

Chemical Contaminants in Wild Caught Fishery Products and Crustaceans – Northern Ireland.

Fera Science Ltd.¹

¹ Fera Science (United Kingdom)

Keywords: Regulating the changing food system, Chemical risks, Emerging challenges and opportunities, Methods, National Reference Laboratories, Products of animal origin, Sampling, Wider consumer interests

<https://doi.org/10.46756/001c.140614>

FSA Research and Evidence

Fifty-nine samples of wild caught fishery products and crustaceans were collected between March 2023 – February 2024 from Kilkeel Fish Market in Northern Ireland. Forty-four of the samples were analysed for the contaminants: mercury, lead and cadmium (heavy metals). The other fifteen samples were tested for dioxins and PCBs:

- 1,2,3,4,6,7,8-HeptaCDD
- 1,2,3,4,6,7,8-HeptaCDF
- 1,2,3,4,7,8,9-HeptaCDF
- 1,2,3,4,7,8-HexaCDD
- 1,2,3,4,7,8-HexaCDF
- 1,2,3,6,7,8-HexaCDD
- 1,2,3,6,7,8-HexaCDF
- 1,2,3,7,8,9-HexaCDD
- 1,2,3,7,8,9-HexaCDF
- 1,2,3,7,8-PentaCDD
- 1,2,3,7,8-PentaCDF
- 2,3,4,6,7,8-HexaCDF
- 2,3,4,7,8-PentaCDF
- 2,3,7,8-TetraCDD
- 2,3,7,8-TetraCDF
- OctaCDD
- OctaCDF

and PCBs (dioxin-like and non-dioxin-like PCBs included for analysis)

- PCB 28 (2,4,4'-Trichlorobiphenyl) *
- PCB 52 (2,2',5,5'-Tetrachlorobiphenyl) *
- PCB 77 (3,3',4,4'-Tetrachlorobiphenyl, 3,3',4,4'-PCB)
- PCB 81 (3,4,4',5-Tetrachlorobiphenyl)
- PCB 101 (2,2',4,5,5'-Pentachlorobiphenyl) *
- PCB 105 (2,3,3',4,4'-Pentachlorobiphenyl)
- PCB 114 (2,3,4,4',5-Pentachlorobiphenyl)
- PCB 118
- PCB 123
- PCB 126
- PCB 138 (2,2',3,4,4',5'-Hexachlorobiphenyl) *
- PCB 153 (2,2',4,4',5,5'-Hexachlorobiphenyl) *
- PCB 156 (2,3,3',4,4',5-Hexachlorobiphenyl)
- PCB 157
- PCB 167
- PCB 169
- PCB 180 (2,2',3,4,4',5,5'-Heptachlorobiphenyl) *
- PCB 189

*non-dioxin-like PCBs.

Concentrations of mercury, lead and cadmium were less than the maximum EU regulatory limits for all samples tested.

Concentrations of dioxins and PCBs were below the EU regulatory limits for these compounds.

1. Introduction

1.1 Background to the study

Eurofins Food Testing Ireland Ltd (Public Analysts) was contracted by the Food Standards Agency (FSA) in Northern Ireland to assess the levels of various chemical contaminants (heavy metals, dioxins and polychlorinated biphenyls (PCBs)) in a number of species of wild caught fishery products and crustaceans landed in Northern Ireland between March 2023 and February 2024.

1.2. Aims and objectives of the study

The official control surveillance programme is undertaken to comply with Article 70 of Commission Implementing Regulation (EU) 2019/627 (EU, 2019) which requires a monitoring programme to be established for wild caught fishery products to control compliance with EU legislation on contaminants. Commission Regulation (EU) 2023/915 on maximum levels for certain contaminants in food and repealing Regulation (EC) No 1881/2006 (EU, 2023), sets down the maximum levels for certain contaminants in food, including fishery products.

The data has the potential to provide support to certifying officers in their attestation of the compliance of wild caught fishery products landed in Northern Ireland with contaminants legislation when signing Export Health Certificates.

The aim of the work was to determine concentrations of defined chemical contaminants in wild caught fishery products to assess whether the levels were within the limits prescribed (EU, 2023) and were safe for placing on the market.

2. Material and methods

2.1. Samples

Fifty-nine samples of wild caught fishery products and crustaceans were collected from 22nd March 2023 to 21st February 2024 from Kilkeel Fish Market in Northern Ireland (Annex A). Forty-four of the samples were analysed for the contaminants: mercury, lead and cadmium (heavy metals). The other fifteen samples were tested for dioxins and PCBs. To plan the purchase and collection of samples, FSA in Northern Ireland shared a list of required products with authorised officers from Newry Mourne and Down District Council, for random sampling.

The type and number of samples of each species collected for analyses were determined based on the quantity of that species landed in Northern Ireland, and any previous exceedances. The species sampled included:

- Dublin Bay Prawn
- Mackerel
- Haddock
- Brown crab
- Herring
- King scallop

On receipt at the laboratory (Eurofins Food Testing Ireland Ltd, Dublin, Ireland) each sample was assigned a unique laboratory reference number, and the sample details were logged into a database.

2.2. Sample preparation

For fin fish, samples were filleted to collect edible muscle tissue and exclude skin, bones and organs. For crustacea, only the white meat was taken to represent the sample. The selected tissue was homogenised in a blender. The aliquots for either metals or dioxins/PCBs analyses were immediately weighed out and the remaining material was stored in a freezer.

2.3. Metal Analysis

Samples were analysed for cadmium, mercury and lead using an in-house (Eurofins WEJ Contaminants GmbH) method based on EN ISO 15763: Determination of trace elements - determination of cadmium, mercury and lead in foodstuffs by Inductively coupled plasma mass spectrometry (ICP-MS) after pressure digestion.

Aliquots of homogenised test sample material were digested in an acid solution using a high-pressure microwave system. The solution was diluted as required before analysis. Quantification of the four elements was by ICP-MS.

The analysis is accredited to ISO 17025, with the inclusion of certified and in-house reference materials and method blanks which were evaluated prior to the reporting of sample data and were used to determine the limits of quantification.

2.4. Dioxin and PCB analysis

Samples were prepared for analysis using a cold extraction method and analysed for dioxins and PCBs using methods by Eurofins Lab Zeeuws-Vlaanderen outlined in Commission Regulation (EU) 2017/644 (EU, 2017). The following analytes were determined:

Dioxins:

- 1,2,3,4,6,7,8-HeptaCDD
- 1,2,3,4,6,7,8-HeptaCDF
- 1,2,3,4,7,8,9-HeptaCDF
- 1,2,3,4,7,8-HexaCDD
- 1,2,3,4,7,8-HexaCDF

- 1,2,3,6,7,8-HexaCDD
- 1,2,3,6,7,8-HexaCDF
- 1,2,3,7,8,9-HexaCDD
- 1,2,3,7,8,9-HexaCDF
- 1,2,3,7,8-PentaCDD
- 1,2,3,7,8-PentaCDF
- 2,3,4,6,7,8-HexaCDF
- 2,3,4,7,8-PentaCDF
- 2,3,7,8-TetraCDD
- 2,3,7,8-TetraCDF
- OctaCDD
- OctaCDF

Dioxin-like PCBs:

- PCB 77 (3,3',4,4'-Tetrachlorobiphenyl, 3,3',4,4'-PCB)
- PCB 81 (3,4,4',5-Tetrachlorobiphenyl)
- PCB 105 (2,3,3',4,4'-Pentachlorobiphenyl)
- PCB 114 (2,3,4,4',5-Pentachlorobiphenyl)
- PCB 118
- PCB 123
- PCB 126
- PCB 156 (2,3,3',4,4',5-Hexachlorobiphenyl)
- PCB 157
- PCB 167
- PCB 169
- PCB 189

Non-dioxin-like PCBs:

- PCB 28 (2,4,4'-Trichlorobiphenyl)

- PCB 52 (2,2',5,5'-Tetrachlorobiphenyl)
- PCB 101 (2,2',4,5,5'-Pentachlorobiphenyl)
- PCB 138 (2,2',3,4,4',5'-Hexachlorobiphenyl)
- PCB 153 (2,2',4,4',5,5'-Hexachlorobiphenyl)
- PCB 180 (2,2',3,4,4',5,5'-Heptachlorobiphenyl)

The value of each congener was multiplied by its World Health Organisation-Toxicity Equivalent Factor (WHO-TEFs). The product was presented as the Toxic Equivalency (TEQ).

- Lower-bound: the concept which requires using zero for the contribution of each congener <Limit of Quantification (LOQ).
- Medium-bound: the concept which requires using half of the limit of quantification calculating the contribution of each congener < LOQ.
- Upper-bound: the concept which requires using the limit of quantification for the contribution of each congener < LOQ.

The analysis is accredited to ISO 17025. Each sample is analysed with the addition of certified standards. The recovery of the standards is checked in each sample against the EU regulation (EU) 2017/644 (EU, 2017). The LOQ is dependent on the LOD, sample weight and sample matrix.

3. Results and discussion

The concentrations of the contaminants measured in the fifty-nine samples were determined by Eurofins and were compared to limits prescribed in Commission Regulation (EU) 2023/915 (EU, 2023).

3.1. Metals analysis

Concentrations of mercury, cadmium and lead were below the regulatory limits for these compounds and are provided in [Table 1](#) in Annex B.

3.2. Dioxin and PCB analysis

Concentrations of dioxins and PCBs were below the regulatory limits for these compounds and are provided in [Table 2](#) in Annex B.

Acknowledgements

Fera Science Ltd.

- Title: Chemical contaminants in wild caught fishery products and crustaceans 2023-2024 – Northern Ireland
- Customer: Food Standards Agency – Northern Ireland
- FSA NI Project Officer: Annmarie O'Toole
- Report Number: Report FR/002638-88
- Fera Project: Number FR/002638-8
- Compiled by: Emma Bradley
- Authorised by: Susan MacDonald

Note: Fera shall not be responsible for confirming or ascertaining the accuracy or completeness of any information or data provided by customer or by any third party on its behalf. Accordingly, any advice given by Fera, or its representatives based on such information or data, including any results contained in any reports and/or any recommendations, interpretation, analysis, guidance, suggestions, proposals, endorsements given by Fera in connection with the services, are given without liability on the part of Fera.

This report has been prepared by Fera after exercise of all reasonable care and skill but is provided without liability in its application and use. This report may not be reproduced except in full, without the written approval of Fera. Whilst care has been taken to ensure that the web links contained in this report are correct at the time of issue, changes may occur.

Copyright © Fera Science Ltd. (Fera) 2024

Published: June 25, 2025 BST.



This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CCBY-4.0). View this license's legal deed at <http://creativecommons.org/licenses/by/4.0> and legal code at <http://creativecommons.org/licenses/by/4.0/legalcode> for more information.

References

EU. (2017). *Commission Regulation (EU) 2017/644 of 5 April 2017 laying down methods of sampling and analysis for the control of levels of dioxins, dioxin-like PCBs and non-dioxin-like PCBs in certain foodstuffs and repealing Regulation (EU) No 589/2014*. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R0644>

EU. (2019). *Commission Implementing Regulation (EU) 2019/627 of 15 March 2019 laying down uniform practical arrangements for the performance of official controls on products of animal origin intended for human consumption in accordance with Regulation (EU) 2017/625 of the European Parliament and of the Council and amending Commission Regulation (EC) No 2074/2005 as regards official controls*. https://eur-lex.europa.eu/eli/reg_impl/2019/627/oj

EU. (2023). *Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food and repealing Regulation (EC) No 1881/2006*. <https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32023R0915>

Annexes

Annex A: Sample details

Sample number	Full Product Text Description	Landing date	Fish Market
FSAWF61	King Scallop	18.04.2023	Kilkeel Fish Market
FSAWF62	King Scallop	24.04.2023	Kilkeel Fish Market
FSAWF63	King Scallop	29.04.2023	Kilkeel Fish Market
FSAWF64	Nephrops	22.08.2023	Kilkeel Fish Market
FSAWF65	Nephrops	22.06.2023	Kilkeel Fish Market
FSAWF66	Nephrops	23.06.2023	Kilkeel Fish Market
FSAWF67	Nephrops	22.06.2023	Kilkeel Fish Market
FSAWF68	Nephrops	25.04.2023	Kilkeel Fish Market
FSAWF69	Nephrops	23.06.2023	Kilkeel Fish Market
FSAWF70	Nephrops	28.04.2023	Kilkeel Fish Market
FSAWF71	Brown Crab	26.08.2023	Kilkeel Fish Market
FSAWF72	Nephrops	28.08.2023	Kilkeel Fish Market
FSAWF73	Nephrops	29.08.2023	Kilkeel Fish Market
FSAWF74	Mackerel	30.08.2023	Kilkeel Fish Market
FSAWF75	Brown Crab	21.08.2023	Kilkeel Fish Market
FSAWF76	Herring	15.08.2023	Kilkeel Fish Market
FSAWF77	Brown Crab	17.08.2023	Kilkeel Fish Market
FSAWF78	Brown Crab	06.08.2023	Kilkeel Fish Market
FSAWF79	Brown Crab	23.03.2023	Kilkeel Fish Market
FSAWF80	Brown Crab	16.08.2023	Kilkeel Fish Market
FSAWF81	Nephrops	16.07.2023	Kilkeel Fish Market
FSAWF82	Nephrops	29.05.2023	Kilkeel Fish Market
FSAWF83	Brown Crab	16.05.2023	Kilkeel Fish Market
FSAWF84	Brown Crab	22.03.2023	Kilkeel Fish Market
FSAWF85	Brown Crab	24.04.2023	Kilkeel Fish Market
FSAWF86	King Scallop	17.04.2023	Kilkeel Fish Market

Sample number	Full Product Text Description	Landing date	Fish Market
FSAWF87	Herring	16.08.2023	Kilkeel Fish Market
FSAWF88	Herring	16.08.2023	Kilkeel Fish Market
FSAWF89	Herring	29.08.2023	Kilkeel Fish Market
FSAWF90	Mackerel	31.08.2023	Kilkeel Fish Market
FSAWF91	Mackerel	13.09.2023	Kilkeel Fish Market
FSAWF92	King Scallop	16.06.2023	Kilkeel Fish Market
FSAWF93	Herring	07.09.2023	Kilkeel Fish Market
FSAWF94	Herring	05.09.2023	Kilkeel Fish Market
FSAWF95	Mackerel	15.09.2023	Kilkeel Fish Market
FSAWF96	Haddock	11.09.2023	Kilkeel Fish Market
FSAWF97	Herring	14.09.2023	Kilkeel Fish Market

Sample number	Full Product Text Description	Landing date	Fish Market
FSAWF98	Mackerel	11.09.2023	Kilkeel Fish Market
FSAWF99	Herring	15.09.2023	Kilkeel Fish Market
FSAWF100	Herring	15.11.2023	Kilkeel Fish Market
FSAWF101	Herring	13.11.2023	Kilkeel Fish Market
FSAWF102	Herring	26.11.2023	Kilkeel Fish Market
FSAWF103	Herring	17.01.2024	Kilkeel Fish Market
FSAWF104	Herring	17.01.2024	Kilkeel Fish Market
FSAWF105	Herring	23.01.2024	Kilkeel Fish Market
FSAWF106	Herring	23.01.2024	Kilkeel Fish Market
FSAWF107	Herring	30.01.2024	Kilkeel Fish Market
FSAWF108	Herring	30.01.2024	Kilkeel Fish Market
FSAWF109	Herring	14.12.2023	Kilkeel Fish Market
FSAWF110	Herring	15.12.2023	Kilkeel Fish Market
FSAWF111	Herring	15.12.2023	Kilkeel Fish Market
FSAWF112	Haddock	09.11.2023	Kilkeel Fish Market
FSAWF113	Mackerel	16.02.2024	Kilkeel Fish Market
FSAWF114	Mackerel	21.02.2024	Kilkeel Fish Market

Sample number	Full Product Text Description	Landing date	Fish Market
FSAWF115	Mackerel	24.01.2024	Kilkeel Fish Market
FSAWF116	Mackerel	24.01.2024	Kilkeel Fish Market
FSAWF117	Mackerel	01.02.2024	Kilkeel Fish Market
FSAWF118	Mackerel	13.02.2024	Kilkeel Fish Market
FSAWF119	Mackerel	21.2.2024	Kilkeel Fish Market

Annex B: Tables

Table 1. Mercury, cadmium and lead concentrations in wild caught fishery products and crustaceans

Concentrations are not corrected for recovery.

Brown Crab

Sample number	Species	Mercury (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
FSAWF75	Brown Crab	0.049	0.17	< 0.02
FSAWF77	Brown Crab	0.16	0.092	< 0.02
FSAWF78	Brown Crab	0.14	0.28	< 0.02
FSAWF79	Brown Crab	0.16	0.15	< 0.02
FSAWF80	Brown Crab	0.046	0.030	< 0.02

Sample number	Species	Mercury (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
FSAWF83	Brown Crab	0.052	< 0.005	< 0.02
FSAWF84	Brown Crab	0.071	0.13	< 0.02
Maximum levels set out in Commission Regulation (EU) 2023/915		0.5	0.5	0.5

Dublin Bay Prawns

Sample number	Species	Mercury (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
FSAWF64	Dublin Bay Prawns	0.099	0.037	< 0.02
FSAWF65	Dublin Bay Prawns	0.057	0.009	0.03
FSAWF67	Dublin Bay Prawns	0.14	0.010	0.03
FSAWF68	Dublin Bay Prawns	0.065	0.007	0.03
FSAWF70	Dublin Bay Prawns	0.15	0.012	0.03
FSAWF73	Dublin Bay Prawns	0.27	0.008	0.02
FSAWF81	Dublin Bay Prawns	0.082	0.009	0.05
FSAWF82	Dublin Bay Prawns	0.15	0.011	0.06
Maximum levels set out in Commission Regulation (EU) 2023/915		0.5	0.5	0.5

Haddock

Sample number	Species	Mercury (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
FSAWF96	Haddock	0.098	< 0.005	< 0.02
Maximum levels set out in Commission Regulation (EU) 2023/915		0.5	0.05	0.3

Herring

Sample number	Species	Mercury (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
FSAWF87	Herring	0.034	< 0.005	< 0.02
FSAWF88	Herring	0.035	< 0.005	< 0.02
FSAWF89	Herring	0.042	< 0.005	< 0.02
FSAWF94	Herring	0.035	< 0.005	< 0.02
FSAWF97	Herring	0.046	< 0.005	< 0.02

Sample number	Species	Mercury (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
FSAWF99	Herring	0.060	< 0.005	< 0.02
FSAWF100	Herring	0.034	< 0.005	< 0.02
FSAWF101	Herring	0.054	< 0.005	< 0.02
FSAWF102	Herring	0.032	< 0.005	< 0.02
FSAWF103	Herring	0.031	< 0.005	< 0.02
FSAWF104	Herring	0.052	0.006	< 0.02
FSAWF105	Herring	0.045	0.010	0.02
FSAWF106	Herring	0.040	0.006	< 0.02
FSAWF107	Herring	0.039	< 0.005	0.03
FSAWF108	Herring	0.027	0.006	< 0.02
FSAWF110	Herring	0.062	0.007	< 0.02
FSAWF111	Herring	0.047	< 0.005	< 0.02
Maximum levels set out in Commission Regulation (EU) 2023/915		0.3	0.05	0.3

King scallop

Sample number	Species	Mercury (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
FSAWF61	King scallop	0.008	0.28	0.07
FSAWF62	King scallop	0.012	0.40	0.10
FSAWF86	King scallop	0.009	0.24	0.16
FSAWF92	King scallop	0.010	0.33	0.09
Maximum levels set out in Commission Regulation (EU) 2023/915		0.5	1.0	1.5

Mackerel

Sample number	Species	Mercury (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
FSAWF90	Mackerel	0.035	< 0.005	< 0.02
FSAWF91	Mackerel	0.037	< 0.005	< 0.02
FSAWF98	Mackerel	0.030	< 0.005	< 0.02
FSAWF115	Mackerel	0.029	0.007	<

Sample number	Species	Mercury (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)
				0.02
FSAWF116	Mackerel	0.043	0.013	< 0.02
FSAWF117	Mackerel	0.040	0.009	0.03
FSAWF118	Mackerel	0.040	0.014	< 0.02
Maximum levels set out in Commission Regulation (EU) 2023/915		0.3	0.1	0.3

Table 2. Dioxin/PCB WHO-TEQ 2005 and Sum ICES6 Marker PCB results for wild caught fishery products and crustaceans samples corrected for recovery.

Brown crab

Sample number	Species	PCDD/F WHO-TEQ upper, ng/kg whole	PCB WHO-TEQ upper, ng/kg whole	PCDD/F + PCB WHO-TEQ upper, ng/kg whole	SUM of ICES 6 upper, µg/kg whole
FSAWF71	Brown Crab	0.145	0.0285	0.174	0.322
FSAWF85	Brown Crab	0.147	0.0461	0.193	0.230
Maximum levels set out in Commission Regulation (EU) 2023/915		3.5		6.5	75

Dublin Bay Prawns

Sample number	Species	PCDD/F WHO-TEQ upper, ng/kg whole	PCB WHO-TEQ upper, ng/kg whole	PCDD/F + PCB WHO-TEQ upper, ng/kg whole	SUM of ICES 6 upper, µg/kg whole
FSAWF66	Dublin Bay Prawns	0.117	0.0580	0.175	0.305
FSAWF69	Dublin Bay Prawns	0.147	0.0776	0.225	0.568
FSAWF72	Dublin Bay Prawns	0.0792	0.0279	0.107	0.154
Maximum levels set out in Commission Regulation (EU) 2023/915		3.5		6.5	75

Haddock

Sample number	Species	PCDD/F WHO-TEQ upper, ng/kg whole	PCB WHO-TEQ upper, ng/kg whole	PCDD/F + PCB WHO-TEQ upper, ng/kg whole	SUM of ICES 6 upper, µg/kg whole
FSAWF112	Haddock	0.0207	0.0105	0.0312	0.0641
Maximum levels set out in Commission Regulation (EU) 2023/915		3.5		6.5	75

Herring

Sample number	Species	PCDD/F WHO-TEQ upper, ng/kg whole	PCB WHO-TEQ upper, ng/kg whole	PCDD/F + PCB WHO-TEQ upper, ng/kg whole	SUM of ICES 6 upper, µg/kg whole
FSAWF76	Herring	0.299	0.181	0.480	4.59
FSAWF93	Herring	0.472	0.674	1.15	9.87
FSAWF109	Herring	0.113	0.117	0.230	2.31
Maximum levels set out in Commission Regulation (EU) 2023/915		3.5		6.5	75

King scallop

Sample number	Species	PCDD/F WHO-TEQ upper, ng/kg whole	PCB WHO-TEQ upper, ng/kg whole	PCDD/F + PCB WHO-TEQ upper, ng/kg whole	SUM of ICES 6 upper, µg/kg whole
FSAWF63	King scallop	0.0600	0.0291	0.0891	0.449
Maximum levels set out in Commission Regulation (EU) 2023/915		3.5		6.5	75

Mackerel

Sample number	Species	PCDD/F WHO-TEQ upper, ng/kg whole	PCB WHO-TEQ upper, ng/kg whole	PCDD/F + PCB WHO-TEQ upper, ng/kg whole	SUM of ICES 6 upper, µg/kg whole
FSAWF74	Mackerel	0.202	0.168	0.370	3.97
FSAWF95	Mackerel	0.607	0.776	1.38	8.85
FSAWF113	Mackerel	0.102	0.238	0.340	3.72
FSAWF114	Mackerel	0.130	0.357	0.488	4.07
FSAWF119	Mackerel	0.167	0.421	0.588	3.81
Maximum levels set out in Commission Regulation (EU) 2023/915		3.5		6.5	75