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Fish, shellfish and fish products – analysis of nutrients

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Content

Summary

The Swedish food composition database contains nutritional values of foods in Sweden. In recent years, new fish species have appeared in the fish counters and the nutritional content, for example the fat quality, has been questioned in some of those. In 2010 the National Food Agency therefore analysed the nutrient content of 33 selected fishes, fish products and shellfishes. The selected products accounted for about 65 percent of the fishes, fish products and shellfishes purchased by consumers in 2009.

The high content of n 3-fatty acids, vitamin D, iodine and selenium in fish and shellfish is an important reason for the Swedish dietary advice "eat fish often, preferably three times a week". Almost all analysed fishes, fish products and shellfishes were rich in n 3-fatty acids. However, the content of n 3-fatty acids was low in the farmed species tilapia and striped catfish as well as in fish balls and fish fingers that are commonly consumed by children. For some fish such as mackerel in tomato sauce, pickled and fresh herring, arctic char and gilt headed bream, the entire recommended daily intake of n 3-fatty acids was covered by one serving (100-150 g).

Only half of the analysed fishes, fish products and shellfishes had a high content of vitamin D, defined as more than 1.6 micrograms per 100 grams. On the other hand, most of these fishes and fish products contained more than the entire recommended daily intake per serving. The highest content of vitamin D was found in the lean fish tilapia, which contained about three times the recommended daily intake of vitamin D per 100 grams.

All the analysed fishes, fish products and shellfishes were sources of selenium, and about two-thirds were also sources of iodine. One serving of tuna, mussels or hoki was sufficient to meet the recommended daily intake of selenium, while one serving of cod, saithe or mussels was sufficient for iodine.

The analyses also showed that fish, fish products and shellfish can be classified as sources of protein, vitamin B_{12} and phosphorus. In particular, concentrations of vitamin B_{12} were high and two-thirds of the analysed samples contained more than the entire daily recommended intake of vitamin B_{12} per 100 gram.

The analyses were part of the annual analytical project carried out by the Swedish National Food Agency to update the food composition database with nutritional values of commonly consumed foods.

Background

The National Food Agency encourages high levels of fish consumption with the dietary advice "Eat fish often, preferably three times a week". It is therefore important that the nutritional values presented for fish are updated and of good quality. The Swedish food composition database was missing values for certain fish, shellfish and fish products that have increased in popularity in Sweden, e.g., striped catfish, scallops and such a common Swedish product as pickled herring. Therefore an analytical project ”2010 Mat från hav, damm och sjö” (2010 Food from the sea, ponds and lakes) (ref. no. 381/2010) was conducted in 2010/2011. The purpose of the project was to produce new analysis data of missing products for the Ffood composition database, but also to update and complement the nutritional values for fish, shellfish and fish products that are being consumed in great amounts but have not recently been analysed by the National Food Agency.

The project group included Veronica Öhrvik and Irene Mattisson from the Nutrition Department (N) and Christina Åstrand and Sören Wretling from the Science Department, Chemistry Division 2. The analyses were conducted at Chemistry Division 2 by Rasmus Grönholm (fat-soluble vitamins), Anders Staffas (carotenoids), Maria Haglund (fatty acids, sugars), Anders Eriksson (starch, sugars, cholesterol), Anna von Malmborg, Kerstin Thorzell and Hanna Sara Strandler (water-soluble vitamins) and Christina Åstrand (metals). Other nutrients were analysed at the National Veterinary Institute (SVA) and ALcontrol AB Sweden. Head Analysts were Anders Staffas (fat-soluble vitamins and carotenoids), Sören Wretling (fatty acids, sugars, starch, cholesterol and external analyses), Hanna Sara Strandler (water-soluble vitamins) and Joakim Engman (metals). Veronica Öhrvik and Irene Mattisson (N) planned the analytical project and conducted samplings, calculations and analysis of nutritional values and other information about fish. Rikard Åsgård (N) quality controled compiled data.

Materials and methods

Sampling

The choices of which fish, shellfish and fish products to include in the project were made in accordance with the following criteria:

- *Missing foods*
  For example, tilapia, striped catfish, pickled herring and scallops were not included in the food composition database.
- *Incomplete foods*
  The entries for certain fish, shellfish and fish products in the food composition database had out-dated nutritional values and the documentation was incomplete regarding e.g., the sampling.
- *High levels of consumption in the households*
  Based on interviews regarding the household purchases (kg) August 2008 to July 2009 (1).
- *High turnover rate in the fish industry and restaurant chains*
  Based on direct inquiries to the companies.

Table 1 shows analysed fish, shellfish and fish products, including their English and Latin name, as well as origin. For a more detailed description of the sub-samples, see Appendix I. The fish, shellfish and fish products that were selected for analysis (table 1) accounted for 65 per cent of the total purchases of fish in Swedish consumers in 2009 (1). Along with the salmon that was analysed at the National Food Agency in 2004, they account for 85 per cent of fish purchases. Several of the fishes are related (see Figure 1), which may explain similarities in nutritional contents.

The sampling is fundamental, and several important aspects that influence the nutritional contents must be taken into consideration in order to acquire high quality food data. For fish for example, the time of catch – before or after spawning – may have a great impact on the fat levels. To achieve averages with reasonable levels of confidence, the number of sub-samples needed per analytical sample is calculated (2). The number of sub-samples needed were calculated for key nutrients in fish – which in the projects was defined as the fatty acid DHA (20:6 n3), vitamin D and iodine in accordance with the formula:

$$\text{Number of samples} \geq (t_{\alpha\, n-1})^2 \times \text{standard deviation}^2/(\text{precision} \times \text{mean value})^2$$

Where alpha is set at 0.05 and precision at 0.1. Standard deviation, mean value and n-1 for the calculation of DHA were borrowed from Torstensson et al 2003 (3) and Usydus et al 2009 (4). Values from Usydus et al 2009 (4) was also used for calculation of the number of specimens needed to achieve satisfactory mean values of vitamin D and selenium. Value for t was collected from student's t table.

It was decided that each aggregate sample would consist of at least 12 specimens in order to obtain a representative sample for quantifying DHA and selenium. The aggregate samples weighed at least 1.5 kg which means that substantially more than 12 specimens of fish and shellfish were used for most species (see Appendix I).

Table 1. Food number, english, swedish and scientific name as well as fishing water/origin for analysed samples

No	English food name	Swedish food name	Scientific name	Fishing water/origin
4585	Alaska pollock autumn	Alaska pollock höst	*Theragra chalcogramma*	FAO 61/67
4559	Alaska pollock spring	Alaska pollock vår	*Theragra chalcogramma*	FAO 61/67
4612	Gilt headed bream	Guldsparid	*Sparus auratus*	FAO 37
4613	Sea bass	Havsabborre	*Dicentrarchus labrax*	FAO 37
4586	Hoki	Hoki	*Macruronus novaezelandiae*	FAO 81
4611	Cape hake	Kapkummel	*Merluccius capsenseis*	FAO 47
4226	Striped catfish	Pangasiusmal	*Pangasius hypophthalmus*	Vietnam
1250	Pink salmon	Pinklax	*Oncorhynchus gorbuscha*	FAO 61
1244	Arctic char	Röding	*Salvelinus alpinus*	Landesjön and Wilhelmina (Sweden)
1202	Saithe	Sej	*Pollachius virens*	FAO 27
4604	Herring autumn	Sill höst	*Clupea harengus*	FAO 27
4603	Herring spring	Sill vår	*Clupea harengus*	FAO 27
4607	Sprat	Skarpsill	*Sprattus sprattus*	FAO 27
4606	Baltic herring autumn	Strömming höst	*Clupea harengus*	FAO 27
4605	Baltic herring spring	Strömming vår	*Clupea harengus*	FAO 27
2468	Tilapia	Tilapia	*Oreochromis niloticus*	China
1246	Cod	Torsk	*Gadus morhua*	FAO 27
1345	Fish balls w lobster sauce canned prepared	Fiskbullar m hummersås konserv tillagad	*Gadidae spp*	Sweden
1294	Fish fingers breaded fried	Fiskpinnar stekta	*Gadidae spp*	Sweden
4602	Fish fingers breaded oven-baked	Fiskpinnar ugnsstekt	*Gadidae spp*	Sweden
4609	Pickled autumn herring drained solids	Inlagd höstsill u lag	*Clupea harengus*	FAO 27
4608	Pickled herring drained solids	Inlagd sill u lag	*Clupea harengus*	FAO 27
4601	Salmon fish balls w sauce prepared	Laxbullar m sås tillagade	*Salmon salar*	FAO 27
1298	Stockfish ling treated w lye boiled	Lutfisk kokt	*Molva molva*	Sweden
1296	Mackerel fillets canned in tomato sauce	Makrillfilé konserv i tomatsås	*Scomber scombrus*	FAO 27
4610	Pickled herring mustard sauce drained solids	Senapssill u sås	*Clupea harengus*	FAO 27
1297	Baltic herring fermented	Surströmming	*Clupea harengus*	FAO 27
1275	Tuna canned in oil drained solids	Tonfisk i olja konserv	*Thunnus thynnus*	FAO 87
1278	Tuna canned in water drained solids	Tonfisk i vatten konserv	*Thunnus thynnus*	FAO 87
1385	Blue mussel boiled drained solids	Blåmusslor kokta m lag avrunna	*Mytilus edulis*	FAO 27
1394	Crayfish freshwater	Kräfta	*Astacidae spp*	China, Spain, Turkey and Sweden
4600	Scallop	Pilgrimsmusslor	*Pecten maximus*	FAO 21
1395	Shrimps	Räkor	*Pandalus borealis*	FAO 27

No – food identification number in food composition database

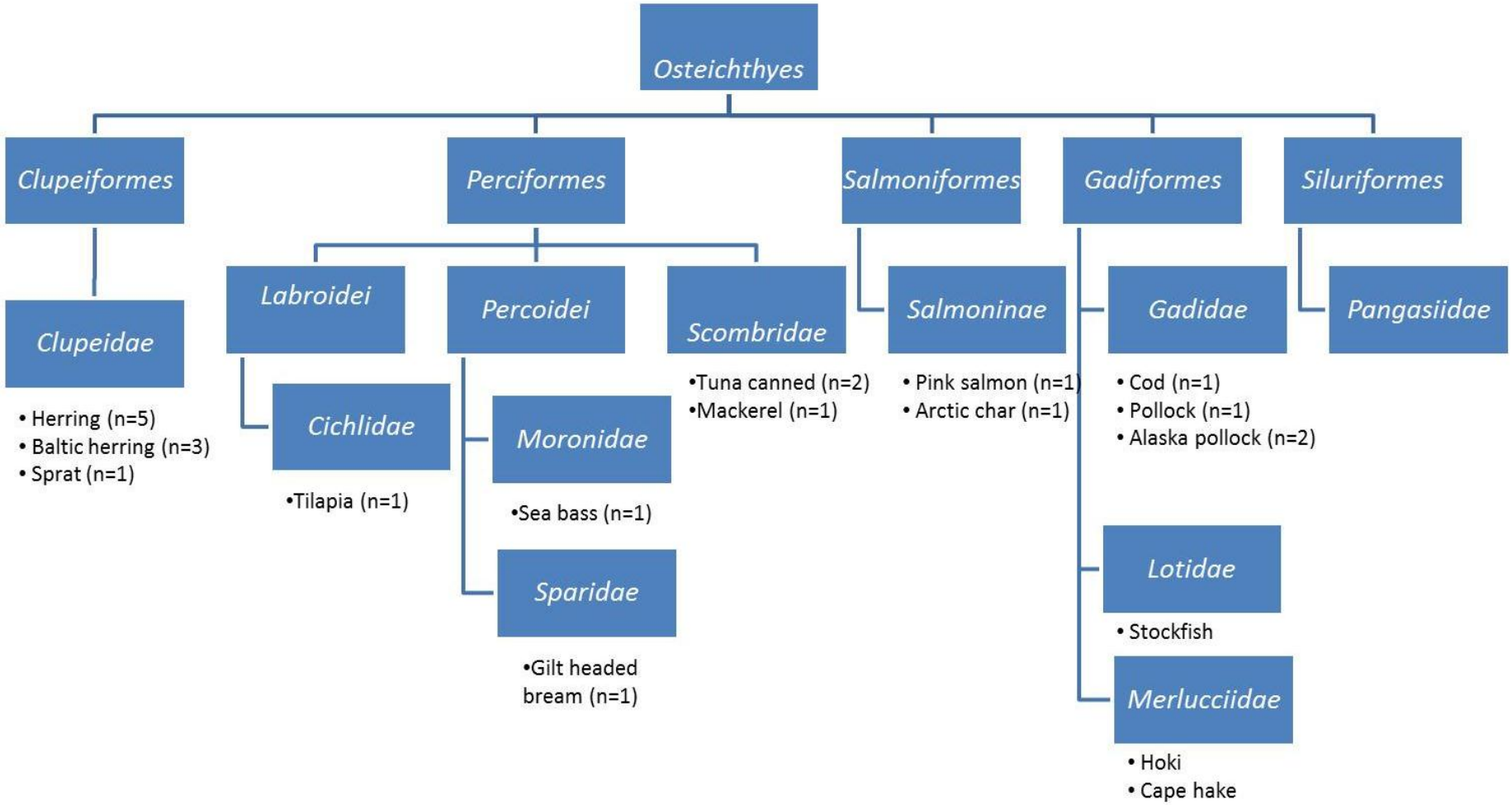

Figure 1. Genealogical tree for the fishes included in the analysis project. Simplified version adapted for the project (5).

Farmed fish

Tilapia
Tilapia is primarily farmed in China and, in 2009, accounted for 0.1 per cent of Swedish fish purchases (1). As tilapia was one of the most common fish for consumption in the USA, it was also expected to become increasingly common in Sweden. Tilapia were mainly sampled at the National Food Agency's border inspections, however, during the sampling period, the number of shipments of tilapia were too few for a complete sample, so tilapia was also purchased directly from three different retail chains.

Striped catfish
Striped catfish accounted for approximately 4 per cent of Swedish fish purchases in 2009 (1). Striped catfish is a fresh water fish farmed primarily in Vietnam. All of the farmed product is exported (6). Striped catfish were sampled from nine different shipments at the National Food Agency's border inspections in Gothenburg and Helsingborg. Two samples were also purchased directly from a retail outlet.

Sea bass
Known also as bass. Sea bass is often sold fresh and whole at the fish counter. The fish are farmed around the Mediterranean and is primarily exported by Greece. Sea bass was bought fresh from fishmongers from three different Greek deliveries.

Gilt headed bream
Also known as a gilt-head sea bream. Gilt headed bream is often sold fresh and whole at the fish counter. The fish are farmed around the Mediterranean and is primarily exported by Greece. Gilt headed bream was bought fresh from fishmongers from three different Greek deliveries.

Arctic char
Arctic char is found both wild and farmed in Sweden. It is becoming more common in fish counters and Sweden, and with its 500-800 tonnes per year, accounts for approximately 15-20 per cent of the total arctic char farming in the world (7). Arctic char farming in Sweden is expected to increase and it is estimated that the total production could reach 50,000 tonnes per year in the country's storage reservoirs (7). The water temperature needs to be below 15 degrees, therefore farms are mainly found in Jämtland and Västerbotten. The largest farm in Sweden is found in Wilhelmina and has a capacity of 2,000 tonnes, corresponding to the total Swedish consumption (7). Arctic char were sampled immediately after slaughter from three different fish farms in Sweden.

Wild-caught fish

Alaska pollock
Alaska pollock is globally the second most wild-caught fish. In 2008, 2.7 million tonnes of Alaska pollock was caught in the world (6). In Sweden, Alaska pollock accounts for more than 4 per cent of fish purchases (1). The price of Alaska pollock has doubled in the last ten years and is now priced at approximately 2 US$/kg (6).

Alaska pollock were sampled at the National Food Agency's border inspections in Gothenburg and Helsingborg. Samples of Alaska pollock caught in spring were taken from four shipments and autumn samples were taken from six shipments.

Hoki
In Sweden, hoki accounts for approximately 1 per cent of fish purchases (1). Hoki were sampled by the National Food Agency's border inspections, however, during the sampling period, the number of shipments of hoki were too few for a complete sample, so hoki was also purchased directly from three different retail chains.

Pink salmon
Pink salmon is also known as humpback salmon. Pink salmon belongs to the same family as the farmed salmon, i.e., salmonids (*Salmondidae*, Figure 1), but is of a different genus (Pacific salmon, *Oncorhynchus*, Figure 1). Pink salmon was purchased from two different retail chains on two separate occasions.

Cape hake
Cape hake from the waters outside Cape Horn (coast of South Africa) were sampled by the National Food Agency's border inspections in Gothenburg and Helsingborg. As there were too few shipments during the sampling period, cape hake was also purchased from two different retail chains.

Herring (Baltic herring)
The volumes of herring and Baltic herring fished in Sweden in the last 5 years have varied between 80,000 and 90,000 tonnes, making herring the most important economic fish in Sweden (8). Herring caught north of Kalmar is called Baltic herring (9). Baltic herring are smaller and leaner due to the lower salt content in the Baltic Sea.

The fat content in herring varies greatly during the year as the herring do not eat when migrating to and from spawning. The fat content following migration can therefore be up to 3.5 times lower than during the summer (10). In order to get a more reliable sample of herring and Baltic herring, sampling was conducted both in spring and autumn. Herring were sampled during spring (March-April 2010) and autumn (September 2012) at weekly intervals directly from 4 different landings of herring caught in the Kattegatt or Skagerack. Baltic herring (spring, February-March 2010) came from the Dioxin Project (11) and had been fished in

the Baltic Sea from a total of 10 different locations (catch zone 25-28) on two separate occasions. Autumn sampling of Baltic herring was conducted by purchasing fresh herring in September 2010 from three different fishmongers.

Sprat
Sprat which is landed in Sweden, approximately 85,000 tonnes (8), is primarily used for fishmeal and oil, but also for anchovies and brisling (previously marketed as sardines). Sprat is popular as a food fish in Eastern Europe. The analysed sprat came from the Dioxin Project (11) and had been fished in the Baltic Sea from a total of 11 different locations (catch zone 25-28) on two separate occasions.

Cod and saithe
Cod and saithe account for approximately 7 per cent of the total fish purchases (1). Cod fishing in Sweden has remained constant at approximately 13,000 tonnes in the last five years, and saithe fishing has fluctuated between 1,500 and 2,000 tonnes per year (8). Cod was last analysed in 1984 for the food composition database but, owing to the high level of consumption, it was important to update the nutritional values for cod in the food composition database. In order to achieve an adequate spread of catch areas, fishermen and seasons, two fresh fillets of cod and two of saithe were purchased every week for six weeks in March and April 2010.

Fish products

Fish balls in lobster sauce
Fish balls account for approximately 4 per cent of fish purchases (1). Lobster sauce was chosen as it is the most common. Fish balls from five different batches of the same brand were included in the sampling. The fish balls with sauce contained 33 per cent meat from cod, haddock, saithe and hake and 0.5 per cent lobster meat. Other ingredients included milk, water, potato flour, rape-seed oil, salt, spice extracts, cream, modified starches, tomato paste, locust bean gum, fish broth extract and aromatics. The fish balls and sauce were heated to 65-70 °C in a microwave prior to analysis, in accordance with the package instructions.

Salmon fish balls in west coast sauce
Salmon balls are becoming more common in stores. West coast sauce was chosen for the sampling as the fish origins in this product were more limited. Salmon balls from five different batches of the same brand were included in the sampling. The salmon balls with sauce contained 30 per cent fish meat (of which 52 per cent was salmon). Other ingredients included milk, water, potato flour, salt, cream, powdered milk, tomato paste, rape-seed oil, modified starches, crab, yeast extract, guar gum, dill and spices. The salmon balls and sauce were heated to 65-70 °C in a microwave prior to analysis, in accordance with the producer's recommendations.

Fish fingers
Fish fingers and breaded fish account for 6 per cent of Swedes' fish purchases (1). The values for fish fingers found in the food composition database were of unknown origin and were registered prior to 1989. Since then, the fish content and the species of fish included in the fish fingers have partly been modified, which is why it was needed to update the nutritional values in fish fingers. Five different products were included in the sampling, all containing different species of cod (Figure 1) with around the same proportion of fish (61-65 per cent). In addition to the fish presented in Appendix 1, ingredients included: water, rape-seed oil or sunflower oil, wheat flour, starch, yeast, salt and spices. Fish fingers were analysed both fried in cooking fat and heated in the oven in accordance with the package instructions.

Mackerel fillets canned in tomato sauce
Mackerel is, after herring and tuna, the most common canned fish consumed in Sweden and accounts for approximately 4 per cent of all fish purchases (1). The mackerel sampled consisted of seven different brands of mackerel in tomato sauce. The fish content varied from 60-70 per cent. In addition to mackerel, the products contained water, tomato paste and salt, some products also contained oil, sugar and antioxidants.

Stockfish
Approximately 2 per cent of the Swedes' fish purchases are stockfish (1). Three different types of stockfish were included in the sampling, all containing additional water, lime and soda.

Fermented Baltic herring
Fermented Baltic herring accounts for approximately 0.2 per cent of all Swedish fish purchases (1). Four different fermented Baltic herring products were included in the sampling.

Pickled herring
Almost 15 per cent of the fish purchases are pickled herring (1). As the fat content for pickled herring varies significantly (10 to 16 g/100g in the samples), it was important to take many samples with different fat contents. Sampling were therefore carried out by the pickled herring producer ABBA. In addition to pickled herring, onions and water, the drained pickled herring sample included sugar, salt, onion, vinegar, carrots, spices, aromatics and preservatives (E211). In the pickled herring in mustard sauce sample, in addition to herring, ingredients also included water, rape-seed oil, ground mustard seed, salt, vinegar, a thickening agent, preservatives, spices and colouring. The drained pickled autumn herring sample contained our finest herring and, in addition to herring, ingredients also included water, sugar, rape-seed oil, ground mustard seed, salt, vinegar, a thickening agent, preservatives, spices and colouring.

Tuna
Canned tuna accounts for almost 5 per cent of Sweden's fish purchases (1). Until now, the majority of canned tuna sold is tuna canned in water, but since tuna in oil is becoming more popular, both tuna in water and tuna in oil were analysed. During the sampling, the 7 different production sites within the operations of the chains Axfood, Coop and ICA were taken into account. The tuna sold in 2010 came primarily from Thailand, but also from Colombia and Mauritius. In addition to tuna, the ingredients included water or sunflower oil, with most of the products also including salt. Tuna needed to be analysed as the old values for tuna were lacking documentation and were analysed or borrowed mainly from the USA prior to 1989.

Shellfish

Blue mussels
In 2009, blue mussels accounted for nearly 1 per cent of the shellfish purchases in Sweden (1). In Sweden, there are approximately 15 mussel farms, owned by five companies, two of which maintain the dominant share of the market (7). The National Food Agency regularly inspects elevated levels of algal toxins and E. coli bacteria in mussels (12). Blue mussels are harvested at the age of 18 months (7). Fresh (live) mussels from two different farming facilities were purchased from three fishmongers in Uppsala.

Scallops
The consumption of scallops in Sweden, measured in kilos, is low (1). In 2010, 2 kg of scallops were caught through commercial fishing in Sweden (8). Scallops were imported frozen from the USA, 1 sample a week for three weeks.

Crayfish
Sweden imports approximately 3,000 tonnes of processed crayfish every year, primarily from China, Turkey and North America (7). 1,500 tonnes of crayfish are caught/fished in Sweden (7). When selecting crayfish, the country of origin, size and the favourites in the year's crayfish test (2010) were taken into account. Swedish, Chinese, Spanish and Turkish crayfish were included in the sampling.

Shrimp
Shrimp accounts for approximately 70 per cent (1) of shellfish purchases and, as documentation was lacking regarding the values for shrimp presented in the Food composition database, it was important to update these values. The aggregate sample consists of a mixture of peeled and unpeeled shrimp of different sizes (from 44-66 pcs/kg to 80-100 pcs/kg) from six different batches.

Sample handling

Upon arrival of the samples to the laboratory, each sample was given a unique number, making it possible to trace the samples back to the producers. All samples were analysed as pooled samples (see Appendix 1).

The samples were handled as laboratory samples as soon as they had come to the laboratory, which includes taking into account factors that may affect stability, such as oxygen and temperature. Some analysed substances are also sensitive to certain wavelengths of visible light. Fresh and frozen fish, frozen fish products and shellfish were stored in their original packaging at -20 ºC. Pickled herring, mackerel, canned tuna, fermented Baltic herring, stockfish, fish balls, salmon fish balls and blue mussels were stored in a dark refrigerated room at a temperature of 3 ºC until the sample preparation.

At least 12 fillets of each fish species were sampled with a total weight of 1.5 kg per species.

It is essential that the samples for analysis are pulverised and homogenous, therefore a food processor was used during the homogenisation of all samples. Following homogenisation, the samples were divided into different jars depending on storage conditions and type of analysis.

Analyses of ash, total fat, nitrogen, water content, sodium, potassium, calcium, magnesium, phosphorus, molybdenum, selenium and iodine were performed at the National Veterinary Institute. The fat content of pink salmon was analysed at ALcontrol AB Sweden. Other analyses were conducted at Chemistry Division 2 at the National Food Agency. The principles that apply to the methods used and the methods which were accredited can be found in Appendix II. The nutrient values are presented in Appendix III, Table 1-6.

Quality assurance of analytical methods

The laboratory at Chemistry Division 2 has extensive experience, both with the analysis of nutrients and quality assurance. Many of the methods used have been accredited since 1995 by SWEDAC, the Swedish accreditation authority, but improvements in the methods used, accreditation of new methods and/or supplementation of the accreditation is a continuous process. The quality system includes procedures, analytical methods and instructions. The quality of the analysis results is routinely inspected through analysis of internal control samples and, where possible, certified reference material. Recovery tests and analysis of blank samples are part of the quality assurance.

Chemistry Division 2 participates regularly in proficiency testing for laboratories, both with accredited and non-accredited methods, and has also organised proficiency testing for metals, vitamins and macronutrients. As part of the

proficiency testing, the same sample was sent to a number of interested laboratories that analysed the sample using customary analytical methods. The analysis results are then compiled by the person responsible for the proficiency testing and processed statistically. Each participant is given their own number so that, in the final report, the different results can be compared without the possibility of linking the results to a specific laboratory.

Analysed nutrients

The fish, shellfish and fish products analysed for nutrient content are listed in Table 2. Logical zeros for fish and shellfish, i.e., nutrients not assumed to be present in fish and shellfish, were carbohydrates (fibre, sugars, starches), alcohol, trans fatty acids, vitamin D_2 and vitamin C. Logical zeros for fish products were alcohol, vitamin D_2 and vitamin C.

Folate (total concentration) was analysed in a selection of samples:

- Stock fish - analysed because some folate forms are very unstable at high pH values and folate values on stock fish are missing in other national food tables (13).
- Drained pickled herring - analysed as folate levels can be affected by storage and loading. Folate values on pickled herring are missing in other national food tables (13).
- Striped catfish - analysed because breeding involves only feedstuff of vegetable origin. Folate values on striped catfish are missing in other national food tables (13).
- Cape hake is analysed as there are no values available to borrow. Transferring data from the closest relatives, cod, Alaska pollock and saithe (Figure 1), does not provide reliable values, as fishing water and other factors differ.
- Fish balls are analysed because the Swedes purchase a large amount of fish balls; 3.6 per cent of all fish and shellfish purchases (1). Missing in other national food tables (13).

Folate values for other analysed samples are transferred from similar food (pink salmon and sprat) or borrowed from other national food tables (other samples).

Table 2. Analysed nutrients

Macronutrients	Water, fat, nitrogen, ash
Carbohydrates (only fish products and shellfish)	Starch, glucose and fructose (monosaccharides), lactose, sucrose and maltose (disaccharides)
Cholesterol	Cholesterol
Fatty acids	4:0, 6:0, 8:0, 10:0, 12:0, 13:0, 14:0, 14:1, 14:1trans, 15:0i, 15:0 ai, 15:0, 15:1, 16:0i, 16:0ai, 16:0, 16:1, 16:1trans, 16:2n 4, 16:3, 16:4n 3, 17:0i, 17:0ai, 17:0, 17:1, 18:0 i, 18:0 ai, 18:0, 18:1, 18:1trans, 18:2, 18:2cis n 6, 18:2trans, 18:2 conj, 18:3n 3, 18:3n 6, 18:3trans, 18:4 n 3, 20:0, 20:1, 20:2n 6, 20:3n 3, 20:3n 6, 20:4n 3, 20:4 n 6, 20:5n 3, 21:5n 3, 22:0, 22:1, 22:2n 6, 22:4n 3, 22:4n 6, 22:5n 3, 22:5n 6, 22:6n 3, 23:0, 24:0, 24:1n 9
Fat-soluble vitamins	Trans-retinol, carotenoids, (alpha- and beta-carotene, beta-cryptoxanthin, lutein, lycopene, zeaxanthin), vitamin D_3, vitamin K_1 and K_2 and tocopherols (alpha-, beta-, gamma- delta-tocopherol)
Water soluble vitamins	Thiamine (thiamine chloride HCl), riboflavin, niacin (total concentration), vitamin B_6 (free and bound for fish products, only free for other samples), vitamin B_{12} (total concentration) and folate (total concentration in stockfish, drained pickled herring, striped catfish, cape hake and fish balls)
Trace elements	Phosphorus (P), iodine (I), iron (Fe), calcium (Ca), potassium (K), magnesium (Mg), sodium (Na), selenium (Se), zinc (Zn), copper (Cu), chromium (Cr), manganese (Mn), molybdenum (Mo), nickel (Ni), cobalt (Co), cadmium (Cd), lead (Pb)

Calculation of nutritional values

The results of the analysis were transferred automatically to the Swedish Food System, the National Food Agency's internal IT system for food data. Each value was registered together with information such as the analytical method, laboratory, and reference.

In the case of herring, Baltic herring and Alaska pollock, an annual average was calculated and published, representing an average of the nutritional values of the two analytical sessions.

Energy, protein, total carbohydrate levels, fatty acids, retinol equivalents, niacin equivalents and salt are calculated, see Table 3. As part of the calculations, the value zero is used for levels "below the detection limit".

Table 3. Calculation of nutritional values

Energy (kJ)	Carbohydrates (g) × 17.0 + protein (g) × 17.0 + fat (g) × 37.0
Energy (kcal)	Energy (kJ) × 0.129
Protein (g)	Nitrogen (g) × 6.25[1]
Fatty acids (g)	Fatty acids (%) × fat ×factor[2]
Total carbohydrates (g) (only fish products)	100 - (water (g) + ash (g) + protein (g) + fat (g))
Retinol equivalents	β-carotene (µg) / 12 + (α-carotene (µg) + β-cryptoxanthin (µg)) / 24
Niacin equivalents	Niacin (mg) + protein (g) × 10 × 1.1[3] / 60
Salt/NaCl (g)	Na (mg) × 2.5 / 1000

[1] Factor for the calculation of nitrogen to protein in fish
[2] Factors for the calculation of fatty acids: fat fish (> 5 % fat) 0.9; lean fish (< 5 % fat) 0.7
[3] Factor for estimating the percentage tryptophan in fish/meat

Food classification

Fish, shellfish and fish products are classified in accordance with LanguaL (www.langual.org). LanguaL is a method employed internationally for the systematic description of food. This information is published with the nutritional values in the NFA's search function ‘Search nutrient content’ (http://www7.slv.se/Naringssok/soklivsmedel.aspx).

Other information regarding samples

In addition to nutrients and classifications, images displaying dimensions and pictures from sample preparation are published in the Swedish Food System. Records from sample preparation and any cooking processes, as well as portion weight, are also published in the Swedish Food System.

Quality control of published data

All the inputted data was checked prior to publishing the results from the analysis project, see Table 4.

Table 4. Quality control

Nutrient	Control
Protein	Factor was checked
Niacin equivalents	Factor was checked
Logical zeros	Checked
Carbohydrates (only fish products)	Calculated carbohydrates (g) - (monosaccharides (g) + disaccharides (g) + starch (g)) = 100 ± 4
Macronutrients	Σ (fat + protein + water + carbohydrates + ash) = 100 ± 0.5
Units	Checked
Langual classification	Checked
Nutritional values	Checked
Detailed information on nutritional values	Checked
Portion weight	Checked
Uploaded pictures and records	Checked

Assessment of nutritive content

Assessment of the nutritive content in fish, fish products and shellfish was conducted in accordance with Commission Regulation (EC) No 1924/2006 (14). Concentrations of nutrients were compared with the conditions for nutrition claims regarding labelling, see Table 5.

Table 5. Nutrition claims and conditions of use

Low fat	the product contains no more than 3 g of fat per 100 g for solids
Low in saturated fat	the sum of saturated fatty acids and trans-fatty acids in the product does not exceed 1,5 g per 100 g for solids and must not provide more than 10 % of energy
Low sugar	contains no more than 5 g of sugars per 100 g for solids
Low salt	contains no more than 0,12 g of sodium per 100 g for solids
Source of protein	at least 12 % of the energy value of the food is provided by protein
High in protein	at least 20 % of the energy value of the food is provided by protein
Source of vitamins/minerals	at least a significant amount (15 per cent of the recommended daily intake) (see Table 6).
High in vitamins/minerals	at least twice the value of 'source of' (see above as well as Table 6).
Source of omega 3 fatty acids[1]	at least 0.3 g alpha-linolenic acid per 100 g and per 100 kcal or at least 40 mg of the sum of eicosapentaenoic acid and docosahexaenoic acid per 100 g and 100 kcal.
High in omega 3 fatty acids[1]	at least twice the value of 'source of' (see above).

[1] In accordance with the supplement of Commission Regulation (EC) No 1924/2006 (14) and Commission Regulation (EC) No 116/2010 (15)

With regard to the assessment of vitamins and minerals, the levels were compared with RDI values for labelling specified in Commission Directive 2008/100/EC (16), see Table 6.

Table 6. Vitamins and minerals that may be declared and their recommended daily intake (RDI) (6)

Vitamin / mineral	RDI	~15 % of RDI
Vitamin A (µg) / retinol equivalents	800	120
Vitamin D (µg)	5	0.8
Vitamin E (mg)	12	1.8
Vitamin K (µg)	75	11
Vitamin C (mg)	80	12
Thiamine (mg)	1.1	0.2
Riboflavin (mg)	1.4	0.2
Niacin (mg)	16	2.4
Vitamin B6 (mg)	1.4	0.2
Vitamin B12 (µg)	2.5	0.4
Folate (µg)	200	30
Potassium (mg)	2,000	300
Chloride (mg)	800	120
Calcium (mg)	800	120
Phosphorus (mg)	700	105
Magnesium (mg)	375	56
Iron (mg)	14	2.1
Zinc (mg)	10	1.5
Copper (mg)	1	0.2
Manganese (mg)	2	0.3
Selenium (µg)	55	8
Chromium (µg)	40	6
Molybdenum (µg)	50	8
Iodine (µg)	150	22

Valid per serving for individual packaged portions, otherwise per 100 g (16)

Correlations between various nutrients were checked using Pearson's correlation coefficient. Minitab® v. 15.1.0.0 (Minitab Ltd., Coventry, UK) was used for statistical analyses.

Results and discussion

Brief information regarding analysed fish, fish products and shellfish is found in Table 1, with further information found in Appendix I. Nutrient levels per 100 grams are presented in alphabetical order for fish, followed by fish products and shellfish in Appendix III, Table 1-6.

Energy and macronutrients

Results concerning energy and macronutrients in all samples are presented in Appendix III, Table 1. All the analysed fish, fish products and shellfish can be classified as a source of protein. The levels in fish and shellfish varied between 15 and 20 g/100 g. Protein content was highest in pink salmon (21.4 g/100 g) and lowest in scallops (9.5 g/100 g). In the case of fish where seasonal samples were taken, the seasonal variation was less than 15 per cent, which, for example, can be due to sampling or measurement uncertainty during analysis. Protein content varied greatly between different fish products; canned tuna contained 24 g/100 g, while the content of the fish and salmon balls (whose fish content was approx. 1/3) was around 6 g/100 g.

Fat content varied greatly between fish (0.5-16 g/100 g) and for some species, fat content varied throughout the year. Autumn herring, which was the fattiest fish analysed, contained 16 g fat /100 g, while the fat content of herring in the spring was only one-fifth (3 g/100 g). The fat content for Baltic herring in the spring was 45 per cent of the fat content in the autumn, while Alaska pollock, being a leaner fish, did not present any measurable difference in fat content between spring and autumn samples. All fish in the cod family (*Gadiformes*, Figure 1) and shellfish had a low fat content of less than 1 g/100 g. The fish products were generally fattier than the fish and shellfish due to the common addition of vegetable oils such as sunflower oil (tuna and some fish fingers) or rape-seed oil (pickled herring in mustard sauce and some fish fingers).

Results for carbohydrates in fish products and processed shellfish are presented in Appendix III, Table 2. The carbohydrate content was highest in pickled herring which mainly consisted of sucrose (16 g/100 g), and fish fingers which mainly contained starch (15 g/100 g).

Fatty acids

Results for all fatty acids, where samples contained more than 0.1 g/100 g, are presented in Appendix III, Table 3a-3c. In Figure 2, fish, shellfish and fish products are ranked in descending order based on content of long-chain n-3 fatty acids, which is an important factor in recommending the consumption of fish three

times a week. The content of long-chain n-3 fatty acids strongly correlates to the fat content ($p<0.001$), however, the ratio of long-chain n-3 fatty acids to other fatty acids is approximately twice as high in the lean cod fish species (*Gadiformes*, Figure 1) when compared with other fish (Figure 2).

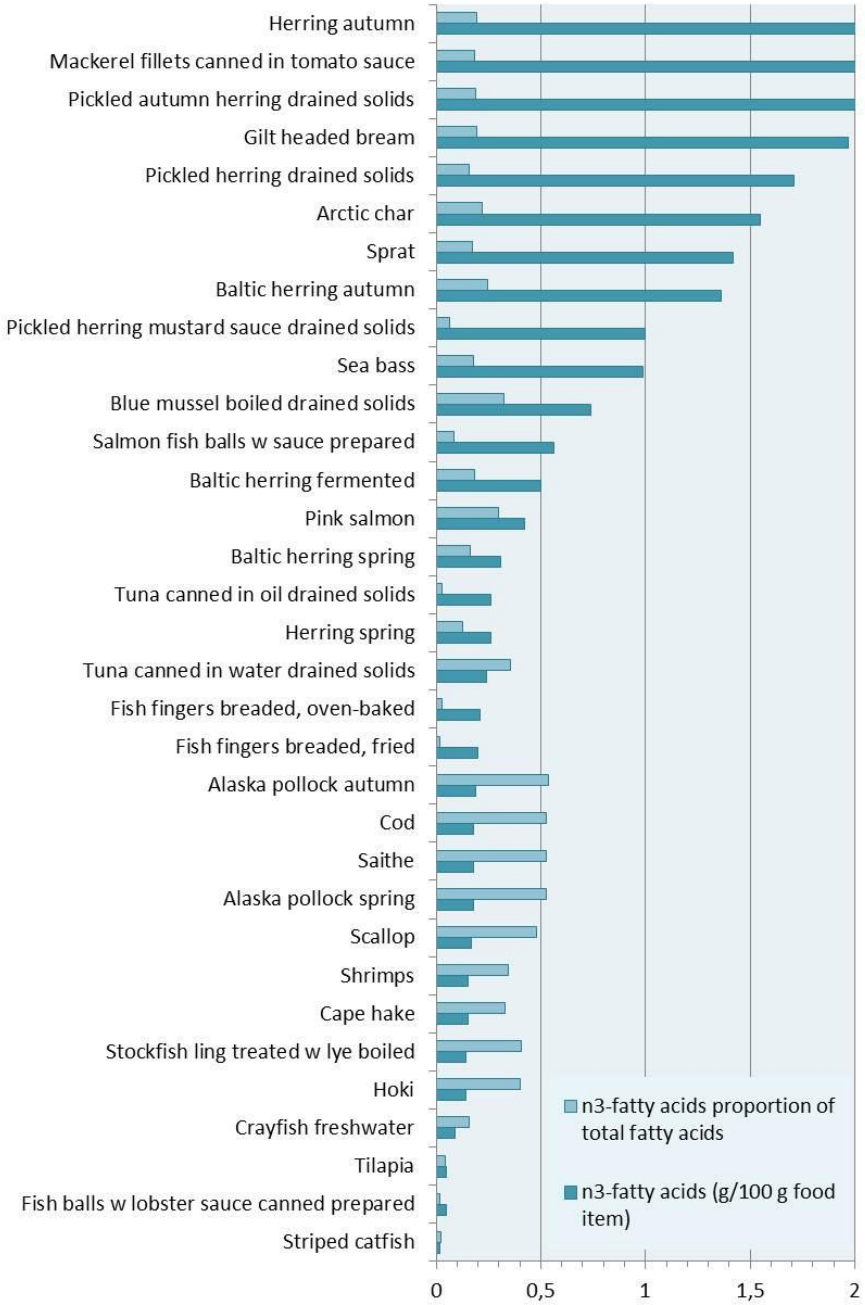

Figure 2. Analysed fish, fish products and shellfish were ranked according to the content of long-chain n-3 fatty acids, i.e., the sum of 20:3 n-3 + 20:4 n-3 + 20:5 n-3 + 21:5 n-3 + 22:4 n-3 + 22:5 n-3 + 22:6 n-3. The red line marks the level of 20:5 n-3 + 22:6 n-3 required for a food to be classified as a source of n-3 fatty acids (0.04 g/100 g and 100 kcal). 20:5 n-3 + 22:6 n-3 in the analysed fish, fish products and shellfish constitutes between 74 and 100 per cent of the sum of long-chain n-3 fatty acids.

Vitamins

The results for fat-soluble vitamins are presented in Appendix III, Table 4a and 4b, and for water-soluble vitamins, Table 5. In addition to fatty acids, the content of vitamin D in fish is an important reason for the recommendation "Eat fish often, preferably three times a week." Approximately half of the fish, fish products and shellfish could be classed as a good source of vitamin D (Figure 3, Table 6). Whereas the other fishes, fish products and shellfish not could be classed as a source of vitamin D.

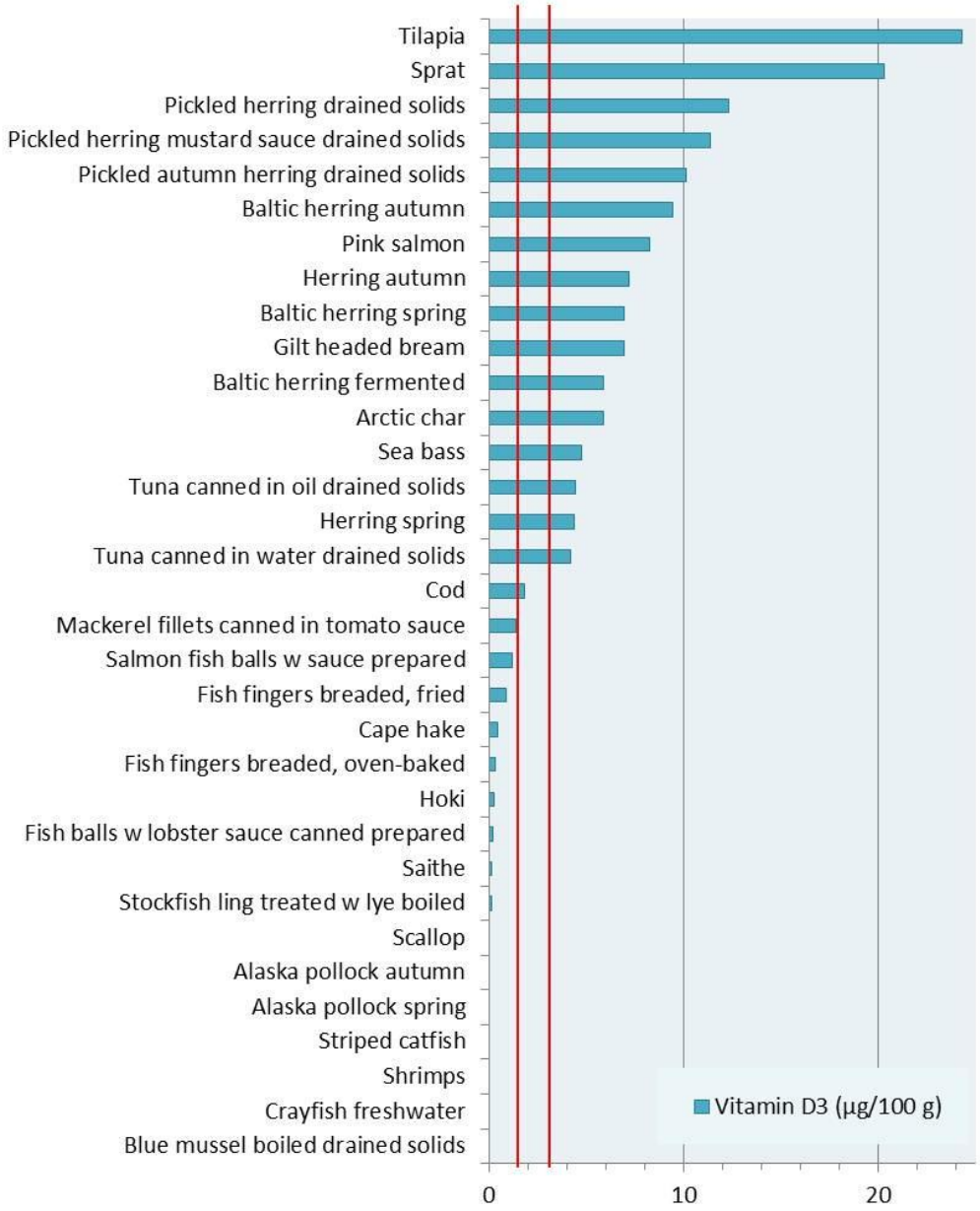

Figure 3. Analysed fish, shellfish and fish products ranked by vitamin D_3 content. The red lines indicate the level of vitamin D required for a food to be classified as a source of vitamin D (0.8 µg/100 g) and to be classified as containing a high level of vitamin D (1.6 µg/100 g).

The higher the fat content, the higher the level of the fat-soluble vitamins D ($p = 0.05$), E ($p = 0.02$) and K ($p = 0.04$). However, the vitamin A content (trans-retinol) did not vary with the fat content. Only shellfish and fish products containing vegetable oil were a source of vitamin E and only sprat could be classed as a source of vitamin A. Pickled herring in mustard sauce was a source of vitamin K, which is likely due to the presence of rape-seed oil. The carotenoid content was below the detection limit for all fish and shellfish with the exception of lutein in Arctic char and zeaxanthin in the farmed fish sea bass, char and tilapia. The concentrations of carotenoids were high in some of the fish products, particularly lycopene in mackerel fillets canned in tomato sauce.

Of the water-soluble vitamins, fish is primarily a source of vitamin B_{12} (Table 6). All the analysed fish, fish products and shellfish were a source of vitamin B_{12}, except for striped catfish and cooked stockfish, fish balls and salmon fish balls. Several of the fish including herring (Figure 1), shrimp and crayfish, contained the entire recommended daily intake of vitamin B_{12} per 100 grams. All the fish can be classed as a source of vitamin B_6, apart from species of cod (not saithe), tilapia and striped catfish. Among the fish products and shellfish, only mackerel fillets canned in tomato sauce and the tuna were sources of vitamin B_6. The content of niacin correlated to the content of vitamin B_6 ($R = 0.94$, $p < 0.000$) and, with the exception of saithe and tilapia, the same fish that were classified as a source of vitamin B_6 could be classed as a source of niacin.

Trace elements

The results for trace elements are presented in Appendix III, Table 6a and 6b. Apart from salmon balls, all analysed samples were a source of selenium (Table 6). Salmon in itself does not contain less selenium than other fish. The low selenium content is probably explained by a dilution effect from other ingredients (approximately 1/3 of the salmon balls consist of fish). Tuna and blue mussels contained more than the recommended daily intake of selenium per 100 grams. The iodine content in food depends greatly on its origin. Mainly fish and fish products containing fish from the Baltic Sea, the Kattegat and Skagerrak (FAO 27, Table 1), i.e., herring fish (Figure 1), cod and saithe could be classed as a source of iodine. All analysed samples except pickled herring, fish balls, salmon balls and stockfish, were also a source of phosphorus, a vitamin of importance for skeletal development.

The fish products or shellfish could not, with the exception of stockfish, be classed as food with a low salt content according to the defining parameters of less than 120 mg sodium per 100 g (Table 6). Fish farmed in fresh water and caught in the Baltic Sea had a sodium content of less than 120 mg per 100 g, as expected. For example, Baltic herring only contains 1/3 the sodium of other herring. The high sodium content in striped catfish farmed in rivers was surprising, but most likely due to the addition of stabilisers containing sodium (for example, sodium polyphosphate, E452) to retain water during processing. The

sodium content in striped catfish was in line with previously reported content from Italy (17). The highest sodium content was found in fish products requiring high amounts of added salt for microbiological reasons, and also in shellfish.

Comments regarding nutrients in focus for fish

Fatty acids

A human's production of long-chain n-3 fatty acids from short-chain n-3 fatty acids is limited (18) and it is therefore recommended that we eat food containing the long-chain n-3 fatty acids, such as fish. Of the analysed fish, fish products and shellfish in this project, most could be classed as having a high content of n-3 fatty acids (Appendix III, Table 3a). However, imported fish such as striped catfish and tilapia, fish products popular with children such as fish balls and fish fingers, and also shrimp and crayfish, did not have high a content of n-3 fatty acids. Several factors can affect the fatty acid composition and thus the proportion of n-3 fatty acids, among other things, feedstuff and cooking is discussed (18). Compared with the other analysed fish, the fatty acid composition of the farmed tilapia and striped catfish was more similar to fish products containing vegetable fats, such as fish fingers (percentage fat), fish balls and tuna in sunflower oil, with less than 2.5 per cent 22:6 n-3 (DHA) and less than 0.8 per cent 20:5 n-3 (EPA), as well as more than 30 per cent of 18:1 (Figure 2). This could partly be explained by the feedstuff's composition, about which we unfortunately did not have any information. It may also partly involve biological explanations, where fish in tropical waters require a lower proportion of n-3 fatty acids in order to move when compared to fish in colder waters such as herring and cod species (18). Studies on how nutritional values are affected by cooking are complex and often give inconsistent results. In a study by Larsen et al (19), neither the steaming, microwaving, baking nor frying of salmon affected the fatty acid composition significantly. Only the deep-frying of fish in oil affected the fatty acid composition, as the concentration of long-chain n-3 fatty acids decreased when the fish was removed from the frying oil (sunflower oil) (19). In a study by Sioen et al (20), however, the levels of n-3 fatty acids decreased when frying both cod and salmon in olive oil.

The calculated content of n-3 fatty acids presented in this report are also affected by the general factors used in calculating fatty acid composition for the content of individual fatty acids. In the case of oily fish (> 5 g/100g, Appendix III, Table 1), the general factor of 0.9 is used, while lean fish (<5 g/100g, Appendix III, Table 1), has a factor of 0.7. Factors are used for correction purposes, as all substances that are soluble in the fat-soluble part/phase of the food are not fatty acids – for example, cholesterol is fat-soluble but not a fatty acid.

Vitamin D

Fish is an important source of vitamin D (21). Previous experiments have demonstrated that the vitamin D content does not correlate to either fat content, size, gender or age (22, 23). The governing factor for vitamin D content is most likely diet. For example, farmed fish require vitamin D supplements for growth and wild salmon contain significantly higher levels than farmed salmon (24). Just as humans, zooplanktons convert 7-dehydrocholesterol into vitamin D_3 when exposed to UV light (23). In this project, vitamin D content correlated to fat content ($p < 0.05$), but lean fish also contained high levels of vitamin D, the highest content being found in the lean farmed fish tilapia, which contained 24 µg/100 g. This high content has previously been recorded in Canada, where levels between 18 and 75 µg/100 g have been reported for tilapia (25). Even the lower concentration of 18 µg/100 g is considered a high vitamin D content, when compared with vitamin D levels in other fish in this analysis project. The fact that tilapia contains as much vitamin D may depend on the feed (23-27), but there are also studies that have shown that tilapia can convert cholesterol (7-dehydroxy cholesterol) into vitamin D_3 when exposed to light, just as we humans do (26). The researchers, however, believed that this production is not relevant to wild fish that live near the surface and fish without major exposure to sunlight (26). It is possible that the use of small rearing boxes affects these conditions. We lack data regarding the vitamin D content of the analysed tilapia's diet. During sampling, we sampled fish from different plants in China, as they may use different feed composition. Salmon feed contains between 2,000 and 4,000 IU/kg (50-100 µg/kg) of vitamin D. In studies with tilapia, feed has contained around 2,000 IU/kg (50 µg/kg). However, the requirement has been calculated at 375 IU/kg (9 µg/kg) feed (27).

In the case of both Baltic herring and other herring, the content of vitamin D was higher in the fattier autumn fish than in the spring fish. The Baltic herring contained 7 and 9 µg/100 g which is significantly lower than previously reported (22, 23); 23 and 32 µg/100 g for fish caught in 1995, and 18 and 16 µg/100 g for fish caught in 1993. Baltic herring in the experiments (22, 23) were analysed using the same method by the same research group and were approximately twice as fatty (average fat content in 1993 was 8.8 g/100 g, and in 1995, 10.6 g/100 g) as the spring and autumn samples of Baltic herring analysed in this project (2.7 and 6.2 g/100 g). In a pilot study for this analysis project, sampling from even earlier in the spring of 2010 (February) found the fat content to be 4 g/100g.

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Appendices

Appendix I. Aggregate samples, distribution of constituent sub-samples and information on sub-samples
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Appendix III. Nutritional values
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Appendix I. Aggregate samples, distribution of constituent sub-samples and information on sub-samples

English name	**Proportion (%) or number (pcs)** (sampling sessions)	**Included fish**	**Samp-ling**	**Best before**	**Date of sample preparation**	**Fishing water/origin**
Alaska Pollock fillet, spring	19 (4)		B	20/08/11-27/11/11	101020	FAO 61
Alaska pollock fillet, autumn	21 (6)		B/ S	24/06/10-02/03/12	101020	FAO 61/67
Blue mussels, boiled	1.8 kg (3)		F	30/04/10-03/05/10	100505	FAO 27
Fish balls in lobster sauce	70 (5)	Cod, haddock, saithe and hake	S	09/11/12-20/01/13	100504	FAO 21/27
Fish fingers	23 % (1)	Alaska pollock 65 %	S	110831	100504	FAO 61/67
	12% (1)	Cod 61 %	S	1109	100504	FAO 27
	23% (1)	Alaska pollock 61 %	S	1109	100504	FAO 61/67
	14% (1)	Hoki, hake, ramsays noting 65 %	S	110917	100504	FAO 41/81
	28% (1)	Saithe 61 %	S	100913	100504	FAO 27
Gilt headed bream fillet	16 (3)		F	Fresh +2 days	101103	FAO 37
Sea bass fillet	13 (3)		F	Fresh +2 days	101103	FAO 37
Hoki fillet	24 (4)		B/S	05/11-06/11	101028	FAO 81
Pickled herring in mustard sauce	7 batches	Herring	Abba	24/07/10-28/12/11	100511	FAO 27: III+IV; FAO 27: IV
Pickled herring, drained	13 batches	Herring	Abba	02/05/10-22/12/11	100511	FAO 27: IV
Our finest pickled herring with onions	16 batches	Herring	Abba	18/07/10-03/08/10	100511	FAO 27: IV
Cape hake fillet	16 (5)		B/S	05/11-12/11	101028	FAO 47

B-border inspection; S-store; F-fishmonger

Appendix I. Aggregate samples, distribution of constituent sub-samples and information on sub-samples

English name	**Proportion (%) or number (pcs)** (sampling sessions)	**Sampling**	**Best before**	**Date of sample preparation**	**Fishing water/origin**
Crayfish	296 (9)				
- 24-30 pcs/kg		S	120329	101028	Turkey
- 24-30 pcs/kg, wild-caught		S	110928	101028	Spain
- 16-22 pcs/kg		S	110604	101028	China
- 20-30 pcs/kg, signal crayfish		S	110722	101028	Småland
- 17-22 pcs/kg		S	1205	101028	Spain
- 29 pcs/kg, wild-caught		S	120515	101028	China
- 16-20 pcs/kg + crayfish tails 26-36 pcs		S	120524	101028	China
- crayfish tails		S	110930	101028	China
Salmon fish balls in west coast sauce	80 pcs (5)	S	121015	100504	FAO 27
Stockfish (long)	3 batches (3)	S	11/02/11-25/02/11	101110	FAO 27
Mackerel fillets canned in tomato sauce					
- mackerel 60 %	1 (1)	S	130704	101028	FAO 27/SE
- mackerel 64 %	1 (1)	S	130702	101028	FAO 27/DE
- mackerel 64 %	1 (1)	S	130511	101028	FAO 27/DK
- mackerel 64 %	1 (1)	S	130813	101028	FAO 27/DE
- mackerel 70 %	1 (1)	S	130510	101028	FAO 27/SE
- mackerel 64 %	1 (1)	S	130906	101028	FAO 27/DE
- mackerel 60 %	1 (1)	S	130422	101028	FAO 27/SE
Striped catfish fillet	16 (12)	B/S	12/12/11-31/07/12	101020	Vietnam
Scallops	1.8 kg (3)	S	101209	100505	FAO 21 (USA)
Pink salmon fillet	20 (5)	S	06/11-12/11	101103	FAO 61/67
Shrimp	1.5 kg (6)	S	03/11/10-08/09/11	100505	FAO 21
Arctic char, fillet	15 (3)	Fish farming	Fresh + 1 day	100505	Landesjön & Wilhelmina
Saithe fillet	16 (8)	F	Fresh + 1 day	100505	FAO 27 (Swe)

B-border inspection; S-store; F-fishmonger

Appendix I. Aggregate samples, distribution of constituent sub-samples and information on sub-samples

English name	**Proportion (%) or number (pcs)** (sampling sessions)	**Sampling**	**Best before**	**Date of sample preparation**	**Fishing water/origin (distribution in per cent)**
Herring fillet, spring	60 (4)	Wholesaler	Fresh + 1 day	100511	FAO 27:IIIa (Kattegatt)
Herring fillet autumn	36 (4)	Wholesaler	Fresh + 1 day	101020	FAO 27:IIIa
Sprat	188 (4)	The Dioxin Project (11)	Fresh + 1 day	100511	Bornholmshavet (Bornholm Sea) (39 %), Gdanskbukten (Gulf of Gdańsk) (20 %), Västra Gotlandshavet (Western Gotland Sea) (32 %), Östra Gotlandshavet (Eastern Gotland Sea) (9 %)
Baltic herring, spring	66 (4)	The Dioxin Project (11)	Fresh + 1 day	100511	Bornholmshavet (Bornholm Sea) (54 %), Gdanskbukten (Gulf of Gdańsk) (14 %), Västra Gotlandshavet (Western Gotland Sea) (19 %), Östra Gotlandshavet (Eastern Gotland Sea) (13 %)
Baltic herring fillet, autumn	65 (3)	F	Fresh + 1 day	101103	Baltic Sea 25-29
Fermented Baltic herring	86 (6)	S	1112	101021	Baltic Sea
Tilapia fillet	12 (4)	B/S	06/05/11-01/03/12	101020	China
Tuna, oil	11 batches (6)	S	03/04/12-31/12/14	100504	Thailand (90 %), FAO 87 (10 %)
Tuna, water	11 batches (6)	S	16/04/12-27/11/12	100504	Thailand (90 %), FAO 87 (10 %)
Cod fillet	14 (7)	F	Fresh + 1 day	100505	27.1.1

B-border inspection; S-store; F-fishmonger

Water
Samples are dried in a heating cabinet at 102 °C ± 3 °C to constant weight. Water is determined gravimetrically as the sample's weight loss. Accredited method (SWEDAC).

Ash
Samples are burned up in an oven at 650 °C ± 25 °C to constant weight. Ash is defined as the gravimetric residue when water and organic material have been burned up. Accredited method (SWEDAC).

Protein
Nitrogen is determined in accordance with Kjeldahl. NMKL nr. 6, 3 Ed. 1976. The sample is subjected to wet digestion in sulphuric acid and organic nitrogen is converted to ammonium ions. Sodium hydroxide is added and the ammonia formed is titrated with hydrochloric acid. Protein is calculated from the nitrogen using a conversion factor. Accredited method (SWEDAC).

Fat
Fat is analysed as raw fat using the EC method B, Commission Directive 98/64/EC. Fat content of pink salmon is analysed using SBR: NMKL No. 131, 1989.

Both standard methods are based on the fat being liberated by hydrolysis and extracted with solvent. The solvent is distilled and the residue weighed to constant weight. Fat is defined as the gravimetrical weight increase. Accredited methods (SWEDAC).

Fatty acid composition
Fatty acids are determined by gas chromatography using a modified IUPAC method (IUPAC 6th Ed, Part 1, 2301 and 2302, 1979). Fatty acid methyl esters are produced from triglycerides by alkaline catalyzed transmethylation. The percentage distribution of a mixture of fatty acid methyl esters is determined by gas chromatography. Accredited method (SWEDAC).

Cholesterol
Cholesterol is determined by gas chromatography using an in-house validated method. The sample is hydrolysed with saturated potassium hydroxide in methanol and cholesterol is extracted with cyclohexane. Quantification is performed based on the calibration curve with 5-β-cholestane-3-ol as an internal standard. Cholesterol is determined directly without derivatisation by gas chromatography on a flame ionisation detector. Accredited method (SWEDAC).

Starch
Starch is determined enzymatically with a modified method of NMKL No. 145 2 Ed., 1997. The starch is hydrolysed in the oven for 30 minutes with Termamyl ® at pH 5.0 and at a temperature of 90°C. The starch is then determined enzymatically using a commercial test (Boehringer Mannheim / R-Biopharm Cat. No. 10 207 748 035). The amount of NADPH formed is measured photometrically and is proportional to the amount of starch. The method was not accredited for fish products at the time of analysis. Validation was performed during the project and accreditation for fish products was obtained retrospectively.

Sugars
Monosaccharides and disaccharides are determined by gas chromatography using an in-house validated method. (Swedish J. Agric. Res. 4:49-52, 1974). Carbohydrates are converted to trimethylsilyl (TMS-ethers) after extraction with 80 per cent ethanol and analysed on a gas chromatograph with a flame ionisation detector. Carbohydrates are quantitatively determined by the calibration curve with phenyl-β-D-glucoside as an internal standard. The method was not accredited for fish products at the time of analysis. Validation was performed during the project and accreditation for fish products was obtained retrospectively.

Metals
Sodium, potassium, calcium, magnesium, phosphorus and molybdenum are determined by ICP-AES (Inductively Coupled Plasma-Atomic Emission Spectrometry) after wet digestion. The in-house method is accredited for calcium, magnesium and molybdenum in food and for sodium, potassium and phosphorus in feed (SWEDAC).

Other metals are determined by ICP-MS (Inductively Coupled Plasma-Mass Spectrometry) after microwave digestion in nitric and hydrochloric acid at 190°C and dilution with water. The method, which is based on EN 15763:2009, was not accredited for food at the time of analysis. Validation was performed during the project and accreditation was obtained retrospectively.

Selenium
Selenium was determined by hydrid-ICP-AES after wet digestion. Accredited method (SWEDAC).

Iodine
Iodine was determined spectrophotometrically according to Gig. Sanit. 1971, 36(4), 67-69. Accredited method (SWEDAC).

Thiamine and riboflavin
Method for analysis of thiamine content (vitamin B1) and riboflavin (vitamin B2) in enriched and non-enriched foods. The detection limit is 0.005 mg/100 g for vitamin B1 and 0.026 mg/100 g for vitamin B2. The common sample treatment begins with an acidic and an enzymatic hydrolysis. Riboflavin is then determined and quantified by isocratic chromate-graphic separation on a C18-column and fluorescence detection. Thiamine is oxidised in a highly alkaline solution to thiochrome, which fluoresces under ultraviolet light. Potassium hexacyanoferrate is used as an oxidising agent. The derivatisation takes place automatically prior to the injection time by using a liquid handling robot (Gilson ASPEC). Thiamine (thiochrome) is then determined and quantified by isocratic chromatographic separation on a C18-column and fluorescence detection. EN 14122 and EN 14152. Accredited methods (SWEDAC).

Folate
Method for analysis of the total folate concentration in enriched and non-enriched foods. The determination is performed using microbiological assay and turbidimetric detection of the growth of Lactobacillus casei, subsp. Rahmnosus (L. rahmnosus, Culture Collection of the University of Gothen¬burg, CCUG 21452, equivalent to L. casei American Type Culture Collection, ATCC 7469). The detection limit is 3.3 µg/100 g. Homogenised samples are suspended in the phosphate buffer and autoclaved to facilitate extraction from the sample matrix. Further extraction is then performed with the help of enzymes. As L. casei cannot use

polyglutamate forms of vitamins for growth, an enzymatic deconjugation is also required prior to analysis. The sample extract is diluted with a basal medium containing all necessary growth factors other than folate. Following the addition of L. casei, the samples are incubated at +37 ºC for 22 hours, after which growth is measured turbidimetrically. By comparing the growth in the sample extract with that of the calibration solution, the vitamin content can be determined. EN14131. AACC 86-47. Accredited method (SWEDAC).

Niacin
Method for analysis of the total niacin content in food, both in enriched products and naturally occurring nicotinic acid and nicotinamide. The determination is performed using micro-biological assay and turbidimetric detection of the growth of Lactobacillus plantarum (L. plantarum) (ATCC 8014). The detectio¬n limit is 0.03 mg/100 g (weighed sample amount is 5 g). Homogenised samples are suspended in sulphuric acid and autoclaved to facilitate extraction from the sample matrix. The sample extract is diluted with a basal medium containing all necessary growth factor¬s other than niacin. Following the addition of L. plantarum, the samples are incubated at +37 ºC for 22 hours, after which growth is measured turbidi¬metrically. By comparing the growth in the sample extract with that of the calibration solution, the vitamin content can be determined. Accredited method (SWEDAC).

Vitamin B6
Method for analysis of vitamin B6 in foods of animal and vegetable origin. Vitamin B6 is specified as pyridoxine hydrochloride. The detection limit is 0.009 mg pyridoxine hydrochloride/100 g if the weighed amount is 5 g. Samples are hydrolysed with 0.1 M HCl while heated. If the samples contain phosphate esters of pyridoxine, pyridoxal or pyridox-amine, the samples are then treated with acid phosphatase. The vegetable samples can be conjugated as pyridoxine glucoside. Therefore, a portion of the vegetable sample extract is also treated with beta-glucosidase to determine the total concentration of the vitamin. B6 vitamins pyridoxine, pyridoxal and pyridoxamine are determined and quantified by isocratic chromatographic separation on a C18-column and fluorescence detection. The sum of the vitamins is reported as vitamin B6. Accredited method (SWEDAC).

Vitamin B12
Method for analysis of total cyanocobalamin, vitamin B12 in foods, both in enriched products and naturally occurring. The determination is performed using microbiological assay and turbidimetric detection of the growth of Lactobacillus leichmanni (American Type Culture Collection, ATCC, 7830). The detection limit is 0.04 µg/100g. Homogenised samples are suspended in acetate buffer and for transformation to cyanocobalamin, which is more stable, a cyanide solution is added. Samples are then autoclaved to facilitate extraction from the sample matrix. The sample extract is diluted with a basal medium containing all necessary growth factors other than folate. Following the addition of L. leichmanni, the samples are incubated at +37 ºC for 22 hours, after which growth is measured turbidimetrically. By comparing the growth in the sample extract with that of the calibration solution, the vitamin content can be determined. Accredited method (SWEDAC).

Trans-retinol
The sample is hydrolysed in an alkaline environment, wherein the retinol esters are converted into retinol. Hydrolysates with low fat content are then extracted with n-hexane on a Kiselguhr-based column (Chem Elut). Extraction in a separatory funnel is used instead for samples with high fat content. Following isocratic liquid chromatographic separation on an amino column, retinol is detected with a UV detector at 325 nm. The quantitative evaluation

is based on a comparison with an external standard. Correction of the concentration is performed for a recovery of 90.5 per cent. The detection limit is 1 µg/100 g. Accredited method (SWEDAC).

Vitamin D_3
Following the addition of an internal standard (vitamin D_2) and alkaline hydrolysis, vitamin D_3 is extracted with n-heptane. The fraction containing vitamin D_2/D_3 is separated by preparative straight phase liquid chromatography (Silica). After evaporation and dissolution in acetonitrile/methanol, vitamin D_3 is determined quantitatively using reversed phase liquid chromatography (C-18). Detection is achieved using UV at 265 nm. The quantitative evaluation is based on a comparison with the internal standard. The detection limit is 0.1 µg/100 g. Accredited method (SWEDAC).

Tocopherols (vitamin E)
The sample is hydrolysed in an alkaline environment, wherein tocopherol esters are converted into tocopherols. Hydrolysates with low fat content are then extracted with n-hexane on a Kiselguhr-based column (Chem Elut). Extraction in a separatory funnel is used instead for samples with high fat content. Following isocratic liquid chromatographic separation on an amino column, tocopherols are detected with a fluorescence detector. The quantitative evaluation is based on a comparison with an external standard. Correction of the alpha-tocopherol content is made for a recovery of 90 per cent, while the levels of beta-, gamma- and delta-tocopherol are corrected for recoveries of 93 per cent, 91 per cent and 85 per cent. The detection limit is 0.006 mg/100 g for alpha-, beta- and gamma-tocopherol, and 0.008 mg/100 g for delta-tocopherol. Accredited method (SWEDAC).

Vitamin K
An internal standard (menaquinone-8) is added to the sample and mixed with 70 per cent ethanol after which the fat-soluble components are extracted in heptane during reflux. The sample is evaporated and analysed using reversed phase liquid chromatography (C-18) with a fluorescence detector. Vitamin K is reduced in a reduction column filled with zinc powder, which means that the vitamin may be detected fluorimetrically. The quantitative evaluation is based on comparison with an external standard, but correction is made for the recovery of the internal standard. The detection limit is 0.3 µg/100 g for both vitamin K_1 and K_2.

Carotenoids
The analyses for alpha- and beta-carotene, beta-cryptoxanthin, lutein and zeaxanthin have been performed with an extraction method which includes alkaline hydrolysis. The sample is first dissolved in ethanol and then hydrolysed using potassium hydroxide. It is then neutralised and extracted with tetrahydrofuran and cyclohexane. Using this method, you get both free carotenoids and carotenoids in ester form as the result. Trans-lycopene has instead been analysed with a direct extraction method without hydrolysis, where the sample is first extracted with ethanol and then with dichloromethane. In both methods, the sample is evaporated to a small volume after extraction, dissolved in dichloromethane and methanol and then analysed by reversed phase liquid chromatography (C-30) with a diode-array detector. When employing hydrolysis, carotenoids break down to some extent and therefore a recovery correction has been made for a recovery of 87 % for all carotenoids analysed by hydrolysis. No recovery correction was made for trans-lycopene. The detection limit is 2 µg/100 g for all analysed carotenoids.

Appendix III, results nutritional values

Table 1. Energy and macronutrients. Content per 100 gram edible part

Food nr	Food name	Energy[1] kJ	Energy[1] kcal	Carbohydrate[1] g	Fat g	Protein[1] g	Nitrogen g	Water g	Ash g
4585	Alaska pollock autumn	291	70	lz	*0.5*	**17.8**	2.85	82.5	1.0
4559	Alaska pollock spring	299	71	lz	*0.5*	**17.4**	2.78	82.2	0.8
4612	Gilt headed bream	775	185	lz	11.4	**18.9**	3.03	66.6	1.2
4613	Sea bass	592	142	lz	6.2	**19.5**	3.12	71.3	1.1
4586	Hoki	300	72	lz	*0.5*	**16.6**	2.66	81.9	1.1
4611	Cape hake	288	69	lz	0.6	**16.6**	2.65	82.7	1.1
4226	Striped catfish	274	65	lz	*1.1*	**13.1**	2.10	83.9	1.3
1250	Pink salmon	432	103	lz	*2.0*	**21.4**	3.43	75.8	1.2
1244	Arctic char	635	152	lz	7.9	**19.9**	3.19	70.4	1.6
1202	Saithe	344	82	lz	*0.5*	**19.1**	3.06	79.3	1.4
4604	Herring autumn	865	207	lz	15.9	**16.3**	2.60	66.3	1.5
4603	Herring spring	430	103	lz	2.9	**17.2**	2.75	76.1	2.1
4607	Sprat	585	140	lz	9.1	**17.6**	2.82	74.0	2.2
4606	Baltic herring autumn	536	128	lz	6.2	**16.9**	2.70	74.3	1.4
4605	Baltic herring spring	411	98	lz	*2.7*	**19.1**	3.05	77.1	1.9
2468	Tilapia	349	84	lz	*1.6*	**17.9**	2.86	80.3	1.0
1246	Cod	328	78	lz	*0.5*	**18.2**	2.91	81.0	1.1
1345	Fish balls w lobster sauce canned prepared	369	88	7.4	4.4	**4.8**	0.77	82.0	1.4
1294	Fish fingers breaded, fried	932	223	16.8	12.1	**11.7**	1.87	57.8	1.6
4602	Fish fingers breaded oven-baked	868	207	19.0	9.1	**12.3**	1.97	57.9	1.7
4609	Pickled autumn herring drained solids	1034	247	23.1	12.0	**11.7**	1.87	50.3	2.9
4608	Pickled herring drained solids	982	235	21.9	12.0	**9.8**	1.56	53.1	3.3
4601	Salmon fish balls w sauce prepared	479	114	7.2	7.2	**5.3**	0.84	78.4	1.9
1298	Stockfish ling treated w lye boiled	119	28	lz	*0.5*	**5.9**	0.94	93.0	0.6
1296	Mackerel fillets canned in tomato sauce	779	186	3.9	13.9	**11.7**	1.87	68.3	2.2
4610	Pickled herring mustard sauce drained solids	1051	251	15.2	17.8	**7.8**	1.25	55.8	3.4
1297	Baltic herring fermented	344	82	lz	3.9	**11.8**	1.88	75.9	9.6
1275	Tuna canned in oil drained solids	789	189	lz	9.9	**24.9**	3.99	63.4	1.8
1278	Tuna canned in water drained solids	444	106	lz	*1.0*	**24.1**	3.85	74.1	1.5
1385	Blue mussel boiled drained solids	474	113	2.3	3.3	**18.5**	2.96	73.5	2.4
1394	Crayfish freshwater	289	69	lz	*0.8*	**15.6**	2.50	80.9	3.0
4600	Scallop	189	45	lz	*0.5*	**9.5**	1.52	87.5	2.0
1395	Shrimps	323	77	lz	*0.6*	**17.6**	2.82	78.7	2.2

[1] Calculated from analysed values; lz – logical zero, i.e. the component is not assumed to occur in the food; *Italic* – the food item may be classified as having low fat content (14, 15); **Fat** - the food item may be classified as source of protein (14, 15)

Appendix III, results nutritional values

Table 2. Carbohydrates in fishproducts and shellfish. Content in gram per 100 gram edible part

Food nr	Food name	Monosaccharides[1]	Disaccharides[1]	Glucose	Fructose	Sucrose	Maltose	Lactose	Starch
1345	Fish balls w lobster sauce canned prepared	**0**	**0.6**	<LOQ	<LOQ	<LOD	<LOD	0.6	4.6
1294	Fish fingers breaded, fried	**0.2**	**1**	0.1	0.1	<LOD	1.0	<LOD	14.2
4602	Fish fingers breaded oven-baked	**0.2**	**0.7**	0.1	0.1	<LOD	0.7	<LOD	16.3
4609	Pickled autumn herring drained solids	2.4	16.9	1.4	1.0	16.9	<LOD	<LOQ	<LOD
4608	Pickled herring drained solids	1.6	17.3	0.9	0.7	17.2	<LOD	0.1	<LOD
4601	Salmon fish balls w sauce prepared	**0.2**	**0.7**	0.1	0.1	<LOD	<LOD	0.7	4.4
1298	Stockfish ling treated w lye boiled	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1296	Mackerel fillets canned in tomato sauce	**3.0**	**0.2**	1.4	1.6	0.2	<LOD	<LOD	<LOD
4610	Pickled herring mustard sauce drained solids	1.2	13.8	0.7	0.5	13.7	<LOD	0.1	<LOD
1297	Baltic herring fermented	0	0	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
1275	Tuna canned in oil drained solids	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1278	Tuna canned in water drained solids	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1385	Blue mussel boiled drained solids	**0.1**	**0**	0.1	<LOQ	<LOQ	<LOD	<LOQ	1.5
1394	Crayfish freshwater	**0**	**0.2**	<LOD	<LOD	0.2	<LOD	<LOD	0.5
4600	Scallop	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1395	Shrimps	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

[1] Calculated from analysed values

Fat - the food item may be classified as having low sugar content (14, 15)

n.a. – not analysed

<LOD – below limit of detection (0.03 g/100 g)

<LOQ - below limit of quantification (0.05 g/100 g)

Appendix III, results nutritional values

Table 3a. Summary fatty acids (g) and cholesterol (mg). Content per 100 gram edible part

Food nr	Food name	SFA[1]	MUFA[1]	PUFA[1]	Sum n3 FA[1]	Sum long chain n3 FA[1]	Sum n6 FA[1]	Sum trans-FA[1]	Cholesterol
4585	Alaska pollock autumn	*0.08*	0.06	0.20	**0.19**	0.19	0.01	lz	72.9
4559	Alaska pollock spring	*0.08*	0.06	0.20	**0.19**	0.18	0.01	lz	68.3
4612	Gilt headed bream	2.30	4.05	3.65	**2.33**	1.97	1.13	lz	80.1
4613	Sea bass	*1.17*	2.30	1.95	**1.19**	0.99	0.67	lz	69.5
4586	Hoki	*0.09*	0.09	0.16	**0.14**	0.14	0.01	lz	43.0
4611	Cape hake	*0.11*	0.16	0.17	**0.15**	0.15	0.01	lz	48.4
4226	Striped catfish	*0.32*	0.31	0.14	0.02	0.02	0.11	lz	34.2
1250	Pink salmon	*0.24*	0.58	0.53	**0.48**	0.42	0.04	lz	48.2
1244	Arctic char	*1.39*	3.07	2.47	**1.86**	1.55	0.48	lz	57.8
1202	Saithe	*0.08*	0.06	0.20	**0.19**	0.18	0.01	lz	58.6
4604	Herring autumn	3.48	6.20	4.28	**3.58**	2.75	0.52	lz	51.7
4603	Herring spring	*0.47*	1.11	0.39	**0.31**	0.26	0.06	lz	62.3
4607	Sprat	2.44	3.17	2.28	**1.73**	1.42	0.40	lz	110
4606	Baltic herring autumn	*1.48*	2.02	1.97	**1.63**	1.36	0.26	lz	67.9
4605	Baltic herring spring	*0.58*	0.71	0.54	**0.38**	0.31	0.13	lz	79.2
2468	Tilapia	*0.35*	0.42	0.32	0.07	0.05	0.24	lz	47.0
1246	Cod	*0.08*	0.05	0.21	**0.19**	0.18	0.02	lz	48.4
1345	Fish balls w lobster sauce canned prepared	*0.62*	1.60	0.84	0.31	0.05	0.51	0.03	22.9
1294	Fish fingers breaded, fried	*1.11*	5.74	4.09	0.94	0.20	3.07	0.08	29.5
4602	Fish fingers breaded oven-baked	*0.84*	4.11	3.22	0.65	0.21	2.50	0.08	35.0
4609	Pickled autumn herring drained solids	2.52	5.02	2.91	**2.51**	2.03	0.25	lz	48.1
4608	Pickled herring drained solids	2.50	5.41	2.52	**2.13**	1.71	0.24	lz	56.9
4601	Salmon fish balls w sauce prepared	*1.35*	3.17	1.98	**0.98**	0.56	0.88	0.09	29.4
1298	Stockfish ling treated w lye boiled	*0.09*	0.07	0.16	**0.14**	0.14	0.02	lz	25.9
1296	Mackerel fillets canned in tomato sauce	2.59	5.64	4.00	**3.12**	2.28	0.70	0.13	39.7
4610	Pickled herring mustard sauce drained solids	2.09	9.37	4.53	**2.26**	1.00	2.13	0.17	37.4
1297	Baltic herring fermented	*0.65*	1.12	0.87	**0.58**	0.5	0.25	0.02	82.2
1275	Tuna canned in oil drained solids	*1.15*	2.39	5.31	**0.30**	0.26	4.95	0.06	45.3
1278	Tuna canned in water drained solids	*0.23*	0.11	0.31	**0.24**	0.24	0.05	0.01	55.9
1385	Blue mussel boiled drained solids	*0.47*	0.54	1.06	**0.86**	0.74	0.15	0.03	30.9
1394	Crayfish freshwater	*0.13*	0.16	0.23	0.12	0.09	0.10	0.00	110
4600	Scallop	*0.09*	0.05	0.20	**0.18**	0.17	0.02	lz	12.6
1395	Shrimps	*0.09*	0.16	0.18	0.16	0.15	0.02	0.00	147

SFA – saturated fatty acids; MUFA – monounsaturated fatty acids; PUFA – polyunsaturated fatty acids; FA – fatty acids; [1] Calculated from analysed values;
Italic - the food item may be classified as having low content of saturated fatty acids (14, 15); **Fat** - the food item may be classified as having high content of n3-fatty acids (14, 15)
lz – logical zero, i.e. the component is not assumed to occur in the food

Appendix III, results nutritional values

Table 3b. Saturated and monounsaturated fatty acids for which at least one food item contained above 0.1 gram per 100 gram. Content gram per 100 gram edible part

Food nr	Food name	14:0	15:0	16:0	18:0	16:1C	18:1cis n9	20:1cis	22:1	24:1n9
4585	Alaska pollock, autumn	0.00	0.00	0.06	0.01	0.01	0.04	0.01	0.00	0.00
4559	Alaska pollock, spring	0.01	0.00	0.06	0.01	0.01	0.04	0.01	0.00	0.00
4612	Gilt headed bream	0.39	0.03	1.50	0.30	0.63	2.73	0.36	0.26	0.05
4613	Sea bass	0.18	0.02	0.79	0.15	0.27	1.62	0.23	0.15	0.02
4586	Hoki	0.01	0.00	0.07	0.01	0.01	0.05	0.02	0.01	0.00
4611	Cape hake	0.01	0.00	0.08	0.01	0.02	0.07	0.03	0.03	0.00
4226	Striped catfish	0.03	0.00	0.22	0.07	0.01	0.28	0.01	0.00	0.00
1250	Pink salmon	0.04	0.01	0.16	0.02	0.05	0.14	0.15	0.23	0.02
1244	Arctic char	0.28	0.02	0.88	0.15	0.50	1.68	0.41	0.42	0.05
1202	Saithe	0.00	0.00	0.06	0.01	0.00	0.04	0.01	0.00	0.00
4604	Herring autumn	1.09	0.11	1.97	0.16	0.63	1.44	1.30	2.68	0.14
4603	Herring spring	0.15	0.01	0.26	0.03	0.08	0.24	0.28	0.49	0.02
4607	Sprat	0.39	0.05	1.69	0.20	0.46	2.42	0.08	0.04	0.16
4606	Baltic herring autumn	0.35	0.03	0.95	0.08	0.29	0.89	0.27	0.50	0.07
4605	Baltic herring spring	0.12	0.01	0.40	0.03	0.09	0.54	0.03	0.01	0.03
2468	Tilapia	0.03	0.00	0.24	0.06	0.05	0.33	0.02	0.00	0.01
1246	Cod	0.00	0.00	0.06	0.01	0.01	0.04	0.00	0.00	0.00
1345	Fish balls w lobster sauce canned prepared	0.08	0.01	0.32	0.10	0.02	1.51	0.03	0.01	0.01
1294	Fish fingers breaded, fried	0.02	<LOD	0.65	0.28	0.04	5.47	0.15	0.05	0.02
4602	Fish fingers breaded oven-baked	0.02	<LOD	0.53	0.20	0.03	3.88	0.12	0.05	0.02
4609	Pickled autumn herring drained solids	0.76	0.05	1.49	0.11	0.57	1.37	1.18	1.79	0.09
4608	Pickled herring drained solids	0.78	0.05	1.46	0.11	0.56	1.37	1.34	2.03	0.1
4601	Salmon fish balls w sauce prepared	0.21	0.02	0.74	0.21	0.15	2.55	0.21	0.17	0.02
1298	Stockfish ling treated w lye boiled	0.00	0.00	0.06	0.02	0.01	0.05	0.01	0.00	0.00
1296	Mackerel fillets canned in tomato sauce	0.72	0.05	1.43	0.26	0.41	2.05	1.12	1.86	0.11
4610	Pickled herring mustard sauce drained solids	0.47	0.03	1.23	0.23	0.32	6.41	1.02	1.44	0.09
1297	Baltic herring fermented	0.09	0.01	0.48	0.04	0.31	0.67	0.06	0.02	0.04
1275	Tuna canned in oil drained solids	0.02	0.01	0.66	0.34	0.03	2.34	0.02	0.00	<LOD
1278	Tuna canned in water drained solids	0.01	0.01	0.14	0.06	0.02	0.08	0.00	0.00	0.00
1385	Blue mussel boiled drained solids	0.05	0.01	0.34	0.05	0.19	0.24	0.07	0.00	0.01
1394	Crayfish freshwater	0.01	0.00	0.09	0.03	0.04	0.11	0.01	0.00	<LOD
4600	Scallop	0.01	0.00	0.06	0.02	0.01	0.03	0.01	0.00	0.00
1395	Shrimps	0.01	0.00	0.07	0.01	0.04	0.08	0.02	0.02	0.00

<LOD – below limit of detection (0.03 g/100 g fatty acids)

Table 3c. Polyunsaturated fatty acids for which at least one food item contained above 0.1 gram per 100 gram. Content gram per 100 gram edible part

Food nr	Food name	18:2cis n6	18:2	18:3n3	18:3[1]	18:4n3	20:4n3	20:4[1]	20:5n3	22:5n3	22:5[1]	22:6n3
4585	Alaska pollock autumn	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.07	0.00	0.01	0.11
4559	Alaska pollock spring	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.07	0.01	0.01	0.11
4612	Gilt headed bream	0.92	0.97	0.22	0.23	0.10	0.10	0.16	0.60	0.33	0.35	0.86
4613	Sea bass	0.56	0.58	0.14	0.15	0.05	0.04	0.07	0.30	0.12	0.13	0.49
4586	Hoki	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.01	0.01	0.10
4611	Cape hake	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.01	0.01	0.10
4226	Striped catfish	0.07	0.07	0.00	0.01	<LOQ	0.00	0.02	0.00	0.00	0.01	0.01
1250	Pink salmon	0.02	0.02	0.01	0.02	0.04	0.02	0.03	0.11	0.03	0.03	0.25
1244	Arctic char	0.36	0.39	0.13	0.15	0.14	0.07	0.11	0.48	0.13	0.14	0.83
1202	Saithe	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.00	0.01	0.14
4604	Herring autumn	0.34	0.36	0.30	0.32	0.52	0.11	0.16	0.78	0.10	0.13	1.67
4603	Herring spring	0.03	0.04	0.02	0.02	0.02	0.01	0.02	0.07	0.01	0.02	0.16
4607	Sprat	0.26	0.27	0.20	0.21	0.12	0.03	0.08	0.48	0.04	0.06	0.84
4606	Baltic herring autumn	0.17	0.17	0.13	0.14	0.14	0.04	0.07	0.43	0.04	0.05	0.82
4605	Baltic herring spring	0.10	0.10	0.04	0.04	0.03	0.01	0.02	0.10	0.01	0.01	0.19
2468	Tilapia	0.17	0.18	0.02	0.03	0.00	0.00	0.02	0.00	0.01	0.02	0.02
1246	Cod	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.03	0.00	0.01	0.15
1345	Fish balls w lobster sauce canned prepared	0.50	0.51	0.26	0.27	0.00	<LOD	<LOD	0.01	<LOD	<LOD	0.03
1294	Fish fingers breaded, fried	3.06	3.08	0.73	0.78	0.01	<LOD	0.02	0.06	0.01	0.01	0.12
4602	Fish fingers breaded oven-baked	2.49	2.51	0.43	0.47	0.01	0.01	0.02	0.06	0.01	0.01	0.13
4609	Pickled autumn herring drained solids	0.14	0.17	0.11	0.14	0.32	0.06	0.09	0.81	0.06	0.08	1.05
4608	Pickled herring drained solids	0.14	0.17	0.11	0.13	0.26	0.05	0.09	0.69	0.06	0.07	0.87
4601	Salmon fish balls w sauce prepared	0.81	0.87	0.38	0.41	0.03	0.04	0.05	0.17	0.08	0.08	0.25
1298	Stockfish ling treated w lye boiled	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.01	0.11
1296	Mackerel fillets canned in tomato sauce	0.51	0.54	0.31	0.36	0.49	0.12	0.16	0.69	0.13	0.17	1.26
4610	Pickled herring mustard sauce drained solids	2.07	2.08	1.09	1.16	0.14	0.03	0.05	0.39	0.04	0.04	0.53
1297	Baltic herring fermented	0.14	0.15	0.04	0.05	0.03	0.03	0.05	0.14	0.03	0.03	0.24
1275	Tuna canned in oil drained solids	4.91	4.95	0.03	0.03	0.01	<LOD	0.02	0.03	0.01	0.03	0.22
1278	Tuna canned in water drained solids	0.01	0.01	0.00	0.01	0.00	0.00	0.02	0.03	0.01	0.03	0.20
1385	Blue mussel boiled drained solids	0.10	0.11	0.05	0.06	0.06	0.01	0.03	0.42	0.02	0.03	0.27
1394	Crayfish freshwater	0.06	0.06	0.03	0.03	0.00	0.00	0.03	0.06	0.00	0.01	0.02
4600	Scallop	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.07	0.00	0.01	0.09
1395	Shrimps	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.09	0.00	0.00	0.06

[1] Calculated from analysed values;
<LOD – below limit of detection (0.03 g/100 g fatty acids); <LOQ - below limit of quantification (0.05 g/100 g fatty acids)

Appendix III, results nutritional values

Table 4a. Fat-soluble vitamins: retinolequivalents, trans-retinol and carotenoids. Content in microgram per 100 gram edible part

Food nr	Food name	Retinolequivalents[1]	Trans-retinol	α-carotene	ß-carotene	Lycopene	ß-cryptoxanhtin	Lutein	Zeaxanthin
4585	Alaska pollock, autumn	4.5	4.5	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
4559	Alaska pollock, spring	5.6	5.6	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
4612	Gilt headed bream	30.6	30.6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
4613	Sea bass	23.9	23.9	<LOD	<LOD	<LOD	<LOD	<LOD	3
4586	Hoki	3.8	3.8	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
4611	Cape hake	3.1	3.1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
4226	Striped catfish	0	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
1250	Pink salmon	6.9	6.9	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
1244	Arctic char	18	18.0	<LOD	<LOD	<LOD	<LOD	2	8
1202	Saithe	3.4	3.4	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
4604	Herring autumn	9.4	9.4	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
4603	Herring spring	3.3	3.3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
4607	Sprat	**276**	276	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
4606	Baltic herring autumn	4.3	4.3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
4605	Baltic herring spring	29.5	29.5	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
2468	Tilapia	1.0	1.0	<LOD	<LOD	<LOD	<LOD	<LOD	4
1246	Cod	2.3	2.3	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
1345	Fish balls w lobster sauce canned prepared	18.9	16.7	<LOD	22	233	9	4	14
1294	Fish fingers breaded, fried	54.3	50.4	<LOD	40	<LOD	14	20	8
4602	Fish fingers breaded oven-baked	20.1	17.9	<LOD	20	<LOD	14	21	10
4609	Pickled autumn herring drained solids	14.2	14.2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
4608	Pickled herring drained solids	11.8	11.8	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
4601	Salmon fish balls w sauce prepared	22.5	19.8	5	30	696	<LOD	20	3
1298	Stockfish ling treated w lye boiled	0	<LOD	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1296	Mackerel fillets canned in tomato sauce	35.9	22.5	<LOD	161	7410	<LOD	31	<LOD
4610	Pickled herring mustard sauce drained solids	18.5	8.2	<LOD	124	<LOD	<LOD	6	<LOD
1297	Baltic herring fermented	6	6.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1275	Tuna canned in oil drained solids	5.9	5.9	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
1278	Tuna canned in water drained solids	7.6	7.6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
1385	Blue mussel boiled drained solids	66.5	61.4	34	44	<LOD	<LOD	56	<LOD
1394	Crayfish freshwater	10.9	<LOD	9	126	<LOD	<LOD	6	6
4600	Scallop	1.1	1.1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
1395	Shrimps	0	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD

[1] Calculated from analysed values

Fat - the food item may be classified as a source of that particular vitamin (14, 15)

n.a. – not analysed

<LOD – below limit of detection (trans-retinol: 1 µg/100 g; carotenoids 2 µg/100 g)

Table 4b. Fat-soluble vitamins: Vitamin D, tocopherols (vitamin E) and vitamin K. Content per 100 gram edible part

Food nr	Food name	Vitamin D_3 µg	α-tocopherol mg	ß-tocopherol mg	γ-tocopherol mg	δ-tocopherol mg	Vitamin K_1 µg	Vitamin K_2 µg
4585	Alaska pollock autumn	<LOQ	0.89	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
4559	Alaska pollock spring	<LOQ	0.87	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
4612	Gilt headed bream	**6.9**	1.41	<LOQ	0.09	<LOQ	<LOQ	1.3
4613	Sea bass	**4.7**	1.59	0.01	0.18	<LOQ	<LOQ	1.9
4586	Hoki	0.2	0.32	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
4611	Cape hake	0.4	0.21	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
4226	Striped catfish	<LOQ	0.21	<LOQ	0.06	<LOQ	<LOQ	<LOQ
1250	Pink salmon	**8.2**	0.35	<LOQ	0.01	<LOQ	<LOQ	<LOQ
1244	Arctic char	**5.8**	1.59	0.01	0.09	<LOQ	<LOQ	3.5
1202	Saithe	0.2	0.92	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
4604	Herring autumn	**7.2**	1.09	<LOQ	0.01	<LOQ	<LOQ	0.6
4603	Herring spring	**4.4**	0.33	<LOQ	<LOQ	<LOQ	<LOQ	0.3
4607	Sprat	**20.3**	0.76	<LOQ	0.01	<LOQ	1.3	0.8
4606	Baltic herring autumn	**9.4**	1.14	<LOQ	0.01	<LOQ	<LOQ	<LOQ
4605	Baltic herring spring	**7.0**	0.54	<LOQ	<LOQ	<LOQ	0.3	<LOQ
2468	Tilapia	**24.3**	0.68	0.01	0.15	<LOQ	1.3	0.4
1246	Cod	**1.8**	0.67	0.08	<LOQ	<LOQ	<LOQ	<LOQ
1345	Fish balls w lobster sauce canned prepared	0.2	0.94	0.05	1.16	0.04	4.2	0.3
1294	Fish fingers breaded, fried	**0.9**	**3.76**	0.18	2.47	0.10	8.1	<LOQ
4602	Fish fingers breaded oven-baked	0.3	**3.91**	0.18	1.53	0.08	6.2	<LOQ
4609	Pickled autumn herring drained solids	**10.1**	0.49	<LOQ	<LOQ	<LOQ	0.3	0.3
4608	Pickled herring drained solids	**12.3**	0.60	<LOQ	<LOQ	<LOQ	<LOQ	0.3
4601	Salmon fish balls w sauce prepared	**1.2**	1.39	0.04	1.10	0.03	4.6	1.6
1298	Stockfish ling treated w lye boiled	0.1	0.09	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
1296	Mackerel fillets canned in tomato sauce	**1.4**	**2.29**	0.03	0.58	0.02	5.1	<LOQ
4610	Pickled herring mustard sauce drained solids	**11.4**	**4.01**	<LOQ	3.92	0.09	**11**	**0.5**
1297	Baltic herring fermented	**5.9**	**4.19**	0.01	0.01	<LOQ	1.6	<LOQ
1275	Tuna canned in oil drained solids	**4.4**	**5.46**	0.28	0.23	0.07	1.3	0.4
1278	Tuna canned in water drained solids	**4.2**	0.36	0.03	<LOQ	<LOQ	<LOQ	0.6
1385	Blue mussel boiled drained solids	<LOQ	**3.07**	0.08	0.17	0.30	2.3	3.6
1394	Crayfish freshwater	<LOQ	**2.04**	0.02	0.14	0.01	2.2	<LOQ
4600	Scallop	<LOQ	0.73	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ
1395	Shrimps	<LOQ	**3.93**	<LOQ	0.01	<LOQ	<LOQ	<LOQ

Fat - the food item may be classified as a source of that particular vitamin (14, 15)
n.a. – not analysed
<LOQ – below limit of detection (Vitamin D_3: 0.1 µg/100 g; tocopherols 6-8 µg/100 g; vitamin K_1 and K_2: 0.3 µg)

Table 5. Water-soluble vitamins. Content per 100 gram edible part

Food nr	Food name	Thiamin mg	Riboflavin mg	Niacin mg	Niacin-equvalents[1]	Vitamin B_6 mg	Vitamin B_{12} µg	Folate µg
4585	Alaska pollock, autumn	0.07	0.07	0.9	4.1	0.06	**1.8**	n.a.
4559	Alaska pollock, spring	0.06	0.07	0.8	3.9	0.06	**1.7**	n.a.
4612	Gilt headed bream	**0.26**	0.13	**6.1**	9.5	**0.42**	**3.4**	n.a.
4613	Sea bass	**0.38**	0.14	**5.0**	8.5	**0.37**	**3.1**	n.a.
4586	Hoki	0.03	0.03	1.6	4.6	0.09	**0.5**	n.a.
4611	Cape hake	0.05	0.03	1.4	4.5	0.08	**1.0**	13
4226	Striped catfish	0.02	0.03	2.0	4.4	0.12	0.4	8
1250	Pink salmon	**0.24**	0.11	**6.4**	10.3	**0.45**	**2.3**	n.a.
1244	Arctic char	0.11	0.09	**6.0**	9.6	**0.47**	**1.8**	n.a.
1202	Saithe	0.11	0.16	2.3	5.8	**0.21**	**3.2**	n.a.
4604	Herring autumn	<LOD	**0.22**	**5.8**	8.7	**0.31**	**8.7**	n.a.
4603	Herring spring	<LOD	**0.20**	**4.1**	7.3	**0.28**	**8.9**	n.a.
4607	Sprat	<LOQ	0.15	**4.4**	7.6	**0.27**	**10.4**	n.a.
4606	Baltic herring autumn	0.01	0.18	**4.3**	7.4	**0.26**	**8.6**	n.a.
4605	Baltic herring spring	0.01	0.16	**3.2**	6.7	**0.21**	**10.0**	18
2468	Tilapia	0.05	0.05	**4.0**	7.2	0.18	**1.1**	n.a.
1246	Cod	0.05	0.05	2.2	5.5	0.14	**1.4**	n.a.
1345	Fish balls w lobster sauce canned prepared	<LOQ	0.05	0.6	1.5	<LOQ	0.3	2
1294	Fish fingers breaded, fried	0.09	0.07	1.2	3.3	0.06	**1.3**	n.a.
4602	Fish fingers breaded oven-baked	0.10	0.07	1.3	3.6	0.07	**1.1**	n.a.
4609	Pickled autumn herring drained solids	<LOD	0.08	1.0	3.2	0.07	**6.1**	n.a.
4608	Pickled herring drained solids	<LOD	0.09	1.1	2.8	0.06	**7.4**	<LOQ
4601	Salmon fish balls w sauce prepared	0.02	0.06	1.1	2.0	0.04	0.3	n.a.
1298	Stockfish ling treated w lye boiled	<LOD	<LOD	<LOD	1.1	<LOD	<LOQ	<LOD
1296	Mackerel fillets canned in tomato sauce	0.05	**0.20**	**5.9**	8.0	**0.29**	**5.4**	n.a.
4610	Pickled herring mustard sauce drained solids	<LOD	0.11	1.3	2.7	0.07	**5.9**	n.a.
1297	Baltic herring fermented	<LOD	0.16	1.3	3.5	0.06	**4.5**	19
1275	Tuna canned in oil drained solids	0.01	0.09	**13.5**	18.1	**0.65**	**2.7**	n.a.
1278	Tuna canned in water drained solids	0.01	0.08	**12.1**	16.5	**0.49**	**2.5**	n.a.
1385	Blue mussel boiled drained solids	0.04	**0.43**	2.0	5.3	0.09	**7.9**	n.a.
1394	Crayfish freshwater	0.04	0.12	1.6	4.4	0.03	**3.6**	n.a.
4600	Scallop	<LOD	<LOQ	0.5	2.2	0.04	**0.6**	n.a.
1395	Shrimps	0.04	<LOQ	1.0	4.2	0.04	**3.5**	n.a.

[1] Calculated from analysed values; **Fat** - the food item may be classified as a source of that particular vitamin (14, 15); n.a. – not analysed
<LOD – below limit of detection (thiamin: 0.005 mg/100 g; riboflavin: 0.026 mg/100 g; niacin: 0.027 mg/100 g; vitamin B_6: 0.007 mg/100 g; vitamin B_{12}: 0.04 µg/100 g; folate: 0.80 µg/100 g)
<LOQ - below limit of quantification (thiamin: 0.006 mg/100 g; riboflavin: 0.029 mg/100 g; niacin: 0.05 mg/100 g; vitamin B_6: 0.003 mg/100 g; vitamin B_{12}: 0.12 µg/100 g; folate: 2.0 µg/100 g)

Table 6a. Minerals: P, Fe, Ca, K, Cu, Mg, Mn, Mo, Na, NaCl, Zn. Content per 100 gram edible part

Food nr	Food name	P mg	Fe mg	Ca mg	K mg	Cu mg	Mg mg	Mn mg	Mo mg	Na mg	NaCl[1] g	Zn mg
4585	Alaska pollock autumn	**168**	0.19	21	255	0.03	27	0.01	1	142	0.36	0.42
4559	Alaska pollock, spring	**134**	0.19	28	192	0.03	26	0.00	3	*104*	0.26	0.44
4612	Gilt headed bream	**261**	0.23	17	**421**	0.04	31	0.01	2	*60*	0.15	0.46
4613	Sea bass	**233**	0.27	32	**368**	0.04	30	0.01	2	*63*	0.16	0.54
4586	Hoki	**173**	0.11	11	**315**	0.01	29	0.01	1	134	0.34	0.27
4611	Cape hake	**176**	0.14	13	**342**	0.02	34	0.01	2	144	0.36	0.28
4226	Striped catfish	**208**	0.09	9	235	0.01	20	0.01	1	318	0.80	0.29
1250	Pink salmon	**263**	0.30	11	**365**	0.04	30	0.01	2	*49*	0.12	0.40
1244	Arctic char	**250**	0.20	14	**379**	0.05	27	0.01	2	*46*	0.12	0.57
1202	Saithe	**240**	0.26	12	**420**	0.06	31	0.01	2	*66*	0.17	0.61
4604	Herring autumn	**248**	0.67	44	225	0.09	34	0.04	3	192	0.48	1.30
4603	Herring spring	**305**	0.57	68	**444**	0.09	39	0.06	3	205	0.51	**1.53**
4607	Sprat	**381**	1.65	**157**	246	0.08	31	0.18	**12**	*68*	0.17	**2.71**
4606	Baltic herring autumn	**263**	0.59	68	**356**	0.07	32	0.06	5	*64*	0.16	**1.57**
4605	Baltic herring spring	**291**	0.98	77	**463**	0.07	33	0.05	3	*68*	0.17	**1.95**
2468	Tilapia	**181**	0.16	18	**353**	0.02	28	0.01	2	*27*	0.07	0.34
1246	Cod	**217**	0.12	12	**402**	0.04	27	0.01	2	*59*	0.15	0.60
1345	Fish balls w lobster sauce canned prepared	57	0.10	28	86	0.02	9	0.02	3	492	1.23	0.33
1294	Fish fingers breaded, fried	**140**	0.32	19	225	0.05	28	0.12	7	452	1.13	0.49
4602	Fish fingers breaded oven-baked	**143**	0.38	18	145	0.06	30	0.14	7	419	1.05	0.57
4609	Pickled autumn herring drained solids	68	0.57	17	62	0.10	13	0.07	3	1083	2.71	0.35
4608	Pickled herring drained solids	66	0.58	19	61	0.11	14	**0.37**	2	1175	2.94	0.39
4601	Salmon fish balls w sauce prepared	33	0.16	18	53	0.02	9	0.02	3	312	0.78	0.45
1298	Stockfish ling treated w lye boiled	24	0.18	**129**	4	0.01	12	0.01	4	*30*	0.08	0.16
1296	Mackerel fillets canned in tomato sauce	**141**	0.83	24	**423**	0.11	32	0.05	9	368	0.92	0.93
4610	Pickled herring mustard sauce drained solids	69	0.57	25	70	0.07	19	0.06	3	1207	3.02	0.44
1297	Baltic herring fermented	**159**	0.67	89	159	0.06	11	0.04	3	3523	8.81	**1.81**
1275	Tuna canned in oil drained solids	**224**	0.84	17	230	0.06	32	0.01	2	406	1.02	0.83
1278	Tuna canned in water drained solids	**206**	1.28	15	220	0.06	28	0.01	2	384	0.96	0.93
1385	Blue mussel boiled drained solids	**393**	**4.16**	66	120	**0.21**	**60**	0.25	**18**	273	0.68	**2.88**
1394	Crayfish freshwater	**148**	0.75	78	148	**0.89**	28	**0.31**	4	893	2.23	**2.06**
4600	Scallop	**467**	0.21	4	113	0.02	18	0.01	3	552	1.38	0.77
1395	Shrimps	**147**	0.22	21	88	0.36	37	0.02	3	630	1.58	1.12

[1] Estimated from analysed values (NaCl is estimated as Na (mg) * 2.5 / 1000)

Italic – the food item may be classified as having low salt content; **Fat** - the food item may be classified as a source of that particular mineral (14, 15)

Appendix III, results nutritional values

Table 6b. Minerals: I, Se, Co, Cr, Ni, Pb, Cd. Content in microgram per 100 gram edible part

Food nr	Food name	I	Se	Co	Cr	Ni	Pb	Cd
4585	Alaska pollock autumn	**49**	**19.4**	0.1	2.2	5.0	0.6	0.3
4559	Alaska pollock spring	**38**	**18.6**	0.1	b.d.	4.5	0.3	0.3
4612	Gilt headed bream	**24**	**16.0**	0.6	1.4	0.0	2.1	u.d.
4613	Sea bass	19	**15.9**	0.3	1.3	0.0	1.2	u.d.
4586	Hoki	4	**42.6**	b.d.	b.d.	3.5	0.7	u.d.
4611	Cape hake	8	**22.1**	b.d.	2.2	0.0	0.9	u.d.
4226	Striped catfish	2	**12.7**	0.1	1.4	0.0	0.4	u.d.
1250	Pink salmon	19	**26.0**	0.1	b.d.	0.0	0.5	u.d.
1244	Arctic char	20	**21.8**	0.1	b.d.	5.3	2.4	u.d.
1202	Pollock	**130**	**27.6**	0.2	b.d.	6.1	1.6	u.d.
4604	Herring autumn	**51**	**25.8**	0.5	1.1	0.0	u.d.	u.d.
4603	Herring spring	**32**	**24.7**	0.4	b.d.	5.2	3.9	u.d.
4607	Sprat	**59**	**22.6**	0.5	0.9	6.0	1.3	2.5
4606	Baltic herring autumn	**34**	**23.1**	0.4	b.d.	4.8	u.d.	u.d.
4605	Baltic herring spring	**25**	**28.3**	0.5	1.5	6.7	u.d.	1.1
2468	Tilapia	4	**27.8**	0.2	0.9	0.0	0.7	u.d.
1246	Cod	**180**	**27.3**	0.1	b.d.	6.6	8.6	u.d.
1345	Fish balls w lobster sauce canned prepared	**28**	**9.3**	0.1	1.1	4.2	u.d.	u.d.
1294	Fish fingers breaded, fried	**34**	**13.0**	0.3	**6.7**	7.5	u.d.	0.4
4602	Fish fingers breaded oven-baked	**55**	**14.3**	0.3	**9.3**	9.1	u.d.	0.4
4609	Pickled autumn herring drained solids	**64**	**14.1**	0.4	1.6	6.1	3.7	0.3
4608	Pickled herring drained solids	**57**	14.2	0.5	b.d.	6.2	1.2	0.2
4601	Salmon fish balls w sauce prepared	30	6.5	0.2	2.6	5.5	u.d.	0.1
1298	Stockfish ling treated w lye boiled	2	**12.3**	b.d.	b.d.	0.0	0.4	u.d.
1296	Mackerel fillets canned in tomato sauce	**36**	**19.9**	0.5	4	5.4	0.3	1.0
4610	Pickled herring mustard sauce drained solids	**33**	**12.6**	0.4	1.1	6.5	1.2	0.3
1297	Baltic herring fermented	17	**10.8**	0.3	1	6.0	1.3	0.7
1275	Tuna canned in oil drained solids	**26**	**86.6**	0.2	1.1	3.9	u.d.	1.7
1278	Tuna canned in water drained solids	**26**	**77.0**	0.2	1.1	4.1	u.d.	1.8
1385	Blue mussel boiled drained solids	N	**68.1**	9.4	**11.1**	27.1	18.2	12.0
1394	Crayfish freshwater	**77**	**18**	3.3	1.4	11.8	1.7	1.3
4600	Scallop	4	**9.7**	0.1	1.5	6.0	1.2	2.7
1395	Shrimps	20	**23**	1.7	1.2	9.3	20.1	26.1

Fat - the food item may be classified as a source of that particular vitamin (14, 15)

N – unknown

b.d. – below limit of detection (Co: 0,1 µg/100 g; Ni: 3,3 µg/100 g; Cr: 0,8 µg/100 g; Pb: 0,2 µg/100 g; Cd: 0,1 µg/100 g)

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