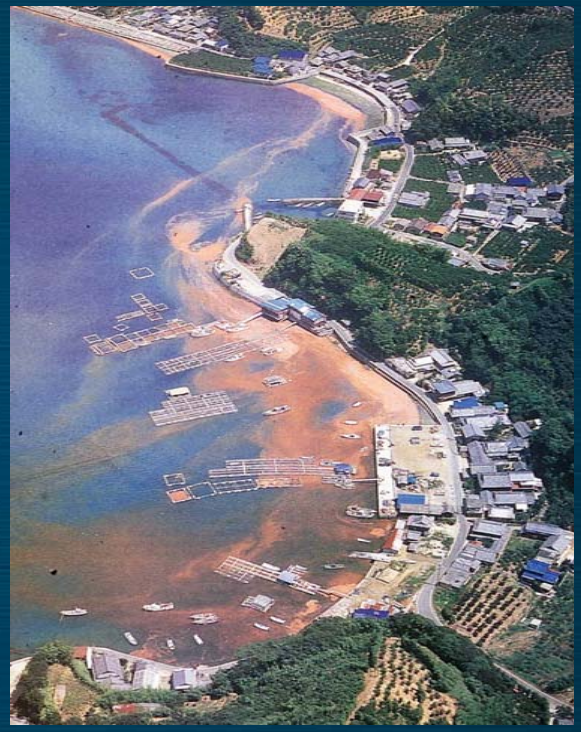
EFSA's evaluation of marine biotoxins

F.X.Rolaf van Leeuwen
Chair WG on Marine biotoxins
Vice chair CONTAM Panel

efsa
European Food Safety Authority

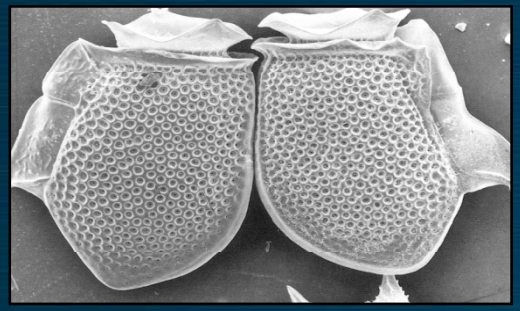
Marine biotoxins

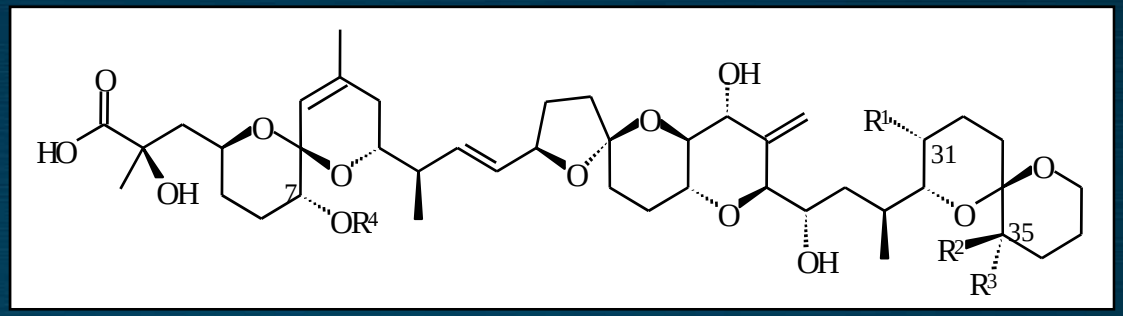
Marine biotoxins are natural toxins produced by algae and are present in shellfish as a result of algae bloom (red tide).



Algea bloom

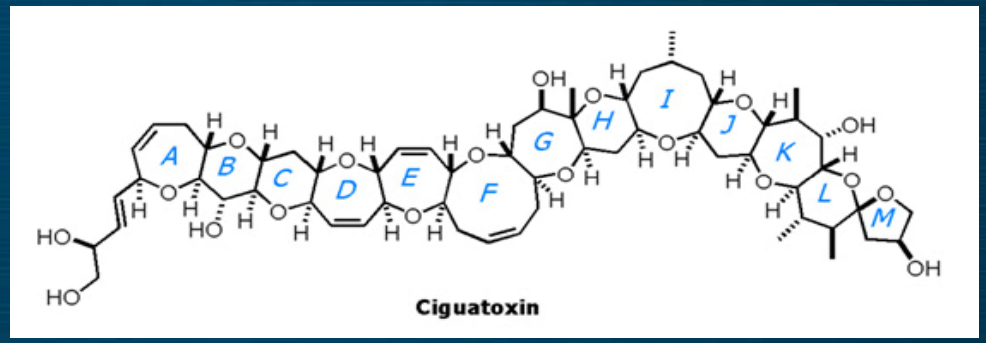
- Shallow waters
- Temperature
  * seasonal variation
  * climate change
- Nutrition
  * eutrophication
  * pollution





Dinophysis sp.

Okadaic acid



Gambierdiscus sp.

Ciguatoxin

Symptoms of shellfish poisoning

- Diarrhea
- Nausea and vomiting
- Abdominal cramps
- Neurological symptoms
- Muscle pain
- Seizures and coma
- Renal failure
- Fatal respiratory paralysis

EFSA has been requested by the European Commission to assess:

- **the current limits of marine biotoxins as established in the EU legislation with regard to human health**
- **the methods of analysis for various marine biotoxins**
- **new emerging toxins**

Marine biotoxins evaluated

The following toxin groups are included in the EFSA evaluation:

azaspiracid (AZA)*
domoic acid (DA)*
okadaic acid (OA)*

brevetoxin (BTX)
ciguatoxin (CTX)

pectenotoxin (PTX)*
saxitoxin (STX)*
yessotoxin (YTX)*

cyclic imines (CI)
palytoxin (PlTX)

*** currently regulated in the EU**

Ostreopsis bloom - palytoxin

Limitations of toxicological database

- Only very small amounts of pure toxins available
- Not all relevant toxins have been purified, and thus not tested
- Limited acute toxicity data in laboratory animals
  - Mostly in mice with intra-peritoneal injection
  - Few oral data for some toxins
- Very few repeated dose toxicity studies in animals
- Limited data on human poisonings

Derivation of health based limit value

It was not possible to establish tolerable daily intakes (TDIs) for any of the biotoxins, but in view of their acute toxicity acute reference doses (ARfDs) were set.

ARfD = estimate of the amount of a substance present in food or drink, expressed on a body weight basis, that can be ingested in a period of 24 hours or less without an appreciable health risk.

Established acute reference doses

Toxin group	Acute Reference Dose
Azaspiracids	0.2 µg AZA-1 eq/kg bw
Palytoxins	0.2 µg PlTX eq/kg bw
Okadaic acid	0.3 µg OA eq/kg bw
Saxitoxins	0.5 µg STX eq/kg bw
Pectenotoxins	0.8 µg PTX-2 eq/kg bw
Yessotoxins	25 µg YTX eq/kg bw
Domoic acid	30 µg DA/kg bw

Derivation of safe levels in shellfish

To convert the ARfD into safe levels of marine biotoxins in shellfish, consumption data are needed.

Data on shellfish consumption for the European situation are limited.

To protect the high consumer EFSA (CONTAM) selected 400g as the large portion size to be used for acute exposure assessments.

In agreement with FAO/IOC/WHO (2004), where 380 g was reported as the highest 97.5th percentile portion size.

Comparison of current EU limits with ARfD's

	Current EU limits	Maximum concentration based on 400 g portion
OA	160 µg OA eq/kg	45 µg OA eq/kg
AZA	160 µg AZA eq/kg	30 µg AZA1 eq/kg
PTX	160 µg OA eq/kg	120 µg PTX2 eq/kg
YTX	1 mg YTX eq/kg	3.75 mg YTX eq/kg
STX	800 µg PSP/kg	75 µg STX eq/kg
DA	20 mg DA/kg	4.5 mg DA/kg

Conclusions on limit values

Based on the available data it appears that the current EU regulatory limit values for OA-, AZA-, STX- and DA-group toxins are not sufficiently protective for consumers.

For YTX- and PTX-group toxins the current EU limit appears to be sufficiently protective for consumers.

For PlTX a safe level of 30 µg/kg has been calculated.

Mouse bioassay (MBA) reference method

In many countries the MBA is considered unacceptable for ethical reasons.

The MBA has limited detection capability for OA, AZA, PTX, YTX and is not considered an appropriate tool for control purposes.

The MBA can quantify STX-group toxins at current EU limit, but not below.

HPLC-methods and multi-toxin methods based on LC-MS/MS are specific and have sufficiently low LODs.

Acknowledgement

Working group members:

Jan Alexander, Diane Benford, Luis Botana, Gerhard Heinemeyer, Philipp Hess, Peter Fürst, Sophie Krys, Angelika Preiss-Weigert, Gian Paolo Rossini, Hans van Egmond, and Philippe Verger.

EFSA staff:

Mari Eskola, Claudia Heppner, Francesco Vernazza

Thank you for your attention