

## Agri-Food & Biosciences Institute

Annual report for marine biotoxin analysis, official  
control monitoring programme for Northern Ireland  
1<sup>st</sup> January 2023 – 31<sup>st</sup> December 2023

**Final Version**  
**20/02/2024**

Document prepared by:	Hugh McEneny, AFBI	20/02/24
Document checked by:	Anna Gadaj, AFBI	20/02/24
Document approved by:	Anna Gadaj, AFBI	20/02/24
Document approved by:	Will Wiltshire, FSANI	28/02/24
Review date:	N/A	
Classification:	Not classified	

Contract reference: FS515003

**11 pages**

Quality statement: This report is a compilation of the information included on the reports provided weekly/monthly to the FSANI and showing the results of the toxin analyses undertaken on samples submitted by third parties. All results were quality checked and approved prior to release to the FSANI and the results compiled in this report have been further checked against a copy of the original reports held on a central database. Information relating to the origin of the samples (place, date and time of collection) is as provided by sampling staff and has not undergone verification checks by AFBI.

## Method standard operating procedures used during the course of the programme:

Determination of Domoic Acid in Shellfish by High Performance Liquid Chromatography (CSD 406)

Determination of Paralytic Shellfish Poison by High Performance Liquid Chromatography (CSD 408/409)

Determination of Lipophilic Toxins in Shellfish Species by LC-MS/MS (CSD 379)

## Results of programme

**Table 1: Monitoring samples received 2023.**

Sample type	Number of samples
Oyster	206
Mussel	212

418 samples in 2023

**Table 2: Tests carried out 2023.**

Test	Oyster	Mussel	Total
Domoic Acid	94	101	195
PSP	92	90	182
Lipophilic Toxins	205	203	408

785 biotoxin tests carried out in 2023.

**Table 3: Positive Northern Ireland monitoring samples 2023 (levels above the regulatory limits)**

Test	Oyster	Mussel	Total
Domoic Acid	0	0	0
PSP	0	0	0
Lipophilic Toxins	0	0	0

0 monitoring samples reported as exceeding regulatory limits in 2023.

**Table 4: Turnaround times 2023**

<b>Test</b>	<b>Target</b>	<b>Percentage within target</b>
Domoic Acid	95% in 3 days	100%
PSP	95% in 3 days	100%
Lipophilic Toxins	95% in 3 days	100%

**Table 5: Overview of the toxin results obtained for each bed monitored in 2023 within NI classified production areas**

**Maximum toxin levels detected in 2023.**

Site location	Site Identification Reference (SIR)	No. of samples received	Shellfish Species	DSP: OA/DTX/PTX (µg/kg)	DSP: AZA (µg/kg)	DSP: YTX (mg/kg)	PSP (µg/kg)	ASP (µg/g)
Belfast Lough	B1-AFFNI 55	21	Mussel	30	NEG	NEG	NEG	<0.3
Belfast Lough	B3-AFFNI 50	23	Mussel	17	NEG	NEG	NEG	<0.3
Belfast Lough	B12-AFFNI 54	21	Mussel	73	NEG	NEG	NEG	<0.3
Belfast Lough	B20-AFFNI 53	21	Mussel	62	NEG	NEG	NEG	<0.3
Carlingford Lough	C1-AFFNI 27	51	Mussel	NEG	NEG	NEG	NEG	<0.3
Carlingford Lough	C11-AFFNI 84	51	Oyster	86	NEG	NEG	NEG	0.36
Carlingford Lough	C15-AFFNI 89	51	Oyster	49	NEG	NEG	NEG	<0.3
Carlingford Lough	NW-Wild Fishery	50	Mussel	NEG	NEG	NEG	NEG	<0.3
Dundrum Bay	DB1-AFFNI 95A	33	Oyster	57	NEG	NEG	NEG	3.0
Killough	K1-AFFNI 18	14	Oyster	30	NEG	NEG	NEG	0.3
Larne Lough	L3-AFFNI 88	17	Oyster	NEG	NEG	NEG	NEG	<0.3
Lough Foyle	PA3O-Wild Fishery	9	Oyster	NEG	NEG	NEG	NEG	<0.3
Lough Foyle	PA4O- Wild Fishery	9	Oyster	NEG	NEG	NEG	NEG	<0.3
Strangford Lough	S2-AFFNI 42	25	Mussel	65	NEG	NEG	NEG	<0.3
Strangford Lough	S7-AFFNI 76	22	Oyster	NEG	NEG	NEG	NEG	<0.3

## Proficiency test results for methods used for official control purposes in 2023.

Performance in proficiency tests is assessed using a z-score. This is calculated for each participant's data.

Each sample /matrix combination is given an assigned value and z-score is calculated thus:  

$$z\text{-score} = \frac{\text{Mean from Laboratory} - \text{Assigned Value}}{\text{Total Error}}$$

The total error is based on values set for the proportional error and the constant error. These values are set by the organisers. The numbers in the z column indicate:

$|z| < 2$  satisfactory performance

$2 < |z| < 3$  questionable performance

$|z| > 3$  unsatisfactory performance

### Domoic Acid 2023 Proficiency Test Summaries

**Table 6: Quasimeme round 2023.1 - HPLC**

Sample ID	Sample description	Assigned value	Reported value	Units	z-score
QST332BT	Scallop Tissue	56.1	58.0	mg/kg	0.30
QST3333BT	Pacific oyster	7.64	7.14	mg/kg	-0.60
QST334BT	King Scallop	20.1	21.76	mg/kg	0.80

**Table 7: Quasimeme round 2023.2 - HPLC**

Sample ID	Sample description	Assigned value	Reported value	Units	z-score
QST341BT	Oyster + scallop Tissue	20.7	21.17	mg/kg	0.2
QST342BT	Mussel Tissue	48.0	47.68	mg/kg	-0.1
QST343BT	Oyster Tissue	13.3	13.18	mg/kg	-0.1

**Table 8: EURLMB 2023 (NI NRL Wageningen) - HPLC**

Sample ID	Sample description	Assigned value	Reported value	Units	z-score
EURLMB/23/A/01	Mixed Scallop Tissue	9.2	9.3	mg/kg	0.09
EURLMB/23/A/02	Mixed Clam Tissue	4.3	3.5	mg/kg	-1.26

PSP 2023 proficiency test summaries

Table 9: Quasimeme round 2023.1 - HPLC

Sample ID	Sample description	Determinant	Assigned value	Reported value	Units	z-score
QST338BT	Mixed mussel tissue	C1C2	2.920	2.724	µmol/kg	-0.22
QST338BT	Mixed mussel tissue	GTX-5	3.560	3.190	µmol/kg	-0.44
QST338BT	Mixed mussel tissue	dc-STX	0.288	0.210	µmol/kg	-0.87
QST338BT	Mixed mussel tissue	GTX-1,4	0.606	0.451	µmol/kg	-0.79
QST338BT	Mixed mussel tissue	GTX-2,3	0.857	0.703	µmol/kg	-0.70
QST338BT	Mixed mussel tissue	STX	0.318	0.299	µmol/kg	-0.19
<b>QST338BT</b>	<b>Mixed mussel tissue</b>	<b>Total toxicity</b>	<b>741</b>	<b>734</b>	<b>µgSTXdiHCl eq./kg</b>	<b>-0.03</b>
QST339BT	Green mussel tissue	C1C2	4.700	4.330	µmol/kg	-0.24
QST339BT	Green mussel tissue	dcGTX-2,3	0.620	0.484	µmol/kg	-0.68
QST339BT	Green mussel tissue	GTX-5	5.440	4.450	µmol/kg	-0.71
QST339BT	Green mussel tissue	dc-STX	0.578	0.467	µmol/kg	-0.70
QST339BT	Green mussel tissue	GTX-1,4	1.310	0.950	µmol/kg	-0.85
QST339BT	Green mussel tissue	GTX-2,3	5.020	4.360	µmol/kg	-0.50
QST339BT	Green mussel tissue	STX	0.919	0.801	µmol/kg	-0.56
<b>QST339BT</b>	<b>Green mussel tissue</b>	<b>Total toxicity</b>	<b>2461</b>	<b>2197</b>	<b>µgSTXdiHCl eq./kg</b>	<b>-0.42</b>
QST340BT	Blue mussel tissue	C-1,2	1.140	0.864	µmol/kg	-0.75
QST340BT	Blue mussel tissue	dcGTX-2,3	0.804	0.602	µmol/kg	-0.77
QST340BT	Blue mussel tissue	GTX-5	1.160	0.780	µmol/kg	-1.26
QST340BT	Blue mussel tissue	dc-STX	0.656	0.398	µmol/kg	-1.45
QST340BT	Blue mussel tissue	GTX-2,3	0.936	0.645	µmol/kg	-1.17
QST340BT	Blue mussel tissue	STX	0.691	0.504	µmol/kg	-1.08
<b>QST340BT</b>	<b>Blue mussel tissue</b>	<b>Total toxicity</b>	<b>1058</b>	<b>688</b>	<b>µgSTXdiHCl eq./kg</b>	<b>-1.30</b>

**Table 10: Quasimeme round 2023.2 - HPLC**

Sample ID	Sample description	Determinant	Assigned Value	Reported Value	Units	z-score
QST347BT	Mussel tissue	dcSTX	1.710	1.158	µmol/kg	-1.20
QST347BT	Mussel tissue	STX	0.082	<0.03	µmol/kg	C
QST347BT	Mussel tissue	GTX-2,3	N/A	<0.03	µmol/kg	N/A
<b>QST347BT</b>	<b>Mussel tissue</b>	<b>Total toxicity</b>	<b>645</b>	<b>431</b>	<b>µgSTXdiHCl eq./kg</b>	<b>-1.20</b>
QST348BT	Mussel tissue	C1C2	7.240	5.236	µmol/kg	-1.0
QST348BT	Mussel tissue	dcGTX-2,3	0.559	0.190	µmol/kg	-2.0
QST348BT	Mussel tissue	dcSTX	0.464	0.327	µmol/kg	-1.0
QST348BT	Mussel tissue	GTX-5	7.770	6.452	µmol/kg	-.07
QST348BT	Mussel tissue	STX	0.638	0.573	µmol/kg	-.04
QST348BT	Mussel tissue	GTX-2,3	1.940	1.378	µmol/kg	-1.1
<b>QST348BT</b>	<b>Mussel tissue</b>	<b>Total toxicity</b>	<b>1516</b>	<b>1106</b>	<b>µgSTXdiHCl eq./kg</b>	<b>-1.0</b>
QST349BT	Clam tissue	dcGTX-2,3	0.167	0.066	µmol/kg	-1.9
QST349BT	Clam tissue	dcSTX	1.060	0.743	µmol/kg	-1.1
QST349BT	Clam tissue	STX	0.427	0.398	µmol/kg	-0.2
QST349BT	Clam tissue	GTX-2,3	0.145	<0.03	µmol/kg	N/A
<b>QST349BT</b>	<b>Patagonian scallop</b>	<b>Total toxicity</b>	<b>636</b>	<b>434</b>	<b>µgSTXdiHCl eq./kg</b>	<b>-1.1</b>

**Table 11: EURLMB 2023 (NI NRL Wageningen) - HPLC**

Sample ID	Sample description	Determinant	Assigned Value	Reported Value	Units	z-score
EURLMB/23/P/01	Mussel Tissue	dcGTX-2,3	52.8	577.5	µgSTXdiHCl eq./kg	36.6
EURLMB/23/P/01	Mussel Tissue	C1C2	180.4	248.4	µgSTXdiHCl eq./kg	1.69
EURLMB/23/P/01	Mussel Tissue	dcSTX	134.1	141.2	µgSTXdiHCl eq./kg	0.23
EURLMB/23/P/01	Mussel Tissue	GTX-5	158.0	165.8	µgSTXdiHCl eq./kg	0.22
EURLMB/23/P/01	Mussel Tissue	GTX-6	257.6	375.0	µgSTXdiHCl eq./kg	1.88
EURLMB/23/P/01	Mussel Tissue	dcNeo	47.0	NR	µgSTXdiHCl eq./kg	NA
EURLMB/23/P/01	Mussel Tissue	C3C4	54.9	NR	µgSTXdiHCl eq./kg	NA
<b>EURLMB/23/P/01</b>	<b>Mussel tissue</b>	<b>Total toxicity</b>	<b>835.5</b>	<b>1508</b>	<b>µgSTXdiHCl eq./kg</b>	<b>4.90</b>
EURLMB/23/P/02	Mixed clam tissue	GTX-2,3	97.0	96.4	µgSTXdiHCl eq./kg	-0.03
EURLMB/23/P/02	Mixed clam tissue	GTX-1,4	620.0	265.1	µgSTXdiHCl eq./kg	-2.15
EURLMB/23/P/02	Mixed clam tissue	dcGTX-2,3	91.9	144.7	µgSTXdiHCl eq./kg	2.3
<b>EURLMB/23/P/02</b>	<b>Mixed clam tissue</b>	<b>Total toxicity</b>	<b>860.9</b>	<b>506</b>	<b>µgSTXdiHCl eq./kg</b>	<b>-1.71</b>



Lipophilic toxins 2023 proficiency test summaries

Table 12: Quasimeme round 2023.1- LC-MS/MS

Sample ID	Sample Description	Determinant	Assigned Value	Reported Value	Units	z-Score
QST335BT	Mussel tissue	AZA-1	414	459	µg/kg	0.54
QST335BT	Mussel tissue	AZA-2	118	124	µg/kg	0.27
QST335BT	Mussel tissue	AZA-3	75.8	83.8	µg/kg	0.52
<b>QST335BT</b>	<b>Mussel tissue</b>	<b>AZA-total</b>	<b>730</b>	<b>800</b>	<b>µg AZA eq./kg</b>	<b>0.54</b>
QST335BT	Mussel tissue	Free-DTX2	9.88	10.3	µg/kg	0.17
QST335BT	Mussel tissue	free-Okadaic-Acid	32.1	30.7	µg/kg	-0.2
<b>QST335BT</b>	<b>Mussel tissue</b>	<b>Total-free-OA+DTX1+DTX2</b>	<b>36.9</b>	<b>36.9</b>	<b>µg OA eq./kg</b>	<b>0</b>
QST335BT	Mussel tissue	Total-DTX2	12.6	12.3	µg/kg	-0.09
QST335BT	Mussel tissue	Total-Okadaic-Acid	66.4	57.6	µg/kg	-0.62
<b>QST335BT</b>	<b>Mussel tissue</b>	<b>Total-hy-OA+DTX1+DTX2</b>	<b>69.7</b>	<b>65.0</b>	<b>µg OA eq./kg</b>	<b>-0.29</b>
<b>QST335BT</b>	<b>Mussel tissue</b>	<b>Total-OA+PTX2</b>	<b>68.5</b>	<b>65.0</b>	<b>µg OA eq./kg</b>	<b>-0.22</b>
QST336BT	Mussel tissue	Free-DTX1	165	183	µg/kg	0.4
QST336BT	Mussel tissue	Free-DTX2	9.07	<10	µg/kg	C
QST336BT	Mussel tissue	free-Okadaic-Acid	77.1	79.1	µg/kg	0.13
<b>QST336BT</b>	<b>Mussel tissue</b>	<b>Total-free-OA+DTX1+DTX2</b>	<b>252</b>	<b>262</b>	<b>µg OA eq./kg</b>	<b>0.19</b>
QST336BT	Mussel tissue	Total-DTX1	216	218	µg/kg	0.04
QST336BT	Mussel tissue	Total-Okadaic-Acid	345	329	µg/kg	-0.23
<b>QST336BT</b>	<b>Mussel tissue</b>	<b>Total-hy-OA+DTX1+DTX2</b>	<b>563</b>	<b>558</b>	<b>µg OA eq./kg</b>	<b>-0.04</b>
<b>QST336BT</b>	<b>Mussel tissue</b>	<b>Total-OA+PTX2</b>	<b>559</b>	<b>558</b>	<b>µg OA eq./kg</b>	<b>-0.01</b>
QST336BT	Mussel tissue	YTX	0.139	0.174	mg/kg	1.03
QST336BT	Mussel tissue	homo-YTX	0.026	0.028	mg/kg	0.15

QST336BT	Mussel tissue	45-OH-YTX	0.069	0.090	mg/kg	0.90
<b>QST336BT</b>	<b>Mussel tissue</b>	<b>Total-YTX</b>	<b>0.222</b>	<b>0.292</b>	<b>mg YTX eq./kg</b>	<b>1.34</b>
QST337BT	Cockle tissue	AZA-1	197	220	µg/kg	0.57
QST337BT	Cockle tissue	AZA-2	53.4	49.3	µg/kg	-0.37
QST337BT	Cockle tissue	AZA-3	30.6	28.2	µg/kg	-0.40
<b>QST337BT</b>	<b>Cockle tissue</b>	<b>AZA-total</b>	<b>334</b>	<b>348</b>	<b>µg AZA eq./kg</b>	<b>0.23</b>
QST337BT	Cockle tissue	Free-DTX1	24.8	21.7	µg/kg	-0.48
QST337BT	Cockle tissue	Free-DTX2	15.9	16.6	µg/kg	0.19
QST337BT	Cockle tissue	free-Okadaic-Acid	92	87.4	µg/kg	-0.20
<b>QST337BT</b>	<b>Cockle tissue</b>	<b>Total-free-OA+DTX1+DTX2</b>	123	119	<b>µg OA eq./kg</b>	-0.17
<b>QST337BT</b>	<b>Cockle tissue</b>	Total-DTX1	157	178	µg/kg	0.50
<b>QST337BT</b>	<b>Cockle tissue</b>	Total-DTX2	24.2	24.7	µg/kg	0.10
<b>QST337BT</b>	<b>Cockle tissue</b>	Total-Okadaic-Acid	167	161	µg/kg	-0.17
<b>QST337BT</b>	<b>Cockle tissue</b>	<b>Total-hy-OA+DTX1+DTX2</b>	329	354	<b>µg OA eq./kg</b>	0.37
<b>QST337BT</b>	<b>Cockle tissue</b>	<b>Total-OA+PTX2</b>	320	354	<b>µg OA eq./kg</b>	0.57
QST337BT	Mussel tissue	YTX	0.331	0.373	mg/kg	0.54
QST337BT	Mussel tissue	homo-YTX	0.041	0.052	mg/kg	0.80
<b>QST337BT</b>	<b>Mussel tissue</b>	<b>Total-YTX</b>	<b>0.354</b>	<b>0.424</b>	<b>mg YTX eq./kg</b>	<b>0.93</b>

**Table 13: Quasimeme round 2023.2- LC-MS/MS**

Sample ID	Sample description	Determinant	Assigned value	Reported value	Units	z-Score
QST344BT	Mussel tissue	AZA-1	1317	1364	µg/kg	0.2
QST344BT	Mussel tissue	AZA-2	338	336	µg/kg	0.0
QST344BT	Mussel tissue	AZA-3	293	352	µg/kg	1.0
<b>QST344BT</b>	<b>Mussel tissue</b>	<b>AZA-total</b>	<b>2394</b>	<b>2462</b>	<b>µg AZA eq./kg</b>	<b>0.2</b>
QST344BT	Mussel tissue	Free-DTX2	256	312	µg/kg	1.1
QST344BT	Mussel tissue	free-Okadaic-Acid	235	264	µg/kg	0.6
<b>QST344BT</b>	<b>Mussel tissue</b>	<b>Total-free-OA+DTX1+DTX2</b>	<b>395</b>	<b>451</b>	<b>µg OA eq./kg</b>	<b>0.7</b>
QST344BT	Mussel tissue	Total-DTX2	366	407	µg/kg	0.5
QST344BT	Mussel tissue	Total-Okadaic-Acid	428	471	µg/kg	0.5
<b>QST344BT</b>	<b>Mussel tissue</b>	<b>Total-hy-OA+DTX1+DTX2</b>	<b>655</b>	<b>715</b>	<b>µg OA eq./kg</b>	<b>0.4</b>
<b>QST344BT</b>	<b>Mussel tissue</b>	<b>Total-OA+PTX2</b>	<b>655</b>	<b>715</b>	<b>µg OA eq./kg</b>	<b>0.5</b>
QST345BT	Mussel tissue	AZA-1	73.3	64.3	µg/kg	-0.6
QST345BT	Mussel tissue	AZA-2	23.6	22.9	µg/kg	-0.1
QST345BT	Mussel tissue	AZA-3	24.1	26.0	µg/kg	0.4
<b>QST345BT</b>	<b>Mussel tissue</b>	<b>AZA-total</b>	<b>148</b>	<b>141.9</b>	<b>µg AZA eq./kg</b>	<b>-0.2</b>
QST345BT	Mussel tissue	Free-DTX2	480	558	µg/kg	0.8
QST345BT	Mussel tissue	free-Okadaic-Acid	86.1	83.3	µg/kg	-0.2
<b>QST345BT</b>	<b>Mussel tissue</b>	<b>Total-free-OA+DTX1+DTX2</b>	<b>383</b>	<b>418</b>	<b>µg OA eq./kg</b>	<b>0.4</b>
QST345BT	Mussel tissue	Total-DTX2	733	785	µg/kg	0.3
QST345BT	Mussel tissue	Total-Okadaic-Acid	<b>183</b>	<b>198</b>	µg/kg	<b>0.4</b>
<b>QST345BT</b>	<b>Mussel tissue</b>	<b>Total-hy-OA+DTX1+DTX2</b>	637	669	<b>µg OA eq./kg</b>	0.2
QST345BT	<b>Mussel tissue</b>	<b>Total-OA+PTX2</b>	<b>628</b>	<b>669</b>	<b>µg OA eq./kg</b>	<b>0.4</b>

QST346BT	Mussel tissue	free-Okadaic-Acid	67.6	68.2	µg/kg	0.0
<b>QST346BT</b>	<b>Mussel tissue</b>	<b>Total-free-OA+DTX1+DTX2</b>	<b>69.4</b>	<b>68.2</b>	<b>µg OA eq./kg</b>	<b>-0.1</b>
QST346BT	Mussel tissue	Total-Okadaic-Acid	181	196	µg/kg	0.4
<b>QST346BT</b>	<b>Mussel tissue</b>	<b>Total-hy-OA+DTX1+DTX2</b>	<b>187</b>	<b>196</b>	<b>µg OA eq./kg</b>	<b>0.2</b>
<b>QST346BT</b>	<b>Mussel tissue</b>	<b>Total-OA+PTX2</b>	<b>187</b>	<b>196</b>	<b>µg OA eq./kg</b>	<b>-0.1</b>

**Table 14: EURLMB 2023 (NI NRL Wageningen)- LC-MS/MS**

Sample ID	Sample description	Determinant	Assigned value	Reported value	Units	z-Score
EURLMB/23/L/01	Mussel tissue	AZA-1	239.8	233.7	µg/kg	-0.13
EURLMB/23/L/01	Mussel tissue	AZA-2	65.2	62.9	µg/kg	-0.16
EURLMB/23/L/01	Mussel tissue	AZA-3	54.2	50.3	µg/kg	-0.31
<b>EURLMB/23/L/01</b>	<b>Mussel tissue</b>	<b>AZA-total</b>	<b>435.4</b>	<b>417.3</b>	<b>µg AZA eq./kg</b>	<b>-0.23</b>
EURLMB/23/L/01	Mussel tissue	free-Okadaic-Acid	34.5	29.3	µg/kg	-0.68
EURLMB/23/L/01	Mussel tissue	Total-DTX2	23.2	10.1	µg/kg	-1.59
EURLMB/23/L/01	Mussel tissue	Total-OA	85.4	96.7	µg/kg	0.57
<b>EURLMB/23/L/01</b>	<b>Mussel tissue</b>	<b>Total-hy-OA+DTX1+DTX2</b>	<b>89.2</b>	<b>75.8</b>	<b>µg OA eq./kg</b>	<b>-0.65</b>
EURLMB/23/L/02	Mussel tissue	free-Okadaic-Acid	919.8	818.9	µg OA eq./kg	-0.91
EURLMB/23/L/02	Mussel tissue	Total-OA	1438	1210	µg/kg	-0.98
<b>EURLMB/23/L/02</b>	<b>Mussel tissue</b>	<b>Total-hy-OA+DTX1+DTX2</b>	<b>1421.9</b>	<b>1210</b>	<b>µg OA eq./kg</b>	<b>-0.91</b>
EURLMB/23/L/02	Mussel tissue	YTX	0.70	0.90	mg/kg	1.69
EURLMB/23/L/02	Mussel tissue	45OH YTX	0.60	0.80	mg/kg	1.11
<b>EURLMB/23/L/02</b>	<b>Mussel tissue</b>	<b>Total-YTX group</b>	<b>1.40</b>	<b>1.6</b>	<b>mg YTX eq./kg</b>	<b>0.89</b>

## **Overall summary of proficiency tests**

The proficiency tests for ASP were 100% satisfactory (8/8); for PSP were 90% satisfactory (45/50), 6% questionable (3/50) and 4% unsatisfactory (2/50); and for lipophilic toxins were 100% satisfactory (80/80).

All questionable and unsatisfactory z-scores have been investigated and addressed via internal non-conformance reports on our quality assurance system.

Overall performance for the three toxin groups is 96.4% satisfactory (133/138), 2.2% questionable (3/138) and 1.4% unsatisfactory (2/138).