

# Facing new facts: marine biotoxins as a challenge for food safety

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# What we know

# From observations...Historical food-borne poisonings illness and lethality

- Fugu and TTX
- Sharks and fish and CTX
- and unknown toxins
- Shellfish and other syndromes
  - Diarrhetic DSP eq. okadaic acid
  - Amnesic ASP domoic acid
  - Paralytic PSP saxitoxins

A real threat: lowest LD50!

Rather acute than chronic approaches to risk



# ... to regulations on evaluated toxins

## Regulation (EC) n° 853/2004 (modified)

### TOXINS HARMFUL TO HUMAN HEALTH in FISH

Prohibition for some species (fish): ANNEX II, section VIII,

Fishery products derived from poisonous fish of the following families

**must not be placed on the market:**

**Tetraodontidae, Molidae,**

**Diodontidae and Canthigasteridae**

### HEALTH STANDARDS FOR LIVE BIVALVE MOLLUSCS

**Maximum levels for some toxins** (=> Includes considerations to chronic risk also): ANNEX II section VII,

« They [shellfish] **must not contain marine biotoxins in total quantities** (measured in the whole body or any part edible separately) **that exceed the following limits:**

(a) for paralytic shellfish poison (PSP), 800 micrograms per kilogram; **STX**

(b) for amnesic shellfish poison (ASP), 20 milligrams of **domoic acid** per kilogram;

(c) for okadaic acid, **dinophysistoxins and pectenotoxins** together, 160 micrograms of **okadaic acid** equivalents per kilogram;

(d) for **yessotoxins**, 3,75 milligrams of yessotoxin equivalent per kilogram; YTX

(e) for **azaspiracids**, 160 micrograms of azaspiracid equivalents per kilogram. AZTX

**Further amendments? New findings!**

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# What we discover

# Anticipating what we'll face: new facts and paradigm

- Madeira and *Gambierdiscus*

First toxin profile of ciguateric fish in Madeira Archipelago (Europe), Otero P et al, Anal Chem 2010

- TTX in Europe:

- Turner et al (2015) TTX in shellfish

in European Northern waters;

- TTX Fish species (*Lagocephalus sceleratus*)

in Lampedusa and in Aude (2014)

(see also EREN report 2016)

- *Alexandrium minutum* in Bretagne in rade de Brest : new blooms since 2010



# Emerging, in what sense?

- New risk factors: climate change, globalized transportation=> New findings on occurrence and spatial distribution
- Adjusted risk assessment=> New findings in toxicological data; consumption data
- ...Both in connection with analytical developments and RA methodology

- Known hazard but related to « new » risks : **refined knowledge on toxicology; modified exposures** (new consumption patterns, altered food combinations) ;
- **New hazard**, appearing or rediscovered/ reintroduced : question related to metrology and detection/ analytical capacities, new onset/occurrence, new processes, reintroduction on a free territory...

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Gaining knowledge to tackle new challenges : what we have to develop and implement

# Performing analytical developments

## – From bioassay to chemistry



- » Development of **large spectra methods** for monitoring the emergence of marine biotoxins in shellfish : multi-hydrophilic toxins' method (PSP+TTX) by HILIC-MS/MS & extension of the EURL lipophilic toxins SOP to domoic acid [in collaboration with Ifremer]
- » **Non targeted analysis** of marine lipophilic biotoxins in fishery products (PhD thesis)



- » Implementation of the Pre-COX method (EN 14526) for the determination of saxitoxin-group toxins in shellfish [with assistance from German NRL/BfR] **STX**



- » **CTX/ TTX**; Method validation in a bid to generate reliable data on contamination levels of emerging toxins (ciguatoxins, tetrodotoxins) in bivalve molluscs, gastropods, fish (possible foreseen collaboration with BfR NRL on certain areas)

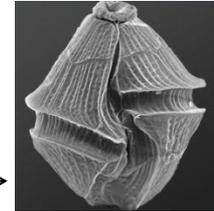
## – Data collection and investigations

- Exploratory monitoring plan for **PSP** contamination of group 1 shellfish (**gastropods, tunicates and echinoderms**)
- Contamination and **depuration kinetics** of phycotoxins in group 1 shellfish in comparison to the kinetics of group 3 shellfish (bivalve molluscs)
- Determination of the lipophilic toxins in **canned mussels** with oil-based sauce : protocol optimization, different approaches for expression of results
- Elucidation of **ciguatera poisoning cases in French West Indies**

# Refining risk assessment

- ACCUTOX research project : accumulation of PSP (*Alexandrium sp.*) in oysters (associated factors: physiological state, ploidy)

- Risk assessment for pinnatoxins from *Vulcanodinium rugosum*



CCT Centre of Sud Manche

Photo credits  
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- PHYCOTOX research group: harmful algae intl conference Nantes 2018

- R and D agreement « contamination of samples from sharks and other species »: ciguatoxins analytical development (LC/MS-MS and neuro 2a cells)



Contamination of sharks, especially tiger and bull sharks, by ciguatoxins: occurrence, analytical methods, human cases reported and ethological information

ANSES Opinion  
Collective Expert Appraisal Report

August 2014 - Scientific Edition  
Revised edition - January 2015

# Specific focus on cyanobacteria

(marine and fresh water)



**-BMAA : bêta –N-methyl amino-L-alanine in shellfish NEW! epidemiological link with neurodegenerative diseases?**

**-Metabolism and distribution/ accumulation of cyanotoxins in fish NEW!**

**-Spiruline in food supplements NEW!**

**- RA on cyanotoxins in water (drinkable +recreational activities)**



# Exerting a constant vigilance

- National monitoring on site (water and shellfish) for toxins /harmful algae : mapping risk areas/ periods and points for vigilance



- Rapid informations exchanges and alerts: EREN network, RASFF, ECDC ...
- And, above all, a strong cooperation: RA, analysis, research!



# EU PROJECTS



“Risk characterization of ciguatera food poisoning in Europe”. The project is co-funded by the European Food Safety Authority (EFSA) and 14 European organizations. [http://www.aecosan.msssi.gob.es/AECOSAN/web/ciguatera/home/aecosan\\_home\\_ciguatera.htm](http://www.aecosan.msssi.gob.es/AECOSAN/web/ciguatera/home/aecosan_home_ciguatera.htm)

The screenshot shows a web browser window displaying the EFSA website. The address bar shows the URL [www.efsa.europa.eu/en/press/news/160420a](http://www.efsa.europa.eu/en/press/news/160420a). The page features the EFSA logo and navigation menus. The main content area displays a news article dated 20 April 2016, titled "Fighting ciguatoxin food poisoning – European scientists join forces". The article text describes a cooperation project involving 13 organizations from six Member States and EFSA, signed on 19 April 2016. It details the risk characterization of ciguatera food poisoning in Europe, mentioning outbreaks in the Canary Islands and Madeira since 2008. A video link is provided at the bottom of the article. On the right side, there are sections for "Subject area" (Chemical contaminants) and "Related News" with links to "Furan in food – EFSA confirms health concerns" and "Pyrrolizidine alkaloids in tea, herbal infusions and food supplements". The Windows taskbar at the bottom shows the system clock as 12:58 on 26/11/2017.

# For more information

# www.anses.fr

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The screenshot shows the ANSES website homepage. At the top, there is a navigation menu with categories: ANSES, Expertise & Assessment, Research & Reference, Monitoring & Surveillance, Europe & International, Job Opportunities, and My Account. Below this is a secondary menu with: News, Our Topics, Alphabetical Index, Opinions, Reports & Publications, Events, Calls & Consultations, and Press Room. The main header features the ANSES logo and the full name: ANSES - French Agency for Food, Environmental and Occupational Health & Safety. A search bar is located on the right. The main content area is divided into several sections: 'ANSES by topic' with a list of areas like Food & nutrition, Occupational health, Environmental health, Animal health & nutrition, Veterinary medicine - ANMV, Plant health & protection, and Plant protection products, biocides & fertilisers; 'Nutrivigilance, a scheme devoted to consumer safety' with an illustration; 'National Research Programme on Environmental and Occupational Health: 33 projects selected, 5.7 million euros mobilised for calls for projects in 2014'; 'ANSES's Scientific Conference: a one-day event devoted to bee health'; 'Find a laboratory' with a map of France; 'Latest Opinions and Reports' with a list of recent publications; 'How to report a health problem' with social media links; and 'News publications' with a list of recent reports. At the bottom, there is a footer with contact information, useful links, and RSS feeds.



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in December 2014!**

# Recent publications/ Anses

- Opinion and report: Contamination of **sharks** (2014)

<https://www.anses.fr/en/system/files/ERCA2013sa0198EN.pdf>

- Opinion on the acute and chronic toxicity of **BMAA** (beta-methylamino-L-alanine) (2017)

<https://www.anses.fr/en/system/files/ERCA2016SA0012EN.pdf>

- **Spiruline** (in French) (2017) **pending!**

- **Cyanotoxins** (in French) : état des connaissances concernant la contamination des poissons d'eau douce par les cyanotoxines (2016):

<https://www.anses.fr/en/system/files/ERCA2015SA0206.pdf>

- **Vigilance** (in French) (2014)

<https://www.anses.fr/fr/system/files/ERCA2012sa0196.pdf>