NIFES

NASJONALT INSTITUTT FOR ERNÆRINGS- OG SJØMATFORSKNING

Rapport

2017

# MONITORING PROGRAMME FOR VETERINARY CONTROL ON SEAFOOD PRODUCTS IMPORTED TO NORWAY FROM THIRD COUNTRIES

**In accordance with Commission Regulation (EC) No 136/2004, Annex II, Part 1.**

## RESULTS FROM 2016

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# 1. Summary

This report summarises results from 2016 from the ongoing monitoring programme for veterinary border control. The programme focus on seafood products imported to Norway from countries outside the European Economic Zone. The National Institute of Nutrition and Seafood Research (NIFES) carried out the analytical work on behalf of the Norwegian Food Safety Authority (NFSA), in cooperation with the personnel at the Norwegian Border Inspection Posts (BIP). We want to thank NFSA for very good cooperation during the conduct of this monitoring programme. An up to date risk assessment for different groups of imported products basis for the sampling plans and the selection of analytical activities. The current trend of hazards, as reported in The Rapid Alert System for Food and Feed (RASFF) notification system, the compositional nature of the products and the annual import quantity of relevant products, are evaluated in this risk assessment. During 2016, 131 samples from BIPs were examined at for chemical, biological and/or microbiological undesirables. The analytical results are listed in Annex 1 and summarized below.

Microbiological analyses were made on 130 of the samples. The results for microbiological quality parameters and indicator organisms for faecal contamination generally showed low bacterial counts, with some exceptions. One sample of yellowfin tuna imported from Sri Lanka had a general plate count of 1.5 x $10^7$/g and a count of 1.0 x $10^7$ hydrogen sulphide ($H_2S$) -producing bacteria. Enterococci in a concentration of 2200 colony-forming unit (cfu)/g was found in a sample of whiteleg shrimp imported from India.

Seventy-five samples were analysed for *L. monocytogenes* during 2016, and the bacterium was detected qualitatively in five samples; in one sample of yellowfin tuna imported from Maldives, and in one sample each of Mangrove red snapper, barramundi, Indian anchovy and white sardinella, all of which were imported from Sri Lanka. In all five samples, the concentration was under 10 *L. monocytogenes* per gram.

Pathogens in the genera *Salmonella* were not detected in any of the samples, however non-pandemic *Vibrio cholera* (non 0:1/non 0:139) was found in one sample of whiteleg shrimp imported from Vietnam. Parasitological examinations were carried out on 68 fish samples, and nematodes were found in 21 samples (31 %). The nematodes were dead and thus not infective at the time of analysis. The highest numbers of nematodes were found in two samples of Greenland halibut imported from Russia, with 23 and 35 detected nematodes.

Twelve samples originating from global aquaculture were analysed for residues of selected prohibited pharmaceuticals. The programme included the dye compounds crystal violet, leuco crystal violet, malachite green, leuco malachite green and brilliant green, and also the antibacterial agents chloramphenicol and nitrofurane metabolites. In one sample of Yellowtail imported from Australia, leuco crystal violet (LCV) was detected (0.13 µg/kg). In another sample of Yellowtail imported from Australia, leuco malachite green (LMG) was detected (0.16

µg/kg). These dyes are not allowed to be used for food producing animals. No residues of the antibacterial agents chloramphenicol and nitrofurane metabolites were detected.
Twenty-nine samples were examined for one or more of the indicators for rancidity and spoilage. One sample of Tuna muscle from Vietnam were found non-compliant with regards to a high TVB-N (total volatile basic nitrogen) level (above 25 mg/100g, which is the general maximum level). It should be noted that this regulation specify that TVB-N analysis should be combined with organoleptic evaluation before a rejection can be done. There are no maximum level for TBARS and histamine, but high TBARS levels specifically indicate lipid peroxidation. The highest TBARS value was found in a sample of white tinned sardinella from Sri Lanka (192 nmol/g ww). TBARS values above 25 nmol/g ww in salmon fillets are considered rancid. In addition, seven oil samples were assayed for verification of the authenticity of their labelled content by fatty acid and sterol composition evaluations. The measured data were in agreement with the labelled content.

Samples were analysed for dioxins (PCDDs), furans (PCDFs), dioxin-like PCBs (DLPCBs), non-dioxin-like PCBs ($PCB_6$ or “indicator” PCBs), polybrominated flame-retardants (PBDEs), chlorinated pesticides, PAHs and the heavy metals cadmium, mercury, lead and arsenic. Only one fish oil sample imported from Turkey was classified as non-compliant with levels of sum dioxins (2.5 pg/g TEQ) and sum total TEQ (9.0 pg/g) exceeding the regulatory maximum levels given for seafood.

## 2. Introduction

As a member of the European Economic Area (EEA), Norway is obliged to monitor the conformity of products imported to the EEA area. A part of this activity is the analytical examination of seafood with respect to microorganisms, parasites and the presence of undesirable substances. The Norwegian Food Safety Authority (NFSA) is the competent authority regarding this veterinary border control in Norway. On behalf of NFSA, NIFES have carried out the analytical examination of the seafood samples in this monitoring programme and elaborated this report.

## 3. Materials and methods

Sampling was carried out by NFSA and the analytical examinations and the writing of this report was conducted by NIFES. The activity and plans target the potentially most potent hazards associated with each kind of imported product. The assessment was based on the compositional nature of the products, on the results from previous monitoring, on the geographical origin of the samples, and on the information available in the RASFF (Rapid Alert System for Food and Feed). This report concerns samples imported in 2016.

At the Border Inspection Posts (BIPs), the staff of NFSA selected samples according to a sampling plan. The samples were then stored frozen in the BIPs until shipment in the frozen state to NIFES for analysis. Upon arrival, samples were registered at the NIFES sample reception unit, each sample photographed, and relevant information registered in a Laboratory Information Management System (LIMS). The microbiological assay was carried out prior to other sample handling. The sample was then further prepared for analyses and split in sub-samples (aliquots) for the different assays and analytical methods.

In general, the edible part of food samples, usually the muscle, was selected for analyses. For species where a legal maximum level was defined, the tissue specified in the regulation was applied. The analytical methods and procedures used were accredited according to the ISO 17025 standard, unless otherwise specified. A summary of the chemical analytical methods, accreditation status and their performance data are listed in Annex 2. If further information regarding the methods is required, please contact NIFES. The pesticides and PAH determinations were in 2016 carried out by Eurofins (www.eurofins.no).

In analytical chemistry, a fixed value of LOQ is most common. However, for the environmental pollutants covered in this report, a sample-specific LOQ values was used rather than a fixed value.

# 4. Results and discussion

A total of 131 samples from the NFSA at Norwegian Border Inspection Post (BIP), have been examined by a selection of methods for microorganisms, parasites and undesirable chemical compounds.

## 4.1. Microbiology

The detailed results from the microbiological examinations are listed in Annex 1 (Table 1) and a total of 130 samples were examined for microorganisms by a range of assays.

The aerobic plate counts on non-selective agar growth media, incubated at 30°C, showed that six of the 56 examined samples (11 %) had plate counts above 1000 cfu/g. The highest count was 1.5 x $10^5$/g in a sample of surimi of Alaska pollock imported from Korea.

Sixty-seven of the 74 examined samples (91 %) had general plate counts at 20°C above 1000 cfu/g. There is no internationally accepted microbiological guideline for this parameter. The highest count was 1.5 x $10^7$/g in a sample of yellowfin tuna imported from Sri Lanka. This sample also had a count of 1.0 x $10^7$ $H_2S$-producing bacteria, however no indicator organisms or pathogens were detected.

The number of $H_2S$-producing bacteria ($H_2SPB$) at 20°C incubation was generally low in most examined samples. Ten of the 74 examined samples (14 %) had > 1000 cfu/g $H_2SPB$. The highest number (1.5 x $10^7$ cfu/g) was found in the above mentioned yellowfin tuna sample from Sri Lanka.

One sample of marine bivalves was examined by the Donovan method specified by EU for examination of *E. coli* in bivalves. This was a sample of Pacific oyster from Korea, had a number of *E. coli* by the Donovan MPN method of 45 bacteria/100 gram sample material (result not shown in Table 1).

Eighty-two samples were analysed for coliforms by an agar plate assay, and nine samples (11 %) had numbers of 10 cfu/g or more. The highest counts were 100 coliforms/g in a sample of haddock imported from China and in a sample of swordfish from Sri Lanka. The latter also had high numbers of general plate counts (2.1 x $10^6$ cfu/g) and $H_2S$-producing bacteria (1.7 x $10^5$ cfu/g).

Most results for determination of thermotolerant coliform bacteria (TCB) in 98 samples examined by agar plate assay were under the limit of detection of 10 cfu/g. However, one sample had a higher concentration where 60 TCB/g were found in a sample of pangasius imported from Vietnam.

The number of *Staphylococcus aureus*, anaerobic sulphite-reducing bacteria and bacteria in the family Enterobacteriaceae, were generally under their respective levels of detection in examined samples. However, one sample of freeze-dried *Acetes* spp. from Thailand had counts of sulphite-reducing bacteria of 700 cfu/g. The sample high plate count of this sample was 4.0 x $10^3$ cfu/g. Further, one sample of Alaska Pollock from Korea had Enterobacteriaceae counts of 200 cfu/g, and with a high plate count, reaching 1.5 x $10^5$ cfu/g.

For enterococci, five of 82 examined samples were above the detection limit of 100 cfu/g. The highest number of enterococci was 2200 cfu/g in a sample of whiteleg shrimp imported from India.

Seventy-five samples were analysed for *L. monocytogenes* during 2016, and the bacterium was detected qualitatively in five samples; in one sample of yellowfin tuna imported from Maldives, and in one sample each of Mangrove red snapper, barramundi, Indian anchovy and white sardinella, all of which were imported from Sri Lanka. In all five samples, the concentration was under 10 *L. monocytogenes* per gram.

Pathogens in the genus *Vibrio* (12 samples analysed) were detected in one sample of whiteleg shrimp (2016-769/1) imported from Vietnam. The bacterial culture was identified as *Vibrio cholera* and was sent to the Norwegian Institute of Public Health for typing. The isolate was of the non-pandemic serotype (non 0:1/non 0:139). The evaluation of toxin production genes was based on multiplex PCR, which includes the genes for choleratoxin; ctxA, zot, and ace. The isolate was negative for all three toxin-production genes. Pathogens in the genus *Salmonella* (103 samples) were not detected in any of the samples analysed during 2016.

### 4.2. Parasites

Parasitological examinations were carried out on 68 fish samples (Annex 1, Table 2), and nematodes were found in 21 of them (31 %). The fish were imported in the frozen stage. Thus, the nematodes were dead and not infective at the time of analysis. However, allergic symptoms may be triggered in sensitive individuals also from dead nematodes. The highest numbers of nematodes were found in three samples of marine fish imported from Russia; two samples of Greenland halibut with 23 and 35 nematodes, and one sample of rose fish with 14 nematodes.

### 4.3. Drug residues and dyes

Twelve samples originating from aquaculture were analysed for residues of prohibited veterinary medicines (unauthorized dyes and antibacterial agents) in 2016. The programme included the dye compounds crystal violet (CV), leuco crystal violet (LCV), malachite green (MG), leuco malachite green (LMG), brilliant green (BG) and the antibacterial agents chloramphenicol and nitrofurane metabolites. In one sample of Yellowtail imported from Australia, leuco crystal violet (LCV) was detected in a concentration of 0.13 µg/kg. In another sample of Yellowtail imported from Australia, leuco malachite green (LMG) was detected in a concentration of 0.16 µg/kg. According to directive 96/23, these dyes are not allowed to be used for food producing animals[1]. Both samples were reanalysed to confirm the findings. Details are found in Table 3. No traces of chloramphenicol or nitrofurane were detected (Table 4).

### 4.4. Rancidity and chemical spoilage parameters

Chemical spoilage indicators were examined in 29 samples in 2016 (Table 5). The data included histamine (20 samples), thiobarbituric reactive substance (TBARS) (10 samples) and total volatile basic nitrogen (TVB-N) (20 samples). According to Commission Regulation 2074/2005 unprocessed fishery products shall be regarded as unfit for human consumption where organoleptic assessment has raised doubts as to their freshness and chemical checks reveal that the TVB-N limits are exceeded. The general limit for TVB-N is 25 mg of nitrogen per 100g of flesh[2]. There are no limits for TBARS and histamine, but high TBARS levels specifically indicate lipid peroxidation and high histamine levels indicate inadequately preserved and improperly refrigerated fish. The highest concentration of histamine in 2016 (10 mg/kg ww) was found in a sample of Indian anchovy from Sri Lanka. The highest TBARS value was found in a sample of white sardinella from Sri Lanka (192 nmol/g ww). TBARS values above 25 nmol/g ww in salmon fillets are considered rancid[3]. Only one sample of Tuna muscle from Vietnam had concentration of TVB-N over 25 mg/100g, which is the general limit according to Commission Regulation 2074/2005. It should be noted that this regulation specify that TVB-N analysis should be combined with organoleptic evaluation before a rejection can be done.

### 4.5. Oil authentication

Seven oil samples (five labelled as fish oil, one as birdbeak dogfish oil and one as squid oil) were assayed for authentication of their labelled content. All oils were of a grade intended for human consumption, except a fish oil from Chile (2016-710/1). The assessment was based on their fatty acid and sterol composition, as well as on the organoleptic appearance of the oils. The fatty acid composition is listed in Table 6a, and the sterol composition is listed in Table 6b. One oil declared as fish oil (not intended for human consumption) (2016-710/1) had unusually high levels of 18:1n-9 (oleic acid), 18:2n-6 (linoleic acid) and 18:3n-3 (alpha-linolenic acid) and low levels of the long chain polyunsaturated fatty acids 22:6n-3 (DHA) and 20:5n-3 (EPA). The same oil labelled as fish oil had sterol composition with high levels of cholesterol and low

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[1] Council Directive 96/23/EC of 29 April 1996 on measures to monitor certain substances and residues thereof in live animals and animal products.

[2] Commission Regulation (EC) No 1022/2008 of 17 October 2008 amending Regulation (EC) No 2074/2005 as regards the total volatile basic nitrogen (TVB-N) limits.

[3] Hamre et al (1998). Oxidative stability of Atlantic salmon (Salmo salar, L.) fillet enriched in alpha-, gamma-, and delta-tocopherol through dietary supplementation Food chemistry 62(2) 173-178.

levels of phytosterols. In summary, in agreement with the labelling, this oil was from farmed salmon, reflecting the composition of plant-based aquaculture feed. An expert evaluation found the data from each of these samples were in agreement with the labelled content, within the range of natural variability.

## 4.6. Undesirable metals

The elemental concentrations of arsenic, cadmium, lead and mercury were examined in 130 samples (Table 7). In accordance with the legal limits given in commission regulation 1881/2006[4] (Annex 3), the undesirable metals were measured in terms of their total elemental concentration as mg/kg (ww). There were no analytical details about the actual chemical speciation. The maximum levels are assigned for naturally moist samples. Some of the analysed samples were imported in a dried state. According to the legislation, for dried samples, the analytical result was then adjusted to compensate for the loss of water.

### *4.6.1. Arsenic (As)*

In seafood, arsenic is mainly present in organo-metal chemical species of low toxicity, such as arsenobetaine and arsenolipids. This character of marine foods differs from foods of terrestrial origin. In terrestrial food, toxic inorganic arsenic species give a significant contribution to the elemental arsenic concentration. In the analysed samples, the highest measured concentration of elemental arsenic was 31 mg/kg ww found in a sample of saithe, imported from China. Given the low toxicity of organically bound species of arsenic, this value gives no reason for concern. There is no EU or Norwegian upper maximum level for arsenic in fish and fishery products intended for human consumption.

### *4.6.2. Cadmium (Cd)*

Of the 130 samples analysed for cadmium, 36% were below the LOQ and no non-compliant samples were found for cadmium in 2016. The highest elemental concentration of cadmium (2.8 mg/kg dry weight basis) was found in one sample of oyster powder. The sample was a dried product, and the original moisture content was not available. Thus, a calculation of a reliable wet weight concentration was not possible. One sample of Argentine shortfin squid, imported from Argentina contained 0.46 mg cadmium / kg ww and one sample of pacific oyster contained 0.33 mg cadmium / kg ww. The regulatory maximum level for cadmium for cephalopods (*e.g.* squid, cuttlefish, octopus) and bivalves (*e.g.* clams, oysters, cockles, mussels, scallops) is 1.0 mg/kg ww. Two processed seafood products from Morocco containing tinned sardines, were both measured to 0.1 mg/kg ww. The samples were taken from processed

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[4] COMMISSION REGULATION (EC) No 1881/2006 of 19 December 2006 with amendments setting maximum levels for certain contaminants in foodstuffs

seafood products, and filet/muscle content of the sample was not available. Thus, a calculation of a reliable fillet concentration value for compliance assessment was not possible. Finally, one sample of Pacific saury from Taiwan had a concentration of cadmium of 0.09 mg/kg ww. The sample of Pacific saury were not intended for human consumption and the maximum level does not apply.

### *4.6.3. Mercury (Hg) and Lead (Pb)*

Of the analysed samples, no mercury concentration above the regulatory maximum limit was found. The two highest values, 0.66 and 0.49 mg/kg ww were found in tuna samples imported from Sri Lanka. No samples were considered non-compliant in respect to their respective maximum levels for lead. Of the 130 analysed samples, 93 (72 %) were below the measurable range for lead. The two highest concentration were a sample of oyster powder imported from New Zealand (0.63 mg/kg) and a sample of dried and salted clip fish (0.41 mg/kg). The samples were dried, and the original moisture content was unavailable. However, since the regulatory maximum level for lead in bivalves (*e.g.* clams, oysters, cockles, mussels, scallops) is 1.5 mg/kg ww and in marine fish fillet is 0.3 mg/kg ww, we can assume that their wet weight values would be below their respective maximum levels.

## 4.7. Persistent organic pollutants (POPs)

A selection of the most relevant samples were analysed for dioxins (PCDDs), furans (PCDFs), dioxin-like PCBs (DL-PCBs), non-dioxin-like PCBs ($PCB_6$ or “indicator” PCBs), polybrominated flame-retardants (PBDEs), chlorinated pesticides and PAHs. Since POPs compounds exhibit a lipophilic character, their highest levels are found in lipid rich tissues including fillets of fat-rich fish. The maximum levels are set for levels in the fillet. Examined samples were limited to fat-rich fish, giving a lower number of analysed samples compared to the number of samples assessed for heavy metals. Note that the dioxins and dioxins-like PCBs are measured in the scale pg/g TEQ (WHO-2005)[5]. TEQ values “toxic equivalency values” are weighted quantities based on the toxicity of each compound (“congener”) of the dioxin and dioxin-like compounds category relative to the most toxic congener of the category. Note also that the maximum levels are defined on the basis of the TEQ-congener sum values and not on the individual congener TEQ-values (See annex 3).

[5] Martin van den Berg et al. (2006) The 2005 World Health Organisation (WHO) Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds. Toxicological Sciences 93(2), 223-241.

#### *4.6.1. The dioxins; PCDDs, PCDFs and DL-PCBs*

Samples from eight different countries (Thailand, Turkey, Russia, Sri Lanka, Argentina, New Zealand, Chile and Vietnam) were analysed for their content of dioxins (sum of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). Dioxin-like PCBs (DL-PCBs) is the sum four non-ortho PCBs (PCB-77, PCB-88, PCB-126, PCB-169) and eight mono-ortho PCBs (PCB-105, PCB-114, PCB-118, PCB-123, PCB-156, PCB-157). The results are given in Table 8. The sums were calculated using the "upper bound" approach (UB-sum), according to the EU commission regulation 1881/2006. One fish oil imported from Turkey was classified as non-compliant with levels of sum dioxins (2.5 pg/g TEQ) and sum total TEQ (9.0 pg/g) exceeding the regulatory maximum level given for this category of seafood (see annex 3).

#### *4.6.2. The non-dioxin like PCBs*

Samples from twelve different countries, a total of 40 samples, were analysed for their content of non-dioxin like PCBs (PCB-28, PCB-52, PCB-101, PCB-138, PCB-153 and PCB-180). In contrast to the TEQ scale of the more toxic DL-PCBs, these measurements are presented with their concentrations using scale µg/kg. None of the analysed samples exceeded the regulatory maximum level. The highest value (33.8 µg/kg ww) was measured in a fish oil imported from Turkey.

#### *4.6.3. Polybrominated diphenyl ethers (PBDE)*

PBDEs are flame-retardants compounds found in plastics, textiles, electronic castings and circuitry. They are eventually released into the environment and are now found in biota and in food and feed. The data for individual PBDE congeners (PBDE-28, 47, 99, 100, 153, 154 and 183) and their UB sum (PBDE7) for the 16 samples analysed, are listed in Table 10. Currently there are no EU or Norwegian regulatory maximum level for PBDEs in marine oil or fishery products intended for human consumption. In 2011, the EFSA Panel on Contaminants in the Food Chain (CONTAM) issued a scientific opinion of PBDEs and identified effects on neurodevelopment as the critical endpoint, and derived benchmark doses (BMDs) for a number of PBDE congeners[6]. In seafood, the PBDE-47 congener is generally the main contributor to the sum PBDE and this was also the case for most of the samples analysed in 2016. There are no regulatory maximum level for the PBDEs. The CONTAM Panel concluded in 2011 that for PBDE-47, −153 and −209, current dietary exposure levels in the EU should not raise a health concern. A fish oil imported from Peru (not intended for human consumption) had the highest level of sum PBDE7 (1.1 µg/kg). The second highest value (0.53 µg/kg) was found in an oil

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[6] Scientific Opinion on Polybrominated Diphenyl Ethers (PBDEs) in Food (2011). EFSA Panel on Contaminants in the Food Chain (CONTAM). EFSA journal 9(5).

sample (birdbeak dogfish oil) imported from New Zealand (intended for human consumption). PBDE-47 (0.32 µg/kg) was the main contributor to the sum. Taking into account a realistic daily intake of fish oil and the analytical value found, this oil would not represent a health hazard.

### *4.6.4. Organochlorine pesticides*

Currently there are no EU or Norwegian regulatory maximum levels for pesticides in marine oil or fishery products intended for human consumption. However, organochlorine pesticides have a persistent and accumulating character that makes them relevant for food safety monitoring in seafood. A high number of organochlorine pesticide compounds are included in this programme and Table 11 gives a summary of data for sample groups rather than individual samples. The samples analysed in 2016 were organised into two sample groups; marine fish fillet and processed seafood products with information on the LOQ values associated with each pesticide and the number of samples below LOQ. Of the 696 individual measurements, only 61 gave values above its associated LOQ. Thus, the measured levels were low or very low in most of the analysed pesticides. The compounds with the highest measured quantity in 2016 were pp-DDE, dieldrin, HCB and toxaphene-50. The chemical compound most frequently detected above LOQ was pp DDE, with a maximum value found in a sample of Greenland halibut (*Reinhardtius hippoglossoides*) imported from Russia (1.3 µg/kg ww). In the same sample, HCB (2.1 µg/kg ww) and Toxaphene-50 (1.7 µg/kg ww) were detected above LOQ. In summary, the measured levels of organochlorine pesticide compounds in 2016 were low or very low in most of the analysed samples.

### *4.6.5. Polyaromatic hydrocarbons, PAH*

Polyaromatic hydrocarbons (PAHs) are hydrocarbons containing only carbon and hydrogen and composed of multiple aromatic rings. There are regulatory maximum levels (ML) in force for the compound benzo(a)pyrene separately and for the sum of four PAHs (PAH4) (benzo(a)antracene, chrysene, benzo(b) fluorantene, benzo(a)pyrene) in fresh bivalves (such as oyster), in oils intended for human consumption and in smoked products (Annex 3). In 2016, one imported sample of pacific oyster was analysed for 16 PAHs[7] (Table 12). The sum-PAH4 was, in accordance with the regulation, calculated in terms of the lower bound (LB) sum: only measureable values contribute to the sum. The LB sum of PAH4 in the pacific oyster sample from Korea was 2.7 µg/kg ww. Benzo(a)pyrene was below LOQ in the oyster sample.

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[7] benzo(a)antracen, chrysen, benzo(b) fluoranten, benzo(k)fluoranten, benzo(j)fluoranten, benzo(a)pyrene, indeni(1,2,3-cd) pyrene, dibenzo(a,h)antracen, benzo(ghi)perylene, dibenzo(a,l)pyrene, dibenzo(a,i)pyrene, dibenzo(a,h)pyrene, dibenzo(a,e)pyrene, cyclopenta(c,d)pyrene, 5-methylchrysene og benzo(c)fluoprene.

# 5. Conclusion

In total 131 samples, collected by the official staff at the Norwegian Border Inspection Posts of the Norwegian Food Safety Authority, were examined for selected chemical, microbiological and/or parasitological undesirables in 2016.

The results for microbiological quality parameters and indicator organisms for faecal contamination generally showed low numbers in the 130 examined samples. Five samples harboured *L. monocytogenes* in concentrations less than 10 cells/g, but no samples had pathogens in the genera *Salmonella*. One sample had non-epidemic *Vibrio cholera* (non 0:1/non 0:139).

Parasitological examinations were carried out on 68 fish samples, and nematodes were found in 21 samples (31 %). The nematodes were dead and not infective at the time of analysis.

Products originating from global aquaculture were examined for residues of selected prohibited pharmaceuticals. The programme included the dye compounds crystal violet, leuco crystal violet, malachite green, leuco malachite green and brilliant green, and also the antibacterial agents chloramphenicol and nitrofurane metabolites. In one sample of Yellowtail imported from Australia, leuco crystal violet (LCV) was detected (0.13 µg/kg). In another sample of Yellowtail imported from Australia, leuco malachite green (LMG) was detected (0.16 µg/kg). These dyes are not allowed to be used for food producing animals No residues of antibacterial agents chloramphenicol and nitrofurane metabolites were detected in 2016.

Chemical spoilage indicators were examined in 29 samples in 2016, and one sample of Tuna muscle from Vietnam had concentration of TVB-N above 25 mg/100g, which is the general maximum level according to the regulations. It should be noted that this regulation specify that TVB-N analysis should be combined with organoleptic evaluation before a rejection can be done. There are no maximum level for TBARS and histamine, but high TBARS levels specifically indicate lipid peroxidation. The highest TBARS value was found in a sample of white sardinella from Sri Lanka (192 nmol/g ww). TBARS values above 25 nmol/g ww in salmon fillets are considered rancid.

Seven oil samples were assayed for verification of the authenticity of their labelled content by fatty acid and sterol composition evaluations and the data for 2016 were in agreement with their labelled content.

Samples in 2016 were analysed for dioxins (PCDDs), furans (PCDFs), dioxin-like PCBs (DL-PCBs), non-dioxin-like PCBs ($PCB_6$ or “indicator” PCBs), polybrominated flame-retardants (PBDEs), chlorinated pesticides and PAHs. Only one fish oil sample imported from Turkey was classified as non-compliant with levels of sum dioxins (2.5 pg/g TEQ) and sum total TEQ (9.0 pg/g) exceeding the regulatory maximum levels given for seafood.

## Annex 1: Data tables

**Table 1. Microbiological examination, n=130.**

**Abbreviations: n.d.**: not detected; **D**: detected; **n.a.**: not available; **TNC**: Too numerous to count (>$10^8$); **CFU**: Colony forming units; **$H_2$SPB**: $H_2S$ producing bacteria; **PC**: Plate count, **Ent.**: Enterobacteriaceae.

| | | | | | | Aerobe PC (cfu/g) agar method | | | Indicator organisms (cfu/g) by agar method | | | Fecal indicator organisms (cfu/g) by agar method | | | Specific pathogens | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 30°C | 20°C | | | | | | | | | | |
| | | | | | | Aerobes | PC | $H_2$SPB | *Enterococcus* | *Coag. pos. Staphylococcus* | Sulph.-red. bact. | Ent. | Coliforms | Thermotolerant coliforms | *Listeria monocytogenes* | *Salmonella* | *Vibrio* |
| **Journal No.** | **Origin** | **Product** | **Scientific name** | **Sample material** | **Incubation test** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/25 g** | **/25 g** | **/20 g** |
| 2016-66/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | | | 30000 | 2000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-67/1 | China | Oil | *Octopus* sp. | Oil | | <1000 | | | | | <100 | | | <10 | | n.d. | |
| 2016-68/1 | China | Oil | *Pesca* sp. | Oil | | <1000 | | | | | <100 | | | <10 | | n.d. | |
| 2016-72/1 | China | Clip fish | *Gadus morhua* | Fillet/muscle | | <1000 | | | <100 | <100 | <100 | | <10 | <10 | | n.d. | |
| 2016-73/1 | China | Clip fish | *Gadus chalcogrammus* | Fillet/muscle | | <1000 | | | <100 | <100 | <100 | | <10 | <10 | | n.d. | |
| 2016-74/1 | China | Clip fish | *Gadus chalcogrammus* | Fillet/muscle | | 1000 | | | <100 | <100 | <100 | | <10 | <10 | | n.d. | |
| 2016-79/1 | Russian Federation | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | 162000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-195/1 | China | Haddock | *Melanogrammus aeglefinus* | Fillet/muscle | | | 41000 | <1000 | <100 | | | | 100 | <10 | n.d. | n.d. | |
| 2016-196/1 | China | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | 40000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-197/1 | China | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | 5000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-198/1 | China | Pacific cod | *Gadus macrocephalus* | Fillet/muscle | | | 100000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-200/1 | Russian Federation | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | 20000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-203/1 | Russian Federation | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | 6000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |

## Table 1. Microbiological examination, n=130.

**Abbreviations: n.d.**: not detected; **D**: detected; **n.a.**: not available; **TNC**: Too numerous to count (>$10^8$); **CFU**: Colony forming units; **$H_2$SPB**: $H_2$S producing bacteria; **PC**: Plate count, **Ent.**: Enterobacteriaceae.

| | | | | | | Aerobe PC (cfu/g) agar method | | | Indicator organisms (cfu/g) by agar method | | | Fecal indicator organisms (cfu/g) by agar method | | | Specific pathogens | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 30°C | 20°C | | | | | | | | | | |
| | | | | | | Aerobes | PC | $H_2$SPB | *Enterococcus* | *Coag. pos. Staphylococcus* | Sulph.-red. bact. | Ent. | Coliforms | Thermotolerant coliforms | *Listeria monocytogenes* | *Salmonella* | *Vibrio* |
| **Journal No.** | **Origin** | **Product** | **Scientific name** | **Sample material** | **Incubation test** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/25 g** | **/25 g** | **/20 g** |
| 2016-205/1 | Russian Federation | Greenland halibut | *Reinhardtius hippoglossoides* | Fillet/muscle | | | 30000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-206/1 | Russian Federation | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | 32000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-340/1 | Russian Federation | Haddock | *Melanogrammus aeglefinus* | Fillet/muscle | | | 45000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-341/1 | Russian Federation | Saithe | *Pollachius virens* | Fillet/muscle | | | 77000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-342/1 | Russian Federation | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | 16000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-369/1 | Canada | American lobster | *Homarus americanus* | Meat | | | 3000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | n.d. |
| 2016-372/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | | | 580000 | 480000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-378/1 | Sri Lanka | Swordfish | *Xiphias gladius* | Fillet/muscle | | | 8700000 | 6200000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-383/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | | | 10000 | 6000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-384/1 | Australia | Yellowtail amberjack | *Seriola lalandi* | Fillet/muscle | | | 3000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-385/1 | Japan | Yellowtail/Japanese amberjack | *Seriola quinqueradiata* | Fillet/muscle | | | 7000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-386/1 | Japan | Yellowtail/Japanese amberjack | *Seriola quinqueradiata* | Fillet/muscle | | | 2000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-435/1 | Russian Federation | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | 200000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |

## Table 1. Microbiological examination, n=130.

**Abbreviations: n.d.**: not detected; **D**: detected; **n.a.**: not available; **TNC**: Too numerous to count (>$10^8$); **CFU**: Colony forming units; **H2SPB**: $H_2S$ producing bacteria; **PC**: Plate count, **Ent.**: Enterobacteriaceae.

| | | | | | | Aerobe PC (cfu/g) agar method | | | Indicator organisms (cfu/g) by agar method | | | Fecal indicator organisms (cfu/g) by agar method | | | Specific pathogens | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 30°C | 20°C | | | | | | | | | | |
| | | | | | | Aerobes | PC | $H_2SPB$ | *Enterococcus* | *Coag. pos. Staphylococcus* | Sulph.-red. bact. | Ent. | Coliforms | Thermotolerant coliforms | *Listeria monocytogenes* | *Salmonella* | *Vibrio* |
| **Journal No.** | **Origin** | **Product** | **Scientific name** | **Sample material** | **Incubation test** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/25 g** | **/25 g** | **/20 g** |
| 2016-436/1 | Russian Federation | Atlantic cod | *Gadus morhua* | Tongue | | | 340000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-544/1 | Russian Federation | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | 10000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-545/1 | Russian Federation | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | <1000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-573/1 | Maldives | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | | | 3000 | <1000 | <100 | | | | <10 | <10 | <10 | n.d. | |
| 2016-704/1 | Russian Federation | Atlantic cod | *Gadus morhua* | Roe | | | 9000 | <1000 | <100 | | <100 | | <10 | <10 | n.d. | n.d. | |
| 2016-707/1 | Taiwan | Pacific saury | *Cololabis saira* | Round | | | <1000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-708/1 | Taiwan | Pacific saury | *Cololabis saira* | Round | | | <1000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-709/1 | Argentina | Argentine shortfin squid | *Illex argentinus* | Fillet/muscle | | | <1000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-710/1 | Chile | Oil | *Octopus* sp. | Oil | | <1000 | | | | | <100 | | | <10 | | n.d. | |
| 2016-719/1 | Canada | Shrimp | *Pandalus* sp. | Peeled | | <1000 | | | | <100 | <100 | | | <10 | | n.d. | n.d. |
| 2016-721/1 | China | Atlantic cod | *Gadus morhua* | Fillet/muscle | | 6000 | | | | <100 | | | <10 | <10 | n.d. | n.d. | |
| 2016-726/1 | China | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | 27000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-741/1 | USA | Blue shrimp | *Penaeus stylirostris* | Peeled | | <1000 | | | | <100 | <100 | | | <10 | | n.d. | n.d. |
| 2016-742/1 | Vietnam | Tuna | *Katsuwonus* sp. | Canned | | <1000 | | | | | | | | | | | |

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| | | | | | | Aerobe PC (cfu/g) agar method | | | Indicator organisms (cfu/g) by agar method | | | Fecal indicator organisms (cfu/g) by agar method | | | Specific pathogens | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 30°C | 20°C | | | | | | | | | | |
| | | | | | | Aerobes | PC | $H_2SPB$ | *Enterococcus* | Coag. pos. *Staphylococcus* | Sulph.-red. bact. | Ent. | Coliforms | Thermotolerant coliforms | *Listeria monocytogenes* | *Salmonella* | *Vibrio* |
| **Journal No.** | **Origin** | **Product** | **Scientific name** | **Sample material** | **Incubation test** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/25 g** | **/25 g** | **/20 g** |
| 2016-749/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | | | 28000 | 1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-750/1 | Vietnam | Pangasius | *Pangasius hypophthalmus* | Fillet/muscle | | | 17000 | <1000 | <100 | | | | 70 | 60 | n.d. | n.d. | |
| 2016-752/1 | Thailand | Pacific cod | *Gadus macrocephalus* | Fillet/muscle | | | 1000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-754/1 | Thailand | Pacific cod | *Gadus macrocephalus* | Fillet/muscle | | | 37000 | <1000 | 200 | | | | 20 | <10 | n.d. | n.d. | |
| 2016-755/1 | Chile | Salmon | *Salmo salar* | Fillet/muscle | | | 27000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-758/1 | Norway/Egypt | Atlantic mackerel | *Scomber scombrus* | Fillet/muscle | | | <1000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-765/1 | Sri Lanka | Mangrove red snapper | *Lutjanus argentimaculatus* | Fillet/muscle | | | 55000 | 1000 | 200 | | | | 10 | <10 | <10 | n.d. | |
| 2016-766/1 | Sri Lanka | Barramundi | *Lates calcarifer* | Fillet/muscle | | | 2000 | <1000 | <100 | | | | <10 | <10 | <10 | n.d. | |
| 2016-767/1 | Sri Lanka | Indian anchovy | *Stolephorus indicus* | Dressed | | | 5000 | <1000 | <100 | | | | <10 | <10 | <10 | n.d. | |
| 2016-768/1 | Sri Lanka | White sardinella | *Sardinella albella* | Dressed | | | 6000 | <1000 | <100 | | | | <10 | <10 | <10 | n.d. | |
| 2016-769/1 | Vietnam | Whiteleg shrimp | *Litopenaeus vannamei* | Peeled | | <1000 | | | | <100 | <100 | | | <10 | | n.d. | detected |
| 2016-816/1 | Sri Lanka | Swordfish | *Xiphias gladius* | Fillet/muscle | | | 10000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-817/1 | Thailand | Whiteleg shrimp | *Litopenaeus vannamei* | Peeled | | | 2000 | <1000 | 100 | | | | <10 | <10 | n.d. | n.d. | n.d. |

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| | | | | | | Aerobe PC (cfu/g) agar method | | | Indicator organisms (cfu/g) by agar method | | | Fecal indicator organisms (cfu/g) by agar method | | | Specific pathogens | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 30°C | 20°C | | | | | | | | | | |
| | | | | | | Aerobes | PC | $H_2SPB$ | *Enterococcus* | *Coag. pos. Staphylococcus* | Sulph.-red. bact. | Ent. | Coliforms | Thermotolerant coliforms | *Listeria monocytogenes* | *Salmonella* | *Vibrio* |
| **Journal No.** | **Origin** | **Product** | **Scientific name** | **Sample material** | **Incubation test** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/25 g** | **/25 g** | **/20 g** |
| 2016-838/1 | New Zealand | Oil | *Deania calcea* | Oil | | <1000 | | | | | <100 | | | <10 | | n.d. | |
| 2016-843/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-844/1 | Thailand | Yellowfin tuna | *Thunnus albacares* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-845/1 | Turkey | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-846/1 | Thailand | Pacific mackerel | *Scomber japonicus* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-847/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-848/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-849/1 | Thailand | Yellowfin tuna | *Thunnus albacares* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-850/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-851/1 | Turkey | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-852/1 | Turkey | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-853/1 | Thailand | Yellowfin tuna | *Thunnus albacares* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-915/1 | Russian Federation | Rose fish | *Sebastes norvegicus* | Dressed | | | 23000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1081/1 | Turkey | Oil | | Oil | | <1000 | | | | | <100 | | | <10 | | n.d. | |
| 2016-1189/1 | Morocco | Oil | | Oil | | <1000 | | | | | <100 | | | <10 | | n.d. | |
| 2016-1190/1 | Morocco | Oil | | Oil | | <1000 | | | | | <100 | | | <10 | | n.d. | |

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| | | | | | | Aerobe PC (cfu/g) agar method | | | Indicator organisms (cfu/g) by agar method | | | Fecal indicator organisms (cfu/g) by agar method | | | Specific pathogens | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 30°C | 20°C | | | | | | | | | | |
| | | | | | | Aerobes | PC | $H_2$SPB | *Enterococcus* | *Coag. pos. Staphylococcus* | Sulph.-red. bact. | Ent. | Coliforms | Thermotolerant coliforms | *Listeria monocytogenes* | *Salmonella* | *Vibrio* |
| **Journal No.** | **Origin** | **Product** | **Scientific name** | **Sample material** | **Incubation test** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/25 g** | **/25 g** | **/20 g** |
| 2016-1191/1 | China | Clip fish | *Gadus morhua* | Fillet/muscle | | <1000 | | | <100 | <100 | <100 | | <10 | <10 | | n.d. | |
| 2016-1192/1 | Korea | Pacific oyster | *Crassostrea gigas* | Fillet/muscle | | | 16000 | <1000 | 200 | | | | | | n.d. | n.d. | n.d. |
| 2016-1193/1 | China | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | 240000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1194/1 | China | Clip fish | *Gadus morhua* | Fillet/muscle | | 10000 | | | <100 | <100 | <100 | | <10 | <10 | | n.d. | |
| 2016-1195/1 | Thailand | Alaska pollock | *Theragra chalcogramma* | Crabsticks | | <1000 | | | | <100 | | <10 | | | | n.d. | |
| 2016-1196/1 | China | Clip fish | *Gadus chalcogrammus* | Fillet/muscle | | <1000 | | | <100 | <100 | <100 | | <10 | <10 | | n.d. | |
| 2016-1208/1 | Thailand | Freeze dried | *Acetes spp.* | Round | | 4000 | | | <100 | <100 | 700 | | <10 | <10 | | n.d. | n.d. |
| 2016-1347/1 | Russian Federation | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | 25000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1454/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | | | 14700000 | 10200000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1458/1 | Sri Lanka | Bigeye tuna | *Thunnus obesus* | Meat | | | 900000 | 280000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1459/1 | Canada | American lobster | *Homarus americanus* | Meat | | | 5000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | n.d. |
| 2016-1474/1 | Morocco | Oil | *Sardina* sp./ *Scomber* sp. | Oil | | <1000 | | | | | <100 | | | <10 | | n.d. | |
| 2016-1582/1 | Taiwan | Pacific saury | *Cololabis saira* | Round | | | <1000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |

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| | | | | | | Aerobe PC (cfu/g) agar method | | | Indicator organisms (cfu/g) by agar method | | | Fecal indicator organisms (cfu/g) by agar method | | | Specific pathogens | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 30°C | 20°C | | | | | | | | | | |
| | | | | | | Aerobes | PC | $H_2$SPB | *Enterococcus* | *Coag. pos. Staphylococcus* | Sulph.-red. bact. | Ent. | Coliforms | Thermotolerant coliforms | *Listeria monocytogenes* | *Salmonella* | *Vibrio* |
| **Journal No.** | **Origin** | **Product** | **Scientific name** | **Sample material** | **Incubation test** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/25 g** | **/25 g** | **/20 g** |
| 2016-1645/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-1655/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-1657/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-1660/1 | Morocco | European pilchard | *Sardina pilchardus* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-1663/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-1664/1 | Philippines | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-1665/1 | New Zealand | Pacific oyster | *Crassostrea gigas* | Spices/ powder | | <1000 | | | | | | <10 | | <10 | | n.d. | |
| 2016-1666/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-1667/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-1668/1 | Morocco | European pilchard | *Sardina pilchardus* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-1707/1 | Philippines | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-1739/1 | Sri Lanka | Swordfish | *Xiphias gladius* | Fillet/muscle | | | 2110000 | 167000 | <100 | | | | 100 | <10 | n.d. | n.d. | |

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| | | | | | | Aerobe PC (cfu/g) agar method | | | Indicator organisms (cfu/g) by agar method | | | Fecal indicator organisms (cfu/g) by agar method | | | Specific pathogens | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 30°C | 20°C | | | | | | | | | | |
| | | | | | | Aerobes | PC | $H_2$SPB | *Enterococcus* | Coag. pos. *Staphylococcus* | Sulph.-red. bact. | Ent. | Coliforms | Thermotolerant coliforms | *Listeria monocytogenes* | *Salmonella* | *Vibrio* |
| **Journal No.** | **Origin** | **Product** | **Scientific name** | **Sample material** | **Incubation test** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/25 g** | **/25 g** | **/20 g** |
| 2016-1740/1 | Australia | Yellowtail amberjack | *Seriola lalandi* | Fillet/muscle | | | 8300000 | 310000 | <100 | | | | 20 | <10 | n.d. | n.d. | |
| 2016-1741/1 | Japan | Yellowtail/Japanese amberjack | *Seriola quinqueradiata* | Fillet/muscle | | | 13000 | <1000 | <100 | | | | 20 | <10 | n.d. | n.d. | |
| 2016-1785/1 | Russian Federation | Greenland halibut | *Reinhardtius hippoglossoides* | Fillet/muscle | | | 204000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1786/1 | Russian Federation | Greenland halibut | *Reinhardtius hippoglossoides* | Fillet/muscle | | | 34000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1787/1 | Russian Federation | Saithe | *Pollachius virens* | Fillet/muscle | | | 86000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1788/1 | Russian Federation | Haddock | *Melanogrammus aeglefinus* | Fillet/muscle | | | 3000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1789/1 | Russian Federation | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | 3000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1902/1 | Sri Lanka | Mangrove red snapper | *Lutjanus argentimaculatus* | Fillet/muscle | | | 1950000 | 560000 | <100 | | | | 20 | <10 | n.d. | n.d. | |
| 2016-1943/1 | USA | Shrimps and prawns | *Crustaceans* | Peeled | | <1000 | | | | <100 | <100 | | | <10 | | n.d. | n.d. |
| 2016-1944/1 | China | Saithe | *Pollachius virens* | Fillet/muscle | | | 18000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1945/1 | China | Saithe | *Pollachius virens* | Fillet/muscle | | | 18000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1946/1 | China | Saithe | *Pollachius virens* | Fillet/muscle | | | 22000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1977/1 | Japan | Japanese seabream | *Pagrus major* | Fillet/muscle | | | 7000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |

## Table 1. Microbiological examination, n=130.

**Abbreviations: n.d.**: not detected; **D**: detected; **n.a.**: not available; **TNC**: Too numerous to count (>$10^8$); **CFU**: Colony forming units; **$H_2$SPB**: $H_2$S producing bacteria; **PC**: Plate count, **Ent.**: Enterobacteriaceae.

| | | | | | | Aerobe PC (cfu/g) agar method | | | Indicator organisms (cfu/g) by agar method | | | Fecal indicator organisms (cfu/g) by agar method | | | Specific pathogens | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 30°C | 20°C | | | | | | | | | | |
| | | | | | | Aerobes | PC | $H_2$SPB | *Enterococcus* | *Coag. pos. Staphylococcus* | Sulph.-red. bact. | Ent. | Coliforms | Thermotolerant coliforms | *Listeria monocytogenes* | *Salmonella* | *Vibrio* |
| **Journal No.** | **Origin** | **Product** | **Scientific name** | **Sample material** | **Incubation test** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/25 g** | **/25 g** | **/20 g** |
| 2016-1980/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Meat | | | 7000 | <1000 | <100 | | | | 80 | <10 | n.d. | n.d. | |
| 2016-1981/1 | India | Whiteleg shrimp | *Litopenaeus vannamei* | Peeled | | | 420000 | 13000 | 2200 | | | | <10 | <10 | n.d. | n.d. | n.d. |
| 2016-1982/1 | China | Saithe | *Pollachius virens* | Fillet/muscle | | | 116000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1983/1 | China | Pacific cod | *Gadus macrocephalus* | Fillet/muscle | | | 40000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1984/1 | Thailand | Bigeye bullseye | *Priacanthus macracanthus* | Surimi/fish balls | | <1000 | | | | <100 | | <10 | | | | n.d. | |
| 2016-1985/1 | China | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | 32000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1986/1 | China | Saithe | *Pollachius virens* | Fillet/muscle | | | 10000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1987/1 | Vietnam | Brown crab | *Cancer pagurus* | Claw meat | | <1000 | | | | <100 | <100 | | | <10 | | n.d. | n.d. |
| 2016-1989/1 | China | Spotted wolffish | *Anarchichas minor* | Fillet/muscle | | | 90000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-1995/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-1996/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-1997/1 | Thailand | Whiteleg shrimp | *Litopenaeus vannamei* | Spices/paste | Sterile | <10 | | | | | | | | | | | |
| 2016-1998/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | Sterile | <10 | | | | | | | | | | | |
| 2016-1999/1 | Thailand | Flower crab | *Portunus pelagicus* | Spices/paste | Sterile | <10 | | | | | | | | | | | |
| 2016-2053/1 | China | Alaska pollock | *Theragra chalcogramma* | Fillet/muscle | | | 126000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-2054/1 | China | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | 11000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-2055/1 | China | Oil | *Octopus* sp. | Oil | | <1000 | | | | | <100 | | | <10 | | n.d.. | |

**Table 1. Microbiological examination, n=130.**

**Abbreviations: n.d.**: not detected; **D**: detected; **n.a.**: not available; **TNC**: Too numerous to count (>$10^8$); **CFU**: Colony forming units; **$H_2$SPB**: $H_2$S producing bacteria; **PC**: Plate count, **Ent.**: Enterobacteriaceae.

| | | | | | | Aerobe PC (cfu/g) agar method | | | Indicator organisms (cfu/g) by agar method | | | Fecal indicator organisms (cfu/g) by agar method | | | Specific pathogens | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 30°C | 20°C | | | | | | | | | | |
| | | | | | | Aerobes | PC | $H_2$SPB | *Enterococcus* | *Coag. pos. Staphylococcus* | Sulph.-red. bact. | Ent. | Coliforms | Thermotolerant coliforms | *Listeria monocytogenes* | *Salmonella* | *Vibrio* |
| **Journal No.** | **Origin** | **Product** | **Scientific name** | **Sample material** | **Incubation test** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/g** | **/25 g** | **/25 g** | **/20 g** |
| 2016-2058/1 | China | Alaska pollock | *Theragra chalcogramma* | Fillet/muscle | | | 50000 | 1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-2059/1 | China | Pacific cod | *Gadus macrocephalus* | Fillet/muscle | | | 62000 | <1000 | <100 | | | | <10 | <10 | n.d. | n.d. | |
| 2016-2061/1 | China | Clip fish | *Gadus chalcogrammus* | Fillet/muscle | | 10000 | | | <100 | <100 | <100 | | <10 | <10 | | n.d. | |
| 2016-2063/1 | Korea | Alaska pollock | *Theragra chalcogramma* | Surimi | | 154000 | | | | <100 | | 200 | | | | n.d. | |
| 2016-2064/1 | Thailand | Alaska pollock | *Theragra chalcogramma* | Surimi | | <1000 | | | | <100 | | <100 | | | | n.d. | |
| 2016-2056/1 | Canada | American lobster | *Homarus americanus* | Minced | | 8000 | | | | <100 | <100 | | | <10 | | n.d. | n.d. |

| Table 2. Nematodes, n=68. | | | | | | |
|---|---|---|---|---|---|---|
| **Journal No.** | **Imported from** | **Product group** | **Species** | **Scientific name** | **Tissue** | **# Nematodes** |
| 2016-79/1 | Russian Federation | Marine fish | Atlantic cod | *Gadus morhua* | Fillet/muscle | 0 |
| 2016-195/1 | China | Marine fish | Haddock | *Melanogrammus aeglefinus* | Fillet/muscle | 3 |
| 2016-196/1 | China | Marine fish | Atlantic cod | *Gadus morhua* | Fillet/muscle | 0 |
| 2016-197/1 | China | Marine fish | Atlantic cod | *Gadus morhua* | Fillet/muscle | 0 |
| 2016-198/1 | China | Marine fish | Pacific cod | *Gadus macrocephalus* | Fillet/muscle | 0 |
| 2016-200/1 | Russian Federation | Marine fish | Atlantic cod | *Gadus morhua* | Fillet/muscle | 3 |
| 2016-203/1 | Russian Federation | Marine fish | Atlantic cod | *Gadus morhua* | Fillet/muscle | 2 |
| 2016-205/1 | Russian Federation | Marine fish | Greenland halibut | *Reinhardtius hippoglossoides* | Fillet/muscle | 1 |
| 2016-206/1 | Russian Federation | Marine fish | Atlantic cod | *Gadus morhua* | Fillet/muscle | 1 |
| 2016-340/1 | Russian Federation | Marine fish | Haddock | *Melanogrammus aeglefinus* | Fillet/muscle | 3 |
| 2016-341/1 | Russian Federation | Marine fish | Saithe | *Pollachius virens* | Fillet/muscle | 0 |
| 2016-342/1 | Russian Federation | Marine fish | Atlantic cod | *Gadus morhua* | Fillet/muscle | 4 |
| 2016-372/1 | Sri Lanka | Marine fish | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | 0 |
| 2016-378/1 | Sri Lanka | Marine fish | Swordfish | *Xiphias gladius* | Fillet/muscle | 0 |
| 2016-383/1 | Sri Lanka | Marine fish | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | 0 |
| 2016-384/1 | Australia | Marine fish | Yellowtail amberjack | *Seriola lalandi* | Fillet/muscle | 0 |
| 2016-385/1 | Japan | Marine fish | Yellowtail/ Japanese amberjack | *Seriola quinqueradiata* | Fillet/muscle | 0 |
| 2016-386/1 | Japan | Marine fish | Yellowtail/ Japanese amberjack | *Seriola quinqueradiata* | Fillet/muscle | 0 |
| 2016-435/1 | Russian Federation | Marine fish | Atlantic cod | *Gadus morhua* | Fillet/muscle | 2 |
| 2016-436/1 | Russian Federation | Marine fish | Atlantic cod | *Gadus morhua* | Tongue | 0 |
| 2016-544/1 | Russian Federation | Marine fish | Atlantic cod | *Gadus morhua* | Fillet/muscle | 2 |
| 2016-545/1 | Russian Federation | Marine fish | Atlantic cod | *Gadus morhua* | Fillet/muscle | 4 |

| Table 2. Nematodes, n=68. | | | | | | |
|---|---|---|---|---|---|---|
| **Journal No.** | **Imported from** | **Product group** | **Species** | **Scientific name** | **Tissue** | **# Nematodes** |
| 2016-573/1 | Maldives | Marine fish | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | 0 |
| 2016-707/1 | Taiwan | Marine fish | Pacific saury | *Cololabis saira* | Round | 2 |
| 2016-708/1 | Taiwan | Marine fish | Pacific saury | *Cololabis saira* | Round | 0 |
| 2016-709/1 | Argentina | Marine fish | Argentine shortfin squid | *Illex argentinus* | Fillet/muscle | 0 |
| 2016-721/1 | China | Marine fish | Atlantic cod | *Gadus morhua* | Fillet/muscle | 0 |
| 2016-726/1 | China | Marine fish | Atlantic cod | *Gadus morhua* | Fillet/muscle | 0 |
| 2016-749/1 | Sri Lanka | Marine fish | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | 0 |
| 2016-750/1 | Vietnam | Freshwater fish | Pangasius | *Pangasius hypophthalmus* | Fillet/muscle | 0 |
| 2016-752/1 | Thailand | Marine fish | Pacific cod | *Gadus macrocephalus* | Fillet/muscle | 0 |
| 2016-754/1 | Thailand | Marine fish | Pacific cod | *Gadus macrocephalus* | Fillet/muscle | 0 |
| 2016-755/1 | Chile | Marine fish | Salmon | *Salmo salar* | Fillet/muscle | 0 |
| 2016-758/1 | Norway/Egypt | Marine fish | Atlantic mackerel | *Scomber scombrus* | Fillet/muscle | 2 |
| 2016-765/1 | Sri Lanka | Marine fish | Mangrove red snapper | *Lutjanus argentimaculatus* | Fillet/muscle | 0 |
| 2016-766/1 | Sri Lanka | Marine fish | Barramundi | *Lates calcarifer* | Fillet/muscle | 0 |
| 2016-767/1 | Sri Lanka | Marine fish | Indian anchovy | *Stolephorus indicus* | Dressed | 0 |
| 2016-768/1 | Sri Lanka | Marine fish | White sardinella | *Sardinella albella* | Dressed | 0 |
| 2016-816/1 | Sri Lanka | Marine fish | Swordfish | *Xiphias gladius* | Fillet/muscle | 0 |
| 2016-915/1 | Russian Federation | Marine fish | Rose fish | *Sebastes norvegicus* | Dressed | 14 |
| 2016-1193/1 | China | Marine fish | Atlantic cod | *Gadus morhua* | Fillet/muscle | 0 |
| 2016-1347/1 | Russian Federation | Marine fish | Atlantic cod | *Gadus morhua* | Fillet/muscle | 6 |
| 2016-1454/1 | Sri Lanka | Marine fish | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | 0 |
| 2016-1458/1 | Sri Lanka | Marine fish | Bigeye tuna | *Thunnus obesus* | Meat | 0 |
| 2016-1582/1 | Taiwan | Marine fish | Pacific saury | *Cololabis saira* | Round | 0 |
| 2016-1739/1 | Sri Lanka | Marine fish | Swordfish | *Xiphias gladius* | Fillet/muscle | 0 |

| Table 2. Nematodes, n=68. | | | | | | |
|---|---|---|---|---|---|---|
| **Journal No.** | **Imported from** | **Product group** | **Species** | **Scientific name** | **Tissue** | **# Nematodes** |
| 2016-1740/1 | Australia | Marine fish | Yellowtail amberjack | *Seriola lalandi* | Fillet/muscle | 0 |
| 2016-1741/1 | Japan | Marine fish | Yellowtail/Japanese amberjack | *Seriola quinqueradiata* | Fillet/muscle | 0 |
| 2016-1785/1 | Russian Federation | Marine fish | Greenland halibut | *Reinhardtius hippoglossoides* | Fillet/muscle | 23 |
| 2016-1786/1 | Russian Federation | Marine fish | Greenland halibut | *Reinhardtius hippoglossoides* | Fillet/muscle | 35 |
| 2016-1787/1 | Russian Federation | Marine fish | Saithe | *Pollachius virens* | Fillet/muscle | 2 |
| 2016-1788/1 | Russian Federation | Marine fish | Haddock | *Melanogrammus aeglefinus* | Fillet/muscle | 1 |
| 2016-1789/1 | Russian Federation | Marine fish | Atlantic cod | *Gadus morhua* | Fillet/muscle | 1 |
| 2016-1902/1 | Sri Lanka | Marine fish | Mangrove red snapper | *Lutjanus argentimaculatus* | Fillet/muscle | 0 |
| 2016-1944/1 | China | Marine fish | Saithe | *Pollachius virens* | Fillet/muscle | 0 |
| 2016-1945/1 | China | Marine fish | Saithe | *Pollachius virens* | Fillet/muscle | 0 |
| 2016-1946/1 | China | Marine fish | Saithe | *Pollachius virens* | Fillet/muscle | 0 |
| 2016-1977/1 | Japan | Marine fish | Japanese seabream | *Pagrus major* | Fillet/muscle | 0 |
| 2016-1980/1 | Sri Lanka | Marine fish | Yellowfin tuna | *Thunnus albacares* | Meat | 0 |
| 2016-1982/1 | China | Marine fish | Saithe | *Pollachius virens* | Fillet/muscle | 0 |
| 2016-1983/1 | China | Marine fish | Pacific cod | *Gadus macrocephalus* | Fillet/muscle | 4 |
| 2016-1985/1 | China | Marine fish | Atlantic cod | *Gadus morhua* | Fillet/muscle | 0 |
| 2016-1986/1 | China | Marine fish | Saithe | *Pollachius virens* | Fillet/muscle | 0 |
| 2016-1989/1 | China | Marine fish | Spotted wolffish | *Anarchichas minor* | Fillet/muscle | 0 |
| 2016-2053/1 | China | Marine fish | Alaska pollock | *Theragra chalcogramma* | Fillet/muscle | 0 |
| 2016-2054/1 | China | Marine fish | Atlantic cod | *Gadus morhua* | Fillet/muscle | 0 |
| 2016-2058/1 | China | Marine fish | Alaska pollock | *Theragra chalcogramma* | Fillet/muscle | 2 |
| 2016-2059/1 | China | Marine fish | Pacific cod | *Gadus macrocephalus* | Fillet/muscle | 0 |

**Table 3. Residues of prohibited veterinary medicines: Dyes, n=12 (2016).**

**CCα:** decision limit, **n.d.**: not detected, **CV**: crystal violet, **LCV**: leuco crystal violet, **MG**: malachite green **LMG**: leuco malachite green, **BG**: brilliant green

| Journal No. | Imported from | Group | Species/ Presentation | Scientific name | Tissue | CV CCα: 0.3 µg/kg | LCV CCα: 0.05 - 0.15 µg/kg | MG CCα: 0.15 µg/kg | LMG CCα: 0.15 µg/kg | BG CCα: 0.15 µg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 2016-384/2 | Australia | Aquaculture | Yellowtail | *Seriola lalandi* | Muscle | n.d. | 0.13 | n.d. | n.d. | n.d. |
| 2016-385/1 | Japan | Aquaculture | Japanese amberjack | *Seriola quinqueradiata* | Muscle | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-386/2 | Japan | Aquaculture | Japanese amberjack | *Seriola quinqueradiata* | Muscle | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-741/1 | USA | Aquaculture | Blue shrimp | *Penaeus stylirostris* | Peeled | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-750/1 | Vietnam | Aquaculture | Striped catfish | *Pangasius hypophthalmus* | Muscle | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-769/1 | Vietnam | Aquaculture | Whiteleg shrimp | *Litopenaeus vannamei* | Peeled | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-817/1 | Thailand | Aquaculture | Scampi | *Penaeus vannamei* | Peeled | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-1740/1 | Australia | Aquaculture | Yellowtail | *Seriola lalandi* | Muscle | n.d. | n.d. | n.d. | 0.16 | n.d. |
| 2016-1741/1 | Japan | Aquaculture | Japanese amberjack | *Seriola quinqueradiata* | Muscle | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-1977/2 | Japan | Aquaculture | Red seabream | *Pagrus major* | Muscle | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-1981/1 | India | Aquaculture | Whiteleg shrimp | *Litopenaeus vannamei* | Peeled | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-1997/1 | Thailand | Aquaculture | Processed seafood product | *Penaeus vannamei* | Mixed | n.d. | n.d. | n.d. | n.d. | n.d. |

**Table 4. Residues of prohibited veterinary medicines:**
**Chloramphenicol and nitrofuran metabolites: Antibacterial agents, n=12 (2016).**

**CCα:** decision limit, **CAM:** chloramphenicol, **AOZ**: 3-amino-2-oxazolidinone, **AMOZ**: 3-amino-5-morpholinomethyl-2-oxazolidinone, **AHD**: 1-amino-hydantoin, **SEM**: semicarbazide

| Journal No. | Imported from | Group | Product/ Presentation | Scientific name | Tissue | CAM CCα: 0.25 µg/kg | AHD CCα: 0.6 µg/kg | AMOZ CCα: 0.4 µg/kg | AOZ CCα: 0.5 µg/kg | SEM CCα: 0.5 µg/kg |
|---|---|---|---|---|---|---|---|---|---|---|
| 2016-384/2 | Australia | Aquaculture | Yellowtail | *Seriola lalandi* | Fillet/muscle | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-385/1 | Japan | Aquaculture | Japanese amberjack | *Seriola quinqueradiata* | Fillet/muscle | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-386/2 | Japan | Aquaculture | Japanese amberjack | *Seriola quinqueradiata* | Fillet/muscle | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-741/1 | USA | Aquaculture | Blue shrimp | *Penaeus stylirostris* | Peeled | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-750/1 | Vietnam | Aquaculture | Striped catfish | *Pangasius hypophthalmus* | Fillet/muscle | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-769/1 | Vietnam | Aquaculture | Whiteleg shrimp | *Litopenaeus vannamei* | Peeled | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-817/1 | Thailand | Aquaculture | Scampi | *Penaeus vannamei* | Peeled | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-1740/1 | Australia | Aquaculture | Yellowtail | *Seriola lalandi* | Fillet/muscle | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-1741/1 | Japan | Aquaculture | Japanese amberjack | *Seriola quinqueradiata* | Fillet/muscle | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-1977/2 | Japan | Aquaculture | Red seabream | *Pagrus major* | Fillet/muscle | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-1981/1 | India | Aquaculture | Whiteleg shrimp | *Litopenaeus vannamei* | Peeled | n.d. | n.d. | n.d. | n.d. | n.d. |
| 2016-1997/1 | Thailand | Aquaculture | Processed seafood product | *Penaeus vannamei* | mixed | n.d. | n.d. | n.d. | n.d. | n.d. |

**Table 5. Rancidity and spoilage parameters, n=29 (2016).**

**TBARS**: Thiobarbituric acid reactive substances, **TVB-N**: Total volatile basic nitrogen

| Journal No. | Imported from | Species/Product | Scientific name | Tissue | Histamine mg/kg ww | TBARS nmol/g ww | TVB-N mg/100g ww |
|---|---|---|---|---|---|---|---|
| 2016-66/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | < 5 | < 4 | 21 |
| 2016-205/1 | Russian Federation | Greenland halibut | *Reinhardtius hippoglossoides* | Fillet/muscle | | < 4 | 8.1 |
| 2016-372/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | < 5 | < 4 | 15 |
| 2016-378/1 | Sri Lanka | Swordfish | *Xiphias gladius* | Fillet/muscle | | < 4 | 15 |
| 2016-383/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | < 5 | < 4 | 23 |
| 2016-573/1 | Maldives | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | < 5 | < 4 | 25 |
| 2016-707/1 | Taiwan, Province Of China | Pacific saury | *Cololabis Saira* | Fillet/muscle | 6.2 | | 16 |
| 2016-708/1 | Taiwan, Province Of China | Pacific saury | *Cololabis Saira* | Fillet/muscle | 6 | | 15 |
| 2016-709/1 | Argentina | Argentine shortfin squid | *Illex argentinus* | Fillet/muscle | | | 22 |
| 2016-721/1 | China | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | 11 |
| 2016-726/1 | China | Atlantic cod | *Gadus morhua* | Fillet/muscle | | | 13 |
| 2016-742/1 | Vietnam | Tuna | *Katsuwonus* sp. | Canned | < 5 | 4.1 | 41 |
| 2016-749/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | < 5 | | 17 |
| 2016-755/1 | Chile | Atlantic salmon | *Salmo salar* | Fillet/muscle | | | 17 |
| 2016-758/2 | Norway | Atlantic mackerel | *Scomber scombrus* | Fillet/muscle | < 5 | 62 | 16 |
| 2016-765/1 | Sri Lanka | Mangrove red snapper | *Lutjanus argentimaculatus* | Fillet/muscle | | | 18 |
| 2016-766/1 | Sri Lanka | Barramundi | *Lates calcarifer* | Fillet/muscle | | | 13 |
| 2016-767/1 | Sri Lanka | Indian anchovy | *Stolephorus indicus* | Fillet/muscle | 10 | 22 | 22 |
| 2016-768/1 | Sri Lanka | White sardinella | *Sardinella albella* | Fillet/muscle | 6.6 | 192 | 20 |
| 2016-816/1 | Sri Lanka | Swordfish | *Xiphias gladius* | Fillet/muscle | | | 19 |

| Table 5. Rancidity and spoilage parameters, n=29 (2016). | | | | | | | |
|---|---|---|---|---|---|---|---|
| **TBARS**: Thiobarbituric acid reactive substances, **TVB-N**: Total volatile basic nitrogen | | | | | | | |
| **Journal No.** | **Imported from** | **Species/Product** | **Scientific name** | **Tissue** | **Histamine mg/kg ww** | **TBARS nmol/g ww** | **TVB-N mg/100g ww** |
| 2016-843/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 5.2 | | |
| 2016-844/1 | Thailand | Yellowfin tuna | *Thunnus albacares* | Canned | < 5 | | |
| 2016-845/1 | Turkey | Skipjack tuna | *Katsuwonus pelamis* | Canned | < 5 | | |
| 2016-846/1 | Thailand | Pacific mackerel | *Scomber japonicus* | Mackerel tomato sauce | < 5 | | |
| 2016-847/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | < 5 | | |
| 2016-848/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | < 5 | | |
| 2016-849/1 | Thailand | Yellowfin tuna | *Thunnus albacares* | Canned | < 5 | | |
| 2016-850/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | < 5 | | |
| 2016-851/1 | Turkey | Skipjack tuna | *Katsuwonus pelamis* | Canned | < 5 | | |
| | | | | Samples analysed | 20 | 10 | 20 |
| | | | | Maximum value | 10 | 192 | 41 |

| Table 6a. Fatty acid composition (area %) n=7 (2016) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sample | 2016-710/1 | 2016-838/1 | 2016-1081/1 | 2016-1189/1 | 2016-1190/1 | 2016-1474/1 | 2016-2055/1 |
| Declared type | **Fish oil** | **Birdbeak dogfish oil** | **Fish oil** | **Fish oil** | **Fish oil** | **Fish oil** | **Squid oil** |
| FAs | % | % | % | % | % | % | % |
| 14:0 | 2.3 | 1.2 | 5.7 | 6.9 | 7.4 | 6.9 | 3.1 |
| 16:0 | 12 | 15 | 19 | 17 | 18 | 17 | 14 |
| 18:0 | 3.7 | 1.8 | 4.3 | 3.5 | 3.5 | 3.5 | 2 |
| **Sum saturatued FAs** | 19 | 19 | 32 | 29 | 30 | 29 | 20 |
| 18:1n-9 | 36 | 23 | 18 | 7.7 | 7.2 | 7.6 | 11 |
| 20:1n-9 | 2 | 9 | 0.7 | 1.5 | 1.4 | 1.7 | 3.8 |
| 22:1n-9 (erucic acid) | 0.2 | 2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.8 |
| **Sum monounsaturated FAs** | 46 | 51 | 27 | 23 | 23 | 24 | 27 |
| 18:2 n-6 | 16 | 0.8 | 2.1 | 1.1 | 1.3 | 3.3 | 1.4 |
| 20:4 n-6 (ARA) | 0.8 | 0.6 | 1.2 | 1.4 | 1.5 | 1.3 | 1.5 |
| **Sum n-6** | 18 | 1.8 | 4.3 | 3.2 | 3.7 | 5.3 | 3.8 |
| 18:3 n-3 | 4.8 | 0.3 | 0.9 | 0.6 | 0.6 | 0.8 | 0.9 |
| 22:5 n-3 (EPA) | 3 | 1.6 | 9.5 | 20 | 21 | 20 | 14 |
| 22:6 n-3 (DHA) | 3.9 | 4.4 | 18 | 9.8 | 8.1 | 9 | 22 |
| Sum EPA og DHA | 6.9 | 6 | 27 | 30 | 29 | 29 | 36 |
| **Sum n-3** | 15 | 8.1 | 32 | 38 | 37 | 37 | 41 |
| **Sum polyunsaturated FAs** | 33 | 10 | 37 | 43 | 42 | 43 | 45 |
| Sum FAs mg /g | 926 | 676 | 921 | 807 | 800 | 763 | 836 |
| **n-3/n-6** | 0.8 | 4.5 | 7.3 | 12 | 9.9 | 6.9 | 11 |

**Table 6b. Sterol composition (mg/kg oil) n=7 (2016)**

| Sample | 2016-710/1 Fish oil mg/kg | 2016-838/1 Birdbeak dogfish oil mg/kg | 2016-1081/1 Fish oil mg/kg | 2016-1189/1 Fish oil mg/kg | 2016-1190/1 Fish oil mg/kg | 2016-1474/1 Fish oil mg/kg | 2016-2055/1 Squid oil mg/kg |
|---|---|---|---|---|---|---|---|
| Cholesterol | 3278 | 5743 | 3917 | 4927 | 6919 | 4748 | 26978 |
| Brassicasterol | 32 | 17 | 12 | 21 | 26 | 42 | 55 |
| Campesterol | 141 | 10 | 121 | 323 | 490 | 330 | 568 |
| Stigmasterol | 7 | 9 | 6 | 5 | 6 | 13 | 45 |
| Sum phytosterols | 253 | 59 | 157 | 377 | 568 | 497 | 1163 |
| Sum total | 3532 | 5802 | 4074 | 5303 | 7487 | 5245 | 28140 |
| Ratio cholesterol/phytosterol | 13 | 97 | 25 | 13 | 12 | 10 | 23 |

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**Table 7. Heavy metal composition, n=130 (2016).**

**n.a.:** Data not available.

| Sample | | | | | As | Cd | Hg | Pb |
|---|---|---|---|---|---|---|---|---|
| **Journal No.** | **Imported from** | **Species** | **Scientific name** | **Tissue/product** | **mg/kg ww** | **mg/kg ww** | **mg/kg ww** | **mg/kg ww** |
| 2016-66/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | 1.7 | 0.012 | 0.49 | < .008 |
| 2016-67/1 | China | Oil | *Octopus sp.* | Squid Oil | 8.2 | < .005 | < .005 | < .03 |
| 2016-68/1 | China | Oil | *Pesca sp.* | Fish oil | 0.01 | < .004 | < .004 | < .03 |
| 2016-72/1 | China | Clip fish | *Gadus morhua* | Fillet/muscle | 1.6 | 0.003 | 0.13 | < .01 |
| 2016-73/1 | China | Clip fish | *Gadus chalcogrammus* | Fillet/muscle | 1.1 | 0.007 | 0.024 | 0.41 |
| 2016-74/1 | China | Clip fish | *Gadus chalcogrammus* | Fillet/muscle | 1 | 0.003 | 0.023 | < .01 |
| 2016-79/1 | Russia | Atlantic cod | *Gadus morhua* | Fillet/muscle | 1.6 | 0.001 | 0.022 | < .006 |
| 2016-195/1 | China | Haddock | *Melanogrammus aeglefinus* | Fillet/muscle | 14 | 0.0006 | 0.038 | 0.005 |
| 2016-196/1 | China | Atlantic cod | *Gadus morhua* | Fillet/muscle | 0.65 | < .0007 | 0.035 | < .004 |
| 2016-197/1 | China | Atlantic cod | *Gadus morhua* | Fillet/muscle | 1.5 | < .0009 | 0.031 | < .005 |
| 2016-198/1 | China | Pacific Cod | *Gadus macrocephalus* | Fillet/muscle | 7.1 | 0.0008 | 0.028 | < .004 |
| 2016-200/1 | Russia | Atlantic cod | *Gadus morhua* | Fillet/muscle | 3.1 | < .0007 | 0.014 | < .004 |
| 2016-203/1 | Russia | Atlantic cod | *Gadus morhua* | Fillet/muscle | 24 | < .0009 | 0.036 | < .005 |
| 2016-205/1 | Russia | Greenland halibut | *Reinhardtius hippoglossoides* | Fillet/muscle | 4.5 | 0.0003 | 0.023 | 0.0004 |
| 2016-206/1 | Russia | Atlantic cod | *Gadus morhua* | Fillet/muscle | 0.77 | < .0009 | 0.04 | < .006 |
| 2016-340/1 | Russia | Haddock | *Melanogrammus aeglefinus* | Fillet/muscle | 9 | 0.0006 | 0.015 | 0.003 |
| 2016-341/1 | Russia | Saithe | *Pollachius virens* | Fillet/muscle | 1.1 | 0.0004 | 0.032 | 0.0008 |
| 2016-342/2 | Russia | Atlantic cod | *Gadus morhua* | Fillet/muscle | 3.8 | 0.0005 | 0.024 | 0.001 |
| 2016-369/2 | Canada | American lobster | *Homerus americanus* | Fillet/muscle | 5.4 | 0.015 | 0.035 | 0.037 |

| Table 7. Heavy metal composition, n=130 (2016). n.a.: Data not available. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sample | | | | | As | Cd | Hg | Pb |
| Journal No. | Imported from | Species | Scientific name | Tissue/product | mg/kg ww | mg/kg ww | mg/kg ww | mg/kg ww |
| 2016-372/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | 2 | 0.023 | 0.48 | 0.001 |
| 2016-378/1 | Sri Lanka | Swordfish | *Xiphias gladius* | Fillet/muscle | 1.3 | 0.06 | 0.37 | 0.001 |
| 2016-383/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | 0.98 | 0.005 | 0.12 | 0.001 |
| 2016-384/2 | Australia | Yellowtail | *Seriola lalandi* | Fillet/muscle | 0.76 | 0.0002 | 0.17 | 0.001 |
| 2016-385/1 | Japan | Japanese amberjack | *Seriola quinqueradiata* | Fillet/muscle | 1.4 | 0.004 | 0.15 | 0.0005 |
| 2016-386/2 | Japan | Japanese amberjack | *Seriola quinqueradiata* | Fillet/muscle | 1.1 | 0.004 | 0.13 | 0.0007 |
| 2016-435/1 | Russia | Atlantic cod | *Gadus morhua* | Fillet/muscle | 2.9 | 0.0005 | 0.065 | 0.0005 |
| 2016-436/1 | Russia | Atlantic cod | *Gadus morhua* | Tongue | 1.7 | 0.002 | 0.015 | 0.0005 |
| 2016-544/1 | Russia | Atlantic cod | *Gadus morhua* | Fillet/muscle | 1.9 | < .001 | 0.092 | < .006 |
| 2016-545/1 | Russia | Atlantic cod | *Gadus morhua* | Fillet/muscle | 1.8 | < .0007 | 0.015 | 0.008 |
| 2016-573/1 | Maldives | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | 0.28 | 0.012 | 0.46 | < .03 |
| 2016-704/1 | Russia | Atlantic cod | *Gadus morhua* | Roe | 1.4 | < .002 | 0.005 | < .008 |
| 2016-707/1 | Taiwan, Province Of China | Pacific saury | *Cololabis Saira* | Whole fish | 1.8 | 0.023 | 0.057 | < .008 |
| 2016-708/1 | Taiwan, Province Of China | Pacific saury | *Cololabis Saira* | Whole fish | 2.3 | 0.031 | 0.051 | < .01 |
| 2016-709/1 | Argentina | Argentine shortfin squid | *Illex argentinus* | Fillet/muscle | 0.67 | 0.46 | 0.004 | < .005 |
| 2016-710/1 | Chile | Oil | *Octopus sp.* | Fish oil | 0.64 | < .004 | < .004 | < .02 |
| 2016-719/1 | Canada | Shrimp | *Pandalus borealis* | Peeled | 1.6 | 0.029 | 0.016 | < .004 |
| 2016-721/1 | China | Atlantic cod | *Gadus morhua* | Fillet/muscle | 3.8 | < .0007 | 0.032 | < .004 |
| 2016-726/1 | China | Atlantic cod | *Gadus morhua* | Fillet/muscle | 3.9 | < .0008 | 0.027 | < .005 |
| 2016-741/1 | USA | Blue shrimp | *Penaeus stylirostris* | Peeled | 0.2 | < .0008 | 0.005 | 0.007 |
| 2016-742/1 | Vietnam | Tuna | *Katsuwonus* sp. | Canned | 1.1 | 0.019 | 0.05 | < .009 |
| 2016-749/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | 0.34 | 0.004 | 0.29 | < .005 |
| 2016-750/1 | Vietnam | Striped catfish | *Pangasius hypophthalmus* | Fillet/muscle | 0.022 | < .0008 | 0.003 | < .005 |

## Table 7. Heavy metal composition, n=130 (2016).

**n.a.:** Data not available.

| Sample | | | | | As | Cd | Hg | Pb |
|---|---|---|---|---|---|---|---|---|
| **Journal No.** | **Imported from** | **Species** | **Scientific name** | **Tissue/product** | **mg/kg ww** | **mg/kg ww** | **mg/kg ww** | **mg/kg ww** |
| 2016-752/1 | Thailand | Pacific Cod | *Gadus macrocephalus* | Fillet/muscle | 1.7 | < .0007 | 0.028 | < .004 |
| 2016-754/1 | Thailand | Pacific Cod | *Gadus macrocephalus* | Fillet/muscle | 5.6 | < .0008 | 0.037 | < .005 |
| 2016-755/1 | Chile | Atlantic salmon | *Salmo salar* | Fillet/muscle | 0.37 | < .002 | 0.005 | < .009 |
| 2016-758/2 | Norway | Atlantic mackerel | *Scomber scombrus* | Fillet/muscle | 1.8 | 0.007 | 0.025 | < .008 |
| 2016-765/1 | Sri Lanka | Mangrove red snapper | *Lutjanus argentimaculatus* | Fillet/muscle | 0.48 | 0.018 | 0.036 | < .007 |
| 2016-766/1 | Sri Lanka | Barramundi | *Lates calcarifer* | Fillet/muscle | 0.86 | < .001 | 0.038 | < .007 |
| 2016-767/1 | Sri Lanka | Indian anchovy | *Stolephorus indicus* | Fillet/muscle | 1.4 | 0.015 | 0.018 | 0.006 |
| 2016-768/1 | Sri Lanka | White sardinella | *Sardinella albella* | Fillet/muscle | 1.8 | 0.023 | 0.028 | 0.079 |
| 2016-769/1 | Vietnam | Whiteleg shrimp | *Litopenaeus vannamei* | Peeled | 0.44 | 0.001 | 0.014 | 0.011 |
| 2016-816/1 | Sri Lanka | Swordfish | *Xiphias gladius* | Fillet/muscle | 0.63 | 0.004 | 0.29 | < .005 |
| 2016-817/1 | Thailand | Whiteleg shrimp | *Litopenaeus vannamei* | Peeled | 0.22 | < .0006 | 0.051 | 0.008 |
| 2016-838/1 | New Zealand | Oil | *Deania calcea* | Birdbeak dogfish oil | < .006 | < .003 | < .003 | < .02 |
| 2016-843/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 1.3 | 0.009 | 0.056 | < .009 |
| 2016-844/1 | Thailand | Yellowfin tuna | *Thunnus albacares* | Canned | 0.8 | 0.007 | 0.026 | < .005 |
| 2016-845/1 | Turkey | Skipjack tuna | *Katsuwonus pelamis* | Canned | 0.45 | 0.024 | 0.11 | < .01 |
| 2016-846/1 | Thailand | Pacific mackerel | *Scomber japonicus* | Mackerel in tomato sauce | 1 | 0.014 | 0.011 | 0.008 |
| 2016-847/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 0.84 | 0.011 | 0.044 | 0.017 |
| 2016-848/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 1.1 | 0.019 | 0.08 | < .005 |
| 2016-849/1 | Thailand | Yellowfin tuna | *Thunnus albacares* | Canned | 0.75 | 0.006 | 0.027 | < .01 |
| 2016-850/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 1.3 | 0.013 | 0.03 | < .005 |
| 2016-851/1 | Turkey | Skipjack tuna | *Katsuwonus pelamis* | Canned | 0.35 | 0.017 | 0.12 | < .004 |
| 2016-852/1 | Turkey | Skipjack tuna | *Katsuwonus pelamis* | Canned | 0.36 | 0.017 | 0.11 | **< .01** |
| 2016-853/1 | Thailand | Yellowfin tuna | *Thunnus albacares* | Canned | 1.1 | 0.005 | 0.021 | **< .01** |

**Table 7. Heavy metal composition, n=130 (2016).**

**n.a.:** Data not available.

| Sample | | | | | As | Cd | Hg | Pb |
|---|---|---|---|---|---|---|---|---|
| Journal No. | Imported from | Species | Scientific name | Tissue/product | mg/kg ww | mg/kg ww | mg/kg ww | mg/kg ww |
| 2016-915/2 | Russia | Rose fish | *Sebastes norvegicus* | Fillet/muscle | 1.7 | 0.028 | 0.004 | 0.01 |
| 2016-1081/1 | Turkey | Oil | | Fish oil | 6.3 | **< .005** | **< .005** | **< .02** |
| 2016-1189/1 | Morocco | Oil | | Fish oil | 3.7 | **< .005** | **< .005** | **< .02** |
| 2016-1190/1 | Morocco | Oil | | Fish oil | 3.4 | **< .005** | **< .005** | **< .02** |
| 2016-1191/1 | China | Clip fish | *Gadus morhua* | Fillet/muscle | 3.1 | **< .003** | 0.048 | **< .01** |
| 2016-1192/1 | Korea | Pacific oyster | *Crassostrea gigas* | Fillet/muscle | 2.9 | 0.33 | 0.004 | 0.056 |
| 2016-1193/1 | China | Atlantic cod | *Gadus morhua* | Fillet/muscle | 0.17 | **< .0005** | 0.062 | **< .002** |
| 2016-1194/1 | China | Clip fish | *Gadus morhua* | Fillet/muscle | 1.1 | 0.003 | 0.019 | 0.025 |
| 2016-1195/1 | Thailand | Alaska pollock | *Theragra chalcogramma* | Crabsticks | 1.8 | 0.03 | 0.005 | 0.009 |
| 2016-1196/1 | China | Clip fish | *Gadus chalcogrammus* | Fillet/muscle | 0.66 | 0.004 | 0.12 | **< .01** |
| 2016-1208/1 | Thailand | Baby shrimp | *Acetes spp* | Whole | 8.9 | 0.18 | 0.012 | 0.22 |
| 2016-1347/1 | Russia | Atlantic cod | *Gadus morhua* | Fillet/muscle | 0.78 | **< .0008** | 0.054 | **< .004** |
| 2016-1454/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | 2.2 | 0.003 | 0.064 | **< .006** |
| 2016-1458/1 | Sri Lanka | Bigeye Tuna | *Thunnus obesus* | Fillet/muscle | 2.3 | 0.013 | 0.49 | **< .007** |
| 2016-1459/2 | Canada | American lobster | *Homerus americanus* | Fillet/muscle | 9.9 | 0.034 | 0.06 | **< .004** |
| 2016-1474/1 | Morocco | Oil | *Sardina* sp./*Scomber* sp. | Fish oil | 1.1 | **< .003** | **< .003** | **< .02** |
| 2016-1582/1 | Taiwan, Province Of China | Pacific saury | *Cololabis Saira* | Whole fish | 2.9 | 0.094 | 0.054 | **< .01** |
| 2016-1668/1 | Morocco | European pilchard | *Sardina pilchardus* | Canned | 2.7 | 0.1 | 0.009 | **< .02** |
| 2016-1645/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 1 | 0.016 | 0.041 | **< .02** |
| 2016-1665/1 | New Zealand | Pacific oyster | *Crassostrea gigas* | Oyster powder | 16 | 2.8 | 0.034 | 0.63 |
| 2016-1655/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 1.6 | 0.02 | 0.04 | **< .02** |
| 2016-1657/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 1.4 | 0.02 | 0.046 | < .02 |
| 2016-1660/1 | Morocco | European pilchard | *Sardina pilchardus* | Canned | 2.7 | 0.11 | 0.009 | < .02 |
| 2016-1663/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 0.92 | 0.022 | 0.056 | < .02 |

**Table 7. Heavy metal composition, n=130 (2016).**

**n.a.:** Data not available.

| Sample | | | | | As | Cd | Hg | Pb |
|---|---|---|---|---|---|---|---|---|
| **Journal No.** | **Imported from** | **Species** | **Scientific name** | **Tissue/product** | **mg/kg ww** | **mg/kg ww** | **mg/kg ww** | **mg/kg ww** |
| 2016-1664/1 | Philippines | Skipjack tuna | *Katsuwonus pelamis* | Canned | 0.59 | 0.017 | 0.055 | < .02 |
| 2016-1666/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 0.33 | 0.013 | 0.035 | < .02 |
| 2016-1667/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 0.44 | 0.015 | 0.037 | < .02 |
| 2016-1707/1 | Philippines | Skipjack tuna | *Katsuwonus pelamis* | Canned | 0.55 | 0.016 | 0.06 | < .005 |
| 2016-1739/1 | Sri Lanka | Swordfish | *Xiphias gladius* | Fillet/muscle | 0.24 | < .001 | 0.01 | < .007 |
| 2016-1740/1 | Australia | Yellowtail | *Seriola lalandi* | Fillet/muscle | 0.34 | < .002 | 0.14 | < .008 |
| 2016-1741/1 | Japan | Japanese amberjack | *Seriola quinqueradiata* | Fillet/muscle | 0.66 | < .002 | 0.083 | < .009 |
| 2016-1785/1 | Russia | Greenland halibut | *Reinhardtius hippoglossoides* | Fillet/muscle | 3.8 | 0.013 | 0.24 | < .006 |
| 2016-1786/1 | Russia | Greenland halibut | *Reinhardtius hippoglossoides* | Fillet/muscle | 4.2 | 0.005 | 0.32 | 0.017 |
| 2016-1787/1 | Russia | Saithe | *Pollachius virens* | Fillet/muscle | 3.8 | < .001 | 0.031 | < .005 |
| 2016-1788/1 | Russia | Haddock | *Melanogrammus aeglefinus* | Fillet/muscle | 5.5 | < .0009 | 0.04 | < .004 |
| 2016-1789/1 | Russia | Atlantic cod | *Gadus morhua* | Fillet/muscle | 0.51 | 0.001 | 0.062 | < .004 |
| 2016-1902/1 | Sri Lanka | Mangrove red snapper | *Lutjanus argentimaculatus* | Fillet/muscle | 1.9 | < .001 | 0.15 | < .007 |
| 2016-1943/1 | United States | Shrimp | *Pandalus borealis* | Peeled | 2.2 | 0.023 | 0.015 | < .004 |
| 2016-1944/1 | China | Saithe | *Pollachius virens* | Fillet/muscle | 31 | < .0009 | 0.034 | < .005 |
| 2016-1945/1 | China | Saithe | *Pollachius virens* | Fillet/muscle | 17 | < .0009 | 0.041 | < .005 |
| 2016-1946/1 | China | Saithe | *Pollachius virens* | Fillet/muscle | 0.84 | < .0008 | 0.063 | < .004 |
| 2016-1977/2 | Japan | Japanese seabream | *Pagrus major* | Fillet/muscle | 1.1 | < .002 | 0.24 | < .008 |
| 2016-1980/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | 0.52 | 0.013 | 0.66 | < .006 |
| 2016-1981/1 | India | Whiteleg shrimp | *Litopenaeus vannamei* | Peeled | 0.17 | < .0006 | 0.006 | < .003 |
| 2016-1982/1 | China | Saithe | *Pollachius virens* | Fillet/muscle | 1.9 | < .0007 | 0.098 | < .004 |
| 2016-1983/1 | China | Pacific Cod | *Gadus macrocephalus* | Fillet/muscle | 3.1 | < .0008 | 0.031 | < .004 |

## Table 7. Heavy metal composition, n=130 (2016).

**n.a.:** Data not available.

| Sample | | | | | As | Cd | Hg | Pb |
|---|---|---|---|---|---|---|---|---|
| **Journal No.** | **Imported from** | **Species** | **Scientific name** | **Tissue/product** | **mg/kg ww** | **mg/kg ww** | **mg/kg ww** | **mg/kg ww** |
| 2016-1984/1 | Thailand | Purple-spotted bigeye | *Priacanthus tayenus* | Processed product | 0.45 | 0.008 | 0.021 | < .005 |
| 2016-1985/1 | China | Atlantic cod | *Gadus morhua* | Fillet/muscle | 2.3 | < .0009 | 0.027 | < .004 |
| 2016-1986/1 | China | Saithe | *Pollachius virens* | Fillet/muscle | 4.2 | < .0009 | 0.091 | < .004 |
| 2016-1987/1 | Vietnam | Brown crab | *Cancer pagurus* | claw | 24 | 0.012 | 0.084 | 0.007 |
| 2016-1989/1 | China | Spotted wolffish | *Anarchichas minor* | Fillet/muscle | 6.2 | < .001 | 0.062 | < .005 |
| 2016-1995/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 0.54 | 0.01 | 0.034 | < .008 |
| 2016-1996/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 1 | 0.009 | 0.037 | 0.017 |
| 2016-1997/1 | Thailand | Whiteleg shrimp | *Litopenaeus vannamei* | Crabsticks | 0.23 | 0.041 | 0.002 | 0.01 |
| 2016-1998/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 0.47 | 0.011 | 0.11 | < .007 |
| 2016-1999/1 | Thailand | Flower crab | *Portunus pelagicus* | Crabsticks | 0.13 | 0.028 | 0.002 | 0.007 |
| 2016-2053/1 | China | Alaska pollock | *Theragra chalcogramma* | Fillet/muscle | 0.73 | 0.002 | 0.013 | < .003 |
| 2016-2054/1 | China | Atlantic cod | *Gadus morhua* | Fillet/muscle | 12 | < .0007 | 0.023 | < .004 |
| 2016-2055/1 | China | Oil | *Octopus* sp. | Squid oil | 11 | < .005 | < .005 | < .02 |
| 2016-2056/1 | China | Alaska pollock | *Theragra chalcogramma* | Lobster | 3.4 | 0.33 | 0.029 | 0.089 |
| 2016-2058/1 | China | Alaska pollock | *Theragra chalcogramma* | Fillet/muscle | 2.4 | 0.002 | 0.019 | < .004 |
| 2016-2059/1 | China | Pacific Cod | *Gadus macrocephalus* | Fillet/muscle | 4.2 | < .0007 | 0.036 | 0.003 |
| 2016-2061/1 | China | Clip fish | *Gadus chalcogrammus* | Fillet/muscle | 0.58 | 0.021 | 0.034 | 0.042 |
| 2016-2063/1 | Korea | Alaska pollock | *Theragra chalcogramma* | Surimi | 0.24 | 0.003 | 0.016 | < .006 |
| 2016-2064/1 | Thailand | Alaska pollock | *Theragra chalcogramma* | Surimi | 0.11 | 0.002 | 0.005 | < .005 |
| | | | | Max value | 31.00 | 2.80 | 0.66 | 0.63 |
| | | | | Next Highest | 24.00 | 0.46 | 0.49 | 0.41 |

**Table 8. Dioxins and dioxin like PCBs, n=19 (2016).**

**MO**: mono orto, **NO**: non-orto, **TEQ**: Toxic equivalents. All sums calculated as upper bound sums[8].

| Journal No. | Imported from | Species | Scientific name | Tissue | Sum MO-PCB | Sum NO-PCB | Sum DL-PCBs | Sum dioxins PCDD/DF | Sum Total TEQ | Non-compliant |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | pg/g TEQ ww | pg/g TEQ ww | pg/g TEQ ww | pg/g TEQ ww | pg/g TEQ ww | NC |
| 2016-66/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | 0.0014 | 0.02 | 0.02 | 0.11 | 0.13 | - |
| 2016-205/1 | Russia | Greenland halibut | *Reinhardtius hippoglossoides* | Fillet/muscle | 0.016 | 0.11 | 0.12 | 0.18 | 0.31 | - |
| 2016-378/1 | Sri Lanka | Swordfish | *Xiphias gladius* | Fillet/muscle | 0.002 | 0.06 | 0.057 | 0.07 | 0.13 | - |
| 2016-709/1 | Argentina | Argentine shortfin squid | *Illex argentinus* | Fillet/muscle | 0.001 | 0.01 | 0.01 | 0.12 | 0.13 | - |
| 2016-710/1 | Chile | Oil | *Octopus* sp. | Fish oil | 0.041 | 0.98 | 1.0 | 1.3 | 2.3 | - |
| 2016-742/1 | Vietnam | Tuna | *Katsuwonus* sp. | Canned | 0.001 | 0.02 | 0.02 | 0.08 | 0.10 | - |
| 2016-765/1 | Sri Lanka | Mangrove red snapper | *Lutjanus argentimaculatus* | Fillet/muscle | 0.0020 | 0.098 | 0.10 | 0.13 | 0.23 | - |
| 2016-766/1 | Sri Lanka | Barramundi | *Lates calcarifer* | Fillet/muscle | 0.004 | 0.12 | 0.12 | 0.15 | 0.28 | - |
| 2016-816/1 | Sri Lanka | Swordfish | *Xiphias gladius* | Fillet/muscle | 0.0007 | 0.015 | 0.02 | 0.06 | 0.07 | - |
| 2016-838/1 | New Zealand | Oil | *Deania calcea* | Birdbeak dogfish oil | 0.043 | 1.0 | 1.1 | 0.59 | 1.7 | - |
| 2016-843/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 0.003 | 0.02 | 0.02 | 0.18 | 0.19 | - |
| 2016-844/1 | Thailand | Yellowfin tuna | *Thunnus albacares* | Canned | 0.0004 | 0.003 | 0.003 | 0.05 | 0.05 | - |
| 2016-845/1 | Turkey | Skipjack tuna | *Katsuwonus pelamis* | Canned | 0.001 | 0.02 | 0.02 | 0.14 | 0.16 | - |
| 2016-846/1 | Thailand | Pacific mackerel | *Scomber japonicus* | Canned | 0.003 | 0.11 | 0.11 | 0.14 | 0.25 | - |

[8] According to the EU regulation 1881/2006

## Table 8. Dioxins and dioxin like PCBs, n=19 (2016).

**MO**: mono orto, **NO**: non-orto, **TEQ**: Toxic equivalents. All sums calculated as upper bound sums[8].

| Journal No. | Imported from | Species | Scientific name | Tissue | Sum MO-PCB | Sum NO-PCB | Sum DL-PCBs | Sum dioxins PCDD/DF | Sum Total TEQ | Non-compliant |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | pg/g TEQ ww | pg/g TEQ ww | pg/g TEQ ww | pg/g TEQ ww | pg/g TEQ ww | NC |
| 2016-847/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 0.0007 | 0.006 | 0.007 | 0.10 | 0.10 | - |
| 2016-848/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 0.0007 | 0.004 | 0.005 | 0.06 | 0.06 | - |
| 2016-849/1 | Thailand | Yellowfin tuna | *Thunnus albacares* | Canned | 0.001 | 0.01 | 0.01 | 0.20 | 0.21 | - |
| 2016-850/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | 0.0006 | 0.004 | 0.004 | 0.05 | 0.05 | - |
| 2016-1081/1 | Turkey | Oil | | Fish oil | 0.24 | 6.2 | 6.4 | 2.5 | 9.0 | NC |
| | | | | **Max value** | 0.24 | 6.2 | 6.5 | 2.5 | 9.0 | |

**Table 9. Non-dioxin like PCBs (µg/kg ww), n=40 (2016)**

The congener sum $PCB_6$ is calculated as the upper bound sum.

Two different analytical methods were used: one GC/MS and one HRGC/HRMS. This is reflected in the two levels of LOQ values, as seen from the: < values.

| Journal No. | Imported from | Species | Scientific Name | Tissue | | PCB 28 | PCB 52 | PCB 101 | PCB 138 | PCB 153 | PCB 180 | UB-Sum $PCB_6$ | Non-comp |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016-66/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | | 0.01 | < .01 | < .01 | 0.01 | 0.02 | < .01 | 0.07 | - |
| 2016-205/1 | Russia | Greenland halibut | *Reinhardtius hippoglossoides* | Fillet/muscle | | 0.23 | 0.25 | 0.29 | 0.25 | 0.63 | 0.12 | 1.8 | - |
| 2016-372/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | | < .08 | < .08 | < .08 | < .08 | < .08 | < .08 | 0.48 | - |
| 2016-378/1 | Sri Lanka | Swordfish | *Xiphias gladius* | Fillet/muscle | | 0.02 | 0.02 | 0.024 | 0.07 | 0.10 | 0.04 | 0.27 | - |
| 2016-383/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | | < .08 | < .08 | < .08 | < .08 | < .08 | < .08 | 0.48 | - |
| 2016-573/1 | Maldives | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | | < .5 | < .4 | < .1 | < .1 | < .1 | < .1 | 1.3 | - |
| 2016-707/1 | Taiwan | Pacific saury | *Cololabis Saira* | Fillet/muscle | | < .3 | < .5 | 0.2 | < .3 | 0.2 | < .1 | 1.6 | - |
| 2016-708/1 | Taiwan | Pacific saury | *Cololabis Saira* | Fillet/muscle | | < .3 | < .5 | 0.2 | < .3 | 0.2 | < .1 | 1.6 | - |
| 2016-709/1 | Argentina | Argentine shortfin squid | *Illex argentinus* | Fillet/muscle | | 0.02 | 0.01 | 0.016 | 0.02 | 0.03 | < .01 | 0.11 | - |
| 2016-710/1 | Chile | Oil | *Octopus* sp. | Fish oil | | 0.61 | 0.54 | 1.4 | 1.1 | 1.8 | 0.57 | 6.0 | - |
| 2016-742/1 | Vietnam | Tuna | *Katsuwonus* sp. | Canned | | 0.03 | < .02 | < .02 | < .02 | < .02 | < .02 | 0.10 | - |
| 2016-749/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | | < .3 | < .3 | < .1 | < .1 | < .1 | < .1 | 1 | - |
| 2016-758/2 | Norway | Atlantic mackerel | *Scomber scombrus* | Fillet/muscle | | < .3 | 0.5 | 1.5 | 3.6 | 4.3 | 0.7 | 11 | - |
| 2016-765/1 | Sri Lanka | Mangrove red snapper | *Lutjanus argentimaculatus* | Fillet/muscle | | < .015 | < .015 | 0.018 | 0.05 | 0.11 | 0.04 | 0.245 | - |
| 2016-766/1 | Sri Lanka | Barramundi | *Lates calcarifer* | Fillet/muscle | | 0.03 | 0.035 | 0.073 | 0.13 | 0.22 | 0.1 | 0.59 | - |
| 2016-767/1 | Sri Lanka | Indian anchovy | *Stolephorus indicus* | Fillet/muscle | | < .3 | < .2 | < .1 | < .1 | < .1 | < .1 | 0.9 | - |
| 2016-768/1 | Sri Lanka | White sardinella | *Sardinella albella* | Fillet/muscle | | < .2 | < .2 | < .06 | 0.1 | 0.2 | 0.07 | 0.83 | - |
| 2016-816/1 | Sri Lanka | Swordfish | *Xiphias gladius* | Fillet/muscle | | < .01 | < .01 | < .01 | 0.01 | 0.018 | < .01 | 0.07 | - |

## Table 9. Non-dioxin like PCBs (µg/kg ww), n=40 (2016)

The congener sum $PCB_6$ is calculated as the upper bound sum.
Two different analytical methods were used: one GC/MS and one HRGC/HRMS. This is reflected in the two levels of LOQ values, as seen from the: < values.

| Journal No. | Imported from | Species | Scientific Name | Tissue | | PCB 28 | PCB 52 | PCB 101 | PCB 138 | PCB 153 | PCB 180 | UB-Sum $PCB_6$ | Non-comp |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016-838/1 | New Zealand | Oil | *Deania calcea* | Birdbeak dogfish oil | | 2.6 | 0.13 | 0.58 | 1.3 | 1.9 | 0.77 | 7.28 | - |
| 2016-843/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | | 0.05 | < .03 | < .03 | < .03 | < .03 | < .03 | 0.18 | - |
| 2016-844/1 | Thailand | Yellowfin tuna | *Thunnus albacares* | Canned | | 0.01 | < .007 | < .007 | < .007 | 0.007 | < .007 | 0.05 | - |
| 2016-845/1 | Turkey | Skipjack tuna | *Katsuwonus pelamis* | Canned | | < .03 | < .03 | < .03 | < .03 | < .03 | < .03 | 0.17 | - |
| 2016-846/1 | Thailand | Pacific mackerel | *Scomber japonicus* | Mackerel tomato sauce | | 0.03 | 0.03 | 0.04 | 0.05 | 0.08 | 0.02 | 0.24 | - |
| 2016-847/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | | 0.02 | < .01 | < .01 | < .01 | < .01 | < .01 | 0.09 | - |
| 2016-848/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | | 0.01 | < .008 | < .008 | < .008 | 0.008 | < .008 | 0.05 | - |
| 2016-849/1 | Thailand | Yellowfin tuna | *Thunnus albacares* | Canned | | < .03 | < .03 | < .03 | < .03 | < .03 | < .033 | 0.20 | - |
| 2016-850/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | | 0.01 | < .008 | < .008 | < .008 | < .008 | < .008 | 0.05 | - |
| 2016-851/1 | Turkey | Skipjack tuna | *Katsuwonus pelamis* | Canned | | < .3 | < .2 | < .06 | < .06 | < .06 | < .06 | 0.74 | - |
| 2016-852/1 | Turkey | Skipjack tuna | *Katsuwonus pelamis* | Canned | | < .4 | < .4 | < .2 | < .2 | < .2 | < .2 | 1.6 | - |
| 2016-853/1 | Thailand | Yellowfin tuna | *Thunnus albacares* | Canned | | < .4 | < .4 | < .2 | < .2 | < .2 | 0.3 | 1.7 | - |
| 2016-1081/1 | Turkey | Oil | | Fish oil | | 2.7 | 1.9 | 4.8 | 8.8 | 13 | 2.6 | 34 | - |
| 2016-1189/1 | Morocco | Oil | | Fish oil | | < .5 | 0.7 | 0.6 | 3.1 | 4.7 | 0.9 | 11 | - |
| 2016-1190/1 | Morocco | Oil | | Fish oil | | < .8 | < .5 | 0.7 | 4.9 | 8 | 1.8 | 17 | - |
| 2016-1454/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Fillet/muscle | | < .1 | < .1 | < .05 | < .05 | < .05 | < .05 | 0.4 | - |
| 2016-1458/1 | Sri Lanka | Bigeye Tuna | *Thunnus obesus* | Fillet/muscle | | < .1 | < .1 | < .05 | < .05 | < .05 | < .05 | 0.4 | |
| 2016-1474/1 | Morocco | Oil | *Sardina* sp./*Scomber* sp. | Fish oil | | < .8 | 0.9 | 0.8 | 3.2 | 6 | 0.9 | 13 | |

## Table 9. Non-dioxin like PCBs (µg/kg ww), n=40 (2016)

The congener sum $PCB_6$ is calculated as the upper bound sum.
Two different analytical methods were used: one GC/MS and one HRGC/HRMS. This is reflected in the two levels of LOQ values, as seen from the: < values.

| Journal No. | Imported from | Species | Scientific Name | Tissue | | PCB 28 | PCB 52 | PCB 101 | PCB 138 | PCB 153 | PCB 180 | UB-Sum $PCB_6$ | Non-comp |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016-1582/1 | Taiwan | Pacific saury | *Cololabis saira* | Fillet/muscle | | < .3 | < 1 | 0.2 | < .3 | < .3 | < .1 | 2.2 | |
| 2016-1645/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | | < .3 | < .1 | < .1 | < .1 | < .1 | < .1 | 0.8 | |
| 2016-1655/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | | < .3 | < .2 | < .1 | < .1 | < .1 | < .1 | 0.9 | |
| 2016-1657/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | | < .2 | < .1 | < .1 | 0.3 | < .1 | < .1 | 0.9 | |
| | | | | Max value | | **2.7** | **1.9** | **4.8** | **8.8** | **13** | **2.6** | **34** | none |
| | | | | Next Highest | | **2.6** | **0.9** | **1.5** | **4.9** | **8.0** | **1.8** | **17** | |

**Table 10. Levels of PBDEs (µg/kg ww), n=16 (2016)**

**n.a.**: Data not available.

| Journal No. | Imported from | Species | Scient. name | Tissue | PBDE-28 | PBDE-47 | PBDE-99 | PBDE-100 | PBDE-153 | PBDE-154 | PBDE-183 | UB Sum 7-PBDE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016-66/1 | Sri Lanka | Yellowfin tuna | *Thunnus albacares* | Muscle | < .002 | < .004 | < .004 | < .002 | < .002 | < .002 | < .004 | 0.02 |
| 2016-205/1 | Russia | Greenland halibut | *Reinhardtius hippoglossoides* | Muscle | 0.01 | 0.16 | 0.006 | 0.02 | 0.004 | 0.02 | < .005 | 0.22 |
| 2016-378/1 | Sri Lanka | Swordfish | *Xiphias gladius* | Muscle | 0.01 | 0.01 | 0.005 | 0.01 | 0.007 | 0.02 | < .002 | 0.07 |
| 2016-709/1 | Argentina | Argentine shortfin squid | *Illex argentinus* | Muscle | < .002 | 0.004 | < .004 | < .002 | < .002 | < .002 | < .004 | 0.02 |
| 2016-710/1 | Chile | Oil | | Fish oil | 0.05 | 0.54 | 0.14 | 0.09 | 0.07 | 0.12 | < .07 | 1.1 |
| 2016-742/1 | Vietnam | Tuna | *Katsuwonus* sp. | Canned | < .003 | < .005 | < .005 | < .003 | < .003 | < .003 | < .005 | 0.03 |
| 2016-816/1 | Sri Lanka | Swordfish | *Xiphias gladius* | Muscle | < .002 | < .003 | < .003 | < .002 | < .002 | 0.002 | < .003 | 0.02 |
| 2016-838/1 | New Zealand | Oil | *Deania calcea* | Birdbeak oil | 0.02 | 0.32 | < .03 | 0.06 | < .02 | 0.06 | < .032 | 0.53 |
| 2016-843/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | < .004 | < .009 | < .009 | < .004 | < .004 | < .004 | < .009 | 0.04 |
| 2016-844/1 | Thailand | Yellowfin tuna | *Thunnus albacares* | Canned | < .001 | < .002 | < .002 | < .001 | < .001 | < .001 | < .002 | 0.01 |
| 2016-845/1 | Turkey | Skipjack tuna | *Katsuwonus pelamis* | Canned | < .005 | < .009 | < .009 | < .005 | < .005 | < .005 | < .009 | 0.05 |
| 2016-846/1 | Thailand | Pacific mackerel | *Scomber japonicus* | Mackere l tomato sauce | < .003 | 0.02 | 0.007 | 0.007 | 0.004 | 0.02 | < .006 | 0.06 |
| 2016-847/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | < .002 | < .005 | < .005 | < .002 | < .002 | < .002 | < .005 | 0.02 |
| 2016-848/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | < .001 | < .003 | < .003 | < .001 | < .001 | < .001 | < .003 | 0.01 |
| 2016-849/1 | Thailand | Yellowfin tuna | *Thunnus albacares* | Canned | < .006 | < .01 | < .01 | < .006 | < .006 | < .006 | < .01 | 0.06 |
| 2016-850/1 | Thailand | Skipjack tuna | *Katsuwonus pelamis* | Canned | < .001 | < .003 | < .003 | < .001 | < .001 | < .001 | < .003 | 0.01 |
| | | | Max value | All | **0.05** | **0.54** | **0.14** | **0.09** | **0.07** | **0.12** | <LOQ | **1.1** |

**Table 11. Maximum levels of pesticides (µg/kg ww), n=24 (2016).**
Maximum levels for each pesticide in each class of species.
Each value will represent only one sample: The sample with highest value for that pesticide. "-": not measured.

| Group | Marine fish (fillet) | Processed sea food products (excluding oil) | #Samples analysed for this parameter/ and number of real values >LOQ | Max value in one sample | LOQ |
|---|---|---|---|---|---|
| Samples/ class | N=15 | N=9 | | | |
| Pesticide | Max value | Max value | N / #values >LOQ | Max value | µg/kg ww |
| Aldrin | <LOQ | <LOQ | 24 / 0 | - | 0.02 - 0.13 |
| Dieldrin | 1.48 | 0.46 | 24 / 3 | 1.48 | 0.03 - 0.19 |
| Endrin | 0.20 | <LOQ | 24 / 1 | 0.20 | 0.05 - 0.39 |
| Mirex | <LOQ | <LOQ | 24 / 0 | - | 0.06 - 0.13 |
| Endosulfane-alfa | <LOQ | <LOQ | 24 / 0 | - | 0.07 - 0.64 |
| Endosulfane-beta | <LOQ | <LOQ | 24 / 0 | - | 0.07 - 0.64 |
| Endosulfane-Sulfate | <LOQ | <LOQ | 24 / 0 | - | 0.07 - 0.64 |
| Cis-chlordane | 0.55 | 0.15 | 24 / 3 | 0.55 | 0.02 - 0.13 |
| Trans-chlordane | 0.11 | <LOQ | 24 / 2 | 0.11 | 0.06 - 0.2 |
| Oxy-chlordane | <LOQ | <LOQ | 24 / 0 | - | 0.09 - 0.6 |
| Hexachlorhexane alfa-HCH | 0.43 | <LOQ | 24 / 1 | 0.43 | 0.04 - 0.3 |
| Hexachlorhexane beta-HCH | 0.91 | <LOQ | 24 / 1 | 0.91 | 0.04 - 0.3 |
| Hexachlorhexane delta-HCH | <LOQ | <LOQ | 24 / 0 | - | 0.04 - 0.3 |
| Hexachlorhexane gamma-HCH | <LOQ | <LOQ | 24 / 0 | - | 0.04 - 0.3 |
| Hexachlorbenzene HCB | 2.1 | 1.1 | 24 / 5 | 2.1 | 0.09 – 0.4 |
| Pentachlorobenzene | <LOQ | <LOQ | 24 / 0 | - | 0.09 – 0.6 |

**Table 11. Maximum levels of pesticides (µg/kg ww), n=24 (2016).**
Maximum levels for each pesticide in each class of species.
Each value will represent only one sample: The sample with highest value for that pesticide. "-": not measured.

| Group | Marine fish (fillet) | Processed sea food products (excluding oil) | #Samples analysed for this parameter/ and number of real values >LOQ | Max value in one sample | LOQ |
|---|---|---|---|---|---|
| Samples/ class | N=15 | N=9 | | | |
| Pesticide | Max value | Max value | N / #values >LOQ | Max value | µg/kg ww |
| Heptachlor | <LOQ | <LOQ | 24 / 0 | - | 0.02 – 0.1 |
| Heptachlor trans epoxide | <LOQ | <LOQ | 24 / 0 | - | 0.05 – 0.4 |
| Heptachlor cis epoxide | 0.3 | 0.1 | 24 / 3 | 0.3 | 0.03 – 0.2 |
| Nonachlor-trans | 0.7 | 0.2 | 24 / 3 | 0.7 | 0.01 – 0.06 |
| Toxaphene-26 | 1.0 | <LOQ | 24 / 2 | 1.0 | 0.09 – 0.6 |
| Toxaphene-50 | 1.7 | <LOQ | 24 / 2 | 1.7 | 0.09 – 0.6 |
| Toxaphene-62 | 0.8 | <LOQ | 24 / 1 | 0.8 | 0.2 – 1.2 |
| o,p-DDD | 0.2 | <LOQ | 24 / 3 | 0.2 | 0.06 – 0.13 |
| o,p-DDE | 0.1 | <LOQ | 24 / 1 | 0.1 | 0.02 – 0.13 |
| o,p-DDT | 0.2 | <LOQ | 24 / 5 | 0.2 | 0.06 – 0.13 |
| p,p-DDD | 0.5 | 0.4 | 24 / 8 | 0.5 | 0.06 – 0.13 |
| p,p-DDE | 1.3 | 0.6 | 24 / 11 | 1.3 | 0.06 – 0.13 |
| p,p-DDT | 0.6 | <LOQ | 24 / 6 | 0.6 | 0.06 – 0.13 |

| Table 12. PAH levels (µg/kg ww). | |
|---|---|
| Sample | 2016-1192/1 |
| Species | **Pacific oyster** |
| Scient. name | *Crassostrea gigas* |
| Tissue/ processing | Muscle |
| 5-methylchrysene | <LOQ |
| Benz(a)anthracene | <LOQ |
| Benzo(a)pyrene | **<LOQ** |
| Benzo(b)fluoranthene | 1.0 |
| Benzo(c)fluorene | <LOQ |
| Benzo(ghi)perylene | <LOQ |
| Benzo(j)fluoranthene | <LOQ |
| Benzo(k)fluoranthene | <LOQ |
| Chrysene | 1.7 |
| Cyclopenta(cd)pyrene | <LOQ |
| Dibenz(ah)anthracene | <LOQ |
| Dibenzo(a,e)pyrene | <LOQ |
| Dibenzo(a,h)pyrene | <LOQ |
| Dibenzo(a,i)pyrene | <LOQ |
| Dibenzo(a,l)pyrene | <LOQ |
| Indeno(1,2,3,-cd)pyrene | <LOQ |
| LB Sum PAH-4 | **2.7** |
| Non-compliant: | - |

## ANNEX 2: Method performance

**A summary of the chemical analytical methods.**

| Compounds | | Matrix | Method principle | Screening method LOD (µg/kg ww) | Analytical method LOD/ CCα in muscle (µg/kg ww) | Analytical method LOQ (µg/kg ww) | Level of action | Laboratory |
|---|---|---|---|---|---|---|---|---|
| Therapeutic agents and dyes | Chloramphenicol | Muscle | LC-MS/MS | n.a. | 0.25 | - | presence (MRPL=0.3) | NIFES |
| | Hydroxy-metronidazole[2] | Muscle | LC-MS/MS | n.a. | 2 | - | presence (MRPL=3.0) | NIFES |
| | 3-Amino-2-oxazolidinone (AOZ) | Muscle | LC-MS/MS | n.a. | 0.5 | - | presence (MRPL=1.0) | NIFES |
| | 1-Aminohydrantoin (AHD) | Muscle | LC-MS/MS | n.a. | 0.6 | - | presence (MRPL=1.0) | NIFES |
| | 3-Amino-5-morpholinomethyl-2-oxazolidinone (AMOZ) | Muscle | LC-MS/MS | n.a. | 0.4 | - | presence (MRPL=1.0) | NIFES |
| | Semicarbazide (SEM) | Muscle | LC-MS/MS | n.a. | 0.5 | - | presence (MRPL=1.0) | NIFES |
| | Malachite green (MG)[2] | Muscle | LC-MS/MS | n.a. | 0.15 | - | presence (MRPL=2.0) | NIFES |
| | Leuco malachite green (LMG)[2] | Muscle | LC-MS/MS | n.a. | 0.15-0-2 | - | presence (MRPL=2.0) | NIFES |
| | Crystal violet (CV) | Muscle | LC-MS/MS | n.a. | 0.3 | - | Presence | NIFES |
| | Leuco crystal violet (LCV) | Muscle | LC-MS/MS | n.a. | 0.05-0.15 | - | Presence | NIFES |
| | Brilliant green[2] (BG) | Muscle | LC-MS/MS | n.a. | 0.15-0-2 | - | Presence | NIFES |
| POPS | PCDD and PCDF (dioxin and furan) congeners | Muscle | GC-HRMS | n.a. | - | $3*10^{-5}$-0.5 ng/kg[1] TEQ | Dioxins maximum levels are in sum TEQ units See annex 3 | NIFES |
| | non-orto PCB congeners | Muscle | GC-HRMS | n.a. | - | $2*10^{-5}$-0.02 ng/kg[1] TEQ | DLPCBs maximum levels are in sum TEQ units See annex 3 | NIFES |

**A summary of the chemical analytical methods.**

| Compounds | | Matrix | Method principle | Screening method LOD (µg/kg ww) | Analytical method LOD/ CCα in muscle (µg/kg ww) | Analytical method LOQ (µg/kg ww) | Level of action | Laboratory |
|---|---|---|---|---|---|---|---|---|
| | Mono-orto PCB congeners | Muscle | GC-HRMS | n.a. | - | $2*10^{-5}$-0.02 ng/kg[1] TEQ | DLPCBs maximum levels are in sum TEQ units See annex 3 | NIFES |
| | Indicator PCB congeners | Muscle | GC-MS | n.a. | - | 0.007-0.4 | See annex 3 | NIFES |
| | Pesticides | Muscle | GC-MS/MS or LC/MS/MS | See table 11 | | | | Eurofins |
| | PBDE-congeners | Muscle | GC-MS | n.a. | - | $2*10^{-6}$-$5*10^{-5}$ | n.a. | NIFES |
| | PAH, benzo(a)pyrene(BaP) SUM $PAH_4$ | Edible parts | GC-MS | n.a. | - | 0.5-1 | See Annex 3 | NIFES |
| **Chemical elements** | Pb | Muscle | ICPMS | n.a. | - | 50-250 | See Annex 3 | NIFES |
| | Cd | Muscle | ICPMS | n.a. | - | 0.5-5 | See Annex 3 | NIFES |
| | As | Muscle | ICPMS | n.a. | - | 2 | See Annex 3 | NIFES |
| | Hg | Muscle | ICPMS | n.a. | - | 30-50 | See Annex 3 | NIFES |
| **Spoilage indicators** | TVB-N[2] | Muscle | Volumetry /titration[3] | n.a. | - | 0.6 mg(N) | - | NIFES |
| | Histamine | Muscle | HPLC-UV | n.a. | - | 5 mg/kg | - | NIFES |
| | TBARS[2] | Muscle | Spectroscopy | n.a. | - | 4 nmol/g | - | NIFES |

1) The TEQ is a toxicity scale, the product of the analytical concentration and a congener specific toxicity factor.
1) ng/kg is the same scale (unit) as pg/g. 1
2) The method is not accredited according to ISO 17025
3) See: Conway, E.I and Byrne, A: An absorption apparatus for the microdetermination of certain volatile substances. Biochem, J. 27, 419-429, 1933

# Annex 3: Legal maximum levels

**A selection of regulatory maximum levels for contaminants in seafood**
**from on EU Commission regulation no 1881/2006**

| Element or pollutant | Unit of measurem ent | Marin Fish Fillet[1] | Some fish species Fillet[1] | Wild caught Eel Fillet[1] | Fresh water Fish Fillet[1] | Smoked seafood products | Fish liver | Crusta-ceans: White meat | Bivalves and (smoked bivalves)[2] | Cephalo-pods[3] | Marine Oils HC[4] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic (As) | mg/kg ww[6] | - | | - | - | - | - | - | - | - | - |
| Cadmium (Cd) | | 0.05 | 0.1-0.3 | 0.1 | 0.05 | - | - | 0.5 | 1.0 | 1.0 | - |
| Mercury (Hg) | | 0.5 | 1.0 | 1.0 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | - |
| Lead (Pb) | | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | - | 0.5 | 1.5 | 1.0 | - |
| Sum of dioxins and furans[5] | pg/g TEQ ww [6] | 3.5 | | 3.5 | 3.5 | - | - | 3.5 | - | - | 1.75 |
| Sum of dioxin like PCBs[5] | | - | - | - | - | - | - | - | - | - | - |
| Sum of dioxins. furans and dioxin like PCBs[5] | | 6.5 | - | 10 | 6.5 | - | 20 | 6.5 | - | - | 6 |
| Sum of six indicator PCBs[5] | ng/g ww[6] | 75 | - | 300 | 125 | - | 200 | 75 | - | - | 200 |
| PAH Benzo[a]pyrene | µg/kg ww [6] | - | - | - | - | 5<br>2 | - | - | 5<br>(6)[2] | - | 2 |
| $PAH_4$, sum of 4 PAH compounds[7] | µg/kg ww[6] | - | - | - | - | 12 | - | - | 30<br>(35)[2] | - | 10 |

Based on Commission regulation no 1881/2006

1) When fish is intended to be eaten whole, the level should be applied to the whole product.
2) Value in brackets concerns smoked bivalves.
3) Without viscera.
4) HC = Human consumption
5) Upper bound sum is assumed.
6) Wet weight (ww); the concentration in a naturally moist sample. Analytical values for dried food should be transformed to their corresponding ww based values before the maximum level is applied.
7) Benzo(a)pyrene, Benzo(a)anthracene, Benzo(b)fluoranthene and chrysene, calculated as a lower bound sum.

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