MONITORING PROGRAMME FOR VETERINARY CONTROL ON SEAFOOD PRODUCTS IMPORTED TO NORWAY FROM THIRD COUNTRIES – RESULTS FROM 2018

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

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This report summarises results from the ongoing monitoring programme for veterinary border control on seafood products imported to Norway from countries outside the EU and the European Economic Area from 2018. The Institute of Marine Research (IMR) 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, made the 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, was evaluated in this risk assessment. A total of 122 samples from the NFSA, collected at the BIPs, were examined by a selection of analytical methods and assays for microorganisms, parasites and undesirable chemical substances. The analytical data are listed in Annex 1 and are summarised below. Microbiological analyses were performed on 104 samples. The results for microbiological indicator organisms for faecal contamination were mostly below detection limit or showed low bacterial counts. The microbiological quality parameters and indicator organisms for faecal contamination generally showed low numbers. However, higher counts were found in one sample of Yellowfin tuna imported from the Maldives and one sample of Pacific cod imported from Thailand. L. monocytogenes was detected in low quantity in one sample of Pacific cod from Thailand and in one sample of Norwegian herring re-imported to Norway from Egypt. No samples had pathogens in the genera Salmonella. Enterobacteriaceae was detected in one sample of feed imported from Chile.Yeast was found in two samples of feed from Chile, and in one sample of dried Yellow Stripe Trevally from Thailand and in Migas from China. Mould was detected in the same dried Yellow Stripe Trevally from Thailand and in Migas from China. Parasitological examination was carried out on 40 fish samples. Nematodes were found in nine of them (22.5%). Since fish were imported frozen, nematodes were dead and not infective. Thirteen seafood samples originating from aquaculture were analysed for residues of prohibited veterinary medicines, unauthorised dyes and antibacterial agents. None of these were detected. The chemical spoilage indicators histamine and total volatile basic nitrogen was examined in nineteen samples and all results were compliant with the maximum levels. Undesirable trace elements were measured in 89 samples. A sample of canned sardine in oil from the Philippines exceeded the maximum Cd level. A sample of small crabs from Thailand, assuming they were intended to be consumed whole, were slightly above the Pb maximum level. A frozen fillet sample of yellowfin tuna imported from Vietnam exceeded the Hg maximum level. Twenty-eight samples were analysed for the persistent organic pollutants dioxins/ furans and PCBs (DLPCBs and NDLPCBs), the PBDE class of compounds, the PAH class of compounds and organochlorine pesticides. One sample of fish oil from Turkey was found non-compliant with its maximum levels for dioxins and for the sum of dioxins and dioxin like PCBs. The levels of PBDEs in twenty-eight samples, and also the fifteen samples analysed for organochlorine pesticides, were within a range commonly observed in seafood. For the PAH class of compounds, one sample was analysed, and found compliant with its maximum levels.

Innhold

1 - Introduction

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

According to Commission Regulation (EC) No 136/2004 (EU, 2004; FOR-2015-11-30-1347) the monitoring plans must be based upon the nature of the products and the potential risks associated with the different product categories, concidering all relevant factors such as frequency and number of incoming consignments and results from previous monitoring. The selection of parameters included in the current analytical activity was based on previous findings in this program, as well as information available in the RASFF, "Rapid Alert System for Food and Feed" system of the European commission.

The spectrum of products examined by NFSA at veterinary border inspection points is large, as it reflects the annual flux and variation in the import activity. Thus, the methods used to examine the products are also diverse.

Microbiological parameters are used to evaluate the quality of seafood products and if proper hygienic measures were applied during production. To evaluate possible fecal contamination, analysis for common indicator organisms were conducted, including assays for coliforms, bacteria in the Enterobacteriaceae family and enterococci. Furthermore, samples were analyzed for specific pathogens relevant for food safety, including bacteria in the geni *Salmonella*, *Listeria* and *Vibrio*. EU microbiological criteria, which Norway has implemented through the EEA agreement, have been established for *Salmonella* and *Listeria monocytogenes* (Commission Regulation 2073/2005). In addition, analysis for H_2S-producing bacteria in unpreserved and non-heat treated seafood was implemented, in order to provide information on the quality of fresh and frozen seafood, as well as hygienic standards during production.

The survey included the chemical spoilage indicators histamine and total volatile basic nitogen (TVN).

Parasites are common in commercially harvested seafood species. Parasites potentially have a negative human health impact and they can reduce the aesthetical appearance of the product. However, in seafood only a few widely distributed parasite species are of consumer health concern. The larvae of several species of roundworms (nematodes) commonly occur in commercially harvested marine fish stocks in temperate sea areas worldwide. In addition to the quality reducing effect of these parasites, they are of human health concern when found alive in undercooked, lightly brined, marinated or raw fish meat products. According to Regulation (EC) No 853/2004, fishery products intended to be consumed raw or almost raw should undergo a freezing treatment to kill viable parasites. This regulation does not apply to farmed fish when the absence of such parasites has been well documented (Commission Regulation 1276/2011). Accordingly, the number of nematodes only was determined in relevant products.

According to current EU legislation (Directive 96/23), some drugs are illegal to use in animals intended for food production. Thus, samples from aquaculture were analyzed for such agents. Chloramphenicol is an antibiotic agent with activity against a broad spectrum of microorganisms. Due to a rare but serious dose-independent adverse effect (aplastic anaemia), this agent is not authorized in the treatment of food-producing animals, including fish. Nitrofuranes were previously widely used in veterinary medicine as an antimicrobial agent. They were banned from use in the European Union (EU) in 1995 due to concerns about the carcinogenicity of their residues in edible tissue. Relevant farmaceuticals were analysed in farmed seafood products.

Persistent organic pollutants (POPs) form a heterogeneous group of lipophilic substances that exhibit a range of chemical and toxicological characteristics. They are persistent in the environment and accumulate in food chains. Some clases of POPs are considered a dietary hazard to human health. The compliance of selected samples with the established maximum levels for food stuffs (EC 1881/2006) was evaluated for the contaminats: dioxins, furans, and dioxin-like PCBs, the EU selected “non-dioxin like-PCBs”, and for the polyaromatic hydrocarbons (PAH). Chlorinated pesticides and flame-retardant compounds in the polybrominated diphenyl ethers family (PBDEs) were also measured. However, maximum limits have not been established for these.

Undesirable trace elements relevant for seafood safety occur naturally in the environment with large geographical variations, due to their geological presence. Furthermore, they are released from anthropogenic sources. These compounds may to some extent accumulate in food chains and thus find their way into wild caught seafood. Cultured seafood can be affected via contaminated feed. As implemented in regulation EC 1881/2006, the elements cadmium (Cd), mercury (Hg), and lead (Pb), were measured and the compliance of the values with the maximum levels was evaluated. Arsenic (As) was also measured, although no maximum limit for As in seafood exists and only a minor fraction of the here measured total arsenic is present in the toxic inorganic form in seafood.

2 - Materials and methods

Sampling was carried out by NFSA at the Norwegian Border Inspection Posts (BIPs) while analytical examinations and the writing of this report was conducted by IMR. The sampling targeted hazards associated with each kind of imported products, and took into account import volumes, compositional nature of the products, results from previous monitoring, geographical origin of samples, and information available in the Rapid Alert System for Food and Feed (RASFF). This report concerns samples imported to Norway in 2018.

Fresh sample were directly shipped to IMR and frozen samples were stored frozen in the BIPs until shipment in the frozen state to IMR for analysis. Upon arrival, samples were registered at the IMR 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 all 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 the samples for human consumption was selected for analyses, according to a manual with specific instructions for each kind of sample. For species where a legal maximum level was defined, the tissue specified in the regulation was selected. 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.

The evaluations of the analytical data in the report is based primarily on the EU maximum levels (Commission Regulation (EU) No. 2006/1881, summed up in Annex 3 of this report; Commission Regulation (EU) No. 2073/2005, 37/2010 and 1019/2013) and EU recommendations. The maximum levels provide a legal framework for trade. For undesirables with no maximum level in place, the reference basis selected for the discussion/ interpretation was published opinions or food safety evaluation from scientific expert committees (when available), or the analytical range commonly observed for this undesirable in seafood from pristine or semi-pristine waters.

3 - Results and discussion

A total of 122 samples from the NFSA at Norwegian BIPs, were examined by a selection of methods for microorganisms, parasites and undesirable chemical species as shown in the table below. Data tables are presented in Annex 1. Method performance data are listed in Annex 2. A summary of EU maximum levels for certain contaminants in foodstuffs are listed in Annex 3.

Samples and assays included in the Norwegian veterinary border control of seafood 2018								
	Fish	Crustaceans	Cephalopods	Bivalves	Feed/ flour	Marine Oils	Processed seafood	Total number
Microorganisms	42	16		1	3	10	32	104
Chemical spoilage indicators	17						4	21
Nematodes	37						3	40
Pharmaceuticals	5	6					2	13
Undesirable elements	32	17	4		1	10	25	89
Halogenated POPs	21					5	2	28
Pesticides	8					5	2	15
PAH							1	1

3.1 - Microbiology

The detailed results from the microbiological examinations are listed in Annex 1 (Table 1). A total of 104 samples were examined for microorganisms by a range of assays.

Incubation test and plate count for nine canned seafood products showed that these products were sterile.

Fifty samples were analysed for the presence of quality reducing H_2S-producing seafood spoiling bacteria. Of these, five samples had 1000 or more cfu/g. These samples included three samples of Yellowfin tuna, two from Sri Lanka and one from the Maldives. The two remaining samples were one sample of Yellowtail from Australia, and one sample of Eastern oysters from Canada.

One sample of Eastern Oysters from Canada was examined for *E. coli* by the Donovan method as specified by EU, and < 18 bacteria/100 gram sample material was found (result not shown in table).

Fifty-nine samples were analysed for coliforms by the 3M TM Petrifilm method, and numbers above the detection level of 10 cfu/g were found in two samples. One sample of Yellowfin tuna imported from the Maldives had counts of 310 coliforms/g, and a sample of Pacific cod fillet imported from Thailand had 60 coliforms/g. The same two samples also showed high counts of thermotolerant coliform bacteria (560 and 60 cfu/g respectively). All results for the determination of thermotolerant coliforms by the 3M TM Petrifilm method (94 samples in total), except the two samples mentioned, were below the detection limit of 10 cfu/g.

Twenty-five samples were analysed for the presence of coagulase positive *Staphylococcus*, and all were under the levels of detection (100 cfu/g). Thirty samples were analysed for the presence of anaerobic sulphite-reducing bacteria, and one sample of shrimp imported from Canada had counts of 1000 cfu/g. Bacteria in the family Enterobacteriaceae were under the detection limit in the nine samples examined, except one sample of feed imported from Chile which contained 10 cfu/g.

Sixty samples were analysed for the presence of enterococci, and two samples had 100 cfu/g, which is the detection limit. These were one sample of Yellowfin tuna from Vietnam, and one of Pacific cod from Thailand.

Fifty-seven samples were analysed for *L. monocytogenes* and the bacterium was detected qualitatively in one sample of Pacific cod from Thailand, and in one sample of Atlantic herring from Norway. The sample of Pacific cod was further examined quantitatively, and the number of *L. monocytogenes* was found to be below the detection limit of 10 cfu/g. The sample of Norwegian herring was exported to Egypt but rejected due to limited storage space at the arrival destination, and was subsequently returned to Norway where it was examined.

No pathogens in the genus *Salmonella* (n=95 samples) were detected. *Vibrio* sp. was qualitatively detected in two of twenty-one analysed samples, one of whole, headless scampi from Vietnam, and one sample of peeled, headless scampi from India. The strains isolated from these two samples were sent to NMBU in Oslo for further characterisation and identified as *V. cholerae* and *V. parahaemolyticus* respectively. The *V. cholerae* isolate did not possess cholera toxin producing genes.

The presence of yeast and moulds were examined in ten samples. Yeast was detected in four samples, in two samples of feed from Chile (2000 and 18000 cfu/g), in one sample of dried Yellow Stripe Trevally from Thailand (1400 cfu/g), and in Migas from China (400 cfu/g). Mould was detected in two samples, the same dried Yellow Stripe Trevally from Thailand (2200 cfu/g), and in Migas from China (100 cfu/g) as the yeast was detected in (not shown in table).

3.2 - Parasites

Parasitological examinations were carried out on fourty fish samples, some of which were processed seafood products (Table 2). Nematodes were found in nine of them (22.5%). The fish were imported frozen; hence the nematodes were dead and not infective at the time of analysis. However, allergic symptoms may be triggered in sensitive individuals from dead as well as live nematodes. The highest numbers of nematodes (21), were found in a sample of Atlantic cod (*Gadus morhua*) imported from the Russian federation.

3.3 - Drug residues and dyes

Thirteen samples originating from aquaculture were analysed for residues of prohibited veterinary medicines (unauthorised dyes and antibacterial agents) in 2018. The analysis 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 nitrofuran metabolites. None unauthorised dyes were detected in any of the analysed samples, nor were any traces of chloramphenicol or nitrofuranes found. Details of analysed samples are given in Table 3 (unauthorised dyes) and Table 4 (antibacterial agents).

3.4 - Chemical spoilage indicators

The chemical spoilage indicator histamine and total volatile basic nitrogen (TVBN)was examined in a total of twenty-nine samples, with nineteen samples analysed for each of them (Table 5). All results were compliant. The two highest histamine values of 20 and 30 mg/kg ww were found in samples of Peruvian anchovy (*Engraulis ringens*). The highest TVBN value of 32.8 mg/100g ww, was found in a sample of Yellowfin tuna (*Thunnus albacares*).

3.5 - Undesirable trace elements

The concentrations of the elements arsenic (As), cadmium (Cd), lead (Pb) and mercury (Hg) were examined in 89 samples, selected by criteria intended to maximize the probability of finding non-compliant concentrations. The analytical data are listed in Table 6.

In seafood, arsenic is mainly present as organo-metal chemical species of low toxicity, such as arsenobetaine and arsenolipids. This characteristic of marine foods set them apart from foods of terrestrial origin, in which toxic inorganic arsenic species give a significant contribution to the elemental arsenic concentration. Thus, no relevant maximum level on elemental As was in place for the samples analysed. The observed values for elemental As were mostly within the range occasionally observed in seafood from pristine waters. However, two samples of Pandalus shrimp from the Russian Federation, were measured with relatively high concentrations of 140 and 170 mg/kg ww.

A sample of canned sardine in oil, *Sardinella longiceps*, from the Philippines, exhibited a Cd value of 0.1 mg/kg ww. This value is assumed to be above its maximum level considering that the analysed food sample had been processed. The listed NHC samples (not intended for human consumption), values were measured up to 0.7 mg/kg ww. The seafood maximum limit does not apply. For a basis of value interpretation: the highest maximum level for elemental Cd in food is 1.0 mg/kg ww (in kidney of bovine animals.)

A significant part of the elemental Hg in seafood is present in the organic form of methylmercury, a compound with a documented toxic character. Thus, there are maximum levels in place for elemental Hg in seafood, but not specifically for the methylmercury species (EU, 2006) (Annex 3). However, all methylmercury is measured as part of the total elemental mercury concentration. A frozen fillet sample of Yellowfin tuna *Thunnus albacares* imported from Vietnam exceeded the maximum Hg level of 1.0 mg/kg ww with a measured value of 1.5 mg/kg ww.

For lead, one sample of small crabs from Thailand (*Sesarma mederi*), was measured to 0.69 mg/kg ww. The maximum level applies to “muscle meat from the limbs and abdomen” or to whole animals if the are intended to be eaten whole (EU,2006, footnote 25), which we assumed for this sample. Thus, the whole crabs were analysed. The measured value was then slightly above the maximum level.

3.6 - 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 (NDL-PCBs), also referred to as: EU-PCB6 or “indicator” PCBs. Also included were polybrominated flame-retardants (PBDEs), chlorinated pesticides and PAHs. Annex 3 provides a summary of the most relevant maximum levels.

3.6.1 - Dioxins (PCDDs), furans (PCDFs) and Polychlorinated Bifenyls (PCBs)

Table 7 lists the sum values of PCB, dioxins and furans, in terms of the summed dioxin like PCBs (DL-PCBs), the summed non-dioxin-like PCBs (NDL-PCBs), and the summed PCDDs and PCDFs, for each of the analysed samples. The maximum levels are defined in terms of upper bound sum-parameters (EU, 2006, footnote 32; EU, 2011) except for the sum-parameter NDL-PCBs which is the summed analytical values in the ng/g w.w. scale. The other sum-parameters are measured in the TEQ pg/g w.w. scale (toxic equivalents): in effect summing toxicities rather than their analytical concentrations, as specified in the regulation (EC) 1881/2006 (EU, 2006).

One Atlantic cod liver sample stood out with high values of sum DL-PCBs compared to the listed fillet values. However, the value was compliant to the fish liver maximum level. One sample of fish oil from Turkey, 2018-539/1 was measured to 2.6 and 7.4 pg/g ww (TEQ), UB LOQ for the sum of PCDD/DFs and for the total sum of dioxins and DL-PCBs respectively. These values are non-compliant regarding the maximum levels.

3.6.2 - Polybrominated diphenyl ethers (PBDEs or BDEs)

BDEs are flame-retardant compounds found in plastics, textiles, electronic castings and circuitry. As these products age and eventually are discarded, the PBDEs finds their way into the environment and from there, into biota and into food and feed. The EU recommends a monitoring of the BDE compound class in food (EU, 2014). However, no maximum limits have been established in food. EFSA performed a risk assessment of BDEs in food in 2011 (EFSA CONTAM Panel, 2011). They concluded that the current dietary exposures of BDE-47, -153 and -209 did not raise health concerns. However, the current dietary exposure of BDE-99 was labelled a potential health concern. The data for individual BDE congeners (BDE-28, 47, 99, 100, 153, 154 and 183) and their upper bound sum (BDE7) for the twenty-eight samples are listed in Table 8. All the measured values were within a range occasionally observed in seafood from pristine waters.

3.6.3 - Organochlorine pesticides

Organochlorine pesticides are legacy compounds, previously used for pest control in agriculture. A number of these compounds have for years been banned from use by international treaties. Due to a history of extensive use, they are characterised by a ubiquitous presence in the environment and in food chains. Presently, low levels of these compounds still find their way into the human diet. Concentration of concern may be found in samples from local hot spots, reflecting historical contamination: These compounds are also found in freshwater species, reflecting a history of agricultural impact.

No less then thirty organochlorine pesticides compounds (listed in Annex 2 together with their corresponding LOQ) were measured in fifteen samples. Most of these compounds could not be quantified (all values < LOQ) in any sample. The values for compounds found in quantity (value > LOQ) in two or more of the samples are listed in Table 9a and 9b. The highest values were found for compounds in the DDT family, with a maximum of 13 ng/g ww for p,p'-DDT, and 12 ng/g ww for beta-HCH (hexachloro-hexane), both found in the same anchoveta oil from China.

3.6.4 - Polyaromatic hydrocarbons (PAH)

PAH-compounds are generated from incomplete combustion of organic matter. In food processing PAHs may be formed from over-heating, and they find their way into smoked products from the smoking process. Bivalves can be contaminated from environmental PAH pollution adsorbed to water-suspended particles when these are ingested by the bivalve. There is a high number of compounds in this class. A few of them exhibit food safety issues: Maximum levels are in place for bivalves and smoked products (Annex 3); for Benzo(a)pyrene (BaP) alone, as well as for the lower bound sum (LB-sum) (EU, 2006) of four selected PAH compounds; BaP, Benzo(a) anthracene, Benzo(b)fluoranthene and chrysene (LB-sum PAH_4).

Only one sample was selected for PAH analysis, a smoked mackerel sample. Twenty individual PAH compounds were measured. Only the PAH data associated with a maximum level are listed. In this sample the measured values were below the limit of detection, and thus below the maximum levels.

4 - Conclusion

In total 122 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 2018.

The results for microbiological quality parameters and indicator organisms for faecal contamination generally showed low numbers in the 104 examined samples. However, higher counts were found in some samples. One sample of Yellowfin tuna imported from the Maldives had 310 coliforms/g and 560 thermotolerant coliform/g, and one sample of Pacific cod imported from Thailand had 60 coliforms/g and 60 thermotolerant coliform/g.

Further, five samples had 1000 or higher cfu/g of quality reducing H_2S-producing seafood spoiling bacteria. These samples included three samples of Yellowfin tuna, two from Sri Lanka and one from the Maldives, as well as one sample of Yellowtail from Australia, and one sample of Eastern oysters from Canada.

L. monocytogenes was detected qualitatively in one sample of Pacific cod from Thailand, however, further quantitative examination showed that the number of bacteria was below the detection limit of 10 cfu/g. *L. monocytogenes* was also detected in one sample of Norwegian herring exported to Egypt and re-imported to Norway. No samples had pathogens in the genera *Salmonella*. Enterobacteriaceae was detected in one sample of feed imported from Chile.

Ten samples were examined for the presence of yeast and moulds. Their presence was detected in four and two samples respectively. Yeast was found in two samples of feed from Chile (2000 and 18000 cfu/g), in one sample of dried Yellow Stripe Trevally from Thailand (1400 cfu/g), and in Migas from China (400 cfu/g). Mould was detected in the same dried Yellow Stripe Trevally from Thailand (2200 cfu/g), and in Migas from China (100 cfu/g) as the yeast was detected in.

Parasitological examinations were carried out on fourty fish samples. Nematodes were found in nine of them (22.5%). The fish were frozen when imported. Hence the nematodes were dead and not infective at the time of analysis. However, also dead nematodes can trigger allergic symptoms in sensitive individuals.

Thirteen samples, originating from global aquaculture were examined for residues of selected prohibited pharmaceuticals. The examination included the dye compounds crystal violet, leuco crystal violet, malachite green, leuco malachite green and brilliant green. And also chloramphenicol and nitrofuran metabolites. No unauthorised dyes, nor residues of prohibited antibacterial agents were detected.

The chemical spoilage indicators were examined in twenty-nine samples. All results were compliant with their maximum levels.

The undesirable trace elements arsenic, cadmium, mercury and lead, were measured in 89 samples. With respect to cadmium, a sample of canned sardine in oil from the Philippines exhibited a value of 0.1 mg/kg ww, which is above its maximum level. One sample of small crabs from Thailand should be noted: Assuming the crabs were intended to be consumed whole, the measured lead concentration was slightly above their maximum level. A frozen fillet sample of yellowfin tuna imported from Vietnam with a value of 1.5 mg/kg ww exceeded the maximum mercury level. There is no maximum level for for arsenic in seafood, reflecting the low toxicity of its marine chemical molecular species. The measured elemental arsenic values were within a range commonly observed in seafood.

Concerning the Chlorinated POP compounds, twenty-eight samples were analysed for dioxins and furans, for PCBs, including the twelve dioxin like PCBs, the six EU selected non-dioxin like PCBs, and seven polybrominated diphenyl ethers. One sample of fish oil from Turkey was non-compliant with its maximum levels. The remaining values were within the ranges commonly found in seafood.

Fifteen samples were analysed for organochlorine pesticides. A majority of the 30 different pesticides could not be detected or quantified in any of the samples. The highest quantifiable values were found for some compounds in the

DDT family, and for beta-HCH, both with a maximum in an anchoveta oil imported from China.

Regarding PAHs, One sample was analysed in 2018. It was compliant with its maximum levels.

5 - References

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6 - ANNEX 1: Data tables

Table 1. Microbiological examination, n=104.

Abbreviations: n.d.: not detected; **D**: detected; **n.a.**: not available; **TNC**: Too numerous to count (>10^8); **CFU**: Colony forming units; **H_2SPB**: H_2S producing bacteria; **PC**: Plate count, **Ent.**: Enterobacteriaceae.

						Aerobe PC (cfu/g) agar method			Indicator organisms (cfu/g) by agar method			Faecal indicator organisms (cfu/g) by agar method			Specific pathogens		
						30°C	20°C		*Entero-coccus*	*Coag. pos. Staphylo-coccus*	Sulph.-red. bact.	Ent.	Coli-forms	Thermo-tolerant coliforms	*Listeria mono-cytogenes*	*Salmo-nella*	*Vibrio*
						Aerobes	PC	H_2SPB									
Journal No.	**Origin**	**Product**	**Scientific name**	**Sample material**	**Incu-bation test**	**/g**	**/g**	**/g**	**/g**	**/g**	**/g**	**/g**	**/g**	**/g**	**/25 g**	**/25 g**	**/20 g**
2018-140/1	JAPAN (JPN)	Yellowtail	*Seriola spp*	Muscle					< 100				< 10	< 10	n.d.	n.d.	
2018-141/1	JAPAN (JPN)	Yellowtail	*Seriola spp*	Muscle					< 100				< 10	< 10	n.d.	n.d.	
2018-142/1	SRI LANKA (LKA)	Yellowfin tuna	*Thunnus albacares*	Muscle					< 100				< 10	< 10	n.d.	n.d.	
2018-143/1	MALDIVES (MDV)	Yellowfin tuna	*Thunnus albacares*	Muscle					< 100				< 10	< 10	n.d.	n.d.	
2018-176/1	THAILAND (THA)	Flour	Unknown	Shrimp powder		3000								< 10		n.d.	
2018-229/1	MAURITANIA (MRT)	Oil	Unknown	Fish oil							< 100			< 10		n.d.	
2018-242/1	CANADA (CAN)	Lobster	*Homarus spp*	White meat			2000	< 1000	< 100				< 10	< 10	n.d.	n.d.	n.d.
2018-279/1	RUSSIAN FEDERATION (RUS)	Atlantic cod	*Gadus morhua*	Muscle			5000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-280/1	RUSSIAN FEDERATION (RUS)	Atlantic cod	*Gadus morhua*	Muscle			10000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-282/1	SRI LANKA (LKA)	Yellowfin tuna	*Thunnus albacares*	Muscle			245000	7000	< 100				< 10	< 10	n.d.	n.d.	
2018-293/1	MALDIVES (MDV)	Yellowfin tuna	*Thunnus albacares*	Muscle			156000	1000	< 100				310	560	n.d.	n.d.	
2018-313/1	CHINA (CN)	Processed seafood product	*Nemipterus bleekeri*	Surimi		< 1000				< 100				< 10		n.d.	

2018-314/1	CHINA (CN)	Processed seafood product	*Litopenaeus vannamei*	Schrimp, boild, battered		43000				< 100	< 100			< 10		n.d.	n.d.
2018-417/1	CANADA (CAN)	Pandalus shrimp	*Pandalus spp*	Whole		2000				< 100	< 100			< 10		n.d.	n.d.
2018-419/1	CANADA (CAN)	Pandalus shrimp	*Pandalus spp*	Whole		25000				< 100	1000			< 10		n.d.	n.d.
2018-539/1	TURKEY (TUR)	Oil	*Engraulis encrasiolus*	Fish oil		< 1000					< 100			< 10		n.d.	
2018-556/1	RUSSIAN FEDERATION (RUS)	Atlantic cod	*Gadus morhua*	Gutted, without head			23000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-558/1	RUSSIAN FEDERATION (RUS)	Atlantic cod	*Gadus morhua*	Gutted, without head			4000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-619/1	CHILE (CHL)	Feed	*Engraulis ringens*	Feed		2000						< 10		< 10		n.d.	
2018-620/1	CHILE (CHL)	Feed	*Engraulis ringens, Strangomera bentincki*	Feed		18000						10		< 10		n.d.	
2018-621/1	SRI LANKA (LKA)	Yellowfin tuna	*Thunnus albacares*	Muscle			2110000	1300000	< 100				< 10	< 10	n.d.	n.d.	
2018-688/1	RUSSIAN FEDERATION (RUS)	Atlantic cod	*Gadus morhua*	Gutted, without head			28000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-689/1	RUSSIAN FEDERATION (RUS)	Atlantic cod	*Gadus morhua*	Muscle			11000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-696/1	AUSTRALIA (AUS)	Yellowtail	*Seriola lalandi*	Muscle/Skin			22000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-774/1	RUSSIAN FEDERATION (RUS)	Atlantic cod	*Gadus morhua*	Fillet			8000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-776/1	RUSSIAN FEDERATION (RUS)	Atlantic cod	*Gadus morhua*	Gutted, without head			12000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-823/1	VIET NAM (VNM)	Whiteleg shrimp	*Penaeus vannamei Boone*	Peeled schrimp			1000	< 1000	< 100				< 10	< 10	n.d.	n.d.	n.d.
2018-861/1	RUSSIAN FEDERATION (RUS)	Greenland halibut	*Reinhardtius hippoglossoides*	Fillet			35000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-873/1	AUSTRALIA (AUS)	Yellowtail	*Seriola spp*	Muscle			440000	104000	< 100				< 10	< 10	n.d.	n.d.	
2018-987/1	RUSSIAN FEDERATION (RUS)	Atlantic cod	*Gadus morhua*	Fillet			18000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-988/1	VIET NAM (VNM)	Yellowfin tuna	*Thunnus albacares*	Muscle			3000	< 1000	100				< 10	< 10	n.d.	n.d.	

2018-1039/1	NEW ZEALAND (NZL)	Flour	*Euphasiacea sp.*	Krill powder		< 1000						< 10		< 10		n.d.	
2018-1054/1	CHINA (CN)	Oil (Anchovy)	*Engraulis ringens*	Oil		< 1000					< 100			< 10		n.d.	
2018-1067/1	RUSSIAN FEDERATION (RUS)	Haddock	*Melanogrammus aeglefinus*	Fillet			14000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-1068/1	RUSSIAN FEDERATION (RUS)	Atlantic cod	*Gadus morhua*	Liver			220000	< 1000	< 100		< 100		< 10	< 10	n.d.	n.d.	
2018-1069/1	RUSSIAN FEDERATION (RUS)	Atlantic halibut	*Hippoglossus hippoglossus*	Fillet			85000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-1071/1	UNITED STATES (USA)	Processed seafood product	*Theragra chalcogramma*	Surimi of pollock		14000				< 100		< 10		< 10		n.d.	
2018-1072/1	VIET NAM (VNM)	Brown crab	*Cancer pagurus*	White meat		< 1000				< 100	< 100			< 10		n.d.	n.d.
2018-1074/1	NEW ZEALAND (NZL)	Processed seafood product	*Macruronus novaezelandiae*	Surimi of hoki		59000				< 100		< 10		< 10		n.d.	
2018-1075/1	VIET NAM (VNM)	Yellowfin tuna	*Thunnus albacares*	Muscle			< 1000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-1076/1	THAILAND (THA)	Processed seafood product	*Rastrelliger brachysoma*	Whole, steamed		3000				< 100			< 10	< 10	n.d.	n.d.	
2018-1080/1	VIET NAM (VNM)	Scampi	*Litopenaeus vannamei*	Schrimp, peeled, boiled		< 1000				< 100	< 100			< 10		n.d.	n.d.
2018-1081/1	VIET NAM (VNM)	Scampi	*Penaeus vannamei*	Whole, headless			18000	< 1000	< 100				< 10	< 10	n.d.	n.d.	det.
2018-1084/1	CHINA (CHN)	Atlantic cod	*Gadus morhua*	Muscle			8000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-1085/1	CHINA (CHN)	Saithe	*Pollachius virens*	Muscle			11000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-1086/1	INDIA (IND)	Scampi	*Litopenaeus vannamei*	Schrimp, peeled, headless			113000	< 1000	< 100				< 10	< 10	n.d.	n.d.	det.
2018-1087/1	THAILAND (TH)	Processed seafood product	*Gadus macrocephalus*	Fillet/muscle battered, fried		< 1000			< 100	< 100	< 100			< 10	n.d.	n.d.	
2018-1088/1	THAILAND (THA)	Mangrove crab	*Sesarma mederi*	Salted			3000	< 1000	< 100				< 10	< 10	n.d.	n.d.	n.d.
2018-1089/1	THAILAND (THA)	Yellow Stripe Trevally	*Selaroides leptolepsis*	Dried		1990000			< 100	< 100	< 100		< 10	< 10		n.d.	
2018-1116/1	VIET NAM (VNM)	Processed tuna	*Katsuwonis pelamis*	Canned tuna in water	Negativ	< 10											

2018-1117/1	THAILAND (THA)	Processed tuna	*Katsuwonis pelamis*	Canned tuna in sunflower oil	Negativ	< 10											
2018-1118/1	PHILIPPINES (PHL)	Processed tuna	*Katsuwonis pelamis*	Canned tuna in water	Negativ	< 10											
2018-1119/1	PHILIPPINES (PHL)	Processed seafood product	*Chanos chanos*	Canned milkfish	Negativ	< 10											
2018-1120/1	PHILIPPINES (PHL)	Processed tuna	*Katsuwonis pelamis*	Canned	Negativ	< 10											
2018-1121/1	THAILAND (THA)	Processed tuna	*Katsuwonis pelamis*	Canned tuna, curried	Negativ	< 10											
2018-1122/1	THAILAND (THA)	Processed tuna	*Katsuwonis pelamis*	Canned tuna, mexican flavour	Negativ	< 10											
2018-1123/1	THAILAND (THA)	Processed tuna	*Katsuwonis pelamis*	Canned tuna in sunflower oil	Negativ	< 10											
2018-1453/1	THAILAND (THA)	Processed seafood product	*Gadus macrocephalus*	Fillet/muscle battered, fried			< 1000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-1455/1	UNITED STATES (USA)	Processed seafood product	*Theragra chalcogramma*	Surimi		< 1000				< 100		< 10		< 10		n.d.	
2018-1458/1	VIET NAM (VNM)	Processed seafood product	*Cancer spp.*	Claw meat		< 1000				< 100	< 100			< 10		n.d.	n.d.
2018-1460/1	CANADA (CAN)	American lobster	*Homarus americanus*	White meat		1000				< 100	< 100			< 10		n.d.	n.d.
2018-1461/1	THAILAND (THA)	Processed seafood product	*Gadus macrocephalus*	Fillet/muscle battered, fried			3000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-1463/1	VIET NAM (VNM)	Scampi	*Litopenaeus vannamei*	Whole, headless			2000	< 1000	< 100				< 10	< 10	n.d.	n.d.	n.d.
2018-1466/1	VIET NAM (VNM)	Scampi	*Litopenaeus vannamei*	Schrimp, peeled, boiled		< 1000				< 100	< 100			< 10		n.d.	n.d.
2018-1488/1	PERU (PER)	Rainbow trout	*Oncorhynchus mykiss*	Fillet			112000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-1489/1	CHINA (CHN)	Saithe	*Pollachius virens*	Fillet			< 1000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-1492/1	CHINA (CHN)	Atlantic cod	*Gadus morhua*	Muscle			12000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-1497/1	THAILAND (THA)	Flour	*Acetes spp.*	Schrimp flour		129000						< 10		< 10		n.d.	
2018-1503/1	CANADA (CAN)	Eastern oyster	*Crassostrea virginica*	Oyster			400000	220000	< 100							n.d.	

2018-1541/1	MALDIVES (MDV)	Yellowfin tuna	*Thunnus albacares*	Muscle			< 1000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-1580/1	ALBANIA (ALB)	Northern shrimp	*Pandalus borealis*	Shells		2000						< 10		< 10		n.d.	
2018-1581/1	CHINA (CHN)	Alaska pollock (clipfish)	*Theragra chalcogramma*	Fillet, dried, salted		< 1000			< 100	< 100	< 100		< 10	< 10		n.d.	
2018-1582/1	CHINA (CHN)	Atlantic cod	*Gadus morhua*	Migas		221800			< 100	< 100	< 100		< 10	< 10		n.d.	
2018-1584/1	CANADA (CAN)	Northern shrimp	*Pandalus borealis*	Whole		< 1000				< 100	< 100			< 10		n.d.	n.d.
2018-1585/1	MOROCCO (MAR)	Oil	Unknown	Fiskeolje		< 1000					< 100			< 10		n.d.	
2018-1586/1	MOROCCO (MAR)	Oil	Unknown	Fiskeolje		< 1000					< 100			< 10		n.d.	
2018-1587/1	CHINA (CHN)	Alaska pollock (clipfish)	*Theragra chalcogramma*	Migas		< 1000			< 100	< 100	< 100		< 10	< 10		n.d.	
2018-1588/1	JAPAN (JPN)	Processed seafood product	Unknown	Surimi		< 1000				< 100		< 10		< 10		n.d.	
2018-1589/1	CHINA (CHN)	Atlantic halibut	*Hippoglossus hippoglossus*	Muscle			50000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-1592/1	PHILIPPINES (PHL)	Yellowfin tuna	*Thunnus albacares*	Muscle			5000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-1643/1	NORWAY (NOR)	Atlantic herring	*Clupea harengus*	Whole			< 1000	< 1000	< 100				< 10	< 10	Påvist	n.d.	
2018-1656/1	ARGENTINA (ARG)	Argentine red shrimp	*Pleoticus muelleri*	Schrinmp, Peeled			100000	< 1000	< 100				< 10	< 10	n.d.	n.d.	n.d.
2018-1804/1	RUSSIAN FEDERATION (RUS)	Atlantic cod	*Gadus morhua*	Muscle			880000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-1806/1	KOREA, REPUBLIC OF (KOR)	Pacific saury	*Cololabis Saira*	Whole			32000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-1837/1	VIET NAM (VNM)	Processed seafood product	*Caridea spp.*	Schrimp, chili marianted		< 1000				< 100	< 100			< 10		n.d.	n.d.
2018-1840/1	VIET NAM (VNM)	Yellowfin tuna	*Thunnus albacares*	Muscle			< 1000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-2058/1	RUSSIAN FEDERATION (RUS)	Atlantic herring	*Clupea harengus*	Fillet			12000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-2122/1	CANADA (CAN)	American lobster	*Homarus americanus*	White meat			< 1000	< 1000	< 100				< 10	< 10	n.d.	n.d.	n.d.

2018-2123/1	VIET NAM (VNM)	Processed seafood product	*Penaeus vannamei*	Schrimp, chili marinated			2000	< 1000	< 100				< 10	< 10	n.d.	n.d.	n.d.
2018-2125/1	THAILAND (THA)	Processed seafood product	*Gadus macrocephalus*	Fishburger, fried, breaded		4000			< 100	< 100	< 100			< 10	n.d.	n.d.	
2018-2126/1	THAILAND (THA)	Processed seafood product	*Rastrelliger kanagurta*	Steamed		< 1000			< 100	< 100	< 100			< 10	n.d.	n.d.	
2018-2129/1	THAILAND (THA)	Pacific Cod	*Gadus macrocephalus*	Fillet			29000	< 1000	100				60	60	< 10	n.d.	
2018-2132/1	VIET NAM (VNM)	Yellowfin tuna	*Thunnus albacares*	Muscle			< 1000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-2158/1	CHINA (CHN)	Nile tilapia	*Oreochromis niloticus*	Fillet			5000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-2272/1	RUSSIAN FEDERATION (RUS)	Pandalus shrimp	*Pandalus spp*	Whole		6000				< 100	< 100			< 10		n.d.	n.d.
2018-2273/1	RUSSIAN FEDERATION (RUS)	Pandalus shrimp	*Pandalus spp*	Whole		187000				< 100	< 100			< 10		n.d.	n.d.
2018-2284/1	PERU (PER)	Oil (Anchovy)	*Engraulis ringens*	Fish oil		15000					< 100			< 10		n.d.	
2018-2285/1	PERU (PER)	Oil (Anchovy)	*Engraulis ringens*	Fish oil		13000					< 100			< 10		n.d.	
2018-2286/1	PERU (PER)	Oil (Anchovy)	*Engraulis ringens*	Fish oil		< 1000					< 100			< 10		n.d.	
2018-2287/1	MOROCCO (MAR)	Oil	*Unknown*	Fish oil		< 1000					< 100			< 10		n.d.	
2018-2288/1	CHINA (CHN)	Oil (Anchovy)	*Engraulis ringens*	Fish oil		< 1000					< 100			< 10		n.d.	
2018-2542/1	PHILIPPINES (PHL)	Processed seafood product	*Sardinella longiceps*	Sardines, canned	Negativ	< 10											
2018-2553/1	TAIWAN, PROVINCE OF CHINA (TWN)	Pacific saury	*Cololabis Saira*	Whole			< 1000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-2554/1	TAIWAN, PROVINCE OF CHINA (TWN)	Pacific saury	*Cololabis Saira*	Whole			< 1000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-140/1	JAPAN (JPN)	Yellowtail	*Seriola spp*	Muscle					< 100				< 10	< 10	n.d.	n.d.	
2018-141/1	JAPAN (JPN)	Yellowtail	*Seriola spp*	Muscle					< 100				< 10	< 10	n.d.	n.d.	
2018-142/1	SRI LANKA (LKA)	Yellowfin tuna	*Thunnus albacares*	Muscle					< 100				< 10	< 10	n.d.	n.d.	

2018-143/1	MALDIVES (MDV)	Yellowfin tuna	*Thunnus albacares*	Muscle					< 100				< 10	< 10	n.d.	n.d.	
2018-176/1	THAILAND (THA)	Flour	Unknown	Shrimp powder		3000								< 10		n.d.	
2018-229/1	MAURITANIA (MRT)	Oil	Unknown	Fish oil							< 100			< 10		n.d.	
2018-242/1	CANADA (CAN)	Lobster	*Homarus spp*	White meat			2000	< 1000	< 100				< 10	< 10	n.d.	n.d.	n.d.
2018-279/1	RUSSIAN FEDERATION (RUS)	Atlantic cod	*Gadus morhua*	Muscle			5000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-280/1	RUSSIAN FEDERATION (RUS)	Atlantic cod	*Gadus morhua*	Muscle			10000	< 1000	< 100				< 10	< 10	n.d.	n.d.	
2018-282/1	SRI LANKA (LKA)	Yellowfin tuna	*Thunnus albacares*	Muscle			245000	7000	< 100				< 10	< 10	n.d.	n.d.	
2018-293/1	MALDIVES (MDV)	Yellowfin tuna	*Thunnus albacares*	Muscle			156000	1000	< 100				310	560	n.d.	n.d.	
2018-313/1	CHINA (CN)	Processed seafood product	*Nemipterus bleekeri*	Surimi		< 1000				< 100				< 10		n.d.	

Table 2. Nematodes, n=40.

Journal No.	Origin	Product group	Species	Scientific name	Tissue	# Nematodes
2018-142/1	Sri Lanka	Marine fish	Yellowfin tuna	*Thunnus albacares*	Muscle	0
2018-143/1	Maldives	Marine fish	Yellowfin tuna	*Thunnus albacares*	Muscle	0
2018-279/1	Russian federation	Marine fish	Atlantic cod	*Gadus morhua*	Muscle	1
2018-280/1	Russian federation	Marine fish	Atlantic cod	*Gadus morhua*	Muscle	0
2018-282/1	Sri Lanka	Marine fish	Yellowfin tuna	*Thunnus albacares*	Muscle	0
2018-293/1	Maldives	Marine fish	Yellowfin tuna	*Thunnus albacares*	Muscle	0
2018-556/1	Russian federation	Marine fish	Atlantic cod	*Gadus morhua*	Gutted, without head	4
2018-558/1	Russian federation	Marine fish	Atlantic cod	*Gadus morhua*	Gutted, without head	15
2018-621/1	Sri Lanka	Marine fish	Yellowfin tuna	*Thunnus albacares*	Muscle	0
2018-688/1	Russian federation	Marine fish	Atlantic cod	*Gadus morhua*	Gutted, without head	21
2018-689/1	Russian federation	Marine fish	Atlantic cod	*Gadus morhua*	Muscle	0
2018-696/1	Russian federation	Marine fish	Yellowtail	*Seriola lalandi*	Muscle	0
2018-774/1	Russian federation	Marine fish	Atlantic cod	*Gadus morhua*	Muscle	0
2018-776/1	Russian federation	Marine fish	Atlantic cod	*Gadus morhua*	Gutted, without head	8
2018-861/1	Russian federation	Marine fish	Greenland halibut	*Reinhardtius hippoglossoides*	Muscle	0
2018-873/1	Australia	Marine fish	Yellowtail	*Seriola spp*	Muscle	0
2018-987/1	Russian federation	Marine fish	Atlantic cod	*Gadus morhua*	Muscle	7
2018-988/1	Viet Nam	Marine fish	Yellowfin tuna	*Thunnus albacares*	Muscle	0
2018-1067/1	Russian federation	Marine fish	Haddock	Melanogrammus aeglefinus	Muscle	0
2018-1069/1	Russian federation	Marine fish	Atlantic halibut	Hippoglossus hippoglossus	Muscle	2
2018-1075/1	Viet Nam	Marine fish	Yellowfin tuna	Thunnus albacares	Muscle	0
2018-1076/1	Thailand	Marine fish	Short mackerel	*Rastrelliger brachysoma*	Smoked whole frozen	0
2018-1084/1	China	Marine fish	Atlantic cod	*Gadus morhua*	Muscle	0
2018-1085/1	China	Marine fish	Saithe	*Pollachius virens*	Muscle	0

2018-1453/1	Thailand	Marine fish	Pacific cod	*Gadus macrocephalus*	Pre-fried breaded muscle	0
2018-1461/1	Thailand	Marine fish	Pacific cod	*Gadus macrocephalus*	Pre-fried breaded muscle	5
2018-1488/1	Peru	Marine fish	Rainbow trout	*Oncorhynchus mykiss*	Muscle	0
2018-1489/1	China	Marine fish	Saithe	*Pollachius virens*	Muscle	0
2018-1492/1	China	Marine fish	Atlantic cod	*Gadus morhua*	Muscle	0
2018-1541/1	Maldives	Marine fish	Yellowfin tuna	*Thunnus albacares*	Muscle	0
2018-1589/1	China	Marine fish	Atlantic halibut	*Hippoglossus hippoglossus*	Muscle	0
2018-1592/1	Philippines	Marine fish	Yellowfin tuna	*Thunnus albacares*	Muscle	0
2018-1804/1	Russian federation	Marine fish	Atlantic cod	*Gadus morhua*	Muscle	0
2018-1840/1	Viet Nam	Marine fish	Yellowfin tuna	*Thunnus albacares*	Muscle	0
2018-2058/1	Russian federation	Marine fish	Atlantic herring	*Clupea harengus*	Muscle	1
2018-2129/1	Thailand	Marine fish	Pacific Cod	*Gadus macrocephalus*	Muscle	0
2018-2132/1	Viet Nam	Marine fish	Yellowfin tuna	*Thunnus albacares*	Muscle	0
2018-2158/1	China	Marine fish	Nile tilapia	*Oreochromis niloticus*	Muscle	0
2018-2553/1	Taiwan, Province of China	Marine fish	Pacific saury	*Cololabis saira*	Whole	0
2018-2554/1	Taiwan, Province of China	Marine fish	Pacific saury	*Cololabis saira*	Whole	0

Table 3. Residues of prohibited veterinary medicines, Dyes, n=13.

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

Journal No.	Origin	Group	Species/ Presentation	Scientific name	Tissue	CV LOD: 0.3 µg/kg	LCV LOD: 0.15µg/kg	MG LOD: 0.15µg/kg	LMG LOD: 0.15µg/kg	BG LOD: 0.15 µg/kg
2018-140/1	Japan	Aquaculture	Yellowtail	*Seriola* sp.	Fillet /Muscle	n.d.	n.d.	n.d.	n.d.	n.d.
2018-141/1	Japan	Aquaculture	Yellowtail	*Seriola* sp.	Fillet /Muscle	n.d.	n.d.	n.d.	n.d.	n.d.
2018-696/2	Australia	Aquaculture	Yellowtail	*Seriola* sp.	Fillet /Muscle	n.d.	n.d.	n.d.	n.d.	n.d.
2018-873/1	Australia	Aquaculture	Yellowtail	*Seriola* sp.	Fillet /Muscle	n.d.	n.d.	n.d.	n.d.	n.d.
2018-1080/1	Vietnam	Aquaculture	Scampi	*Litopenaeus vannamei*	Muscle, peeled	n.d.	n.d.	n.d.	n.d.	n.d.
2018-1081/1	Vietnam	Aquaculture	Scampi	*Penaeus vannamei*	Whole	n.d.	n.d.	n.d.	n.d.	n.d.
2018-1086/1	India	Aquaculture	Scampi	*Litopenaeus vannamei*	Muscle, peeled	n.d.	n.d.	n.d.	n.d.	n.d.
2018-1119/1	Philippines	Aquaculture	Milkfish	*Chanos* sp.	Muscle	n.d.	n.d.	n.d.	n.d.	n.d.
2018-1463/1	Vietnam	Aquaculture	Scampi	*Litopenaeus vannamei*	Whole	n.d.	n.d.	n.d.	n.d.	n.d.
2018-1466/1	Vietnam	Aquaculture	Scampi	*Litopenaeus vannamei*	Muscle, peeled	n.d.	n.d.	n.d.	n.d.	n.d.
2018-1488/1	Peru	Aquaculture	Rainbow trout	*Oncorhynchus mykiss*	Fillet /Muscle	n.d.	n.d.	n.d.	n.d.	n.d.
2018-2123/1	Vietnam	Aquaculture	Processed product	*Litopenaeus vannamei*	Muscle, peeled	n.d.	n.d.	n.d.	n.d.	n.d.
2018-2158/1	China	Aquaculture	Nile tilapia	*Oreochromis niloticus*	Fillet /Muscle	n.d.	n.d.	n.d.	n.d.	n.d.

Table 4. Residues of prohibited veterinary medicines, Antibacterial agents, Chloramphenicol and nitrofuran metabolites, n=13.

n.d.: not detected**, CAM:** chloramphenicol, **AHD**: 1-amino-hydantoin, **AOZ**: 3-amino-2-oxazolidinone, **AMOZ**: 3-amino-5-morpholinomethyl-2-oxazolidinone, **SEM**: semicarbazide

Journal No.	Origin	Group	Product/ Presentation	Scientific name	Tissue	CAM LOD: 0.25 µg/kg	AHD LOD: 0.6 µg/kg	AOZ LOD: 0.5 µg/kg	AMOZ LOD: 0.4 µg/kg	SEM LOD: 0.5 µg/kg
2018-140/1	Japan	Aquaculture	Yellowtail	*Seriola* sp.	Fillet /Muscle	n.d.	n.d.	n.d.	n.d.	n.d.
2018-141/1	Japan	Aquaculture	Yellowtail	*Seriola* sp.	Fillet /Muscle	n.d.	n.d.	n.d.	n.d.	n.d.
2018-696/2	Australia	Aquaculture	Yellowtail	*Seriola* sp.	Fillet /Muscle	n.d.	n.d.	n.d.	n.d.	n.d.
2018-873/1	Australia	Aquaculture	Yellowtail	*Seriola* sp.	Fillet /Muscle	n.d.	n.d.	n.d.	n.d.	n.d.
2018-1080/1	Vietnam	Aquaculture	Scampi	*Litopenaeus vannamei*	Muscle, peeled	n.d.	n.d.	n.d.	n.d.	n.d.
2018-1081/1	Vietnam	Aquaculture	Scampi	*Penaeus vannamei*	Whole	n.d.	n.d.	n.d.	n.d.	n.d.
2018-1086/1	India	Aquaculture	Scampi	*Litopenaeus vannamei*	Muscle, peeled	n.d.	n.d.	n.d.	n.d.	n.d.
2018-1119/1	Philippines	Aquaculture	Milkfish	*Chanos* sp.	Muscle	n.d.	n.d.	n.d.	n.d.	n.d.
2018-1463/1	Vietnam	Aquaculture	Scampi	*Litopenaeus vannamei*	Whole	n.d.	n.d.	n.d.	n.d.	n.d.
2018-1466/1	Vietnam	Aquaculture	Scampi	*Litopenaeus vannamei*	Muscle, peeled	n.d.	n.d.	n.d.	n.d.	n.d.
2018-1488/1	Peru	Aquaculture	Rainbow trout	*Oncorhynchus mykiss*	Fillet /Muscle	n.d.	n.d.	n.d.	n.d.	n.d.
2018-2123/1	Vietnam	Aquaculture	Processed product	*Litopenaeus vannamei*	Muscle, peeled	n.d.	n.d.	n.d.	n.d.	n.d.
2018-2158/1	China	Aquaculture	Nile tilapia	*Oreochromis niloticus*	Fillet /Muscle	n.d.	n.d.	n.d.	n.d.	n.d.

Table 5. Selected chemical spoilage indicators, Histamine and total volatile basic nitrogen (TVBN).

Journal No.	Origin	Species	Scient. name	Tissue/product	Histamine n=19 mg/kg w.w.	TVBN n=19 mg/100g w.w.
2018-140/1	Japan	Yellowtail	*Seriola* sp.	Muscle	<5	16.4
2018-141/1	Japan	Yellowtail	*Seriola* sp.	Muscle	<5	15.6
2018-142/1	Sri Lanka	Yellowfin tuna	*Thunnus albacares*	Muscle	<5	25.0
2018-143/1	Maldives	Yellowfin tuna	*Thunnus albacares*	Muscle	<5	28.0
2018-282/1	Sri Lanka	Yellowfin tuna	*Thunnus albacares*	Muscle	<5	32.8
2018-293/1	Maldives	Yellowfin tuna	*Thunnus albacares*	Muscle	<5	24.2
2018-313/1	China	Delasa threadfin bream	*Nemipterus bleekeri*	Surimi Crab sticks	-	4
2018-314/1	China	Scampi	*Litopenaeus vannamei*	Panned muscle	-	4.9
2018-619/1	Chile	Peruvian anchovy	*Engraulis ringens*	Pellets for feed NHC	20	-
2018-620/1	Chile	Peruvian anchovy	*Engraulis ringens*	Pellets for feed NHC	30	-
2018-621/1	Sri Lanka	Yellowfin tuna	*Thunnus albacares*	Muscle	<5	22.4
2018-861/1	Russian federation	Greenland halibut	*Reinhardtius hippoglossoides*	Muscle	-	10.0
2018-873/1	Australia	Yellowtail	*Seriola* sp.	Muscle	-	17.0
2018-988/1	Viet Nam	Yellowfin tuna	*Thunnus albacares*	Muscle	<5	15.1
2018-1069/1	Russian federation	Halibut	*Hippoglossus hippoglossus*	Muscle	-	8.7
2018-1075/1	Viet Nam	Yellowfin tuna	*Thunnus albacares*	Muscle	-	21.0
2018-1076/1	Thailand	Short mackerel	*Rastrelliger brachysoma*	Smoked whole frozen	-	23.1
2018-1116/1	Viet Nam	Tuna	*Katsuwonus pelamis*	Canned muscle in water	<5	-
2018-1117/1	Thailand	Tuna	*Katsuwonus pelamis*	Canned muscle	<5	-
2018-1118/1	Philippines	Tuna	*Katsuwonus pelamis*	Canned muscle in water	<5	-
2018-1121/1	Thailand	Tuna	*Katsuwonus pelamis*	Canned muscle with spices	<5	-
2018-1122/1	Thailand	Tuna	*Katsuwonus pelamis*	Canned muscle with spices	<5	-
2018-1123/1	Thailand	Tuna	*Katsuwonus pelamis*	Muscle in oil	<5	-
2018-1488/1	Peru	Rainbow trout	*Oncorhynchus mykiss*	Muscle	-	17.9

2018-1497/1	Thailand	Acetes	*Acetes* sp.	Prawn meal	<5	-
2018-1541/1	Maldives	Yellowfin tuna	*Thunnus albacares*	Muscle	<5	22.5
2018-1592/1	Philippines	Yellowfin tuna	*Thunnus albacares*	Muscle	<5	21.4
2018-1643/1	Reimported from Egypt, Norwegian origin	Herring	*Clupea harengus*	Whole	<5	19.2
2018-1806/1	Republic of Korea	Pacific saury	*Cololabis saira*	Whole	-	16.0

Table 6. Elemental concentration of undesireable elments, n=89.

Arsenic (As), Cadmium (Cd), Mercury (Hg) and Lead (Pb). (mg/kg ww).
"NHC" = "Not for human consumption", different maximum levels then apply.

Journal No.	Origin	Group	Product	Scientific name	Tissue/ variant	As	Cd	Hg	Pb
2018-671/1	ARGENTINA	Cephalopod	Argentine shortfin squid	*Illex argentinus*	*Muscle*	0.71	0.13	0.005	< .005
2018-671/2	ARGENTINA	Cephalopod	Argentine shortfin squid	*Illex argentinus*	*Muscle*	*0.77*	*0.16*	*0.005*	*0.021*
2018-673/1	ARGENTINA	Cephalopod	Argentine shortfin squid	*Illex argentinus*	*Muscle*	*0.71*	*0.07*	*0.005*	*< .005*
2018-673/2	ARGENTINA	Cephalopod	Argentine shortfin squid	*Illex argentinus*	*Muscle*	*0.53*	*0.24*	*0.005*	*< .006*
2018-1460/1	CANADA	Crustacean	American lobster	*Homarus americanus*	*Muscle*	*4.8*	*0.15*	*0.06*	*0.02*
2018-2122/1	CANADA	Crustacean	American lobster	*Homarus americanus*	*Muscle*	*9.4*	*0.01*	*0.14*	*0.007*
2018-1656/1	ARGENTINA	Crustacean	Argentine red shrimp	*Pleoticus muelleri*	*Peeled*	*0.62*	*0.07*	*0.006*	*0.011*
2018-242/1	CANADA	Crustacean	Lobster	*Homarus spp*	*Muscle*	*7.2*	*0.01*	*0.07*	*0.02*
2018-1088/1	THAILAND	Crustacean	Mangrove crab	*Sesarma mederi*	*Muscle*	*0.42*	*0.02*	*0.017*	*0.69*
2018-1584/1	CANADA	Crustacean	Northern shrimp	*Pandalus borealis*	*Fillet*	*14*	*0.04*	*0.031*	*0.006*
2018-417/2	CANADA	Crustacean	Pandalus shrimp	*Pandalus spp*	*Peeled*	*8.1*	*0.23*	*0.07*	*< .005*
2018-419/2	CANADA	Crustacean	Pandalus shrimp	*Pandalus spp*	*Peeled*	*8.6*	*0.22*	*0.05*	*< .005*
2018-2272/1	RUSSIAN FEDERATION	Crustacean	Pandalus shrimp	*Pandalus spp*	*Peeled*	*170*	*0.14*	*0.04*	*< .006*
2018-2273/1	RUSSIAN FEDERATION	Crustacean	Pandalus shrimp	*Pandalus spp*	*Peeled*	*140*	*0.13*	*0.03*	*< .005*
2018-1080/1	VIET NAM	Crustacean	Scampi	*Lipenaus vannamei*	*Peeled*	*0.15*	*< .0007*	*0.007*	*0.009*
2018-1081/1	VIET NAM	Crustacean	Scampi	*Lipenaus vannamei*	*Peeled*	*0.18*	*0.001*	*0.01*	*0.01*
2018-1086/1	INDIA	Crustacean	Scampi	*Lipenaus vannamei*	*Peeled*	*0.19*	*< .0009*	*0.007*	*< .005*
2018-1463/1	VIET NAM	Crustacean	Scampi	*Lito Penaeus Vannamei*	*Peeled*	*0.36*	*0.001*	*0.01*	*0.01*
2018-1466/1	VIET NAM	Crustacean	Scampi	*Lipenaus vannamei*	*Peeled*	*0.23*	*0.0009*	*0.007*	*0.02*
2018-823/1	VIET NAM	Crustacean	Whiteleg shrimp	*Penaeus vannamei Boone*	*Peeled*	*0.52*	*0.001*	*0.006*	*< .005*
2018-1458/1	VIET NAM	Crustacean	Processed seafood product	*Cancer spp*	*Muscle*	*21*	*0.03*	*0.1*	*0.01*
2018-2158/1	CHINA	Fresh water fish	Nile tilapia	*Oreochromis niloticus*	*Fillet*	*0.24*	*< .001*	*0.004*	*< .005*
2018-619/1	CHILE	Marine feed-NHC	Feed	*Engraulis ringens*	*Pellets*	*1.9*	*0.33*	*0.012*	*0.10*
2018-620/1	CHILE	Marine feed-NHC	Feed	*n.a.*	*Pellets*	*1.5*	*0.13*	*0.021*	*0.13*
2018-2580/1	JAPAN	Marine feed-NHC	Flour	*n.a.*	*Flour*	*2.9*	*0.66*	*0.11*	*0.11*
2018-1492/1	CHINA	Marine fish	Atlantic cod	*Gadus morhua*	*Fillet*	*4.6*	*0.001*	*0.02*	*< .004*
2018-1068/1	RUSSIAN FEDERATION	Marine fish	Atlantic cod	*Gadus morhua*	*Liver*	*5.4*	*0.16*	*0.009*	*< .02*
2018-1069/1	RUSSIAN FEDERATION	Marine fish	Atlantic halibut	*Hippoglossus hippoglossus*	*Fillet*	*9.3*	*< .0008*	*0.08*	*< .004*
2018-1589/1	CHINA	Marine fish	Atlantic halibut	*Hippoglossus hippoglossus*	*Fillet*	*2.1*	*< .001*	*0.09*	*< .005*
2018-2058/1	RUSSIAN FEDERATION	Marine fish	Atlantic herring	*Clupea harengus*	*Fillet*	*2*	*0.05*	*0.07*	*< .008*
2018-861/1	RUSSIAN FEDERATION	Marine fish	Greenland halibut	*Reinhardtius hippoglossoides*	*Fillet*	*5.7*	*< .002*	*0.02*	*< .008*

2018-1067/1	RUSSIAN FEDERATION	Marine fish	Haddock	*Melanogrammus aeglefinus*	*Fillet*	*2.1*	*0.001*	*0.03*	*< .005*
2018-2129/1	THAILAND	Marine fish	Pacific Cod	*Gadus macrocephalus*	*Fillet*	*8.2*	*< .0009*	*0.03*	*< .005*
2018-1488/1	PERU	Marine fish	Rainbow trout	*Oncorhynchus mykiss*	*Fillet*	*0.27*	*< .001*	*0.006*	*< .007*
2018-1489/1	CHINA	Marine fish	Saithe	*Pollachius virens*	*Fillet*	*2.4*	*0.001*	*0.08*	*< .004*
2018-142/1	SRI LANKA	Marine fish	Yellowfin tuna	*Thunnus albacares*	*Fillet*	*1*	*0.03*	*0.3*	*< .006*
2018-143/1	MALDIVES	Marine fish	Yellowfin tuna	*Thunnus albacares*	*Fillet*	*0.5*	*0.009*	*0.22*	*< .006*
2018-282/1	SRI LANKA	Marine fish	Yellowfin tuna	*Thunnus albacares*	*Fillet*	*0.56*	*0.007*	*0.21*	*< .007*
2018-293/1	MALDIVES	Marine fish	Yellowfin tuna	*Thunnus albacares*	*Fillet*	*1*	*0.03*	*0.17*	*< .007*
2018-621/1	SRI LANKA	Marine fish	Yellowfin tuna	*Thunnus albacares*	*Fillet*	*1.6*	*0.01*	*0.3*	*< .006*
2018-988/1	VIET NAM	Marine fish	Yellowfin tuna	*Thunnus albacares*	*Fillet*	*0.81*	*0.02*	*0.43*	*< .006*
2018-1075/1	VIET NAM	Marine fish	Yellowfin tuna	*Thunnus albacares*	*Fillet*	*2.1*	*0.003*	*0.08*	*< .006*
2018-1541/1	MALDIVES	Marine fish	Yellowfin tuna	*Thunnus albacares*	*Fillet*	*1*	*0.01*	*0.36*	*< .006*
2018-1592/1	PHILIPPINES	Marine fish	Yellowfin tuna	*Thunnus albacares*	*Fillet*	*1.2*	*0.007*	*0.16*	*< .006*
2018-1840/1	VIET NAM	Marine fish	Yellowfin tuna	*Thunnus albacares*	*Fillet*	*0.9*	*0.02*	*0.15*	*< .006*
2018-2132/1	VIET NAM	Marine fish	Yellowfin tuna	*Thunnus albacares*	*Fillet*	*1.9*	*0.05*	*1.5*	*< .006*
2018-140/1	JAPAN	Marine fish	Yellowtail	*Seriola spp*	*Fillet*	*0.41*	*< .002*	*0.16*	*< .009*
2018-141/1	JAPAN	Marine fish	Yellowtail	*Seriola spp*	*Fillet*	*0.44*	*< .002*	*0.17*	*< .008*
2018-696/2	AUSTRALIA	Marine fish	Yellowtail	*Seriola lalandi*	*Fillet*	*0.66*	*< .002*	*0.08*	*< .008*
2018-873/1	AUSTRALIA	Marine fish	Yellowtail	*Seriola spp*	*Fillet*	*0.45*	*< .002*	*0.07*	*< .008*
2018-1806/1	KOREA, REPUBLIC	Marine fish-NHC	Pacific saury	*Cololabis Saira*	*Fillet*	*3.3*	*0.08*	*0.09*	*< .01*
2018-2553/1	TAIWAN	Marine fish-NHC	Pacific saury	*Cololabis Saira*	*Fillet*	*2.6*	*0.1*	*0.041*	*< .009*
2018-2554/1	TAIWAN	Marine fish-NHC	Pacific saury	*Cololabis Saira*	*Fillet*	*2.9*	*0.12*	*0.05*	*< .01*
2018-539/1	TURKEY	Marine Oil-HC	Oil	*Engraulis encrasicolus*	*Oil*	*7.3*	*< .004*	*< .004*	*0.03*
2018-1054/1	CHINA	Marine Oil-HC	Oil	*Engraulis ringens*	*Oil*	*< .009*	*< .005*	*< .005*	*< .02*
2018-1585/1	MOROCCO	Marine Oil-HC	Oil	*n.a.*	*Oil*	*1.4*	*< .005*	*< .005*	*< .02*
2018-1586/1	MOROCCO	Marine Oil-HC	Oil	*n.a.*	*Oil*	*6*	*< .004*	*< .004*	*< .02*
2018-2284/1	PERU	Marine Oil-HC	Oil	*Engraulis ringens*	*Oil*	*7.1*	*< .004*	*0.01*	*< .02*
2018-2285/1	PERU	Marine Oil-HC	Oil	*Engraulis ringens*	*Oil*	*7.3*	*< .005*	*0.04*	*< .02*
2018-2286/1	PERU	Marine Oil-HC	Oil	*Engraulis ringens*	*Oil*	*6.9*	*0.021*	*0.04*	*< .02*
2018-2287/1	MOROCCO	Marine Oil-HC	Oil	*Pesca*	*Oil*	*3*	*< .004*	*0.007*	*< .02*
2018-2288/1	CHINA	Marine Oil-HC	Oil	*Engraulis ringens,*	*Oil*	*0.01*	*< .005*	*< .005*	*< .02*
2018-229/1	MAURITANIA	Marine Oil-NHC	Oil	*n.a.*	*Oil*	*12*	*< .004*	*< .004*	*< .02*
2018-1497/1	THAILAND	Prawn flour-HC	Flour	*n.a.*	*Flour*	*13*	*0.3*	*0.03*	*0.25*
2018-2565/1	THAILAND	Processed Marine fish	Processed tuna	*n.a.*	*Fillet*	*0.83*	*0.008*	*0.03*	*< .02*
2018-2566/1	THAILAND	Processed Marine fish	Processed tuna	*n.a.*	*Fillet*	*0.66*	*0.02*	*0.07*	*< .02*

2018-2583/1	THAILAND	Processed Marine fish	Processed tuna	*Katsuwonus pelamis*	*Fillet*	*0.86*	*0.01*	*0.03*	*< .005*
2018-2584/1	THAILAND	Processed Marine fish	Processed tuna	*Katsuwonus pelamis*	*Fillet*	*1.4*	*0.02*	*0.04*	*< .006*
2018-2585/1	THAILAND	Processed Marine fish	Processed tuna	*Katsuwonus pelamis*	*Fillet*	*1.5*	*0.02*	*0.04*	*< .007*
2018-2586/1	THAILAND	Processed Marine fish	Processed tuna	*Thunnus albacares*	*Fillet*	*0.92*	*0.01*	*0.02*	*< .02*
2018-2587/1	THAILAND	Processed Marine fish	Processed tuna	*Katsuwonus pelamis*	*Fillet*	*1.1*	*0.02*	*0.04*	*< .02*
2018-2588/1	THAILAND	Processed Marine fish	Processed tuna	*Katsuwonus pelamis*	*Fillet*	*0.36*	*0.01*	*0.06*	*< .02*
2018-2591/1	THAILAND	Processed Marine fish	Processed tuna	*Katsuwonus pelamis*	*Fillet*	*2*	*0.02*	*0.07*	*< .006*
2018-314/1	CHINA	Processed prawns	Processed seafood product	*n.a.*	*Peeled*	*0.13*	*0.003*	*0.009*	*< .01*
2018-1837/1	VIET NAM	Processed prawns	Processed seafood product	*n.a.*	*Peeled*	*0.21*	*0.001*	*0.004*	*< .005*
2018-2123/1	VIET NAM	Processed prawns	Processed seafood product	*Penaeus vannamei*	*Peeled*	*0.23*	*0.002*	*0.007*	*0.006*
2018-1076/1	THAILAND	Processed Seafood	Processed seafood product	*n.a.*	*Fillet*	*0.95*	*0.02*	*0.009*	*0.02*
2018-1453/1	THAILAND	Processed Seafood	Processed seafood product	*Gadus macrocephalus*	*Fillet*	*3.8*	*0.004*	*0.019*	*< .009*
2018-1455/1	USA	Processed Seafood	Processed seafood product	*Theragra chalcogramma*	*Fillet*	*1.5*	*0.001*	*0.008*	*< .004*
2018-1461/1	THAILAND	Processed Seafood	Processed seafood product	*Gadus macrocephalus*	*Fillet*	*4.2*	*0.002*	*0.03*	*< .008*
2018-1588/1	JAPAN	Processed Seafood	Processed seafood product	*n.a.*	*Fillet*	*0.11*	*0.002*	*0.023*	*< .006*
2018-2126/1	THAILAND	Processed Seafood	Processed seafood product	*Rastrelliger kanagurta*	*Fillet*	*0.82*	*0.01*	*0.01*	*0.008*
2018-2125/1	THAILAND	Processed Seafood	Processed seafood product	*Gadus macrocephalus*	*Fishburger*	*2*	*0.003*	*0.05*	*< .009*
2018-2542/1	PHILIPPINES	Processed Seafood	Processed seafood product	*Sardinella longiceps*	*Gutted*	*2.5*	*0.10*	*0.02*	*< .02*
2018-2581/1	MOROCCO	Processed Seafood	Processed seafood product	*n.a.*	*Gutted*	*1.8*	*0.06*	*0.01*	*< .02*
2018-2582/1	MOROCCO	Processed Seafood	Processed seafood product	*n.a.*	*Gutted*	*1.7*	*0.055*	*0.008*	*< .02*
2018-313/1	CHINA	Processed seafood - Surimi	Processed seafood product	*n.a.*	*Fillet*	*0.094*	*0.006*	*0.02*	*0.02*
2018-1071/1	USA	Surimi-marin fish	Processed seafood product	*Theragra chalcogramma*	*Fillet*	*0.84*	*0.002*	*0.01*	*< .004*
2018-1074/1	NEW ZEALAND	Surimi-marin fish	Processed seafood product	*Macruronus novaezelandiae*	*Fillet*	*1.3*	*< .0009*	*0.16*	*< .005*
	Maximum value					*170*	*0.7*	*1.5*	*0.7*
	Second largest value					*140*	*0.5*	*0.4*	*0.3*

Table 7. Dioxins and PCBs, n=28. Dioxins (PCDD) + furans (PCDF), dioxin like PCBs (DLPCBC), and non-dioxinlike PCBs NDL-PCBs. (pg/g w.w. TEQ).

The analytical concentrations of 28 different compounds are summed as "Toxic Equivalence values" (TEQ-values)[9], to give three distinct (Upper bound) sum-parameters: Sum-PCDD+PCDF, sum DLPCBs and total TEQ sum. TEQ-values are provided in the pg/g (w/w) scale (pico-grams per gram in the naturally moist sample state). The indicator NDL-PCBs are provided as the Upper bound sum of their analytical concentrations (Not TEQ-values), in the µg/kg (w/w) scale.

Journal No.	Origin	Product	Scientific name	Tissue/ sample type	Sum DLPCBs	PCDDs+ PCDFs	Total TEQ	Sum NDL-PCBS
2018-1068/1	RUSSIAN FEDERATION	Atlantic cod	*Gadus morhua*	Liver	4.5	2.0	6.5	38
2018-1069/1	RUSSIAN FEDERATION	Atlantic halibut	*Hippoglossus hippoglossus*	Fillet	0.23	0.20	0.44	2.0
2018-861/1	RUSSIAN FEDERATION	Greenland halibut	*Reinhardtius hippoglossoides*	Fillet	0.30	0.18	0.48	2.9
2018-1116/1	VIET NAM	Processed tuna	*n.a.*	Fillet	0.01	0.03	0.04	0.03
2018-1117/1	THAILAND	Processed tuna	*n.a.*	Fillet	0.03	0.18	0.20	0.19
2018-1118/1	PHILIPPINES	Processed tuna	*n.a.*	Fillet	0.01	0.10	0.11	0.07
2018-1121/1	THAILAND	Processed tuna	*n.a.*	Fillet	0.02	0.06	0.08	0.05
2018-1122/1	THAILAND	Processed tuna	*n.a.*	Fillet	0.02	0.06	0.08	0.05
2018-1123/1	THAILAND	Processed tuna	*n.a.*	Fillet	0.03	0.15	0.18	0.17
2018-1488/1	PERU	Rainbow trout	*Oncorhynchus mykiss*	Fillet	0.07	0.10	0.17	0.37
2018-142/1	SRI LANKA	Yellowfin tuna	*Thunnus albacares*	Fillet	0.02	0.08	0.09	0.14
2018-143/1	MALDIVES	Yellowfin tuna	*Thunnus albacares*	Fillet	0.03	0.10	0.13	0.10
2018-282/1	SRI LANKA	Yellowfin tuna	*Thunnus albacares*	Fillet	0.01	0.08	0.09	0.06
2018-293/1	MALDIVES	Yellowfin tuna	*Thunnus albacares*	Fillet	0.30	0.17	0.47	0.79
2018-621/1	SRI LANKA	Yellowfin tuna	*Thunnus albacares*	Fillet	0.01	0.05	0.06	0.12
2018-988/1	VIET NAM	Yellowfin tuna	*Thunnus albacares*	Fillet	0.01	0.03	0.03	0.06
2018-1075/1	VIET NAM	Yellowfin tuna	*Thunnus albacares*	Fillet	0.01	0.08	0.08	0.05
2018-1541/1	MALDIVES	Yellowfin tuna	*Thunnus albacares*	Fillet	0.01	0.04	0.04	0.05
2018-140/1	JAPAN	Yellowtail	*Seriola spp*	Fillet	0.43	0.30	0.73	3.0
2018-141/1	JAPAN	Yellowtail	*Seriola spp*	Fillet	0.40	0.26	0.65	2.3
2018-873/1	AUSTRALIA	Yellowtail	*Seriola spp*	Fillet	0.33	0.16	0.49	2.3
2018-1119/1	PHILIPPINES	Processed seafood	*Chanos spp*	Fillet	0.03	0.13	0.16	0.14

2018-539/1	TURKEY	Oil	*Engraulis encrasicolus*	Oil	4.83	2.6	7.40	25
2018-1054/1	CHINA	Oil	*Engraulis ringens*	Oil	0.04	0.89	0.93	0.40
2018-1585/1	MOROCCO	Oil	*Oil*	Oil	1.76	0.68	2.43	14
2018-1586/1	MOROCCO	Oil	*Oil*	Oil	1.72	0.48	2.20	15
2018-229/1	MAURITANIA	Oil	*n.a.*	Oil	0.79	0.87	1.66	5.0
2018-1076/1	THAILAND	Processed seafood	*Rastrelliger Brachysoma*	Fillet	0.17	0.23	0.41	1.3
	Maximum values				4.8	2.6	7.4	38
	Second largest value				4.5	2.0	6.5	25

Table 8. Selected Brominated Flame Retardants, PBDEs (µg/kg w.w.), n=28.

Journal No.	Origin	Species	Scient. Name	Tissue	PBDE-28	PBDE-47	PBDE-99	PBDE-100	PBDE-153	PBDE-154	PBDE-183	UB Sum 7-PBDE
2018-1068/1	RUSSIAN FEDERAT.	Atlantic cod	*Gadus morhua*	Liver	0.15	1.9	1	0.5	0.15	0.49	< .15	4.4
2018-1069/1	RUSSIAN FEDERAT.	Atlantic halibut	*Hippoglossus hippoglossus*	Fillet	0.007	0.10	0.002	0.02	0.004	0.03	< .009	0.17
2018-861/1	RUSSIAN FEDERAT.	Greenland halibut	*Reinhardtius hippoglossoides*	Fillet	0.007	0.10	0.004	0.02	< .004	0.01	< .02	0.15
2018-1116/1	VIET NAM	Processed tuna	*n.a.*	Fillet	< .0004	0.003	< .0007	0.001	< .0007	0.001	< .003	0.009
2018-1117/1	THAILAND	Processed tuna	*n.a.*	Fillet	< .003	0.005	0.008	< .003	< .005	< .003	< .02	0.05
2018-1118/1	PHILIPPINES	Processed tuna	*n.a.*	Fillet	< .001	0.002	< .002	< .001	< .002	< .001	< .008	0.02
2018-1121/1	THAILAND	Processed tuna	*n.a.*	Fillet	< .0009	0.01	0.008	0.002	< .002	0.001	< .006	0.02
2018-1122/1	THAILAND	Processed tuna	*n.a.*	Fillet	< .0009	0.003	0.004	< .0009	< .002	< .0009	< .007	0.02
2018-1123/1	THAILAND	Processed tuna	*n.a.*	Fillet	< .003	0.48	1.2	0.22	0.12	0.12	< .02	2.2
2018-1488/1	PERU	Rainbow trout	*Oncorhynchus mykiss*	Fillet	0.002	0.02	0.008	0.006	< .003	0.005	< .01	0.06
2018-142/1	SRI LANKA	Yellowfin tuna	*Thunnus albacares*	Fillet	< .001	0.01	< .002	0.002	< .002	0.004	< .007	0.02
2018-143/1	MALDIVES	Yellowfin tuna	*Thunnus albacares*	Fillet	< .001	0.00	< .002	0.001	< .002	0.002	< .007	0.02
2018-282/1	SRI LANKA	Yellowfin tuna	*Thunnus albacares*	Fillet	< .0009	0.00	< .002	< .0009	< .002	< .0009	< .006	0.02
2018-293/1	MALDIVES	Yellowfin tuna	*Thunnus albacares*	Fillet	0.002	0.03	0.008	0.03	0.004	0.032	< .008	0.11
2018-621/1	SRI LANKA	Yellowfin tuna	*Thunnus albacares*	Fillet	< .002	0.003	< .003	< .002	< .003	< .002	< .013	0.03
2018-988/1	VIET NAM	Yellowfin tuna	*Thunnus albacares*	Fillet	< .0009	0.002	< .002	< .0009	< .002	< .0009	< .006	0.01
2018-1075/1	VIET NAM	Yellowfin tuna	*Thunnus albacares*	Fillet	< .0008	0.001	< .001	< .0008	< .001	< .0008	< .005	0.01
2018-1541/1	MALDIVES	Yellowfin tuna	*Thunnus albacares*	Fillet	< .0008	0.002	< .001	< .0008	< .001	< .0008	< .006	0.01
2018-140/1	JAPAN	Yellowtail	*Seriola spp*	Fillet	0.01	0.19	0.02	0.05	0.01	0.07	< .02	0.37
2018-141/1	JAPAN	Yellowtail	*Seriola spp*	Fillet	0.01	0.16	0.02	0.04	0.008	0.07	0.02	0.32
2018-873/1	AUSTRALIA	Yellowtail	*Seriola spp*	Fillet	0.01	0.26	0.07	0.06	0.02	0.04	< .016	0.47
2018-1119/1	PHILIPPINES	Processed seafood	*Chanos spp*	Fillet	< .002	0.02	0.006	0.004	< .003	0.007	< .011	0.05
2018-539/1	TURKEY	Oil	*Engraulis encrasicolus*	Oil	0.05	0.42	0.13	0.10	< .04	0.12	< .16	1.0
2018-1054/1	CHINA	Oil	*Engraulis ringens*	Oil	< .022	0.03	< .037	< .022	< .04	< .02	< .07	0.24

2018-1585/1	MOROCCO	Oil	n.a.	Oil	< .024	0.33	< .04	0.06	< .04	0.03	< .17	0.69
2018-1586/1	MOROCCO	Oil	n.a.	Oil	< .025	0.39	< .043	0.05	< .043	< .03	< .18	0.76
2018-229/1	MAURITAN.	Oil	n.a.	Oil	< .023	0.22	0.07	0.03	< .04	< .02	0.03	0.43
2018-1076/1	THAILAND	Processed seafood	n.a.	Fillet	< .003	0.01	0.006	0.005	< .005	0.007	< .02	0.06
			Maximum value		2.6	1.9	1.2	0.5	0.2	0.5	0.03	4.4
			Second largest		2.0	0.48	0.2	0.2	0.1	0.1	0.02	2.2

Table 9a. Selected Chloro-pesticides, first pesticide table. (µg/kg w.w.), n=15.

Journal No.	Origin	Species	Scient. Name	Tissue	Alfa HCH	beta-HCH	cis-Chlordane	cis-Heptachlor epoxide	Diel-drin	HCB	Mirex
2018-2158/1	CHINA	Nile tilapia	*Oreochromis niloticus*	Fillet	< .2	< .2	< .07	< .1	< .1	< .3	< .07
2018-1589/1	CHINA	Atlantic halibut	*Hippoglossus hippoglossus*	Fillet	< .2	< .2	0.07	< .1	< .1	< .4	< .07
2018-2058/1	RUSSIA	Atlantic herring	*Clupea harengus*	Fillet	0.31	< .2	1.1	0.43	2.4	2.0	0.15
2018-1592/1	PHILIPPINES	Yellowfin tuna	*Thunnus albacares*	Fillet	< .2	< .2	< .07	< .1	< .1	< .3	< .07
2018-2132/1	VIET NAM	Yellowfin tuna	*Thunnus albacares*	Fillet	< .2	< .2	< .07	< .1	< .1	< .3	0.49
2018-1806/1	REPUBLIC OF KOREA	Pacific saury	*Cololabis Saira*	Fillet	0.24	0.6	0.24	< .1	0.28	0.72	< .07
2018-2553/1	TAIWAN CHINA	Pacific saury	*Cololabis Saira*	Fillet	1.5	1.0	0.59	< .3	0.81	2.6	< .2
2018-2554/1	TAIWAN CHINA	Pacific saury	*Cololabis Saira*	Fillet	1.6	1.2	0.55	0.30	0.82	2.6	< .2
2018-2284/1	PERU	Oil	*Engraulis ringens*	Oil	< .3	0.87	< .3	< .4	1.8	2.4	< .3
2018-2285/1	PERU	Oil	*Engraulis ringens*	Oil	< .3	0.86	< .3	< .4	1.4	1.9	< .3
2018-2286/1	PERU	Oil	*Engraulis ringens*	Oil	< .3	0.73	0.29	< .4	1.7	2.4	< .3
2018-2287/1	MOROCCO	Oil	*Pesca*	Oil	< .3	< .3	0.65	0.68	3.5	3.6	< .3
2018-2288/1	CHINA	Oil	*Engraulis ringens,*	Oil	< 1	12	< 1	< 1.4	< 1.4	< 4.8	< 1
2018-2126/1	THAILAND	Processed seafood product	*Rastrelliger kanagurta*	Fillet	< .2	< .2	< .007	< .1	< .1	< .3	< .07
2018-2542/1	PHILIPPINES	Processed seafood product	*Sardinella longiceps*	Gutted	< .2	< .2	< .007	< .1	< .1	< .3	< .07
			Maximum value		1.6	12	1.1	0.7	3.5	3.6	0.5

Table 9b. Selected Chloro-pesticides, second pesticide table. (µg/kg w.w.), n=15.

Journal No.	Origin	Species	Scient. Name	Tissue	o,p'-DDD	o,p'-DDT	p,p'-DDD	p,p'-DDE	p,p'-DDT	Toxaphene Parlar 50	trans-Nonachlor
2018-2158/1	CHINA	Nile tilapia	*Oreochromis niloticus*	Fillet	< .07	< .07	< .07	< .07	< .07	< .3	< .03
2018-1589/1	CHINA	Atlantic halibut	*Hippoglossus hippoglossus*	Fillet	< .07	< .07	< .07	0.25	< .07	< .3	0.15
2018-2058/1	RUSSIA	Atlantic herring	*Clupea harengus*	Fillet	0.10	< .07	1.6	6.9	0.51	5.3	2.0
2018-1592/1	PHILIPPINES	Yellowfin tuna	*Thunnus albacares*	Fillet	< .07	< .07	< .07	< .07	< .07	< .3	< .03
2018-2132/1	VIET NAM	Yellowfin tuna	*Thunnus albacares*	Fillet	< .07	< .07	< .07	0.56	0.11	< .3	< .03
2018-1806/1	REPUBLIC OF KOREA	Pacific saury	*Cololabis Saira*	Fillet	0.11	0.10	0.25	0.60	0.12	0.41	0.22
2018-2553/1	TAIWAN CHINA	Pacific saury	*Cololabis Saira*	Fillet	0.25	< .2	0.53	0.84	< .2	< 1	0.36
2018-2554/1	TAIWAN CHINA	Pacific saury	*Cololabis Saira*	Fillet	0.22	< .2	0.52	0.80	< .2	< 1	0.39
2018-2284/1	PERU	Oil	*Engraulis ringens*	Oil	< .3	< .3	1.4	6.6	0.80	1.3	< .1
2018-2285/1	PERU	Oil	*Engraulis ringens*	Oil	< .3	< .3	0.70	3	< .3	< 1.2	0.23
2018-2286/1	PERU	Oil	*Engraulis ringens*	Oil	< .3	< .3	0.97	6.7	0.70	< 1.2	0.15
2018-2287/1	MOROCCO	Oil	*Pesca*	Oil	< .3	< .3	0.73	3.1	< .3	2.5	0.96
2018-2288/1	CHINA)	Oil	*Engraulis ringens,*	Oil	< 1.4	< 3.8	< 27.	11	13	< 4.8	< .5
2018-2126/1	THAILAND	Processed seafood product	*Rastrelliger kanagurta*	Fillet	< .07	0.13	0.29	0.59	0.44	< .3	< .03
2018-2542/1	PHILIPPINES	Processed seafood product	*Sardinella longiceps*	Gutted	< .07	< .07	< .07	0.26	< .07	< .3	< .03
			Maximum value		0.2	0.1	1.6	11	13	5.3	2.0

Table 10. Selected PAH compounds (µg/kg w.w.), n=1.

Journal No.	Imported from	Group	Species	Scient. name	Tissue	BaP	LB Sum PAH_4
2018-1076/1	THAILAND	Processed seafood (steamed and Smoked)	Short mackerel	*Rastrelliger Brachysoma*	Fish fillet	< .05	0

7 - ANNEX 2: Method performance data

Table 11: A summary of the 2018 chemical analytical methods at IMR.
IMR=Institute of Marine Research, Bergen, Norway.

Compounds		Matrix	Method principle	Analytical method LOD in muscle (µg/kg w.w.)	Analytical method LOQ (µg/kg w.w.)	Level of action	Laboratory
Therapeutic agents and dyes	Chloramphenicol	Muscle	LC-MS/MS	0.25	-	Presence (MRPL=0.3)	IMR
	3-Amino-2-oxazolidinone (AOZ)	Muscle	LC-MS/MS	0.5	-	Presence (MRPL=1.0)	IMR
	1-Aminohydrantoin (AHD)	Muscle	LC-MS/MS	0.6	-	Presence (MRPL=1.0)	IMR
	3-Amino-5-morpholinomethyl-2-oxazolidinone (AMOZ)	Muscle	LC-MS/MS	0.4	-	Presence (MRPL=1.0)	IMR
	Semicarbazide (SEM)	Muscle	LC-MS/MS	0.5	-	Presence (MRPL=1.0)	IMR
	Malachite green (MG)	Muscle	LC-MS/MS	0.15	-	Presence (MRPL=2.0)	IMR
	Leuco malachite green (LMG)	Muscle	LC-MS/MS	0.15	-	Presence (MRPL=2.0)	IMR
	Crystal violet (CV)	Muscle	LC-MS/MS	0.15	-	Presence	IMR
	Leuco crystal violet (LCV)	Muscle	LC-MS/MS	0.15	-	Presence	IMR
	Brilliant green (BG)	Muscle	LC-MS/MS	0.15	-	Presence	IMR
POPs	PCDD and PCDF (dioxin and furan) congeners	Muscle	HRGC-HRMS	-	$2*10^{-5}$-0.02 ng/kg[1] TEQ	See annex 3	IMR
	non-orto PCB congeners	Muscle	HRGC-MSMS	-	$2*10^{-5}$-0.02 ng/kg[1] TEQ	See annex 3	IMR
	Mono-orto PCB congeners	Muscle	HRGC-MSMS	-	$2*10^{-5}$-0.02 ng/kg[1] TEQ	See annex 3	IMR
	NDLPCB congeners	Muscle	HRGC-MSMS	-	0.005-0.03	See annex 3	IMR
	PBDE-congeners	Muscle	HRGC-NCI/MS	-	0.0004-0.02	n.a.	IMR
	PAH, benzo(a)pyrene(BaP) SUM PAH	See annex 3	GC-MS	-	0.05-0.4	See Annex 3	IMR
Chemical elements	Pb	Muscle	ICPMS	-	4-20	See Annex 3	IMR
	Cd	Muscle	ICPMS	-	0.5-10	See Annex 3	IMR
	As	Muscle	ICPMS	-	10-80	See Annex 3	IMR
	Hg	Muscle	ICPMS	-	2-10	See Annex 3	IMR
Indicators of spoilage	TVB-N	Muscle	CONWAY	-	0.6 mg(N)	-	IMR
	Histamine	Muscle	HPLC-UV	-	5 mg/kg	-	IMR

Table 12: Chlorinated pesticides analysed with their corresponding limit of quantification (LOQ) as provided by sub-contractor			
Pesticide	**LOQ [µg/kg dw]**	**Pesticide**	**LOQ [µg/kg dw]**
alpha-Endosulfan	1.04	Pentachlorobenzene	1.04
beta-Endosulfan	0.27	trans-Nonachlor	1.28
Endosulfan sulphite	0.27	Dieldrin	0.31
trans-Chlordane	0.21	Endrin	0.63
cis-Chlordane	0.21	Aldrin	0.21
Oxychlordane	1.04	Mirex	0.21
Hexachlorobenzene (HCB)	1.04	Toxaphene Parlar 26	1.04
alpha-HCH	0.52	Toxaphene Parlar 50	1.04
beta-HCH	0.52	Toxaphene Parlar 62	2.08
gamma-HCH (Lindane)	0.52	o,p'-DDD	0.21
delta-HCH	0.52	o,p'-DDE	0.21
Heptachlor	0.21	o,p'-DDT	0.21
trans-Heptachlor epoxide	0.63	p,p'-DDD	0.21
cis-Heptachlor epoxide	0.31	p,p'-DDE	0.21
Octachlorstyrene	0.10	p,p'-DDT	0.21

8 - ANNEX 3: Regulatory maximum levels

Table 13: A selection of regulatory maximum levels for contaminants in seafood from on EU Commission regulation no 1881/2006

Element or pollutant	Unit of measure-ment	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)		-		-	-	-	-	-	-	-	-
Cadmium (Cd)	mg/kg w.w.[6]	0.05	0.1-0.3[8]	0.1	0.05	*[6,8]	-	0.5	1.0[6]	1.0	-
Mercury (Hg)		0.5	1.0	1.0	0.5	*[6,8]	0.5	0.5	0.5[6]	0.5	-
Lead (Pb)		0.3	0.3	0.3	0.3	*[6,8]	-	0.5	1.5[6]	1.0	-
Sum of dioxins and furans[5]		3.5	3.5	3.5	3.5	*[6,8]	-	3.5	3.5[6]	3.5	1.75
Sum of dioxin like PCBs[5]	pg/g TEQ w.w. [6]	-	-	-	-	*[6,8]	-	-	-	-	-
Sum of dioxins. furans and dioxin like PCBs[5]		6.5	6.5	10	6.5	*[6,8]	20	6.5	6.5[6]	6.5	6
Sum of six NDLPCBs[5]	ng/g w.w.[6]	75	75	300	125	*[6,8]	200	75	75[6]	75	200
PAH Benzo[a]pyrene	µg/kg w.w. [6]	-	-	-	-	2 - 5[6,8]	-	-	5 (6)[2]	-	2
PAH_4, sum of 4 PAH compounds[7]	µg/kg w.w.[6]	-	-	-	-	12 - 30[6,8]	-	-	30 (35)[2]	-	10

Based on Commission regulation 1881/2006, Commission Regulation 1259/2011 amending Regulation 1881/2006 and Commission regulation (EU) 835/2011 amending Regulation 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 pg/g fat
- 5) Upper bound sum calculation is assumed.
- 6) Wet weight (w.w.); the concentration in a naturally moist sample. Values for dried or otherwise processed food should be transformed to w.w.
- 7) Benzo(a)pyrene, Benzo(a)anthracene, Benzo(b)fluoranthene and chrysene, assuming a lower bound sum calculation.
- 8) Value change with different biological species

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