

Provision of Statutory Shellfish Monitoring Services for Scotland- Chemical Contaminant Analysis of Shellfish from Classified Harvesting Areas (2022)

Report to Food Standards Scotland



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Chemical Contaminant Analysis of Shellfish from Classified Harvesting Areas (2022)

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Contents

Glossary of Main Terms	4
Executive Summary	5
1. Background to Study	6
2. Methods	8
2.1 Sample Collection and Preparation	8
2.2 Contaminants measured – Specific Analytes.....	8
2.3 PCDD/F and PCB - Analytical Methodology	9
2.4 Polycyclic Aromatic Hydrocarbons (PAH) - Analytical Methodology.....	10
2.5 Trace Elements - Analytical Methodology	10
2.6 Fat analysis.....	11
3. Results	11
4. References	13
Table 1: Overview of all Samples*	16
Table 2: Samples: Chemical contaminant testing	18
Table 3a: PCDD/Fs and PCB - TEQ and ICES6 summary, Whole weight	20
Table 3b: PCDD/Fs and PCB - TEQ and ICES6 summary, Fat weight	21
Table 4a: PCDD/F & PCB concentrations, Whole weight	23
Table 4b: PCDD/F & PCB concentrations, Fat weight	28
Table 5: PAH concentrations (µg/kg Whole weight)	33
Table 6: Trace Element concentrations (mg/kg whole weight)	39

Glossary of Main Terms

Term or Acronym	General Meaning of Term
µg/kg	Microgram per kilogram (part per billion)
FAPAS	Food Analysis Proficiency Assurance Scheme
fat weight	Values based on the assessed fat content of the sample
FSA	Food Standards Agency
FSS	Food Standards Scotland
GC-HRMS	Gas chromatography - high resolution mass spectrometry
GC-MS	Gas chromatography –unit resolution mass spectrometry
Heavy Metals	A loosely defined subset of naturally occurring metallic elements that have a high atomic weight and a density of 5g/mL or more.
ICP-MS	Inductively coupled plasma-mass spectrometry
LIMS	Laboratory Information Management System
LOD	Limit of Detection
LOQ	Limit of Quantification
Lower bound (lb)	Assumes values at less than the limit of detection are zero (e.g.<0.07 = 0)
mg/kg	Milligram per kilogram (part per million)
ng/kg	Nanogram per kilogram (part per trillion)
<i>Non-ortho</i> -PCB	Non-ortho-substituted PCB (co-planar)
<i>Ortho</i> -PCB	Ortho-substituted PCB (non planar)
PAH 4	Sum of 4 PAHs (benzo[a]pyrene, benzo[a]anthracene, benzo[b]fluoranthene, chrysene)
PAHs	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyl
PCDD/F	Polychlorinated dibenzo- <i>p</i> -dioxin/ polychlorinated dibenzofuran (dioxins)
Sum of ICES 6	Sum of PCB28, PCB52, PCB101, PCB138, PCB153 and PCB180
TEF	Toxic Equivalency Factor – toxicity expressed for each dioxin-like compound relative to 2,3,7,8-TCDD (TEF = 1).
TEQ	Toxic Equivalence – product of the congener concentration and the TEF
Total TEQ	Total of the Sum of all the Toxic Equivalences (TEQs) for each group of compounds
Trace Element	An element in a sample that has an average concentration of less than 100 parts per million (< 100 mg/kg)
Upper bound (ub)	assumes values at less than the limit of detection is equal to the limit of detection (e.g. <0.07 = 0.07)
whole weight	Values based on the sample as received
WHO	World Health Organisation
WHO-TEQ 2005	World Health Organisation TEQ based on TEF values as set in 2005

Executive Summary

This study on chemical contaminants in shellfish from Scottish classified shellfish production areas fulfils the requirements of UK legislation to adopt appropriate monitoring measures and carry out compliance checks on shellfish produced for human consumption. Marine shellfish bio-accumulate environmental contaminants because of their inability to metabolise them to easily excreted compounds. The study determines concentrations of regulated environmental contaminants in the flesh of edible species with a view to determine current levels of occurrence and to allow estimation of consumer exposure.

The study analysed 27 samples of shellfish including common mussels, Pacific oysters, common cockles and razor clams for polycyclic aromatic hydrocarbons (PAHs), trace elements, polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs). The methodologies used for the analyses were UKAS accredited to the ISO 17025 standard and follow retained European regulations for data quality criteria.

All measured analytes were below their maximum regulatory levels in the test samples. Contaminant profiles from the 2022 study are similar to the previous year's data however the concentration ranges for the analytes were lower for trace elements and PAHs.

1. Background to Study

Marine shellfish are an excellent source of protein, are high in essential minerals and low in fat. In many parts of the UK and in Scotland in particular, the shellfish industry makes a significant contribution to the local economy. Shellfish have a recognised potential for bio-accumulating contaminants and some bivalve species such as mussels, are commonly used as early indicators of local pollution. Bivalves feed by filtering plankton from the surrounding water. This feeding mechanism leads to the bio-accumulation of pollutants of biogenic and anthropogenic origin such as polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) collectively referred to as dioxins, polychlorinated biphenyls (PCBs), trace elements and polycyclic aromatic hydrocarbons (PAHs) from the surrounding waters. The bio-accumulation potential of the shellfish species used for food is particularly relevant in the case of environmental contaminants with long half-lives such as PCDD/Fs and PCBs. These contaminants have been the subject of several studies (Garraud et al 2007, Lee et al 2007, Fernandes et al 2009, Fernandes et al 2012) relating to the occurrence and bio-accumulation in marine species and the resulting potential for human exposure arising from the consumption of the edible species.

Due to potential food safety concerns, the European Union has defined limits for the control of these contaminants in a range of foods including shellfish. (Commission Regulation (EC) No 1881/2006, as amended). The European Union (Withdrawal) Act as amended (HMSO 2018) converted directly applicable European legislation as it stood at the end of the transition period (11pm on 31 December 2020) into UK law.

PCDD/Fs and PCBs are recognised environmental and food contaminants that are known to bio-accumulate in fish and shellfish. The extent of this accumulation is evident by the levels of these contaminants detected in various studies. In the UK, Total Diet Studies (TDS) (e.g. FSA 2003, FSA 2012 -FD 12/04) carried out over the last two decades; fish (including shellfish) has consistently been one of the highest PCDD/F and PCB containing food groups. Human dietary exposure can therefore be significantly influenced by the fish and shellfish component of the diet, particularly in high level consumers and low body-weight individuals. Although metabolised in many fish species, PAHs persist in shellfish as filter feeding species appear unable to affect bio-transformation of these contaminants. Other than this bio-accumulation pathway, PAHs can also arise in fish and shellfish through some food preparation and processing methods – e.g. smoked fish are known to contain elevated levels

of PAHs. Some PAH compounds have been shown to be genotoxic and carcinogenic, the most studied of which benzo[a]pyrene (BaP) is regulated in a range of foods including shellfish (SCF Opinion 2002, Commission Regulation (EC) No. 208/2005). However, more recent evaluation by the European Food Safety Authority (EFSA) CONTAM panel, concluded that a set of 4 compounds; benzo[a]pyrene, chrysene, benzo[a]anthracene and benzo[b]fluoranthene (collectively referred to as PAH4) were more suitable indicators of PAH toxicity in food (EFSA, 2008). These four compounds were subsequently included in the updated Commission Regulation (EC) No. 835/2011.

Some trace elements e.g. cadmium, mercury and lead, are established toxic contaminants. Others, such as copper, chromium, selenium and zinc are essential to health but may be toxic at high levels of exposure. These elements may enter marine and aquatic environments and bio-accumulate in some species. Some potentially toxic elements occur naturally as part of the local geology, but others may also be found in the location of certain industries, as a result of unauthorised discharge, or as a result of other anthropogenic activity.

As part of its monitoring requirements in support of UK regulations, Food Standards Scotland (FSS) has overseen the collection of shellfish, from classified shellfish production areas within relevant local authority areas. Shellfish from classified production areas are monitored, with the edible tissues analysed for the contaminants described above. Sampling officers from Scotland were required to obtain suitable shellfish samples from designated sampling points within classified shellfish production areas, as defined by the FSS. The collection of shellfish and transport logistics were co-ordinated by Cefas. Samples were taken and live shellfish sent to Fera Science Limited (Fera), with the edible tissues analysed for the contaminants described above at Fera in York.

Fera has generated environmental contaminant data on shellfish collected from new and existing shellfish production areas in Scotland since 2007. This report collates the results of the individual analyses for dioxins, PAHs and trace elements in samples of shellfish collected from classified Scottish production areas in the last quarter of 2021 and first quarter of 2022.

2. Methods

2.1 Sample Collection and Preparation

Twenty-seven samples of shellfish, including species of, common mussels (16 samples) Pacific oysters (6), razor clams (3) and common cockles (2) were collected from November 2021 until March 2022. The sampling period was timed to coincide with the period of optimal contaminant concentrations in the shellfish which relates to the period before annual spawning. Details on the locations, with descriptions of the samples and identification are given in Table 1.

On receipt at the laboratory each sample was given a unique laboratory reference number and the sample details were logged into a Nautilus LIMS database. The samples were stored frozen prior to analysis. Sample preparation consisted of shelling followed by thorough homogenisation. Aliquots were then taken for PAH, trace element and dioxin analysis as appropriate. Dioxin sample aliquots underwent additional freeze-drying and were re-homogenised prior to analysis. Table 2 contains information on which analyses were performed on each sample.

2.2 Contaminants measured – Specific Analytes

The following analytes were determined: Regulated contaminants are highlighted in **bold**, and summarised regulation limits are listed below:

Analytes	Maximum regulatory levels (MRL) relevant for live bivalve molluscs (whole weight)
Lead	1.5 mg/kg
Cadmium	1.0 mg/kg
Mercury	0.50 mg/kg
Dioxins and PCBs	Sum of dioxins (WHO PCDD/F-TEQ): 3.5 pg/g Sum of dioxins and dioxin-like PCBs (WHO PCDD/F-PCB-TEQ): 6.5 pg/g Sum of PCB28, PCB52, PCB101, PCB138, PCB153 and PCB180 (ICES 6 Indicator PCBs): 75 ng/g
PAHs	Benzo[a]pyrene: 5.0 µg/kg Sum of Benzo[a]pyrene, Benzo[a]anthracene, Benzo[b]fluoranthene and Chrysene): 30 µg/kg

Dioxins - **all 17, 2378-Cl substituted PCDDs and PCDFs.**

Dioxin-like PCBs - **IUPAC no. 77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169 and 189.**

Non dioxin-like PCBs - IUPAC numbers 18, **28**, 31, 47, 49, 51, **52**, 99, **101**, 128, **138**, **153** and **180**.

PAHs - acenaphthene, acenaphthylene, fluorene, phenanthrene, anthracene, fluoranthene, benzo[c]fluorene, pyrene, benzo[e]pyrene, benzo[b]naphtho[2,1-d]thiophene, anthanthrene, coronene, benzo[ghi]fluoranthene, **benzo[a]anthracene**, **chrysene**, **benzo[b]fluoranthene**, benzo[j]fluoranthene, benzo[k]fluoranthene, **benzo[a]pyrene**, cyclopenta[cd]pyrene, indeno[1,2,3-cd]pyrene, dibenzo[a,h]anthracene, benzo[ghi]perylene, dibenzo[a,l]pyrene, dibenzo[a,e]pyrene, dibenzo[a,i]pyrene, dibenzo[a,h]pyrene and the alkylated PAH, 5-methylchrysene.

Trace elements – Chromium (Cr), Manganese (Mn), Cobalt (Co), Nickel (Ni), Copper (Cu), Zinc (Zn), Arsenic (As), Selenium (Se), Silver (Ag), **Cadmium (Cd), Mercury (Hg), Lead (Pb)**

2.3 PCDD/F and PCB - Analytical Methodology

(Fera SOPs FSG 401-414)

The method used for the preparation, extraction and analysis of samples has been reported previously (Fernandes et al 2004) and is part of the CEN EN16215:2012 standard. In brief, samples were fortified with ¹³C-labelled analogues of target compounds and exhaustively extracted using mixed organic solvents. Ortho substituted PCBs were separated from non-ortho substituted PCBs and PCDD/Fs by fractionation on activated carbon. The two fractions were further purified using adsorption chromatography on alumina. Analytical measurement was carried out using GC-HRMS for the seventeen, 2,3,7,8-Cl substituted PCDD/F congeners and non-ortho substituted PCBs. GC-MS was used for the measurement of the ortho substituted PCBs.

All analyses were UKAS accredited to ISO 17025 standards, with the inclusion of reference material (in-house reference material, LIMS No. S11-018695 crude cod liver oil) and method blanks which were evaluated prior to reporting. Further quality assurance measures included the successful participation in international inter-comparison exercises such as the Norwegian Institute of Public Health's "Dioxins in Food" on an annual basis. Quality control evaluation for the accompanying data follows the criteria specified for chlorinated dioxins and PCBs (retained Commission Regulation No 589/2014). In addition, as the National Reference Laboratory (NRL) for dioxins and halogenated contaminants, Fera participates in Chemical Contaminant Analysis of Shellfish from Classified Harvesting Areas in Scotland (2022) Report to Food Standards Scotland

proficiency testing (PT) exercises and other inter-laboratory exercises organised by the European Union Reference Laboratory (EU-RL) and achieves consistently good results.

2.4 Polycyclic Aromatic Hydrocarbons (PAH) - Analytical Methodology

(Fera SOP FSG 410)

The analytical methodology for the PAHs has been reported before [21] and is based on internal standardisation with GC-MS measurement. An aliquot of the homogenised sample was fortified with ¹³C-labelled analogues of target compounds and saponified with methanolic potassium hydroxide. The extracted PAH solutions were purified in two stages with a dimethylformamide/cyclohexane partition followed by adsorption chromatography on activated silica. Purified extracts were sensitivity standardised and measured using GC-MS. The analytical procedure for PAHs is UKAS accredited to the ISO 17025 standard and includes the assessment of method blanks and reference materials, (e.g. T0658, PAHs in cocoa butter) for compliance with the accreditation criteria. The methodology also meets the criteria required for evaluating data against the maximum permitted limits for benzo[a]pyrene as specified in retained Commission Regulations. Fera regularly participates in FAPAS PT exercises for PAHs in food and achieves consistently good results.

2.5 Trace Elements - Analytical Methodology

(Fera SOP FSG 461 and 457)

Aliquots of the homogenised sample were weighed into allotted digestion vessels and a mixture (4:1) of nitric acid and hydrochloric acid added. The vessels were capped and the contents digested using a high-pressure microwave digestion system. Reagent blanks, certified reference materials and a spiked sample were also taken through the procedure. The resulting solutions were transferred to pre-marked acid-clean plastic test tubes and diluted to 10 ml with deionised water. The digest solutions together with a set of standards covering the expected concentration range, were internally standardised with indium and rhodium in dilute nitric acid (1 %v/v). Measurements were made using an Agilent 7700x ICP-MS with collision cell.

In common with the other two sets of analyses, the analytical procedure is accredited to the ISO 17025 standard. The criteria used to assess data included checks on instrument drift, spike recovery, replicate agreement, limits of detection and certified reference material (e.g. CE 278K mussel tissue) values. Regular, successful participation in FAPAS inter-comparison exercises provides further confidence in the data. In addition, as NRL for trace

elements, Fera participates in PT exercises and other inter-laboratory exercises organised by the EU-RL and achieves consistently good results.

2.6 Fat analysis

For samples requiring dioxin and PCB analysis, total fat was determined by the Werner-Schmidt method under UKAS accreditation, by Microsearch Laboratories Ltd.

3. Results

Analyte concentrations are presented in Tables 3 to 6. Concentration units reflect current convention as required by regulation, and data were rounded to two decimal places or as appropriate. The reporting limits (quoted as “<”) for dioxins, PCBs and PAHs are estimated as a dynamic parameter and therefore represent the limits of determination that prevail during the measurement. For PCDD/Fs, PCBs, metals and PAHs, the reporting limits are consistent with the requirements of UK regulations. Data on the reference materials that were analysed concurrently with the samples, were within established acceptable limits, and are available if required. Measurement uncertainty (MU) was calculated and applied to data following guidelines and principals set out in Measurement Uncertainty For Persistent Organic Pollutants By Isotope-Dilution Mass Spectrometry (Epp, et al 2014). MU and reference material data can be made available if required.

In addition to the concentration of individual congeners, the dioxin-like toxicity of the samples arising from PCDD/Fs and dioxin-like PCBs has also been reported as a toxic equivalent (WHO-TEQ), which is calculated by multiplying the concentration of each congener of interest by its toxicity equivalency factor (WHO-TEF). The TEQs are presented in terms of the 2005 TEFs (van den Berg et al 2006). Additionally, the sum of the ICES-6 Marker PCBs is also provided. The regulations for shellfish are based on whole weight concentrations; however, in keeping with previous reports to Food Standards Scotland, the results for PCDD/Fs and PCBs have also been reported on a fat weight basis.

In general, the patterns of the three contaminant classes were consistent with those recorded last year, while the levels of dioxins, PCBs and PAHs were slightly lower.

Twenty samples were tested for PCDD/Fs and PCBs. All samples contained PCDD/Fs and PCBs above the LOQ. Levels found were well within the regulatory limits. The range for total

TEQ (PCDD/F + PCB) on a whole weight, upper bound basis (ub) was 0.05 ng TEQ/kg to 0.16 ng TEQ/kg.

The concentration of ICES-6 PCBs on a whole weight basis (ub) ranged from 0.08 µg/kg to 0.84 µg/kg. PCB 138 and PCB153 were found above LOQ in all samples. Tables 3a and 3b summarise TEQ and ICES6 data, while Tables 4a and 4b presents results for analyte concentrations on a whole and fat weight basis respectively. The highest TEQ and ICES6 concentrations were measured in common mussels from Stream Sound: Ux Ness (S22-010851). The major contributor to the PCB WHO-TEQ was PCB126, which accounted for 90% of the total. In general, higher levels of PCDD/Fs and PCBs were observed in razor clams compared to other species tested.

PAHs were detected in all 26 samples analysed. All samples showed levels below MRL for BaP (5 µg/kg) and PAH4 (30 µg/kg). BaP concentrations ranged from <0.12 µg/kg to 0.98 µg/kg and the sum of PAH4 concentrations (ub) ranged from 0.25 µg/kg to 5.11 µg/kg. This range is much lower than for last year's study, where the range for the sum of PAH4 was 0.10 to 15 µg/kg. The samples with the highest PAH4 were razor clams from North Berwick (S22-057844) at 5.09 µg/kg and Pacific Oysters from Loch Creran: Rubha Mor (S22-010536) at 5.11 µg/kg which also contained BbF at 2.84 µg/kg, the highest level for a regulated PAH in this year's study. In general, PAH4 concentrations were higher in razor clams than other species tested. The results from PAH analysis are given in Table 5.

Twenty-five samples were analysed for heavy metals, results of which are detailed in Table 6. Concentrations of the regulated heavy metals (Cd, Hg, Pb) were all below the regulatory limit. The concentration ranges for Cd, Hg and Pb were 0.02 mg/kg to 0.169 mg/kg, <0.007 mg/kg to 0.014 mg/kg and 0.041 mg/kg to 0.154 mg/kg respectively. The highest concentration of Pb was found in a sample of common mussels (0.154 mg/kg, S22-011559 Baltasound Mussels) The highest concentration of Cd was found in a sample of Pacific Oysters (0.169 mg/kg, S22-010536, Loch Creran: Rubha Mor), which also contained the highest levels of Zn and As. The 3 most abundant heavy metals were zinc, manganese and copper, with zinc present at the highest concentration.

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Table 1: Overview of all Samples*

Local Authority	Production Area	Site Name	Site Identification Number	Grid Reference	Species	Date Sample Taken	Date Received at Fera	FERA LIMS No.
Argyll and Bute	Loch Creran: Rubha Mor	Rubha Mor	AB-130-022-13	NM 91717 40655	Pacific Oysters	31/01/2022	01/02/2022	S22-010536
Argyll and Bute	Loch Fyne: Otter Ferry	Ballimore	AB-151-039-13	NR 92173 83504	Pacific Oysters	07/02/2022	08/02/2022	S22-011292
Argyll and Bute	Loch Gair	Loch Gair Common Cockles	AB-863-2347-04	NR 92640 90950	Common Cockles	14/02/2022	16/02/2022	S22-012042
Argyll and Bute	Loch Spelve: North	Adura	AB-200-1915-08	NM 6995 2992	Common Mussels	08/03/2022	09/03/2022	S22-014954
Argyll and Bute	Porte Na Coite	Porte na Coite	AB-876-2389-13	NM 50964 55568	Pacific Oysters	01/03/2022	02/03/2022	S22-014270
Argyll and Bute	Seil Point	Poll A Bhrochain	AB-245-070-13	NM 77094 19383	Pacific Oysters	01/02/2022	02/02/2022	S22-010668
Comhairle nan Eilean Siar: Lewis & Harris	Loch Leurbost	Loch Leurbost	LH-168-114-08	NB 3725 2492	Common Mussels	14/02/2022	15/02/2022	S22-011822
Comhairle nan Eilean Siar: Lewis & Harris	Loch Roag: Eilean Chearstaigh	Eilean Scarastaigh	LH-344-697-08	NB 1911 3316	Common Mussels	15/02/2022	16/02/2022	S22-012035
Comhairle nan Eilean Siar: Lewis & Harris	Loch Seaforth	Loch Seaforth	LH-193-126-08	NB 2104 1230	Common Mussels	15/02/2022	16/02/2022	S22-012036
East Lothian	North Berwick	North Berwick Razors	EL-736-1707-16	NT 5010 8661	Razors	12/12/2021	15/12/2021	S21-057844
Highland: Lochaber	Arisaig	Sgeirean Buidhe	HL-004-202-13	NM 6387 8535	Pacific Oysters	02/02/2022	03/02/2022	S22-010722
Highland: Lochaber	Loch Eil	Garvan	HL-134-217-08	NM 9908 7803	Common Mussels	08/02/2022	09/02/2022	S22-011442
Highland: Skye & Lochalsh	Loch Harport: Inner	Carbost Cockles	SL-890-2350-04	NG 3944 3174	Common Cockles	01/02/2022	02/02/2022	S22-010662
Highland: Sutherland	Loch Inchard	Loch Inchard Site 1 D. Ross	HS-162-311-08	NC 2482 5355	Common Mussels	07/02/2022	09/02/2022	S22-011456
Highland: Sutherland	Loch Laxford	Weavers Bay	HS-167-320-08	NC 2134 4858	Common Mussels	07/02/2022	09/02/2022	S22-011443
Orkney Islands	Bay of Skail: Westray	Bay of Skail: Westray	OI-871-2380-13	HY 4558 5078	Pacific Oysters	07/03/2022	09/03/2022	S22-014953

Chemical Contaminant Analysis of Shellfish from Classified Harvesting Areas in Scotland (2022)
Report to Food Standards Scotland

Local Authority	Production Area	Site Name	Site Identification Number	Grid Reference	Species	Date Sample Taken	Date Received at Fera	FERA LIMS No.
Shetland Islands	Aith Voe Sletta	Point of Sletta	SI-326-393-08	HU 3420 5880	Common Mussels	16/02/2022	18/02/2022	S22-012388
Shetland Islands	Baltasound Mussels	Buness	SI-010-1128-08	HP 6320 0876	Common Mussels	07/02/2022	10/02/2022	S22-011559
Shetland Islands	Basta Voe Outer	Outer	SI-323-403-08	HU 5293 9569	Common Mussels	08/02/2022	10/02/2022	S22-011560
Shetland Islands	Busta Voe Lee North	Busta Voe	SI-327-409-08	HU 3470 6630	Common Mussels	16/02/2022	18/02/2022	S22-012387
Shetland Islands	Clift Sound: Whal Wick	Kallee Ness	SI-038-2007-08	HU 3938 3532	Common Mussels	02/02/2022	04/02/2022	S22-010855
Shetland Islands	Dales Voe: Scarvar Ayre	South Side	SI-050-686-08	HU 4318 7037	Common Mussels	08/02/2022	10/02/2022	S22-011558
Shetland Islands	Point of Hamna Ayre	Point of Hamna Ayre	SI-374-763-08	HU 3341 6141	Common Mussels	16/02/2022	18/02/2022	S22-012385
Shetland Islands	Stream Sound: Ux Ness	Whalsies Ayre	SI-373-945-08	HU 3849 3490	Common Mussels	02/02/2022	04/02/2022	S22-010851
Shetland Islands	Vementry North	Treawick	SI-322-465-08	HU 2890 5940	Common Mussels	16/02/2022	18/02/2022	S22-012386
South Ayrshire	Ayr Bay	Ayr Bay Razors	SA-841-2263-16	NS 31846 19388	Razors	23/11/2021	25/11/2021	S21-056763
South Ayrshire	Heads of Ayr	Heads of Ayr razors	SA-866-2362-16	NS 27009 18217	Razors	23/11/2021	25/11/2021	S21-056762

**Quality statement: Information relating to the origin of the samples (place, date of collection and GR/NGR details) is as provided by sampling staff and has not undergone verification checks by Fera or Cefas*

Table 2: Samples: Chemical contaminant testing

Local Authority	Production Area	Sample Site Name	Site Identification Number	Species	PAHs	Trace Elements	DXN/PCBs	FERA LIMS No.
Argyll and Bute	Loch Creran: Rubha Mor	Rubha Mor	AB-130-022-13	Pacific Oysters	X	X	X	S22-010536
Argyll and Bute	Loch Fyne: Otter Ferry	Ballimore	AB-151-039-13	Pacific Oysters	X	---	---	S22-011292
Argyll and Bute	Loch Gair	Loch Gair Common Cockles	AB-863-2347-04	Common Cockles	X	X	X	S22-012042
Argyll and Bute	Loch Spelve: North	A dura	AB-200-1915-08	Common Mussels	X	X	X	S22-014954
Argyll and Bute	Porte Na Coite	Porte na Coite	AB-876-2389-13	Pacific Oysters	X	X	X	S22-014270
Argyll and Bute	Seil Point	Poll A Bhrochain	AB-245-070-13	Pacific Oysters	X	X	X	S22-010668
Comhairle nan Eilean Siar: Lewis & Harris	Loch Leurbost	Loch Leurbost	LH-168-114-08	Common Mussels	X	X	---	S22-011822
Comhairle nan Eilean Siar: Lewis & Harris	Loch Roag: Eilean Chearstaigh	Eilean Scarastaigh	LH-344-697-08	Common Mussels	X	X	X	S22-012035
Comhairle nan Eilean Siar: Lewis & Harris	Loch Seaforth	Loch Seaforth	LH-193-126-08	Common Mussels	X	X	X	S22-012036
East Lothian	North Berwick	North Berwick Razors	EL-736-1707-16	Razors	X	X	X	S21-057844
Highland: Lochaber	Arisaig	Sgeirean Buidhe	HL-004-202-13	Pacific Oysters	X	X	X	S22-010722
Highland: Lochaber	Loch Eil	Garvan	HL-134-217-08	Common Mussels	X	X	---	S22-011442
Highland: Skye & Lochalsh	Loch Harport: Inner	Carbost Cockles	SL-890-2350-04	Common Cockles	---	X	---	S22-010662
Highland: Sutherland	Loch Inchard	Loch Inchard Site 1 D. Ross	HS-162-311-08	Common Mussels	X	---	---	S22-011456
Highland: Sutherland	Loch Laxford	Weavers Bay	HS-167-320-08	Common Mussels	X	X	---	S22-011443
Orkney Islands	Bay of Skail: Westray	Bay of Skail: Westray	OI-871-2380-13	Pacific Oysters	X	X	X	S22-014953

Local Authority	Production Area	Sample Site Name	Site Identification Number	Species	PAHs	Trace Elements	DXN/PCBs	FERA LIMS No.
Shetland Islands	Aith Voe Sletta	Point of Sletta	SI-326-393-08	Common Mussels	X	X	---	S22-012388
Shetland Islands	Baltasound Mussels	Buness	SI-010-1128-08	Common Mussels	X	X	X	S22-011559
Shetland Islands	Basta Voe Outer	Outer	SI-323-403-08	Common Mussels	X	X	X	S22-011560
Shetland Islands	Busta Voe Lee North	Busta Voe	SI-327-409-08	Common Mussels	X	X	X	S22-012387
Shetland Islands	Clift Sound: Whal Wick	Kallee Ness	SI-038-2007-08	Common Mussels	X	X	X	S22-010855
Shetland Islands	Dales Voe: Scarvar Ayre	Southside	SI-050-686-08	Common Mussels	X	X	X	S22-011558
Shetland Islands	Point of Hamna Ayre	Point of Hamna Ayre	SI-374-763-08	Common Mussels	X	X	X	S22-012385
Shetland Islands	Stream Sound: Ux Ness	Whalsies Ayre	SI-373-945-08	Common Mussels	X	X	X	S22-010851
Shetland Islands	Vementry North	Treawick	SI-322-465-08	Common Mussels	X	X	X	S22-012386
South Ayrshire	Ayr Bay	Ayr Bay Razors	SA-841-2263-16	Razors	X	X	X	S21-056763
South Ayrshire	Heads of Ayr	Heads of Ayr razors	SA-866-2362-16	Razors	X	X	X	S21-056762

Table 3a: PCDD/Fs and PCB - TEQ and ICES6 summary, Whole weight

Fera LIMS No.	Species	Production Area	Site Name	PCDD/F ng/kg TEQ lb	PCDD/F ng/kg TEQ ub	PCB ng/kg TEQ lb	PCB ng/kg TEQ ub	Total (PCDD/F+ PCB) ng/kg TEQ lb	Total (PCDD/F+ PCB) TEQ ng/kg ub	ICES6 µg/kg lb	ICES6 µg/kg ub
S22-010536	Pacific Oysters	Loch Creran: Rubha Mor	Rubha Mor	0.11	0.11	0.05	0.05	0.16	0.16	0.23	0.26
S22-012042	Common Cockles	Loch Gair	Loch Gair Common Cockles	0.01	0.04	0.02	0.02	0.03	0.06	0.12	0.14
S22-014954	Common Mussels	Loch Spelve: North	Adura	0.04	0.06	0.02	0.02	0.06	0.08	0.12	0.15
S22-014270	Pacific Oysters	Porte Na Coite	Porte na Coite	0.05	0.07	0.03	0.03	0.08	0.1	0.14	0.17
S22-010668	Pacific Oysters	Seil Point	Poll A Bhrochain	0.1	0.1	0.05	0.05	0.15	0.15	0.21	0.24
S22-012035	Common Mussels	Loch Roag: Eilean Chearstaigh	Eilean Scarastaigh	0.01	0.04	0.02	0.02	0.03	0.06	0.08	0.11
S22-012036	Common Mussels	Loch Seaforth	Loch Seaforth	0.03	0.05	0.03	0.03	0.06	0.08	0.13	0.16
S21-057844	Razors	North Berwick	North Berwick Razors	0.07	0.07	0.06	0.06	0.13	0.13	0.51	0.52
S22-010722	Pacific Oysters	Arisaig	Sgeirean Buidhe	0.05	0.06	0.03	0.03	0.08	0.09	0.13	0.16
S22-014953	Pacific Oysters	Bay of Skail: Westray	Bay of Skail: Westray	0.01	0.04	0.01	0.01	0.02	0.05	0.04	0.08
S22-011559	Common Mussels	Baltasound Mussels	Buness	0.01	0.04	0.03	0.03	0.04	0.07	0.18	0.2
S22-011560	Common Mussels	Basta Voe Outer	Outer	0.01	0.04	0.02	0.02	0.03	0.06	0.1	0.13
S22-012387	Common Mussels	Busta Voe Lee North	Busta Voe	0.03	0.05	0.03	0.03	0.06	0.08	0.11	0.14
S22-010855	Common Mussels	Clift Sound: Whal Wick	Kallee Ness	0.03	0.05	0.11	0.11	0.14	0.16	0.74	0.76
S22-011558	Common Mussels	Dales Voe: Scarvar Ayre	Southside	0.06	0.07	0.03	0.03	0.09	0.1	0.17	0.2
S22-012385	Common Mussels	Point of Hamna Ayre	Point of Hamna Ayre	0.01	0.04	0.02	0.02	0.03	0.06	0.08	0.11
S22-010851	Common Mussels	Stream Sound: Ux Ness	Whalsies Ayre	0.03	0.05	0.11	0.11	0.14	0.16	0.82	0.84

Chemical Contaminant Analysis of Shellfish from Classified Harvesting Areas in Scotland (2022)
Report to Food Standards Scotland

Fera LIMS No.	Species	Production Area	Site Name	PCDD/F ng/kg TEQ lb	PCDD/F ng/kg TEQ ub	PCB ng/kg TEQ lb	PCB ng/kg TEQ ub	Total (PCDD/F+ PCB) ng/kg TEQ lb	Total (PCDD/F+ PCB) TEQ ng/kg ub	ICES6 µg/kg lb	ICES6 µg/kg ub
S22-012386	Common Mussels	Vementry North	Treawick	0.01	0.04	0.02	0.02	0.03	0.06	0.08	0.11
S21-056763	Razors	Ayr Bay	Ayr Bay Razors	0.02	0.04	0.04	0.04	0.06	0.08	0.46	0.47
S21-056762	Razors	Heads of Ayr	Heads of Ayr razors	0.02	0.04	0.04	0.04	0.06	0.08	0.46	0.47

Table 3b: PCDD/Fs and PCB - TEQ and ICES6 summary, Fat weight

Fera LIMS No.	Species	Production Area	Site Name	Fat as % of whole	PCDD/F ng/kg TEQ lb	PCDD/F ng/kg TEQ ub	PCB ng/kg TEQ lb	PCB ng/kg TEQ ub	Total (PCDD/F+ PCB) ng/kg TEQ lb	Total (PCDD/F+ PCB) TEQ ng/kg ub	ICES6 µg/kg lb	ICES6 µg/kg ub
S22-010536	Pacific Oysters	Loch Creran: Rubha Mor	Rubha Mor	0.84	12.57	12.61	6.1	6.16	18.67	18.77	30.92	30.92
S22-012042	Common Cockles	Loch Gair	Loch Gair Common Cockles	0.59	2.4	4.29	2.95	3.09	5.35	7.38	21.15	21.8
S22-014954	Common Mussels	Loch Spelve: North	Adura	0.85	5.46	5.47	2.76	2.77	8.22	8.24	14.98	14.98
S22-014270	Pacific Oysters	Porte Na Coite	Porte na Coite	0.65	10.05	10.1	4.83	4.84	14.88	14.94	24.04	24.04
S22-010668	Pacific Oysters	Seil Point	Poll A Bhrochain	0.76	14.75	14.77	6.46	6.48	21.21	21.25	31.24	31.24
S22-012035	Common Mussels	Loch Roag: Eilean Chearstaigh	Eilean Scarastaigh	0.59	2.73	3.91	3.24	3.25	5.97	7.16	14.8	14.8
S22-012036	Common Mussels	Loch Seaforth	Loch Seaforth	0.76	5.18	5.75	3.83	3.88	9.01	9.63	17.99	18.43

Fera LIMS No.	Species	Production Area	Site Name	Fat as % of whole	PCDD/F ng/kg TEQ lb	PCDD/F ng/kg TEQ ub	PCB ng/kg TEQ lb	PCB ng/kg TEQ ub	Total (PCDD/F+ PCB) ng/kg TEQ lb	Total (PCDD/F+ PCB) TEQ ng/kg ub	ICES6 µg/kg lb	ICES6 µg/kg ub
S21-057844	Razors	North Berwick	North Berwick Razors	1.12	6.68	6.71	5.44	5.46	12.12	12.17	45.37	45.37
S22-010722	Pacific Oysters	Arisaig	Sgeirean Buidhe	0.66	8.6	8.65	5.24	5.25	13.84	13.9	20.38	20.38
S22-014953	Pacific Oysters	Bay of Skail: Westray	Bay of Skail: Westray	0.48	3.96	4.59	2.76	2.78	6.72	7.37	10.53	11.75
S22-011559	Common Mussels	Baltasound Mussels	Buness	0.75	2.04	4.32	3.62	3.72	5.66	8.04	26.67	27.02
S22-011560	Common Mussels	Basta Voe Outer	Outer	0.89	2.7	3.21	1.99	2.04	4.69	5.25	11.79	12.63
S22-012387	Common Mussels	Busta Voe Lee North	Busta Voe	1.03	3.71	4.17	2.55	2.6	6.26	6.77	11.18	11.81
S22-010855	Common Mussels	Clift Sound: Whal Wick	Kallee Ness	0.73	5.23	5.38	14.15	14.17	19.38	19.55	102.6	102.6
S22-011558	Common Mussels	Dales Voe: Scarvar Ayre	Southside	1.45	4.63	4.63	2.45	2.45	7.08	7.08	13.17	13.17
S22-012385	Common Mussels	Point of Hamna Ayre	Point of Hamna Ayre	0.94	1.81	3.18	1.86	1.92	3.67	5.1	9.05	9.59
S22-010851	Common Mussels	Stream Sound: Ux Ness	Whalsies Ayre	0.74	5.89	5.93	14.89	14.9	20.78	20.83	111.92	111.92
S22-012386	Common Mussels	Vementry North	Treawick	0.97	2.76	3.02	2.03	2.03	4.79	5.05	9.84	9.84
S21-056763	Razors	Ayr Bay	Ayr Bay Razors	1.25	2.21	2.28	3.38	3.41	5.59	5.69	37.64	37.72
S21-056762	Razors	Heads of Ayr	Heads of Ayr razors	1.02	2.43	2.94	4.2	4.24	6.63	7.18	45.38	45.59

Table 4a: PCDD/F & PCB concentrations, Whole weight

	FERA LIMS No.	S22-010536	S22-012042	S22-014954	S22-014270
	Species	Pacific Oysters	Common Cockles	Common Mussels	Pacific Oysters
	Production Area	Loch Creran: Rubha Mor	Loch Gair	Loch Spelve: North	Porte Na Coite
	Site Name	Rubha Mor	Loch Gair Common Cockles	Adura	Porte na Coite
	Units				
PCB 18	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 28	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 31	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 47	µg/kg	0.02	<0.01	<0.01	<0.01
PCB 49	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 51	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 52	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 99	µg/kg	0.02	0.01	<0.01	0.01
PCB 101	µg/kg	0.03	0.02	0.02	0.02
PCB 105	µg/kg	0.01	<0.01	<0.01	<0.01
PCB 114	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 118	µg/kg	0.04	0.02	0.02	0.03
PCB 123	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 128	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 138	µg/kg	0.07	0.04	0.04	0.04
PCB 153	µg/kg	0.13	0.05	0.06	0.08
PCB 156	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 157	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 167	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 180	µg/kg	<0.01	0.01	<0.01	<0.01
PCB 189	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 77	ng/kg	2.17	1.55	0.89	1.56
PCB 81	ng/kg	0.12	0.06	0.05	0.09
PCB 126	ng/kg	0.45	0.15	0.2	0.27
PCB 169	ng/kg	0.13	0.06	0.08	0.08
2378TCDD	ng/kg	0.01	<0.01	<0.01	<0.01
12378PeCDD	ng/kg	0.04	<0.01	0.02	0.02
123478HxCDD	ng/kg	0.01	<0.01	<0.01	<0.01
123678HxCDD	ng/kg	0.03	<0.01	0.02	0.02
123789HxCDD	ng/kg	0.02	<0.01	0.01	0.01
1234678HpCDD	ng/kg	0.03	0.06	0.12	0.03
OCDD	ng/kg	0.08	0.26	0.59	0.09
2378TCDF	ng/kg	0.21	0.03	0.08	0.13
12378PeCDF	ng/kg	0.03	0.01	0.02	0.02
23478PeCDF	ng/kg	0.08	0.02	0.03	0.05
123478HxCDF	ng/kg	<0.01	<0.01	0.01	<0.01
123678HxCDF	ng/kg	0.01	<0.01	<0.01	<0.01
123789HxCDF	ng/kg	<0.01	<0.01	<0.01	<0.01
234678HxCDF	ng/kg	0.03	0.01	0.01	0.01
1234678HpCDF	ng/kg	<0.01	0.03	0.04	<0.01
1234789HpCDF	ng/kg	<0.01	<0.01	<0.01	<0.01
OCDF	ng/kg	<0.01	0.02	0.04	<0.01

	FERA LIMS No.	S22-010668	S22-012035	S22-012036	S21-057844
	Species	Pacific Oysters	Common Mussels	Common Mussels	Razors
	Production Area	Seil Point	Loch Roag: Eilean Chearstaigh	Loch Seaforth	North Berwick
	Site Name	Poll A Bhrochain	Eilean Scarastaigh	Loch Seaforth	North Berwick Razors
	Units				
PCB 18	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 28	µg/kg	<0.01	<0.01	<0.01	0.02
PCB 31	µg/kg	<0.01	<0.01	<0.01	0.02
PCB 47	µg/kg	<0.01	<0.01	<0.01	0.02
PCB 49	µg/kg	<0.01	<0.01	<0.01	0.02
PCB 51	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 52	µg/kg	<0.01	<0.01	<0.01	0.03
PCB 99	µg/kg	0.02	<0.01	<0.01	0.04
PCB 101	µg/kg	0.03	0.01	0.02	0.12
PCB 105	µg/kg	<0.01	<0.01	<0.01	0.02
PCB 114	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 118	µg/kg	0.04	0.01	0.02	0.08
PCB 123	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 128	µg/kg	<0.01	<0.01	<0.01	0.02
PCB 138	µg/kg	0.06	0.03	0.05	0.15
PCB 153	µg/kg	0.12	0.04	0.06	0.19
PCB 156	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 157	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 167	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 180	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 189	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 77	ng/kg	2.01	0.47	1.75	5.11
PCB 81	ng/kg	0.12	0.03	0.07	0.43
PCB 126	ng/kg	0.43	0.17	0.25	0.53
PCB 169	ng/kg	0.15	0.06	0.08	0.14
2378TCDD	ng/kg	0.01	<0.01	<0.01	0.01
12378PeCDD	ng/kg	0.04	<0.01	0.01	0.02
123478HxCDD	ng/kg	0.01	<0.01	<0.01	0.02
123678HxCDD	ng/kg	0.02	<0.01	0.01	0.03
123789HxCDD	ng/kg	0.02	<0.01	<0.01	0.02
1234678HpCDD	ng/kg	0.04	0.06	0.06	0.15
OCDD	ng/kg	0.12	0.27	0.24	0.51
2378TCDF	ng/kg	0.19	0.04	0.09	0.12
12378PeCDF	ng/kg	0.03	<0.01	0.01	0.02
23478PeCDF	ng/kg	0.07	0.02	0.03	0.04
123478HxCDF	ng/kg	<0.01	<0.01	<0.01	0.02
123678HxCDF	ng/kg	0.02	<0.01	<0.01	0.01
123789HxCDF	ng/kg	<0.01	<0.01	<0.01	<0.01
234678HxCDF	ng/kg	0.03	<0.01	<0.01	0.02
1234678HpCDF	ng/kg	<0.01	<0.01	<0.01	0.04
1234789HpCDF	ng/kg	<0.01	<0.01	<0.01	0.01
OCDF	ng/kg	0.01	0.01	0.02	0.04

	FERA LIMS No.	S22-010722	S22-014953	S22-011559	S22-011560
	Species	Pacific Oysters	Pacific Oysters	Common Mussels	Common Mussels
	Production Area	Arisaig	Bay of Skail: Westray	Baltasound Mussels	Basta Voe Outer
	Site Name	Sgeirean Buidhe	Bay of Skail: Westray	Buness	Outer
	Units				
PCB 18	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 28	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 31	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 47	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 49	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 51	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 52	µg/kg	<0.01	<0.01	0.01	<0.01
PCB 99	µg/kg	0.01	<0.01	0.02	<0.01
PCB 101	µg/kg	0.02	<0.01	0.03	0.02
PCB 105	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 114	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 118	µg/kg	0.02	<0.01	0.04	0.02
PCB 123	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 128	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 138	µg/kg	0.04	0.01	0.06	0.03
PCB 153	µg/kg	0.07	0.03	0.08	0.05
PCB 156	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 157	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 167	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 180	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 189	µg/kg	<0.01	<0.01	<0.01	<0.02
PCB 77	ng/kg	1.55	0.43	1.46	0.5
PCB 81	ng/kg	0.09	0.03	0.07	0.03
PCB 126	ng/kg	0.31	0.12	0.24	0.15
PCB 169	ng/kg	0.09	0.03	0.06	0.05
2378TCDD	ng/kg	<0.01	<0.01	<0.01	<0.01
12378PeCDD	ng/kg	0.02	<0.01	<0.01	<0.01
123478HxCDD	ng/kg	<0.01	<0.01	<0.01	<0.01
123678HxCDD	ng/kg	0.01	<0.01	<0.01	<0.01
123789HxCDD	ng/kg	0.01	<0.01	<0.01	<0.01
1234678HpCDD	ng/kg	0.02	0.01	0.05	0.03
OCDD	ng/kg	0.09	0.03	0.22	0.08
2378TCDF	ng/kg	0.11	0.04	0.06	0.04
12378PeCDF	ng/kg	0.01	<0.01	<0.01	<0.01
23478PeCDF	ng/kg	0.04	0.02	0.02	0.02
123478HxCDF	ng/kg	<0.01	<0.01	<0.01	<0.01
123678HxCDF	ng/kg	<0.01	<0.01	<0.01	<0.01
123789HxCDF	ng/kg	<0.01	<0.01	<0.01	<0.01
234678HxCDF	ng/kg	<0.01	<0.01	<0.01	<0.01
1234678HpCDF	ng/kg	<0.01	<0.01	0.01	0.01
1234789HpCDF	ng/kg	<0.01	<0.01	<0.01	<0.01
OCDF	ng/kg	<0.01	<0.01	0.03	0.01

	FERA LIMS No.	S22-012387	S22-010855	S22-011558	S22-012385
	Species	Common Mussels	Common Mussels	Common Mussels	Common Mussels
	Production Area	Busta Voe Lee North	Clift Sound: Whal Wick	Dales Voe: Scarvar Ayre	Point of Hamna Ayre
	Site Name	Busta Voe	Kallee Ness	Southside	Point of Hamna Ayre
	Units				
PCB 18	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 28	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 31	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 47	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 49	µg/kg	<0.01	0.01	<0.01	<0.01
PCB 51	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 52	µg/kg	<0.01	0.03	<0.01	<0.01
PCB 99	µg/kg	0.01	0.07	0.02	<0.01
PCB 101	µg/kg	0.02	0.2	0.03	0.01
PCB 105	µg/kg	<0.01	0.04	<0.01	<0.01
PCB 114	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 118	µg/kg	0.02	0.2	0.03	0.01
PCB 123	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 128	µg/kg	<0.01	0.03	<0.01	<0.01
PCB 138	µg/kg	0.04	0.25	0.06	0.03
PCB 153	µg/kg	0.05	0.26	0.08	0.04
PCB 156	µg/kg	<0.01	0.01	<0.01	<0.01
PCB 157	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 167	µg/kg	<0.01	0.01	<0.01	<0.01
PCB 180	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 189	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 77	ng/kg	0.77	3.33	0.9	0.47
PCB 81	ng/kg	0.05	0.12	0.05	0.03
PCB 126	ng/kg	0.23	0.92	0.3	0.15
PCB 169	ng/kg	0.08	0.09	0.12	0.06
2378TCDD	ng/kg	<0.01	<0.01	<0.01	<0.01
12378PeCDD	ng/kg	0.01	0.01	0.02	<0.01
123478HxCDD	ng/kg	<0.01	<0.01	0.01	<0.01
123678HxCDD	ng/kg	0.01	<0.01	0.02	<0.01
123789HxCDD	ng/kg	<0.01	<0.01	0.02	<0.01
1234678HpCDD	ng/kg	0.04	0.03	0.07	0.04
OCDD	ng/kg	0.11	0.1	0.2	0.11
2378TCDF	ng/kg	0.07	0.11	0.09	0.06
12378PeCDF	ng/kg	0.02	0.01	0.02	0.01
23478PeCDF	ng/kg	0.04	0.03	0.05	0.02
123478HxCDF	ng/kg	<0.01	<0.01	0.02	<0.01
123678HxCDF	ng/kg	<0.01	<0.01	0.01	<0.01
123789HxCDF	ng/kg	<0.01	<0.01	<0.01	<0.01
234678HxCDF	ng/kg	0.01	<0.01	0.02	0.01
1234678HpCDF	ng/kg	<0.02	<0.01	0.03	0.01
1234789HpCDF	ng/kg	<0.01	<0.01	<0.01	<0.01
OCDF	ng/kg	0.01	0.01	0.04	0.01

	FERA LIMS No.	S22-010851	S22-012386	S21-056763	S21-056762
	Species	Common Mussels	Common Mussels	Razors	Razors
	Production Area	Stream Sound: Ux Ness	Vementry North	Ayr Bay	Heads of Ayr
	Site Name	Whalsies Ayre	Treawick	Ayr Bay Razors	Heads of Ayr razors
	Units				
PCB 18	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 28	µg/kg	<0.01	<0.01	0.01	0.01
PCB 31	µg/kg	<0.01	<0.01	0.01	0.01
PCB 47	µg/kg	<0.01	<0.01	0.02	0.02
PCB 49	µg/kg	0.01	<0.01	0.02	0.02
PCB 51	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 52	µg/kg	0.04	<0.01	0.03	0.03
PCB 99	µg/kg	0.08	<0.01	0.05	0.06
PCB 101	µg/kg	0.21	0.01	0.09	0.09
PCB 105	µg/kg	0.05	<0.01	0.02	0.02
PCB 114	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 118	µg/kg	0.22	0.01	0.07	0.07
PCB 123	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 128	µg/kg	0.03	<0.01	0.02	0.02
PCB 138	µg/kg	0.28	0.03	0.14	0.14
PCB 153	µg/kg	0.29	0.04	0.19	0.19
PCB 156	µg/kg	0.01	<0.01	<0.01	<0.01
PCB 157	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 167	µg/kg	0.02	<0.01	<0.01	<0.01
PCB 180	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 189	µg/kg	<0.01	<0.01	<0.01	<0.01
PCB 77	ng/kg	3.62	0.48	4.57	4.68
PCB 81	ng/kg	0.13	0.03	0.22	0.22
PCB 126	ng/kg	0.97	0.17	0.37	0.37
PCB 169	ng/kg	0.1	0.06	0.07	0.06
2378TCDD	ng/kg	<0.01	<0.01	<0.01	<0.01
12378PeCDD	ng/kg	0.01	<0.01	<0.01	<0.01
123478HxCDD	ng/kg	<0.01	<0.01	<0.01	<0.01
123678HxCDD	ng/kg	<0.01	0.01	<0.01	<0.01
123789HxCDD	ng/kg	<0.01	<0.01	<0.01	<0.01
1234678HpCDD	ng/kg	0.03	0.04	0.03	0.02
OCDD	ng/kg	0.1	0.12	0.15	0.12
2378TCDF	ng/kg	0.13	0.06	0.09	0.1
12378PeCDF	ng/kg	0.01	0.01	<0.01	<0.01
23478PeCDF	ng/kg	0.03	0.02	0.02	0.02
123478HxCDF	ng/kg	<0.01	<0.01	<0.01	<0.01
123678HxCDF	ng/kg	<0.01	<0.01	<0.01	<0.01
123789HxCDF	ng/kg	<0.01	<0.01	<0.01	<0.01
234678HxCDF	ng/kg	<0.01	<0.01	<0.01	<0.01
1234678HpCDF	ng/kg	<0.01	0.02	<0.01	<0.01
1234789HpCDF	ng/kg	<0.01	<0.01	<0.01	<0.01
OCDF	ng/kg	0.01	0.01	0.01	0.01

Table 4b: PCDD/F & PCB concentrations, Fat weight

	FERA LIMS No.	S22-010536	S22-012042	S22-014954	S22-014270
	Species	Pacific Oysters	Common Cockles	Common Mussels	Pacific Oysters
	Production Area	Loch Creran: Rubha Mor	Loch Gair	Loch Spelve: North	Porte Na Coite
	Site Name	Rubha Mor	Loch Gair Common Cockles	Adura	Porte na Coite
	Units				
PCB 18	µg/kg	0.22	<0.63	<0.16	<1.25
PCB 28	µg/kg	0.82	<0.65	0.33	0.71
PCB 31	µg/kg	0.49	<0.63	0.16	0.33
PCB 47	µg/kg	1.93	<0.63	0.4	0.74
PCB 49	µg/kg	0.73	<0.63	0.21	0.77
PCB 51	µg/kg	<0.16	<0.63	<0.03	0.15
PCB 52	µg/kg	1.08	0.75	0.45	1.01
PCB 99	µg/kg	2.77	1.71	0.96	1.97
PCB 101	µg/kg	4.14	2.54	1.78	3.24
PCB 105	µg/kg	1.29	1.14	0.59	1.01
PCB 114	µg/kg	0.05	<0.63	<0.02	<0.04
PCB 118	µg/kg	4.92	2.98	2.25	3.99
PCB 123	µg/kg	<0.09	<0.63	<0.02	<0.01
PCB 128	µg/kg	0.56	<0.63	0.49	0.46
PCB 138	µg/kg	8.7	7.19	4.87	6.72
PCB 153	µg/kg	15.27	8.88	7.07	11.67
PCB 156	µg/kg	0.18	<0.63	0.22	0.17
PCB 157	µg/kg	0.17	<0.63	0.11	<0.16
PCB 167	µg/kg	0.47	<0.63	0.21	0.44
PCB 180	µg/kg	0.91	1.79	0.48	0.69
PCB 189	µg/kg	<1.72	<1.45	<0.14	<0.3
PCB 77	ng/kg	259.13	261.79	104.26	240.78
PCB 81	ng/kg	14.67	10.77	6	13.43
PCB 126	ng/kg	53.95	25.18	23.61	42.41
PCB 169	ng/kg	15.35	9.47	9.47	13.09
2378TCDD	ng/kg	1.36	<1.09	0.44	1.1
12378PeCDD	ng/kg	4.73	<0.75	1.81	3.72
123478HxCDD	ng/kg	1.41	0.54	0.99	1.3
123678HxCDD	ng/kg	3.32	1.35	1.84	2.39
123789HxCDD	ng/kg	2.26	1.29	1.33	1.94
1234678HpCDD	ng/kg	3.94	9.29	14.52	4.71
OCDD	ng/kg	9.66	43.17	69.2	13.77
2378TCDF	ng/kg	24.63	5.36	9.79	19.5
12378PeCDF	ng/kg	3.5	1.79	1.89	2.91
23478PeCDF	ng/kg	9.03	2.87	3.94	7.48
123478HxCDF	ng/kg	<0.12	1.53	1.18	<0.15
123678HxCDF	ng/kg	1.55	1.22	0.84	1.26
123789HxCDF	ng/kg	<0.11	<0.47	<0.05	<0.14
234678HxCDF	ng/kg	3.09	2.02	1.63	2.08
1234678HpCDF	ng/kg	<1.24	4.48	4.22	<1.56
1234789HpCDF	ng/kg	<0.14	<0.6	0.34	<0.15
OCDF	ng/kg	0.51	4.12	4.77	1.11

	FERA LIMS No.	S22-010668	S22-012035	S22-012036	S21-057844
	Species	Pacific Oysters	Common Mussels	Common Mussels	Razors
	Production Area	Seil Point	Loch Roag: Eilean Chearstaigh	Loch Seaforth	North Berwick
	Site Name	Poll A Bhrochain	Eilean Scarastaigh	Loch Seaforth	North Berwick Razors
	Units				
PCB 18	µg/kg	<0.21	<0.25	<0.31	0.63
PCB 28	µg/kg	0.65	0.31	<0.44	2.09
PCB 31	µg/kg	0.31	<0.15	<0.31	1.37
PCB 47	µg/kg	1.21	0.68	0.43	1.61
PCB 49	µg/kg	0.68	0.25	0.39	1.78
PCB 51	µg/kg	0.19	0.07	<0.31	0.18
PCB 52	µg/kg	0.99	0.44	0.69	2.79
PCB 99	µg/kg	2.37	1	1.29	3.78
PCB 101	µg/kg	3.7	1.87	2.47	10.39
PCB 105	µg/kg	1.21	0.55	0.93	2.2
PCB 114	µg/kg	<0.03	<0.03	<0.31	0.08
PCB 118	µg/kg	4.94	2.11	3.03	6.74
PCB 123	µg/kg	<0.17	<0.04	<0.31	<0.17
PCB 128	µg/kg	0.57	0.39	<0.31	1.34
PCB 138	µg/kg	8.37	4.72	6.45	13
PCB 153	µg/kg	16.33	6.99	8.03	16.96
PCB 156	µg/kg	0.21	0.17	<0.31	0.31
PCB 157	µg/kg	0.21	0.08	<0.31	0.21
PCB 167	µg/kg	0.5	0.21	<0.31	0.49
PCB 180	µg/kg	1.2	0.47	0.35	0.14
PCB 189	µg/kg	<0.5	<0.07	<0.31	<0.34
PCB 77	ng/kg	265.3	79.49	231.42	454.65
PCB 81	ng/kg	16.35	4.56	9.04	38.36
PCB 126	ng/kg	56.46	28.21	33.59	47.03
PCB 169	ng/kg	19.21	10.64	10.9	12.78
2378TCDD	ng/kg	1.9	0.48	<0.53	1.32
12378PeCDD	ng/kg	5.82	<0.96	1.88	1.93
123478HxCDD	ng/kg	1.8	1.09	1.03	1.54
123678HxCDD	ng/kg	3.28	1.57	1.85	2.91
123789HxCDD	ng/kg	2.98	1.32	1.32	1.6
1234678HpCDD	ng/kg	5.39	9.99	8.32	13.57
OCDD	ng/kg	15.45	45.65	32.15	45.16
2378TCDF	ng/kg	25.53	6.7	11.98	10.73
12378PeCDF	ng/kg	4.21	1.39	1.69	1.51
23478PeCDF	ng/kg	9.41	3.03	4.39	3.46
123478HxCDF	ng/kg	0.52	0.65	0.58	1.71
123678HxCDF	ng/kg	2.09	0.57	0.59	1.26
123789HxCDF	ng/kg	0.58	<0.17	<0.11	<0.35
234678HxCDF	ng/kg	3.47	<1.76	1.08	1.71
1234678HpCDF	ng/kg	<1.4	<2.23	<1.9	3.54
1234789HpCDF	ng/kg	<0.52	<0.17	<0.36	1.02
OCDF	ng/kg	1.57	1.83	2.33	3.43

	FERA LIMS No.	S22-010722	S22-014953	S22-011559	S22-011560
	Species	Pacific Oysters	Pacific Oysters	Common Mussels	Common Mussels
	Production Area	Arisaig	Bay of Skail: Westray	Baltasound Mussels	Basta Voe Outer
	Site Name	Sgeirean Buidhe	Bay of Skail: Westray	Buness	Outer
	Units				
PCB 18	µg/kg	<0.22	<1.64	<0.47	<1.41
PCB 28	µg/kg	0.63	<0.42	1.19	<0.36
PCB 31	µg/kg	0.44	<0.18	<0.35	0.2
PCB 47	µg/kg	0.52	<0.15	0.95	0.55
PCB 49	µg/kg	0.49	<0.07	1.07	0.31
PCB 51	µg/kg	0.04	<0.01	<0.35	<0.01
PCB 52	µg/kg	0.85	0.47	1.62	0.5
PCB 99	µg/kg	1.66	0.8	2.89	0.93
PCB 101	µg/kg	2.52	1.46	4.48	1.72
PCB 105	µg/kg	0.78	<0.49	1.3	0.43
PCB 114	µg/kg	<0.01	<0.03	<0.35	<0.02
PCB 118	µg/kg	3.31	1.75	4.76	1.7
PCB 123	µg/kg	<0.05	<0.01	<0.35	0.02
PCB 128	µg/kg	0.33	0.15	<0.35	0.35
PCB 138	µg/kg	5.43	3.15	8.08	3.87
PCB 153	µg/kg	10.45	5.45	11.3	5.7
PCB 156	µg/kg	0.12	0.11	<0.35	0.13
PCB 157	µg/kg	0.12	0.08	<0.35	<0.08
PCB 167	µg/kg	0.3	0.17	<0.35	0.23
PCB 180	µg/kg	0.5	<0.8	<0.35	<0.48
PCB 189	µg/kg	<0.22	<0.06	<1.66	<1.73
PCB 77	ng/kg	233.53	89.91	195.08	56.67
PCB 81	ng/kg	13.64	6.25	9.14	3.49
PCB 126	ng/kg	46.87	24.77	31.7	17.22
PCB 169	ng/kg	12.93	6.98	8.12	5.94
2378TCDD	ng/kg	0.98	<0.58	<0.6	<0.5
12378PeCDD	ng/kg	3.61	1.57	<1.65	1.06
123478HxCDD	ng/kg	0.84	0.54	0.42	0.43
123678HxCDD	ng/kg	1.85	1.01	0.9	0.69
123789HxCDD	ng/kg	1.53	0.58	0.52	0.48
1234678HpCDD	ng/kg	3.55	2.3	6.29	3.11
OCDD	ng/kg	13.69	7.32	29.29	9.38
2378TCDF	ng/kg	16.68	9.37	7.81	5.05
12378PeCDF	ng/kg	1.97	1.35	1.26	0.88
23478PeCDF	ng/kg	5.37	3.19	2.55	2.45
123478HxCDF	ng/kg	<0.09	<0.31	0.47	0.51
123678HxCDF	ng/kg	0.75	0.76	0.52	0.45
123789HxCDF	ng/kg	<0.23	<0.11	<0.26	<0.1
234678HxCDF	ng/kg	1.4	1.37	0.82	0.75
1234678HpCDF	ng/kg	<1.65	0.86	1.66	1.14
1234789HpCDF	ng/kg	<0.05	<0.19	<0.2	<0.17
OCDF	ng/kg	0.59	0.6	4.11	1.27

	FERA LIMS No.	S22-012387	S22-010855	S22-011558	S22-012385
	Species	Common Mussels	Common Mussels	Common Mussels	Common Mussels
	Production Area	Busta Voe Lee North	Clift Sound: Whal Wick	Dales Voe: Scarvar Ayre	Point of Hamna Ayre
	Site Name	Busta Voe	Kallee Ness	Southside	Point of Hamna Ayre
	Units				
PCB 18	µg/kg	<0.25	<0.23	<0.19	<0.25
PCB 28	µg/kg	<0.36	0.67	0.33	<0.26
PCB 31	µg/kg	<0.25	0.26	0.19	<0.25
PCB 47	µg/kg	0.32	1.04	0.55	0.41
PCB 49	µg/kg	0.34	1.81	0.32	<0.25
PCB 51	µg/kg	<0.25	0.04	<0.06	<0.25
PCB 52	µg/kg	0.65	4.69	0.66	0.41
PCB 99	µg/kg	0.98	10.24	1.08	0.69
PCB 101	µg/kg	1.81	26.94	2.32	1.23
PCB 105	µg/kg	0.51	6.03	0.6	0.39
PCB 114	µg/kg	<0.25	0.1	0.01	<0.25
PCB 118	µg/kg	1.87	27.17	2.17	1.27
PCB 123	µg/kg	<0.25	<0.15	<0.02	<0.25
PCB 128	µg/kg	<0.25	3.82	0.43	<0.25
PCB 138	µg/kg	3.74	33.82	4.02	3.03
PCB 153	µg/kg	4.98	35.55	5.51	4.38
PCB 156	µg/kg	<0.25	1.74	0.14	<0.25
PCB 157	µg/kg	<0.25	0.7	0.08	<0.25
PCB 167	µg/kg	<0.25	1.75	0.17	<0.25
PCB 180	µg/kg	<0.27	0.93	0.33	<0.28
PCB 189	µg/kg	<0.25	<0.49	<0.1	<0.64
PCB 77	ng/kg	74.25	457.7	61.83	49.58
PCB 81	ng/kg	4.77	16.25	3.47	3.11
PCB 126	ng/kg	22.47	126.15	21.04	16.12
PCB 169	ng/kg	7.58	12.14	7.99	6.39
2378TCDD	ng/kg	<0.43	0.44	0.52	<0.43
12378PeCDD	ng/kg	1.38	1.5	1.62	<0.92
123478HxCDD	ng/kg	0.6	0.51	0.86	0.36
123678HxCDD	ng/kg	1.25	1.22	1.7	0.74
123789HxCDD	ng/kg	0.54	0.5	1.06	0.68
1234678HpCDD	ng/kg	4	4.79	4.91	3.97
OCDD	ng/kg	10.23	14.42	13.5	11.17
2378TCDF	ng/kg	7.17	15.34	6.04	6.07
12378PeCDF	ng/kg	1.45	1.46	1.71	1.18
23478PeCDF	ng/kg	3.58	4.39	3.26	2.46
123478HxCDF	ng/kg	0.4	<0.46	1.1	0.4
123678HxCDF	ng/kg	0.44	<0.68	0.93	0.48
123789HxCDF	ng/kg	<0.08	<0.2	0.5	<0.17
234678HxCDF	ng/kg	1.33	1.24	1.6	1.09
1234678HpCDF	ng/kg	<1.66	<1.24	2.37	1.41
1234789HpCDF	ng/kg	<0.14	<0.19	0.59	<0.14
OCDF	ng/kg	1.3	1.87	2.62	1.54

	FERA LIMS No.	S22-010851	S22-012386	S21-056763	S21-056762
	Species	Common Mussels	Common Mussels	Razors	Razors
	Production Area	Stream Sound: Ux Ness	Vementry North	Ayr Bay	Heads of Ayr
	Site Name	Whalsies Ayre	Treawick	Ayr Bay Razors	Heads of Ayr razors
	Units				
PCB 18	µg/kg	<0.24	<0.19	0.34	0.36
PCB 28	µg/kg	0.71	0.31	1.12	1.32
PCB 31	µg/kg	0.32	0.16	0.82	0.99
PCB 47	µg/kg	1.27	0.49	1.5	1.7
PCB 49	µg/kg	1.79	0.18	1.65	1.92
PCB 51	µg/kg	0.12	0.05	<0.43	<0.52
PCB 52	µg/kg	4.92	0.44	2.6	2.89
PCB 99	µg/kg	11.11	0.79	4.18	5.76
PCB 101	µg/kg	28.05	1.27	7.58	9.21
PCB 105	µg/kg	6.9	0.41	1.86	2.36
PCB 114	µg/kg	0.12	<0.01	<0.67	<0.82
PCB 118	µg/kg	29.89	1.51	5.56	6.96
PCB 123	µg/kg	<0.28	<0.03	<0.27	<0.33
PCB 128	µg/kg	4.26	0.25	1.36	1.73
PCB 138	µg/kg	37.88	3.1	11.26	13.73
PCB 153	µg/kg	39.37	4.45	15.08	18.23
PCB 156	µg/kg	1.83	0.12	0.26	0.28
PCB 157	µg/kg	0.82	0.06	0.11	0.13
PCB 167	µg/kg	2.12	0.13	0.19	0.26
PCB 180	µg/kg	0.99	0.27	<0.08	<0.21
PCB 189	µg/kg	<0.07	<0.07	<0.13	<0.18
PCB 77	ng/kg	490.7	49.34	365.46	460.37
PCB 81	ng/kg	17.96	3.14	17.9	21.28
PCB 126	ng/kg	131.92	17.69	29.37	36.75
PCB 169	ng/kg	13.17	6.3	5.45	5.74
2378TCDD	ng/kg	0.69	<0.25	0.28	<0.26
12378PeCDD	ng/kg	1.43	0.91	0.51	0.65
123478HxCDD	ng/kg	0.58	0.45	<0.05	<0.37
123678HxCDD	ng/kg	1.16	1.1	0.49	<0.44
123789HxCDD	ng/kg	0.42	0.67	<0.24	<0.34
1234678HpCDD	ng/kg	4.5	4.51	2.41	2.1
OCDD	ng/kg	13.16	12.14	12.1	11.49
2378TCDF	ng/kg	18.08	5.95	7.5	9.67
12378PeCDF	ng/kg	1.79	1.12	<0.57	<0.68
23478PeCDF	ng/kg	4.69	2.53	1.55	2.18
123478HxCDF	ng/kg	0.44	0.44	0.3	<0.68
123678HxCDF	ng/kg	0.52	0.35	0.3	0.42
123789HxCDF	ng/kg	<0.38	<0.05	<0.19	<0.33
234678HxCDF	ng/kg	1.3	0.97	0.67	0.93
1234678HpCDF	ng/kg	1.26	1.57	<0.76	<0.95
1234789HpCDF	ng/kg	<0.25	<0.1	<0.23	<0.52
OCDF	ng/kg	1.63	1.18	<0.97	1.19

NOTE: where shown *i* = indicative

Table 5: PAH concentrations ($\mu\text{g}/\text{kg}$ Whole weight)

FERA LIMS No.	S22-010536	S22-011292	S22-012042	S22-014954	S22-014270
Species	Pacific Oysters	Pacific Oysters	Common Cockles	Common Mussels	Pacific Oysters
Production Area	Loch Creran: Rubha Mor	Loch Fyne: Otter Ferry	Loch Gair	Loch Spelve: North	Porte Na Coite
Site Name	Rubha Mor	Ballimore	Loch Gair Common Cockles	A dura	Porte na Coite
acenaphthylene	<0.3	<0.06	<0.31	<0.06	<0.25
acenaphthene	<0.69	<0.12	<0.7	<0.11	<0.76
fluorene	<0.6	<0.44	<0.61	<0.43	<0.51
phenanthrene	1.23	<1	<0.8	<0.98	0.73
anthracene	0.19	<0.05	0.1	<0.05	0.11
fluoranthene	3.05	<0.8	1.33	<0.78	1.59
benzo[c]fluorene	0.09	<0.01	0.05	<0.01	0.07
pyrene	2.96	<0.83	1.58	<0.81	1.23
benzo[ghi]fluoranthene	1.37	0.15	0.55	<0.07	0.71
benzo[a]anthracene	0.72	0.09	0.69	<0.03	0.56
benzo[b]naphtho[2,1-d]thiophene	0.1	0.02	0.17	<0.01	0.14
cyclopenta[cd]pyrene	0.06	<0.01	<0.1	<0.01	0.05
chrysene	1.18	0.19	0.84	0.09	0.75
5-methylchrysene	<0.03	<0.01	<0.05	<0.01	<0.04
benzo[b]fluoranthene	2.84	0.23	1.08	0.12	1.88
benzo[j]fluoranthene	0.67	0.07	0.67	0.04	0.5
benzo[k]fluoranthene	1.18	0.1	0.7	0.05	0.77
benzo[e]pyrene	3.5	0.29	1.02	0.18	1.65
benzo[a]pyrene	0.37	<0.13	0.58	<0.12	0.44
indeno[1,2,3-cd]pyrene	0.51	<0.06	0.74	<0.06	0.38
dibenz[a,h]anthracene	0.14	<0.09	0.21	<0.09	0.14
benzo[ghi]perylene	0.63	0.06	0.77	0.06	0.46
anthanthrene	<0.1	<0.1	<0.1	<0.1	<0.1
dibenzo[a,l]pyrene	<0.18	<0.2	<0.21	<0.19	<0.15
dibenzo[a,e]pyrene	<0.13	<0.1	<0.17	<0.1	<0.16
dibenzo[a,i]pyrene	<0.1	<0.1	<0.1	<0.1	<0.1
dibenzo[a,h]pyrene	<0.1	<0.1	<0.1	<0.1	<0.1
coronene	<0.1	<0.1	0.22	<0.1	<0.1
PAH 4 Sum lb	5.11	0.51	3.19	0.21	3.63
PAH 4 Sum ub	5.11	0.64	3.19	0.36	3.63

NOTE: where shown *i* = indicative

FERA LIMS No.	S22-010668	S22-011822	S22-012035	S22-012036	S21-057844
Species	Pacific Oysters	Common Mussels	Common Mussels	Common Mussels	Razors
Production Area	Seil Point	Loch Leurbost	Loch Roag: Eilean Chearstaigh	Loch Seaforth	North Berwick
Site Name	Poll A Bhrochain	Loch Leurbost	Eilean Scarastaigh	Loch Seaforth	North Berwick Razors
acenaphthylene	<0.3	<0.25	<0.85	<0.82	0.32
acenaphthene	<0.69	<0.76	<2.19	<2.11	<0.69
fluorene	<0.61	<0.51	<0.55	<0.53	0.62
phenanthrene	1.13	<0.67	<1.14	<1.1	2.26
anthracene	0.13	0.05	0.02	0.13	0.37
fluoranthene	2.19	0.47	<0.89	<0.86	3.88
benzo[c]fluorene	0.08	0.02	<0.01	<0.01	0.21
pyrene	1.56	<0.65	<0.93	<0.9	3.05
benzo[ghi]fluoranthene	1.04	0.23	<0.07	0.17	1.31
benzo[a]anthracene	0.49	0.21	0.08	0.15	1.4
benzo[b]naphtho[2,1-d]thiophene	0.16	0.04	<0.02	<0.04	0.2
cyclopenta[cd]pyrene	<0.22	0.02	<0.01	<0.04	0.02
chrysene	0.69	0.25	0.09	0.16	1.19
5-methylchrysene	<0.01	<0.01	<0.01	<0.01	<0.06
benzo[b]fluoranthene	2.06	0.67	0.34	0.44	1.7
benzo[j]fluoranthene	0.51	0.27	0.11	0.18	0.73
benzo[k]fluoranthene	0.83	0.26	0.12	0.15	0.82
benzo[e]pyrene	1.55	0.66	0.28	0.55	2.26
benzo[a]pyrene	0.22	0.18	0.12	<0.12	0.8
indeno[1,2,3-cd]pyrene	0.29	0.28	0.17	0.16	0.5
dibenzo[ah]anthracene	0.13	<0.09	<0.07	<0.07	0.11
benzo[ghi]perylene	0.42	0.42	0.19	0.36	0.61
anthanthrene	<0.1	<0.1	<0.1	<0.1	<0.1
dibenzo[a,l]pyrene	<0.18	<0.13	<0.2	<0.19	<0.18
dibenzo[a,e]pyrene	<0.13	<0.16	<0.13	<0.12	<0.13
dibenzo[a,i]pyrene	<0.1	<0.1	<0.1	<0.1	<0.1
dibenzo[a,h]pyrene	<0.1	<0.1	<0.1	<0.1	<0.1
coronene	<0.1	0.14	<0.1	<0.1	0.23
PAH 4 Sum lb	3.46	1.31	0.63	0.87	5.09
PAH 4 Sum ub	3.46	1.31	0.63	0.75	5.09

FERA LIMS No.	S22-010722	S22-011442	S22-011456	S22-011443	S22-014953
Species	Pacific Oysters	Common Mussels	Common Mussels	Common Mussels	Pacific Oysters
Production Area	Arisaig	Loch Eil	Loch Incharad	Loch Laxford	Bay of Skail: Westray
Site Name	Sgeirean Buidhe	Garvan	Loch Incharad Site 1 D. Ross	Weavers Bay	Bay of Skail: Westray
acenaphthylene	<0.3	<0.1	<0.06	<0.06	<0.3
acenaphthene	<0.69	<0.12	<0.11	<0.12	<0.69
fluorene	<0.6	<0.44	<0.43	<0.44	<0.6
phenanthrene	<0.79	1.21	<0.98	<1	<0.79
anthracene	<0.04	0.09	<0.05	<0.05	<0.04
fluoranthene	0.88	2.02	<0.78	<0.8	<0.54
benzo[c]fluorene	0.02	0.09	<0.01	<0.01	0.02
pyrene	0.82	2.09	<0.81	<0.83	<0.66
benzo[ghi]fluoranthene	0.38	0.93	<0.07	<0.07	0.13
benzo[a]anthracene	0.18	0.69	<0.01	<0.01	0.07
benzo[b]naphtho[2,1-d]thiophene	<0.06	0.18	<0.01	<0.01	<0.01
cyclopenta[cd]pyrene	<0.01	<0.05	<0.01	<0.01	<0.01
chrysene	0.28	1.1	<0.07	<0.07	0.15
5-methylchrysene	<0.01	<0.04	<0.01	<0.01	<0.01
benzo[b]fluoranthene	0.65	2.48	<0.05	<0.05	0.29
benzo[j]fluoranthene	0.15	0.9	0.02	0.01	0.07
benzo[k]fluoranthene	0.24	0.98	<0.02	<0.02	0.11
benzo[e]pyrene	0.65	3.45	0.04	0.06	0.25
benzo[a]pyrene	<0.12	0.5	<0.12	<0.13	<0.12
indeno[1,2,3-cd]pyrene	0.12	0.61	<0.05	<0.05	0.06
dibenzo[ah]anthracene	<0.07	0.16	<0.09	<0.09	<0.07
benzo[ghi]perylene	0.18	1.03	0.02	0.02	0.06
anthanthrene	<0.1	<0.1	<0.1	<0.1	<0.1
dibenzo[a,l]pyrene	<0.18	<0.2	<0.19	<0.2	<0.18
dibenzo[a,e]pyrene	<0.13	<0.1	<0.1	<0.1	<0.13
dibenzo[a,i]pyrene	<0.1	<0.1	<0.1	<0.1	<0.1
dibenzo[a,h]pyrene	<0.1	<0.1	<0.1	<0.1	<0.1
coronene	<0.1	0.19	<0.1	<0.1	<0.1
PAH 4 Sum ub	1.11	4.77	<0.01	<0.01	0.51
PAH 4 Sum lb	1.23	4.77	0.25	0.26	0.63

FERA LIMS No.	S22-012388	S22-011559	S22-011560	S22-012387	S22-010855
Species	Common Mussels	Common Mussels	Common Mussels	Common Mussels	Common Mussels
Production Area	Aith Voe Sletta	Baltasound Mussels	Basta Voe Outer	Busta Voe Lee North	Clift Sound: Whal Wick
Site Name	Point of Sletta	Buness	Outer	Busta Voe	Kallee Ness
acenaphthylene	<0.07	0.36	<0.25	<0.85	<0.25
acenaphthene	<0.12	<0.75	<0.74	<2.2	<0.74
fluorene	<0.45	<0.51	<0.5	1.04	<0.5
phenanthrene	<1.02	0.85	<0.65	<1.15	1.11
anthracene	<0.05	0.32	<0.04	0.25	0.13
fluoranthene	<0.81	1.94	<0.45	<0.9	0.58
benzo[c]fluorene	<0.01	0.03	0.01	<0.04	<0.03
pyrene	<0.84	2.16	<0.63	<0.94	1.08
benzo[ghi]fluoranthene	<0.07	0.38	0.14	0.35	0.26
benzo[a]anthracene	<0.01	0.92	0.12	0.3	0.19
benzo[b]naphtho[2,1-d]thiophene	<0.01	0.09	<0.03	0.1	0.05
cyclopenta[cd]pyrene	<0.01	0.09	0.01	0.03	0.05
chrysene	<0.07	0.85	0.18	0.46	0.24
5-methylchrysene	<0.01	<0.03	<0.01	<0.02	<0.01
benzo[b]fluoranthene	<0.05	1.06	0.43	0.93	0.52
benzo[j]fluoranthene	0.01	0.54	0.16	0.34	0.2
benzo[k]fluoranthene	<0.02	0.53	0.16	0.33	0.21
benzo[e]pyrene	0.03	1.14	0.46	1.16	0.66
benzo[a]pyrene	<0.13	0.98	<0.14	0.23	0.17
indeno[1,2,3-cd]pyrene	<0.05	0.73	0.18	0.39	0.27
dibenzo[ah]anthracene	<0.09	0.17	<0.09	<0.08	<0.09
benzo[ghi]perylene	0.01	0.77	0.28	0.54	0.38
anthanthrene	<0.1	0.13	<0.1	<0.1	<0.1
dibenzo[a,l]pyrene	<0.2	0.27	<0.12	<0.2	<0.13
dibenzo[a,e]pyrene	<0.1	<0.2	<0.16	<0.13	<0.16
dibenzo[a,i]pyrene	<0.1	<0.1	<0.1	<0.1	<0.1
dibenzo[a,h]pyrene	<0.1	<0.1	<0.1	<0.1	<0.1
coronene	<0.1	0.21	<0.1	<0.1	0.11
PAH 4 Sum lb	<0.01	3.81	0.73	1.92	1.12
PAH 4 Sum ub	0.26	3.81	0.87	1.92	1.12

FERA LIMS No.	S22-011558	S22-012385	S22-010851	S22-012386
Species	Common Mussels	Common Mussels	Common Mussels	Common Mussels
Production Area	Dales Voe: Scarvar Ayre	Point of Hamna Ayre	Stream Sound: Ux Ness	Vementry North
Site Name	Southside	Point of Hamna Ayre	Whalsies Ayre	Treawick
acenaphthylene	<0.25	<0.82	0.26	<0.84
acenaphthene	<0.76	<2.11	<0.73	<2.16
fluorene	<0.51	<0.53	<0.49	<0.54
phenanthrene	<0.67	<1.1	0.85	<1.13
anthracene	0.04	0.05	0.13	0.03
fluoranthene	<0.47	<0.86	0.51	<0.88
benzo[c]fluorene	0.01	<0.01	<0.02	<0.01
pyrene	<0.65	<0.9	0.77	<0.92
benzo[ghi]fluoranthene	0.16	0.13	0.23	<0.07
benzo[a]anthracene	0.13	0.12	0.21	0.06
benzo[b]naphtho[2,1-d]thiophene	0.04	<0.03	0.05	<0.01
cyclopenta[cd]pyrene	0.02	<0.01	0.03	<0.04
chrysene	0.2	0.17	0.24	0.09
5-methylchrysene	<0.01	<0.01	<0.01	<0.01
benzo[b]fluoranthene	0.59	0.47	0.59	0.31
benzo[j]fluoranthene	0.2	0.18	0.25	0.11
benzo[k]fluoranthene	0.21	0.17	0.23	0.11
benzo[e]pyrene	0.74	0.56	0.78	0.27
benzo[a]pyrene	0.15	0.15	0.19	<0.12
indeno[1,2,3-cd]pyrene	0.31	0.22	0.28	0.15
dibenzo[ah]anthracene	<0.09	<0.07	<0.09	<0.07
benzo[ghi]perylene	0.48	0.29	0.42	0.19
anthanthrene	<0.1	<0.1	<0.1	<0.1
dibenzo[a,l]pyrene	<0.16	<0.19	<0.1	<0.2
dibenzo[a,e]pyrene	<0.16	<0.12	<0.16	<0.13
dibenzo[a,i]pyrene	<0.1	<0.1	<0.1	<0.1
dibenzo[a,h]pyrene	<0.1	<0.1	<0.1	<0.1
coronene	0.19	0.15	0.12	<0.1
PAH 4 Sum lb	1.07	0.91	1.23	0.46
PAH 4 Sum ub	1.07	0.91	1.23	0.58

FERA LIMS No.	S21-056763	S21-056762
Species	Razors	Razors
Production Area	Ayr Bay	Heads of Ayr
Site Name	Ayr Bay Razors	Heads of Ayr razors
acenaphthylene	<0.3	<0.3
acenaphthene	<0.68	<0.68
fluorene	<0.6	<0.6
phenanthrene	1.2	1.26
anthracene	0.22	0.25
fluoranthene	2.56	2.36
benzo[c]fluorene	0.24	0.2
pyrene	1.58	1.81
benzo[ghi]fluoranthene	0.81	0.77
benzo[a]anthracene	0.9	0.8
benzo[b]naphtho[2,1-d]thiophene	<0.01	0.11
cyclopenta[cd]pyrene	<0.01	<0.05
chrysene	0.9	0.75
5-methylchrysene	<0.04	<0.03
benzo[b]fluoranthene	1.38	1.16
benzo[j]fluoranthene	0.62	0.56
benzo[k]fluoranthene	0.67	0.56
benzo[e]pyrene	1.84	1.3
benzo[a]pyrene	0.62	0.51
indeno[1,2,3-cd]pyrene	0.38	0.33
dibenzo[ah]anthracene	0.1	0.08
benzo[ghi]perylene	0.44	0.36
anthanthrene	<0.1	<0.1
dibenzo[a,l]pyrene	<0.18	<0.18
dibenzo[a,e]pyrene	<0.13	<0.13
dibenzo[a,i]pyrene	<0.1	<0.1
dibenzo[a,h]pyrene	<0.1	<0.1
coronene	0.11	<0.1
PAH 4 Sum lb	3.8	3.22
PAH 4 Sum ub	3.8	3.22

Table 6: Trace Element Concentrations (mg/kg whole weight)

FERA LIMS No.	S22-010536	S22-012042	S22-014954	S22-014270	S22-010668
Species	Pacific Oysters	Common Cockles	Common Mussels	Pacific Oysters	Pacific Oysters
Production Area	Loch Creran: Rubha Mor	Loch Gair	Loch Spelve: North	Porte Na Coite	Seil Point
Site Name	Rubha Mor	Loch Gair Common Cockles	Adura	Porte na Coite	Poll A Bhrochain
Chromium	0.05	0.12	0.17	0.33	0.06
Manganese	3.08	2.14	3.36	2.01	3
Cobalt	0.022	0.178	0.039	0.042	0.022
Nickel	<0.07	2.51	0.19	0.26	<0.07
Copper	6.65	0.34	0.56	6.47	7.43
Zinc	129.5	6	6.7	102.3	153.8
Arsenic	1.59	0.92	1.3	1.38	1.95
Selenium	0.24	0.23	0.32	0.16	0.22
Silver	0.302	0.004	0.004	0.306	0.36
Cadmium	0.169	0.029	0.052	0.122	0.12
Mercury	0.012	0.007	0.008	0.008	0.014
Lead	0.101	0.052	0.122	0.097	0.048

FERA LIMS No.	S22-011822	S22-012035	S22-012036	S21-057844	S22-010722
Species	Common Mussels	Common Mussels	Common Mussels	Razors	Pacific Oysters
Production Area	Loch Leurbost	Loch Roag: Eilean Chearstaigh	Loch Seaforth	North Berwick	Arisaig
Site Name	Loch Leurbost	Eilean Scarastaigh	Loch Seaforth	North Berwick Razors	Sgeirean Buidhe
Chromium	0.13	0.1	0.07	0.1	0.05
Manganese	1.47	0.65	0.79	0.79	1.57
Cobalt	0.027	0.019	0.021	0.064	0.015
Nickel	0.17	0.14	0.14	0.08	<0.07
Copper	0.61	0.51	0.64	1.4	5.33
Zinc	9.2	8.7	10.1	14.4	99.1
Arsenic	1.44	1.21	1.57	1.48	1.34
Selenium	0.29	0.3	0.34	0.36	0.15
Silver	0.003	0.003	<0.003	0.097	0.201
Cadmium	0.07	0.064	0.078	0.023	0.098
Mercury	<0.007	<0.007	<0.007	0.012	0.01
Lead	0.105	0.061	0.12	0.061	0.041

FERA LIMS No.	S22-011442	S22-010662	S22-011443	S22-014953	S22-012388
Species	Common Mussels	Common Cockles	Common Mussels	Pacific Oysters	Common Mussels
Production Area	Loch Eil	Loch Harport: Inner	Loch Laxford	Bay of Skail: Westray	Aith Voe Sletta
Site Name	Garvan	Carbost Cockles	Weavers Bay	Bay of Skail: Westray	Point of Sletta
Chromium	0.09	0.38	0.19	0.05	0.14
Manganese	3.51	1.34	1.35	0.73	0.7
Cobalt	0.027	0.141	0.024	0.016	0.022
Nickel	0.1	2.64	0.27	0.08	0.18
Copper	0.61	0.4	0.72	3.46	0.85
Zinc	6.3	4.2	7.2	78.2	11.9
Arsenic	1.14	1.01	1.26	1.56	1.39
Selenium	0.25	0.17	0.3	0.15	0.37
Silver	0.006	<0.003	0.004	0.171	<0.003
Cadmium	0.066	0.041	0.051	0.123	0.106
Mercury	0.011	<0.007	<0.007	0.008	<0.007
Lead	0.078	0.04	0.109	0.046	0.079

FERA LIMS No.	S22-011559	S22-011560	S22-012387	S22-010855	S22-011558
Species	Common Mussels	Common Mussels	Common Mussels	Common Mussels	Common Mussels
Production Area	Baltasound Mussels	Basta Voe Outer	Busta Voe Lee North	Clift Sound: Whal Wick	Dales Voe: Scarvar Ayre
Site Name	Buness	Outer	Busta Voe	Kallee Ness	Southside
Chromium	0.84	0.1	0.09	0.16	0.13
Manganese	0.92	0.85	0.6	0.49	0.74
Cobalt	0.061	0.019	0.018	0.018	0.023
Nickel	1.2	0.14	0.13	0.15	0.17
Copper	0.75	0.7	0.84	0.89	1
Zinc	11.6	13.3	11.9	11.6	15.9
Arsenic	1.25	1.28	1.14	1.05	1.34
Selenium	0.28	0.29	0.3	0.24	0.34
Silver	<0.003	0.003	<0.003	<0.003	<0.003
Cadmium	0.062	0.091	0.084	0.062	0.104
Mercury	<0.007	<0.007	<0.007	<0.007	<0.007
Lead	0.154	0.072	0.099	0.083	0.101

FERA LIMS No.	S22-012385	S22-010851	S22-012386	S21-056763	S21-056762
Species	Common Mussels	Common Mussels	Common Mussels	Razors	Razors
Production Area	Point of Hamna Ayre	Stream Sound: Ux Ness	Vementry North	Ayr Bay	Heads of Ayr
Site Name	Point of Hamna Ayre	Whalsies Ayre	Treawick	Ayr Bay Razors	Heads of Ayr razors
Chromium	0.2	0.1	0.15	0.19	0.2
Manganese	0.8	0.41	1.17	0.84	0.72
Cobalt	0.025	0.017	0.02	0.069	0.065
Nickel	0.19	0.1	0.16	0.12	0.14
Copper	0.71	0.81	0.77	1.11	0.97
Zinc	9.9	12	10.9	15	14.9
Arsenic	1.24	1.06	1.16	1.52	1.43
Selenium	0.31	0.24	0.31	0.35	0.33
Silver	<0.003	<0.003	0.003	0.165	0.122
Cadmium	0.136	0.068	0.145	0.026	0.023
Mercury	<0.007	<0.007	<0.007	0.01	0.009
Lead	0.09	0.086	0.073	0.041	0.044

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