Provision of Statutory Shellfish Monitoring Services for Scotland- Chemical Contaminant Analysis of Shellfish from Classified Harvesting Areas (2026)

Report to Food Standards Scotland

  

June 2026 – Final Report

Contract reference RDE888 – CEFAS25-89/C8549

Chemical Contaminant Analysis of Shellfish from Classified Harvesting Areas (2026)

Prime Contractor:	Centre for Environment, Fisheries & Aquaculture Science Pakefield Road, Lowestoft Suffolk NR33 0HT
Contract Customer:	Food Standards Scotland 4th Floor, Pilgrim House Old Ford Road Aberdeen AB11 5RL
Supplier:	Fera Science Ltd. (Fera) York Biotech Campus Sand Hutton York YO41 1LZ, UK
Principal Workers:	F. Smith, M. Holland, S. Kam, V. Nguyen M. Walls, M. Baxter, B. Watkin, C. Irvin, A. Oxley, Z. Steel
Project Manager:	A. Woodward
Team Manager:	A. Woodward
Head of Business Unit:	E. Bradley

Document prepared by:	A. Woodward	20/05/2026
Document checked by Fera:	F. Smith	20/05/2026
Document checked by Cefas:	A Lewis	21/05/2026
Document approved by Cefas:	A Lewis	23/06/2026
Document approved by Cefas	K Litster	26/06/2026

Quality statement: All results were quality checked and approved prior to release to FSS. Results relate only to the samples received. Information relating to the origin of the samples (place and date of collection) is as provided by sampling staff and has not undergone verification checks by Fera or Cefas.

Contents

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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
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)
Non-ortho-PCB	Non-ortho-substituted PCB (co-planar)
Ortho-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-*p*-dioxin/ polychlorinated dibenzofuran (dioxins)
PFAS	Polyfluorinated and perfluorinated alkyl substances
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	TEQ based on TEF values set by World Health Organisation 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 as well as some currently unregulated compounds of interests 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 11 samples of shellfish (8 common mussels and 3 razor clams) for polycyclic aromatic hydrocarbons (PAHs), trace elements, inorganic arsenic, polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), polychlorinated biphenyls (PCBs) and per and polyfluorinated alkyl substances (PFAS). 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 this study are similar to data reported in previous years.

1. Background to Study

Marine shellfish are an excellent source of high-quality protein, are rich in essential minerals, and are typically low in fat. In many parts of the UK — and in Scotland in particular — the shellfish industry continues to make a significant contribution to local and regional economies. In parallel with their nutritional value, shellfish are recognised for their potential to bioaccumulate environmental contaminants. As a consequence, bivalve molluscs such as mussels are widely used as sentinel organisms for monitoring local marine pollution.

Bivalves feed by filtering plankton and suspended particulates from surrounding waters. This feeding strategy results in the bioaccumulation of contaminants of both biogenic and anthropogenic origin present in the aquatic environment. This bioaccumulation potential is of particular relevance for persistent environmental contaminants with long biological and environmental half-lives, including polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs). These compounds have been extensively studied in marine ecosystems, with multiple investigations demonstrating their occurrence, trophic transfer and accumulation in edible marine species, and the associated potential for human dietary exposure through shellfish consumption (e.g. Garraud et al., 2007; Lee et al., 2007; Fernandes et al., 2009; Fernandes et al., 2012; OSPAR, 2023).

Due to food safety concerns, the European Union has historically established maximum permitted levels for dioxins and PCBs in foods, including fish and shellfish (EC, 2006). This framework has since been consolidated and updated under Regulation (EU) 2023/915, which now also explicitly includes maximum levels for selected per- and polyfluoroalkyl substances (PFAS) alongside dioxins and non-dioxin like PCBs. Following EU exit, directly applicable EU food safety legislation in force at the end of the transition period was retained in UK law under the European Union (Withdrawal) Act 2018., which was prior to the introduction of legislative limits for PFAS within the EU, and so no such limits are currently in place within UK legislation.

PCDD/Fs and PCBs remain widely recognised environmental and food contaminants that bioaccumulate in aquatic food webs. Although emissions have declined substantially over recent decades, legacy contamination persists in sediments and biota. Monitoring data confirm that fish and shellfish continue to contain detectable concentrations of these compounds. UK Total Diet Studies and more recent official monitoring programmes consistently identify fish and seafood among the food groups contributing most significantly to dietary exposure to dioxins and PCBs, particularly for high level consumers and individuals with lower body weight (FSA, 2012; FSA/FSS, 2022; EFSA, 2026).

Polycyclic aromatic hydrocarbons (PAHs) arise primarily from incomplete combustion processes. While many finfish species can metabolise PAHs to some extent, shellfish lack effective detoxification pathways and therefore tend to accumulate these compounds in edible tissues. In addition to environmental exposure, PAHs may also be introduced during food processing, with smoked or heat treated fish and shellfish products frequently showing higher concentrations (EC, 2023; FSA, 2025).

Several trace elements — including arsenic, cadmium, mercury and lead — are established toxic contaminants of concern in shellfish. Arsenic commonly occurs in organic forms in seafood, with arsenobetaine predominating in fish and crustaceans and generally regarded as non-toxic. In molluscs and seaweeds, arsenosugars are the dominant species; while their toxicological profiles are not fully characterised, current evidence suggests relatively low toxicity. In contrast, inorganic arsenic species (As(III) and As(V)) remain the most toxic forms and are therefore of greatest regulatory concern. Other elements such as copper, chromium, selenium and zinc are essential micronutrients but may become toxic at elevated exposure levels. These elements can enter marine environments through natural geological sources or via anthropogenic inputs such as industrial activity, historic contamination or unauthorised discharges (EFSA, 2019; FSS, 2022).

Per and polyfluoroalkyl substances (PFAS) are a large group of synthetic fluorinated compounds first developed in the 1940s. Their exceptional thermal and chemical stability, combined with water and oil repellent properties, has led to widespread historical and current use in numerous industrial and consumer applications, including aqueous film forming foams (AFFF), metal plating, polymer manufacture, textiles, food contact materials and cosmetics. It is estimated that several thousand distinct PFAS are currently or have historically been placed on the global market. The same properties that make PFAS commercially valuable also confer extreme environmental persistence and resistance to degradation.

As a result of their extensive use and persistence, PFAS are now ubiquitously detected in aquatic environments, wildlife and humans. Seafood — particularly fish and shellfish — has been identified as one of the principal contributors to dietary PFAS exposure in Europe. Recent assessments by the European Food Safety Authority have established a tolerable weekly intake for a group of four key PFAS (PFOS, PFOA, PFNA and PFHxS) and concluded that exposure in some population groups may exceed health based guidance values, with immune system effects identified as the critical endpoint (EFSA CONTAM Panel, 2022). PFOS and PFOA remain of particular concern due to their bioaccumulative properties and long human half lives, and PFOA is classified by the International Agency for Research on Cancer as possibly carcinogenic to humans (IARC, 2016).

2. Methods

2.1 Sample Collection and Preparation

Sampling officers were required to obtain suitable shellfish samples from designated sampling points within classified shellfish production areas, as defined by 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). Eleven samples of shellfish, including species of common mussels (8 samples) and razor clams (3) were collected between January and March 2026. 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, inorganic arsenic, PFAS and dioxin analysis, in line with the monitoring plan determined by FSS. 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	UK 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

No UK regulations exist for PFAS or inorganic arsenic. For the purpose of evaluating results from this study the EU limits for inorganic arsenic are 0.50 mg/kg for all bivalve molluscs except scallops which have a limit of 0.1 mg/kg. Maximum levels for PFOS, PFOA, PFNAS and PFHxS in bivalve molluscs came into effect within the EU from 1st January 2023 and are given in Table 7 (European Commission 2022).

Dioxins **- all 17, 2,3,7,8-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]naptho[2,1-d]thiophene, anthanthrene, coronene, benzo[ghi]fluoranthene, **benzo[a]anthracene (BaA)**, **chrysene (Chr)**, **benzo[b]fluoranthene (BbF)**, benzo[j]fluoranthene, benzo[k]fluoranthene, **benzo[a]pyrene (BaP)**, 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), total arsenic (As), inorganic arsenic (*i*-As), selenium (Se), silver (Ag), **cadmium** (**Cd), mercury (Hg), lead (Pb)**

PFAS – perfluoro-n-nonanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), perfluorooctanesulfonic acid (PFOS), perfluoro-n-decanoic acid (PFDA), perfluoro-1-butanesulfonic acid (PFBS), perfluoro-n-dodecanoic acid (PFDoA), perfluoro-n-heptanoic acid (PFHpA), perflouoro-n-hexanoic acid (PFHxA), perfluoro-n-pentanoic acid (PFPeA), perfluoro-n-butanoic acid (PFBA), perfluoro-n-octanoic acid (PFOA).

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 ^{13}C-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

All analyses were UKAS accredited to ISO17025 standards, with the inclusion of a reference material (FAPAS T06133 Cod liver oil) and method blanks which were evaluated prior to reporting. Quality control evaluation for the accompanying data follows the criteria specified for chlorinated dioxins and PCBs. In addition, as the National Reference Laboratory (NRL) for dioxins and halogenated contaminants, Fera participates in 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 (Rose et al 2007) and is based on internal standardisation with GC-MS measurement. An aliquot of the homogenised sample was fortified with ^{13}C-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 ISO17025 and includes the assessment of method blanks and reference materials 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 Food Analysis Proficiency Assurance Scheme (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.

The analytical procedure is accredited to ISO17025. 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.

Inorganic arsenic was determined using in-house method FSG 466. The procedure can be summarised as: A representative test portion of the sample is treated with a diluted nitric acid and hydrogen peroxide solution in a heated oven. Hereby the arsenic species are extracted into solution and As (III) is oxidised to As (V). The inorganic arsenic is selectively separated from other arsenic compounds using anion exchange HPLC (High Performance Liquid Chromatography) coupled online to the element-specific detector ICP-MS (Inductively Coupled Plasma Mass Spectrometry) for the determination of the mass fraction of inorganic arsenic. External calibration with solvent matrix-matched standards is used for quantification of the amount of inorganic arsenic. This procedure Is UKAS accredited to ISO17025.

2.6 Fat analysis

For samples requiring dioxin and PCB analysis, total fat was determined by the Werner-Schmidt method under UKAS accreditation, by ifp-labs UK West Yorkshire Ltd.

2.7 Poly and Per-Fluorinated Alkyl Substances - Analytical Methodology

(FSG/417 - Accredited to ISO17025)

Aliquots of homogenised test samples were spiked with stable isotope standards (internal standards) and extracted using alkaline methanol. The resulting solvent extracts were evaporated to near-dryness, resuspended in deionised water and passed through WAX SPE columns. WAX columns allow for the retention of both short and longer chain PFAS analytes due to the ionic exchange and reverse phase properties. Non-specific interferences were washed from the column whilst retained PFAS analytes were eluted using ammonia in methanol. Samples were concentrated and reconstituted in methanol and analysed by ultra-high performance liquid chromatography coupled to a tandem mass spectrometer (UHPLC-MS/MS) and quantified against calibration standards of known concentrations of the PFAS.

3. Results

Analyte concentrations are presented in Tables 3 to 7. The limits of quantification (LOQ, 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. 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 principles set out in "Measurement Uncertainty For Persistent Organic Pollutants By Isotope-Dilution Mass Spectrometry" (Eppe et al 2014). MU and reference material data can be made available if required.

Eleven samples were tested for PCDD/Fs and PCBs. All samples contained PCDD/Fs and PCBs above the LOQ but well within the regulatory limits. Concentrations of individual congeners on a whole and fat weight basis are given in Table 4.

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 Tables 3a and 3b in terms of the 2005 TEFs (van den Berg et al 2006) on a whole and fat weight basis respectively.

Additionally, the sum of the ICES-6 Marker PCBs is also provided (Tables 3a and 3b). 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.

The range for total TEQ (PCDD/F + PCB) on a whole weight, upper bound basis (UB) was 0.07 ng TEQ/kg to 0.18 ng TEQ/kg.

The concentration of ICES-6 PCBs on a whole weight basis (UB) ranged from 0.17 µg/kg to 0.32 µg/kg.

The samples containing the highest concentrations of total TEQ and ICES6 were S26-005982 (Mussels, Olnafirth Inner) and S26-005676 (Razors, Gullane point South) respectively.

Similar to 2025 (and unlike 2024 and 2023), several PCB's analysed were measured above LOQ in all samples, they were PCB's 47, 77, 81, 99, 101, 118, 126, 138, 153 and 169. Since 2022, there has been an increase in the number of PCB's detected each year, albeit it none have been over any regulatory limits, it also worth noting 10 of 25 PCB's analysed as part of this project were not measured above LOQ in any sample.

PAH's were detected in all 11 samples analysed. All samples showed levels below the MRL for BaP (5 µg/kg) and PAH4 (30 µg/kg). BaP was detected above LOQ in 7 of the 11samples. Sum of PAH4 concentrations (UB) ranged from 1.06 µg/kg to 5.59 µg/kg. The sample containing the highest concentration of PAH4 (5.59 µg/kg) was a mussel sample from Foula Wick (S26-005924). PAH4 concentrations were generally higher in the razor samples compared to the mussels. Full results from the PAH analysis are displayed in table 5. Oysters typically contain the highest concentrations of PAH's, however, none were analysed as part of the 2026 programme.

All 11 samples were analysed for heavy metals and inorganic arsenic. The 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 0.189 mg/kg, <0.007 mg/kg to 0.013 mg/kg and 0.066 mg/kg to 0.182 mg/kg respectively. All samples contained quantifiable levels of Cd and Pb, whereas Hg was detected above LOQ in 7 of the 8 of samples.

The highest concentration of Cd was found in a sample of common mussels from Busta Voe Lee North (S26-001079). The highest concentration of Pb was found in a sample of common mussels from Busta Voe Lee South (S26-001061). The highest concentration of Hg was found in a sample of razor clams from North Berwick (S26-005675). Across all samples there was only one instance of an element being not being measured above LOQ (S26-007342), all other elements had a 100% incidence level. Mean values for all elements were broadly lower in 2026 vs 2025 and similar to those measured in 2024.

Inorganic arsenic concentrations (shown as "*i*- As" in Table 6) ranged from <0.007 mg/kg to 0.016 mg/kg, with a mean of 0.01 mg/kg. In previous years there had been potential issues with over-estimation due to interference of monomethyl arsenic, however this year inorganic arsenic was measured by HPLC. Therefore, the results presented represent the true value of inorganic arsenic and are all very low for all samples.

All 11 samples were analysed for PFAS. Seven of the eight samples of mussels received returned values of 0 µg/kg for the lower bound SUM PFAS 4 except one which was measured as 0.05 µg/kg, comprising solely of PFOA, whereas the 3 razor clam samples had measurable levels of between 0.13 and 0.14 µg/kg. However, this was comprised of PFOS only.

Only one of the eight mussel samples analyses contained any PFAS residue above the LOQ (PFOA – 0.05 µg/kg – S26-005982) all other samples returned concentrations below the LOQ.

The only PFAS compound measured above LOQ in the razor clam samples was PFOS (L-, Br and total). All other compounds were less than LOQ.

Data for PFAS can be found in Table 7, with the current EU MPL included for comparison.

In general, the patterns of the contaminant classes were consistent with those recorded in previous years.

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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.
Shetland Islands	Basta Voe Cove	Inner - Site 1 - Thomason	SI-324-399-08	HU51679757	Common mussels	11/02//2026	13/02/2026	S26-005981
Shetland Islands	Busta Voe Lee North	Hevden Ness	SI-327-755-08	HU 3564 6621	Common mussels	13/01/2026	16/01/2026	S26-001079
Shetland Islands	Busta Voe Lee South	Buddascord	SI-328-936-08	HU 3440 6430	Common mussels	13/01/2026	16/01/2026	S26-001061
Shetland Islands	Dales Voe: Scarvar Ayre	Scarvar Ayre 2	SI-050-871-08	HU42226993	Common mussels	24/02/2026	25/02/2026	S26-007342
Highland: Ross & Cromarty	Loch Broom Mussels	Loch Broom Mussels	RC-878-2396-08	NH 16480 87680	Common mussels	13/01/2026	15/01/2026	S26-000925
Shetland Islands	Olna Firth Inner	Clubb of Mulla	SI-232-731-08	HU39576376	Common mussels	10/02/2026	13/02/2026	S26-005982
Shetland Islands	Olna Firth Outer	Foula Wick	SI-232-434-08	HU37376482	Common mussels	10/02/2026	12/02/2026	S26-005924
Shetland Islands	Papa Little Voe	Bight Of Warwick	SI-235-1351-08	HU 3479 6056	Common mussels	13/01/2026	16/01/2026	S26-001067
East Lothian	Gullane Point South	Gullane South	EL-703-1525-16	NT43718181	Razors	08/02/2026	10/02/2026	S26-005676
East Lothian	Gullane Point North	Gullane North	EL-601-1087-16	NT46623849	Razors	08/02/2026	10/02/2026	S26-005674
East Lothian	North Berwick Razors	North Berwick Razors	EL-736-1707-16	NT50508705	Razors	08/02/2026	10/02/2026	S26-005675

Table 2: Samples: Chemical contaminant monitoring plan

FERA LIMS No.	Production Area	Sample Site Name	Species	Trace Elements	*i*-As	PAHs	DXN/ PCBs	PFAS
S26-005981	Basta Voe Cove	Inner - Site 1 - Thomason	Common mussels	X	X	X	X	X
S26-001079	Busta Voe Lee North	Hevden Ness	Common mussels	X	X	X	X	X
S26-001061	Busta Voe Lee South	Buddascord	Common mussels	X	X	X	X	X
S26-007342	Dales Voe: Scarvar Ayre	Scarvar Ayre 2	Common mussels	X	X	X	X	X
S26-000925	Loch Broom Mussels	Loch Broom Mussels	Common mussels	X	X	X	X	X
S26-005982	Olna Firth Inner	Clubb of Mulla	Common mussels	X	X	X	X	X
S26-005924	Olna Firth Outer	Foula Wick	Common mussels	X	X	X	X	X
S26-001067	Papa Little Voe	Bight Of Warwick	Common mussels	X	X	X	X	X
S26-005676	Gullane Point South	Gullane South	Razors	X	X	X	X	X
S26-005674	Gullane Point North	Gullane North	Razors	X	X	X	X	X
S26-005675	North Berwick Razors	North Berwick Razors	Razors	X	X	X	X	X

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

FERA LIMS No.	S26-000925	S26-001061	S26-001067	S26-001079	S26-005674
Description	Common mussels	Common mussels	Common mussels	Common mussels	Razors
	Loch Broom Mussels	Buddascord	Bight Of Warwick	Hevden Ness	Gullane North
PCDD/F TEQ LB (ng/kg)	0.01	0.07	0.04	0.03	0.05
PCDD/F TEQ UB (ng/kg)	0.04	0.08	0.07	0.07	0.07
PCB TEQ LB (ng/kg)	0.02	0.03	0.04	0.04	0.03
PCB TEQ UB (ng/kg)	0.03	0.04	0.05	0.05	0.04
PCDD/F + PCB WHO-TEQ LB (ng/kg)	0.03	0.1	0.08	0.07	0.08
PCDD/F + PCB WHO-TEQ UB (ng/kg)	0.07	0.12	0.12	0.12	0.11
SUM ICES 6 LB (µg/kg)	0.15	0.17	0.20	0.19	0.20
SUM ICES 6 UB (µg/kg)	0.18	0.20	0.23	0.22	0.22

FERA LIMS No.	S26-005675	S26-005676	S26-005924	S26-005981	S26-005982
Description	Razors	Razors	Common mussels	Common mussels	Common mussels
	North Berwick Razors	Gullane South	Foula Wick	Inner - Site 1 - Thomason	Clubb of Mulla
PCDD/F TEQ LB (ng/kg)	0.06	0.07	0.09	0.07	0.13
PCDD/F TEQ UB (ng/kg)	0.08	0.09	0.10	0.08	0.13
PCB TEQ LB (ng/kg)	0.03	0.04	0.04	0.03	0.04
PCB TEQ UB (ng/kg)	0.04	0.05	0.05	0.04	0.01
PCDD/F + PCB WHO-TEQ LB (ng/kg)	0.09	0.11	0.13	0.10	0.17
PCDD/F + PCB WHO-TEQ UB (ng/kg)	0.12	0.14	0.15	0.12	0.18
SUM ICES 6 LB (µg/kg)	0.22	0.30	0.18	0.20	0.21
SUM ICES 6 UB (µg/kg)	0.24	0.32	0.21	0.23	0.24

FERA LIMS No.	S26-007342
Description	Common mussels Scarvar Ayre 2
PCDD/F TEQ LB (ng/kg)	0.06
PCDD/F TEQ UB (ng/kg)	0.08
PCB TEQ LB (ng/kg)	0.03
PCB TEQ UB (ng/kg)	0.04
PCDD/F + PCB WHO-TEQ LB (ng/kg)	0.09
PCDD/F + PCB WHO-TEQ UB (ng/kg)	0.12
SUM ICES 6 LB (µg/kg)	0.14
SUM ICES 6 UB (µg/kg)	0.17

Fera

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

FERA LIMS No.	S26-000925	S26-001061	S26-001067	S26-001079	S26-005674
Description	Common mussels	Common mussels	Common mussels	Common mussels	Razors
	Loch Broom Mussels	Buddascord	Bight Of Warwick	Hevden Ness	Gullane North
Fat %	0.20	1.68	0.82	0.83	0.77
PCDD/F TEQ LB (ng/kg)	15.03	4.85	5.46	4.42	8.26
PCDD/F TEQ UB (ng/kg)	15.03	4.85	8.00	6.50	8.26
PCB TEQ LB (ng/kg)	9.37	2.05	5.10	4.31	3.78
PCB TEQ UB (ng/kg)	9.38	2.05	5.10	4.31	3.79
PCDD/F + PCB WHO-TEQ LB (ng/kg)	24.40	6.90	10.56	8.73	12.04
PCDD/F + PCB WHO-TEQ UB (ng/kg)	24.41	6.90	13.10	10.81	12.05
SUM ICES 6 LB (µg/kg)	81.99	11.07	26.45	24.75	26.89
SUM ICES 6 UB (µg/kg)	81.99	11.07	26.45	24.75	26.89

FERA LIMS No.	S26-005675	S26-005676	S26-005924	S26-005981	S26-005982
Description	Razors	Razors	Common mussels	Common mussels	Common mussels
	North Berwick Razors	Gullane South	Foula Wick	Inner - Site 1 - Thomason	Clubb of Mulla
Fat %	0.95	1.10	0.88	1.17	1.20
PCDD/F TEQ LB (ng/kg)	7.60	7.65	11.22	6.24	10.44
PCDD/F TEQ UB (ng/kg)	7.65	7.74	11.23	6.31	10.54
PCB TEQ LB (ng/kg)	3.26	3.80	4.20	3.03	3.83
PCB TEQ UB (ng/kg)	3.27	3.80	4.20	3.04	3.83
PCDD/F + PCB WHO-TEQ LB (ng/kg)	10.86	11.45	15.42	9.27	14.27
PCDD/F + PCB WHO-TEQ UB (ng/kg)	10.92	11.54	15.43	9.35	14.37
SUM ICES 6 LB (µg/kg)	24.14	28.75	21.80	19.24	19.23
SUM ICES 6 UB (µg/kg)	24.14	28.75	21.80	19.24	19.23

FERA LIMS No.	S26-007342
Description	Common mussels
	Scarvar Ayre 2
Fat %	0.73
PCDD/F TEQ LB (ng/kg)	10.13
PCDD/F TEQ UB (ng/kg)	10.21
PCB TEQ LB (ng/kg)	3.72
PCB TEQ UB (ng/kg)	3.72
PCDD/F + PCB WHO-TEQ LB (ng/kg)	13.85
PCDD/F + PCB WHO-TEQ UB (ng/kg)	13.93
SUM ICES 6 LB (μg/kg)	21.27
SUM ICES 6 UB (μg/kg)	21.27

Fera

Table 4: PCDD/F & PCB concentrations

	FERA LIMS No.	S26-000925		S26-001061	
	Description	Common mussels Loch Broom Mussels		Common mussels Buddascord	
	Units	Whole	Fat (%)	Whole	Fat (%)
2,3,7,8-TCDD	ng/kg	<0.01	1.57	0.82	48.59
1,2,3,7,8-PeCDD	ng/kg	<0.01	4.46	0.07	4.31
1,2,3,4,7,8-HxCDD	ng/kg	<0.01	3.91	0.3	17.76
1,2,3,6,7,8-HxCDD	ng/kg	<0.01	3.76	0.12	6.97
1,2,3,7,8,9-HxCDD	ng/kg	<0.01	3.62	<0.01	0.38
1,2,3,4,6,7,8-HpCDD	ng/kg	0.06i	28.25i	<0.01	<0.01
OCDD	ng/kg	0.3i	152.6i	0.02i	1.27i
2,3,7,8-TCDF	ng/kg	0.06	30.11	<0.01	<0.04
1,2,3,7,8-PeCDF	ng/kg	<0.01	4.75	<0.01	0.11
2,3,4,7,8-PeCDF	ng/kg	0.02	11.59	<0.01	<0.06
1,2,3,4,7,8-HxCDF	ng/kg	<0.01	2.59i	<0.01	0.11i
1,2,3,6,7,8-HxCDF	ng/kg	<0.01	1.71	<0.01	0.01
1,2,3,7,8,9-HxCDF	ng/kg	<0.01	0.68	<0.01	0.21
2,3,4,6,7,8-HxCDF	ng/kg	<0.01	3.53i	<0.01	0.45i
1,2,3,4,6,7,8-HpCDF	ng/kg	0.01	5.53	0.03	1.66
1,2,3,4,7,8,9-HpCDF	ng/kg	<0.01	0.57	0.06	3.69
OCDF	ng/kg	0.01	6.91	0.08	4.81
PCB 77	ng/kg	0.73	366.43	<0.01	0.25
PCB 81	ng/kg	0.06	30.82	<0.01	0.13
PCB 126	ng/kg	0.16	81.29	<0.01	0.19
PCB 169	ng/kg	0.05	27.51	0.04	2.12
PCB 105	µg/kg	<0.01	2.51	<0.01	0.3
PCB 114	µg/kg	<0.01	0.07	<0.01	0.52
PCB 118	µg/kg	0.02	7.75	0.02	0.97
PCB 123	µg/kg	<0.01	0.35	<0.01	<0.01
PCB 156	µg/kg	<0.01	0.81	<0.01	0.4
PCB 157	µg/kg	<0.01	<0.31	0.02	1.38
PCB 167	µg/kg	<0.01	0.84	0.01	0.69
PCB 189	µg/kg	<0.01	0.1	0.03	1.6
PCB 28	µg/kg	<0.01	3.54	0.01	0.79
PCB 52	µg/kg	<0.01	3.34	0.11	6.29
PCB 101	µg/kg	0.02	10.38	0.28	16.4
PCB 138	µg/kg	0.06	28.44	0.14	8.19
PCB 153	µg/kg	0.07	34.22	0.03	1.71
PCB 180	µg/kg	<0.01	2.07	0.08	4.78
PCB 18	µg/kg	<0.01	0.75	0.01	0.62
PCB 31	µg/kg	<0.01	1.96	0.01	0.82
PCB 47	µg/kg	0.02	8.31	<0.01	0.37
PCB 49	µg/kg	<0.01	2.31	0.03	1.89
PCB 51	µg/kg	<0.01	1.71	0.03	1.88
PCB 99	µg/kg	0.01	5.91	<0.01	0.28
PCB 128	µg/kg	<0.01	<0.04	0.04	2.58

	FERA LIMS No.	S26-001067		S26-001079	
	Description	Common mussels Bight Of Warwick		Common mussels Hevden Ness	
	Units	Whole	Fat (%)	Whole	Fat (%)
2,3,7,8-TCDD	ng/kg	<0.01	0.78	<0.01	0.4
1,2,3,7,8-PeCDD	ng/kg	<0.02	<2.24	<0.02	<1.92
1,2,3,4,7,8-HxCDD	ng/kg	<0.01	0.8	<0.01	1.06
1,2,3,6,7,8-HxCDD	ng/kg	0.02	2.15	0.02	1.98
1,2,3,7,8,9-HxCDD	ng/kg	<0.01	<1.1	<0.01	<0.95
1,2,3,4,6,7,8-HpCDD	ng/kg	0.06i	6.95i	0.05i	5.92i
OCDD	ng/kg	0.17i	20.51i	0.12i	14.14i
2,3,7,8-TCDF	ng/kg	0.14	17.07	0.11	13.68
1,2,3,7,8-PeCDF	ng/kg	0.02	2.86	0.02	2.38
2,3,4,7,8-PeCDF	ng/kg	0.06	6.84	0.05	6.19
1,2,3,4,7,8-HxCDF	ng/kg	<0.01	<1.45	<0.01	0.65i
1,2,3,6,7,8-HxCDF	ng/kg	0.01	1.63	<0.01	0.87
1,2,3,7,8,9-HxCDF	ng/kg	<0.01	<0.45	<0.01	<0.42
2,3,4,6,7,8-HxCDF	ng/kg	0.02i	2.75i	0.02i	2.03i
1,2,3,4,6,7,8-HpCDF	ng/kg	<0.02	2.23	<0.02	<2.1
1,2,3,4,7,8,9-HpCDF	ng/kg	<0.01	<0.28	<0.01	0.3
OCDF	ng/kg	0.02	2.09	0.02	1.85
PCB 77	ng/kg	0.9	109.9	0.75	89.77
PCB 81	ng/kg	0.08	9.43	0.06	7.78
PCB 126	ng/kg	0.37	45.6	0.32	38.15
PCB 169	ng/kg	0.11	12.87	0.1	12.28
PCB 105	µg/kg	<0.01	0.84	<0.01	0.76
PCB 114	µg/kg	<0.01	0.02	<0.01	<0.02
PCB 118	µg/kg	0.02	3.02	0.02	2.55
PCB 123	µg/kg	<0.01	<0.08	<0.01	<0.06
PCB 156	µg/kg	<0.01	0.24	<0.01	0.22
PCB 157	µg/kg	<0.01	0.12	<0.01	0.1
PCB 167	µg/kg	<0.01	0.3	<0.01	0.27
PCB 189	µg/kg	<0.01	0.03	<0.01	0.04
PCB 28	µg/kg	<0.01	0.52	<0.01	0.35
PCB 52	µg/kg	<0.01	1.09	<0.01	0.77
PCB 101	µg/kg	0.03	3.79	0.03	3.12
PCB 138	µg/kg	0.07	9.02	0.06	7.79
PCB 153	µg/kg	0.1	11.63	0.1	12.35
PCB 180	µg/kg	<0.01	0.4	<0.01	0.37
PCB 18	µg/kg	<0.01	0.34	<0.01	0.21
PCB 31	µg/kg	<0.01	0.46	<0.01	0.32
PCB 47	µg/kg	0.15	18.76	0.03	4.06
PCB 49	µg/kg	<0.01	0.85	<0.01	0.51
PCB 51	µg/kg	0.03	4.26	<0.01	1.05
PCB 99	µg/kg	0.02	2.17	0.02	1.88
PCB 128	µg/kg	<0.01	<0.01	<0.01	<0.01

	FERA LIMS No.	S26-005674		S26-005675	
	Description	Razors Gullane North		Razors North Berwick Razors	
	Units	Whole	Fat (%)	Whole	Fat (%)
2,3,7,8-TCDD	ng/kg	<0.01	0.85	<0.01	0.94
1,2,3,7,8-PeCDD	ng/kg	0.01	1.77	0.02	1.84
1,2,3,4,7,8-HxCDD	ng/kg	<0.01	0.96	<0.01	0.86
1,2,3,6,7,8-HxCDD	ng/kg	0.02	2.38	0.02	2
1,2,3,7,8,9-HxCDD	ng/kg	0.01	1.7	0.01	1.37
1,2,3,4,6,7,8-HpCDD	ng/kg	0.13i	16.78i	0.12i	12.19i
OCDD	ng/kg	0.55i	72.43i	0.47i	48.93i
2,3,7,8-TCDF	ng/kg	0.15	18.94	0.17	17.37
1,2,3,7,8-PeCDF	ng/kg	0.02	2.43	0.02	1.89
2,3,4,7,8-PeCDF	ng/kg	0.06	7.46	0.06	6.51
1,2,3,4,7,8-HxCDF	ng/kg	0.02	2.5	0.02	1.74
1,2,3,6,7,8-HxCDF	ng/kg	0.01	1.5	<0.01	1.04
1,2,3,7,8,9-HxCDF	ng/kg	<0.01	0.51	<0.01	<0.48
2,3,4,6,7,8-HxCDF	ng/kg	0.02	2.1	0.02	1.87
1,2,3,4,6,7,8-HpCDF	ng/kg	0.05	7.07	0.04	4.6
1,2,3,4,7,8,9-HpCDF	ng/kg	<0.01	0.36	<0.01	<0.26
OCDF	ng/kg	0.06	7.25	0.04	4.55
PCB 77	ng/kg	1.97	257.57	2.27	237.97
PCB 81	ng/kg	0.13	16.99	0.16	16.75
PCB 126	ng/kg	0.26	33.56	0.27	28.79
PCB 169	ng/kg	0.06	7.44	0.06	6.52
PCB 105	µg/kg	0.01	1.37	0.01	1.25
PCB 114	µg/kg	<0.01	<0.03	<0.01	0.04
PCB 118	µg/kg	0.03	3.96	0.03	3.64
PCB 123	µg/kg	<0.01	0.09	<0.01	<0.1
PCB 156	µg/kg	<0.01	0.27	<0.01	0.19
PCB 157	µg/kg	<0.01	0.12	<0.01	0.08
PCB 167	µg/kg	<0.01	<0.22	<0.01	<0.18
PCB 189	µg/kg	<0.01	<0.03	<0.01	<0.02
PCB 28	µg/kg	<0.01	0.96	<0.01	0.77
PCB 52	µg/kg	0.01	1.49	0.01	1.25
PCB 101	µg/kg	0.04	4.74	0.04	4.37
PCB 138	µg/kg	0.07	9.09	0.08	8.17
PCB 153	µg/kg	0.08	10.2	0.09	9.28
PCB 180	µg/kg	<0.01	0.41	<0.01	0.3
PCB 18	µg/kg	<0.01	0.51	<0.01	0.32
PCB 31	µg/kg	<0.01	0.83	<0.01	0.66
PCB 47	µg/kg	0.03	4.12	0.03	3.17
PCB 49	µg/kg	<0.01	0.99	<0.01	0.84
PCB 51	µg/kg	<0.01	1	<0.01	0.7
PCB 99	µg/kg	0.02	2.74	0.02	2.56
PCB 128	µg/kg	<0.01	0.08	<0.01	<0.01

	FERA LIMS No.	S26-005676		S26-005924	
	Description	Razors Gullane South		Common mussels Foula Wick	
	Units	Whole	Fat (%)	Whole	Fat (%)
2,3,7,8-TCDD	ng/kg	<0.01	0.76	<0.01	0.54
1,2,3,7,8-PeCDD	ng/kg	0.02	1.9	0.03	3.47
1,2,3,4,7,8-HxCDD	ng/kg	<0.01	<0.87	0.02	1.72
1,2,3,6,7,8-HxCDD	ng/kg	0.03	2.3	0.03	3.86
1,2,3,7,8,9-HxCDD	ng/kg	0.02	1.73	0.02	2.09
1,2,3,4,6,7,8-HpCDD	ng/kg	0.16i	14.1i	0.15i	16.69i
OCDD	ng/kg	0.71i	64.68i	0.26i	29.1i
2,3,7,8-TCDF	ng/kg	0.20	18.15	0.14	16.04
1,2,3,7,8-PeCDF	ng/kg	0.02	1.77	0.04	4.24
2,3,4,7,8-PeCDF	ng/kg	0.07	6.34	0.10	11.34
1,2,3,4,7,8-HxCDF	ng/kg	0.02	1.86	0.02	1.75
1,2,3,6,7,8-HxCDF	ng/kg	0.01	1.34	0.02	2.77
1,2,3,7,8,9-HxCDF	ng/kg	<0.01	0.46	<0.01	0.83
2,3,4,6,7,8-HxCDF	ng/kg	0.02i	2.27i	0.05	5.46
1,2,3,4,6,7,8-HpCDF	ng/kg	0.07i	6.1i	0.05	5.3
1,2,3,4,7,8,9-HpCDF	ng/kg	<0.01	<0.37	<0.01	<1.02
OCDF	ng/kg	0.06i	5.73i	0.05	5.33
PCB 77	ng/kg	2.86	259.91	0.74	84.38
PCB 81	ng/kg	0.20	17.95	0.06	6.99
PCB 126	ng/kg	0.37	33.3	0.32	36.67
PCB 169	ng/kg	0.08	6.94	0.12	13.27
PCB 105	µg/kg	0.02	1.78	<0.01	0.71
PCB 114	µg/kg	<0.01	0.06	<0.01	<0.02
PCB 118	µg/kg	0.05	4.85	0.02	2.68
PCB 123	µg/kg	<0.01	0.16	<0.01	<0.06
PCB 156	µg/kg	<0.01	0.38	<0.01	0.2
PCB 157	µg/kg	<0.01	0.11	<0.01	0.1
PCB 167	µg/kg	<0.01	0.29	<0.01	0.24
PCB 189	µg/kg	<0.01	0.02	<0.01	0.03
PCB 28	µg/kg	<0.01	0.79	<0.01	0.52
PCB 52	µg/kg	0.01	1.34	<0.01	0.92
PCB 101	µg/kg	0.06	5.59	0.03	2.93
PCB 138	µg/kg	0.11	10.01	0.06	7.01
PCB 153	µg/kg	0.12	10.72	0.09	9.87
PCB 180	µg/kg	<0.01	0.3	<0.01	0.55
PCB 18	µg/kg	<0.01	0.29	<0.01	0.39
PCB 31	µg/kg	<0.01	0.57	<0.01	0.45
PCB 47	µg/kg	0.10	9.16	0.03	3.42
PCB 49	µg/kg	0.01	1.01	<0.01	0.62
PCB 51	µg/kg	0.02	1.94	<0.01	0.82
PCB 99	µg/kg	0.03	3.14	0.02	1.83
PCB 128	µg/kg	<0.01	<0.06	<0.01	<0.01

	FERA LIMS No.	S26-005981		S26-005982	
	Description	Common mussels Inner - Site 1 - Thomason		Common mussels Clubb of Mulla	
	Units	Whole	Fat (%)	Whole	Fat (%)
2,3,7,8-TCDD	ng/kg	<0.01	0.41	0.01	0.9
1,2,3,7,8-PeCDD	ng/kg	0.02	1.7	0.04	2.94
1,2,3,4,7,8-HxCDD	ng/kg	<0.01	0.67	0.02	1.63
1,2,3,6,7,8-HxCDD	ng/kg	0.02	1.81	0.04	3.63
1,2,3,7,8,9-HxCDD	ng/kg	0.01	0.89	0.02	2.03
1,2,3,4,6,7,8-HpCDD	ng/kg	0.08i	6.87i	0.16i	13.47i
OCDD	ng/kg	0.12i	10.57i	0.32i	26.54i
2,3,7,8-TCDF	ng/kg	0.13	11.47	0.19	15.83
1,2,3,7,8-PeCDF	ng/kg	0.03	2.53	0.05	4.58
2,3,4,7,8-PeCDF	ng/kg	0.08	6.8	0.12	10.22
1,2,3,4,7,8-HxCDF	ng/kg	0.01	0.88	0.02	1.64
1,2,3,6,7,8-HxCDF	ng/kg	0.01	1.02	0.03	2.18
1,2,3,7,8,9-HxCDF	ng/kg	<0.01	<0.68	<0.01	<0.92
2,3,4,6,7,8-HxCDF	ng/kg	0.03	2.48	0.06i	5.14i
1,2,3,4,6,7,8-HpCDF	ng/kg	0.02	1.53	0.05i	4.16i
1,2,3,4,7,8,9-HpCDF	ng/kg	<0.01	<0.54	<0.01	0.7
OCDF	ng/kg	<0.02	1.71	0.05i	4.31i
PCB 77	ng/kg	0.78	66.47	1.12	93.54
PCB 81	ng/kg	0.07	6.18	0.10	7.95
PCB 126	ng/kg	0.31	26.29	0.40	33.46
PCB 169	ng/kg	0.11	9.64	0.14	11.94
PCB 105	µg/kg	<0.01	0.6	<0.01	0.72
PCB 114	µg/kg	<0.01	0.02	<0.01	0.02
PCB 118	µg/kg	0.03	2.31	0.03	2.37
PCB 123	µg/kg	<0.01	<0.04	<0.01	0.07
PCB 156	µg/kg	<0.01	0.2	<0.01	0.18
PCB 157	µg/kg	<0.01	0.08	<0.01	0.09
PCB 167	µg/kg	<0.01	0.21	<0.01	0.21
PCB 189	µg/kg	<0.01	<0.04	<0.01	<0.02
PCB 28	µg/kg	<0.01	0.39	<0.01	0.43
PCB 52	µg/kg	<0.01	0.77	<0.01	0.75
PCB 101	µg/kg	0.03	2.78	0.03	2.62
PCB 138	µg/kg	0.07	5.99	0.07	6.07
PCB 153	µg/kg	0.10	8.87	0.11	8.99
PCB 180	µg/kg	<0.01	0.44	<0.01	0.37
PCB 18	µg/kg	<0.01	0.25	<0.01	0.31
PCB 31	µg/kg	<0.01	0.32	<0.01	0.36
PCB 47	µg/kg	0.03	2.73	<0.03	<2.32
PCB 49	µg/kg	<0.01	0.46	<0.01	0.49
PCB 51	µg/kg	<0.01	0.66	<0.01	0.43
PCB 99	µg/kg	0.02	1.67	0.02	1.68
PCB 128	µg/kg	<0.01	<0.01	<0.01	<0.01

	FERA LIMS No.	S26-007342	
	Description	Common mussels Scarvar Ayre 2	
	Units	Whole	Fat (%)
2,3,7,8-TCDD	ng/kg	<0.01	0.61
1,2,3,7,8-PeCDD	ng/kg	0.02	3.18
1,2,3,4,7,8-HxCDD	ng/kg	<0.01	1.37
1,2,3,6,7,8-HxCDD	ng/kg	0.02	3.42
1,2,3,7,8,9-HxCDD	ng/kg	0.01	1.54
1,2,3,4,6,7,8-HpCDD	ng/kg	0.09i	13.07i
OCDD	ng/kg	0.15i	21.33i
2,3,7,8-TCDF	ng/kg	0.11	15.48
1,2,3,7,8-PeCDF	ng/kg	0.03	3.76
2,3,4,7,8-PeCDF	ng/kg	0.08	10.57
1,2,3,4,7,8-HxCDF	ng/kg	<0.01	1.32
1,2,3,6,7,8-HxCDF	ng/kg	0.01	1.69
1,2,3,7,8,9-HxCDF	ng/kg	<0.01	<0.82
2,3,4,6,7,8-HxCDF	ng/kg	0.03	3.92
1,2,3,4,6,7,8-HpCDF	ng/kg	0.03	3.96
1,2,3,4,7,8,9-HpCDF	ng/kg	<0.01	0.33
OCDF	ng/kg	0.03	3.63
PCB 77	ng/kg	0.56	76.51
PCB 81	ng/kg	0.05	6.69
PCB 126	ng/kg	0.23	32.15
PCB 169	ng/kg	0.09	12.66
PCB 105	µg/kg	<0.01	0.8
PCB 114	µg/kg	<0.01	0.03
PCB 118	µg/kg	0.02	2.63
PCB 123	µg/kg	<0.01	0.04
PCB 156	µg/kg	<0.01	0.21
PCB 157	µg/kg	<0.01	0.09
PCB 167	µg/kg	<0.01	0.26
PCB 189	µg/kg	<0.01	0.03
PCB 28	µg/kg	<0.01	0.52
PCB 52	µg/kg	<0.01	0.94
PCB 101	µg/kg	0.02	2.71
PCB 138	µg/kg	0.05	6.9
PCB 153	µg/kg	0.07	9.66
PCB 180	µg/kg	<0.01	0.54
PCB 18	µg/kg	<0.01	0.36
PCB 31	µg/kg	<0.01	0.46
PCB 47	µg/kg	0.02	3.15
PCB 49	µg/kg	<0.01	0.55
PCB 51	µg/kg	<0.01	0.75
PCB 99	µg/kg	0.01	1.65
PCB 128	µg/kg	<0.01	<0.01

NOTE: *where shown i = indicative*

Table 5: PAH concentrations (µg/kg Whole weight)

FERA LIMS No.	S26-000925	S26-001061	S26-001067	S26-001079	S26-005674
Description	Common mussels	Common mussels	Common mussels	Common mussels	Razors
	Loch Broom Mussels	Buddascord	Bight Of Warwick	Hevden Ness	Gullane North
acenaphthylene	<0.29	<0.54	<0.3	<0.54	<0.16
acenaphthene	<0.75	<0.98	<0.76	<0.97	<0.67
fluorene	<0.8	<0.94	<0.81	<0.93	<0.86
phenanthrene	<1.13	3.66	3.71	4.59	1.5
anthracene	0.06	0.3	0.11	0.26	0.09
fluoranthene	1.41	1.87	<1.08	0.97	4.15
benzo[c]fluorene	0.05	<0.22	0.02	<0.07	0.13
pyrene	<1.2	1.48	<1.22	0.82	1.74
benzo[ghi]fluoranthene	0.46	0.47	0.22	0.24	1.29
benzo[a]anthracene	**0.28**	**0.31**	**0.11**	**0.11**	**1.07**
benzo[b]naphtho[2,1-d]thiophene	0.12	<0.1	0.06	<0.05	0.38
cyclopenta[cd]pyrene	0.03	0.05	0.02	0.03	0.02
chrysene	**0.42**	**0.49**	**0.29**	**0.25**	**1.36**
5-methylchrysene	<0.01	<0.04	<0.01	<0.01	<0.06
benzo[b]fluoranthene	**0.68**	**1.07**	**0.55**	**0.48**	**1.96**
benzo[j]fluoranthene	0.27	0.44	0.17	0.16	0.84
benzo[k]fluoranthene	<0.26	0.4	<0.16	0.13	0.92
benzo[e]pyrene	1.05	1.26	0.66	0.59	2.71
benzo[a]pyrene	**<0.21**	**0.3**	**<0.21**	**<0.22**	**0.78**
indeno[1,2,3-cd]pyrene	<0.26	0.52	<0.22	<0.2	0.78
dibenz[a,h]anthracene	<0.07	<0.1	<0.07	<0.08	<0.18
benzo[ghi]perylene	0.36	0.73	0.4	0.41	0.75
anthanthrene	<0.1	<0.1	<0.1	<0.1	<0.1
dibenzo[a,l]pyrene	<0.31	<0.31	<0.31	<0.31	<0.31
dibenzo[a,e]pyrene	<0.23	<0.19	<0.23	<0.19	<0.24
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	<0.15
PAH 4 Sum UB	**1.59**	**2.17**	**1.16**	**1.06**	**5.17**
PAH 4 Sum LB	**1.38**	**2.17**	**0.95**	**0.84**	**5.17**

FERA LIMS No.	S26-005675	S26-005676	S26-005924	S26-005981	S26-005982
Description	Razors	Razors	Common mussels	Common mussels	Common mussels
	North Berwick Razors	Gullane South	Foula Wick	Inner - Site 1 - Thomason	Clubb of Mulla
acenaphthylene	<0.16	0.18	<0.16	<0.17	<0.16
acenaphthene	<0.68	<0.68	<0.67	<0.68	<0.67
fluorene	<0.87	<0.87	<0.86	<0.87	<0.86
phenanthrene	1.39	1.65	1.88	<1.16	1.7
anthracene	0.05	0.13	0.04	<0.02	0.03
fluoranthene	3.88	4.33	4.17	1.65	3.81
benzo[c]fluorene	0.12	0.13	0.11	0.03	0.08
pyrene	1.6	1.7	2.07	<1.19	1.81
benzo[ghi]fluoranthene	1.15	1.52	1.71	0.63	1.64
benzo[a]anthracene	**0.88**	**1.12**	**0.81**	**0.38**	**0.84**
benzo[b]naphtho[2,1-d]thiophene	0.31	<0.01	0.21	0.1	0.21
cyclopenta[cd]pyrene	0.02	<0.01	0.16	0.05	0.16
chrysene	**1.17**	**1.49**	**2**	**0.88**	**1.89**
5-methylchrysene	<0.06	<0.05	<0.03	<0.01	<0.03
benzo[b]fluoranthene	**1.72**	**2.05**	**2.26**	**0.97**	**2.21**
benzo[j]fluoranthene	0.76	0.86	1.07	0.39	1
benzo[k]fluoranthene	0.78	0.98	0.84	0.35	0.82
benzo[e]pyrene	2.31	4.35	2.36	1.08	2.37
benzo[a]pyrene	**0.63**	**0.75**	**0.52**	**0.27**	**0.52**
indeno[1,2,3-cd]pyrene	0.62	0.72	0.75	0.33	0.79
dibenzo[ah]anthracene	<0.15	<0.16	<0.14	<0.1	<0.14
benzo[ghi]perylene	0.57	0.69	0.89	0.31	0.94
anthanthrene	<0.1	<0.1	<0.1	<0.1	<0.1
dibenzo[a,l]pyrene	<0.31	<0.31	<0.31	<0.31	<0.31
dibenzo[a,e]pyrene	<0.24	<0.24	<0.24	<0.24	<0.24
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	<0.15	0.2	<0.15	<0.16	<0.15
PAH 4 Sum UB	**4.4**	**5.41**	**5.59**	**2.5**	**5.46**
PAH 4 Sum LB	**4.4**	**5.41**	**5.59**	**2.5**	**5.46**

FERA LIMS No.	S26-007342
Description	Common mussels Scarvar Ayre 2
acenaphthylene	<0.12
acenaphthene	<0.72
fluorene	<0.79
phenanthrene	1.2
anthracene	<0.06
fluoranthene	2.29
benzo[c]fluorene	0.03
pyrene	1.64
benzo[ghi]fluoranthene	0.53
benzo[a]anthracene	**0.25**
benzo[b]naphtho[2,1-d]thiophene	0.07
cyclopenta[cd]pyrene	0.07
chrysene	**0.66**
5-methylchrysene	<0.01
benzo[b]fluoranthene	**0.76**
benzo[j]fluoranthene	0.33
benzo[k]fluoranthene	0.25
benzo[e]pyrene	0.88
benzo[a]pyrene	**<0.22**
indeno[1,2,3-cd]pyrene	0.31
dibenzo[ah]anthracene	<0.1
benzo[ghi]perylene	0.39
anthanthrene	<0.1
dibenzo[a,l]pyrene	<0.39
dibenzo[a,e]pyrene	<0.31
dibenzo[a,i]pyrene	<0.1
dibenzo[a,h]pyrene	<0.1
coronene	0.11
PAH 4 Sum UB	**1.89**
PAH 4 Sum LB	**1.67**

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

FERA LIMS No.	S26-000925	S26-001061	S26-001067	S26-001079	S26-005674
Description	Common mussels	Common mussels	Common mussels	Common mussels	Razors
	Loch Broom Mussels	Buddascord	Bight Of Warwick	Hevden Ness	Gullane North
Chromium	0.15	0.16	0.09	0.09	0.59
Manganese	2.28	1.74	0.65	0.72	3.06
Cobalt	0.033	0.033	0.022	0.024	0.072
Nickel	0.12	0.14	0.09	0.1	0.2
Copper	0.8	1.22	0.88	0.94	1.15
Zinc	13.4	18.2	15.1	14.3	15.6
Arsenic	2.16	2.22	1.8	1.95	1.51
i-As	0.007	0.016	< 0.007	< 0.007	0.011
Selenium	0.59	0.45	0.3	0.32	0.26
Silver	0.009	0.003	0.005	0.005	0.106
Cadmium	0.067	0.101	0.17	0.189	0.02
Mercury	0.009	0.007	0.009	0.01	0.008
Lead	0.066	0.182	0.138	0.152	0.091

FERA LIMS No.	S26-005675	S26-005676	S26-005924	S26-005981	S26-005982
Description	Razors	Razors	Common mussels	Common mussels	Common mussels
	North Berwick Razors	Gullane South	Foula Wick	Inner - Site 1 - Thomason	Clubb of Mulla
Chromium	0.37	0.45	0.27	0.1	0.14
Manganese	3.01	3.47	1.61	0.69	1.47
Cobalt	0.086	0.082	0.036	0.025	0.034
Nickel	0.18	0.22	0.18	0.1	0.12
Copper	1.26	1.11	1.14	0.89	1.07
Zinc	16.6	15	24.1	19.9	23.5
Arsenic	1.49	1.49	2.06	2.32	2.12
i-As	< 0.007	0.01	0.01	< 0.007	< 0.007
Selenium	0.28	0.25	0.4	0.38	0.41
Silver	0.215	0.088	0.007	0.005	0.006
Cadmium	0.021	0.02	0.117	0.115	0.124
Mercury	0.013	0.009	0.007	0.008	0.007
Lead	0.088	0.099	0.166	0.11	0.175

FERA LIMS No.	S26-007342
Description	Common mussels
	Scarvar Ayre 2
Chromium	0.11
Manganese	0.59
Cobalt	0.023
Nickel	0.09
Copper	0.62
Zinc	21.2
Arsenic	1.54
i- As	< 0.007
Selenium	0.34
Silver	0.004
Cadmium	0.136
Mercury	<0.007
Lead	0.125

Table 7: PFAS Concentrations (µg/kg whole weight)

FERA LIMS No.		S26-000925	S26-001061	S26-001067	S26-001079	S26-005674
Description	MPL Regulation (EU) 2023/915	Common mussels	Common mussels	Common mussels	Common mussels	Razors
		Loch Broom Mussels	Buddascord	Bight Of Warwick	Hevden Ness	Gullane North
PFNA	**1**	<0.05	<0.05	<0.05	<0.05	<0.05
L- PFHxS		<0.04	<0.04	<0.04	<0.04	<0.04
Br-PFHxS		<0.01	<0.01	<0.01	<0.01	<0.01
Total PFHxS	**1.5**	<0.05	<0.05	<0.05	<0.05	<0.05
L-PFOS		<0.04	<0.04	<0.04	<0.04	0.13
Br-PFOS		<0.01	<0.01	<0.01	<0.01	0.01
Total PFOS	**3**	<0.05	<0.05	<0.05	<0.05	0.14
PFDA		<0.05	<0.05	<0.05	<0.05	<0.05
PFBS		<0.04	<0.04	<0.04	<0.04	<0.04
PFDoA		<0.05	<0.05	<0.05	<0.05	<0.05
PFHpA		<0.05	<0.05	<0.05	<0.05	<0.05
PFHxA		<0.05	<0.05	<0.05	<0.05	<0.05
PFPeA		<0.08	<0.08	<0.08	<0.08	<0.08
PFOA	**0.7**	<0.05	<0.05	<0.05	<0.05	<0.05
SUM EU 4 PFAS LB	**5**	0	0	0	0	0.14
SUM EU 4 PFAS UB		0.2	0.2	0.2	0.2	0.29

FERA LIMS No.		S26-005675	S26-005676	S26-005924	S26-005981	S26-005982
Description	MPL Regulation (EU) 2023/915	Razors	Razors	Common mussels	Common mussels	Common mussels
		North Berwick Razors	Gullane South	Foula Wick	Inner - Site 1 - Thomason	Clubb of Mulla
PFNA	**1**	<0.05	<0.05	<0.05	<0.05	<0.05
L- PFHxS		<0.04	<0.04	<0.04	<0.04	<0.04
Br-PFHxS		<0.01	<0.01	<0.01	<0.01	<0.01
Total PFHxS	**1.5**	<0.05	<0.05	<0.05	<0.05	<0.05
L-PFOS		0.12	0.11	<0.04	<0.04	<0.04
Br-PFOS		0.01	0.02	<0.01	<0.01	<0.01
Total PFOS	**3**	0.13	0.13	<0.05	<0.05	<0.05
PFDA		<0.05	<0.05	<0.05	<0.05	<0.05
PFBS		<0.04	<0.04	<0.04	<0.04	<0.04
PFDoA		<0.05	<0.05	<0.05	<0.05	<0.05
PFHpA		<0.05	<0.05	<0.05	<0.05	<0.05
PFHxA		<0.05	<0.05	<0.05	<0.05	<0.05
PFPeA		<0.08	<0.08	<0.08	<0.08	<0.08
PFOA	**0.7**	<0.05	<0.05	<0.05	<0.05	0.05
SUM EU 4 PFAS LB	**5**	0.13	0.13	0	0	0.05
SUM EU 4 PFAS UB		0.28	0.28	0.2	0.2	0.2

FERA LIMS No.		S26-007342
Description	MPL Regulation (EU) 2023/915	Common mussels
		Scarvar Ayre 2
PFNA	**1**	<0.05
L- PFHxS		<0.04
Br-PFHxS		<0.01
Total PFHxS	**1.5**	<0.05
L-PFOS		<0.04
Br-PFOS		<0.01
Total PFOS	**3**	<0.05
PFDA		<0.05
PFBS		<0.04
PFDoA		<0.05
PFHpA		<0.05
PFHxA		<0.05
PFPeA		<0.08
PFOA	**0.7**	<0.05
SUM EU 4 PFAS LB	**5**	0
SUM EU 4 PFAS UB		0.2