Meeting

Advice on the risk to human health from consumption of bivalve molluscs (shellfish) harvested from UK waters associated with marine biotoxins

This is a paper for discussion.

This does not represent the views of the Committee and should not be cited.

Introduction

1. The Food Standards Agency (FSA) is considering the current advice and monitoring programme for marine biotoxins and whether there is a need to update or change existing legislative standards.

2. The main purpose of this work is to identify any emerging marine biotoxins in UK waters, including considerations on increasing occurrence with increasing temperatures due to climate change. The views of the Committee on the Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) were sought on whether any of these emerging marine biotoxins would pose a risk to human health.

3. A scoping paper on emerging biotoxins (TOX/2023/59) was presented to the COT at the December 2023 meeting. This paper provided an overview of potentially emerging biotoxins, brief summaries of any available toxicological information, occurrence data, with an emphasis on UK waters, and any additional relevant information, such as proposed or current limits/monitoring and considerations in other countries.

4. To assist the Committee in reaching a conclusion on which marine biotoxins potentially pose a risk to UK consumers, Members requested that the Secretariat produce a) a table providing the main toxicological information of the marine biotoxins discussed in the scoping paper for easier comparison and b) a table of the main toxicological information of currently regulated marine biotoxins. This would help the Committee compare non-regulated biotoxins to those already monitored, and to enable Members to put the potential risk of emerging biotoxins into perspective.

5. The Committee requested that the table should include a summary of the toxicological endpoint(s), the lethal doses, and information regarding the occurrence of each biotoxin. Due to difficulties in fitting all required information into one single table, each biotoxin has been placed into an individual table summarising the requested information on occurrence, lethal doses, adverse effects, health-based guidance values (HBGVs), human intoxications, and any comments deemed relevant. Annex A provides information regarding the identified emerging biotoxins, Annex B provides information regarding regulated biotoxins.

6. All information regarding emerging biotoxins has been extracted from the original scoping paper (TOX/2023/59) and its references. All information regarding regulated biotoxins has been extracted from the appropriate EFSA scientific opinion.

7. In addition, a table (Annex C) has been included providing estimated adult exposures (78.6 kg bodyweight) to unregulated marine biotoxins, based on EFSA’s shellfish portion size of 400 g, and a fish portion of 140 g, as suggested by the Ministry of Agriculture Fisheries and Food portion size book. Due to the limited nature of the occurrence data, the exposure assessment was done as an approximate estimate to aid Members in prioritisation rather than aiming to provide a full exposure assessment. The occurrence data used in the exposure assessment has previously been discussed in the scoping paper and summarised in Annex A. The original sources of the occurrence data for the respective biotoxins were a combination of surveillance studies, submissions by member states in response to EFSAs calls for data, country specific monitoring data, and research projects including laboratory-based studies and field studies.

8. Please note, pinnatoxin (TOX/2023/37) and pectenotoxin (TOX/2023/58) have been discussed separately and have not been included in the tables.

Questions on which the views of the Committee are sought:

i. Does the Committee consider there to be enough information to conclude on which marine biotoxins potentially pose a risk to UK consumers, based on the toxicology and occurrence data?

ii. Based on the available information does the Committee consider it possible to comment on which marine biotoxins pose the highest risk to UK consumers (provide a risk ranking)?

iii. Are there any data gaps, or any further information the Committee would like to highlight?

iv. Does the Committee have any other comments.

Secretariat

July 2024

TOX/2024/25 – Annex A

The following table(s) summarise key occurrence data, and toxicological information, of the currently non-regulated marine biotoxins, as discussed in the scoping paper (TOX/2023/59).

Table 1: Brevetoxin (BTX), **Toxicological endpoint(s):** Neurotoxicity

Occurrence Data (Concentration/ Species/Country)	**HBGVs/Maximum levels permitted**	**Lethal dose (LD50/LD100/MLD) in animals**	**Human Intoxications**	**Adverse effect(s)/Sy**

		LD50		**Neurologica shellfish poi (NSP)**
		Mice (i.p. administration; after 24 hours).		**Humans**
	No regulatory limits in Europe.	· 170 - >300 µg/kg bw (BTX-3),		Nausea, vom diarrhoea, pa cramps, bronchoconst paralysis, sei coma.
82 to 345 µg/kg (BTX-2 + BTX-3; Mussels; France).	**USA**	· 200 – 400 µg/kg bw (BTX-(B)2)		
	action level	· 211 µg/kg bw (S-deoxy-BTX-B2),		Recreational
880 to 49,000 µg BTX-2 equivalents/kg (Shellfish; Mexico, New Zealand, USA).	≥ 0.8 mg BTX-2 equivalents/kg shellfish.	Mice (oral administration)	A few hundred intoxications reported but true number probably underestimated (ANSES,2021).	Irritant effect inhalation/de exposure.
		· 6600 mg/kg (BTX-2)		**Animals**
	Australia/New Zealand	· 520 mg/kg bw (BTX-3).		Depolarizatio and muscle c membranes r impairment o and peripher system, inclu neurovegetat neuromuscul cardiorespira symptoms an signs such as seizure and d body tempera
580 to 6000 µg BTX-3 equivalents/kg (Fish; Mexico, New Zealand, USA).	Maximum level 20 MUs*/100g, BTX analogue not specified.	Mice (i.v. administration)	No human fatalities or persistent symptoms reported (EFSA, 2010; CEFAS, 2014).	
		· 94 µg/kg bw (BTX-3)		
	ANSES	· 200 µg/kg bw (BTX-2).		
	proposed guidance level	**MLD**		***In vitro***
	180 µg BTX-3 equivalent/kg shellfish meat.	Mice (i.p. administration)		Chromosoma (BTX-2)
		· 100 µg/kg bw (BTX-4; 6-24 hours)		
		· 200 – 500		

Table 2: Cyclic imines (CIs) (Excluding PnTX and portimine), **Toxicological endpoint(s):** Neurotoxicity (SPX and GYM)

Occurrence Data (Concentration/ Species/Country)	HBGVs/Maximum levels permitted	Lethal dose (LD50/LD100/MLD) in animals	Human Intoxications	Adverse effect(s)/Sym

LD50:

Mice (i.p. administration)

- 40 µg/kg bw (SPX mixture; crude extract),
- 8 µg/kg bw (SPX C; fed mice),
- 6.9 µg/kg bw (13-desmethyl SPX C; fed and fasted mice),
- 27.9 µg/kg bw (13-desmethyl SPX C),
- 8 µg/kg bw (20-methyl SPX G; fed mice),
- 32.2 µg/kg bw (13,19-didesmethyl SPX C),
- 450 µg/kg bw (GYM A; crude extract),
- 96 µg/kg bw (GYM A; >95% pure),
- 80 µg/kg bw (GYM A),
- 800 µg/kg bw (GYM-B),
- Overall, 500-1005 µg/kg bw (SPX).

Table 3: Palytoxin (PITX), **Toxicological endpoint(s):**

Occurrence Data (Concentration/ Species/Country)	HBGVs/Maximum levels permitted	Lethal dose (LD50/LD100/MLD) in animals	Human Intoxications	Adverse effect(s)/Sym

Humans

Myalgia and weakness, pos accompanied b fever, nausea a vomiting, and rhabdomyolysi characterised b injury to skelet muscle, muscl breakdown and leakage of myo into plasma.

Renal failure a disseminated intravascular coagulation.

Death.

Skin, eye and respiratory irri

Animals

Reduced intrac pH.

Rabbits

increased meta of arachidonic and the produc eicosanoids; arachidonic ac metabolised to prostaglandins releasing norepinephrine

Intoxications reported.

LD50

Some reports

Table 4: Saxitoxin (STX), Toxicological **endpoint(s):** Neurotoxicity

Occurrence Data (Concentration/ Species/Country)	HBGVs/Maximum levels permitted	Lethal dose (LD50/LD100/MLD) in animals	Human Intoxications	Adverse effect(s)/Sym

Paralytic shellf
poisoning (PSP

Humans

Mild symptoms
tingling sensat
numbness, mo
around the lips
spreading to fa
neck, headach
dizziness, naus

Moderately sev
symptoms:
incoherent spe
progression of
prickling sensa
arms and legs,
stiffness, non-
coordination o
general weakn
and feeling of
lightness, sligh
respiratory diff
and rapid pulse

Severe to extre
severe sympto
muscular para
pronounced
respiratory diff
to fetal respira
paralysis.

Death from
respiratory arr

EU

800 µg STX
equivalents/kg
shellfish meat.

FAO/IOC/WHO
provisional ARfD of
0.7 µg STX

Recreational

Table 5: Tetrodotoxin (TTX), **Toxicological endpoint(s):** Neurotoxicity

Occurrence Data (Concentration/ Species/Country)	HBGVs/Maximum levels permitted	Lethal dose (LD50/LD100/MLD) in animals	Human Intoxications	Adverse effect(s)/Sym

	No maximum levels in the EU.			**Humans** Perioral numbn and paraesthe with or without symptoms to li numbness, ear motor paralysi incoordination, slurred speech normal reflexe generalised fla paralysis, apho and fixed/dilat pupils to hypox hypotension, bradycardia, ca dysrhythmias a unconsciousne Death, caused respiratory fail and cardiac co
TTX and analogues: 0.0003 to 0.541 mg/kg (gastropods and bivalves; France; Spain; Italy; Greece; The Netherlands; Ireland; UK). TTX most common analogue in all regions.	**EFSA** ARfD 0.25 µg/kg bw. **Kasteel et al. (2017)** ARfD 1.33 µg/kg bw. **Finch et al. (2018)** ARfD 10.1 nmol/kg (3.2 µg/kg). **Unknown**	**LD50** Mice (i.p. administration and s.c. administration) · 8-13 µg/kg bw Mice (oral administration and intragastric administration) · 232 µg/kg bw and 532 µg/kg bw **LD100** Mice (oral administration) · 1000 µg/kg bw	Some human case reports. Onset of symptoms within 10-45 minutes of ingestion, although delayed responses of 3-6 hours have also been reported. (EFSA, 2017;	**Animals** Skeletal muscl fasciculation, a lethargy, ataxi ascending progressive pa and death. Mice: urine production significantly decreased (at µg/kg and 125 daily). Exposu the highest concentration

Table 6: Novel azaspiracids (AZAs), **Toxicological endpoint(s):**

Occurrence Data (Concentration/ Species/Country)	**HBGVs/Maximum levels permitted**	**Lethal dose (LD50/LD100/MLD) in animals**	**Human Intoxications**	**Adverse effect(s)/Sym**
Japan	No information available.	No information available.	None reported	No information available.

Table 7: Novel PSP analogues domoic acid analogues, **Toxicological endpoint(s):**

Occurrence Data (Concentration/ Species/Country)	**HBGVs/Maximum levels permitted**	**Lethal dose (LD50/LD100/MLD) in animals**	**Human Intoxications**	**Adverse effect(s)/Sym**
No information available.	No information available.	No information available.	None reported.	No information available.

Table 8: Cyanobacteria toxin(s), **Toxicological endpoint(s):** Depending on cyanotoxin, ranging from neurotoxicity, hepatotoxicity, cytotoxicity to dermal toxicity and irritation.

Occurrence Data (Concentration/ Species/Country)	**HBGVs/Maximum levels permitted**	**Lethal dose (LD50/LD100/MLD) in animals**	**Human Intoxications**	**Adverse effect(s)/Sym**

Humans

MCs

Most commonl
gastroenteritis

Intrahepatic
haemorrhage

Fatalities (afte
mistreated wa
used in dialysis

BMAA

Implicated in
neurodegenera
diseases: Amy
lateral sclerosi
Parkinsonism-
dementia com
and Alzheimer

Animals

MCs

Lung effects
(thickening of
alveolar septu
disruption of c
junctions, alve
collapse, and l
apoptosis).

Serum profile
changes (incre

TOX/2024/25 – Annex B

The following table(s) summarise key occurrence data, and toxicological information, of current regulated marine biotoxins extracted from the appropriate EFSA scientific opinion.

Table 9: Saxitoxin, **Toxicological endpoint(s):** Neurotoxicity

See Annex A: Emerging Biotoxins, Table 4, for further details.

Table 10: Domoic Acid, **Toxicological endpoint(s):** Neurotoxicity

Occurrence Data (Country/ Species/ Concentration)	**HBGVs /Maximum levels permitted**	**Lethal dose (LD50/LD100/ MLD) in animals**	**Human Intoxications**	**Adverse effect(s)/Symptoms**	**Co**

Humans

Amnesic Shellfish Poisoning (ASP) including gastrointestinal symptoms (vomiting, diarrhoea, or abdominal cramps) and/or neurological symptoms (confusion, loss of memory, potential seizure, or coma).

Animals

Mice (oral administration)

Scratching (35 mg/kg bw) *, clinical signs (not detailed; 71 mg DA/kg bw; acidified extract), death (71 to 83mg DA/kg bw; acidified extract).

Rats (oral administration)

Flaccidity, head on floor, inactivity, mastication, seizures, mild to moderate CNS damage, death (n=1-4; given 60-80 mg/kg bw DA *per os*).

Table 11: Okadaic Acid (and OA group toxins), **Toxicological endpoint(s):** Gastrointestinal (DSP)

Occurrence Data (Country/ Species/ Concentration)	**HBGVs /Maximum levels permitted**	**Lethal dose (LD50/LD100/ MLD) in animals**	**Human Intoxications**	**Adverse effect(s)/Symptom**

			DSP reported in Japan, the Netherlands, Norway, Sweden, Belgium, Portugal, UK, Canada, Chile and New Zealand.	
			Japan 164 people suffering with diarrhoea, nausea, vomiting and abdominal pain from eating mussels or scallops containing mostly DTX1. Intakes estimated 48 µg OA equivalents/person for mild symptoms or 80-280 µg OA equivalents/person for severe symptoms.	**Humans** Diarrhoeic Shellfish Poisoning (DSP): diarrhoea, nausea, vomiting and abdominal pain. Fever, chill, and headache. **Animals** Mice Intestinal injury (200 µg/kg bw) and liver injury (375 µg/kg bw i.p. administration and 1000-2000 µg OA/kg bw).
Denmark, France, Germany, Ireland, The Netherlands, Norway, Portugal, Spain, Sweden, UK.	**EU** 160 µg OA equivalents/kg shellfish meat. **FAO/IOC/WHO** ARfD 0.33µg OA equivalents/kg	**LD50** Mice (i.p. administration): · 204 µg/kg bw, · 200 µg/kg bw , · 225 µg/kg. **Lethal dose** Mice (i.p. administration): · 200 µg/ kg bw.	**Portugal** 6 cases from consuming: razor clams: 500 µg OA equivalents /kg flesh. 1 case from consuming	Hypersection in the small intestine (75, 150 and 250 µg/kg bw), severe mucosal injury, extravasion of serum into lamina propria of villi, degeneration of absorptive epithelium of iliac villi, and desquamation of the

Table 12: Dinophysis toxins, **Toxicological endpoint(s):** Gastrointestinal (DSP; as part of OA group)

Occurrence Data (Country/ Species/ Concentration)	HBGVs /Maximum levels permitted	Lethal dose (LD50/LD100/ MLD) in animals	Human Intoxications	Adverse effect(s)/Symptoms	Comm

Denmark, France, Germany, Ireland, The Netherlands, Norway, Portugal, Spain, Sweden, UK.			**Humans** As part of OA group toxins, See Table 3. **Animals** Mice (i.p. administration).
Shellfish.		**LD50** Mice (i.p. administration): · 350 µg/kg bw (DTX2).	Intestinal injury (50-500 µg/kg bw for DTX1 and at 375 µg/kg bw for DTX3) Bleeding in the abdomen (DTX3).
Of 6072 samples: **DTX 1.** 416 samples ≥ LOD up to 160 µg toxin/kg shellfish meat. 89 samples >160 µg toxin /kg shellfish meat.	None specific for DTX. See Table 3 for HBGVs for OA equivalents.	**Lethal dose** Mice (i.p. administration): · 160 µg/kg bw for (DTX 1), See Table 3. · 200 to 500 µg/kg bw. (DTX 3).	Mice (oral administration). Light diarrhoea and slight reduced bodyweight. Light erosions to the stomach, intestinal damage (600 and 700 µg/kg).
DTX2		Mice (oral	Mice and rat (i.p.

Table 13: Yessotoxins (and analogues), **Toxicological endpoint(s):**

Occurrence Data (Country/ Species/ Concentration)	HBGVs /Maximum levels permitted	Lethal dose (LD50/LD100/ MLD) in animals	Human Intoxications	Adverse effect(s)/Symptoms	Com

				Humans No reports on adverse effects in humans.	
		LD50* Mice (i.p. administration; male). · 80-462 µg/kg bw (YTX), · 301 µg/kg bw (Di-desulfoYTX),		**Animals** Mice (i.p. administration). Dyspnoea and death (≥ 300 µg/kg). Restlessness and jumping before death at lethal doses. Shivering (at 750 and 1000 µg/kg) and cramps.	Anal meth iden level toxin shell varie inclu ELISA HPLC MS/M
Germany, Italy, Norway, Portugal, Spain, United Kingdom. Shellfish. “not detected” to 9620 µg YTX eq./kg shellfish meat.	**EU** 1 mg YTX eq./kg shellfish meat. **EFSA** ARfD 25 µg YTX equivalents/kg bw 3.75 mg YTX eq./kg shellfish meat.	Mice (i.p. administration; female), · 112-750 µg/kg bw (YTX), · 444 µg/kg bw (1a-HomoYTX). **Lethal dose **** Mice (i.p. administration; sex not reported) · 100 µg/kg bw (1a-HomoYTX),	No reports of human illness.	Vacuolation in the cardiac muscle, and intracellular oedema, cardiac damage (500 µg/kg), swelling of myocardial cells (5-10mg/kg) and alterations of myocardiocytes (1-2 mg/kg YTX). Cytoplasmic protrusions of myocardiocytes, rounding of mitochondria and fibre modifications (1mg/kg 1a-homoYTX	*,** S Table EFSA for fu deta rega mou strai refer No infor avail on LI YTX- toxin the c route ***Fo

Table 14: Azaspiracids, **Toxicological endpoint(s):** Gastrointestinal (similar to DSP)

Occurrence Data (Country/ Species/ Concentration)	HBGVs/ Maximum levels permitted	Lethal dose (LD50/LD100/ MLD) in animals	Human Intoxications	Adverse effect(s)/Symptoms	Com

				Humans AZA poisoning (AZP): nausea, vomiting, diarrhoea and stomach cramps.	
				Animals Mice (oral administration),	
			AZA poisoning reported across the Netherlands, Ireland, Italy, France, and the UK.	Shortened villi, injury to small intestine (600 or 700 µg/kg bw; slow recovery after 24h). 38% increase in liver weight after 24h, fine fat droplets distributed in liver (500 µg/kg bw).	
			Netherlands 8 cases, unwell after consuming 8-10 mussels harvested from the west coast of Ireland. Intakes estimated initially between 6.7 µg (5th percentile) and 24.9 µg (95th percentile) per person, with a median	Dose-dependent necrotic lymphocytes in the thymus, spleen, and Peyer´s patches of the small intestine (500 to 700 µg/kg bw),	
		Lethal dose Mice (i.p. administration; male) · 200µg/kg		Changes to the small intestine: congestion, watery substance in the lumen, small changes to surface epithelial cells, atrophic lamina propria spatially	Som long repe dose toxic
EU					

TOX/2024/25 – Annex C

Table 15: Estimated adult exposures (78.6 kg bodyweight) to unregulated marine biotoxins, based on EFSA's shellfish portion size of 400 g, and a fish portion size of 140 g, as suggested by the Ministry of Agriculture Fisheries and Food portion size book.

Toxin	Occurrence	HBGVs	Exposure Assessment in Adults
Brevetoxin.	82 to 345 µg/kg (BTX-2 + BTX-3; Mussels; France). 880 to 49,000 µg BTX-2 equivalents/kg (Shellfish; Mexico, New Zealand, USA). 580 to 6000 µg BTX-3 equivalents/kg (Fish; Mexico, New Zealand, USA).	No regulatory limits set. **EFSA** ARfD for sum of PITX and ostreocin-D: 0.2 µg/kg bw. **NRL for Marine Biotoxins** provisional limit 250 µg/kg shellfish. **ANSES** Short term toxicity reference value for PITX 0.08 µg/kg bw per day.	0.42 to 1.8 µg/kg bw. 4.5 to 250 µg/kg bw. 1.03 to 11 µg/kg bw.

	SPX: Norway, Spain, Italy.	**CRLBM/EURL** proposed guidance level 400 µg sum of SPXs/kg shellfish meat.	
Cyclic imines (excluding PnTX and portimine).	Toxin producing organism: Scotland, Italy, Denmark, Ireland. PtTX and GYM not detected in Europe. GYM found in imported shellfish.		N/A

		No regulatory limits set.	
Palytoxin (PITX).	300 to 625 µg/kg shellfish meat (PITXs; Mussels and sea urchins; France; Greece; Italy; Spain;).	**EFSA** ARfD for sum of PITX and ostreocin-D: 0.2 µg/kg bw.	1.5 to 3.2 µg/kg bw.
		NRL for Marine Biotoxins provisional limit 250 µg/kg shellfish.	
		ANSES Short term toxicity reference value for PITX 0.08 µg/kg bw per day.	

Saxitoxin (STX).	Toxin producing algae: Norway, Portugal, France, Germany, Italy, Turkey, Egypt.	**EU** 800 µg STX equivalents/kg shellfish meat. **FAO/IOC/WHO** provisional ARfD of 0.7 µg STX equivalents/kg bw. **EFSA** ARfD 0.5 µg STX equivalents/kg bw. **ANSES** TRV ~ 0.1 µg/kg bw. **OHA** TDI 0.05 µg/kg bw per day. **Interim drinking water guidance levels** 1 µg/L (Australia, New Zealand and OHA) 3 µg/L (Brazil, Australia, and WHO).	N/A

		No maximum levels in the EU.	
		EFSA ARfD 0.25 µg/kg bw.	
Tetrodotoxin (TTX).	TTX and analogues: 0.0003 to 0.541 mg/kg (gastropods and bivalves; France; Spain; Italy; Greece; The Netherlands; Ireland; UK). TTX most common analogue in all regions.	**Kasteel et al. (2017)** ARfD 1.33 µg/kg bw. **Finch et al. (2018)** ARfD 10.1 nmol/kg (3.2 µg/kg). **Unknown** 110 µg TTX equivalent/kg shellfish meat. (Reference not found, taken from a review by Katikou 2019 citing the study Kasteel et al. 2017).	0.0015 to 2.8µg/kg bw

Novel azaspiracids (AZAs).	Japan	No information available.	N/A
Novel PSP analogues domoic acid analogues.	No information available.	No information available.	N/A

		MCs: **EFSA** TDI of 0.04 µg/kg bw per day. **ANSES** Subchronic TRV 1 ng/kg bw per day. **WHO** Provisional TDI of 0.04 µg/kg bw. **OHA** TDI of 0.05 µg/kg (for MC-LR specifically). **ATX:** **WHO** No formal TDI set. NOAEL 98 µg/kg bw per day. **CYN:** **WHO**	
Cyanobacteria toxin(s).	Northern Ireland (Lough Neagh) **MCs:** 100 µg/kg fresh weight (Fish muscle; Europe). 45 to 142 µg MC-LR/kg fresh weight (Saltwater mussels; Greece). **NOD**: 80 to 817 µg/kg dw (Shellfish; Finland; Poland). **BMMA:** 900 to 14,000µg/kg (Oysters; France; Sweden; Greece). **2 DAB:** 1,100 to 9,700 µg/kg (Mussels; France). **DAB:**	**MCs:** 0.18µg/kg bw. 0.23 to 0.72 µg/kg bw. **NOD:** 0.41 to 4.2 µg/kg bw. **BMMA:** 4.6 to 71µg/kg bw. **2 DAB:** 5.6 to 49µg/kg bw.	

References:

Marine biotoxins in shellfish – azaspiracid group[1] - scientific opinion of the panel on contaminants in the food chain (2008) European Food Safety Authority: Marine biotoxins in shellfish – Azaspiracid group[1] - Scientific Opinion of the Panel on Contaminants in the Food chain | EFSA (europa.eu) (Accessed: 09 May 2024).

Marine biotoxins in shellfish – domoic acid (2009) European Food Safety Authority. Marine biotoxins in shellfish – Domoic acid | EFSA (europa.eu) (Accessed: 06 May 2024).

Marine biotoxins in shellfish - okadaic acid and analogues - scientific opinion of the panel on contaminants in the food chain (2008) European Food Safety Authority: Marine biotoxins in shellfish - okadaic acid and analogues - Scientific Opinion of the Panel on Contaminants in the Food chain | EFSA (europa.eu) (Accessed: 06 May 2024).

Marine biotoxins in shellfish – summary on regulated marine biotoxins (2009) European Food Safety Authority: Marine biotoxins in shellfish – Summary on regulated marine biotoxins | EFSA (europa.eu) (Accessed: 08 May 2024).

Marine biotoxins in shellfish – yessotoxin group[1] - scientific opinion of the panel on contaminants in the food chain (2009) European Food Safety Authority: Marine biotoxins in shellfish – Yessotoxin group[1] - Scientific Opinion of the Panel on Contaminants in the Food chain | EFSA (europa.eu) (Accessed: 08 May 2024.