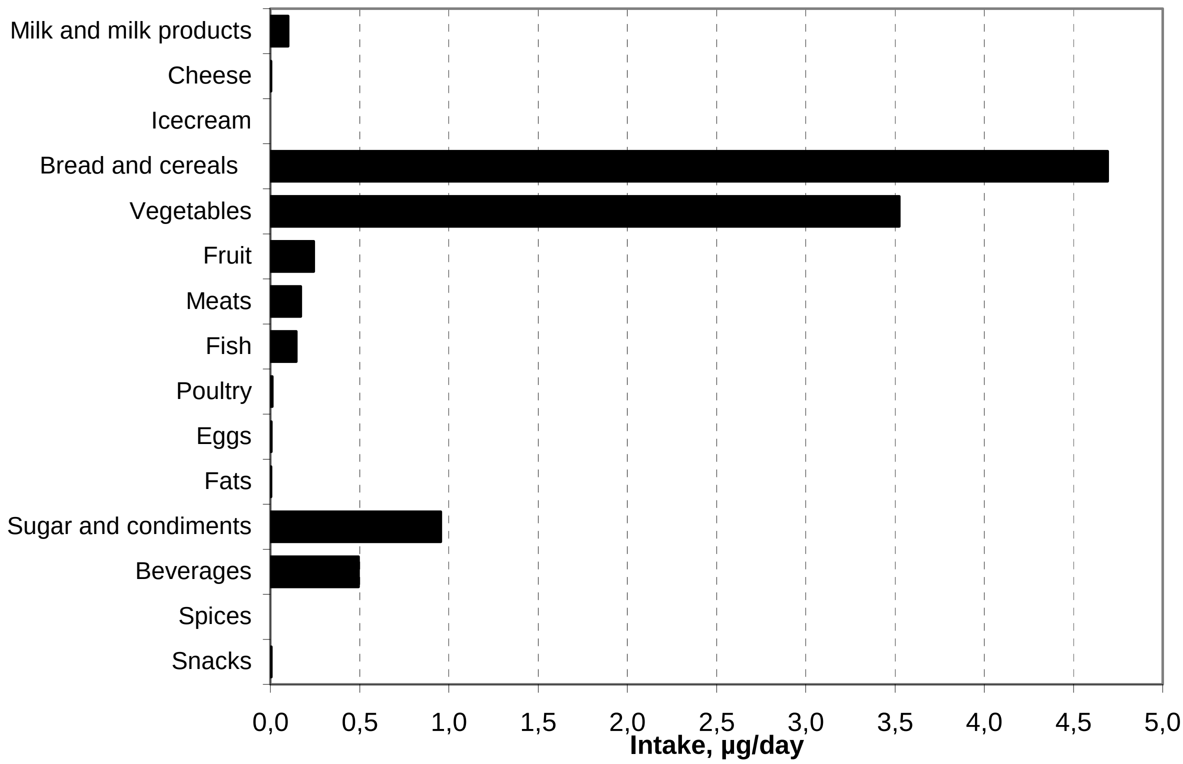

Figure 3. *Intake of cadmium from main food groups by Danes aged 15-75 years*

Keeping in mind the low safety factor, if any, the margin between the intake of cadmium via food in Denmark and the PTWI value, which corresponds to the adverse effect level, is modest. When setting the PTWI value, an average intestinal absorption rate of 5 % was assumed. This value may vary depending on factors such as the food matrix and the chemical species of cadmium present in the food. For a more detailed risk assessment, studies on absorption rate and cadmium speciation in the foods contributing most to the intake are needed.

Lead

Ingested lead is accumulated in the body, and its most adverse effect is associated with the development of the central nervous system in the foetus and newborn child. A possible association between increased lead content in blood and reduced intelligence quotient has been substantiated, and a lower threshold value could not be set. A PTWI value has been established at 25µg/kg body weight [21], which is equivalent to 257 µg/person/day. The mean and 95th percentile intake of lead (Table 5), which have been estimated at 17 µg/day and 30 µg/day for 1998-2003, are equivalent to 7 and 11 % of the PTWI value, respectively. The median intake value, which is 16 µg/day, is in good accordance with the mean value. The food groups that contribute mostly to the lead intake are beverages followed by vegetables, bread and cereals, fruit and sugars, as shown in Figure 4. The high proportion of lead intake from beverages is caused by a high mass of beverages in the total diet combined with the reported concentrations in Appendix 11.1.1.

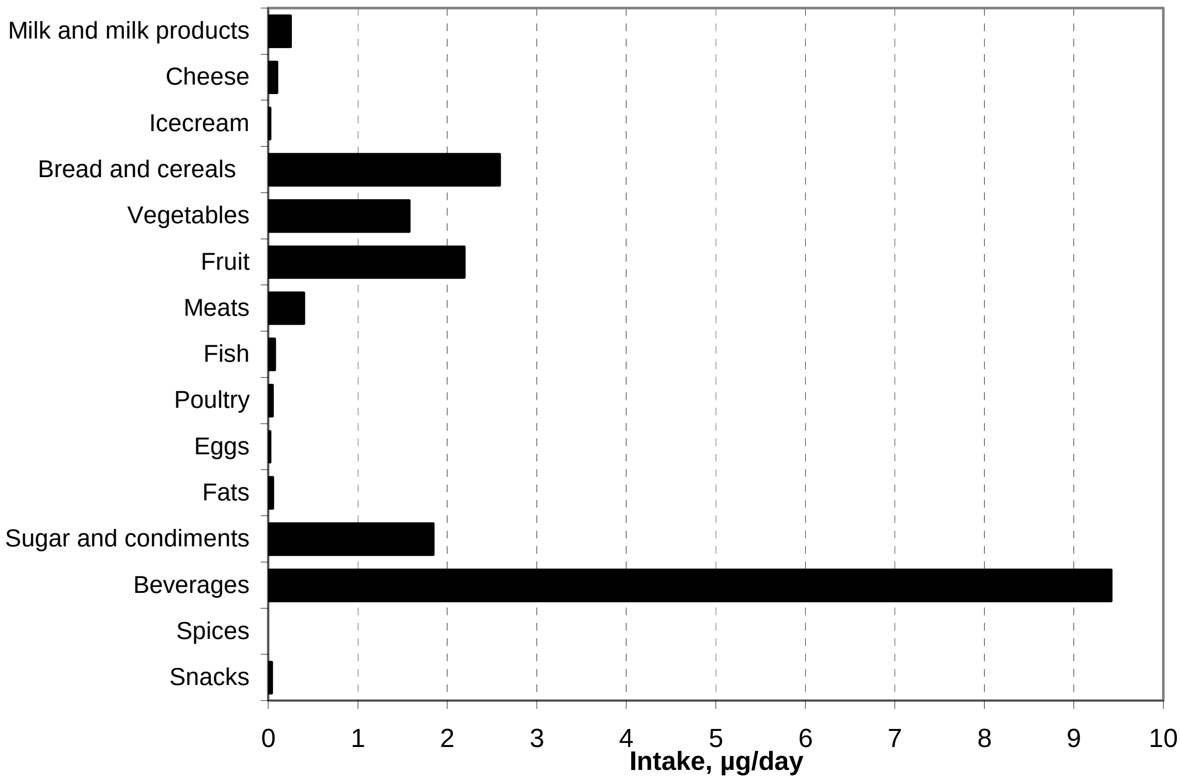

Figure 4. *Intake of lead from main food groups by Danes aged 15-75 years*

The dietary intake of lead estimated for the most recent monitoring period is unchanged in comparison with the 3rd monitoring period but much lower than those estimated for the 1st and 2nd monitoring periods (Table 5). This is consistent with the general decrease in the lead content in foods during the same time period, and the possible adverse effects of lead to adults is not a matter of concern.

A 2-year-old child, however, with a body weight of 15 kg consumes on average 59 % of the adult food consumption [9]. Because the dietary survey does not include consumption data for this age group, we made the assumption that the child's diet is composed of the same foods as that of the adult. This is, however, an approximation because of known differences between the adult's and the child's diet for certain lead-containing food items such as wine and offal. Therefore, a conservative estimate of the mean and 95th percentile lead intake for the 2-year old is equal to or less than 11 µg/day (20 % of the PTWI) and 17 µg/day (31 % of the PTWI), respectively. The tendency of small children to ingest soil or inhale lead-containing dust from *e.g.* playgrounds or house dust represents an additional source of lead exposure that should be kept to a minimum. If not strictly observed, the PTWI value may be exceeded when also taking these environmental lead sources of exposure into account.

Nickel

The dietary intake of nickel does not represent any health risks to the general population. Although troublesome to some sensitised individuals, a tolerable oral intake of nickel has not been established. The estimated mean and 95th percentile intake of nickel at 104 µg/day and 190 µg/day, respectively, (Table 5) are lower than those estimated for the three previous monitoring periods.

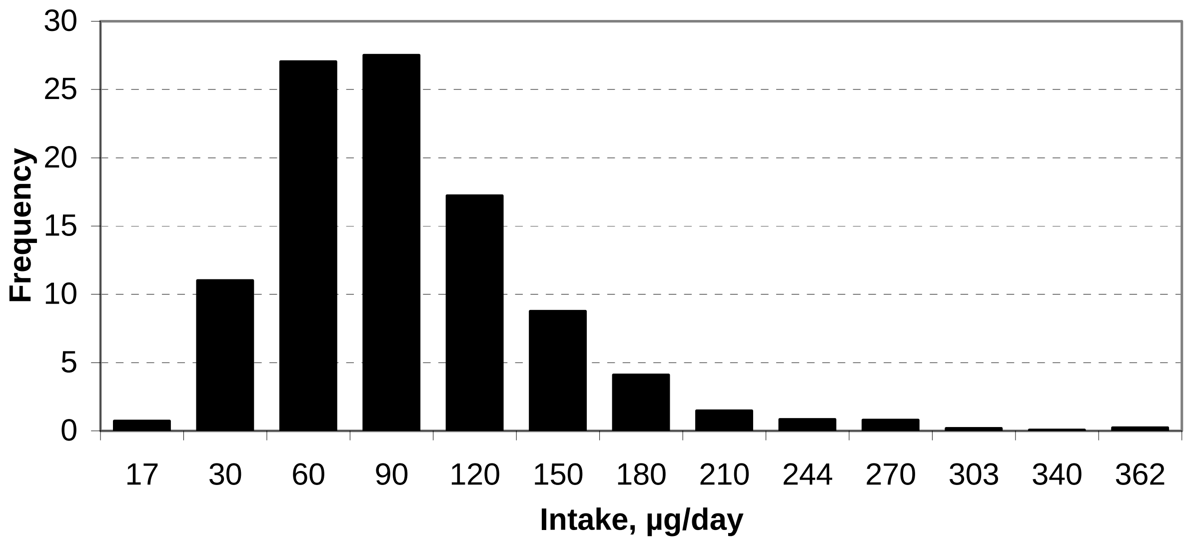

Figure 5. *Distribution in nickel intake in the Danes aged 15-75 years*

The distribution in nickel intake is shown in Figure 5 and has a median value of 95 µg/day, but the upper end indicates that some individuals are exposed to this trace element at up to 350 µg/day. The food groups that contribute the most to the nickel intake are beverages followed by cereals and milk, as shown in Figure 6. Considering the additional risk of nickel exposure from metallic surfaces in direct contact with food, e.g. water kettles or nickel-containing kitchen utensils, adverse effects may occur. Even more importantly, the varying nickel content in drinking water (Table 5), due to the migration of this metal from water installations, may cause an intake not reflected by the present mean intake estimate, and therefore pose a problem to sensitised individuals. In cases of high nickel migration from drinking water installations, the intake *via* water may, for certain individuals, increase by 20-30 µg/day.

The food groups that contribute the most to the intake of nickel are beverages, followed by bread and cereals and sugars. The reason for the high nickel intake from beverages is similar to that mentioned for lead from beverages.

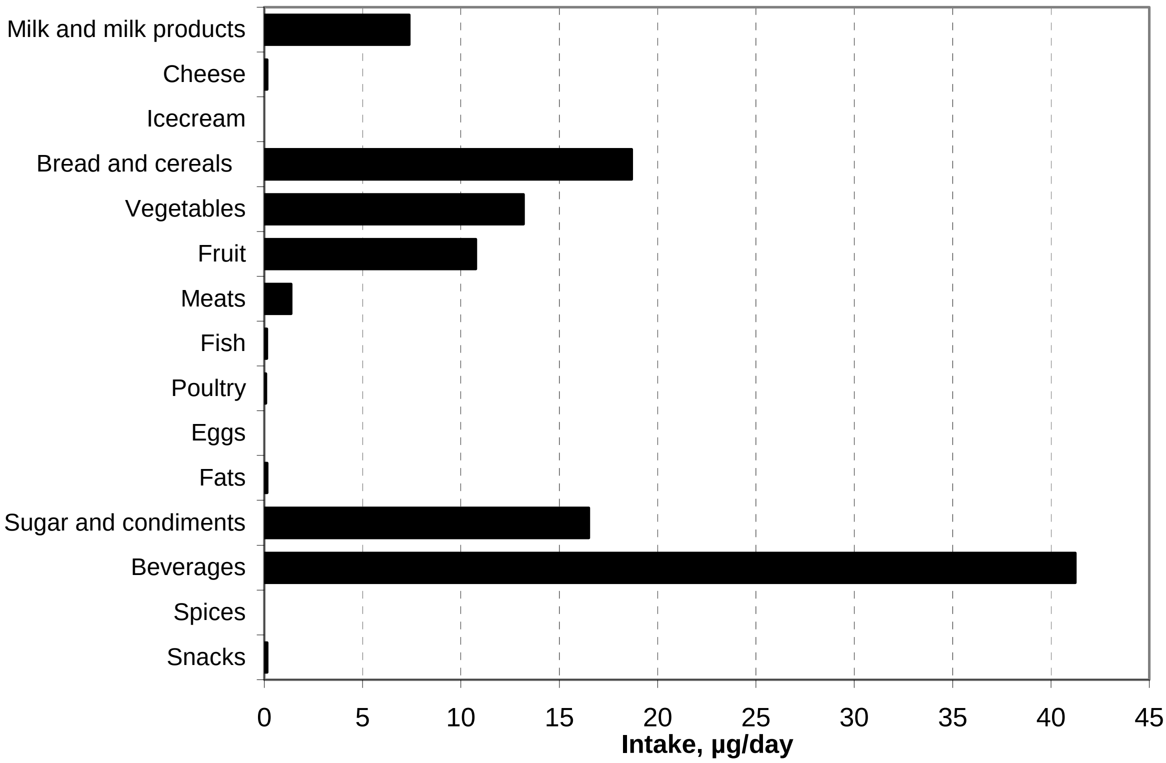

Figure 6. *Intake of nickel from main food groups by Danes aged 15-75 years*

Mercury

Ingested mercury is accumulated in the body, and the most toxic species is methyl mercury, which occurs in fish. The adverse effect of inorganic mercury first shows in the kidneys, while methyl mercury may affect the central nervous system. The PTWI value has been established at 5µg/kg body weight/week for mercury in general and at 1,6 µg/kg body weight/week specifically for methyl mercury [18]. The mean and 95th percentile dietary intakes of mercury, which have been estimated at 1.9 µg/day and 4.1 µg/day for 1998-2003 (Table 5), have been evaluated in the following way. About 60 % of the mean mercury intake (1.1 µg/day) originates from fish (Figure 7). It is assumed that all mercury contained in fish is present as methyl mercury, whereas the mercury in all other foods occurs as inorganic mercury. Because fish is the main contributor to the total mercury intake and the PTWI value for methyl mercury is lower than that for mercury, the estimated intake of mercury as methyl mercury from fish will lead to the most restrictive risk assessment. As indicated in Table 5, the methyl mercury fraction of the total mercury intakes corresponds to 12 % of the PTWI for the mean intake and to 41 % of the PTWI for the 95th percentile intake.

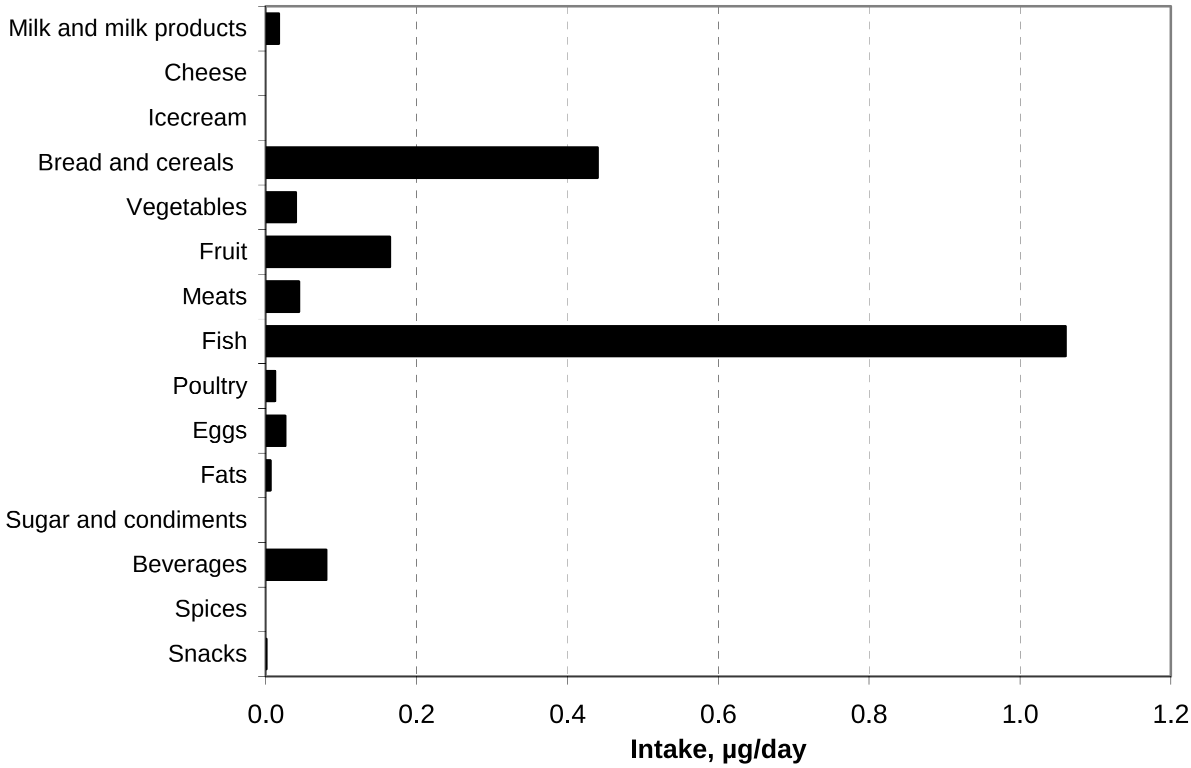

Figure 7. *Intake of mercury from main food groups by Danes aged 15-75 years.*

In comparison with previous monitoring periods, the mercury intake was evaluated more seriously during the 1998-2003 monitoring period. This is because of the newly issued and lower tolerable intake for methyl mercury, which reflects the greater toxicological concern for the mercury species.

Selenium

Selenium is an essential element to humans and is a constituent in selenoamino acids contained in selenoenzymes, such as the glutathione peroxidases. This group of enzymes catalyses the reduction of peroxides and thereby takes part in the body's anti-oxidative defence. A severely low selenium intake may cause heart disease (Keshan's disease). Therefore, possible adverse health effects are associated with a low intake of this element and justify the focus on the low percentile selenium intake of the population. The food groups that contribute the most to the selenium intake are meat (including offal), followed by bread and cereals and fish, as shown in Figure 8.

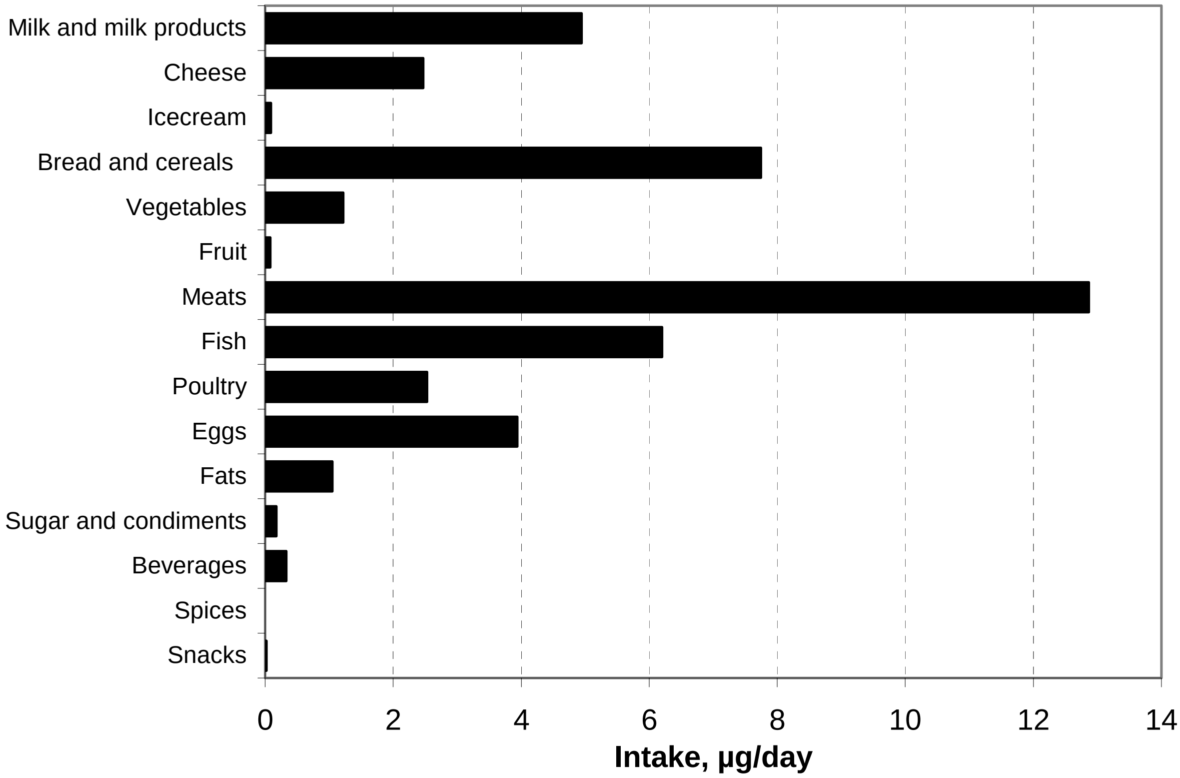

Figure 8. *Intake of selenium from main food groups by Danes aged 15-75 years*

The estimated mean and 5th percentile intake of selenium in 1998-2003 are 42 and 22 µg/day, respectively, and the selenium intake shows only small changes with a decreasing tendency over that past 20 years (Table 5). The selenium intake is in good agreement with the recommended level of 40 and 50 µg/day for women and men, respectively. Few individuals have an intake below the lower intake of 20 µg/day [22]. The recommendations do, however, not take into consideration the possible cancer-preventive effect of selenium at higher doses [23].

Arsenic

Arsenic, being a potentially toxic element in its inorganic chemical forms [19], occurs in seafood as the non-toxic arsenobetaine and other minor organoarsenicals [24]. Inorganic arsenic however, may lead to the development of skin cancer. The intake of arsenic from the total diet given in Table 5 was estimated in the first monitoring period at 118 µg/day [10]. In the two following monitoring periods (2nd and 3rd), only the arsenic content in fish was followed and consequently a re-evaluation of the total dietary arsenic intake was not possible. In the 4th period, however, a wider range of foods were included in the programme (11.1.6), and the arsenic intake from these food groups was estimated at 64 µg/day (Table 5). A vast majority of the intake (91 % of the total intake) occurs from fish, as shown in Figure 9.

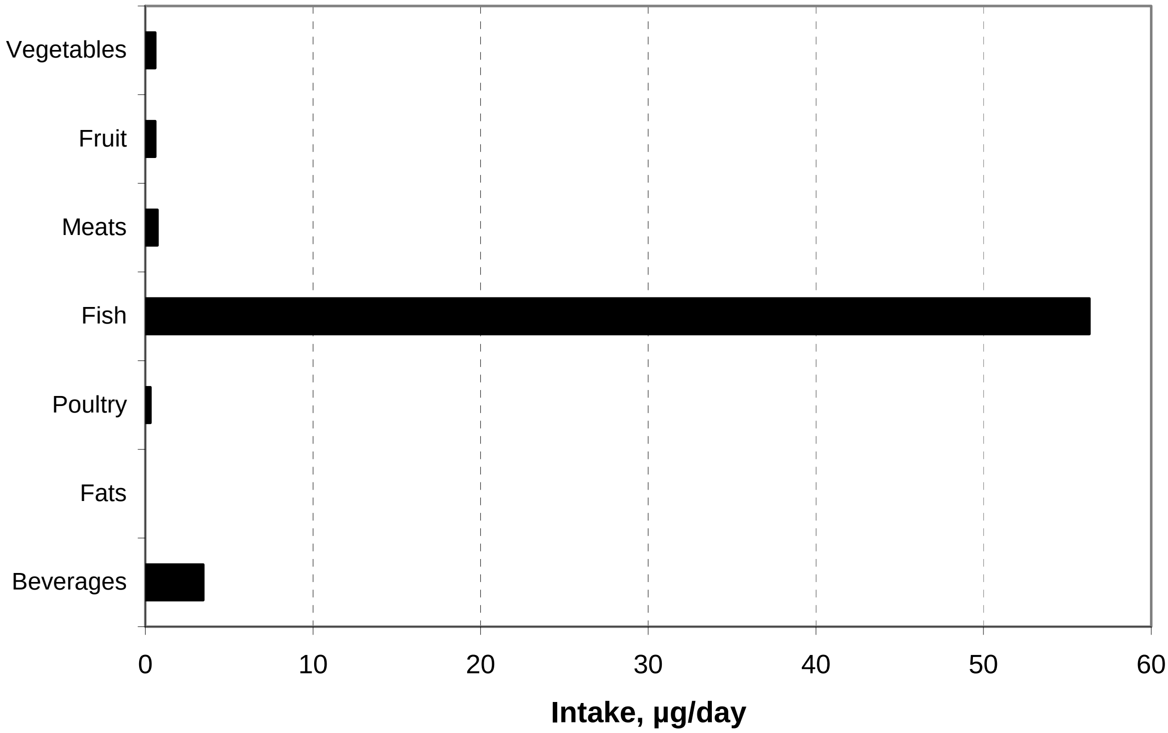

Figure 9. *Intake of arsenic from main food groups by Danes aged 15-75 years*

Assuming that inorganic arsenic occurs in fish and other seafood products at 5 % of the total arsenic [19], the intake of the inorganic forms via seafood corresponds to 2 % of the PTWI value for inorganic arsenic, which is 15 µg/body weight/week or 154 µg/person/day [25]. A more relevant method for monitoring arsenic in seafood in relation to human health risk assessment should therefore particularly include the inorganic arsenic species [26].

7 Nitrate in vegetables

7.1 Introduction

Nitrate is present as a natural constituent in plants and may accumulate in different tissues of the plant. Vegetables are the main contributors of nitrates in the human diet, generally providing approximately 80 % of the total daily intake [27]. The level of nitrate content can vary considerably according to plant species, extent of fertiliser use, humidity, temperature and amount of sunlight. For this reason, the nitrate levels of some commodities e.g. lettuce vary with geographic location and tend to be higher in samples from northern Europe than from Mediterranean countries.

The acute toxicity of nitrate is low, but in food and in the gastrointestinal tract the nitrate ion can be reduced to nitrite, which has a higher acute toxicity. However, the major health problem with nitrite is its contribution to the formation of nitrosamines, which have been found to be potent carcinogens in animal experiments. Several of the nitrosamines are therefore supposed to be carcinogenic in humans [28].

The content of nitrate in various vegetables has been monitored during several periods from 1984 to 1988 [29,30] and from 1993 to 1996 [31]. The selection of crops in the present monitoring program for nitrates in vegetables is based on these previous studies. There are EU regulations for the nitrate content of different vegetables such as head lettuce, iceberg and spinach. From April 2004 the nitrate content in baby food and processed cereal based food for infants and young children was also regulated by the EU. Nitrate content data for these types of vegetables and products on the Danish market will also be presented.

7.2 Sampling, analytical method and quality assurance

The sampling was carried out on a nationwide basis by authorized personnel from local food control units. Samples collected in 1998 and 1999 were analysed for nitrate at the regional laboratory in Odense, whereas samples collected during the period from 2000 to 2003 were sent to the regional laboratory in Copenhagen. Samples from the latter period were primarily taken at GASA and at the vegetable market in Copenhagen. The analyses were performed according to the method for the determination of nitrate in fruits and vegetables from the Danish Veterinary and Food Administration (FIA-method, TM-1481). The limit of detection was 5 mg/kg for nitrate. The regional laboratories in Odense and Copenhagen both participate in intercalibrations/performance tests through FAPAS Food Analysis Performance Assessment Scheme, Central Science Laboratory, UK.

7.3 Data on contents

Head lettuce, iceberg, spinach and potatoes were analysed for nitrate in each year of the present monitoring period from 1998 - 2003. As in the previous monitoring periods from 1984 – 1988 and 1993 – 1996, crops of both Danish and foreign vegetables were collected from open air and from greenhouses. In 2002 and 2003, samples of beetroot, rucola lettuce, celery and fennel and as well as baby food were also analysed for nitrate, whereas samples of Danish Chinese cabbage were only collected in 2003.

The results for each year are shown in Appendix 11.2.1 and 11.2.2. In total 1447 samples were analysed for nitrate content during the period from 1998 to 2003. The nitrate content varied widely according to the crop. In general the highest values were found in head lettuce and spinach and the lowest contents in potatoes. However, as shown in the appendix, there is a considerable variation in the nitrate contents within the same crop, which is illustrated by the great differences between the minimum and maximum values. In accordance with these findings, it is well known that great differences in nitrate contents may be obtained in the same crop (e.g. head lettuce) even when grown within a short distance from one another.

Lettuce and spinach

Most head lettuce in Denmark is grown in greenhouses and as shown appendix 11.2.1 and 11.2.2 only a minor part of the samples were collected in open air. Furthermore, due to collection problems during the period from 2000 to 2003, it was difficult to determine whether Danish samples of head lettuce were grown in open air or under glass. In the present study, these unknown samples were assumed to come from greenhouses. The same problem occur with head lettuce samples of foreign origin, and therefore these samples were not further categorised and thus consisted of both lettuce grown under glass and in open air. The average and median nitrate content in Danish head lettuce were similar during the whole period from 1998 to 2003. As shown in the appendix, the nitrate content in foreign head lettuce seemed to increase during the monitoring period. From 1998 to 2001 the mean and median values for the nitrate content were lower in foreign than in Danish head lettuce from greenhouses, whereas the contents were very similar in 2002 and 2003. In accordance with earlier Danish monitoring programs [30,31] the nitrate content in iceberg lettuce is considerably lower than for head lettuce, which was observed for lettuce of both Danish and foreign origin. Furthermore, very similar nitrate contents were found in Danish and foreign samples of iceberg lettuce between 1998 and 2003. Also for Danish spinach the nitrate content showed relatively small changes throughout the monitoring period, whereas the content of nitrate in foreign spinach seemed to increase from 1998 to 2003. Higher nitrate contents were obtained in fresh spinach than in frozen and preserved spinach for both the Danish and the foreign samples. This is expected due to the loss of nitrate during freezing and frozen storage and during the blanching process.

Potatoes

In the present monitoring period, the content of nitrate in Danish potatoes was found to be very similar from year to year and with an average value of approximately 100 mg/kg, varying between 76 mg/kg in 1999 to 120 mg/kg in 2002. As in the previous two monitoring periods (1984 – 1988 and 1993- 1996) higher nitrate contents were found in foreign than in Danish potatoes. Thus, the content was nearly two times higher in the foreign potatoes in 1998, 1999 and 2000, respectively. However, in 2001 no differences were observed between the nitrate contents of foreign and Danish potatoes. In 2002 and 2003, only Danish potatoes were analysed for nitrate.

Other vegetables and baby food

In the present monitoring period, different other vegetables were included in the last two years of the program such as baby food, beetroot, celery, Chinese cabbage, fennel and lettuce from rucola. As shown in appendix 11.2.2, the lowest nitrate contents were found in baby food with mean values of 9 mg/kg and 34 mg/kg in 2002 and 2003, respectively. The corresponding maximum values for these two years were 24 mg/kg and 120 mg/kg. In 2004 the European Union introduced maximum nitrate levels of 200 mg/kg for baby food as well as and processed cereal-based foods for infants and young children. Thus, the mean as well as the maximum values obtained in the present study are far below the EU maximum limit, indicating that nitrate in baby food does not represent a food safety problem. Compared to the other vegetables, relatively low levels of nitrate were also found in celery. The highest nitrate contents were found in samples of rucola lettuce with mean values of 5276 mg/kg (median value 5300 mg/kg) and 5399 mg/kg (median value 5850 mg/kg) in 2002 and 2003 (appendix 11.2.2). One sample of rucola lettuce collected in 2000 had a content 6100 mg/kg. This shows, that rucola lettuce may contain high levels of nitrate in comparison to the other vegetables mentioned in the appendix 11.2.1 and 11.2.2. There are no regulations in EU for the nitrate content in rucola lettuce. However, compared to e.g. head lettuce harvested between 1st October and 31st March, the EU maximum limit for nitrate of 4500 mg/kg will be exceeded for most of the rucola samples.

7.4 Developments in nitrate contents of vegetables over time

In the two previous Danish monitoring periods from 1984-1988 and 1993-1996, lettuce included both iceberg and head lettuces. For this reason the data for head lettuce and iceberg from the present period were collected so as to compare the nitrate content between the different monitoring periods. The results for lettuce and beetroot are shown in Figure 10. Data for beetroot was only available from 2002 and 2003 (appendix 11.2.2). The average content of nitrate in Danish lettuce showed a small decrease from the previous monitoring period (1993 – 1996), but an increase compared to the first period (1984 – 1988). For foreign lettuce a small increase in the nitrate content was observed in the present period compared with the foregoing period from 1993 to 1996. The contents of nitrate were lower in foreign lettuce than in Danish lettuce. As shown in appendix 11.2.1 and 11.2.2, most of the Danish samples are mainly head lettuce grown in greenhouses and they generally contain higher amounts of nitrate than the foreign samples. This may explain the differences between the observed nitrate contents in Danish and foreign lettuce. The nitrate content varies throughout the year with the highest concentration occurring in the winter, where the temperature and amount of natural light are limiting growth factors. In Denmark, normally no artificial light is used in the greenhouses during the winter period, and for this reason the content of nitrate in Danish produced lettuce may be higher compared to foreign lettuce grown in areas with more natural light and higher temperatures.

In total, the average content of nitrate in all the lettuce samples is similar for the last two monitoring periods, but slightly higher compared to the first period from 1984 – 1988. As seen in Figure 10, the content of nitrate in beetroot from this monitoring period has the same level as the foregoing period (1993 – 1996), but is considerably lower compared to the first monitoring period between 1984 and 1988.

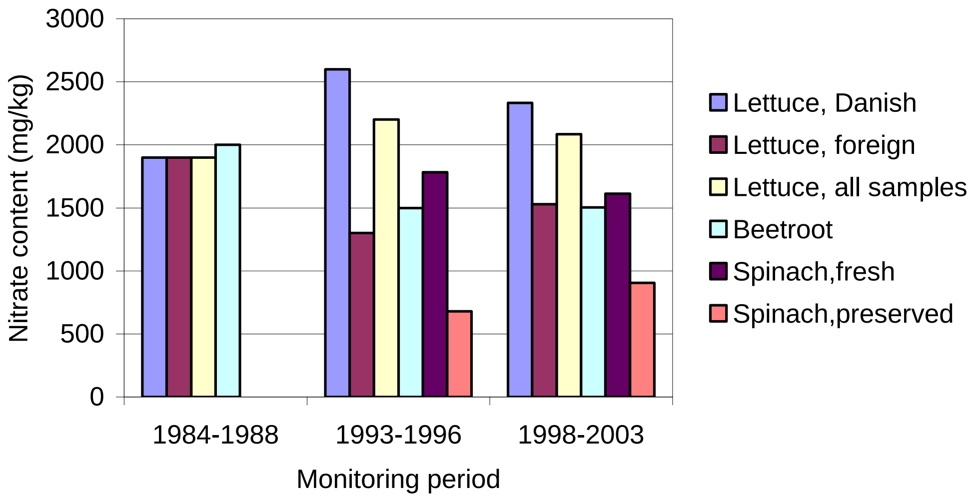

Figure 10*. Comparison of the average content of nitrate in lettuce, beetroot and spinach during the years 1984 - 1988, 1993 – 1996 and 1998 - 2003.*

Figure 11 shows that in the present monitoring period as well as in the two foregoing periods higher contents of nitrate were found in foreign than in Danish potatoes. The highest average contents were found for the 1993 – 1996 period, varying between 140 mg/kg and 260 mg/kg for Danish and foreign potatoes, respectively. The lowest contents were observed for the monitoring period between 1984 and 1988, where average values for Danish and foreign potatoes between 80 mg/kg and 120 mg/kg. The observed differences may have several causes, such as different cultivars, places of origin with respect to e.g. climate and soil, fertilization and dry matter contents.

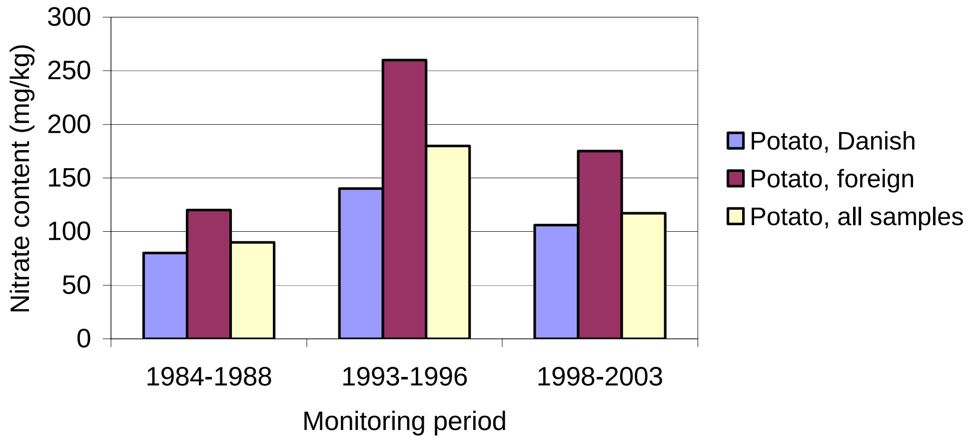

Figure 11. *Comparison of the average nitrate contents in potatoes during the periods 1984 – 1988, 1993 – 1996 and 1998 – 2003.*

7.5 Intake calculations

The average intake of nitrate from various vegetables from the present period compared to the two previous monitoring periods is shown in Figure 12. For each product, the mean value of contents from all the years in each monitoring period were used for the intake calculations. The consumption surveys do not distinguish between the consumption of Danish and foreign vegetables of lettuce and potatoes, and therefore the nitrate contents in the Danish and foreign samples were pooled for the intake calculations. In the period 1984 – 1988, consumption data was obtained from Statistics Denmark [32] and in this survey Chinese cabbage was included in the consumption of lettuce, consisting of both head lettuce and iceberg lettuce. In the dietary survey from 1993 – 1996, data from the Danish Veterinary and Food Administration was used [31], where separate consumption data is available for Chinese cabbage, iceberg lettuce and other lettuce (Figure 10).

In the period 1998 – 2003, dietary survey data was only available for the total intake of head lettuce and iceberg lettuce, and therefore Figure 12 does not have separate columns for the intake of head and iceberg lettuce.

The nitrate intake from potatoes is similar for the first period from 1984 – 1988 and for the present period with mean intakes of 13.7 mg/day and 11.7 mg/day, respectively. As shown in Figure 12, the nitrate intake from potatoes in the present has decreased by about 50 % compared to the period from 1993 – 1996. There are several explanations to this. As shown in Figure 11, the nitrate content in potatoes has decreased considerably from 175 mg/kg in the period 1993 – 1996 to 120 mg/kg in the period 1998 – 2003, when referring to all the samples that consist of both Danish and foreign potatoes. In addition, the average consumption of potatoes has decreased in the same period from 124 g/day [31] to about 100 g/day [9]. These conditions may explain the observed differences in nitrate intake.

In the two foregoing monitoring periods, potatoes were the major individual contributor to the nitrate intake from vegetables followed by lettuce. However, in the present period the nitrate intake from lettuce has increased considerably compared to the periods from 1984– 1988 and from 1993 – 1996 (Figure 12). Furthermore, the nitrate intake from lettuce was considerably higher than for potatoes in the present monitoring period, where the mean intakes were approximately 19 mg/day and 12 mg/day for lettuce and potatoes, respectively. The content of nitrate for all the lettuce samples (Figure 10) was approximately 2000 mg/kg in all three of the monitoring periods, but the intake of lettuce has increased during the present period. Thus, in the monitoring periods 1984 – 1988 and 1993 – 1996, the intake of both iceberg lettuce and head lettuce was similar corresponding to approximately 4 g/day [32]. In the last monitoring period from 1998 – 2003, the intake of lettuce increased to about 9 g/day, which shows that the consumption of lettuce is nearly doubled compared to the earlier periods. These differences can thus explain that lettuce is now a more important contributor to the intake of nitrate than potatoes.

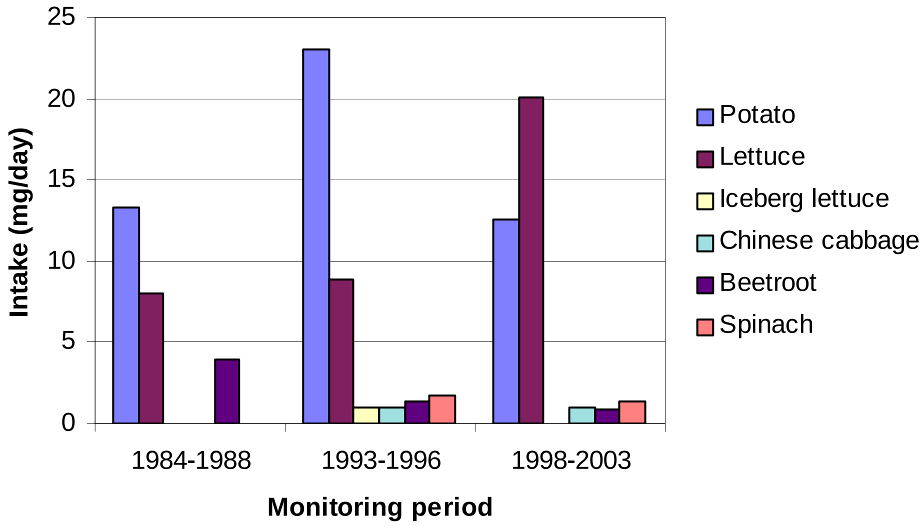

Figure 12. *Comparison of the nitrate intake from vegetables included in the monitoring programmes from 1984 – 1988, 1993 – 1996 and 1998 – 2003.*

The nitrate intake from beetroot has decreased during the whole period from 3.9 mg/day in 1984 – 1988 to 0.8 mg/day in the period 1998 – 2003. Although the nitrate content in beetroot was higher in the first period compared to the present period (Figure 10), the average differences in nitrate intake between the two periods are mainly due to a lower consumption. Thus, the consumption of beetroot has decreased from 2 g/day in 1984 – 1988 [33,34] to 0.5 g/day in 1998 – 2003 [9].

The intake of nitrate from the vegetables included in the Danish Food Monitoring programme is now approximately 36 mg/day, which is very similar to the value obtained in last monitoring period from 1993 – 1996 corresponding to 37 mg/day. In the first monitoring period from 1984 – 1988 the intake of nitrate from vegetables was estimated to be approximately 30 mg/day. In addition to the vegetables monitored in the present programs, other vegetables, fruits, bread and dairy products will also contribute to nitrate intake. The same is true of drinking water, which is another important contributor to nitrate intake. By assuming that the intake of nitrate from these sources is in the same range as suggested for the last monitoring period from 1993 –1996, this will give a total nitrate intake of approximately 60 mg/day.

7.6 Safety assessment

The acceptable daily intake (ADI) for nitrate is 5 mg per kg body weight (EU Scientific Committee for Food, 1995). The value is expressed as sodium nitrate, which after conversion gives a value of 3.7 mg nitrate per kg body weight. This corresponds to a daily intake of 257 mg nitrate for a person weighing 70 kg, which is fairly high compared to the actual estimated intake of approximately 60 mg/day. The mean content of nitrate found in samples of baby food collected during 2002 and 2003 is low compared to the EU maximum limit of 200 mg/kg, indicating that nitrate in baby food does not represent a food safety problem.

8 Organic environmental contaminants

8.1 Introduction

Organic environmental contaminants refer to a large number of compounds found as contaminants in the environment as a consequence of industrial pollution. A number of substances have been found to be persistent in the environment and are found as contaminants in our foods today. Analyses for organochlorine compounds are carried out because of their potentially hazardous health effects on humans. Attention has been directed towards persistent organochlorine contaminants such as PCB (polychlorinated biphenyls), dioxins and compounds that have earlier been widely used as pesticides (for example DDT).

PCB is a group of 209 compounds that, due to their physical and chemical properties, were utilized for industrial purposes since the 1930s. PCB has been widely used as an isolating material in capacitors and transformers. Furthermore, because of its chemical stability and fire-retarding properties, PCB has been used in hydraulic systems and as an additive to paints, printing inks, coolants, and cutting oils, and PCB has been used as a plasticizer in plastics.

Dioxins is a short expression for a group of 210 compounds including polychlorinated dibenzo-*p*-dioxins (PCDD) and polychlorinated dibenzofuranes (PCDF). Dioxins are formed during industrial and household combustion processes and as by products by certain industrial productions eg metal manufacturing and metal reclamation. A subgroup of PCB congeners has the same toxicological effects as dioxins and they are referred to as dioxin-like PCB.

The studies comprise a number of organochlorine pesticides, which were earlier used mostly as insect-controlling pesticides and are today found as environmental contaminants.

Sources of intake for organochlorine compounds

Contents of organochlorine compounds may derive from the pollution of the environment where the compounds, being fat-soluble and because of their apolar properties, accumulate up through the food chain. In meat, eggs, dairy products and farmed fish, contents of the organochlorine compounds may also derive from residual contents in feedstuffs or, in the case of organochlorine pesticides, from applications in the environment around the animals. The occurrence of persistent organochlorine compounds in the environment is changing relatively slowly over a span of years; similar time trends are characteristic of their contents in fish, meat, eggs, and dairy products, which are the foods making the greatest contributions to the intake of organochlorine compounds.

Compounds analysed

In the monitoring system two analytical chemical methods are used for analysing the organic environmental contaminants, one includes the organochlorine pesticides and indicator PCB and the other dioxin and PCB. Both methods analyse for the presence of PCB in the samples, but the dioxin and PCB method includes more PCB congeners and attains lower limits of detection than the method for the analysis of organochlorine pesticides and indicator PCB. Therefore and because of a very large difference in the number of samples obtained using the two different analytical methods, results are treated separately in the present report.

The method analysing for organochlorine pesticides and indicator PCB comprises a number of organochlorine pesticides: p,p'-DDT with its metabolites p,p'-DDE, p,p'-DDD and o,p'-DDT, aldrin, isodrin, endrin, dieldrin, HCB (hexachlorobenzene), α- and β-HCH (hexachlorocyclohexane), lindane (γ-HCH), heptachlor and heptachlor epoxide, which is a metabolite of heptachlor, α-chlordan, γ-chlordan, oxychlordan, trans-nonachlor, α-endosulfan. Very few samples contained the compounds aldrin, isodrin, endrin, heptachlor and γ-chlordan. Hence the results of these substances are not included in the present report. The values for p,p'-DDT, p,p'-DDE, p,p'-DDD and o,p'-DDT are reported here as the sum of the four, referred to as ΣDDT, which mainly consist of the metabolite p,p'-DDE as DDT is no longer in use.

Ten indicator PCB congeners are included in the analytical method also covering the organochlorine pesticides. Each PCB congener is named by a number and the determination involves a specific determination of 10 individual indicator PCB congeners: PCB28, PCB52, PCB101, PCB105, PCB118, PCB138, PCB153, PCB156, PCB170, and PCB180. Indicator PCB-sum is calculated as the sum of the 10 congeners.

The method analysing for dioxins and PCB incorporates 17 dioxins, 12 dioxin-like PCB and 7 non dioxin-like PCB. The dioxins determined are the 2,3,7,8 chlorine substituted congeners (PCDDs and PCDFs), which have been assigned dioxin toxicity equivalency factors (TEF). The dioxin-like PCB has been assigned TEF-values as well, and the congerners are: PCB 77, PCB 81, PCB 126, PCB 169, PCB 105, PCB 114, PCB 118, PCB 123, PCB 156, PCB 157, PCB 167 and PCB 189. The TEF-values are used to weigth the concentrations of the individual congeners before summing to produce the total toxic equivalency for dioxin (TEQ). The non dioxin-like PCB included are: PCB 28, PCB 52, PCB 101, PCB 138, PCB 153, PCB 170 and PCB 180.

Regulation of organochlorine pesticides, PCB and dioxins

From 1st December 1994, the import and sale of lindane were prohibited, and from 1st July 1995 all use was prohibited [35]. In 1988 dieldrin was discontinued, whereas aldrin was withdrawn already in 1963. The use of DDT was prohibited in 1984, and heptachlor has not been used since 1972 [36]. HCB and α- and β-HCH have never been permitted for use in Denmark. However, since the time of the Second World War organochlorine pesticides have been used worldwide and are still being used in some developing countries. A substance such as DDT has been widely used, e.g. for controlling malaria-carrying mosquitoes as well as the control of insect pests in Denmark. Previously the stability of the substance was considered an advantage in relation to its insect-controlling purposes; and it was not realized until later that DDT and other organochlorine pesticides degrade slowly in animals and humans. Being also highly fat-soluble, the substances concentrate in fatty tissues from which they are not readily eliminated.

Table 7 shows the maximum residue limits (MRLs) for organochlorine pesticides in fat from meat, dairy products, and eggs [37].

Table 7. *Maximum residue limits for organochlorine pesticides (General view, details in reference [37])*

Substance	Maximum residue limit (mg/kg*)		
	Fat from meat	Milk, cheese, etc.	Eggs
Aldrin	0.2	0.006	0.02
Chlordan	0.05	0.002	0.005
ΣDDT	1.0	0.04	0.05
Dieldrin	0.2	0.006	0.02
Endosulfan	0.1	0.004	0.1
Endrin	0.05	0.0008	0.005
Heptachlor	0.2	0.004	0.02
HCB	0.2	0.01	0.02
α-HCH	0.2	0.004	0.02
β-HCH	0.1	0.003	0.01
Lindane	0.02 (0,7**)	0.001	0.1

* mg/kg fat for meat and dairy products, and mg/kg fresh weight for eggs.

**Poultry.

In fish and fish products, a national maximum residue limit of 2 mg/kg for ΣDDT has been established, while fish liver has a MRL of 5 mg/kg for ΣDDT [38]. No corresponding maximum residue limits exist for the other substances.

Since the 1980s, the introduction of regulations in Denmark has led to significant restrictions on the use of PCB. Thus, in 1986 the import and sale of PCB and PCB-containing products were prohibited [39]. Until January 1995, use of larger, existing transformers and capacitors containing PCB was permitted, while smaller transformers and capacitors containing PCB may be used for as long as they last [39]. Even though the use of PCB has been regulated over a number of years in most western countries, the substances will, due to their stability, remain in the environment for many years to come.

For dioxins maximum levels for a range of foodstuffs of animal origin has been established by EU and enforced by July 1, 2002 [40]. Action levels for dioxins have been introduced as well [41]. Foodstuffs with contents of dioxins above the action levels but below the maximum levels are allowed to be marketed, but the EU member state is committed to try to find the cause for the increased levels of dioxins. Maximum levels and action levels are listed in Table 8.

Table 8. *Maximum levels and actions levels for dioxins in foodstuffs*

Products	pg WHO-PCDD/F-TEQ/g fat or product*	
	Maximum level	Action level
Meat and meat products from ruminants	3	2
Meat and meat products from poultry	2	1.5
Meat and meat products from pigs	1	0.6
Liver and derived products	6	4
Muscle meat of fish and fishery products	4*	3*
Milk and milk products	3	2
Hen eggs and eggs products	3	2
Vegetable oil	0.75	0.5
Fish oil for human consumption	2	1.5
Fruit, vegetable and cereals	-	0.4

Assessment of contents in fish oil in relation to recommended values for acceptable contents

In the previous monitoring report (1993-1997), a list of recommended values for acceptable contents of indicator PCB and organochlorine pesticides in fish oil [42] was described. The values are listed in Table 9. These values may serve as an indication of the quantities that are tolerable in other foods. Fish oil has been included in the monitoring period by a survey of fish oil food supplements.

Table 9. *Recommended values for acceptable contents of PCB and organochlorine pesticides in fish oil [42].*

Substance	mg/kg fish oil
ΣDDT	0.4
Dieldrin	0.1
Heptachlor epoxide	0.02
HCB	0.05
α-HCH	0.02
β-HCH	0.02
Lindane	0.02
PCB-153	0.1
Indicator ΣPCB	0.4

It should be noted that the recommended value for ΣDDT in fish oil is somewhat lower than the maximum residue limits of fish products and fish liver.

8.2 Sampling, analytical methods, and quality assurance

Lean fish such as cod, plaice, and flounder have appreciably lower contents of organochlorine pesticides and indicator PCB than fat fish such as herring or salmon. The monitoring study was planned with the intent of closely following all food items with either a high content of residues or high consumption. Cod liver and herring were used for monitoring the pollution levels of the different Danish waters from the Baltic Sea in the East to the North Sea in the West. Furthermore, the following fish were investigated: Farmed trout from fish farming and sea farming and farmed eel as well as fish from retail trade; herring (raw, smoked, pickled), mackerel (raw, smoked, in tomato sauce), salmon, (raw), Greenland halibut (raw), garfish (raw), plaice (raw), cod (raw), swordfish (raw) and lumpsucker (raw).

For the analyses of meat, eggs, milk and farmed fish, sampling was performed according to EU directive 96/23/EC on measures for monitoring certain substances in live animals and animal products. In addition, surveys of imported dairy products, including imported milk, butter and cheese, were made. Samples of meat and farmed fish were taken at the slaughter-houses; eggs were taken at the egg packing stations, and milk was taken either at the dairy works or directly from the livestock.

The monitored substances are fat-soluble, and hence they will be found in the lipid phase i.e. the fat. Therefore, dairy products having relatively high fatty contents, such as butter, milk fat and cheese were sampled.

Kidney fat from cattle and pigs and subcutaneous fat from poultry were also was analysed. Studies [43,44,45,46] have shown that the contents of organochlorine pesticides and indicator PCB in such fatty tissues are representative of the contents in the market meat when measured on the basis of fat. Fillets of fish were analysed after removing the skin, as it is presumed that only few people eat the fish skin and that the migration of the substances from the skin to the rest of the fish during preparation is minimal.

In Appendix 11.3.1 the number of various food samples within the monitoring period is presented.

The chemical analyses of organochlorine pesticides and indicator PCB were carried out at the regional laboratory in Århus or until 1999 at the regional laboratory in Aalborg in accordance with the quality assurance manual. The analytical procedure includes extraction using an organic solvent, after which the organochlorine contaminants are isolated from the fatty phase and detected by gas chromatography with EC detection. For further information on the analytical methods, see reference [47]. The results are calculated as mg/kg fish/cod liver/eggs (fresh weight), or as mg/kg fat for pigs, cattle, poultry, and dairy products.

The sampling plans for the analyses of dioxin and related PCB are presented in Appendix 11.3.2 and 11.3.3. The tables show the number of samples of the various foods and human milk. The majority of the analyses of dioxins and related PCB were performed at the Danish Institute for Food and Veterinary Research. Samples from 2003 of fat from poultry, beef, pork and sheep were carried out at the regional laboratory in Ringsted.

The analyses were carried out in accordance to the requirements for sampling and analytical method described in EU directive 2002/69/EC [48]. Both the laboratories participate in international ring tests.

For the analyses of meat, eggs, milk and farmed fish sampling was made according to EU directive 96/23/EC setting measures to monitoring certain substances in live animals and animal products. Samples of meat and farmed fish were taken at slaughterhouses; eggs were taken at the egg packing stations and milk was taken either at dairy works or directly at livestocks. In addition surveys were made of dairy products and fish oil supplements collected at retail stores and wild fish collected by the Danish Directorate of Fisheries.

Limit of detection

Contents of persistent organochlorine pesticides and indicator PCB in foods have decreased, since these substances are no longer in use. In order to follow the lower contents and to better estimate the dietary intake of the population, all findings above the limit of detection have been reported since 1995. This limit varies for the different substances and may also vary from year to year. Appendix 11.3.31 presents tables with the limit of detections used.

8.3 Data on contents

8.3.1 Organochlorine pesticides and indicator PCB

The average contents of the substances analysed in various foods are presented in Appendix 11.3.4 to 11.3.24. The tables show the total number of samples for each of the foodstuffs under study, the number of samples with contents above the detection limits; the average contents of the individual organochlorine compounds; Median, 90%-quantile (given only in some cases; see below); and the maximum value. The indicator PCB-sum has been calculated as the sum of the averages in Appendix 11.3.24 for 10 indicator congeners.

Calculation of average contents

Calculations of the average contents of the various organochlorine environmental contaminants in foods are briefly described below.

For the environmental contaminants PCB and organochlorine pesticides, it may be assumed that they are present in varying quantities everywhere in the environment. When calculating the average contents of the various substances, values below limit of detection e.g. the content may be zero or it may be just below the limit of detection. To compensate for this fact in calculations of average contents in the present monitoring period, values below the limit of detection are set to one-third of the limit of detection. One-third of the limit of detection was chosen on the basis of what had been used in the previous monitoring period for figures below the limit of detection when only a few data are above the limit of detection. This approach will probably lead to an overestimation of the contents in those cases where no contents were found in any samples and an underestimation in those cases where the contents were found in almost all the samples.

For the monitoring period 1983-1987, values below the reporting limit were set to zero if the average was above the limit, which leads to an underestimation of the contents. For calculated averages below the reporting limit, the contents were set to the limit, which leads to an overestimation of the contents. For the monitoring period 1988-1992, values below the reporting limit were set to one-half of the reporting limit. For the monitoring period 1993-1997, a statistic programme was used to calculate the intake, using a logarithmic normal distribution or one-third of the limit of detection to calculate the average content. Finally for the monitoring period 1998-2003, all values below the limit of detection were set to one-third of the limit of detection.

Different estimation methods for the contents in foods, different detection limits or reporting limits from year to year as well as differences in the dietary data make a comparison of the estimated intake between the different monitoring periods difficult. However calculations from the third and fourth monitoring period are expected to be comparable, bearing in mind the differences described above.

Contents in fish

The contents of organochlorine pesticides and indicator PCB in fish depend among other things on the fish species as well as on the water where the fish was caught. The contents of these substances vary according to the fish species due to the fact that the fatty content of different fish species varies. Differences in the organochlorine levels between the bodies of water may be explained by differences in the environmental pollution of the waters with organochlorine pesticides and indicator PCB. The present monitoring period does not include additional information on factors concerning the fish, such as their food basis, age and sex. It is, however, likely that a relationship exists between these parameters and the variation in the contents of organochlorine pesticides and indicator PCB in the fish. Partly for that reason, even when the samples are grouped according to fish species and waters, there are great variations within the same species and the same body of water.

In Figure 13 and Figure 14, the average contents of organochlorine compounds in herring and cod liver are displayed. In the figures, the bars illustrate the fish samples according to their Danish fishing grounds; 1) the Baltic Sea, the Belts, the Sound; and 2) the North Sea, the Skagerrak, the Kattegat 3) all waters.

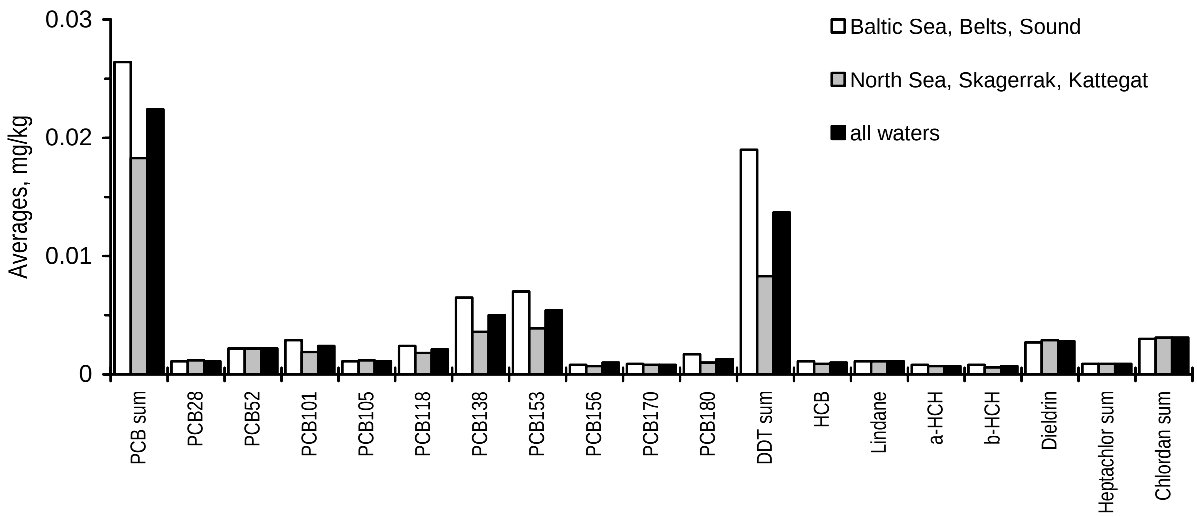

Figure 13. *Average contents of organochlorine pesticides and indicator PCB in herring.*

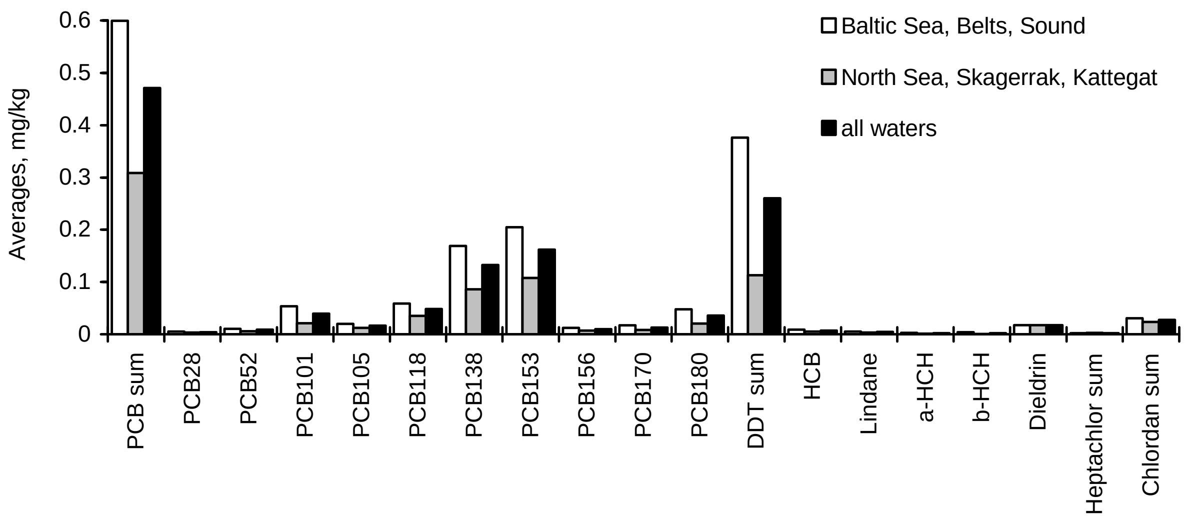

Figure 14. *Average contents of organochlorine pesticides and indicator PCB in cod liver.*

It appears in Figure 13 and Figure 14 that the organochlorine contents in fish from the Baltic Sea typically are higher than the content in fish from the North Sea. Thus, the measured contents reflect a higher pollution level in the inner Danish waters. The highest contributions found in fish are from ΣDDT, PCB-153 and PCB-138.

As the organochlorine compounds accumulate in the fat tissue of fish, cod liver with a fat content of 30-80 per cent, has a higher content of organochlorine pesticides than herring with a fat content of 1-15 per cent [49,50], depending on, e.g., the time of the year.

Contents in products of animal origin

In animal fat, ΣDDT is detected at low levels in the majority of animal fat samples, and HCB is also detected at low levels in the majority of samples, except for poultry and pork samples where HCB is only detected in a few samples. Indicator PCB is not commonly detected in animal fat samples, however the average summarised indicator PCB contents are at the same level as the content of HCB.

The majority of dairy products contain ΣDDT and HCB at low average levels except for Danish butter, where the compounds are only found in a few samples. Lindane occurs mostly in foreign cheese. Dieldrin is found in foreign produced dairy products more often than in Danish produced dairy products, however, the average levels are the same.

Contents in fruits and vegetables

The monitoring programme does not comprise analyses for indicator PCB in cereals, fruits and vegetables, however organochlorine pesticides in fruits and vegetables are reported in the sub-report on pesticides [51].

8.3.2 Dioxins and PCB

The measured contents of dioxins and PCB in food items analysed are presented in Appendix 11.3.25 to 11.3.28. For each foodstuff the tables show the total number of samples, the minimum value, mean, median, 90%-fractile and the maximum value. The contents of dioxins and dioxin-like PCB as well as the sum of the dioxins and dioxin-like PCB are listed as toxic equivalency for dioxin (TEQ). TEQ is calculated by multiplying the concentration of each congener with an assigned dioxin toxicity equivalency factor (TEF). The weighted concentrations are summed to produce TEQ for dioxins, TEQ for dioxin-like PCB and Total TEQ that is the sum of TEQ for dioxins and dioxin-like PCB. The TEF values are shown in Table 10.

Table 10. *Dioxin toxicity equivalency factors (TEF) as defined by WHO [52]*

Congener	TEF-value	Congener	TEF-value
PCDD		**Non-ortho PCB**	
2,3,7,8-TCDD	1	PCB 77	0,0001
1,2,3,7,8-PeCDD	1	PCB 81	0,0001
1,2,3,4,7,8-HxCDD	0,1	PCB 126	0,1
1,2,3,6,7,8-HxCDD	0,1	PCB 169	0,01
1,2,3,7,8,9-HxCDD	0,1		
1,2,3,4,6,7,8-HpCDD	0,01		
OCDD	0,0001		
PCDF		**Mono-ortho PCB**	
2,3,7,8-TCDF	0,1	PCB 105	0,0001
1,2,3,7,8-PeCDF	0,05	PCB 114	0,0005
2,3,4,7,8-PeCDF	0,5	PCB 118	0,0001
1,2,3,4,7,8-HxCDF	0,1	PCB 123	0,0001
1,2,3,6,7,8-HxCDF	0,1	PCB 156	0,0005
1,2,3,7,8,9-HxCDF	0,1	PCB 157	0,0005
2,3,4,6,7,8-HxCDF	0,1	PCB 167	0,00001
1,2,3,4,6,7,8-HpCDF	0,01	PCB 189	0,0001
1,2,3,4,7,8,9-HpCDF	0,01		
OCDF	0,0001		

In Figure 15 and Figure 16 the results of the dioxin TEQ are displayed together with the EU maximum levels for dioxins. It can be seen that for foodstuffs of animal origin the measured values of dioxins are generally well below the maximum levels. The same is true for the action levels, which are approximately 25% lower than the maximum level.

Three out of four samples of herring caught east of Bornholm exceeded the dioxin maximum level, and one eel sample out of five caught in the Sound exceeded the action level. These results reflects the fact that the Baltic Sea has higher levels of organic environmental contaminants than the other seas surrounding Denmark, and that fatty fish has a tendency to accumulate organic contaminants due to the lipophillic behaviour of the compounds.

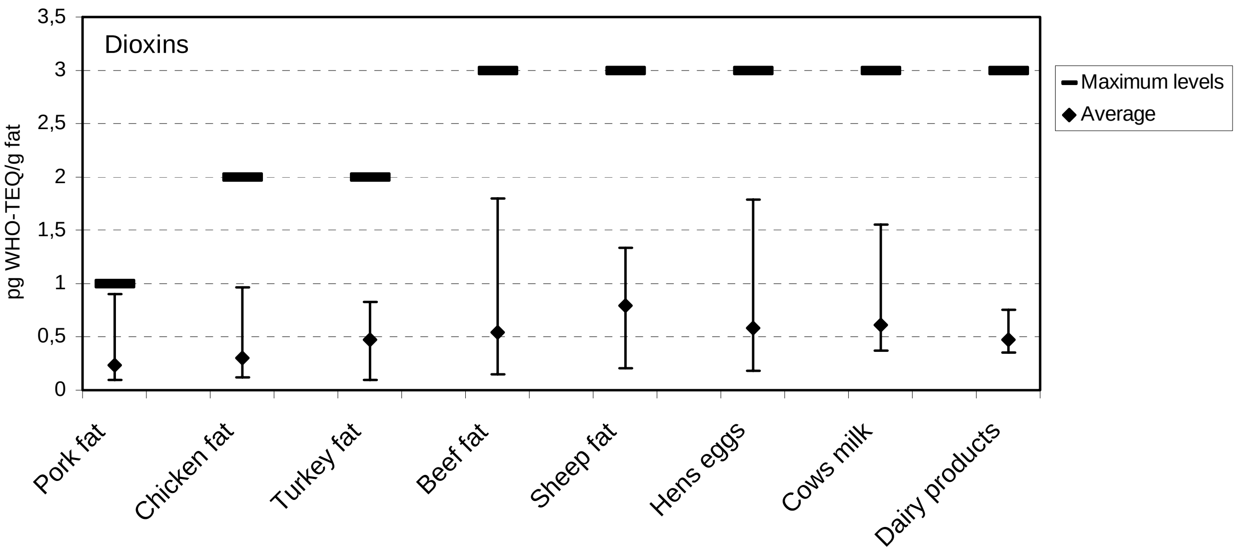

Figure 15. *Contents of dioxins in foodstuffs of animal origin. The average values are shown in addition to the maximum and the minimum. EU maximum levels are indicated for each foodstuff.*

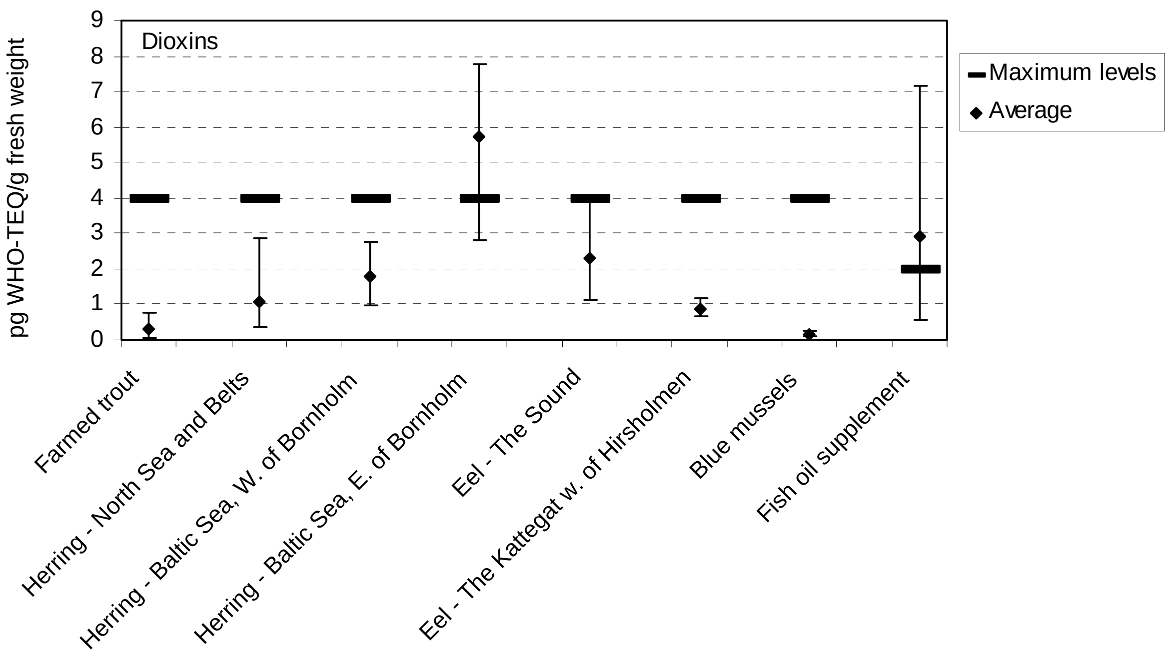

***Figure 16**. Contents of dioxins in fish and fish oil supplement. The average values are shown in addition to the maximum and the minimum. EU maximum levels are indicated for fish and fish oil respectively.*

Two out of five samples of fish oil supplements exceeded the maximum level but these samples were analysed before the maximum level for fish oil for human consumption was established. The supplements were based on cod liver oil, which has a tendency for high levels of dioxins and PCB if not properly cleaned.

In Figure 17 and Figure 18 the results of the sum of TEQ for dioxins and dioxin-like PCB are displayed. The proposed EU maximum levels for the sum of TEQ for dioxins and dioxin-like PCB are indicated on the graphs. For the analysed foodstuffs the same trend is seen as for the dioxin-TEQ alone: The foodstuffs of animal origins are generally well below the proposed maximum levels and Baltic Herring from east of Bornholm and eel from the Sound has a high risk for exceeding the maximum level. In fact the situation for the eel is worse because the content of PCB is relatively higher.

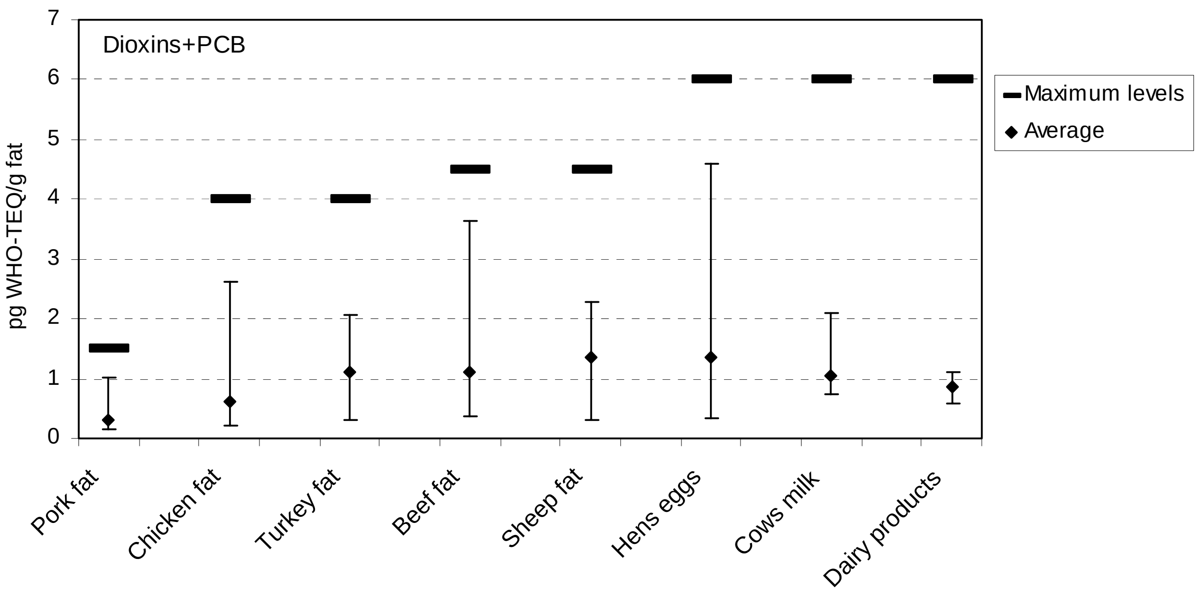

Figure 17. *Contents of the sum of dioxins and dioxin-like PCB in foodstuffs of animal origin. The average values are shown in addition to the maximum and the minimum. Proposed EU maximum levels are indicated for each foodstuff.*

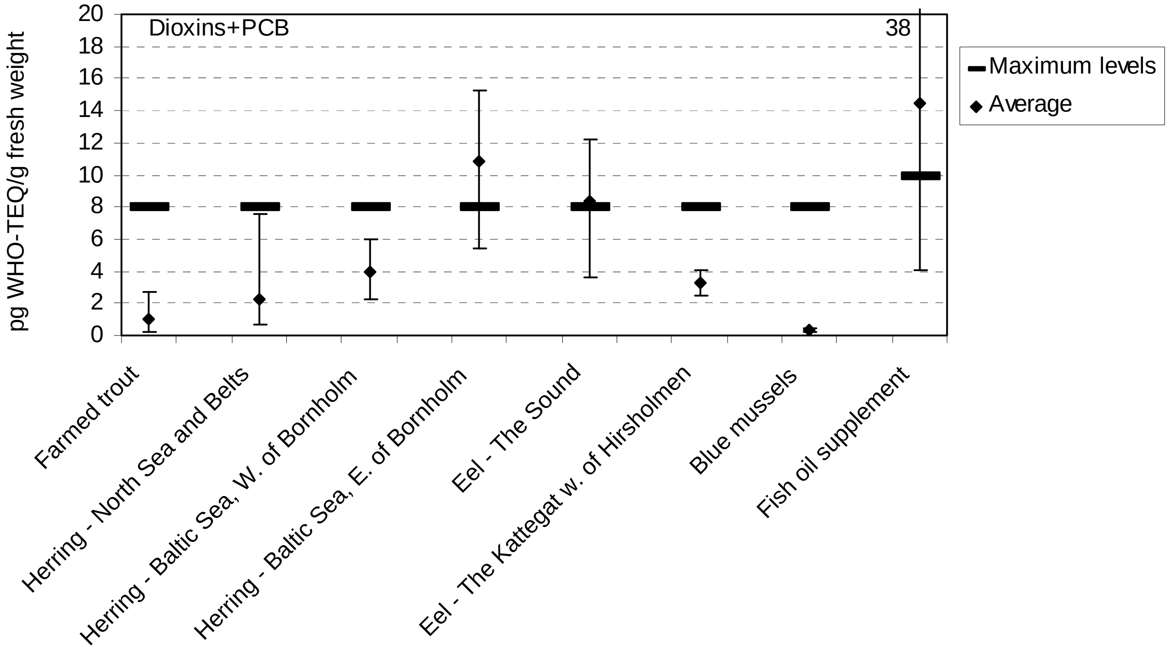

Figure 18. *Contents of the sum of dioxins and dioxin-like PCB in fish and fish oil supplement. The average values are shown in addition to the maximum and the minimum. Proposed EU maximum levels are indicated for fish and fish oil respectively.*

8.4 Development in contents over time

This section is focussing on organochlorine pesticides and indicator PCB due to the fact that dioxins and dioxin-like PCB were only included in the present monitoring period. Any significant changes in levels are expected to occur over a longer time of years than has been covered so far.

Fish

Contents of organochlorine environmental contaminants in fish have significantly decreased during the 1970s and the beginning of the 1980s [53]. However developments in recent years do not show a clear trend, but rather a more or less steady state condition. This section discusses the development in organochlorine contaminants during the three latest monitoring periods (1988-2003).

The contents of contaminants in fish depend on a number of significant factors, which were not taken into consideration in the present monitoring period, e.g. the food basis of the fish, their age, weight and sex, and the time of year. In particular, a decline in concentration over time may be seen if the fish caught today are younger, and thus, other things being equal, have not had the same time to accumulate the contaminants. Such an effect will hardly be distinguishable from the effect of lower concentrations in the marine environment over time.

Cod liver was selected to model the development over time, since almost all the cod liver results are above the limit of detection. Statistic analyses of data from cod liver showed that the distribution of concentrations is best described by a logarithmic normal distribution, and that the development over time can be described by a linear regression based on logarithmized data [54]. As the cod liver and herring data sets contain observations below the limit of detection, a special programme was used to estimate regression lines for the organochlorine compounds [55]. The programme describes results by means of a logarithmic normal distribution estimating values below the limit of detection on the basis of values above the limit of detection. By means of an analysis of variance, the programme did at the same time assess whether the regression lines for different waters could be pooled. This programme has been used on the results of cod liver and herring. Waters that have been pooled because their regression lines do not differ significantly, and because the waters are at the same time physically joined, are indicated by the same symbol in Figure 19 to Figure 25.

Figure 19 shows the development over time for total PCB in cod liver. Total PCB is a measure of the entire PCB content based on a previously used analytical method. The content of PCB is today estimated by summarising the content of the individual PCB compounds analysed. Total PCB content for the period 1994 to 2003 is estimated using the correlation between Total PCB and indicator PCB-sum described in the monitoring programme 1993-1997. A significant decline in the PCB concentration is seen from the beginning of the first monitoring period in 1988, but since the mid of the 1990s the decline has almost been absent. The indicator PCB concentration in cod liver from the Baltic Sea, the Belts, and the Sound is typically highest, while the concentration in cod liver from the Skagerrak typically is lowest.

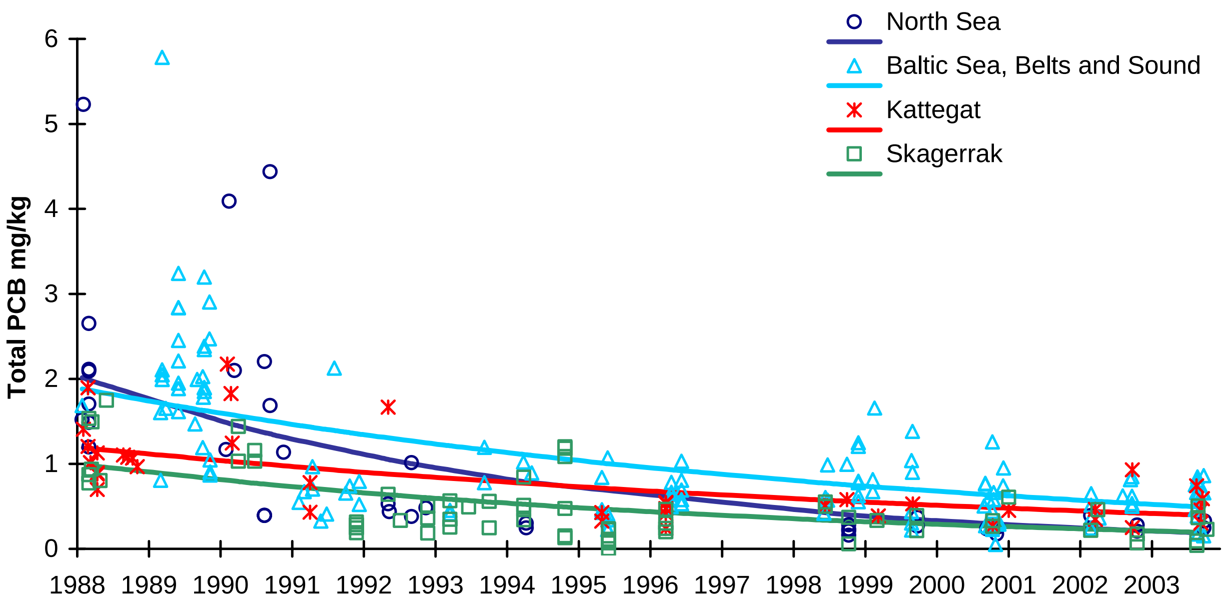

Figure 19. *Total PCB in cod liver from Danish waters, 1988 - 2003. Each point represents one sample, and the lines show the regressions based on logarithmized data. Data for the period 1998 to 2003 is estimated from the indicator PCB-sum.*

In Figure 20 the corresponding development over time for indicator PCB-sum in cod liver is seen. Indicator PCB congeners have been analysed since 1994 and the figure show no significant decline in the indicator PCB levels in cod liver from the Danish waters.

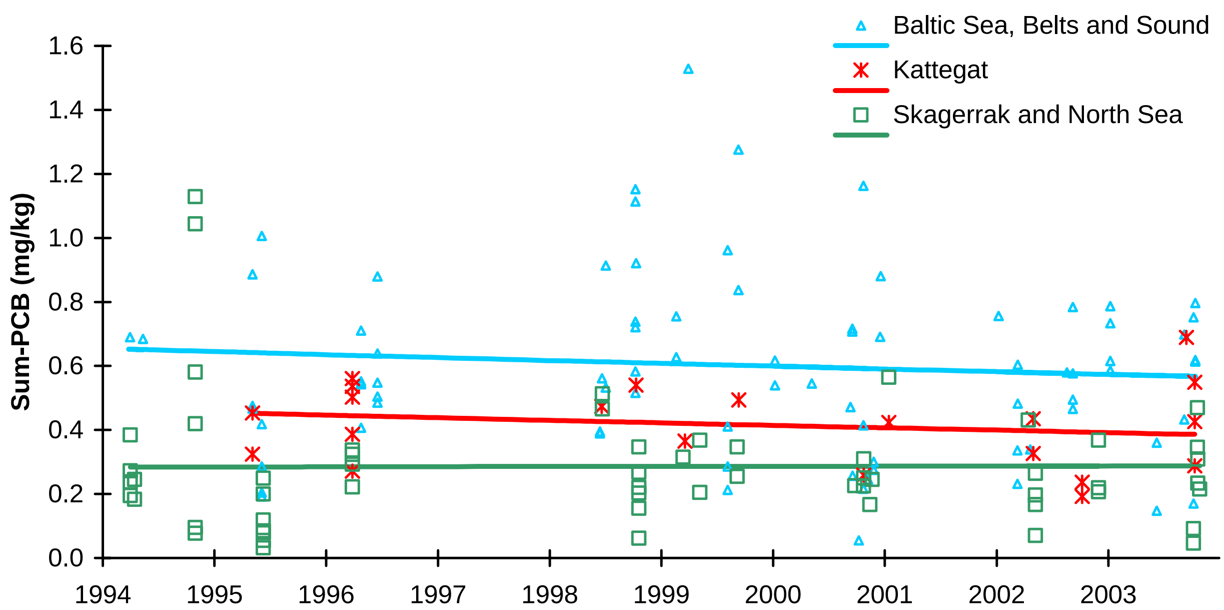

Figure 20. *Indicator ΣPCB in cod liver from Danish waters, 1994 - 2003. Each point represents one measurement, and the lines show the linear regressions based on logarithmized data.*

In Figure 21 the development over time for ΣDDT in cod liver is seen. Also here a significant decline is seen in the concentration of DDT from 1988 to the mid of the 1990s and then almost steady-state conditions. The highest concentrations are found in cod liver from the Baltic Sea and the lowest in cod liver from the Skagerrak.

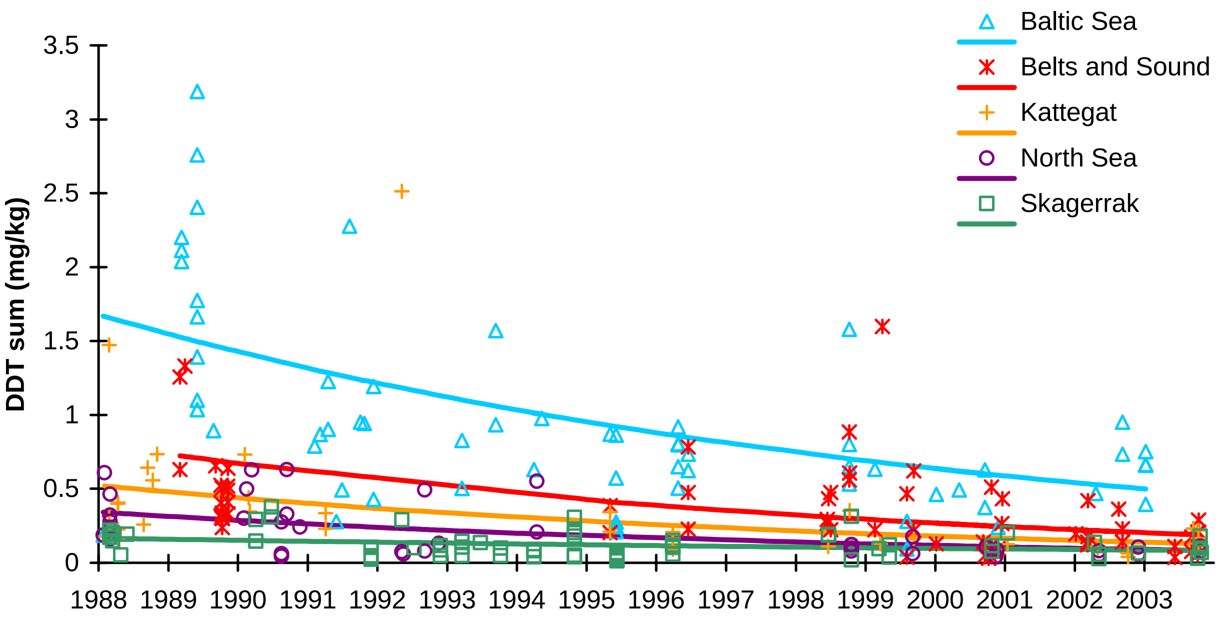

Figure 21. *DDT in cod liver from Danish waters, 1988 - 2003. Each point represents one measuring, and the lines show the linear regressions based on logarithmized data. One Baltic Sea sample from 1989 had a content of 7.77 mg/kg and is not displayed in the graph.*

Figure 22 and Figure 23 show the development over time for HCB and dieldrin, respectively. The development for these substances is as for DDT, a decline for, especially the Baltic Sea, until the mid of the 1990s and then an almost steady state. Only in cod liver from the Baltic Sea, a significant decline is observed.

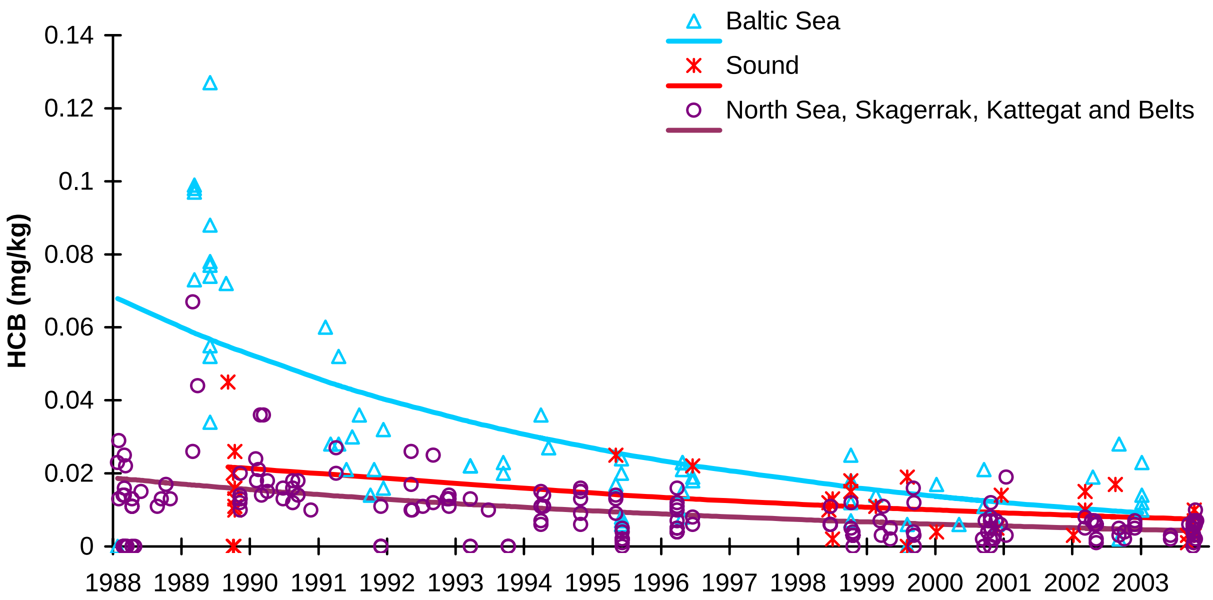

Figure 22. *HCB in cod liver from Danish waters, 1988 - 2003. Each point represents one sample, and the lines show the linear regressions based on logarithmized data.*

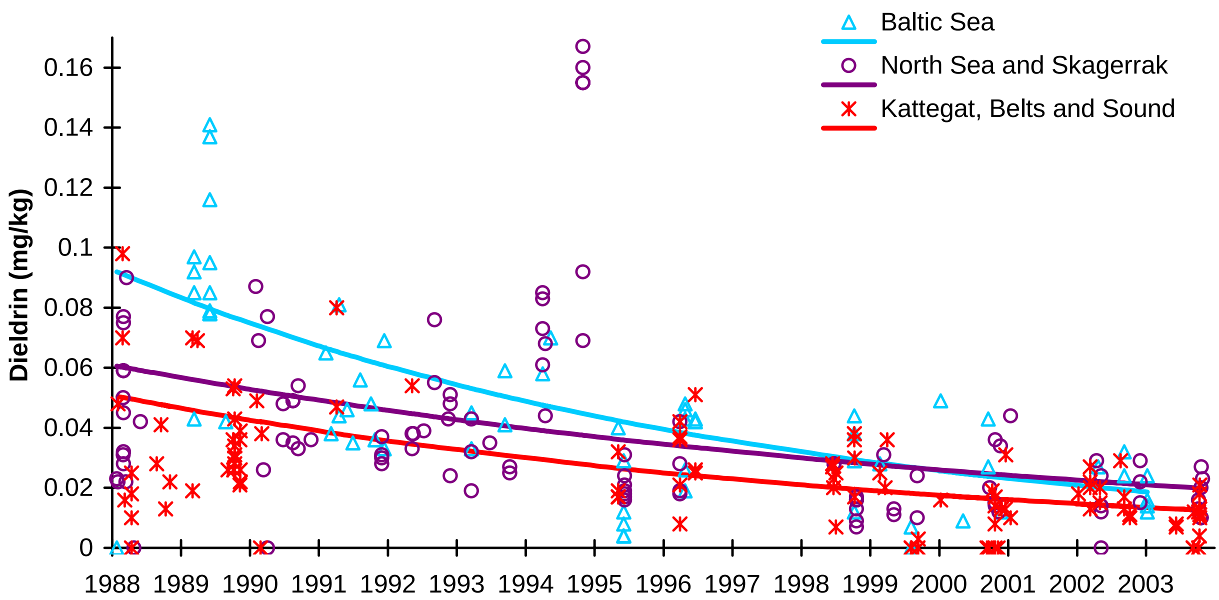

Figure 23. *Dieldrin in cod liver from Danish waters, 1988 - 2003. Each point represents one sample, and the lines show the regression lines from a linear regression based on logarithmized data.*

For herring several samples that contain ΣDDT above the limit of detection, Figure 24 shows that the ΣDDT content from the Baltic Sea is typically higher than the content in herring from other waters. The contents of ΣDDT in other waters than the Baltic Sea are typically below the limit of detection in the previous monitoring periods, but above the limit of detection in the present monitoring period from 1998 to 2003, due to lower limit of detection. Hence, the regression line, based on the logarithmized data for other waters than the Baltic Sea, shows a slight increase in the level of ΣDDT since 1988. However, the content of ΣDDT in herring is not expected to have increased during the period since 1988, but rather to be due to technical differences.

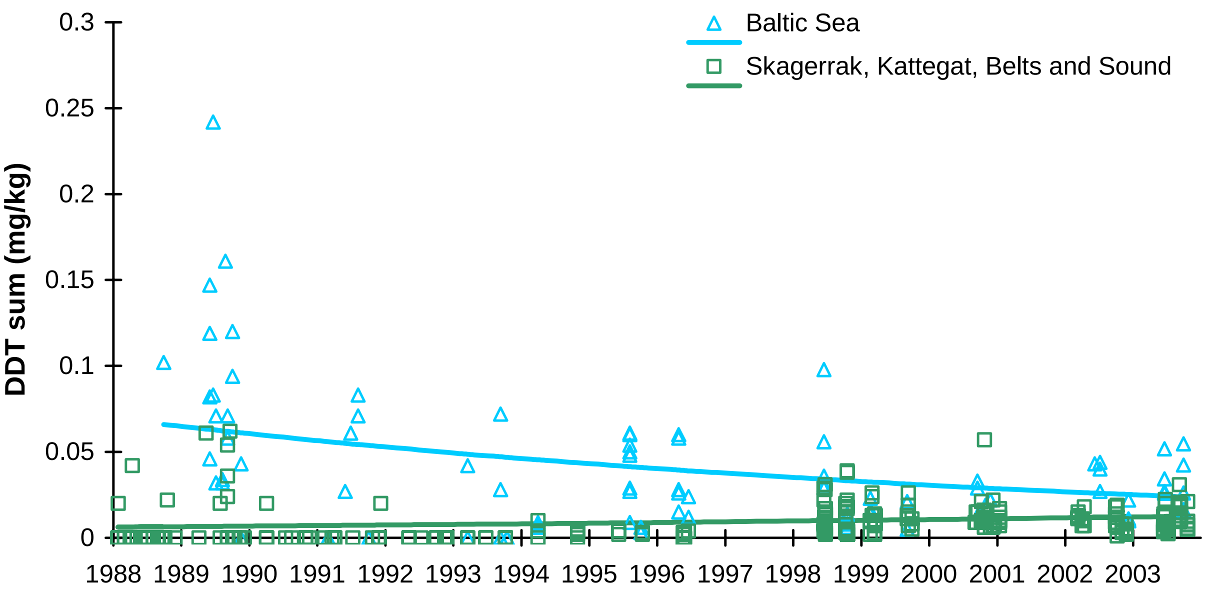

Figure 24. *DDT in herring from Danish waters, 1988 - 2003. Each point represents one sample, and the lines show the regression lines from a linear regression based on logarithmized data.*

Since 1988, fish samples shows overall tendency towards a decline in concentrations over time, but with an almost steady state since 1995.

In general, when solely considering the 4th monitoring period (1998-2003), no clear development for organochlorine pesticides and indicator PCB in fish is seen. Accordingly, the year of catch has been disregarded in the calculation of contents in the appendixes 11.3.4 to 11.3.24.

Products of animal origin

In products of animal origin only few compounds are found above the limit of detection. Hence it is difficult to observe any development in concentrations. However a few compounds were found in a significant number of samples, and means was estimated using one third of the limit of detection for the samples with concentrations below the limit of detection. This approach is however problematic for the indicator PCB-sum, as it is the sum of ten compounds and therefore influenced by ten limits of detections and their variation between the different years. Especially the limits of detection for the year 2003 are significantly lower than the other years. Hence, comparisons of the average content between different years should be done with caution for the indicator PCB-sum.

The findings in animal fat are almost all just above the limit of detection, and the average contents do not differ from year to year. The most pronounced compounds in fat from different animals are the same, but some inequalities between the different food items are seen.

For pork fat (Figure 25) the highest average was found for ΣDDT, but indicator PCB-sum and HCB were also found. The compounds were found at almost the same levels from 1998 to 2003 with a minor decrease for ΣDDT.

In beef fat (Figure 26) ΣDDT, indicator PCB-sum and HCB were also found, where ΣDDT and HCB had the highest average contents, but also dieldrin was found in samples of beef fat. The distribution between the substances as well as the levels seems to be very constant throughout the monitoring period.

For poultry fat (Figure 27), almost the same picture is seen, findings of ΣDDT, indicator PCB-sum and HCB were almost at a constant average level, and there were also findings of dieldrin. In addition to these compounds, and in contrast to the other animal fats, lindane was observed in a significant number of samples of poultry fat, but at very low levels just above the limit of detection.

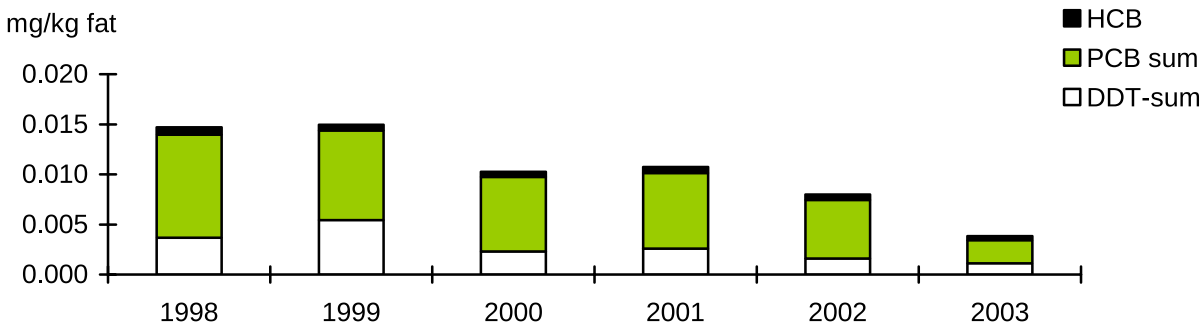

Figure 25. *Pork fat, 1998-2003. Average contents of substances found in pork fat (mg/kg).*

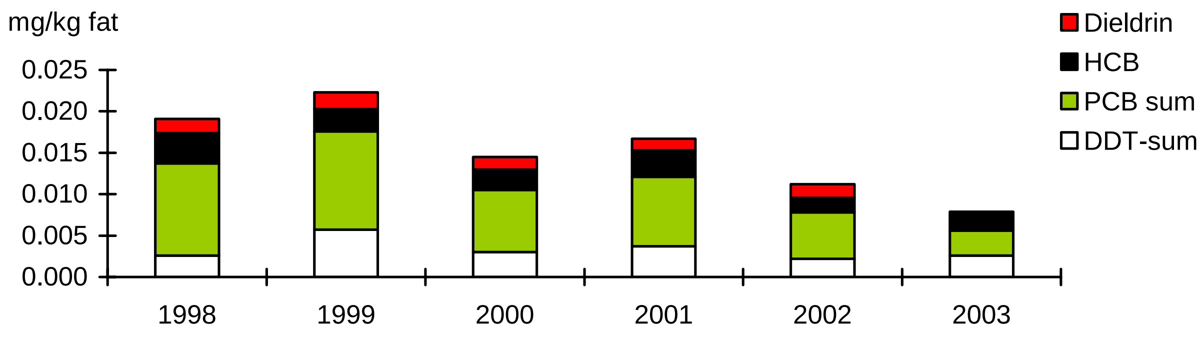

Figure 26. *Beef fat, 1998-2003. Average contents of substances found in beef fat (mg/kg).*

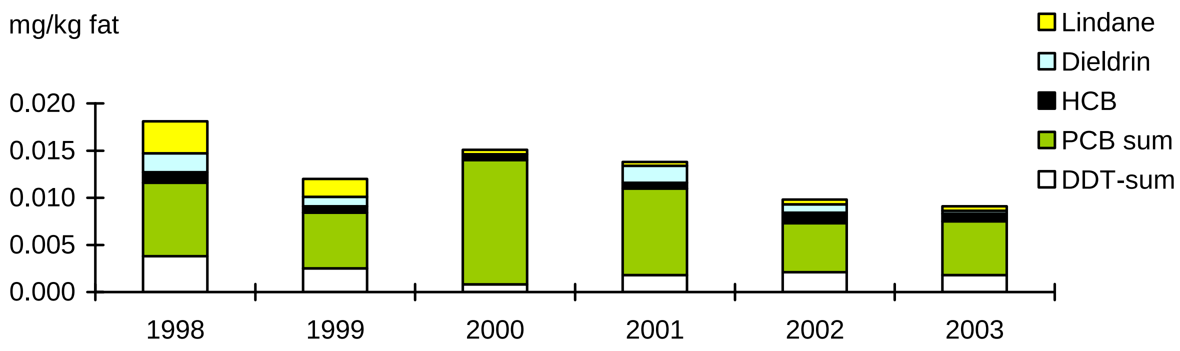

Figure 27. *Poultry fat, 1998-2003. Average contents of substances found in poultry fat (mg/kg).*

Figure 28 shows the average contents of the organochlorine contaminants in dairy products. A distinction is made between dairy of Danish and foreign origin. It seems that the average contents of the substances in Danish and foreign dairy produce were about the same, except for the content of indicator PCB-sum in Danish milk and ΣDDT in foreign butter, where higher average levels was found. Although there were almost no differences between the average levels, there were differences between the frequencies of the findings, for instance dieldrin was found with a frequency that is two to ten times higher in foreign than in the Danish dairy produce.

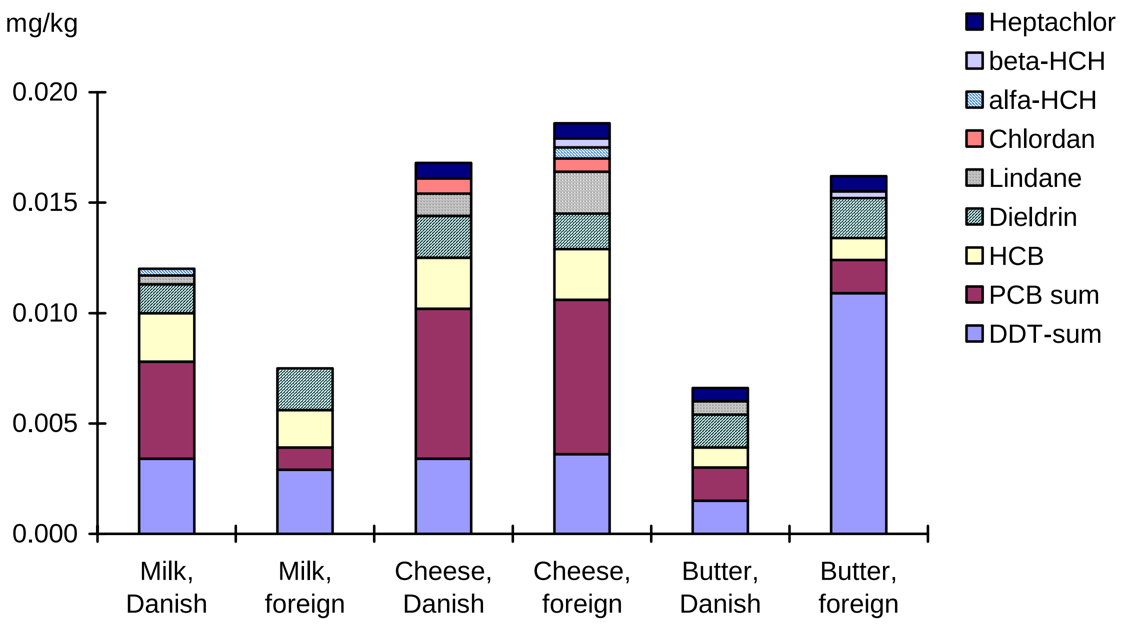

Figure 28. *Dairy produce, average contents of the substances (mg/kg). A distinction has been made between samples of Danish and foreign origin*

8.5 Intake calculations

8.5.1 Organochlorine pesticides and indicator PCB

Procedure

Section 5.2 describes how the intake calculations were carried out, and Appendix 11.3.30 lists the product types used for the different food items, as well as their percentages of fat.

For samples of dairy produce, it was noted whether the product is of Danish or foreign origin. For example, the contents of ΣDDT are higher in foreign than in Danish butter: 0.011 mg/kg in samples of foreign butter and 0.002 mg/kg in samples of Danish butter. The distribution between the consumption of Danish and foreign cheese and butter is known, and it was taken into consideration in the calculation of average intakes. The average contents in Danish and foreign cheese have been summed up after being multiplied by 0.7 for Danish cheese and 0.3 for foreign cheese, respectively [56]. For butter, considerably fewer foreign samples than Danish samples have been analysed; hence, the intake calculations were based on the Danish figures.

In the calculation of daily intakes, the contribution from herring was taken from the content in raw herring sampled directly for this purpose and not herring where the sampling had the purpose of following the development over time in the different Danish waters. As cod roe has not been analysed, the content of organochlorine compounds in cod roe has been estimated relative to the fat content of 3.7%

For certain food items where data from the 4th monitoring period is absent, e.g. vegetable oils or margarine, results from the 3rd monitoring period were used. In the 3rd monitoring period, organochlorine pesticides and indicator PCB were not found in samples of vegetable oils nor were organochlorine pesticides found in the analyses of grain and cereals in the present monitoring period. For these foods, the contents were set to zero in the calculation of the Danish population's intake of organochlorine pesticides.

Assessment of daily intakes

The calculated average daily intakes of organochlorine compounds are presented in Table 11, excluding any contribution from fruits and vegetables. Furthermore, the 0.90 and 0.95 quantiles for the daily intake are given in the table.

__Table 11.__ Calculated intakes as µg per day, excluding fruit and vegetables

Substance	Average (µg/day)	0.90 quantile (µg/day)	0.95 quantile (µg/day)
ΣChlordan	0.11	0.19	0.23
ΣDDT	0.27	0.46	0.60
Dieldrin	0.13	0.21	0.25
Endosulfan A	0.03	0.05	0.06
HCB	0.09	0.14	0.16
α-HCH	0.04	0.06	0.07
β-HCH	0.04	0.06	0.07
Heptachlor sum	0.05	0.08	0.09
Lindane	0.06	0.09	0.10
PCB28	0.09	0.14	0.17
PCB52	0.10	0.15	0.18
PCB101	0.08	0.13	0.16
PCB105	0.08	0.12	0.14
PCB118	0.07	0.11	0.13
PCB138	0.10	0.16	0.20
PCB153	0.10	0.17	0.21
PCB156	0.04	0.06	0.07
PCB170	0.05	0.07	0.09
PCB180	0.06	0.09	0.10
Indicator PCB-sum *	0.90	1.41	1.66

*The intake of indicator ΣPCB was calculated on the basis of the sum of average contents of the 10 indicator PCB congeners. Due to rounding off, the indicator ΣPCB is not in accordance with the figures obtained by adding the average contents of the individual PCB congeners in the table.

Intake calculations have been made for organochlorine pesticides and indicator PCB, and in comparison with the previous monitoring periods the intakes have apparently decreased. The following values for average daily intakes were reported for ΣDDT: < 3.4 µg/day (1983-1987), < 2 µg/day (1988-1992), 0.5 µg/day (1993-1997) and 0.3 µg/day (1998-2003), and for indicator PCB sum: 2.2 µg/day (1993-1997) and 0.9 µg/day (1998-2003). For the other organochlorine pesticides, the values for daily intake were < 1.2 µg/day (1983-1987), < 0.8 µg/day (1988-1992), 0.2 - 0.3 µg/day (1993-1997) and 0.04 – 0.13 µg/day in the present period. When comparing the figures for average daily intakes of indicator PCB and ΣDDT in the monitoring periods, it is important to bear in mind that dietary data as well as calculation methods for average contents (see Section 8.3) differ.

In the first monitoring period (1983-1987), intake calculations were performed using only a few foodstuffs i.e. those that were assumed to contribute with the largest part of the intake of the substances concerned. In the second monitoring period (1988-1992), the intake calculations were based on the average daily intake of fish and the total average intake of fat. In the third monitoring period (1993-1997), two methods for the calculation of average contents were used, which should lead to a more real picture of the intake. In the present monitoring period (1998-2003), average contents were calculated using a simpler estimation method (see

Section 8.3), however expecting to obtain results comparable with results from the 3rd monitoring period. When comparing the intakes from the four periods the greatest uncertainty is the '<' symbols, as it is impossible, to say whether <3.4 µg/day is greater or lesser than <2 µg/day for the ΣDDT. As it appears from Section 8.4, there is a generally downward trend for the contents of organochlorine compounds in fish. The development for products of animal origin is, however, as seen in Figure 25 to Figure 27, not so clear.

Organochlorine pesticides in fruits and vegetables have been described in the sub-report on pesticides [51]. As mentioned earlier, the calculations are more difficult when the majority of measuring is below the limit of detection. The limit of detections for fruits and vegetables are higher than those presented in Appendix 11.3.31, and only a few results are above the limit of detection. Thus, it does not make any sense to compare the intake from fruits and vegetables with the intake from fish and products of animal origin as reported here. In spite of an occasionally higher estimated intake from fruits and vegetables [51], the largest contribution of organochlorine environmental contaminants is assumed to derive from fish, meat, dairy products, and eggs.

A histogram for the intake distribution for adults of PCB-153, which is often used as an indicator for PCB [57], is shown in Figure 29, and for ΣDDT and HCB in Figure 30 and Figure 31. The contribution from fruits and vegetables is not included. The HCB histogram is closer to a normal distribution (bell-shaped) than the other two histograms, reflecting the fact that especially milk and cheese contribute to the intake. The distribution for the intake of milk and cheese is more evenly distributed than for e.g. fish, of which many eat next to nothing and a few eat a lot. Both for PCB and ΣDDT, the contribution from fish is greater, which causes the histogram to appear more lopsided.

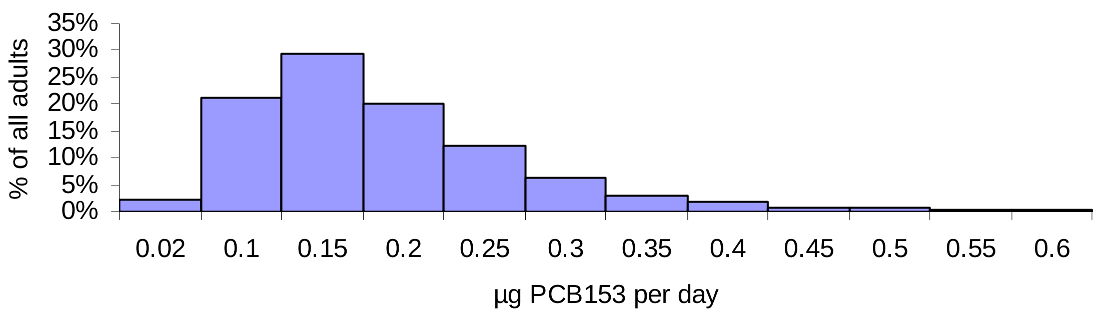

Figure 29. *Daily intake of PCB153 (µg per day), distribution for adults*

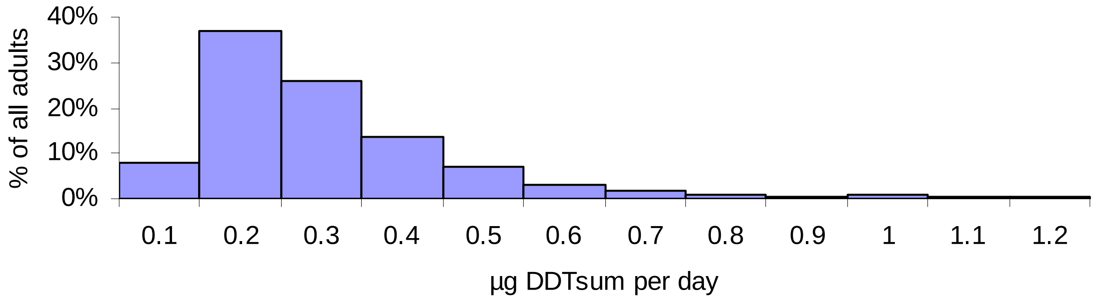

Figure 30. *Daily intake of ΣDDT (µg per day), distribution for adults.*

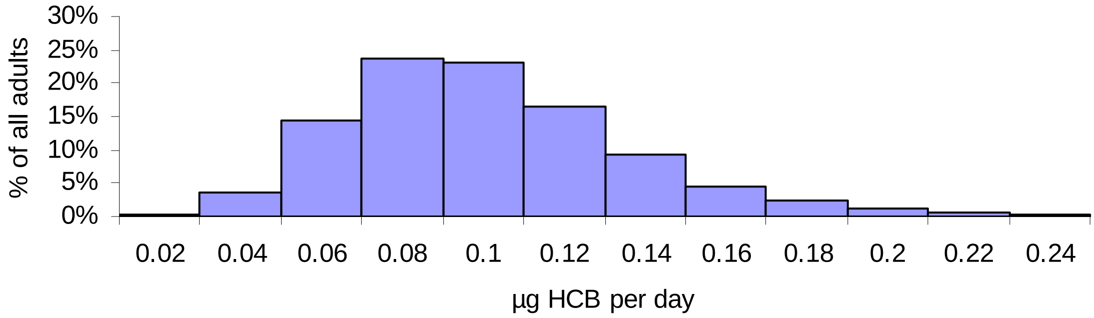

Figure 31. *Daily intake of HCB (µg per day), distribution for adults.*

Contributions of individual foods groups to the daily intake

Figure 32 shows the estimated contributions of individual food groups to the average daily intake of PCB153, ΣDDT and HCB, but does not include fruits and vegetables. The group of fats includes the contributions from composite products, butter, vegetable oil and cod liver oil. Especially fish contributes to the average daily intake of ΣDDT and also PCB153, where there is an apparently more even distribution between the contributions of the food groups. In Appendix 11.3.20, it is seen that contents of PCB153 above the limit of detection are found predominantly in fish. Figure 32 shows that foods where many samples have contents below the limit of detection may nonetheless are great contributors to the calculated average intake, if the limit of detection is relatively high and the consumption is of a certain size. An example is PCB153, where the contribution from eggs, fats, meat and milk products originates from only a few samples with content above the limit of detection.

For ΣDDT, approximately 45% of the average daily intake derives from fish. As seen in Appendix 11.3.12, HCB was only found in low quantities in fish, which in fact is also reflected in a low contribution to the average daily intake of HCB from fish.

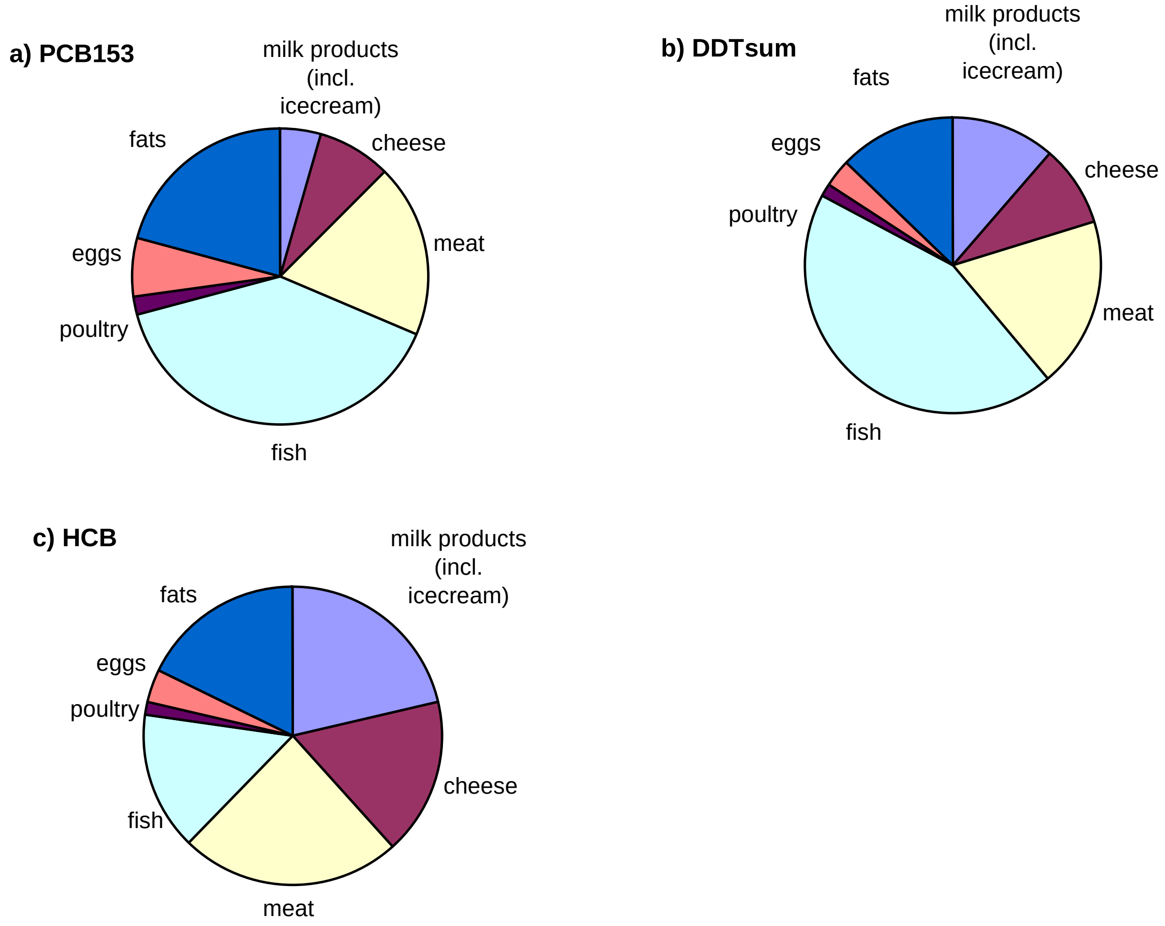

Figure 32. *Adults, estimated contributions of various food groups to intakes of a) PCB153, b) ΣDDT, and c) HCB. Fruits and vegetables are not included.*

Similar calculations of the contribution of individual food groups to the daily intake have been made for children (Figure 33). For PCB153 the distribution is similar to the contribution for adults, whereas for DDT-sum and HCB children have a higher intake of the compounds through milk and a smaller part of the intake from fish.

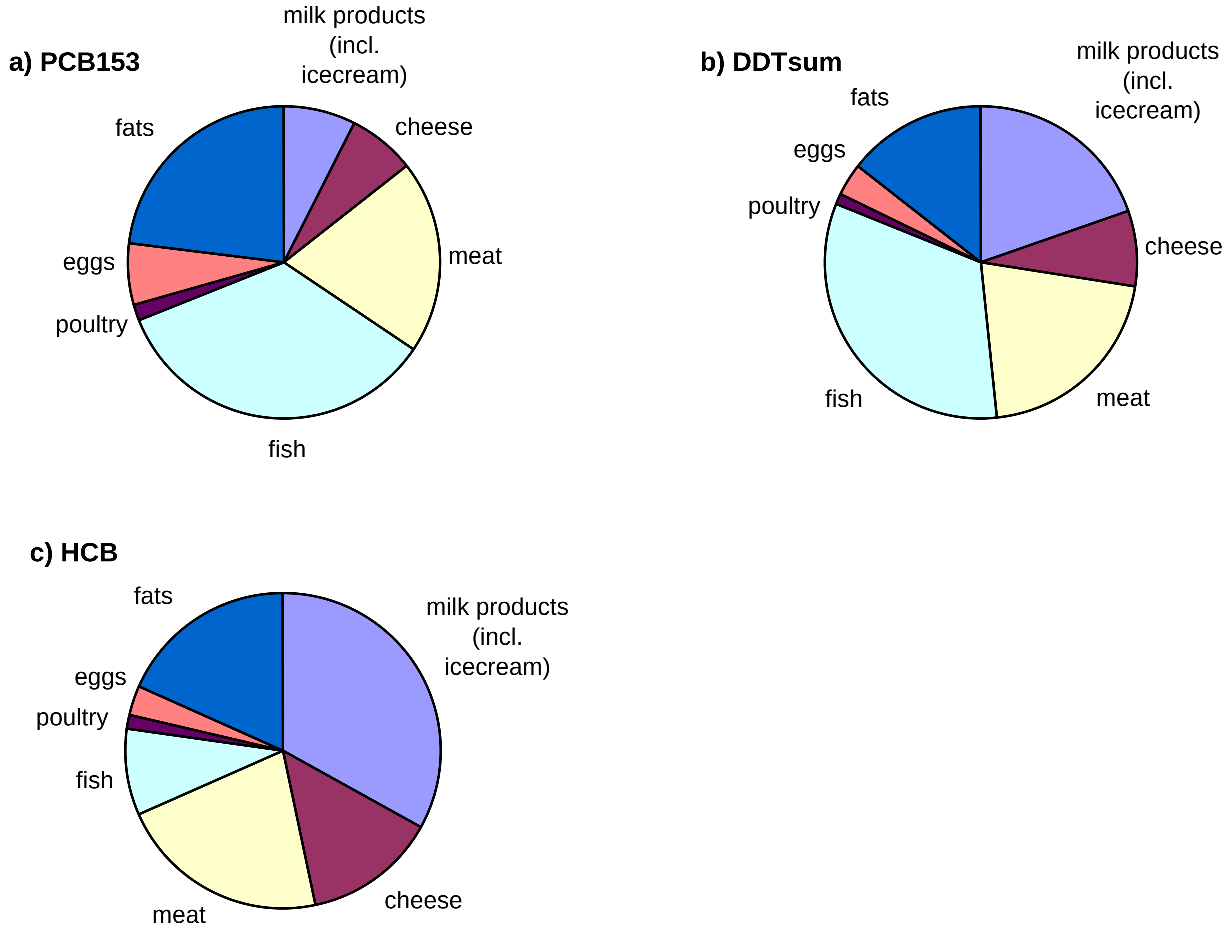

Figure 33. *Children, estimated contributions of various food groups to intakes of a) PCB153, b) ΣDDT, and c) HCB. Fruits and vegetables are not included.*

Cod liver and fish oils

The dietary survey has not recorded any significant consumption of cod liver. In order to illustrate the significance which cod liver may have for the intakes of indicator ΣPCB and ΣDDT, Table 12 gives an example of how much cod liver must be consumed to double the fish-derived part of the daily average intakes of these substances. It is seen that an average daily consumption of cod liver of 0.4 g and 0.5 g is required to double the contribution from fish to the average daily intakes of indicator ΣPCB and ΣDDT, respectively. This corresponds to a yearly consumption of one to two tins of 125 g.

Table 12. *Rough estimates of how much cod liver must be consumed to double the fish-derived part of the average intakes of indicator ΣPCB and ΣDDT, respectively*

Substance	Content* (mg/kg liver)	Intake from fish ** (µg/day)	Required consumption of cod liver to double the contribution from fish (g/day)
ΣPCB	0.47	0.20	0.4
ΣDDT	0.26	0.12	0.5

* Average of averages for all waters.
** The part of the average daily intake of the substance deriving from fish.

Likewise for fish oils, no real picture of the Danish consumption exists. Table 13 shows the approximate contents [58] of ΣPCB and ΣDDT in fish oils. In order to double the fish-derived part of the average daily intakes of ΣPCB and ΣDDT, a daily consumption of 3.0 g and 2.9 g, respectively, of an ordinary fish oil is required. If the fish oil consists of cod liver oil a daily consumption of 1.1 g is required for doubling the average intake of ΣPCB and 0.6 g is required for doubling the average intake of ΣDDT. The contents of organochlorine environmental contaminants in the individual fish oil samples vary considerably. The use of an average content in fish oil in Table 13 may be somewhat misleading, as the consumer will typically buy one bottle of fish oil and use the entire contents.

Table 13. *Rough estimates of how much fish oil must be consumed to double the fish-derived part of the average daily intakes of indicator ΣPCB and ΣDDT, respectively.*

Substance	Fish oil type	Content* (mg/kg fish oil)	Intake from fish ** (µg/day)	Required consumption of fish oil to double the contribution from fish (g/day)
ΣPCB	Fish oil	0.06	0.20	3.0
ΣDDT	Fish oil	0.04	0.12	2.9
ΣPCB	Cod liver oil	0.18	0.20	1.1
ΣDDT	Cod liver oil	0.20	0.12	0.6

* Average contents [58].
** The part of the average daily intake of the substance deriving from fish.

8.5.2 Dioxins and PCB

The intake calculations are carried out as described in Section 5.2. Dioxins and dioxin-like PCB accumulates in fatty tissue and this fact is the basis for allocation of a figure of content to the many type of food item in the consumption survey despite the relatively few type of foodstuffs analysed in the monitoring programme.

The Danish action plan for dioxins started in 2000 and ended in 2004. The samples taken from 2000 to 2003 are a part of the present monitoring programme, but because the action plan ran for one more year, the intake calculations were carried out using the average contents in the analysed foodstuffs from the period 2000-2004 [59].

Table 14 summarises the calculated daily intakes. There are two sets of calculations. One with the calculated intake from food excluding fish and another where fish is included and the salmon part of the intake has been given three different levels of dioxins and PCB contents.

Table 14. *Calculated daily intakes of dioxins and dioxin-like PCB.*

Dioxin and dioxin-like PCB	pg WHO-TEQ/kg bw/day	
	Average	95% percentile
Food excluding fish		
Adults	0.51	0.91
Children age 4-14	1.1	2.0
Children age 4-6	1.5	2.4
Food including fish		
Adults – salmon at relative low levels of dioxins	0.82	1.8
Adults – salmon at middle levels of dioxins	0.92	2.3
Adults – salmon at maximum levels of dioxins	1.1	3.7

For the calculation excluding fish, intake figures by adults as well as children have been obtained. It appears that children because of the relatively large food intake compared to their bodyweight have two to three times the daily intake of dioxins and dioxin-like PCB than adults. The 95%-percentile for children is close to or exceeds the Tolerable weekly intake (TWI) at 14 pg WHO-TEQ/kg bw/week (which is equivalent to 2 pg WHO-TEQ/kg bw/day).

To account for the difficulties in selecting the true composition of fish meal with regards to catching area and thereby level of contamination, the intake from food, including fish, has been carried out by setting the contents of dioxins and PCB in salmon to three different levels. The calculations show that the average intake of dioxins and dioxin-like PCB for adults are close to 50% of TWI. Consumers with high dietary intake of dioxins and dioxin-like PCB are close to or exceed TWI.

The contribution from the main food groups to the average intake is 30-40% from milk or milk products, 3-4% from eggs, 13-18% from meat and 38-55% from fish.

8.6 Safety assessment

A common aspect for many of the organochlorine compounds included in the monitoring programme is that the liver is one of the most sensitive organ systems in the experimental animals. Following high daily doses, mice and rats have been observed to develop cancer of the liver. None of the substances cause genotoxicity, i.e. damage to the DNA, and it is generally agreed that the carcinogenic effects of these substances show thresholds. Some of these organochlorine compounds have also shown a potential to affect hormone systems *in vitro* and to affect reproduction and developmental neurotoxicity *in vivo*, but these effects are in most cases only seen at higher doses than those producing liver toxicity. Impact on certain enzyme systems in the liver is a characteristic effect of these substances and is also believed to be of significance for some of the effects that can be observed on various hormone systems in experimental animals following the administration of high doses.

Tolerable daily intake (TDI) or Acceptable daily intake (ADI) values established for the organochlorine compounds are briefly mentioned below. More detailed descriptions and backgrounds for some of the established values may be found in reference [60].

HCB: In 1998, IPCS under WHO suggested a TDI of 0.17 μg/kg bodyweight per day for the non-carcinogenic effects of HCB, while 0.16 μg/kg bodyweight per day was suggested as a recommended value for the carcinogenic effect of HCB [61].

Lindane: The substance was most recently assessed by the FAO/WHO Joint Meeting on Pesticide Residues (JMPR) in 1997, where a provisional ADI of 1 μg/kg bodyweight was established [62].

α- and β-HCH: No ADI or TDI values have been established for α- and β-HCH. The American ATSDR (Agency for Toxic Substances and Disease Registry) has suggested a 'Minimal Risk Level' of 0.6 μg/kg bodyweight/day for β-HCH [63].

Cis and trans-chlordane: JMPR established an ADI of 0.5 μg/kg bodyweight for chlordane in 1986. *Oxychlordane* and *trans-nonachlor* are major constituents of technical chlordane, and may be regarded as included in the ADI for chlordane [64].

Heptachlor and heptachlor epoxide: JMPR assessed these substances in 1991, and established an ADI of 0.1 μg/kg bodyweight for the sum of heptachlor and heptachlor epoxide [65].

Dieldrin and aldrin: Aldrin is rapidly converted into dieldrin in plants and animals; therefore dieldrin is the subject of the greatest safety interest. Already in 1977, JMPR established an ADI of 0.1 μg/kg bodyweight for the sum of dieldrin and aldrin. For dieldrin, IPCS suggested a TDI of 0.05 μg/kg bodyweight in 1989 [66].

Endrin: JMPR has evaluated endrin in 1963, 1965 and 1970, where an ADI of 0.2 μg/kg bodyweight was established [67].

Isodrin: Isodrin has not been evaluated by JMPR, however based on its structure, the toxicity of isodrin is considered to be similar to aldrin, dieldrin and endrin.

ΣDDT: In 2000, JMPR established a Provisional Tolerable Daily Intake (PTDI) of 10 µg/kg bodyweight for all combinations of DDT, DDD, and DDE, based on studies in humans [68]. Later, the US Environmental Protection Agency has established an RfD (corresponding to tolerable daily intake) of 0.5 µg/kg bodyweight/day [69] for the non-carcinogenic effects of DDT. On the background of recent studies and assessments, a TDI of 0.5 µg/kg bodyweight for the sum of DDT, DDE, and DDD is considered the most relevant.

Endosulfan: In 1998, JMPR established an ADI of 6 µg/kg bodyweight for endosulfan [70].

Dioxins: Polychlorinated dibenzo-*p*-dioxins (PCDD), polychlorinated dibenzofurans (PCDF), and dioxin-like polychlorinated biphenyls were evaluated in 2001 by both the EC Scientific Committee on Food (SCF) and the Joint FAO/WHO Expert group on Food Additives (JECFA) [71]. The SCF established a tolerable weekly intake of 14 picogram/kg bodyweight [72] whereas JECFA established a monthly tolerable intake of 70 picogram/kg bodyweight [73]

PCB: The safety assessment of the non-dioxin-like PCB is particularly complicated, involving mixtures of congeners having different toxicological properties and effects. Most toxicological studies were carried out on the original, commercial products that are not representative of the mixtures that are concentrated in the food chains. There are also a number of other uncertainties in the existing toxicological studies concerning PCB [60]. On the basis of various considerations discussed in the reference [60], a TDI for total PCB of 0.1 µg/kg bodyweight/day is considered appropriate.

Figure 34 gives the calculated intakes of the organochlorine substances for adult's relative to the ADI/TDI values discussed above, and Figure 35 displays the calculated results for children.

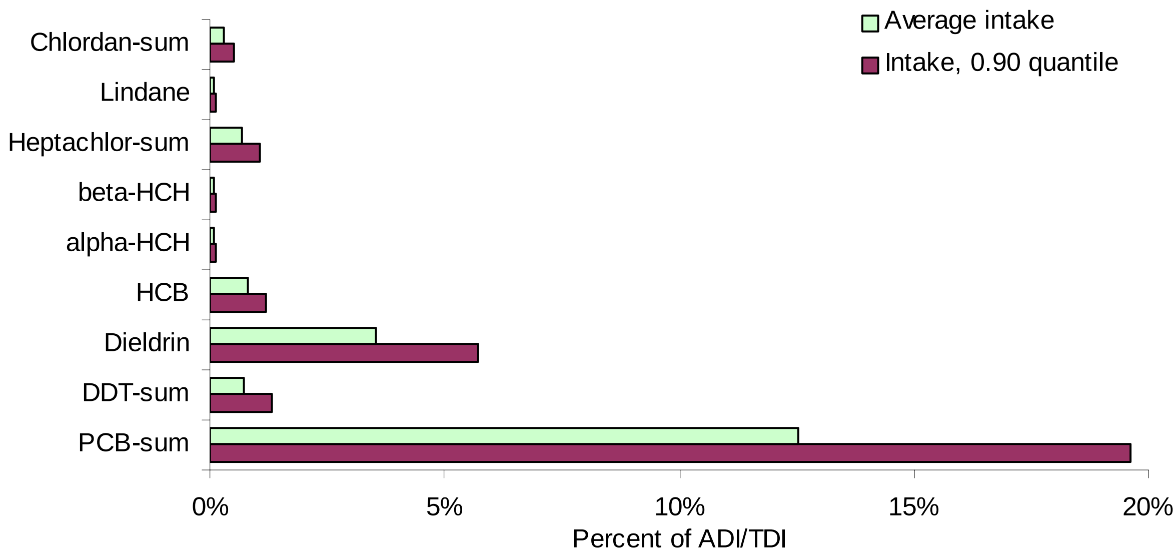

Figure 34. *Adults, average and 0.90 quantile intake relative to ADI/TDI*

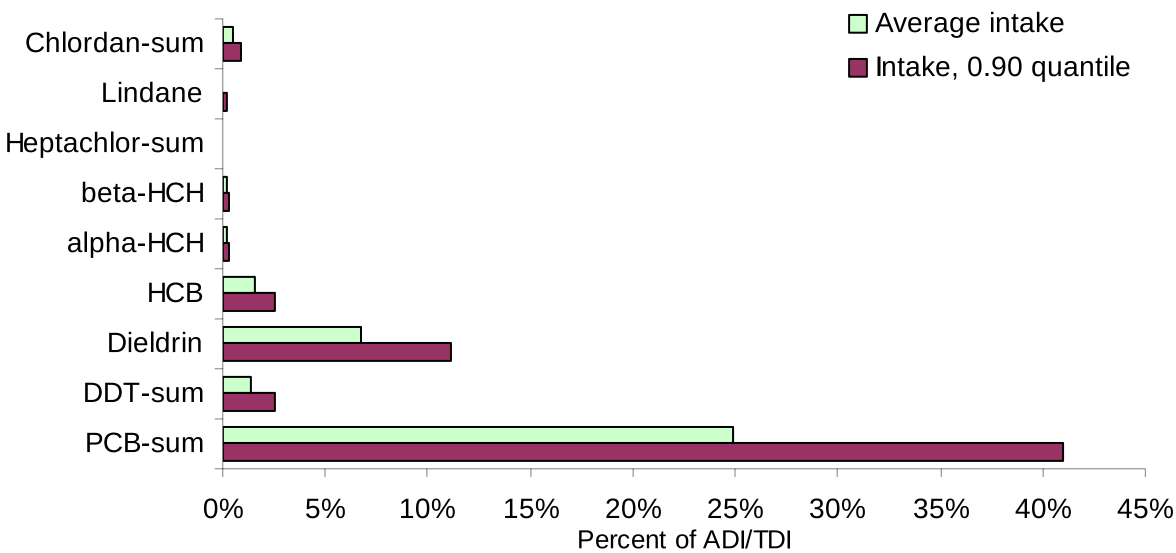

Figure 35. *Children, average and 0.90 quantile intake relative to ADI/TDI*

The calculated intakes percentage of ADI/TDI are higher for children, approximately twice as high as for adults, due to children's high intake of some food groups, e.g. milk, in relation to their weight. The results, however, give no occasion for any immediate safety concerns, even for children with high intakes of the substances. In this context should be mentioned that the protection level for PCB is significantly lower than that for the other organochlorine substances measured.

The ADI/TDI does not indicate any danger line, but the quantity which humans can ingest daily on a life-long basis without any recognizable health hazard. For the above-mentioned organochlorine substances, it is the total quantity that is assimilated in the human body, rather than the daily intake, which is important. Thus, short-term or long-term (weeks, months) intakes above the ADI/TDI are of no health significance, as long as the average exposure over very long periods of time is kept below this value.

For dioxins and dioxin-like PCB the average estimated intake for adults constitutes 50% of the TWI. Persons with high dietary intake of dioxin and dioxin-like PCB (e.g. the 0.95 quantile) are close to or exceed the TWI, depending on the origin and hence the contamination level in especially the fatty fish they consume.

For children the intake of dioxins and dioxin-like PCB from food, excluding fish, is two to three times the intake estimated for adults. Milk and milk products are the dominant contributors to the intake. A larger proportion of children are likely to exceed the TWI than compared to adults.

The overall risk assessment for the life time exposure of dioxin and dioxin-like PCB by adults and children does not find short time intake above TWI critical. The consumer is within a safe margin for dioxin exposure as long as the general dietary advises is followed, especially concerning intake of fatty fish.

8.7 Human milk

Human milk has been included in the present monitoring period and the samples have been analysed for chlorinated pesticides, PCB and dioxins. The milk is obtained from two hospitals in Denmark (Hvidovre and Skejby) and is collected from mothers who are 25 – 29 years old and are giving birth for the first time. This standardised sampling plan ensures that the results from different surveys can be compared over a period of time and internationally as proposed by WHO. In Appendix 11.3.29 the results are presented.

Surveys of human milk have previously been conducted in Denmark [74]. The results from 1993-94 showed a significant decrease by 50-80% in contents of chlorinated pesticides and PCB over a ten years period. Dioxins were analysed for the first time in Danish human milk in 1986 and the time trend to the results from 1993-94 showed only a minor decrease.

In Figure 36 and Figure 37 the results from the human milk samples collected in 1999 and 2000 are displayed together with the results from the last survey of Danish human milk in 1993-94. The bars represent the average contents from each of the years 1999 and 2002. One sample from each of the years 1999 an 2002 were removed before calculating the average used in Figure 36. These two samples were obvious outliers compared to the rest of the samples with different profiles of compounds e.g. high levels of β-HCH and DDT and low levels of PCB. In Figure 37 all samples were included.

The time trend with decreasing levels of most chlorinated pesticides and PCB has continued during the last 8-9 years period. The decrease is 50-60%. For dioxins and the sum of dioxins and dioxin-like PCB the decrease over the last 8-9 years amounts to 38% and 46% respectively.

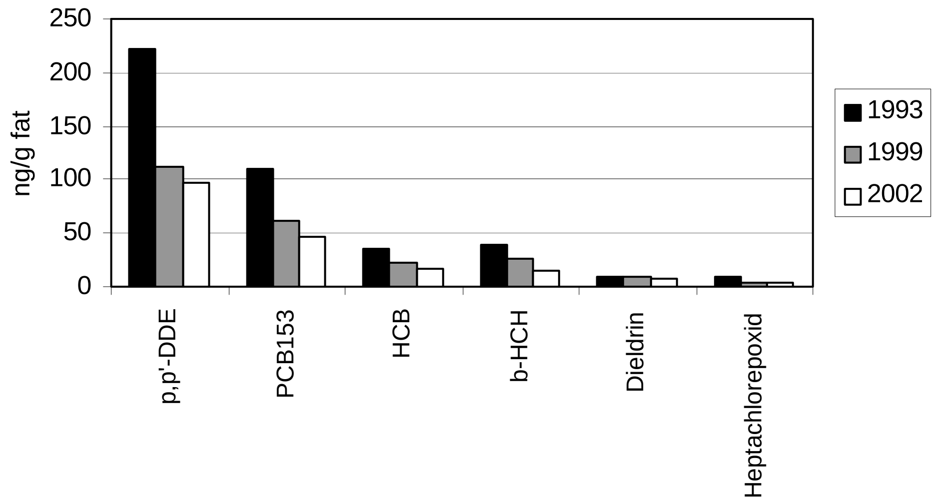

***Figure 36**. Chlorinated pesticides and indicator PCB in Danish human milk. Average contents in human milk samples collected in 1993[74], 1999 and 2002.*

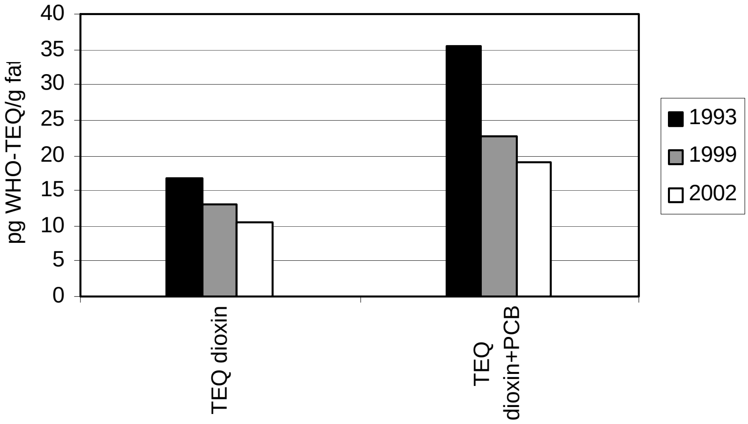

Figure 37. *Dioxins and the sum of dioxins and dioxin-like PCB in Danish human milk. Average contents in human milk samples collected in 1993[74], 1999 and 2002.*

9 Mycotoxins (ochratoxin A)

9.1 Introduction

Mycotoxins are toxins produced by fungi. They can cause disease in humans and animals and can give rise to lesions of, e.g. the liver, kidneys, or the nervous system. Some mycotoxins have been found carcinogenic in animal experiments, and a few are believed to have similar effects in humans. Ochratoxin A has been classified as a possible human carcinogen. Examples of mycotoxins that may be important in connection with foods are aflatoxins, ochratoxin A, patulin, and trichothecenes.

Fungi of the genera *Aspergillus* and *Penicillium* produce Ochratoxin A. *P. verrucosum* is assumed to be the only important ochratoxin A producing species under Danish climatic conditions where, given favourable conditions, it is capable of producing considerable quantities of toxin. The occurrence of ochratoxin A in Danish-produced grain is considered the potentially most serious problem in relation to the occurrence of mycotoxins in Danish crops; but also other mycotoxins may be found in Danish crops.

Analysis of ochratoxin A in cereals has been a part of the monitoring programme since 1986. The results from the period 1986-1997 were reported in the reports for the monitoring programme 1988-1992 [8] and 1993-1997 [13] as well as in two articles [75,76]. All results for samples of wheat and rye kernels and flour analysed since 1986 are included in the present report; see Appendix 11.4.

A Danish maximum limit of 5 μg/kg for contents of ochratoxin A in cereals for human consumption was introduced in 1995. EU regulation was introduced in 2002, and this lowered the maximum limit to 3 μg/kg.

9.2 Sampling and analytical methods

Ochratoxin A may occur in grain that has been harvested having a high content of water and dried inefficiently or too slowly, or in grain that has been stored under humid conditions. The occurrence may vary from year to year due to climatic differences during harvest, for which reason samples are collected and analysed for ochratoxin A every year.

As mentioned, ochratoxin A in cereals has been a part of the monitoring programme since 1986. The problem with the occurrence of ochratoxin A has been reduced in this period. Therefore, the number of samples was reduced during the years, and the number of products monitored was also reduced as discussed in the report from the 3rd monitoring period [13] and

[76]. In the period 1998-2003, there have also been changes. In 1998 and 1999 samples of both wheat flour and kernels and rye flour and kernels were analysed, in 2000 wheat flour and rye flour were analysed, and in 2001, 2002 and 2003 only rye flour have been analysed. The total number of samples each year is listed in Appendix 11.4.

The samples were randomly taken at flourmills or in retail shops all over Denmark. The samples can have both a Danish or foreign origin.

The analyses of samples from 1998 and 1999 were carried out at the regional laboratory in Aalborg. The samples from 2000-2003 were analysed at the regional laboratory in Ringsted. All samples were analysed using immunoaffinity columns and HPLC/FLD.

9.3 Data on contents

The results are shown in the tables in Appendix 11.4. In this table, all the results for wheat and rye kernels and flour from 1986 are shown. The results of flour and kernels have been pooled. Sixteen consecutive years of monitoring wheat (Figure 38) and eighteen consecutive years of monitoring rye (Figure 39) are now available.

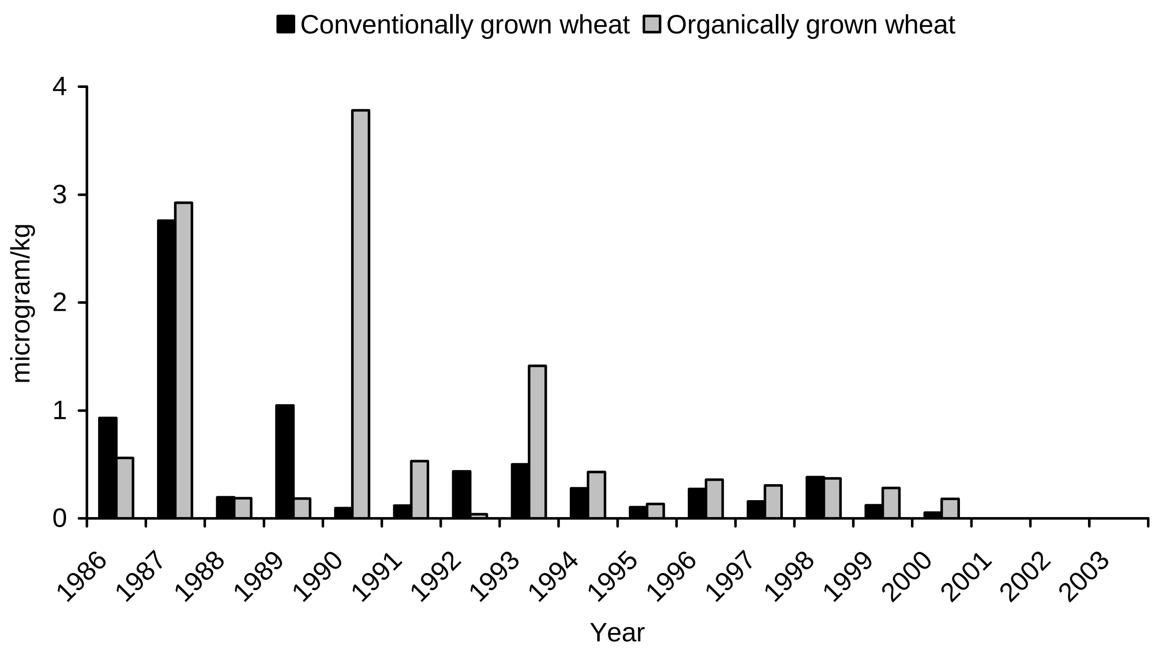

Figure 38. *Mean content of ochratoxin A in conventionally or organically grown wheat (kernels and flour samples are pooled) in the period 1986-2000.*

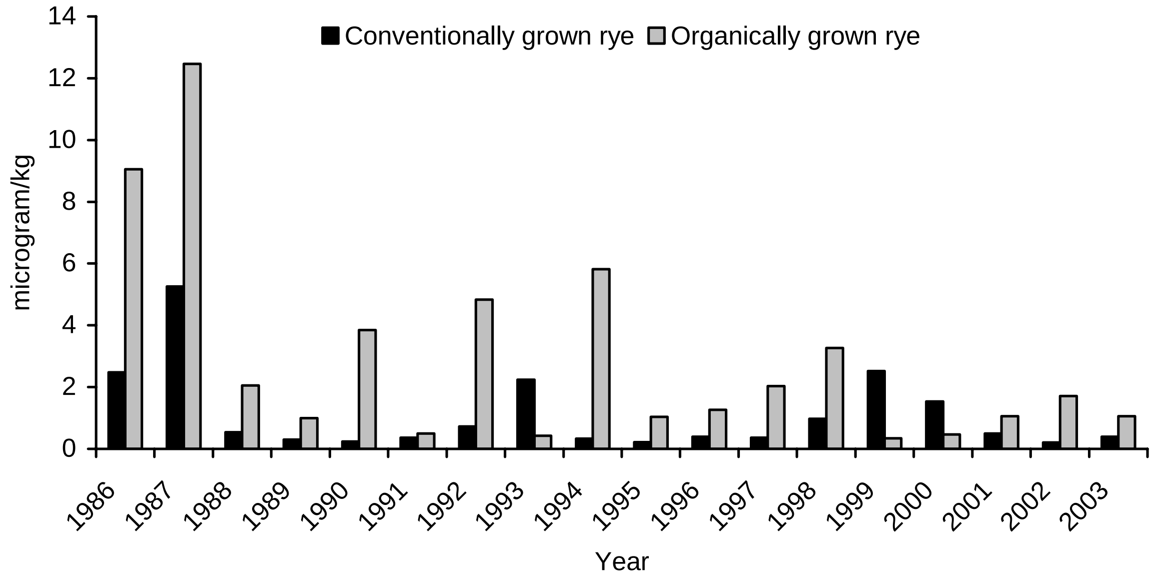

Figure 39. *Mean content of ochratoxin A in conventionally or organically grown rye (kernels and flour samples are pooled) in the period 1986-2003.*

The occurrence and content of ochratoxin A in cereals depend on many factors, one is the weather conditions before and during harvest; i.e. wet harvest years give generally higher contents of ochratoxin A in cereals. The occurrence of ochratoxin A over the years also depends on the agricultural practice, particularly it may change with changes in grain-drying and storage procedures. The relation between weather conditions and content of ochratoxin A might not always be clear, e.g. in years with wet harvest conditions, the agricultural sector could be more aware of the importance of grain-drying. While in years with more dry harvest conditions, this aspect might be paid less attention.

The harvest years 1998 and 1999 were the first harvest years for several years with wet or average harvest conditions, and the levels of ochratoxin A in cereals were found to be lower than in the wet mid-1980s. The Danish agricultural grain-drying capacities were improved after the problems with wet grain in the mid-1980s. The present data indicate that this is a contributing factor to the lower contents found in the latest years. Improved agricultural practices have also been shown to be effective in relation to decreasing the content of ochratoxin A in pig feed and correspondingly in Danish pigs [77].

Since ochratoxin A was included in the Danish monitoring system in 1986, organically grown cereals have tended to have higher contents of ochratoxin A than the corresponding conventional products (Figure 38 and Figure 39), especially for rye. The difference between the two categories has decreased in the last years. However, the mean content of ochratoxin A in wheat and especially rye have also been highest in organically grown cereals in the 4th monitoring period (see tables in Appendix 11.4).

The problem with ochratoxin A contents in cereals was pointed out to the organic farming industry in the mid-1990s, and since then the industry is attempting to make improvements, e.g. in the form of better drying and storage conditions and improved self-imposed control at the mills. These attempts seem to have improved the quality of organically grown cereals.

The difference between organic and conventional cereals can presumably be explained in terms of grain drying and storage conditions. The use or absence of fungicides has probably no significant influence on the growth of *P. verrucosum* and potential ochratoxin A production in the critical period just after harvest and during storage. However, one cannot preclude the possibility that there may be differences between the organic and the conventional cultivation methods, which may render organic grain more susceptible to the growth of *P. verrucosum*, e.g. higher amount of impurities in organic cereals or less uniform maturity could mean that correct handling and drying is even more important for organic than for conventional cereals.

9.4 Intake calculations

The intake calculations were carried out as described in Section 5.2.

In the report of the 3rd monitoring period [13], comprehensive intake calculations were performed. The main conclusions were that cereals are the main sources of the Danish population's intake of ochratoxin A, and that the intake of ochratoxin A for persons who eat organic cereals was found to be higher than for persons who eat conventional cereals.

Here only two intake estimates for adults are calculated based on the data for wheat and rye kernels and flour from this monitoring period 1998-2003 (tables in Appendix 11.4), one for consumption of exclusively conventional wheat and rye and one for consumption of exclusively organic wheat and rye. The estimates of ochratoxin A content in all other food items included in the intake estimate are the same as those used in the report of the 3rd monitoring period [13]. All estimates of content in food items are listed in the table in Appendix 11.4.

The results of the intake calculations are shown in Table 15. There is still a difference between the intake estimates exclusively based on the consumption of conventional and organic cereals, respectively. However, the difference is rather small.

Table 15. *Calculated estimated intakes by an adult Danish person (70 kg) via the total food supply. One estimate is based on exclusively consumption of conventional wheat and rye, and the other estimate is based on exclusively consumption of organic wheat and rye.*

	Consumption of conventional wheat and rye (ng/kg bw/day)	Consumption of organic wheat and rye (ng/kg bw/day)
Average intake (mean)	1.8	2.3
High intake (0.95 quantile)	3.3	4.1

Wheat contributes to 14% and rye to 34% of the average intake based on the consumption of conventional cereals, and wheat contributes to 17% and rye to 43% of the average intake based on the consumption of organic cereals.

9.5 Safety assessment

Several risk assessments of ochratoxin A have been carried out internationally, and it has been proposed to establish the tolerable daily intake in the interval between "as low as possible and no higher than 5 ng/ kg bodyweight/day or up to 14 ng/kg bodyweight/day, depending on the toxic effect and calculation method on which the establishment is based". SCF reassessed ochratoxin A in 1998 [78] and recommended a TDI value as low as possible and no higher than 5 ng/kg bodyweight/day. This TDI value was based on the possible carcinogenic effect, corresponding to the limit arrived at by a Nordic toxicology group in 1991 [79], and has been in use in Denmark since then.

The intake estimates based on data from the 4th monitoring period show that persons having a high intake of ochratoxin A (the 0.95 quantile) have intakes below the TDI value of 5 ng/kg bw/day, both based on the consumption of exclusively conventional or organic cereals. This is an improvement compared to earlier monitoring periods [4].

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11 Appendices

11.1 Appendix to Trace elements

11.1.1 Contents of lead (µg/kg fresh weight) in foods sampled, 1998-2003

Foodstuff	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Pb							
Vegetables:							
Aubergines	10	2	6.2	< 0.4	48.2	1.1	9.8
Beans	9	0	3.1	0.6	8.7	2.7	4.9
Beetroots	10	0	5.6	3.5	8.1	5.4	7.8
Broccoli	10	1	5.3	< 0.4	23.5	2.3	9.5
Brussel sprouts	9	0	5.8	2.2	20.5	3.8	8.7
Cabbage	11	0	1.2	0.5	5.3	0.8	1.5
Carrots	39	0	8.8	0.5	34.0	6.1	22.5
Cauliflower	10	4	1.1	< 0.8	2.2	1.0	2.1
Celeriac	9	0	3.2	0.8	5.8	3.5	4.1
Celery	12	0	3.0	1.0	7.4	2.3	6.3
Chinese cabbage	10	0	1.6	0.4	4.0	1.3	2.8
Cucumber	10	0	1.4	0.6	3.4	1.3	2.4
Curly kale	15	0	35.4	5.1	79.5	32.7	77.7
Leeks	11	0	2.1	0.6	3.6	2.2	3.4
Lettuce	31	0	16.3	0.5	139	8.1	35.9
Mushrooms	10	0	2.0	0.8	3.9	1.9	3.1
Onions	20	0	1.9	0.7	8.0	1.3	2.9
Peas	10	0	3.6	1.1	9.0	3.1	6.4
Pepper	13	0	1.9	1.1	4.5	1.7	2.8
Potatoes	30	8	1.7	< 0.8	7.2	1.5	2.9
Rhubarb	8	0	47.0	23.5	87.6	33.9	85.6
Spinach	28	0	22.4	2.4	92.7	12.4	52.5
Squash	10	0	1.5	0.6	2.9	1.2	2.7
Tomato	20	0	1.6	0.5	5.7	0.9	3.0
Offal:							
Liver, calf	20	0	22.6	6.0	60.9	18.5	45.6
Liver, chicken	12	10	< 6.0	< 6.0	6.2	< 6.0	< 6.0
Liver, ox	14	0	19.0	9.7	35.6	18.0	26.7
Liver, pig	19	9	6.8	< 6.0	20.0	6.0	9.8
Kidney, calf	23	0	46.0	22.0	80.9	42.6	71.5
Kidney, ox	43	0	45.7	20.0	84.9	43.8	66.5
Kidney, pig	32	10	9.8	< 6.0	56.8	7.3	14.0
Meat products:							
Pate, meat	10	0	6.5	2.5	12.0	6.4	8.3
Pork, flank, cooked	10	2	3.9	< 2.0	13.0	3.3	5.3
Pork, liver paste	10	0	5.1	2.7	8.4	5.0	7.9
Pork, mettwurst, smoked	11	2	3.6	< 2.0	7.3	3.1	6.8
Pork, saddle, smoked	10	8	< 2.0	< 2.0	3.4	< 2.0	2.7

Foodstuff	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Pork, sausage, frankfurter	13	2	9.7	< 2.0	70.7	3.8	9.3
Pork, sausage, saveloy	9	1	6.3	< 2.0	27.0	3.8	11.1
Sausage, chicken	11	1	4.7	< 2.0	9.2	4.1	7.4
Sausage, salami	10	2	4.1	< 2.0	11.0	3.5	7.2
Sausage, turkey	8	2	3.0	< 2.0	4.3	3.2	4.0
Meat:							
Beef	41	18	< 5.0	< 5.0	29.0	< 5.0	9.5
Chicken	30	23	< 5.0	< 5.0	15.0	< 5.0	6.8
Lamb	7	6	< 5.0	< 5.0	5.5	< 5.0	< 5.0
Mutton	2	2	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Pork	43	30	< 5.0	< 5.0	24.6	< 5.0	< 5.0
Turkey	12	11	< 5.0	< 5.0	5.0	< 5.0	< 5.0
Veal	18	10	< 5.0	< 5.0	18.0	< 5.0	< 5.0
Fish:							
Cod	30	19	3.7	< 2.0	37.0	< 2.0	7.0
Cod liver	10	4	5.0	< 2.0	14.0	3.5	10.0
Eel	8	1	6.1	< 2.0	12.0	4.2	12.0
Flounder	22	12	2.6	< 2.0	13.0	< 2.0	5.9
Garfish	15	5	3.8	< 2.0	23.6	2.6	4.3
Herring	18	2	8.5	< 2.0	30.3	5.4	20.7
Mackerel	22	17	< 2.0	< 2.0	10.0	< 2.0	5.6
Mussel	15	0	142	31	383	144	180
Plaice	21	13	< 2.0	< 2.0	6.5	< 2.0	3.1
Shrimp	10	3	4.3	< 2.0	7.0	4.6	6.7
Tuna	12	8	< 2.0	< 2.0	4.8	< 2.0	3.1
Beverages:							
Apple juice	6	0	5.7	1.3	10.9	5.2	10.2
Beer, lager	15	9	0.7	< 0.6	3.7	< 0.6	2.5
Fruit juice	6	0	39.5	4.0	207	6.9	108
Orange juice	11	4	4.2	< 0.6	15.2	1.9	13.3
Red wine	15	0	28.4	12.9	43.8	26.8	43.0
Soft drinks	21	12	1.4	< 0.6	11.3	< 0.6	1.8
Water, carbonated	4	2	0.8	< 0.6	2.1	< 0.6	1.7
White wine	10	0	30.5	16.5	58.0	27.8	47.6
Dairy products:							
Blended spread	5	4	< 4.0	< 4.0	5.0	< 4.0	< 4.0
Butter	5	5	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Cheese, brie	10	4	3.5	< 2.0	10.6	2.5	7.6
Cheese, firm, Danbo	10	3	3.4	< 3.0	4.2	3.4	4.1
Cocoa, instant	9	0	2.7	1.5	5.8	2.2	4.5
Cream, whipping	10	6	< 2.0	< 2.0	3.9	< 2.0	3.7

Foodstuff	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Ice cream, dairy	11	5	2.9	< 2.0	11.6	2.3	3.6
Milk, buttermilk	10	5	< 0.4	< 0.4	0.6	< 0.4	0.5
Milk, partly skimmed	10	5	0.5	< 0.4	1.8	< 0.4	0.8
Milk, skimmed	10	4	0.8	< 0.4	3.1	0.5	1.3
Milk, skimmed with chocolate	2	0	2.3	2.3	2.4	2.3	2.3
Milk, whole	10	8	< 0.5	< 0.5	1.0	< 0.5	0.6
Ymer	10	4	1.7	< 0.6	7.8	0.6	3.9
Yoghurt	11	7	< 0.6	< 0.6	1.9	< 0.6	1.1
Bread and cereals:							
Bread, white	10	7	< 20.0	< 20.0	42.0	< 20.0	29.4
Bread, white coarse grain	10	8	< 20.0	< 20.0	28.0	< 20.0	27.1
Bread, white roll	10	7	< 20.0	< 20.0	27.0	< 20.0	20.7
Bread, wholemeal	10	10	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0
Breakfast cereal	10	7	< 20.0	< 20.0	41.0	< 20.0	26.6
Corn flakes	10	8	< 20.0	< 20.0	61.0	< 20.0	25.0
Crispbread, rye	7	7	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0
Crispbread, wheat	3	3	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0
Oats, rolled	10	10	< 20.0	< 20.0	59.0	< 20.0	< 20.0
Pasta	10	6	21.0	< 20.0	59.0	< 20.0	55.4
Rice, polished	6	6	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0
Rye bread	10	9	< 20.0	< 20.0	27.0	< 20.0	< 20.0
Rye bread, wholemeal	20	19	< 20.0	< 20.0	24.0	< 20.0	< 20.0
Rye flour, whole meal	10	7	< 20.0	< 20.0	33.0	< 20.0	25.8
Wheat flour	10	8	< 20.0	< 20.0	20.0	< 20.0	20.0

11.1.2 Contents of cadmium (µg/kg fresh weight) in foods sampled, 1998-2003

Foodstuff (Cd)	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Vegetables:							
Aubergines	10	1	2.9	< 0.3	16.9	0.9	4.4
Beans	9	1	1.0	< 0.3	2.2	1.0	1.8
Beetroots	10	0	28.0	12.5	42.5	28.0	37.0
Broccoli	10	0	6.0	2.6	10.6	5.7	9.8
Brussel sprouts	9	0	7.3	5.0	11.7	6.7	10.2
Cabbage	11	0	4.1	1.4	9.3	3.8	6.9
Carrots	39	0	26.4	2.1	62.8	23.5	56.3
Cauliflower	10	0	4.4	2.1	7.6	3.9	7.0
Celeriac	9	1	63.5	< 0.3	116	58.9	108
Celery	12	0	21.5	1.3	49.4	20.8	38.4
Chinese cabbage	10	0	13.9	6.2	36.1	10.9	20.6
Cucumber	10	8	< 0.3	< 0.3	1.7	< 0.3	0.5
Curly kale	15	0	16.7	3.9	50.2	11.7	29.5
Leeks	11	0	19.8	1.8	49.2	19.2	37.5
Lettuce	31	0	21.3	3.5	69.6	15.3	40.6
Mushrooms	10	0	13.5	3.9	38.2	9.4	25.9
Onions	20	0	16.4	5.3	40.6	15.1	25.3
Peas	10	0	3.3	1.4	8.5	2.4	5.1
Pepper	13	4	2.8	< 0.3	13.6	0.5	9.4
Potatoes	30	0	13.4	0.8	37.6	12.7	20.8
Rhubarb	8	0	24.2	8.1	44.7	20.5	40.7
Spinach	28	0	63.8	< 0.3	278	58.4	92.5
Squash	10	3	1.7	< 0.3	9.4	0.9	2.3
Tomato	20	9	3.1	< 0.3	21.8	0.6	7.7
Offal:							
Liver, calf	20	0	40.8	11.3	239	24.6	52.7
Liver, chicken	12	0	15.6	6.7	46.9	14.2	18.2
Liver, ox	14	0	64.2	11.7	174	59.9	91.8
Liver, pig	19	0	25.1	13.6	47.5	23.8	33.9
Kidney, calf	23	0	126	44.0	448	105	195
Kidney, ox	43	0	434	29.0	2710	345	643
Kidney, pig	32	0	206	61.7	461	176	349
Meat products:							
Pate, meat	10	0	9.4	3.9	18.1	7.7	17.2
Pork, flank, cooked	10	9	1.1	< 1.0	2.8	< 1.0	2.0
Pork, liver paste	10	0	12.7	10.6	17.5	11.9	15.3
Pork, mettwurst, smoked	11	2	2.7	< 1.0	4.0	3.2	3.8
Pork, saddle, smoked	10	10	< 1.0	< 1.0	1.3	< 1.0	1.0
Pork, sausage, frankfurter	13	8	2.1	< 1.0	5.1	1.8	4.9
Pork, sausage, saveloy	9	5	2.0	< 1.0	3.8	1.9	3.2

Foodstuff (Cd)	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Sausage, chicken	11	4	2.8	< 1.0	6.6	2.9	5.3
Sausage, salami	10	9	< 1.0	< 1.0	2.5	< 1.0	1.8
Sausage, turkey	8	6	1.2	< 1.0	2.6	1.2	2.2
Meat:							
Beef	41	40	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Chicken	30	30	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Lamb	7	7	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Mutton	2	2	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Pork	43	43	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Turkey	12	12	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Veal	18	18	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Fish:							
Cod	30	29	< 0.6	< 0.6	0.8	< 0.6	< 0.6
Cod liver	10	0	24.8	2.9	75.0	18.0	43.0
Eel	8	4	0.6	< 0.6	1.5	0.6	1.2
Flounder	22	9	1.1	< 0.6	7.4	0.6	1.8
Garfish	15	7	1.4	< 0.6	5.0	0.7	3.1
Herring	18	0	4.3	0.7	13.8	4.0	7.6
Mackerel	22	0	3.9	1.2	13.1	3.2	4.3
Mussel	15	0	101	54.8	169	95.8	140
Plaice	21	16	< 0.6	< 0.6	1.4	< 0.6	1.1
Shrimp	10	1	25.8	< 0.6	56.1	26.3	50.6
Tuna	12	0	11.6	5.4	32.4	7.6	20.6
Beverages:							
Apple juice	6	0	0.4	0.3	0.5	0.4	0.5
Beer, lager	15	13	< 0.1	< 0.1	0.3	< 0.1	< 0.1
Fruit juice	6	0	2.1	0.1	8.9	0.6	5.7
Orange juice	11	6	0.1	< 0.1	0.4	< 0.1	0.4
Red wine	15	1	0.3	< 0.1	0.6	0.3	0.4
Soft drinks	21	21	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Water, carbonated	4	4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
White wine	10	0	0.3	0.1	0.5	0.3	0.5
Dairy products:							
Blended spread	5	5	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Butter	5	5	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Cheese, brie	10	10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cheese, firm, Danbo	10	9	< 1.0	< 1.0	1.1	< 1.0	< 1.0
Cocoa, instant	9	0	2.9	2.2	3.4	2.9	3.3
Cream, whipping	10	10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ice cream, dairy	11	9	< 1.0	< 1.0	2.4	< 1.0	1.6
Milk, buttermilk	10	7	0.2	< 0.1	0.8	< 0.1	0.7
Milk, partly skimmed	10	10	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Foodstuff (Cd)	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Milk, skimmed	10	10	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Milk, skimmed with chocolate	2	0	3.3	3.3	3.4	3.3	3.4
Milk, whole	10	10	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Ymer	10	8	< 0.4	< 0.4	0.5	< 0.4	0.4
Yoghurt	11	10	< 0.4	< 0.4	1.0	< 0.4	< 0.4
Bread and cereals:							
Bread, white	10	0	20.4	15.0	24.0	21.0	24.0
Bread, white coarse grain	10	0	42.5	14.0	81.0	40.5	71.1
Bread, white roll	10	0	22.7	17.0	34.0	21.5	28.6
Bread, wholemeal	10	0	24.6	20.0	29.0	24.0	28.1
Breakfast cereal	10	1	27.8	< 1.5	66.0	27.0	54.3
Corn flakes	10	2	3.0	< 1.5	8.2	2.3	5.6
Crispbread, rye	7	0	7.5	5.4	10.0	6.7	9.5
Crispbread, wheat	3	0	22.3	18.0	30.0	19.0	27.8
Oats, rolled	10	0	23.2	13.0	110.0	23.5	29.8
Pasta	10	0	21.7	8.9	33.0	22.0	29.4
Rice, polished	6	0	17.9	8.2	27.0	17.0	26.5
Rye bread	10	10	7.2	5.1	12.0	7.0	9.7
Rye bread, wholemeal	20	12	26.8	4.5	110.0	14.5	61.6
Rye flour, whole meal	10	10	8.1	4.3	9.9	8.7	9.7
Wheat flour	10	1	32.1	15.0	58.0	30.0	43.6

11.1.3 Contents of nickel (µg/kg fresh weight) in foods sampled, 1998-2003

Foodstuff (Ni)	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Vegetables:							
Aubergines	10	0	6	1	16	3	12
Beans	9	0	250	78	434	251	346
Beetroots	10	0	26	15	39	27	34
Broccoli	10	0	97	5	329	35	273
Brussel sprouts	9	0	38	28	47	39	47
Cabbage	11	0	23	5	53	15	49
Carrots	39	0	44	13	145	31	105
Cauliflower	10	0	22	9	38	21	37
Celeriac	9	0	81	2	137	76	135
Celery	12	0	27	8	62	22	46
Chinese cabbage	10	0	20	7	41	19	31
Cucumber	10	1	5	< 1	14	3	11
Curly kale	15	0	87	28	190	80	151
Leeks	11	0	28	8	64	18	50
Lettuce	31	0	35	4	173	25	78
Mushrooms	10	0	4	1	10	3	7
Onions	20	0	34	7	73	35	52
Peas	10	0	449	130	1070	281	1043
Pepper	13	1	26	< 1	96	6	74
Potatoes	30	0	33	4	365	17	56
Rhubarb	8	0	78	38	133	68	113
Spinach	28	0	60	9	341	28	137
Squash	10	0	50	3	156	33	107
Tomato	20	4	16	< 1	142	4	29
Offal:							
Liver, calf	20.0	19.0	< 9	< 9	42	< 9	< 9
Liver, chicken	12.0	7.0	< 9	< 9	24	< 9	13
Liver, ox	14.0	13.0	< 9	< 9	73	< 9	< 9
Liver, pig	19.0	15.0	< 9	< 9	22	< 9	11
Kidney, calf	23.0	11.0	< 9	< 9	16	< 9	10
Kidney, ox	43.0	10.0	14	< 9	153	10	19
Kidney, pig	32.0	3.0	43	< 6	217	18	111
Meat products:							
Pate, meat	10	0	52	14	213	34	79
Pork, flank, cooked	10	0	18	< 9	58	15	32
Pork, liver paste	10	0	26	9	84	16	50
Pork, mettwurst, smoked	11	0	47	13	144	26	117
Pork, saddle, smoked	10	3	< 9	< 9	< 9	< 9	< 9
Pork, sausage, frankfurter	13	0	88	< 9	524	39	215
Pork, sausage, saveloy	9	0	37	19	58	32	55
Sausage, chicken	11	1	39	< 9	154	21	105
Sausage, salami	10	1	14	< 9	40	14	20

Foodstuff (Ni)	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Sausage, turkey	8	0	16	< 9	25	16	24
Meat:							
Beef	41	25	< 7	< 7	35	< 7	< 7
Chicken	30	16	< 7	< 7	44	< 7	< 7
Lamb	7	5	< 7	< 7	24	< 7	11
Mutton	2	1	< 7	< 7	< 7	< 7	< 7
Pork	43	34	< 7	< 7	65	< 7	< 7
Turkey	12	11	< 7	< 7	< 7	< 7	< 7
Veal	18	10	< 7	< 7	37	< 7	10
Fish:							
Cod	30	18	8	< 5	71	< 5	20
Cod liver	10	2	17	< 5	70	11	25
Eel	8	6	< 5	< 5	5	< 5	5
Flounder	22	13	7	< 5	36	< 5	16
Garfish	15	5	9	< 5	21	7	17
Herring	17	12	< 5	< 5	21	< 5	8
Mackerel	22	21	< 5	< 5	7	< 5	< 5
Mussel	15	0	197	80	506	145	375
Plaice	21	2	20	< 5	70	15	42
Shrimp	10	5	20	< 5	143	< 5	38
Tuna	12	10	14	< 5	143	< 5	9
Beverages:							
Apple juice	6	0	9	5	12	10	12
Beer, lager	15	0	9	2	58	4	4
Fruit juice	6	0	113	5	578	20	311
Orange juice	11	0	14	4	21	14	19
Red wine	15	0	21	11	30	22	26
Soft drinks	21	3	4	< 1	11	2	10
Water, carbonated	4	2	1	< 1	2	1	2
White wine	10	0	23	13	39	21	33
Dairy products:							
Blended spread	5	5	< 7	< 7	< 7	< 7	< 7
Butter	5	5	< 7	< 7	< 7	< 7	< 7
Cheese, brie	10	0	49	39	56	48	55
Cheese, firm, Danbo	10	0	67	57	76	67	75
Cocoa, instant	9	0	172	112	216	164	211
Cream, whipping	10	10	< 3	< 3	< 3	< 3	< 3
Ice cream, dairy	11	0	24	15	74	19	24
Milk, buttermilk	10	0	10	9	13	9	12
Milk, partly skimmed	10	0	7	6	8	7	7
Milk, skimmed	10	0	8	7	9	8	9

Foodstuff (Ni)	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Milk, skimmed with chocolate	2	0	181	176	186	181	185
Milk, whole	10	0	10	5	13	10	11
Ymer	10	0	18	16	19	18	18
Yoghurt	11	0	12	7	16	13	15
Bread and cereals:							
Bread, white	10	7	< 60	< 60	176	< 60	112
Bread, white coarse grain	10	2	154	< 60	308	150	295
Bread, white roll	10	9	< 60	< 60	62	< 60	< 60
Bread, wholemeal	10	8	< 60	< 60	107	< 60	77
Breakfast cereal	10	2	392	< 60	1200	190	939
Corn flakes	10	7	< 60	< 60	156	< 60	129
Crispbread, rye	7	5	< 60	< 60	95	< 60	76
Crispbread, wheat	3	2	< 60	< 60	72	< 60	64
Oats, rolled	10	0	1411	380	1680	1195	2462
Pasta	10	0	94	67	124	99	116
Rice, polished	6	0	286	187	368	275	352
Rye bread	10	11	< 60	< 60	119	< 60	80
Rye bread, wholemeal	20	9	123	< 60	414	84	318
Rye flour, whole meal	10	3	68	< 60	105	69	99
Wheat flour	10	9	< 60	< 60	74	< 60	< 60

11.1.4 Contents of mercury (µg/kg fresh weight) in foods sampled, 1998-2003

Foodstuff (Hg)	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Vegetables:							
Aubergines	10	10	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Beans	9	9	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Beetroots	10	10	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Broccoli	10	10	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Brussel sprouts	9	9	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Cabbage	11	11	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Carrots	39	22	< 0.2	< 0.2	0.5	< 0.2	0.4
Cauliflower	10	10	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Celeriac	9	3	0.3	< 0.2	0.5	0.3	0.4
Celery	12	7	0.2	< 0.2	0.4	< 0.2	0.3
Chinese cabbage	10	10	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Cucumber	10	10	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Curly kale	15	0	5.4	1.9	11.1	4.7	9.2
Leeks	11	11	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Lettuce	31	22	0.2	< 0.2	2.0	< 0.2	0.6
Mushrooms	10	0	3.6	1.3	10.5	2.6	7.0
Onions	20	19	< 0.2	< 0.2	0.6	< 0.2	< 0.2
Peas	10	10	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Pepper	13	13	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Potatoes	30	29	< 0.4	< 0.4	0.8	< 0.4	< 0.4
Rhubarb	8	8	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Spinach	28	0	0.8	0.2	2.6	0.6	1.5
Squash	10	10	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Tomato	20	20	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Offal:							
Liver, calf	20	20	< 3.0	< 3.0	4.0	< 3.0	< 3.0
Liver, chicken	12	11	< 3.0	< 3.0	6.1	< 3.0	3.6
Liver, ox	14	14	< 3.0	< 3.0	3.5	< 3.0	< 3.0
Liver, pig	19	18	< 3.0	< 3.0	13.3	< 3.0	< 3.0
Kidney, calf	23	19	< 3.0	< 3.0	6.3	< 3.0	5.3
Kidney, ox	43	25	5.6	< 3.0	14.9	4.9	10.9
Kidney, pig	32	25	5.0	< 3.0	24.5	< 3.0	8.1
Meat products:							
Pate, meat	10	10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Pork, flank, cooked	10	10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Pork, liver paste	10	10	< 1.0	< 1.0	1.2	< 1.0	1.1
Pork, mettwurst, smoked	11	11	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Pork, saddle, smoked	10	10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Pork, sausage, frankfurter	13	13	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Pork, sausage, saveloy	9	9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Foodstuff (Hg)	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Sausage, chicken	11	10	< 1.0	< 1.0	4.7	< 1.0	1.2
Sausage, salami	10	9	< 1.0	< 1.0	2.0	< 1.0	1.3
Sausage, turkey	8	8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Meat:							
Beef	41	41	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Chicken	30	28	< 2.0	< 2.0	3.1	< 2.0	< 2.0
Lamb	7	7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Mutton	2	2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Pork	43	40	< 2.0	< 2.0	6.5	< 2.0	< 2.0
Turkey	12	12	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Veal	18	18	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Fish:							
Cod	30	0	57.9	21.1	160	48.9	94.7
Cod liver	10	1	17.2	< 2.6	47.9	13.1	41.7
Eel	8	0	178	20.5	488	94.8	459
Flounder	22	0	40.0	2.9	102	36.8	60.1
Garfish	15	0	71.6	29.9	184	55.9	130
Herring	18	0	41.2	18.1	77.1	34.6	64.5
Mackerel	22	0	34.1	22.2	44.7	34.2	42.2
Mussel	15	0	10.3	2.6	27.7	8.0	22.2
Plaice	21	0	35.3	2.9	80.4	28.7	72.4
Shrimp	10	0	20.0	5.9	57.7	13.9	36.3
Tuna	12	0	474	154	1900	218	968
Beverages:							
Apple juice	6	6	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Beer, lager	15	15	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Fruit juice	6	6	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Orange juice	11	11	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Red wine	15	15	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Soft drinks	21	21	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Water, carbonated	4	4	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
White wine	10	10	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Dairy products:							
Blended spread	5	5	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Butter	5	5	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Cheese, brie	10	0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Cheese, firm, Danbo	10	10	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Cocoa, instant	9	0	0.4	0.1	1.3	0.4	0.6
Cream, whipping	10	10	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Ice cream, dairy	11	11	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Milk, buttermilk	10	7	< 0.1	< 0.1	0.2	< 0.1	0.1
Milk, partly skimmed	10	10	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Foodstuff (Hg)	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Milk, skimmed	10	9	< 0.1	< 0.1	0.1	< 0.1	< 0.1
Milk, skimmed with chocolate	2	0	0.3	0.3	0.3	0.3	0.3
Milk, whole	10	10	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ymer	10	5	0.1	< 0.1	0.3	< 0.1	0.1
Yoghurt	11	10	< 0.1	< 0.1	0.1	< 0.1	< 0.1

11.1.5 Contents of selenium (µg/kg fresh weight) in foods sampled, 1998-2003

Foodstuff (Se)	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Vegetables:							
Aubergines	10	5	0.7	< 0.4	1.7	0.5	1.4
Beans	9	1	3.9	< 0.4	7.2	4.5	7.0
Beetroots	10	6	< 0.8	< 0.8	1.4	< 0.8	1.2
Broccoli	10	1	7.1	0.4	20.2	6.0	14.3
Brussel sprouts	9	0	25.5	6.0	54.2	29.1	48.5
Cabbage	11	2	5.1	< 0.4	29.3	2.5	5.7
Carrots	39	10	2.5	< 0.4	13.0	1.2	7.8
Cauliflower	10	1	22.8	< 0.8	166.0	6.1	31.9
Celeriac	9	1	4.3	0.4	12.0	2.5	7.6
Celery	12	4	2.1	< 0.4	7.2	2.4	3.5
Chinese cabbage	10	4	2.5	< 0.4	14.1	1.0	5.3
Cucumber	10	7	< 0.4	< 0.4	1.9	< 0.4	0.8
Curly kale	15	4	29.6	< 0.8	95.5	15.4	83.8
Leeks	11	1	7.0	< 0.4	23.6	3.5	20.7
Lettuce	31	17	1.1	< 0.4	7.3	< 0.4	2.8
Mushrooms	10	0	129	35.4	473	92.7	181
Onions	20	2	7.2	< 0.4	49.7	2.0	21.1
Peas	10	0	8.9	4.0	24.0	6.4	14.1
Pepper	13	6	5.0	< 0.4	53.9	0.7	2.7
Potatoes	30	9	1.4	< 0.8	3.4	1.1	2.8
Rhubarb	8	8	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Spinach	28	2	6.0	< 0.4	88.8	1.1	11.2
Squash	10	4	1.4	< 0.4	4.1	1.2	2.9
Tomato	20	8	2.7	< 0.4	22.7	0.9	5.8
Offal:							
Liver, calf	20	0	367	62	1050	307	572
Liver, chicken	12	0	461	315	538	469	514
Liver, ox	14	0	337	119	717	322	501
Liver, pig	19	0	457	371	618	449	559
Kidney, calf	23	0	1229	767	1600	1220	1457
Kidney, ox	43	0	1135	391	1530	1140	1427
Kidney, pig	32	0	1639	1150	2326	1610	1938
Meat products:							
Pate, meat	10	0	188	118	294	145	290
Pork, flank, cooked	10	0	104	66.0	141	105	137
Pork, liver paste	10	0	196	161	220	196	212
Pork, mettwurst, smoked	11	0	74.4	52.0	93.0	80.0	93.0
Pork, saddle, smoked	10	0	116	82.0	164	113	144
Pork, sausage, frankfurter	13	0	71.1	57.0	93.0	71.0	76.8
Pork, sausage, saveloy	9	0	66.9	58.0	82.0	65.0	76.4
Sausage, chicken	11	0	103	63.0	203	99.0	121

Foodstuff (Se)	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Sausage, salami	10	0	94.7	75.0	113	96.0	109
Sausage, turkey	8	0	78.1	61.0	88.0	82.0	85.9
Meat:							
Beef	41	0	101	61.0	161	99.4	130
Chicken	30	0	94.6	64.0	149	94.4	107
Lamb	7	0	23.6	12.0	37.0	23.0	31.0
Mutton	2	0	22.5	21.0	24.0	22.5	23.7
Pork	43	0	126	95.3	259	123	138
Turkey	12	0	89.0	32.7	137	95.6	126
Veal	18	0	76.4	13.0	106	81.1	99.1
Fish:							
Cod	30	0	269	167	377	272	339
Cod liver	10	0	635	296	1742	539	811
Eel	8	0	335	238	677	295	473
Flounder	22	0	233	170	358	230	324
Garfish	15	0	262	222	297	258	296
Herring	18	0	331	218	535	292	501
Mussel	15	0	294	158	565	293	393
Mackerel	22	0	250	201	375	245	292
Plaice	21	0	325	177	1223	302	394
Shrimp	10	0	187	134	237	179	222
Tuna	12	0	772	488	1141	791	1040
Beverages:							
Apple juice	6	4	0.3	< 0.3	0.6	< 0.3	0.6
Beer, lager	15	2	1.2	< 0.3	2.5	1.3	2.5
Fruit juice	6	3	1.7	< 0.3	9.5	< 0.3	5.0
Orange juice	11	4	0.4	< 0.3	0.8	0.4	0.7
Red wine	15	3	0.7	< 0.3	2.2	0.6	1.5
Soft drinks	21	16	0.4	< 0.3	2.8	< 0.3	1.9
Water, carbonated	4	1	0.5	< 0.3	1.0	0.5	0.8
White wine	10	4	0.4	< 0.3	1.3	0.3	0.9
Dairy products:							
Blended spread	5	5	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
Butter	5	5	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
Cheese, brie	10	0	58.4	5.7	105	50.7	94.7
Cheese, firm, Danbo	10	0	87.5	69.1	94.8	90.3	94.8
Cocoa, instant	9	0	13.9	11.8	15.3	13.6	15.1
Cream, whipping	10	0	12.9	10.1	16.0	12.7	15.6
Ice cream, dairy	11	2	8.4	< 4.0	16.0	7.9	12.1
Milk, buttermilk	10	0	15.2	11.8	17.0	15.7	16.6
Milk, partly skimmed	10	0	15.4	11.3	20.1	15.0	19.4

Foodstuff (Se)	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Milk, skimmed	10	0	16.6	14.0	19.3	16.4	19.0
Milk, skimmed with chocolate	2	0	13.1	12.1	14.1	13.1	13.9
Milk, whole	10	0	16.1	12.8	19.0	15.9	18.3
Ymer	10	0	26.2	23.2	28.4	26.8	27.8
Yoghurt	11	0	18.3	15.5	20.2	18.9	19.7
Bread and cereals:							
Bread, white	10	5	44.3	< 40	98	44	75.5
Bread, white coarse grain	10	4	56.7	< 40	154	55	112.6
Bread, white roll	10	2	61.8	< 40	99	63	87.3
Bread, wholemeal	10	9	< 40	< 40	41	< 40	< 40
Breakfast cereal	10	1	85.1	< 40	207	71	151.2
Corn flakes	10	5	49.5	< 40	96	49.5	80.7
Crispbread, rye	7	5	< 40	< 40	101	< 40	69.8
Crispbread, wheat	3	3	< 40	< 40	< 40	< 40	< 40
Oats, rolled	10	2	49.7	< 40	208	51	88.8
Pasta	10	2	63.7	< 40	208	52	97.3
Rice, polished	6	2	87	< 40	149	87.5	147.5
Rye bread	10	7	< 40	< 40	54	< 40	< 40
Rye bread, wholemeal	20	19	< 40	< 40	113	< 40	< 62.2
Rye flour, whole meal	10	8	< 40	< 40	50	< 40	43.7
Wheat flour	10	9	< 40	< 40	52	< 40	< 40

11.1.6 Contents of arsenic (µg/kg fresh weight) in foods sampled, 1998-2003

Foodstuff (As)	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Vegetables:							
Aubergines	10	4	2.2	< 0.4	8.5	0.5	6.8
Beans	9	1	1.5	< 0.4	2.7	1.3	2.6
Beetroots	10	4	1.1	< 0.7	2.7	0.9	2.0
Broccoli	10	0	1.9	0.7	4.2	1.0	3.8
Brussel sprouts	9	0	4.8	1.1	8.9	4.9	7.6
Cabbage	11	1	0.9	< 0.4	3.1	0.7	1.2
Carrots	39	0	2.6	0.7	6.3	2.2	4.9
Cauliflower	10	2	2.0	< 0.7	5.8	1.4	4.2
Celeriac	9	0	2.7	0.6	7.3	2.1	4.4
Celery	12	0	2.8	1.3	6.8	2.3	4.1
Chinese cabbage	10	0	2.2	0.6	4.3	1.6	3.9
Cucumber	10	3	2.0	< 0.4	6.1	0.9	5.0
Curly kale	15	0	5.0	2.1	8.2	5.1	7.4
Leeks	11	0	2.1	0.7	4.8	1.7	3.6
Lettuce	31	1	3.8	< 0.4	16.1	2.3	9.4
Mushrooms	10	0	20.1	9.0	38.9	17.5	30.4
Onions	20	0	5.5	0.8	28.6	2.7	11.1
Peas	10	1	1.6	< 0.7	2.8	1.4	2.7
Pepper	13	5	0.7	< 0.4	2.3	0.5	1.4
Potatoes	30	14	1.4	< 0.7	10.5	1.0	2.7
Rhubarb	8	0	1.9	0.7	5.3	1.4	3.4
Spinach	28	0	8.1	1.5	24.1	6.2	17.9
Squash	10	3	1.5	< 0.4	5.4	0.8	3.4
Tomato	20	9	0.5	< 0.4	1.0	0.4	0.9
Offal:							
Liver, calf	20	1	19.0	< 4.0	112	13.0	26.8
Liver, chicken	12	1	22.7	5.7	62.1	19.5	40.4
Liver, ox	14	2	12.8	4.2	32.0	11.5	22.1
Liver, pig	19	0	14.5	6.0	23.0	14.0	22.2
Kidney, calf	23	0	43.1	14.0	63.3	49.0	61.5
Kidney, ox	43	0	47.2	14.0	136	46.0	63.3
Kidney, pig	32	0	34.0	13.0	79.6	35.0	61.3
Meat products:							
Pate, meat	10	0	13.3	8.5	19.0	13.0	17.2
Pork, flank, cooked	10	0	7.7	3.4	13.0	7.1	11.2
Pork, liver paste	10	0	12.6	11.0	15.0	12.0	15.0
Pork, mettwurst, smoked	11	1	6.4	< 3.0	11.0	6.5	9.7
Pork, saddle, smoked	10	0	7.0	4.3	12.0	6.8	8.5
Pork, sausage, frankfurter	13	0	5.4	< 3.0	11.0	4.8	8.7
Pork, sausage, saveloy	9	0	8.0	4.5	12.0	7.8	11.2
Sausage, chicken	11	0	56.1	7.3	261	18.0	206

Foodstuff (As)	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Sausage, salami	10	0	7.2	4.5	11.0	6.6	9.8
Sausage, turkey	8	0	9.9	4.8	16.0	9.7	14.6
Meat:							
Beef	41	3	5.1	< 5.0	14.0	< 5.0	8.3
Chicken	30	1	14.2	< 5.0	61.4	9.2	31.2
Lamb	7	5	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Mutton	2	2	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Pork	43	3	7.1	< 5.0	81.1	< 5.0	8.1
Turkey	12	1	5.5	< 5.0	11.0	5.8	7.3
Veal	18	3	< 5.0	< 5.0	8.0	5.1	6.4
Fish:							
Cod	30	0	2409	316	12179	1931	4619
Cod liver	10	0	2773	1565	4003	2673	3830
Eel	8	0	477	243	654	505	608
Flounder	22	0	2000	197	6667	1061	4520
Garfish	15	0	352	120	771	343	476
Herring	18	0	1514	334	2648	1470	1999
Mackerel	22	0	2027	1458	2612	2084	2435
Mussel	15	0	1077	413	2024	972	1858
Plaice	21	0	10708	3268	23989	8569	19807
Shrimp	10	0	4099	271	20924	2555	5554
Tuna	12	0	1179	677	2327	1132	1453
Beverages:							
Apple juice	6	5	2.1	< 2.0	6.3	< 2.0	4.0
Beer, lager	15	6	4.2	< 2.0	10.0	3.5	6.0
Fruit juice	6	2	9.3	< 2.0	43.8	2.4	24.3
Orange juice	11	5	3.4	< 2.0	12.0	2.0	9.3
Red wine	15	3	4.4	< 2.0	14.0	2.7	9.7
Soft drinks	21	19	< 2.0	< 2.0	2.3	< 2.0	< 2.0
Water, carbonated	4	3	3.5	< 2.0	8.9	< 2.0	6.8
White wine	10	0	8.7	2.8	21.3	7.7	12.9
Dairy products:							
Blended spread	5	5	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
Butter	5	5	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
Cheese, brie	10	5	7.4	< 4.0	13.9	6.3	13.9
Cheese, firm, Danbo	10	2	6.6	< 5.0	9.9	6.2	9.2
Cocoa, instant	9	3	1.1	< 1.0	1.5	1.2	1.5
Cream, whipping	10	9	< 4.0	< 4.0	4.2	< 4.0	< 4.0
Ice cream, dairy	11	6	< 3.0	< 3.0	5.5	< 3.0	4.9
Milk, buttermilk	10	2	0.8	< 0.7	1.2	0.8	1.1
Milk, partly skimmed	10	2	1.4	< 0.8	2.9	1.1	2.6
Milk, skimmed	10	0	1.1	0.9	1.4	1.0	1.4
Milk, skimmed with chocolate	2	1	1.1	< 1.0	1.4	1.1	1.3
Milk, whole	10	1	1.6	< 0.9	2.1	1.7	2.0

Foodstuff (As)	Number	Number < LOD	Average	Minimum	Maximum	Median	0.90 quantile
Ymer	10	2	1.4	< 1.0	1.7	1.5	1.7
Yoghurt	11	4	1.1	< 1.0	1.9	1.1	1.6

11.2 Appendix to Nitrate

11.2.1 Nitrate content (mg/kg fresh weight) in vegetables from 1998, 1999, 2000 and 2001

Year and type of vegetable	No. samples	Minimum (mg/kg)	Maximum (mg/kg)	Mean (mg/kg)	Median (mg/kg)	90th perc. (mg/kg)
1998						
Head lettuce, greenhouse (Danish)	78	747	4484	2734	2644	4092
Head lettuce, open air (Danish)	7	784	2828	1711	1694	2828
Head lettuce, foreign	25	16	3063	1311	1524	2680
Iceberg, Danish	33	93	2525	1092	1031	1750
Iceberg, foreign	20	316	1544	1012	1024	1497
Spinach, fresh Danish	8	908	3158	1777	1406	3158
Spinach, frozen Danish	6	13	1323	871	946	1323
Spinach, foreign	7	24	1817	927	958	1817
Potatoes, Danish	50	7	311	116	106	229
Potatoes, foreign	25	62	498	210	187	365
1999						
Head lettuce, greenhouse (Danish)	73	835	4255	2667	2609	3863
Head lettuce, open air (Danish)	10	193	2480	1291	1197	2222
Head lettuce, foreign	20	34	3104	1586	1567	2660
Iceberg, Danish	18	192	1822	873	864	1354
Iceberg, foreign	20	422	3074	960	780	1573
Spinach, fresh Danish	12	106	2425	1294	1171	2425
Spinach, frozen Danish	9	83	1665	1028	1213	1665
Spinach, foreign	3	808	1964	1073	1073	1964
Potatoes, Danish	69	<5	305	76	68	154
Potatoes, foreign	30	26	592	179	152	367
2000						
Head lettuce, greenhouse (Danish)	63	1000	5800	2793	2600	4300
Head lettuce, foreign	24	29	4450	2230	2275	4450
Iceberg, Danish	5	420	930	626	560	930
Iceberg, foreign	38	0	1750	928	943	1400
Spinach, Danish, fresh	3	610	3800	1680	630	3800
Spinach, Danish, frozen	5	315	1190	828	875	1190
Spinach, foreign	9	315	1100	718	690	1100
Potatoes, Danish	74	17	415	112	105	185
Potatoes, foreign	2	150	250	200	200	250
Rucola	1	6100	6100	6100	6100	6100
2001						
Head lettuce, Danish (greenhouse)	39	69	4053	2379	2400	3800
Head lettuce, foreign	10	1100	2800	1678	1600	2800
Iceberg, Danish	3	577	960	789	830	960
Iceberg, foreign	21	430	1000	745	750	1000
Spinach, Danish fresh	15	440	3767	1676	1500	3200
Spinach, foreign	10	140	2000	1011	920	1850
Spinach, frozen (D+F)	8	140	1700	889	820	1700
Potatoes, Danish	39	11	350	106	93	205
Potatoes, new, Danish	4	4	220	127	108	220
Potatoes, foreign	15	33	250	108	100	160

11.2.2 Nitrate content (mg/kg fresh weight) in vegetables from 2002 and 2003

Year and type of vegetable	Number of samples	Minimum (mg/kg)	Maximum (mg/kg)	Mean (mg/kg)	Median (mg/kg)	90th percentile (mg/kg)
2002						
Head lettuce, greenhouse (Danish)	79	95	5100	2324	2300	3400
Head lettuce, open air (Danish)	3	360	1500	1020	1200	1500
Head lettuce, foreign	10	1200	3300	2463	2600	3050
Iceberg, Danish	8	230	2300	833	650	2300
Iceberg, foreign	15	260	1400	736	780	1100
Spinach, Danish	22	140	3800	1493	1400	2767
Spinach, foreign	6	690	2500	1570	1450	2500
Potato, Danish	90	13	380	120	110	190
Potato, Danish, new	4	<5	44	17	11	44
Beetroot, Danish	28	96	4300	1400	1150	2900
Ruccola	11	660	8000	5276	5300	7060
Fennel, Danish	2	905	1100	1002	1003	1100
Fennel, foreign	9	140	1300	756	810	1300
Celery, Danish	21	7	675	254	220	580
Celery, foreign	7	60	220	190	190	220
Baby food	14	<5	24	9	13	19
2003						
Head lettuce, greenhouse (Danish)	47	520	3900	2545	2700	3600
Head lettuce, open air (Danish)	1	1000	1000	1000	1000	1000
Head lettuce, foreign	9	1100	1800	4733	5850	7800
Iceberg, Danish	10	290	1000	748	830	990
Iceberg, foreign	9	480	1400	953	1000	1400
Spinach, Danish fresh	20	110	3900	1779	1900	2996
Spinach, foreign	4	360	2800	1357	1135	2800
Potato, Danish	55	15	280	105	88	220
Chinese cabbage (Danish)	23	270	1900	869	800	1300
Beetroot, Danish	20	220	4900	1648	1250	3850
Rucola	13	1700	7800	5399	5850	7000
Fennel, Danish	2	905	1100	1002	1002	1100
Fennel, foreign	9	140	1300	756	810	1300
Celery, Danish	17	<5	940	279	170	610
Celery, foreign	5	80	850	518	560	850
Baby food	17	<5	120	34	21	110

11.3 Appendix to Organic environmental contaminants

11.3.1 Number of samples of different foods for OCPs and indicator PCB

Foodstuff	1998 Number of samples	1999 Number of samples	2000 Number of samples	2001 Number of samples	2002 Number of samples	2003 Number of samples	1998-2003 Samples, total
Poultry fat	34	60	63	45	45	45	292
Beef fat	153	60	50	41	41	40	385
Pork fat	121	160	152	150	150	151	884
Lamb fat	4	10	9	6	5	3	37
Fats, composite	2			9	3	6	20
Milk products		90	45	44	48	72	299
Cheese	80	31	30		34	31	203
Butter	123				10	14	157
Mixed butter fat	9						9
Eggs	25	35	60	55	50	55	280
Cod		10					10
Eel farmed	40	40	10	20	10	10	130
Garfish		5					5
Greenland halibuts					9		9
Herring		10				18	28
Herring, pickled						10	10
Herring, smoked						12	12
Lumpsucker		4			7		11
Mackerel					6	14	20
Mackerel, smoked						18	18
Mackerel, tinned in tomato						6	6
Plaice		10					10
Rainbow trout, farmed	40	22	35	75	51	50	273
Salmon		11			9		20
Swordfish					6		6
Trout, marine farmed		18	19	20	10	10	77
Cod liver	22	16	25		23	25	111
Herring	60	30	38		44	47	219
Fish oil		21					21
Cod liver oil		9					9

11.3.2 Number of samples of different foods analysed for dioxins and PCB, 1998-2003 *

Foodstuff	2000 Number of samples	2001 Number of samples	2002 Number of samples	2003 Number of samples	2000-2003 Samples, total
Poultry fat	5	5	5	29	44
Beef fat	5	5	5	10	25
Pork fat	5	5	5	10	25
Sheep	-	5	5	10	20
Hens eggs	5	5	10	3	23
Cows milk	5	5	5	4	19
Dairy products	-	10	-	-	10
Farmed trout	5	-	5	10	20
Wild fish	5	-	20	15	40
Fish oil supplements	5	-	-	-	5

*Dioxins were incorporated in the monitoring programme from the year 2000. The analytical method includes dioxins, dioxin-like PCB and non dioxin-like PCB.

11.3.3 Number of human samples analysed for dioxins, PCB and chlorinated pesticides, 1998-2003

Type of human sample	1999 Number of samples	2002 Number of samples	1998-2003 Samples, total
Human milk	19	19	38

11.3.4 Tables of contents for alpha-HCH

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	6	0.0004	<d.	<d.	0.004
Turkey fat	85	1	0.0003	<d.	<d.	0.002
Duck fat	5	0				
Other poultry fat	4	0				
Beef fat	385	0				
Pork fat	884	3	0.0004	<d.	<d.	0.020
Lamb sheep fat	37	0				
Animal fats, other	20	0				
Milk, Danish	248	5	0.0003	<d.	<d.	0.001
Milk, foreign	41	0				
Cheese, Danish	40	0				
Cheese, foreign	166	5	0.0005	<d.	<d.	0.003
Butter, Danish	126	0				
Butter, foreign	22	0				
Butter fat, mixed	10	0				
Eggs	280	0				
Cod, raw	10	0				
Eel, farmed, raw	130	121	0.002	0.002	0.003	0.003
Garfish, raw	5	0				
Greenland halibut, raw	7	6	0.001	0.001	0.002	0.002
Herring, raw	26	15	0.0004	0.0003	0.001	0.001
Herring, pickled	11	11	0.0006	0.001	0.001	0.001
Herring, smoked	12	12	0.0004	0.0003	0.001	0.001
Lumpsucker, raw	11	7	0.001	0.001	0.002	0.002
Mackerel, raw	20	15	0.0006	0.001	0.001	0.001
Mackerel, smoked	18	18	0.0008	0.001	0.001	0.002
Mackerel, tinned in tomato	6	5	0.0002	0.0002	0.000	0.0004
Plaice, raw	10	0				
Rainbow trout, farmed, raw	273	20	0.0004	<d.	<d.	0.0003
Salmon, raw	20	2	0.0004	<d.	0.000	0.001
Swordfish, raw	6	0				
Trout, marine farmed, raw	77	25	0.0007	<d.	0.001	0.001
Fish oil	21	3	0.002	<d.	0.007	0.009
Cod liver oil	9	4	0.005	<d.	0.009	0.015
Herring:	219	90	0.0007	<d.	0.001	0.002
The Baltic Sea	37	19	0.0008	0.0003	0.002	0.002
The Sound	34	18	0.0009	0.001	0.002	0.002
The Belts	38	15	0.0006	<d.	0.001	0.001
The Kattegat	34	8	0.0006	<d.	0.0006	0.001
The Skagerrak	40	13	0.0007	<d.	0.0010	0.001
The North Sea	36	17	0.0007	<d.	0.0010	0.002
Cod liver:	111	77	0.002	0.001	0.006	0.010
The Baltic Sea	19	18	0.004	0.004	0.007	0.009
The Sound	22	17	0.004	0.002	0.010	0.010
The Belts	21	18	0.002	0.001	0.003	0.005
The Kattegat	14	9	0.001	0.001	0.004	0.004
The Skagerrak	19	9	0.002	<d.	0.003	0.005
The North Sea	16	6	0.001	<d.	0.002	0.002

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.5 Tables of contents for beta-HCH

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	2	0.0003	<d.	<d.	0.002
Turkey fat	85	0				
Duck fat	5	0				
Other poultry fat	4	0				
Beef fat	385	5	0.0003	<d.	<d.	0.005
Pork fat	884	0				
Lamb sheep fat	37	0				
Animal fats, other	20	2	0.0004	<d.	0.0002	0.002
Milk, Danish	248	0				
Milk, foreign	41	0				
Cheese, Danish	40	0				
Cheese, foreign	166	11	0.0004	<d.	<d.	0.005
Butter, Danish	126	0				
Butter, foreign	22	1	0.0003	<d.	<d.	0.001
Butter fat, mixed	10	0				
Eggs	280	0				
Cod, raw	10	0				
Eel, farmed, raw	130	111	0.0021	0.002	0.003	0.005
Garfish, raw	5	0				
Greenland halibut, raw	7	0				
Herring, raw	26	8	0.0005	<d.	0.001	0.001
Herring, pickled	11	8	0.0005	0.0004	0.0006	0.001
Herring, smoked	12	4	0.0005	<d.	0.001	0.001
Lumpsucker, raw	11	7	0.0008	0.001	0.001	0.002
Mackerel, raw	20	0				
Mackerel, smoked	18	0				
Mackerel, tinned in tomato	6	2	0.0003	<d.	0.0003	0.0004
Plaice, raw	10	0				
Rainbow trout, farmed, raw	273	7	0.0004	<d.	<d.	0.0004
Salmon, raw	20	2	0.0005	<d.	0.0001	0.004
Swordfish, raw	6	0				
Trout, marine farmed, raw	77	25	0.0006	<d.	0.001	0.002
Fish oil	21	2	0.0017	<d.	<d.	0.009
Cod liver oil	9	0				
Herring:	219	58	0.0007	<d.	0.001	0.004
The Baltic Sea	37	24	0.0010	0.001	0.002	0.003
The Sound	34	4	0.0005	<d.	0.001	0.001
The Belts	38	18	0.0008	<d.	0.002	0.004
The Kattegat	34	6	0.0005	<d.	0.0004	0.001
The Skagerrak	40	3	0.0005	<d.	<d.	0.001
The North Sea	36	3	0.0005	<d.	<d.	0.002
Cod liver:	111	56	0.003	0.000	0.007	0.022
The Baltic Sea	19	16	0.006	0.006	0.010	0.013
The Sound	22	15	0.004	0.002	0.007	0.022
The Belts	21	20	0.003	0.002	0.005	0.005
The Kattegat	14	3	0.001	<d.	0.002	0.003
The Skagerrak	19	1	0.001	<d.	<d.	0.001
The North Sea	16	1	0.001	<d.	<d.	0.001

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.6 Tables of contents for chlordan-sum

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	4	0.0011	<d.	<d.	0.0045
Turkey fat	85	0				
Duck fat	5	0				
Other poultry fat	4	0				
Beef fat	385	1	0.0011	<d.	<d.	0.0020
Pork fat	884	1	0.0010	<d.	<d.	0.0020
Lamb sheep fat	37	1	0.0012	<d.	<d.	0.0024
Animal fats, other	20	0				
Milk, Danish	248	0				
Milk, foreign	41	0				
Cheese, Danish	40	1	0.0017	<d.	<d.	0.0190
Cheese, foreign	166	4	0.0012	<d.	<d.	0.0060
Butter, Danish	126	0				
Butter, foreign	22	0				
Butter fat, mixed	10	0				
Eggs	280	0				
Cod, raw	10	0				
Eel, farmed, raw	130	126	0.0093	0.008	0.015	0.0256
Garfish, raw	5	0				
Greenland halibut, raw	7	7	0.0136	0.011	0.022	0.0320
Herring, raw	26	18	0.0021	0.001	0.002	0.0048
Herring, pickled	11	11	0.0067	0.007	0.008	0.0099
Herring, smoked	12	12	0.0027	0.002	0.003	0.0047
Lumpsucker, raw	11	11	0.0094	0.009	0.015	0.0170
Mackerel, raw	20	17	0.0016	0.002	0.003	0.0032
Mackerel, smoked	18	17	0.0027	0.002	0.004	0.0042
Mackerel, tinned in tomato	6	6	0.0012	0.001	0.001	0.0006
Plaice, raw	10	0				
Rainbow trout, farmed, raw	273	147	0.0020	0.001	0.002	0.0070
Salmon, raw	20	12	0.0048	0.004	0.010	0.0130
Swordfish, raw	6	1	0.0010	<d.	0.001	0.0010
Trout, marine farmed, raw	77	60	0.0034	0.002	0.005	0.0080
Fish oil	21	5	0.0248	<d.	0.105	0.2000
Cod liver oil	9	9	0.0931	0.059	0.194	0.2010
Herring:	219	130	0.0031	0.001	0.003	0.0218
The Baltic Sea	37	24	0.0032	0.002	0.004	0.0055
The Sound	34	18	0.0030	0.001	0.004	0.0053
The Belts	38	20	0.0027	0.001	0.003	0.0040
The Kattegat	34	17	0.0029	<d.	0.003	0.0054
The Skagerrak	40	21	0.0031	<d.	0.002	0.0180
The North Sea	36	22	0.0028	0.001	0.002	0.0040
Cod liver:	111	108	0.0272	0.020	0.060	0.1210
The Baltic Sea	19	18	0.0426	0.039	0.066	0.1210
The Sound	22	21	0.0287	0.019	0.068	0.0810
The Belts	21	21	0.0219	0.016	0.052	0.0730
The Kattegat	14	14	0.0212	0.023	0.031	0.0360
The Skagerrak	19	19	0.0210	0.017	0.033	0.0900
The North Sea	16	16	0.0282	0.023	0.060	0.0630

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.7 Tables of contents for DDT-sum

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	97	0.002	<d.	0.004	0.017
Turkey fat	85	85	0.002	0.001	0.004	0.015
Duck fat	5	1	0.002	<d.	0.004	0.007
Other poultry fat	4	2	0.015	0.008	0.036	0.045
Beef fat	385	285	0.003	0.002	0.007	0.025
Pork fat	884	705	0.003	0.002	0.005	0.099
Lamb sheep fat	37	36	0.006	0.004	0.008	0.075
Animal fats, other	20	12	0.003	0.001	0.007	0.028
Milk, Danish	248	203	0.003	0.002	0.005	0.171
Milk, foreign	41	34	0.003	0.003	0.005	0.009
Cheese, Danish	40	33	0.003	0.003	0.007	0.015
Cheese, foreign	166	131	0.004	0.002	0.008	0.068
Butter, Danish	126	26	0.002	<d.	0.003	0.058
Butter, foreign	22	14	0.011	0.001	0.027	0.068
Butter fat, mixed	10	2	0.001	<d.	0.002	0.003
Eggs	280	29	0.001	<d.	0.001	0.010
Cod, raw	10	3	0.001	<d.	0.001	0.002
Eel, farmed, raw	130	130	0.061	0.061	0.086	0.175
Garfish, raw	5	5	0.005	0.002	0.011	0.015
Greenland halibut, raw	7	7	0.015	0.011	0.029	0.029
Herring, raw	26	26	0.008	0.007	0.014	0.017
Herring, pickled	11	11	0.011	0.012	0.016	0.017
Herring, smoked	12	12	0.007	0.006	0.011	0.012
Lumpsucker, raw	11	11	0.015	0.014	0.021	0.022
Mackerel, raw	20	20	0.004	0.004	0.005	0.006
Mackerel, smoked	18	18	0.005	0.004	0.010	0.012
Mackerel, tinned in tomato	6	6	0.002	0.001	0.002	0.003
Plaice, raw	10	0				
Rainbow trout, farmed, raw	273	272	0.005	0.004	0.008	0.028
Salmon, raw	20	18	0.015	0.012	0.029	0.071
Swordfish, raw	6	6	0.009	0.009	0.018	0.022
Trout, marine farmed, raw	77	77	0.013	0.011	0.020	0.049
Fish oil	21	10	0.04	<d.	0.24	0.30
Cod liver oil	9	9	0.20	0.28	0.32	0.36
Herring:	219	219	0.014	0.011	0.027	0.098
The Baltic Sea	37	37	0.027	0.023	0.047	0.098
The Sound	34	34	0.015	0.013	0.027	0.039
The Belts	38	38	0.015	0.014	0.025	0.031
The Kattegat	34	34	0.009	0.010	0.015	0.019
The Skagerrak	40	40	0.009	0.008	0.015	0.057
The North Sea	36	36	0.007	0.005	0.012	0.022
Cod liver:	111	111	0.260	0.141	0.629	1.599
The Baltic Sea	19	19	0.599	0.629	0.831	1.579
The Sound	22	22	0.282	0.223	0.474	0.885
The Belts	21	21	0.274	0.141	0.607	1.599
The Kattegat	14	14	0.144	0.126	0.227	0.353
The Skagerrak	19	19	0.108	0.096	0.192	0.314
The North Sea	16	16	0.092	0.085	0.122	0.176

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.8 Tables of contents for Endosulfan A

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	0				
Turkey fat	85	0				
Duck fat	5	0				
Other poultry fat	4	0				
Beef fat	385	0				
Pork fat	884	0				
Lamb sheep fat	37	0				
Animal fats, other	20	0				
Milk, Danish	248	1	0.0008	<d.	<d.	0.003
Milk, foreign	41	0				
Cheese, Danish	40	0				
Cheese, foreign	166	0				
Butter, Danish	126	0				
Butter, foreign	22	0				
Butter fat, mixed	10	0				
Eggs	280	0				
Cod, raw	10	0				
Eel, farmed, raw	130	7	0.0007	<d.	<d.	0.002
Garfish, raw	5	0				
Greenland halibut, raw	7	0				
Herring, raw	26	0				
Herring, pickled	11	0				
Herring, smoked	12	0				
Lumpsucker, raw	11	3	0.0006	<d.	0.001	0.001
Mackerel, raw	20	1	0.0006	<d.	<d.	0.001
Mackerel, smoked	18	0				
Mackerel, tinned in tomato	6	0				
Plaice, raw	10	0				
Rainbow trout, farmed, raw	273	38	0.0006	<d.	0.000	0.002
Salmon, raw	20	0				
Swordfish, raw	6	0				
Trout, marine farmed, raw	77	15	0.0009	<d.	0.001	0.002
Fish oil	21	1	0.002	<d.	<d.	0.011
Cod liver oil	9	0				
Herring:	219	4	0.0009	<d.	<d.	0.001
The Baltic Sea	37	0				
The Sound	34	0				
The Belts	38	1	0.0009	<d.	<d.	0.001
The Kattegat	34	3	0.001	<d.	<d.	0.001
The Skagerrak	40	0				
The North Sea	36	0				
Cod liver:	111	4	0.002	<d.	<d.	0.037
The Baltic Sea	19	0				
The Sound	22	1	0.003	<d.	<d.	0.037
The Belts	21	0				
The Kattegat	14	2	0.003	<d.	0.007	0.017
The Skagerrak	19	1	0.002	<d.	<d.	0.016
The North Sea	16	0				

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.9 Tables of contents for endrin

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	0				
Turkey fat	85	0				
Duck fat	5	0				
Other poultry fat	4	0				
Beef fat	385	0				
Pork fat	884	3	0.0003	<d.	<d.	0.004
Lamb sheep fat	37	0				
Animal fats, other	20	0				
Milk, Danish	248	0				
Milk, foreign	41	0				
Cheese, Danish	40	0				
Cheese, foreign	166	0				
Butter, Danish	126	0				
Butter, foreign	22	0				
Butter fat, mixed	10	0				
Eggs	280	0				
Cod, raw	10	0				
Eel, farmed, raw	130	0				
Garfish, raw	5	0				
Greenland halibut, raw	7	4	0.007	0.0010	0.0010	0.0010
Herring, raw	26	4	0.0008	<d.	0.0008	0.0013
Herring, pickled	11	0				
Herring, smoked	12	0				
Lumpsucker, raw	11	1	0.0006	<d.	<d.	0.002
Mackerel, raw	20	1	0.0008	<d.	<d.	0.001
Mackerel, smoked	18	0				
Mackerel, tinned in tomato	6	0				
Plaice, raw	10	0				
Rainbow trout, farmed, raw	273	1	0.0007	<d.	<d.	0.0003
Salmon, raw	20	4	0.0007	<d.	0.0010	0.002
Swordfish, raw	6	0				
Trout, marine farmed, raw	77	2	0.0008	<d.	<d.	0.0008
Fish oil	21	0				
Cod liver oil	9	0				
Herring:	219	0				
The Baltic Sea	37	0				
The Sound	34	0				
The Belts	38	0				
The Kattegat	34	0				
The Skagerrak	40	0				
The North Sea	36	0				
Cod liver:	111	1	0.0009	<d.	<d.	0.010
The Baltic Sea	19	0				
The Sound	22	0				
The Belts	21	0				
The Kattegat	14	0				
The Skagerrak	19	0				
The North Sea	16	1	0.001	0.002	0.028	0.034

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.10 Tables of contents for dieldrin

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	13	0.001	<d.	<d.	0.007
Turkey fat	85	4	0.001	<d.	<d.	0.004
Duck fat	5	0				
Other poultry fat	4	1	0.006	<d.	0.013	0.019
Beef fat	385	30	0.002	<d.	<d.	0.008
Pork fat	884	12	0.001	<d.	<d.	0.015
Lamb sheep fat	37	0				
Animal fats, other	20	0				
Milk, Danish	248	70	0.001	<d.	0.003	0.010
Milk, foreign	41	25	0.002	0.002	0.003	0.006
Cheese, Danish	40	6	0.002	<d.	0.003	0.007
Cheese, foreign	166	45	0.002	<d.	0.003	0.012
Butter, Danish	126	2	0.002	<d.	<d.	0.007
Butter, foreign	22	5	0.002	<d.	0.002	0.016
Butter fat, mixed	10	0				
Eggs	280	4	0.000	<d.	<d.	0.003
Cod, raw	10	0				
Eel, farmed, raw	130	130	0.013	0.012	0.018	0.024
Garfish, raw	5	0				
Greenland halibut, raw	7	7	0.007	0.006	0.010	0.016
Herring, raw	26	26	0.003	0.003	0.005	0.006
Herring, pickled	11	11	0.005	0.005	0.006	0.006
Herring, smoked	12	12	0.003	0.003	0.004	0.004
Lumpsucker, raw	11	11	0.005	0.004	0.006	0.009
Mackerel, raw	20	19	0.003	0.003	0.004	0.006
Mackerel, smoked	18	18	0.004	0.004	0.006	0.007
Mackerel, tinned in tomato	6	6	0.001	0.001	0.002	0.002
Plaice, raw	10	0				
Rainbow trout, farmed, raw	273	216	0.001	0.001	0.002	0.007
Salmon, raw	20	15	0.003	0.003	0.006	0.007
Swordfish, raw	6	0				
Trout, marine farmed, raw	77	73	0.003	0.002	0.005	0.011
Fish oil	21	3	0.009	<d.	0.050	0.063
Cod liver oil	9	7	0.025	0.013	0.060	0.065
Herring:	219	206	0.003	0.002	0.005	0.014
The Baltic Sea	37	35	0.004	0.003	0.006	0.011
The Sound	34	30	0.003	0.003	0.005	0.005
The Belts	38	33	0.002	0.001	0.004	0.005
The Kattegat	34	32	0.003	0.002	0.005	0.007
The Skagerrak	40	40	0.003	0.002	0.005	0.014
The North Sea	36	36	0.003	0.003	0.005	0.012
Cod liver:	111	105	0.018	0.016	0.031	0.049
The Baltic Sea	19	18	0.024	0.024	0.043	0.049
The Sound	22	19	0.018	0.020	0.031	0.038
The Belts	21	19	0.012	0.012	0.020	0.036
The Kattegat	14	14	0.015	0.014	0.020	0.030
The Skagerrak	19	19	0.021	0.020	0.032	0.044
The North Sea	16	16	0.017	0.015	0.028	0.034

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.11 Tables of contents for heptachlor

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	2	0.0005	<d.	<d.	0.003
Turkey fat	85	2	0.0005	<d.	<d.	0.002
Duck fat	5	0				
Other poultry fat	4	0				
Beef fat	385	0				
Pork fat	884	0				
Lamb sheep fat	37	0				
Animal fats, other	20	0				
Milk, Danish	248	0				
Milk, foreign	41	0				
Cheese, Danish	40	1	0.0007	<d.	<d.	0.004
Cheese, foreign	166	25	0.0007	<d.	0.001	0.009
Butter, Danish	126	2	0.0006	<d.	<d.	0.003
Butter, foreign	22	2	0.0007	<d.	<d.	0.004
Butter fat, mixed	10	0				
Eggs	280	0				
Cod, raw	10	0				
Eel, farmed, raw	130	64	0.0015	<d.	0.003	0.004
Garfish, raw	5	0				
Greenland halibut, raw	7	5	0.0008	0.0010	0.001	0.001
Herring, raw	26	14	0.0006	0.0003	0.001	0.001
Herring, pickled	11	11	0.0005	0.0005	0.001	0.001
Herring, smoked	12	8	0.0007	0.0004	0.001	0.001
Lumpsucker, raw	11	6	0.0012	0.001	0.002	0.002
Mackerel, raw	20	15	0.0010	0.0006	0.002	0.002
Mackerel, smoked	18	8	0.0010	<d.	0.001	0.001
Mackerel, tinned in tomato	6	1	0.0011	<d.	0.000	0.000
Plaice, raw	10	0				
Rainbow trout, farmed, raw	273	45	0.0007	<d.	0.000	0.001
Salmon, raw	20	4	0.0006	<d.	0.001	0.001
Swordfish, raw	6	0				
Trout, marine farmed, raw	77	15	0.0008	<d.	<d.	0.001
Fish oil	21	1	0.0008	<d.	<d.	0.004
Cod liver oil	9	3	0.002	<d.	0.006	0.008
Herring:	219	56	0.0009	<d.	0.001	0.002
The Baltic Sea	37	10	0.0009	<d.	0.001	0.002
The Sound	34	11	0.0008	<d.	0.001	0.001
The Belts	38	11	0.0008	<d.	0.001	0.001
The Kattegat	34	7	0.0009	<d.	0.001	0.001
The Skagerrak	40	6	0.0009	<d.	0.000	0.001
The North Sea	36	11	0.0009	<d.	0.001	0.001
Cod liver:	111	68	0.003	0.002	0.005	0.010
The Baltic Sea	19	10	0.003	0.002	0.005	0.007
The Sound	22	12	0.003	0.002	0.005	0.010
The Belts	21	13	0.002	0.001	0.004	0.007
The Kattegat	14	10	0.002	0.002	0.002	0.003
The Skagerrak	19	12	0.003	0.002	0.006	0.010
The North Sea	16	11	0.003	0.002	0.006	0.007

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.12 Tables of contents for HCB

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	48	0.001	<d.	0.002	0.005
Turkey fat	85	28	0.001	<d.	0.002	0.011
Duck fat	5	0				
Other poultry fat	4	3	0.006	0.005	0.011	0.013
Beef fat	385	320	0.003	0.002	0.004	0.088
Pork fat	884	185	0.0006	<d.	0.0010	0.016
Lamb sheep fat	37	34	0.005	0.004	0.011	0.021
Animal fats, other	20	17	0.006	0.003	0.015	0.033
Milk, Danish	248	234	0.002	0.002	0.003	0.028
Milk, foreign	41	35	0.002	0.002	0.002	0.005
Cheese, Danish	40	33	0.002	0.002	0.004	0.006
Cheese, foreign	166	145	0.002	0.002	0.004	0.014
Butter, Danish	126	35	0.0009	<d.	0.002	0.007
Butter, foreign	22	11	0.0010	0.001	0.002	0.004
Butter fat, mixed	10	1	0.0004	<d.	0.0001	0.002
Eggs	280	6	0.0002	<d.	<d.	0.005
Cod, raw	10	0				
Eel, farmed, raw	130	130	0.005	0.005	0.007	0.010
Garfish, raw	5	0				
Greenland halibut, raw	7	7	0.004	0.003	0.005	0.007
Herring, raw	26	19	0.001	0.001	0.001	0.002
Herring, pickled	11	11	0.0012	0.0011	0.002	0.002
Herring, smoked	12	12	0.0009	0.0010	0.001	0.001
Lumpsucker, raw	11	11	0.004	0.004	0.006	0.007
Mackerel, raw	20	17	0.0009	0.0009	0.002	0.002
Mackerel, smoked	18	16	0.0010	0.0010	0.002	0.002
Mackerel, tinned in tomato	6	5	0.0004	0.0004	0.001	0.001
Plaice, raw	10	0				
Rainbow trout, farmed, raw	273	183	0.0008	0.0010	0.001	0.005
Salmon, raw	20	13	0.002	0.001	0.003	0.004
Swordfish, raw	6	1	0.0004	<d.	0.001	0.001
Trout, marine farmed, raw	77	59	0.001	0.001	0.003	0.004
Fish oil	21	3	0.004	<d.	0.018	0.033
Cod liver oil	9	5	0.011	0.003	0.023	0.034
Herring:	219	146	0.0010	0.0010	0.002	0.003
The Baltic Sea	37	28	0.0013	0.0010	0.003	0.003
The Sound	34	28	0.0011	0.0010	0.002	0.002
The Belts	38	22	0.0008	0.0005	0.001	0.002
The Kattegat	34	23	0.0009	0.0009	0.001	0.002
The Skagerrak	40	26	0.0009	0.0007	0.002	0.002
The North Sea	36	19	0.0008	0.0004	0.001	0.002
Cod liver:	111	106	0.007	0.006	0.016	0.028
The Baltic Sea	19	18	0.013	0.012	0.023	0.028
The Sound	22	21	0.009	0.010	0.017	0.019
The Belts	21	20	0.005	0.004	0.011	0.012
The Kattegat	14	13	0.005	0.005	0.007	0.012
The Skagerrak	19	18	0.006	0.006	0.008	0.019
The North Sea	16	16	0.006	0.006	0.009	0.016

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.13 Tables of contents for lindane

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	42	0.001	<d.	0.004	0.009
Turkey fat	85	22	0.001	<d.	0.002	0.008
Duck fat	5	0				
Other poultry fat	4	2	0.006	0.005	0.011	0.011
Beef fat	385	24	0.001	<d.	<d.	0.006
Pork fat	884	6	0.0004	<d.	<d.	0.019
Lamb sheep fat	37	0				
Animal fats, other	20	0				
Milk, Danish	248	4	0.0004	<d.	<d.	0.009
Milk, foreign	41	0				
Cheese, Danish	40	7	0.0010	<d.	0.002	0.004
Cheese, foreign	166	69	0.002	<d.	0.005	0.046
Butter, Danish	126	5	0.0006	<d.	<d.	0.002
Butter, foreign	22	0				
Butter fat, mixed	10	1	0.0010	<d.	0.0004	0.004
Eggs	280	0				
Cod, raw	10	0				
Eel, farmed, raw	130	107	0.003	0.003	0.004	0.012
Garfish, raw	5	0				
Greenland halibut, raw	7	0				
Herring, raw	26	14	0.001	0.000	0.003	0.004
Herring, pickled	11	0				
Herring, smoked	12	4	0.0005	<d.	0.0005	0.001
Lumpsucker, raw	11	10	0.003	0.001	0.006	0.006
Mackerel, raw	20	1	0.00070	<d.	<d.	0.001
Mackerel, smoked	18	0				
Mackerel, tinned in tomato	6	1	0.0005	<d.	0.0002	0.000
Plaice, raw	10	0				
Rainbow trout, farmed, raw	273	52	0.0009	<d.	0.0002	0.001
Salmon, raw	20	9	0.0013	<d.	0.002	0.004
Swordfish, raw	6	0				
Trout, marine farmed, raw	77	45	0.0010	0.0003	0.0010	0.002
Fish oil	21	2	0.002	<d.	<d.	0.005
Cod liver oil	9	1	0.002	<d.	0.002	0.004
Herring:	219	132	0.0011	0.0005	0.002	0.004
The Baltic Sea	37	31	0.0013	0.0010	0.002	0.003
The Sound	34	21	0.0010	0.0006	0.002	0.002
The Belts	38	27	0.0011	0.0008	0.002	0.003
The Kattegat	34	23	0.0013	0.0010	0.002	0.004
The Skagerrak	40	17	0.0010	<d.	0.002	0.002
The North Sea	36	14	0.0010	<d.	0.002	0.003
Cod liver:	111	80	0.005	0.003	0.012	0.016
The Baltic Sea	19	18	0.006	0.006	0.012	0.016
The Sound	22	16	0.006	0.004	0.015	0.016
The Belts	21	17	0.004	0.002	0.009	0.014
The Kattegat	14	8	0.003	0.002	0.010	0.016
The Skagerrak	19	11	0.003	0.002	0.006	0.016
The North Sea	16	10	0.005	0.003	0.012	0.013

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.14 Tables of contents for PCB-28

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	3	0.0007	<d.	<d.	0.003
Turkey fat	85	2	0.0006	<d.	<d.	0.005
Duck fat	5	0				
Other poultry fat	4	0				
Beef fat	385	9	0.0013	<d.	<d.	0.012
Pork fat	884	6	0.0007	<d.	<d.	0.011
Lamb sheep fat	37	1	0.0009	<d.	<d.	0.008
Animal fats, other	20	0				
Milk, Danish	248	30	0.0013	<d.	<d.	0.016
Milk, foreign	41	1	0.0010	<d.	<d.	0.003
Cheese, Danish	40	2	0.002	<d.	<d.	0.005
Cheese, foreign	166	4	0.0009	<d.	<d.	0.005
Butter, Danish	126	0				
Butter, foreign	22	0				
Butter fat, mixed	10	0				
Eggs	280	0				
Cod, raw	10	0				
Eel, farmed, raw	130	68	0.0016	0.0010	0.003	0.004
Garfish, raw	5	0				
Greenland halibut, raw	7	5	0.0009	0.0010	0.001	0.001
Herring, raw	26	1	0.0008	<d.	<d.	0.0003
Herring, pickled	11	0				
Herring, smoked	12	0				
Lumpsucker, raw	11	3	0.0007	<d.	0.001	0.001
Mackerel, raw	20	0				
Mackerel, smoked	18	0				
Mackerel, tinned in tomato	6	0				
Plaice, raw	10	0				
Rainbow trout, farmed, raw	273	75	0.0008	<d.	0.001	0.003
Salmon, raw	20	5	0.0007	<d.	0.001	0.001
Swordfish, raw	6	0				
Trout, marine farmed, raw	77	19	0.0011	0.0000	0.001	0.002
Fish oil	21	1	0.002	<d.	<d.	0.005
Cod liver oil	9	2	0.004	<d.	0.009	0.016
Herring:	219	49	0.001	<d.	0.001	0.002
The Baltic Sea	37	15	0.001	<d.	0.001	0.001
The Sound	34	5	0.001	<d.	0.001	0.001
The Belts	38	13	0.001	<d.	0.001	0.002
The Kattegat	34	5	0.001	<d.	0.001	0.001
The Skagerrak	40	3	0.001	<d.	<d.	0.002
The North Sea	36	8	0.001	<d.	0.001	0.001
Cod liver:	111	81	0.004	0.004	0.010	0.017
The Baltic Sea	19	13	0.006	0.006	0.010	0.012
The Sound	22	18	0.005	0.004	0.013	0.017
The Belts	21	18	0.005	0.003	0.010	0.014
The Kattegat	14	11	0.003	0.003	0.005	0.007
The Skagerrak	19	12	0.004	0.003	0.007	0.011
The North Sea	16	9	0.003	0.003	0.006	0.009

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.15 Tables of contents for PCB-52

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	3	0.0008	<d.	<d.	0.003
Turkey fat	85	0				
Duck fat	5	1	0.0018	<d.	0.002	0.004
Other poultry fat	4	0				
Beef fat	385	4	0.0010	<d.	<d.	0.006
Pork fat	884	12	0.0008	<d.	<d.	0.006
Lamb sheep fat	37	0				
Animal fats, other	20	0				
Milk, Danish	248	8	0.0009	<d.	<d.	0.006
Milk, foreign	41	0				
Cheese, Danish	40	1	0.0013	<d.	<d.	0.007
Cheese, foreign	166	2	0.0006	<d.	<d.	0.007
Butter, Danish	126	0				
Butter, foreign	22	0				
Butter fat, mixed	10	0				
Eggs	280	4	0.0030	<d.	<d.	0.001
Cod, raw	10	0				
Eel, farmed, raw	130	45	0.0022	<d.	0.003	0.006
Garfish, raw	5	0				
Greenland halibut, raw	7	7	0.001	0.001	0.002	0.002
Herring, raw	26	4	0.002	<d.	0.001	0.002
Herring, pickled	11	10	0.002	0.002	0.003	0.003
Herring, smoked	12	5	0.001	<d.	0.001	0.001
Lumpsucker, raw	11	7	0.002	0.001	0.003	0.005
Mackerel, raw	20	5	0.001	<d.	0.002	0.003
Mackerel, smoked	18	0				
Mackerel, tinned in tomato	6	0				
Plaice, raw	10	0				
Rainbow trout, farmed, raw	273	130	0.001	<d.	0.001	0.003
Salmon, raw	20	6	0.002	<d.	0.001	0.002
Swordfish, raw	6	0				
Trout, marine farmed, raw	77	53	0.002	0.001	0.002	0.003
Fish oil	21	1	0.002	<d.	<d.	0.019
Cod liver oil	9	3	0.006	<d.	0.017	0.017
Herring:	219	92	0.002	<d.	0.001	0.006
The Baltic Sea	37	19	0.002	0.001	0.002	0.006
The Sound	34	14	0.002	<d.	0.001	0.002
The Belts	38	21	0.002	0.001	0.001	0.002
The Kattegat	34	11	0.002	<d.	0.001	0.002
The Skagerrak	40	13	0.002	<d.	0.002	0.004
The North Sea	36	14	0.002	<d.	0.001	0.003
Cod liver:	111	78	0.009	0.006	0.0180	0.0390
The Baltic Sea	19	14	0.013	0.014	0.0216	0.0330
The Sound	22	17	0.011	0.010	0.0180	0.0390
The Belts	21	17	0.009	0.007	0.0210	0.0360
The Kattegat	14	9	0.006	0.005	0.0100	0.0180
The Skagerrak	19	11	0.007	0.003	0.0148	0.0280
The North Sea	16	10	0.006	0.004	0.0105	0.0120

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.16 Tables of contents for PCB-101

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	0				
Turkey fat	85	0				
Duck fat	5	0				
Other poultry fat	4	0				
Beef fat	385	0				
Pork fat	884	6	0.0006	<d.	<d.	0.004
Lamb sheep fat	37	0				
Animal fats, other	20	0				
Milk, Danish	248	6	0.0007	<d.	<d.	0.008
Milk, foreign	41	0				
Cheese, Danish	40	0				
Cheese, foreign	166	2	0.0005	<d.	<d.	0.002
Butter, Danish	126	0				
Butter, foreign	22	0				
Butter fat, mixed	10	0				
Eggs	280	0				
Cod, raw	10	0				
Eel, farmed, raw	130	119	0.003	0.004	0.006	0.011
Garfish, raw	5	5	0.003	0.002	0.004	0.004
Greenland halibut, raw	7	7	0.002	0.001	0.003	0.003
Herring, raw	26	22	0.002	0.002	0.004	0.005
Herring, pickled	11	11	0.002	0.002	0.002	0.002
Herring, smoked	12	11	0.002	0.002	0.002	0.002
Lumpsucker, raw	11	11	0.002	0.003	0.004	0.004
Mackerel, raw	20	10	0.002	0.001	0.003	0.005
Mackerel, smoked	18	5	0.001	<d.	0.002	0.002
Mackerel, tinned in tomato	6	2	0.001	<d.	0.001	0.001
Plaice, raw	10	7	0.002	0.002	0.003	0.005
Rainbow trout, farmed, raw	273	217	0.001	0.001	0.002	0.007
Salmon, raw	20	15	0.002	0.002	0.004	0.005
Swordfish, raw	6	0				
Trout, marine farmed, raw	77	72	0.002	0.002	0.004	0.009
Fish oil	21	3	0.005	<d.	0.026	0.031
Cod liver oil	9	7	0.017	0.016	0.034	0.034
Herring:	219	197	0.002	0.002	0.004	0.010
The Baltic Sea	37	36	0.003	0.003	0.005	0.007
The Sound	34	32	0.002	0.002	0.003	0.005
The Belts	38	38	0.003	0.003	0.004	0.007
The Kattegat	34	32	0.002	0.002	0.003	0.005
The Skagerrak	40	32	0.002	0.002	0.004	0.010
The North Sea	36	26	0.001	0.001	0.003	0.005
Cod liver:	111	109	0.040	0.031	0.076	0.131
The Baltic Sea	19	19	0.065	0.060	0.090	0.126
The Sound	22	22	0.053	0.054	0.093	0.104
The Belts	21	21	0.045	0.031	0.113	0.131
The Kattegat	14	14	0.024	0.022	0.040	0.043
The Skagerrak	19	17	0.021	0.021	0.035	0.058
The North Sea	16	16	0.019	0.014	0.027	0.055

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.17 Tables of contents for PCB-105

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	2	0.0008	<d.	<d.	0.001
Turkey fat	85	0				
Duck fat	5	0				
Other poultry fat	4	0				
Beef fat	385	0				
Pork fat	884	1	0.0010	<d.	<d.	0.008
Lamb sheep fat	37	0				
Animal fats, other	20	0				
Milk, Danish	248	0				
Milk, foreign	41	0				
Cheese, Danish	40	0				
Cheese, foreign	166	4	0.0009	<d.	<d.	0.001
Butter, Danish	126	0				
Butter, foreign	22	0				
Butter fat, mixed	10	0				
Eggs	280	0				
Cod, raw	10	0				
Eel, farmed, raw	130	76	0.002	0.0020	0.004	0.014
Garfish, raw	5	0				
Greenland halibut, raw	7	4	0.0008	0.0010	0.001	0.002
Herring, raw	26	7	0.0007	<d.	0.001	0.003
Herring, pickled	11	7	0.006	0.0006	0.001	0.001
Herring, smoked	12	6	0.0006	0.0002	0.001	0.001
Lumpsucker, raw	11	1	0.0006	<d.	<d.	0.002
Mackerel, raw	20	4	0.0006	<d.	0.001	0.002
Mackerel, smoked	18	0				
Mackerel, tinned in tomato	6	0				
Plaice, raw	10	0				
Rainbow trout, farmed, raw	273	58	0.0006	<d.	0.000	0.002
Salmon, raw	20	7	0.0009	<d.	0.002	0.003
Swordfish, raw	6	0				
Trout, marine farmed, raw	77	20	0.0009	<d.	0.001	0.002
Fish oil	21	8	0.004	<d.	0.012	0.013
Cod liver oil	9	6	0.009	0.013	0.014	0.016
Herring:	219	56	0.0011	<d.	0.001	0.003
The Baltic Sea	37	16	0.0014	<d.	0.002	0.003
The Sound	34	9	0.0009	<d.	0.001	0.001
The Belts	38	13	0.0011	<d.	0.001	0.003
The Kattegat	34	10	0.0012	<d.	0.002	0.003
The Skagerrak	40	4	0.0011	<d.	<d.	0.002
The North Sea	36	5	0.0012	<d.	0.000	0.002
Cod liver:	111	108	0.017	0.014	0.030	0.060
The Baltic Sea	19	19	0.020	0.019	0.027	0.042
The Sound	22	22	0.025	0.024	0.043	0.060
The Belts	21	20	0.016	0.012	0.031	0.046
The Kattegat	14	14	0.015	0.014	0.221	0.036
The Skagerrak	19	18	0.014	0.010	0.025	0.054
The North Sea	16	15	0.009	0.009	0.015	0.017

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.18 Tables of contents for PCB-118

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	4	0.0009	<d.	<d.	0.003
Turkey fat	85	1	0.0008	<d.	<d.	0.001
Duck fat	5	0				
Other poultry fat	4	0				
Beef fat	385	8	0.0008	<d.	<d.	0.005
Pork fat	884	0				
Lamb sheep fat	37	0				
Animal fats, other	20	3	0.0009	<d.	0.001	0.001
Milk, Danish	248	0				
Milk, foreign	41	0				
Cheese, Danish	40	2	0.0004	<d.	<d.	0.002
Cheese, foreign	166	8	0.0006	<d.	<d.	0.005
Butter, Danish	126	0				
Butter, foreign	22	0				
Butter fat, mixed	10	0				
Eggs	280	0				
Cod, raw	10	0				
Eel, farmed, raw	130	130	0.008	0.008	0.011	0.020
Garfish, raw	5	4	0.0013	0.001	0.002	0.002
Greenland halibut, raw	7	6	0.0019	0.001	0.003	0.004
Herring, raw	26	18	0.0016	0.001	0.003	0.005
Herring, pickled	11	11	0.002	0.002	0.003	0.004
Herring, smoked	12	12	0.0012	0.001	0.002	0.002
Lumpsucker, raw	11	11	0.0019	0.002	0.003	0.003
Mackerel, raw	20	9	0.0011	<d.	0.002	0.004
Mackerel, smoked	18	7	0.0010	<d.	0.002	0.004
Mackerel, tinned in tomato	6	3	0.0005	0.000	0.001	0.001
Plaice, raw	10	1	0.0005	<d.	0.000	0.002
Rainbow trout, farmed, raw	273	186	0.0009	0.001	0.001	0.005
Salmon, raw	20	15	0.002	0.002	0.003	0.005
Swordfish, raw	6	0				
Trout, marine farmed, raw	77	76	0.002	0.002	0.004	0.008
Fish oil	21	3	0.011	<d.	0.029	0.105
Cod liver oil	9	9	0.021	0.027	0.037	0.039
Herring:	219	196	0.002	0.002	0.003	0.009
The Baltic Sea	37	37	0.003	0.002	0.004	0.006
The Sound	34	31	0.002	0.002	0.003	0.004
The Belts	38	38	0.003	0.003	0.004	0.007
The Kattegat	34	33	0.002	0.002	0.003	0.004
The Skagerrak	40	29	0.002	0.001	0.004	0.009
The North Sea	36	27	0.002	0.001	0.003	0.034
Cod liver:	111	111	0.048	0.043	0.085	0.152
The Baltic Sea	19	19	0.061	0.058	0.086	0.103
The Sound	22	22	0.065	0.057	0.112	0.123
The Belts	21	21	0.051	0.047	0.086	0.152
The Kattegat	14	14	0.046	0.044	0.060	0.087
The Skagerrak	19	19	0.035	0.034	0.061	0.850
The North Sea	16	16	0.026	0.027	0.035	0.038

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.19 Tables of contents for PCB-138

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	5	0.0008	<d.	<d.	0.005
Turkey fat	85	4	0.0008	<d.	<d.	0.004
Duck fat	5	0				
Other poultry fat	4	0				
Beef fat	385	56	0.0013	<d.	0.003	0.015
Pork fat	884	41	0.0008	<d.	<d.	0.009
Lamb sheep fat	37	0				
Animal fats, other	20	6	0.0016	<d.	0.005	0.007
Milk, Danish	248	2	0.0007	<d.	<d.	0.005
Milk, foreign	41	0				
Cheese, Danish	40	6	0.0012	<d.	0.002	0.005
Cheese, foreign	166	50	0.0011	<d.	0.003	0.005
Butter, Danish	126	0				
Butter, foreign	22	1	0.0005	<d.	<d.	0.002
Butter fat, mixed	10	0				
Eggs	280	1	0.0006	<d.	<d.	0.027
Cod, raw	10	0				
Eel, farmed, raw	130	130	0.017	0.016	0.025	0.041
Garfish, raw	5	3	0.002	0.002	0.004	0.005
Greenland halibut, raw	7	7	0.003	0.002	0.004	0.005
Herring, raw	26	24	0.004	0.003	0.007	0.011
Herring, pickled	11	11	0.002	0.002	0.003	0.004
Herring, smoked	12	11	0.003	0.002	0.005	0.005
Lumpsucker, raw	11	10	0.003	0.002	0.004	0.005
Mackerel, raw	20	10	0.002	0.001	0.003	0.008
Mackerel, smoked	18	13	0.002	0.002	0.003	0.005
Mackerel, tinned in tomato	6	5	0.001	0.001	0.001	0.002
Plaice, raw	10	0				
Rainbow trout, farmed, raw	273	221	0.002	0.001	0.003	0.010
Salmon, raw	20	16	0.003	0.003	0.007	0.009
Swordfish, raw	6	1	0.001	<d.	0.001	0.002
Trout, marine farmed, raw	77	75	0.004	0.004	0.007	0.012
Fish oil	21	7	0.016	<d.	0.081	0.092
Cod liver oil	9	9	0.058	0.049	0.102	0.108
Herring:	219	207	0.005	0.004	0.009	0.024
The Baltic Sea	37	37	0.007	0.006	0.012	0.024
The Sound	34	34	0.005	0.005	0.009	0.011
The Belts	38	38	0.007	0.006	0.013	0.017
The Kattegat	34	34	0.004	0.004	0.006	0.010
The Skagerrak	40	34	0.004	0.003	0.007	0.016
The North Sea	36	30	0.003	0.003	0.006	0.008
Cod liver:	111	111	0.132	0.117	0.229	0.441
The Baltic Sea	19	19	0.167	0.160	0.227	0.414
The Sound	22	22	0.180	0.168	0.311	0.419
The Belts	21	21	0.159	0.115	0.394	0.441
The Kattegat	14	14	0.111	0.109	0.166	0.176
The Skagerrak	19	19	0.080	0.065	0.133	0.163
The North Sea	16	16	0.071	0.067	0.106	0.110

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.20 Tables of contents for PCB-153

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	10	0.0009	<d.	<d.	0.006
Turkey fat	85	7	0.0010	<d.	<d.	0.005
Duck fat	5	0				
Other poultry fat	4	1	0.007	<d.	0.018	0.026
Beef fat	385	53	0.0014	<d.	0.003	0.024
Pork fat	884	61	0.0010	<d.	<d.	0.012
Lamb sheep fat	37	9	0.002	<d.	0.004	0.012
Animal fats, other	20	10	0.003	0.001	0.007	0.008
Milk, Danish	248	2	0.0005	<d.	<d.	0.003
Milk, foreign	41	0				
Cheese, Danish	40	5	0.0008	<d.	0.002	0.004
Cheese, foreign	166	64	0.0014	<d.	0.003	0.008
Butter, Danish	126	2	0.0006	<d.	<d.	0.002
Butter, foreign	22	2	0.0005	<d.	<d.	0.002
Butter fat, mixed	10	1	0.0007	<d.	0.000	0.001
Eggs	280	3	0.0004	<d.	<d.	0.004
Cod, raw	10	0				
Eel, farmed, raw	130	130	0.016	0.014	0.025	0.049
Garfish, raw	5	5	0.003	0.002	0.005	0.006
Greenland halibut, raw	7	7	0.004	0.004	0.008	0.009
Herring, raw	26	25	0.004	0.004	0.006	0.011
Herring, pickled	11	11	0.002	0.002	0.003	0.003
Herring, smoked	12	12	0.003	0.004	0.006	0.006
Lumpsucker, raw	11	11	0.003	0.003	0.003	0.004
Mackerel, raw	20	14	0.003	0.002	0.005	0.009
Mackerel, smoked	18	15	0.002	0.002	0.004	0.006
Mackerel, tinned in tomato	6	5	0.001	0.001	0.002	0.002
Plaice, raw	10	6	0.001	0.001	0.002	0.002
Rainbow trout, farmed, raw	273	237	0.002	0.002	0.004	0.011
Salmon, raw	20	16	0.003	0.003	0.006	0.011
Swordfish, raw	6	4	0.001	0.001	0.002	0.003
Trout, marine farmed, raw	77	77	0.005	0.005	0.009	0.017
Fish oil	21	13	0.014	0.004	0.069	0.088
Cod liver oil	9	9	0.051	0.047	0.096	0.098
Herring:	219	206	0.006	0.005	0.010	0.105
The Baltic Sea	37	37	0.007	0.007	0.011	0.017
The Sound	34	33	0.005	0.005	0.008	0.010
The Belts	38	38	0.008	0.007	0.013	0.027
The Kattegat	34	34	0.005	0.005	0.007	0.016
The Skagerrak	40	37	0.004	0.003	0.005	0.018
The North Sea	36	30	0.003	0.002	0.008	0.013
Cod liver:	111	111	0.16	0.15	0.28	0.54
The Baltic Sea	19	19	0.20	0.21	0.27	0.28
The Sound	22	22	0.22	0.24	0.29	0.37
The Belts	21	21	0.20	0.16	0.40	0.54
The Kattegat	14	14	0.15	0.15	0.20	0.30
The Skagerrak	19	19	0.09	0.08	0.16	0.19
The North Sea	16	16	0.09	0.08	0.12	0.15

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.21 Tables of contents for PCB-156

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	0				
Turkey fat	85	0				
Duck fat	5	0				
Other poultry fat	4	0				
Beef fat	385	0				
Pork fat	884	0				
Lamb sheep fat	37	0				
Animal fats, other	20	0				
Milk, Danish	248	0				
Milk, foreign	41	0				
Cheese, Danish	40	0				
Cheese, foreign	166	0				
Butter, Danish	126	0				
Butter, foreign	22	0				
Butter fat, mixed	10	0				
Eggs	280	0				
Cod, raw	10	0				
Eel, farmed, raw	130	18	0.0007	<d.	0.0010	0.003
Garfish, raw	5	0				
Greenland halibut, raw	7	0				
Herring, raw	26	7	0.0004	<d.	<d.	0.002
Herring, pickled	11	2	0.004	<d.	0.002	0.002
Herring, smoked	12	8	0.0002	0.0002	0.0003	0.0004
Lumpsucker, raw	11	0				
Mackerel, raw	20	0				
Mackerel, smoked	18	0				
Mackerel, tinned in tomato	6	0				
Plaice, raw	10	0				
Rainbow trout, farmed, raw	273	22	0.0004	<d.	<d.	0.001
Salmon, raw	20	3	0.0006	<d.	0.0010	0.001
Swordfish, raw	6	0				
Trout, marine farmed, raw	77	5	0.0005	<d.	<d.	0.001
Fish oil	21	2	0.002	<d.	<d.	0.004
Cod liver oil	9	3	0.003	<d.	0.005	0.006
Herring:	219	33	0.0010	<d.	0.0003	0.048
The Baltic Sea	37	10	0.0009	<d.	0.0006	0.004
The Sound	34	6	0.0007	<d.	0.0003	0.001
The Belts	38	9	0.0007	<d.	0.0003	0.001
The Kattegat	34	3	0.0007	<d.	<d.	0.000
The Skagerrak	40	4	0.0007	<d.	<d.	0.000
The North Sea	36	2	0.0007	<d.	<d.	0.000
Cod liver:	111	104	0.010	0.008	0.0200	0.086
The Baltic Sea	19	19	0.012	0.011	0.0184	0.026
The Sound	22	21	0.016	0.015	0.0256	0.037
The Belts	21	20	0.010	0.007	0.0200	0.023
The Kattegat	14	14	0.008	0.007	0.0140	0.015
The Skagerrak	19	15	0.009	0.004	0.0104	0.086
The North Sea	16	15	0.004	0.004	0.0065	0.009

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.22 Tables of contents for PCB-170

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	0				
Turkey fat	85	1	0.0004	<d.	<d.	0.002
Duck fat	5	0				
Other poultry fat	4	1	0.003	<d.	0.008	0.011
Beef fat	385	0				
Pork fat	884	2	0.0005	<d.	<d.	0.001
Lamb sheep fat	37	0				
Animal fats, other	20	2	0.0005	<d.	0.0001	0.003
Milk, Danish	248	0				
Milk, foreign	41	0				
Cheese, Danish	40	0				
Cheese, foreign	166	1	0.0004	<d.	<d.	0.001
Butter, Danish	126	0				
Butter, foreign	22	0				
Butter fat, mixed	10	0				
Eggs	280	0				
Cod, raw	10	0				
Eel, farmed, raw	130	43	0.0010	<d.	0.002	0.005
Garfish, raw	5	0				
Greenland halibut, raw	7	1	0.0004	<d.	0.0004	0.001
Herring, raw	26	8	0.0004	<d.	0.0004	0.001
Herring, pickled	11	5	0.0003	<d.	0.0003	0.000
Herring, smoked	12	6	0.0003	0.0002	0.0004	0.001
Lumpsucker, raw	11	0				
Mackerel, raw	20	2	0.0003	<d.	0.0001	0.001
Mackerel, smoked	18	2	0.0003	<d.	0.0002	0.001
Mackerel, tinned in tomato	6	0				
Plaice, raw	10	0				
Rainbow trout, farmed, raw	273	51	0.0004	<d.	0.0001	0.001
Salmon, raw	20	2	0.0005	<d.	0.0001	0.001
Swordfish, raw	6	0				
Trout, marine farmed, raw	77	14	0.0005	<d.	0.0005	0.001
Fish oil	21	2	0.006	<d.	<d.	0.087
Cod liver oil	9	3	0.003	<d.	0.005	0.006
Herring:	219	57	0.0008	<d.	0.0008	0.003
The Baltic Sea	37	16	0.0009	<d.	0.0010	0.003
The Sound	34	8	0.0008	<d.	0.0005	0.001
The Belts	38	17	0.0009	<d.	0.0010	0.002
The Kattegat	34	7	0.0008	<d.	0.0004	0.001
The Skagerrak	40	5	0.0007	<d.	<d.	0.001
The North Sea	36	8	0.0008	<d.	0.0007	0.001
Cod liver:	111	104	0.013	0.011	0.024	0.041
The Baltic Sea	19	19	0.017	0.017	0.024	0.033
The Sound	22	22	0.017	0.018	0.024	0.027
The Belts	21	20	0.017	0.014	0.034	0.041
The Kattegat	14	14	0.013	0.013	0.021	0.027
The Skagerrak	19	15	0.007	0.006	0.014	0.016
The North Sea	16	14	0.006	0.006	0.010	0.010

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.23 Tables of contents for PCB-180

Foodstuff	Number of samples	Samples >d.*	Mean**	Median	90% fractile	Maximum
			mg/kg***	mg/kg***	mg/kg***	mg/kg***
Chicken fat	197	9	0.0005	<d.	<d.	0.002
Turkey fat	85	2	0.0005	<d.	<d.	0.003
Duck fat	5	0				
Other poultry fat	4	1	0.010	<d.	0.026	0.037
Beef fat	385	19	0.0008	<d.	<d.	0.013
Pork fat	884	20	0.0005	<d.	<d.	0.004
Lamb sheep fat	37	6	0.0007	<d.	0.0008	0.004
Animal fats, other	20	10	0.0013	0.0004	0.003	0.006
Milk, Danish	248	1	0.0003	<d.	<d.	0.001
Milk, foreign	41	0				
Cheese, Danish	40	1	0.0009	<d.	<d.	0.001
Cheese, foreign	166	21	0.0006	<d.	0.001	0.003
Butter, Danish	126	3	0.0009	<d.	<d.	0.001
Butter, foreign	22	1	0.0005	<d.	<d.	0.001
Butter fat, mixed	10	0				
Eggs	280	1	0.0003	<d.	<d.	0.002
Cod, raw	10	0				
Eel, farmed, raw	130	129	0.004	0.004	0.006	0.014
Garfish, raw	5	0				
Greenland halibut, raw	7	2	0.0008	<d.	0.0018	0.003
Herring, raw	26	14	0.0007	<d.	0.0009	0.002
Herring, pickled	11	8	0.0004	0.0004	0.0006	0.001
Herring, smoked	12	11	0.0007	0.0007	0.0011	0.001
Lumpsucker, raw	11	3	0.0006	<d.	0.0010	0.001
Mackerel, raw	20	12	0.0007	0.0006	0.0012	0.002
Mackerel, smoked	18	12	0.0008	0.0006	0.0020	0.003
Mackerel, tinned in tomato	6	6	0.0003	0.0003	0.0005	0.001
Plaice, raw	10	0				
Rainbow trout, farmed, raw	273	135	0.0007	<d.	0.0010	0.003
Salmon, raw	20	7	0.0008	<d.	0.0011	0.003
Swordfish, raw	6	1	0.0006	<d.	0.0010	0.002
Trout, marine farmed, raw	77	50	0.0010	0.001	0.0020	0.004
Fish oil	21	6	0.005	<d.	0.018	0.023
Cod liver oil	9	14	0.011	0.013	0.026	0.028
Herring:	219	103	0.0013	<d.	0.002	0.007
The Baltic Sea	37	27	0.0019	0.002	0.003	0.007
The Sound	34	15	0.0012	<d.	0.002	0.004
The Belts	38	26	0.0019	0.001	0.003	0.007
The Kattegat	34	12	0.0010	<d.	0.001	0.002
The Skagerrak	40	10	0.0010	<d.	0.001	0.005
The North Sea	36	13	0.0009	<d.	0.001	0.002
Cod liver:	111	111	0.036	0.029	0.063	0.135
The Baltic Sea	19	19	0.051	0.053	0.074	0.104
The Sound	22	22	0.047	0.044	0.069	0.079
The Belts	21	21	0.046	0.035	0.105	0.135
The Kattegat	14	14	0.028	0.029	0.045	0.053
The Skagerrak	19	19	0.019	0.017	0.033	0.044
The North Sea	16	16	0.016	0.015	0.026	0.028

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.24 Tables of contents for PCB-sum

Foodstuff	Number of samples	Samples >d.*	Mean**	Maximum
			mg/kg***	mg/kg***
Chicken fat	197	20	0.0054	0.014
Turkey fat	85	9	0.0041	0.013
Duck fat	5	1	0.0018	0.004
Other poultry fat	4	1	0.0205	0.074
Beef fat	385	96	0.0066	0.054
Pork fat	884	92	0.0059	0.025
Lamb sheep fat	37	13	0.0034	0.016
Animal fats, other	20	12	0.0068	0.024
Milk, Danish	248	36	0.0044	0.030
Milk, foreign	41	1	0.0010	0.003
Cheese, Danish	40	12	0.0068	0.012
Cheese, foreign	166	80	0.0070	0.019
Butter, Danish	126	3	0.0015	0.003
Butter, foreign	22	2	0.0015	0.004
Butter fat, mixed	10	1	0.0007	0.001
Eggs	280	7	0.0036	0.008
Cod, raw	10	0		
Eel, farmed, raw	130	130	0.0563	0.160
Garfish, raw	5	5	0.0089	0.015
Greenland halibut, raw	7	7	0.0149	0.025
Herring, raw	26	26	0.0158	0.037
Herring, pickled	11	11	0.0206	0.014
Herring, smoked	12	12	0.0119	0.018
Lumpsucker, raw	11	11	0.0133	0.019
Mackerel, raw	20	18	0.0100	0.028
Mackerel, smoked	18	16	0.0074	0.015
Mackerel, tinned in tomato	6	6	0.0037	0.006
Plaice, raw	10	7	0.0035	0.007
Rainbow trout, farmed, raw	273	238	0.0100	0.040
Salmon, raw	20	18	0.0158	0.039
Swordfish, raw	6	4	0.0026	0.007
Trout, marine farmed, raw	77	77	0.0196	0.049
Fish oil	21	13	0.0646	0.40
Cod liver oil	9	9	0.1824	0.33
Herring:	219	215	0.0228	0.069
The Baltic Sea	37	37	0.0291	0.062
The Sound	34	34	0.0216	0.035
The Belts	38	38	0.0287	0.072
The Kattegat	34	34	0.0199	0.029
The Skagerrak	40	37	0.0187	0.062
The North Sea	36	35	0.0168	0.040
Cod liver:	111	111	0.4712	1.53
The Baltic Sea	19	19	0.6128	1.15
The Sound	22	22	0.6325	1.11
The Belts	21	21	0.5533	1.53
The Kattegat	14	14	0.4082	0.69
The Skagerrak	19	19	0.2887	0.57
The North Sea	16	16	0.2461	0.37

*d.=limit of detection. The limit of detection varies during the monitoring period; see Appendix 11.3.31
** mean is calculated including 1/3*d. for values below the detection limit.
*** mg/kg fish and egg and mg/kg fat for the rest of the foods.

11.3.25 Occurrence of dioxins in selected foods in 2000-2003

TEQ dioxin (PCDD & PCDF)

Foodstuff	Number of samples	Minimum	Mean	Median	90% fractile	Maximum
			pg WHO-TEQ upper bound/g*			
Chicken fat	38	0.12	0.30	0.23	0.59	0.97
Turkey fat	3	0.10	0.47	0.49	0.76	0.83
Beef fat	25	0.15	0.54	0.43	0.87	1.80
Pork fat	25	0.10	0.24	0.20	0.36	0.90
Sheep fat	20	0.21	0.79	0.75	1.24	1.34
Hens eggs	23	0.18	0.58	0.39	1.11	1.79
Cows milk	19	0.37	0.61	0.58	0.79	1.55
Dairy products	10	0.36	0.48	0.46	0.56	0.75
Farmed trout	20	0.07	0.29	0.17	0.71	0.75
Herring - North Sea and Belts	13	0.36	1.08	0.99	1.88	2.89
Herring - S. Baltic Sea, w. of Bornholm	10	0.95	1.79	1.65	2.60	2.76
Herring - S. Baltic Sea, e. of Bornholm	4	2.79	5.71	6.13	7.64	7.78
Eel - The Sound	5	1.11	2.29	2.12	3.64	3.94
Eel - The Kattegat w. of Hirsholmen	5	0.65	0.89	0.93	1.11	1.19
Blue mussels	3	0.12	0.18	0.15	0.24	0.26
Fish oil supplement	5	0.58	2.89	2.23	5.33	7.14

*pr. g fat except for fish, which is pr. g fresh weight

11.3.26 Occurrence of dioxin-like PCB in selected foods in 2000-2003

TEQ PCB (mono and ortho PCB)

Foodstuff	Number of samples	Minimum	Mean	Median	90% frac-tile	Maximum
			pg WHO-TEQ upper bound/g*			
Chicken fat	38	0.05	0.32	0.12	0.86	1.65
Turkey fat	3	0.22	0.63	0.43	1.08	1.24
Beef fat	25	0.21	0.58	0.45	1.17	1.86
Pork fat	25	0.05	0.09	0.06	0.19	0.21
Sheep fat	20	0.10	0.56	0.60	0.90	0.96
Hens eggs	23	0.15	0.78	0.52	1.76	2.82
Cows milk	19	0.28	0.45	0.45	0.57	0.73
Dairy products	10	0.24	0.39	0.38	0.47	0.47
Farmed trout	20	0.17	0.78	0.45	1.92	2.02
Herring - North Sea and Belts	13	0.31	1.21	1.04	1.86	4.70
Herring - S. Baltic Sea, w. of Bornholm	10	1.29	2.18	2.07	3.04	3.49
Herring - S. Baltic Sea, e. of Bornholm	4	2.65	5.17	5.30	7.09	7.44
Eel - The Sound	5	2.44	6.02	6.79	7.88	8.29
Eel - The Kattegat w. of Hirsholmen	5	1.83	2.43	2.31	2.91	2.94
Blue mussels	3	0.12	0.17	0.17	0.21	0.22
Fish oil supplement	5	3.45	11.56	7.82	21.85	30.90

*pr. g fat except for fish, which is pr. g fresh weight

11.3.27 Occurrence of total TEQ (dioxins and dioxin-like PCB) in selected food items in 2000-2003

TEQ total (dioxin & PCB)

Foodstuff	Number of samples	Minimum	Mean	Median	90% frac-tile	Maximum
			pg WHO-TEQ upper bound/g*			
Chicken fat	38	0.21	0.63	0.35	1.43	2.62
Turkey fat	3	0.31	1.10	0.92	1.84	2.07
Beef fat	25	0.38	1.10	0.78	1.97	3.65
Pork fat	25	0.15	0.30	0.26	0.37	1.01
Sheep fat	20	0.30	1.35	1.37	2.01	2.29
Hens eggs	23	0.34	1.36	0.90	3.05	4.60
Cows milk	19	0.73	1.06	0.95	1.39	2.09
Dairy products	10	0.60	0.86	0.88	1.03	1.11
Farmed trout	20	0.26	1.07	0.59	2.64	2.74
Herring - North Sea and Belts	13	0.68	2.30	2.04	3.74	7.58
Herring - S. Baltic Sea, w. of Bornholm	10	2.30	3.97	3.60	5.36	5.94
Herring - S. Baltic Sea, e. of Bornholm	4	5.44	10.88	11.43	14.73	15.22
Eel - The Sound	5	3.56	8.31	9.38	11.33	12.24
Eel - The Kattegat w. of Hirsholmen	5	2.48	3.33	3.28	4.00	4.05
Blue mussels	3	0.24	0.35	0.32	0.45	0.48
Fish oil supplement	5	4.02	14.45	9.72	27.18	38.04

*pr. g fat except for fish, which is pr. g fresh weight

11.3.28 Occurrence of PCB 153 in selected foods in 2000-2003

PCB 153*

Foodstuff	Number of samples	Minimum	Mean	Median	90% fractile	Maximum
				ng/g**		
Chicken fat	38	0.14	0.90	0.45	2.30	4.30
Turkey fat	3	0.69	1.73	1.07	2.95	3.42
Beef fat	25	0.55	1.52	1.03	3.05	4.49
Pork fat	25	0.18	0.70	0.64	1.07	1.49
Sheep fat	20	0.73	2.09	1.97	3.12	4.49
Hens eggs	23	0.47	2.23	1.64	4.68	7.42
Cows milk	19	0.61	0.88	0.78	1.16	1.35
Dairy products	10	0.51	0.88	0.85	1.18	1.59
Farmed trout	20	0.47	2.25	1.53	5.23	5.92
Herring - North Sea and Belts	13	1.04	3.60	3.81	6.37	6.77
Herring - S. Baltic Sea, w. of Bornholm	10	7.02	10.26	10.33	12.65	13.95
Herring - S. Baltic Sea, e. of Bornholm	4	9.10	20.04	18.95	30.35	33.15
Eel - The Sound	5	22.70	34.43	34.35	42.46	44.10
Eel - The Kattegat w. of Hirsholmen	5	8.46	10.95	11.90	12.75	12.85
Blue mussels	3	0.43	0.54	0.56	0.61	0.62
Fish oil supplement	5	18.10	66.96	76.40	95.68	100.00

*Determined by the analytical method used for dioxins. This method has lower detection limit than the method use for indicator PCB (Appendix 11.3.31).
**pr. g fat except for fish, which is pr. g fresh weight

11.3.29 Occurrence of dioxins, PCB and chlorinated pesticides in human milk collected in 1999 and 2002

Human milk Compound*	Number of samples	Minimum	Mean	Median	90% fractile	Maximum
		pg WHO-TEQ upper bound/g fat				
TEQ WHO dioxin	38	5.8	11.8	11.6	15.4	24.0
TEQ WHO PCB	38	3.6	9.1	8.0	13.3	25.3
TEQ WHO Total (dioxin & PCB)	38	10.8	20.8	19.4	28.6	45.6
		ng/g fat				
PCB 28	38	0.7	4.2	3.1	8.0	14.9
PCB 52	38	0.1	0.6	0.6	1.0	2.2
PCB 101	38	0.2	0.9	0.7	1.3	4.8
PCB 105	38	0.5	2.4	2.0	3.4	10.9
PCB 114	38	0.2	0.5	0.4	0.7	2.9
PCB 118	38	4.3	10.6	9.1	14.5	43.6
PCB 123	38	0.1	0.2	0.1	0.3	0.6
PCB 138	38	7.2	32.5	29.9	55.5	67.7
PCB 153	38	9.3	55.8	47.7	91.5	137.0
PCB 156	38	0.9	5.0	4.1	9.3	15.1
PCB 157	38	0.2	0.8	0.7	1.2	2.9
PCB 167	38	0.4	1.4	1.2	2.4	3.2
PCB 170	38	1.7	12.0	10.6	21.1	35.2
PCB 180	38	3.2	24.8	21.1	44.8	83.0
PCB 189	38	0.1	0.2	0.2	0.3	0.4
HCB	38	2	21	20	27	76
β-HCH	38	7	117	20	29	2787
Oxychlordane	38	2	5	5	9	17
trans-Nonachlor	38	2	5	4	8	14
Dieldrine	38	3	10	10	14	15
Heptachlorepoxid	38	2	4	3	6	10
sum-DDT	38	44	217	111	176	3240

*In addition to the listed chlorinated pesticides the following compounds were analysed and detected in few samples or below detection limit (app. 1-2 ng/g fat): α-HCH, Lindane, *cis*-chlordane, *trans*-chlordane, heptachlor, aldrine, endrine, isodrine, endosulfan A

11.3.30 Commodity types used in the calculation of daily intakes of organic environmental contaminants

Foodstuff	FoodId	g fat/100 g *foodstuff*	Commodity type used in calculation.
Full milk	156	3.5	milk
A38	157	3.5	milk
Cocoa milk	159	1.8	milk
Creme fraîche 18%	160	18.6	milk
Creme fraîche 38%	161	38.4	milk
Cream 13%	165	13.5	milk
Cream 38%, double cream	166	38.1	milk
Buttermilk	168	0.5	milk
Low-fat milk	170	1.6	milk
Skimmed milk	251	0.3	milk
Quark, 5+	261	0.4	milk
Junket, plain	332	3.5	milk
Yoghurt, plain	333	3.6	milk
Low-fat yoghurt with juice	334	1.6	milk
Yoghurt with fruit, unspec.	335	3.2	milk
Skimmed-milk powder	366	1.7	milk
Ice cream	848	10.0	milk
Quark with fruit	1300	8.2	milk
Cottage cheese, 20+	260	5.4	cheese*
Quark, 5+	261	0.4	cheese*
Cheese, unripened, smoked, 40+	264	10.3	cheese*
Processed cheese, 45+	265	24.5	cheese*
Feta 40+	363	19.2	cheese*
Cheese, cream 70+	364	36.9	cheese*
Cheese, hard, parmesan, grate	365	30.0	cheese*
Cheese, Danish Blue, 60+	755	36.1	cheese*
Brie cheese, 60+	759	33.6	cheese*
Cheese, processed, 30+	760	16.5	cheese*
Cheese, firm, Danbo 45+	769	25.0	cheese*
Cheese, firm, Danbo 30+	775	15.7	cheese*
Cheese, firm, Danbo 20+	776	12.1	cheese*
Cheese, firm, Havarti 60+	779	38.1	cheese*
Feta cheese, 50+	787	25.2	cheese*
Bacon, roasting piece	13	42.0	pork fat
Black pudding	16	20.8	pork fat
Lamb, unspec., raw	138	30.5	lamb fat
Lamb, fore end, raw	139	13.3	lamb fat
Liver, calf, raw	144	3.9	beef fat
Liver, pig, raw	146	3.2	pork fat
Ham, boiled, tinned	248	5.4	pork fat
Ham, smoked	249	13.0	pork fat
Ham, smoked, boiled	250	14.0	pork fat

Foodstuff	FoodId	g fat/100 g *foodstuff*	Commodity type used in calculation.
Salami	274	41.7	pork/beef fat**
Pork tenderloin, trimmed, raw	286	5.3	pork fat
Pork shoulder with rind, raw	287	12.9	pork fat
Frankfurt sausage	292	23.2	pork fat
Mettwurst, raw	294	17.3	pork fat
Pork roll	295	25.2	pork fat
Saveloy	296	22.8	Pork fat
Liver paste	297	21.7	pork fat
Pork fillet, smoked	298	2.2	pork fat
Pork, brawn	299	18.2	pork fat
Pork, hand, approx. 16% fat, raw	376	16.0	pork fat
Pork, tenderloin, trimmed, raw	378	3.8	pork fat
Pork, loin with rind, raw	379	18.3	pork fat
Pork, loin, defatted (approx. 3 mm fat), raw	380	12.2	pork fat
Pork, collar, defatted, raw	381	11.8	pork fat
Pork, collar with rind, raw	382	22.5	pork fat
Beef, inside “cap on”, raw	418	8.6	beef fat
Beef, outside, round, raw	420	6.2	beef fat
Beef, rumpsteak “cap on”, raw	424	10.4	beef fat
Beef, fillet, defatted, raw	428	6.4	beef fat
Beef, striploin “cap on”, raw	429	17.3	beef fat
Beef, Brisket, anterior part, raw	436	15.1	beef fat
Beef brisket, posterior part, raw	438	27.8	beef fat
Saddle of pork, smoked, boiled	548	10.0	pork fat
Salt meat	549	3.0	beef fat
Beef brisket, boiled	551	22.1	beef fat
Lamb leg, trimmed, raw	941	5.5	lamb fat
Garfish	82	2.7	garfish, raw
Caviar, Danish (roe, lump-sucker)	118	5.7	lumpsucker, raw
Salmon, raw	135	10.0	salmon, raw
Mackerel, raw	175	24.4	mackerel
Mackerel, smoked	177	24.3	mackerel, smoked
Mackerel in tomato sauce, tinned	178	15.5	mackerel in tomato sauce
Shrimps, tinned	219	1.2	plaice, raw
Plaice, raw	236	1.5	plaice, raw
Herring, pickled	244	15.9	herring, pickled
Herring, smoked	245	12.3	herring, raw
Herring, raw	246	13.1	herring, raw
Cod fillet, raw	312	0.6	cod
Cod roe, tinned	317	3.7	cod relative to fat content
Tuna in water, tinned	318	1.0	tuna in water
Eel, raw	353	31.5	eel, raw
Eel, smoked	354	27.8	eel, raw
Rainbow trout, farmed, raw	886	6.7	rainbow trout, farmed
Saithe, fillet, frozen	908	0.2	plaice, raw
Shrimps, frozen	910	1.1	plaice, raw
Duck, meat and skin, raw	6	39.3	duck fat

Foodstuff	FoodId	g fat/100 g *foodstuff*	Commodity type used in calculation.
Duck, meat, raw	7	5.1	duck fat
Goose, meat and skin, raw	66	33.6	other poultry fat
Goose, meat, raw	67	7.1	other poultry fat
Hen, meat, raw	97	2.7	chicken fat
Turkey, meat, raw	110	2.2	turkey fat
Chicken, meat, raw	131	5.7	chicken fat
Chicken, meat and skin, raw	132	11.8	chicken fat
Eggs, yolk, raw	339	30.9	eggs
Eggs, whole, raw	340	11.2	eggs
Eggs, white, raw	341	0.0	eggs
Eggs, whole, powdered	1032	41.8	eggs
Butter, salted	269	81.4	butter
Soyabean oil	271	100.0	vegetable oil
Cod liver oil	315	100.0	Cod liver oil
Grapeseed oil	328	100.0	vegetable oil
Olive oil	482	100.0	vegetable oil
Rape seed oil	1100	100.0	vegetable oil
Mixed butter fat	1235	80.8	mixed butter fat
Margarine, 80% fat, vegetable fat, table use	1250	82.6	margarine
Margarine, 80% fat for frying/baking, vegetable fat	1253	82.5	margarine
Margarine, 80% fat for frying/baking, animal and vegetable fat	1254	82.6	margarine

* Based on 70% of contents in Danish cheese and 30% of contents in foreign cheese.

** Based on an average of average contents in beef fat and pork fat.

11.3.31 Limits of detection for organochlorine pesticides and indicator PCB

Limit of detection for cheese (mg/kg fat).

Year Substance	1998	1999	2000	2001	2002	2003
α-HCH	0.002	0.001	0.003	0.001	0.001	0.001
β-HCH	0.001	0.001	0.001	0.001	0.001	0.001
ΣChlordan	0.004	0.005	0.005	0.003	0.003	0.002
ΣDDT	0.002	0.001	0.001	0.001	0.001	0.001
Dieldrin	0.005	0.003	0.003	0.002	0.001	0.001
Endosulfan A	0.001	0.001	0.001	0.004	0.002	0.001
HCB	0.001	0.001	0.001	0.001	0.001	0.001
ΣHeptachlor	0.002	0.001	0.001	0.002	0.002	0.001
Lindane	0.002	0.001	0.001	0.001	0.001	0.001
ΣPCB	0.031	0.019	0.019	0.022	0.010	0.007
PCB28	0.007	0.002	0.002	0.003	0.001	0.001
PCB52	0.004	0.001	0.001	0.003	0.001	0.001
PCB101	0.002	0.002	0.002	0.002	0.001	0.001
PCB105	0.005	0.004	0.004	0.004	0.001	0.001
PCB118	0.001	0.003	0.003	0.002	0.001	0.001
PCB138	0.003	0.002	0.002	0.003	0.001	0.001
PCB153	0.002	0.002	0.002	0.002	0.001	0.001
PCB156	0.001	0.001	0.001	0.001	0.001	0.001
PCB170	0.003	0.001	0.001	0.001	0.001	0.001
PCB180	0.003	0.001	0.001	0.001	0.001	0.001

Limit of detection for milk, butter ect. (mg/kg fat).

Year Substance	1998	1999	2000	2001	2002	2003
α-HCH	0.002	0.001	0.001	0.001	0.001	0.001
β-HCH	0.001	0.001	0.001	0.001	0.001	0.001
ΣChlordan	0.003	0.003	0.003	0.003	0.003	0.002
ΣDDT	0.002	0.002	0.002	0.002	0.002	0.000
Dieldrin	0.005	0.003	0.002	0.002	0.001	0.002
Endosulfan A	0.001	0.004	0.004	0.004	0.001	0.001
HCB	0.001	0.001	0.001	0.001	0.001	0.001
ΣHeptachlor	0.002	0.002	0.002	0.002	0.001	0.001
Lindane	0.002	0.001	0.001	0.001	0.001	0.002
ΣPCB	0.034	0.022	0.022	0.022	0.013	0.012
PCB28	0.007	0.003	0.003	0.003	0.001	0.002
PCB52	0.004	0.003	0.003	0.003	0.002	0.002
PCB101	0.002	0.002	0.002	0.002	0.002	0.002
PCB105	0.006	0.004	0.004	0.004	0.002	0.001
PCB118	0.002	0.002	0.002	0.002	0.001	0.001
PCB138	0.003	0.003	0.003	0.003	0.001	0.001
PCB153	0.003	0.002	0.002	0.002	0.001	0.002
PCB156	0.001	0.001	0.001	0.001	0.001	0.001
PCB170	0.003	0.001	0.001	0.001	0.001	0.001
PCB180	0.003	0.001	0.001	0.001	0.001	0.0004

Limit of detection for fish oil including cod liver oil (mg/kg).

Substance \ Year	1998
α-HCH	0.002
β-HCH	0.004
ΣChlordan	0.009
ΣDDT	0.002
Dieldrin	0.004
Endosulfan A	0.004
HCB	0.002
ΣHeptachlor	0.004
Lindane	0.004
ΣPCB	0.042
PCB28	0.004
PCB52	0.010
PCB101	0.002
PCB105	0.005
PCB118	0.002
PCB138	0.004
PCB153	0.003
PCB156	0.004
PCB170	0.004
PCB180	0.004

Limit of detection for cod liver and herring (mg/kg).

Substance \ Year	1998	1999	2000	2002	2003
α-HCH	0.002	0.002	0.004	0.001	0.001
β-HCH	0.002	0.002	0.002	0.001	0.001
ΣChlordan	0.010	0.010	0.012	0.003	0.004
ΣDDT	0.002	0.002	0.002	0.001	0.001
Dieldrin	0.002	0.002	0.005	0.006	0.003
Endosulfan A	0.004	0.004	0.004	0.001	0.002
HCB	0.002	0.002	0.002	0.001	0.001
ΣHeptachlor	0.004	0.004	0.003	0.001	0.004
Lindane	0.002	0.002	0.004	0.004	0.002
ΣPCB	0.033	0.031	0.040	0.017	0.022
PCB28	0.004	0.004	0.006	0.002	0.004
PCB52	0.001	0.001	0.006	0.004	0.004
PCB101	0.002	0.002	0.003	0.002	0.003
PCB105	0.004	0.004	0.005	0.001	0.002
PCB118	0.002	0.002	0.005	0.001	0.002
PCB138	0.004	0.004	0.003	0.002	0.003
PCB153	0.004	0.002	0.005	0.002	0.003
PCB156	0.004	0.004	0.002	0.001	0.001
PCB170	0.004	0.004	0.002	0.001	0.001
PCB180	0.004	0.004	0.003	0.001	0.001

Limit of detection for egg (mg/kg).

Substance \ Year	1998	1999	2000	2001	2002	2003
α-HCH	0.001	0.001	0.001	0.001	0.0005	0.0004
β-HCH	0.002	0.001	0.001	0.001	0.0002	0.0003
ΣChlordan	0.002	0.002	0.002	0.003	0.001	0.001
ΣDDT	0.001	0.001	0.001	0.001	0.0005	0.0005
Dieldrin	0.002	0.002	0.002	0.002	0.0004	0.0005
Endosulfan A	0.001	0.001	0.001	0.001	0.0002	0.0002
HCB	0.001	0.001	0.001	0.001	0.0003	0.0002
ΣHeptachlor	0.002	0.001	0.001	0.001	0.001	0.001
Lindane	0.001	0.001	0.001	0.001	0.0004	0.0004
ΣPCB	0.014	0.015	0.015	0.016	0.005	0.004
PCB28	0.002	0.002	0.002	0.002	0.001	0.001
PCB52	0.002	0.001	0.001	0.001	0.001	0.001
PCB101	0.002	0.001	0.001	0.001	0.0002	0.0003
PCB105	0.001	0.002	0.002	0.002	0.001	0.001
PCB118	0.001	0.002	0.002	0.002	0.0004	0.0003
PCB138	0.001	0.002	0.002	0.002	0.001	0.001
PCB153	0.001	0.002	0.002	0.002	0.0004	0.0004
PCB156	0.002	0.001	0.001	0.001	0.0001	0.0001
PCB170	0.001	0.001	0.002	0.002	0.0003	0.0001
PCB180	0.001	0.002	0.001	0.001	0.0003	0.0002

Limit of detection for animal fat (pork, beef, poultry, lamb etc.)(mg/kg fat).

Substance \ Year	1998	1999	2000	2001	2002	2003
α-HCH	0.002	0.001	0.001	0.001	0.001	0.001
β-HCH	0.001	0.001	0.001	0.001	0.001	0.001
ΣChlordan	0.004	0.004	0.004	0.004	0.003	0.002
ΣDDT	0.002	0.002	0.001	0.001	0.001	0.001
Dieldrin	0.005	0.003	0.004	0.004	0.005	0.001
Endosulfan A	0.001	0.001	0.001	0.001	0.001	0.001
HCB	0.001	0.001	0.001	0.001	0.001	0.001
ΣHeptachlor	0.002	0.002	0.002	0.001	0.001	0.001
Lindane	0.002	0.002	0.001	0.001	0.001	0.001
ΣPCB	0.034	0.026	0.024	0.024	0.018	0.007
PCB28	0.007	0.003	0.001	0.001	0.002	0.001
PCB52	0.004	0.002	0.003	0.003	0.003	0.001
PCB101	0.002	0.002	0.002	0.002	0.003	0.001
PCB105	0.006	0.003	0.005	0.005	0.001	0.001
PCB118	0.002	0.003	0.004	0.004	0.002	0.001
PCB138	0.003	0.003	0.003	0.003	0.002	0.001
PCB153	0.003	0.003	0.003	0.003	0.002	0.001
PCB156	0.001	0.001	0.001	0.001	0.001	0.001
PCB170	0.003	0.003	0.001	0.001	0.001	0.001
PCB180	0.003	0.003	0.001	0.001	0.001	0.001

Limit of detection for marine fish (mg/kg).

Year Substance	1998	1999	2000	2002	2003
α-HCH	0.001	0.001	0.004	0.001	0.001
β-HCH	0.001	0.001	0.002	0.001	0.001
ΣChlordan	0.005	0.005	0.012	0.003	0.004
ΣDDT	0.001	0.001	0.002	0.001	0.001
Dieldrin	0.001	0.001	0.005	0.006	0.003
Endosulfan A	0.002	0.002	0.004	0.001	0.002
HCB	0.001	0.001	0.002	0.001	0.001
ΣHeptachlor	0.002	0.002	0.003	0.001	0.004
Lindane	0.001	0.001	0.004	0.004	0.002
ΣPCB	0.021	0.021	0.040	0.017	0.022
PCB28	0.002	0.002	0.006	0.002	0.004
PCB52	0.006	0.006	0.006	0.004	0.004
PCB101	0.001	0.001	0.003	0.002	0.003
PCB105	0.002	0.002	0.005	0.001	0.002
PCB118	0.001	0.001	0.005	0.001	0.002
PCB138	0.002	0.002	0.003	0.002	0.003
PCB153	0.001	0.001	0.005	0.002	0.003
PCB156	0.002	0.002	0.002	0.001	0.001
PCB170	0.002	0.002	0.002	0.001	0.001
PCB180	0.002	0.002	0.003	0.001	0.001

Limit of detection for farmed fish (mg/kg).

Year Substance	1998	1999	2000	2001	2002	2003
α-HCH	0.001	0.001	0.004	0.001	0.001	0.001
β-HCH	0.001	0.001	0.002	0.001	0.001	0.001
ΣChlordan	0.005	0.005	0.012	0.003	0.003	0.004
ΣDDT	0.002	0.001	0.002	0.001	0.001	0.001
Dieldrin	0.001	0.001	0.005	0.006	0.006	0.003
Endosulfan A	0.002	0.002	0.004	0.001	0.001	0.002
HCB	0.001	0.001	0.002	0.001	0.001	0.001
ΣHeptachlor	0.002	0.002	0.003	0.001	0.001	0.004
Lindane	0.001	0.001	0.004	0.004	0.004	0.002
ΣPCB	0.021	0.021	0.040	0.017	0.017	0.022
PCB28	0.002	0.002	0.006	0.002	0.002	0.004
PCB52	0.006	0.006	0.006	0.004	0.004	0.004
PCB101	0.001	0.001	0.003	0.002	0.002	0.003
PCB105	0.002	0.002	0.005	0.001	0.001	0.002
PCB118	0.001	0.001	0.005	0.001	0.001	0.002
PCB138	0.002	0.002	0.003	0.002	0.002	0.003
PCB153	0.001	0.001	0.005	0.002	0.002	0.003
PCB156	0.002	0.002	0.002	0.001	0.001	0.001
PCB170	0.002	0.002	0.002	0.001	0.001	0.001
PCB180	0.002	0.002	0.003	0.001	0.001	0.001

11.4 Appendix to Mycotoxins

11.4.1 Occurrence of ochratoxin A in wheat (kernels and flour) from the Danish marked, in relation to harvest years (1986-2003) and method of cultivation (conventional and organic)

Product	Harvest year* (estimated harvest conditions)	No. of samples	Number of samples containing ochratoxin A in the interval (µg/kg)			Mean (µg/kg)	Maximum (µg/kg)
			**d.-4.9	5.0-25	>25		
Conventionally grown wheat	1986 (average)	61	25	3	0	0.9	24
	1987 (very wet)	41	22	2	2	2.8	37
	1988 (dry)	63	13	0	0	0.2	2.6
	1989 (very dry)	68	17	1	1	1.0	51
	1990 (very dry)	63	7	0	0	0.1	4.7
	1991 (very dry)	69	22	0	0	0.1	1.7
	1992 (very dry)	65	29	2	0	0.4	9.3
	1993 (average)	111	76	0	1	0.5	32
	1994 (dry)	78	53	1	0	0.3	16
	1995 (very dry)	71	20	0	0	0.1	0.6
	1996 (very dry)	66	36	1	0	0.3	8.0
	1997 (very dry)	68	39	0	0	0.2	0.9
	1998 (wet)	67	25	1	0	0.4	16
	1999 (average)	35	12	0	0	0.1	1.1
	2000 (dry)	70	8	0	0	0.1	0.7
	Total 1986-2000	996				0.4	
	Total 1998-2000	172				0.2	
Organically grown wheat	1986 (average)	10	5	0	0	0.6	4.9
	1987 (very wet)	10	4	2	0	2.9	21
	1988 (dry)	8	2	0	0	0.2	1.2
	1989 (very dry)	17	3	0	0	0.2	2.9
	1990 (very dry)	11	6	0	1	3.8	36
	1991 (very dry)	16	5	1	0	0.5	6.8
	1992 (very dry)	2	1	0	0	0.04	0.08
	1993 (average)	21	16	1	0	1.4	19
	1994 (dry)	11	11	0	0	0.4	0.6
	1995 (very dry)	21	19	0	0	0.1	0.4
	1996 (very dry)	21	21	0	0	0.4	1.0
	1997 (very dry)	22	18	0	0	0.3	1.5
	1998 (wet)	23	10	0	0	0.4	1.7
	1999 (average)	13	6	0	0	0.3	1.6
	2000 (dry)	13	4	0	0	0.2	1.2
	Total 1986-2000	219				0.7	
	Total 1998-2000	49				0.3	

* Harvest conditions in harvest years were assessed as one of five: very wet, wet, average, dry, and very dry. For details, see Jørgensen *et al.* (1996).
** d.: limit of detection.

11.4.2 Occurrence of ochratoxin A in rye (kernels and flour) from the Danish marked, in relation to harvest years (1986-2003) and method of cultivation (conventional and organic)

Product	Harvest year* (estimated harvest conditions)	Number of samples	Number of samples containing ochratoxin A in the interval (µg/kg)			Mean (µg/kg)	Maximum (µg/kg)
			**d.-4.9	5.0-25	>25		
Conventionally grown rye	1986 (average)	102	35	4	3	2.5	77
	1987 (very wet)	40	17	6	1	5.3	121
	1988 (dry)	89	19	3	0	0.5	12
	1989 (very dry)	97	29	1	0	0.3	9.2
	1990 (very dry)	64	11	1	0	0.2	8.4
	1991 (very dry)	69	38	1	0	0.4	7.2
	1992 (very dry)	64	27	2	1	0.7	26
	1993 (average)	77	56	5	3	2.2	33
	1994 (dry)	75	61	0	0	0.3	4.2
	1995 (very dry)	83	69	0	0	0.2	3.1
	1996 (very dry)	75	53	2	0	0.4	9.8
	1997 (very dry)	80	47	2	0	0.4	8.4
	1998 (wet)	74	42	2	0	1.0	12
	1999 (average)	42	21	0	2	2.5	63
	2000 (dry)	45	25	2	0	1.5	25
	2001 (average)	42	23	0	0	0.5	3.6
	2002 (dry)	56	34	0	0	0.2	1.6
	2003 (very dry)	41	28	0	0	0.4	2.0
	Total 1986-2003	1215				1.0	
	Total 1998-2003	300				1.0	
Organically grown rye	1986 (average)	12	8	0	1	9.1	100
	1987 (very wet)	22	11	7	2	12.5	120
	1988 (dry)	11	7	1	0	2.1	20
	1989 (very dry)	14	5	2	0	1.0	6.4
	1990 (very dry)	16	10	2	1	3.8	37
	1991 (very dry)	16	14	0	0	0.5	1.4
	1992 (very dry)	1	1	0	0	4.8	4.8
	1993 (average)	10	8	0	0	0.4	1.3
	1994 (dry)	15	13	1	1	5.8	68
	1995 (very dry)	28	27	1	0	1.0	5.7
	1996 (very dry)	32	29	2	0	1.3	5.9
	1997 (very dry)	37	30	2	1	2.0	45
	1998 (wet)	32	28	0	2	3.3	55
	1999 (average)	17	8	0	0	0.3	2.0
	2000 (dry)	8	3	0	0	0.5	3.0
	2001 (average)	24	14	2	0	1.1	7.6
	2002 (dry)	26	15	2	0	1.7	19
	2003 (very dry)	21	13	2	0	1.1	8.7
	Total 1986-2003	342				2.7	
	Total 1998-2003	128				1.6	

* Harvest conditions in harvest years were assessed as one of five: very wet, wet, average, dry, and very dry. For details, see Jørgensen *et al.* (1996).

** d.: limit of detection.

11.4.3 Estimates of ochratoxin A contents (μg/kg) in foods included in intake calculations

Foodstuff (Food Id. No.)	Conventional wheat and rye 1998-2003 (μg/kg)	Organic wheat and rye 1998-2003 (μg/kg)
Wheat bran (86) a	0.7	0.7
Wheat bread, wheat products (174, 532, 533, 594, 854, 1009, 1016, 1018, 1310, 1311, 1313, 1317, 1318, 1456-1458, 1463-1470) b	0.14	0.21
Pasta, cooked (398) f	0.04	0.06
Oatmeal (530) a	0.4	0.4
Wheat flour (531, 542) c	0.2	0.3
Rye bread products (535, 536, 732, 1309, 1314, 1315) d	0.7	1.12
Rye flour and kernels (541, 862) c	1.0	1.6
Raisins (227) a	1.0	1.0
Pork products (248-250, 298, 374, 376, 378-382, 548, 925, 1247) a	0.15	0.15
Poultry products (6,7,66,67,97, 110,131,132) a	0.03	0.03
Coffee (105) a	0.035	0.035
Red wine (237) a	0.3	0.3
Beer (346, 348-350,979) a	0.05	0.05

a) See page 132 in [OV 1993-97].
b) Calculated on the basis of factor of 70% for contents of wheat in the products
c) Calculated on the basis of all samples of both kernels and flour.
d) Calculated on the basis of a factor of 70% for contents of rye in the products.
f) Calculated on the basis of samples of wheat and 70% water in cooked product.