Climate change as potential driver of emerging risks for food safety

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European Food Safety Authority (EFSA)

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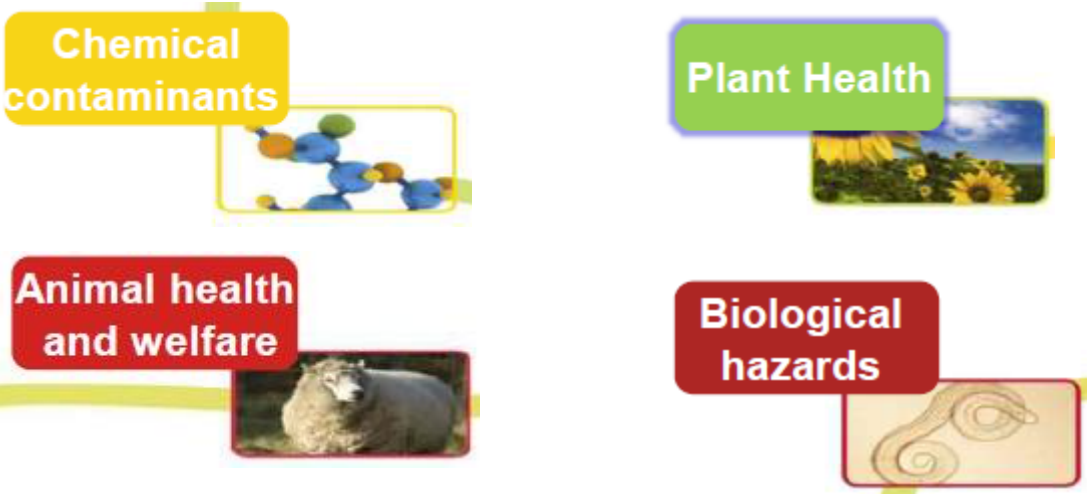
EFSA

- Provides EU risk managers with independent, up-to-date **scientific advice** on questions linked to the food chain
- **Communicates** to the public on its outputs and the information on which they are based
- **Cooperates** with Member States, institutional partners and other interested parties to provide consistent advide to increase trust in the EU food Safety system

OVERVIEW

- Background on EFSA Emerging Risks identification activities
- Climate change as a driver of emerging risks for food safety
- EFSA's activities related to climate changes - Examples for:

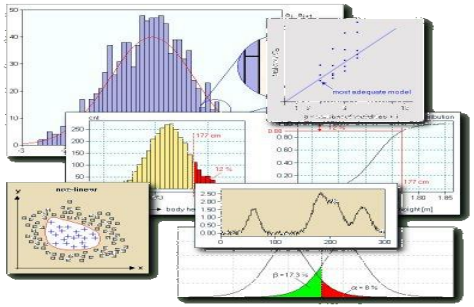


- Food for thought

IDENTIFICATION OF EMERGING RISKS

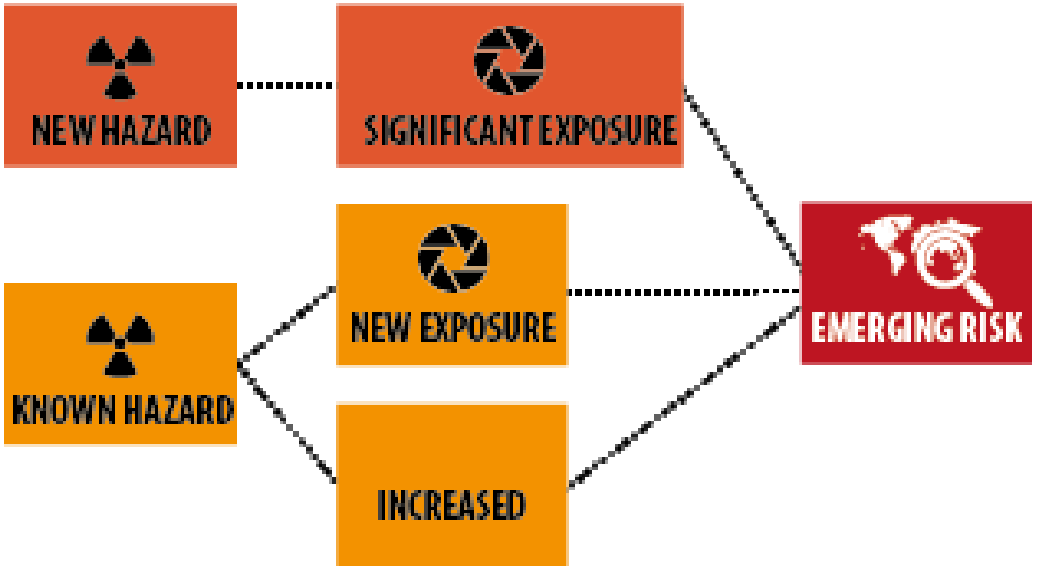
Collecting and collating

Analyse and filter



Sharing

DEFINITION


NEW HAZARD
SIGNIFICANT EXPOSURE
KNOWN HAZARD
NEW EXPOSURE
INCREASED
EMERGING RISK

AIM OF THE EMERGING RISKS ACTIVITIES

Early identification of emerging issues to better anticipate risk assessment needs

- Stimulate research
- Data generation/collection
- Risk assessment methodologies

CLIMATE CHANGE AS A DRIVER OF EMERGING RISKS (1)

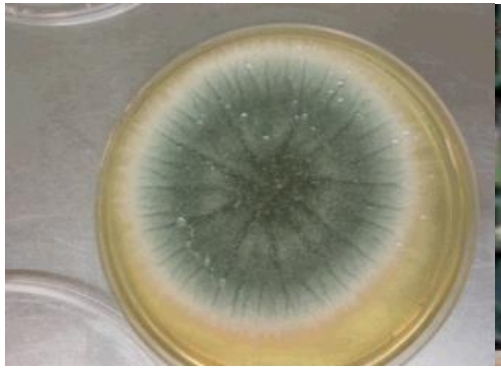
Potential impact on	EFSA's area
Occurrence, dominance, persistence, geographic/temporal distribution, behaviour, toxicity, virulence of: phytoplankton (dynoflagellates, diatoms and cyanobacteria HAB), bacteria, viruses, parasites, fungi, vectors and invasive alien species	Contaminants- Biological hazard - Animal health - Plant health - Pesticides
Susceptibility to disease/infestation	Animal health - Plant health – GMO – Pesticides - Contaminants
Biophysical reactions to thermal stress, nutrients and water availability	Plant health - Animal health - Feed additives - Contaminants
Transport pathways, fate and exposure	Contaminants

CLIMATE CHANGE AS A DRIVER OF EMERGING RISKS (2)

Potential impact on	EFSA's area
Changing patterns (amount, type) of pesticide and fertilizers use	Pesticides - Contaminants
Changing patterns (amount, type) of veterinary drugs use and additives	Animal Health – Contaminants - Feed additives
Increase sewage input into coastal environment	Biological hazards - Contaminants
Food hygiene in e.g. storage and transport	Biological hazards
Nutritional value	Nutrition
Other drivers (social behaviour, consumption patterns, farming practices, technologies …)	all

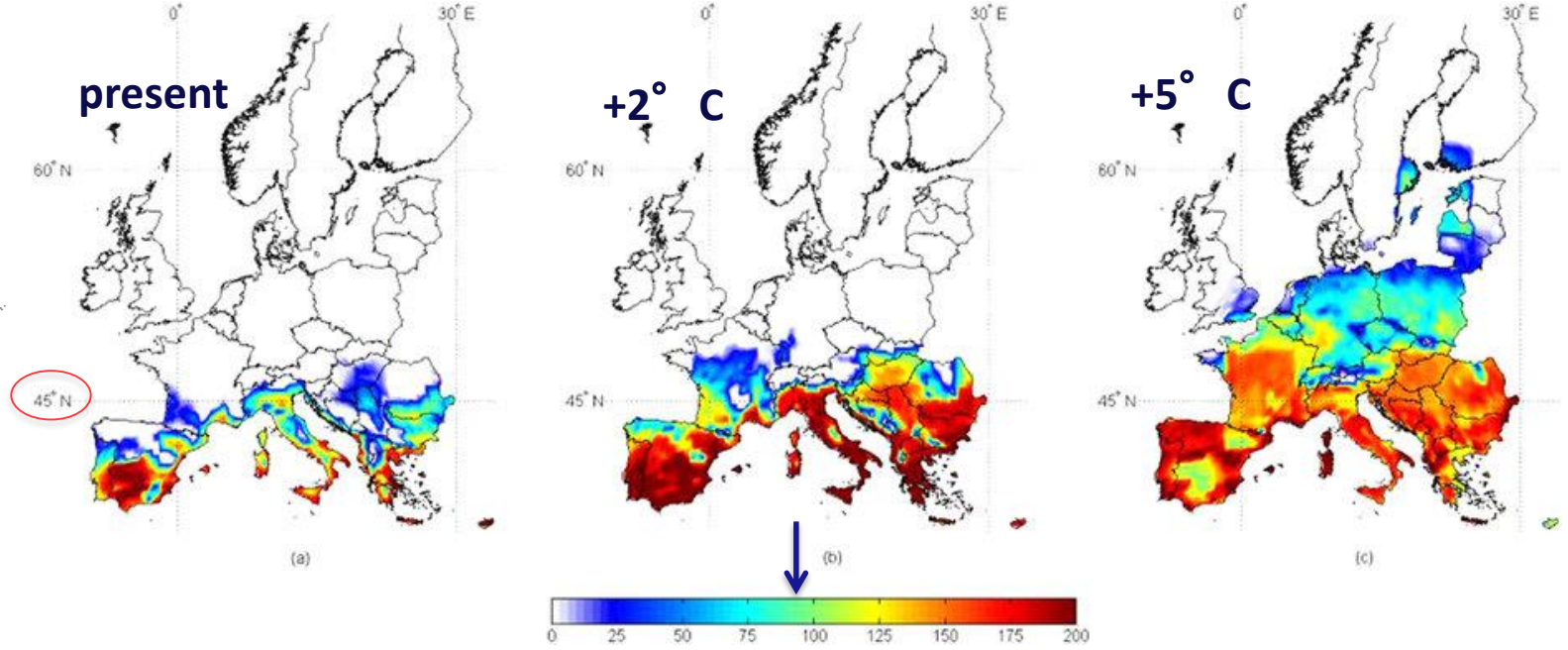
AFLATOXINS IN CEREAL: EFSA GRANT

Modelling, predicting and mapping the emergence of aflatoxins from *Aspergilus flavus* and *A. parasiticus* in maize, wheat and rice due to climate change

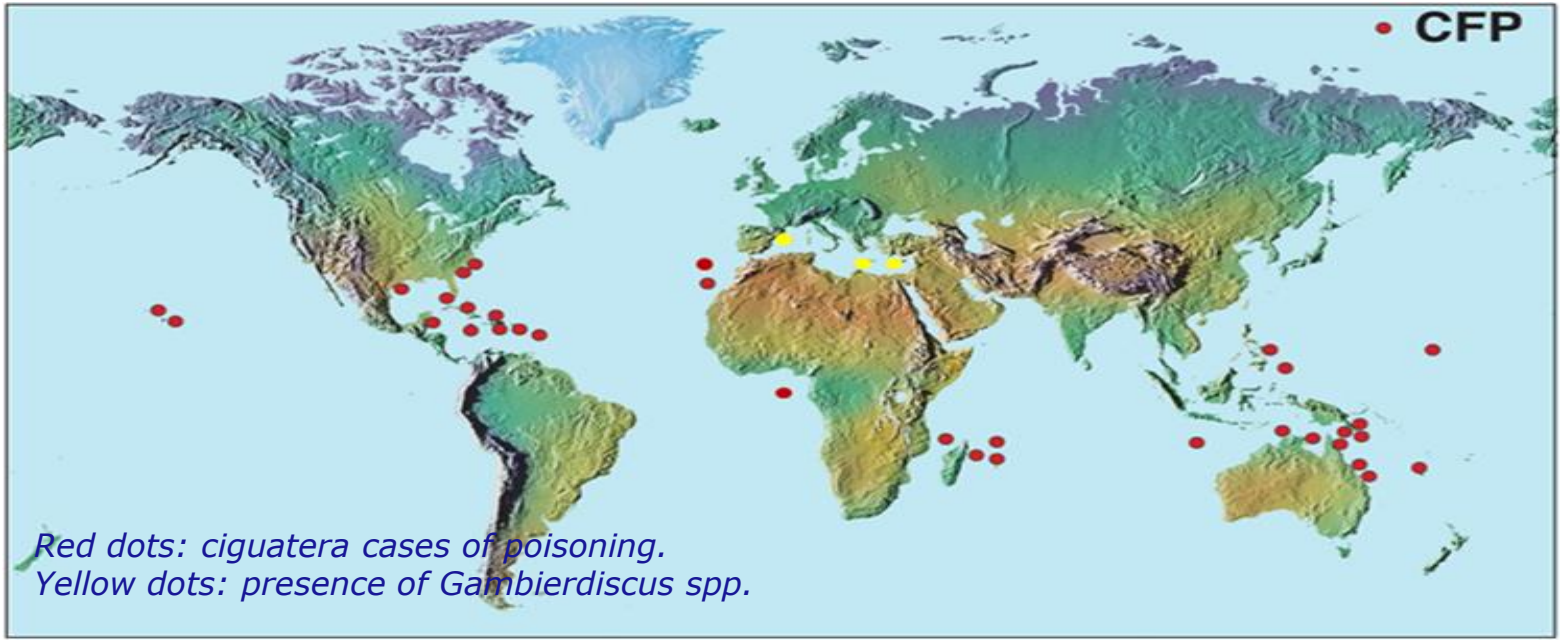


RISKS OF AF IN MAIZE, WHEAT AND RICE IN THE EU

The risk of aflatoxin contamination due to *A. flavus* is expected to increase in maize, both in the + 2 ° C and + 5 ° C scenarios, to be negligible in wheat and absent in rice.



CIGUATERA

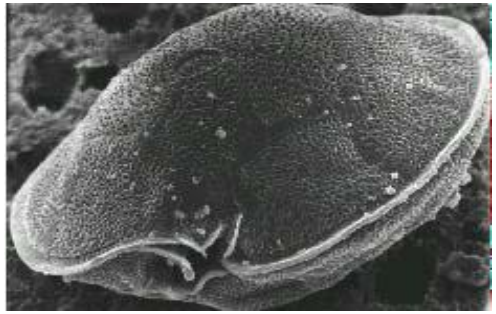


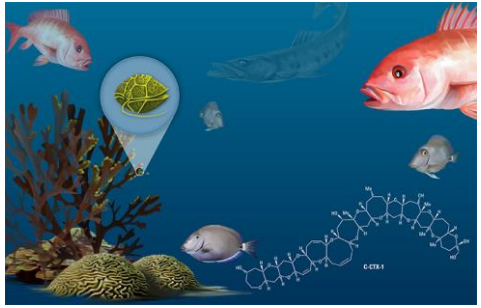
Red dots: ciguatera cases of poisoning.
Yellow dots: presence of Gambierdiscus spp.

Mainly in inter-tropical latitudes. Increasing incidence in non-endemic areas ⟹ tropicalization scenario of the Mediterranean Sea?

CIGUATERA - BACKGROUND

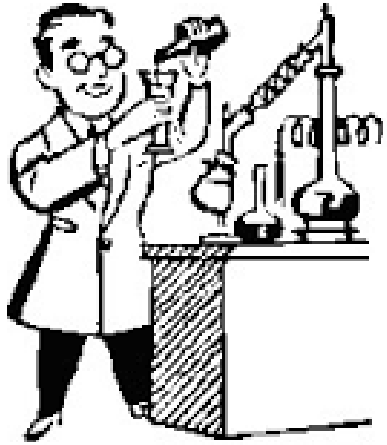
- 20.000 - 500.000 people suffering annually
- outbreaks reported in Canary Islands and Madeira
- Gambierdiscus spp. present in Canary Islands, Madeira and in the Mediterranean





CIGUATERA – FRAMEWORK PARTNERSHIP AGREEMENT

- GP/EFSA/AFSCO/2015/03 FPA "Risk characterization of ciguatera food poisoning in Europe" (ongoing)



CIGUATERA – DATA FOR CLIMATE CHANGE MODELS

Data generation

+

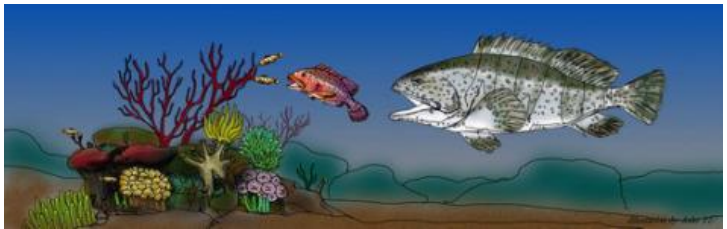
Data collection

Gambierdiscus and fish data

Oceanographic data

Meteorological data

Future development/calibration/validation of models



CYANOTOXINS – THE LINK WITH CLIMATE CHANGES

- temperature
- stratification
- flooding
- nutrients.

spatial and temporal distribution of cyanobacteria blooms

CYANOTOXINS – EFSA'S PROCUREMENT

- EFSA/SCER/2014/04 "Review and analysis of occurrence, exposure and toxicity of cyanobacteria toxins in food"
- Environmental factors
- Spatial and temporal distribution of blooms
- Effects on the toxicity of the blooms??

PLANT HEALTH – CLIMATE CHANGE SCENARIOS FOR *BEMISIA TABACI*

Risks to plant health posed by *Bemisia tabaci* species complex and viruses it transmits for the EU territory

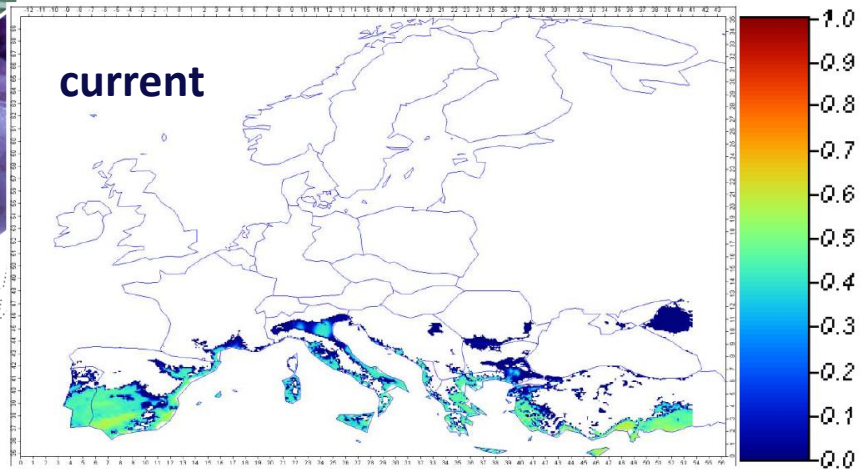


Figure E.4: Distribution of the probability of virus establishment obtained considering the current temperature and climatic situation

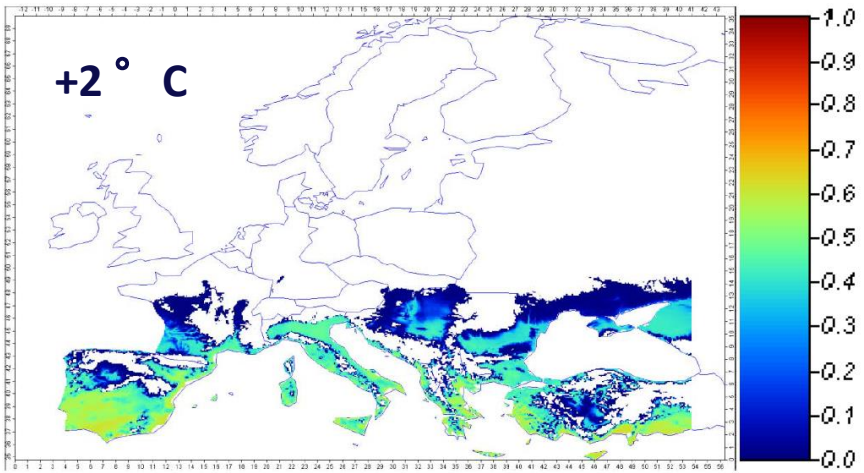


Figure E.5: Distribution of the probability of virus establishment in the climate change scenario + 2 °C.

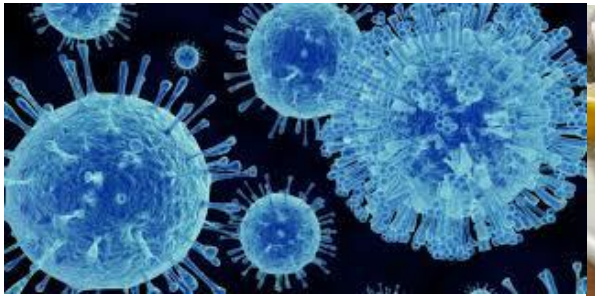
ANIMAL HEALTH

Monitoring distribution of arthropod vectors

Vectornet: European network for sharing data on the geographic distribution of arthropod vectors, transmitting human and animal disease agents (https://vectornet.ecdc.europa.eu/).

BIOLOGICAL HAZARDS: NOROVIRUS IN OYSTERS

Technical specifications for a European baseline survey of norovirus in oysters



FOOD FOR THOUGHT (1) - COLLABORATION

- *Preparedness* to anticipate
- Identifying and prioritasing emerging risks of most concern
- Impact of climate change: difficult prediction …. Several interacting factors
- International cooperation: data, models, methodologies, expertise

FOOD FOR THOUGHT (2) - DATA

- Relations between environmental factors associated to climate changes and food safety
- Monitor geographic distribution

FOOD FOR THOUGHT (2) - MODELS

- Explore climatic scenarios; predict future trends and maps; propose potential control options

- Impact on toxicity
- Impact on occurrence/incidence (algae, bacteria …)

- Uncertainties and limitations
- Integrated/holistic approach
- Predictions could be used by risk managers to adopt control and mitigation measures.

FOOD FOR THOUGHT (2) - METHODS

Risk assessment methods may need to be reviewed: how to ensure that the impact of climate change is adequately considered?

Future risks could be very different from those of today …

Many thanks!

Questions ?

BACK-UP SLIDES

IDENTIFICATION ER: PROCESS IN PLACE

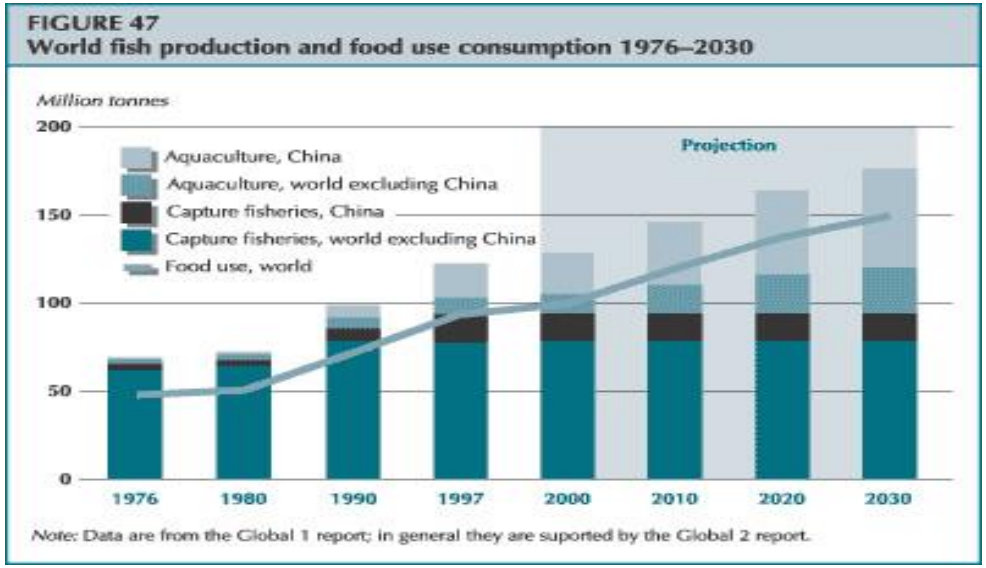
Identification of priority emerging issues

Information sources and data collection

Evaluation to identify emerging risks

SEAFOOD

- Production
- consumption



RISKS

2014 notifications by product category and by classification

product category	alert	border rejection	information for attention	information for follow-up	total
alcoholic beverages	3	1		1	5
animal by-products				5	
bivalve molluscs and products thereof	35	43	41	6	125
cephalopods and products thereof	2	13	6		21
cereals and bakery products	45	43	13	15	116
cocoa and cocoa preparations, coffee and tea	6	41	6	9	62
compound feeds	3	1		12	16
confectionery	12	5	1	11	29
crustaceans and products thereof	5	40	20	7	72
dietetic foods, food supplements, fortified foods	57	50	34	63	204
eggs and egg products	5				5
fats and oils	3	12	3	1	19
feed additives		1	12	16	29
feed materials	25	55	31	98	209
feed premixtures			2	1	
fish and fish products	118	82	92	31	323
food additives and flavourings	3	1	11	10	25
food contact materials	23	104	36	22	185
fruits and vegetables	91	369	149	11	620
gastropods	3		2		5

AFLATOXINS'GRANT

Data limitations

- Limited or no information for the modelling of *A. parasiticus* in the three crops and for aflatoxins other than AFB_1
- Sufficient information for the modelling of *A. flavus* and AFB_1 in detail.
- *A. flavus*-AFB_1 model linked to phenology data in maize, wheat and rice

AFLATOXINS'GRANT

Approach

Risk of AF contamination predicted using the *A. flavus* AFB_1 model, predicted crop flowering and harvest dates and meteorological data.

Climate scenarios:

Daily meteorological data obtained from LARS-WG 5.0 weather generator.

For each of three scenarios (actual, +2.0° C, +5.0° C), weather was simulated over the period of a year, and repeated 100 times, on a grid scale of 50x50km.

Results on climate, crop phenology and aflatoxin risk used for statistical analysis and mapping.

AFLATOXINS'GRANT

Results

- Predictions showed a reduction in season length and an advance in flowering and harvest dates for all crops. This could allow an enlargement of the crop growing areas towards the north, particularly for rice and maize.

- +2° C: higher levels of contamination expected in areas where maize is currently grown.
- +5° C: levels intermediary between actual and +2° C, but the area affected is much wider, extending northwards.

AFLATOXINS'GRANT

Consortium

- P. Battilani et al., Università Cattolica del Sacro Cuore Piacenza, Italy
- H. van der Fels-Klerx, Institute of Food Safety Wageningen, Netherlands
- C. Booij, Plant Research International Wageningen, Netherlands
- A. Moretti, A. Logrieco, Istituto di Scienze delle Produzioni Alimentari Bari, Italy
- F. Miglietta, P. Toscano, Institute of Biometeorology, Firenze, Italy
- M. Miraglia, B. De Santis, C. Brera, Italian Institute of Health, Roma, Italy

AFLATOXINS'GRANT

The report is published on EFSA's website:

http://www.efsa.europa.eu/en/supporting/pub/223e.htm

CIGUATERA FPA

Objectives

- To determine the incidence of ciguatera in Europe and the epidemiological characteristics of cases.
- To assess the presence of ciguatoxin in food and the environment in Europe.
- To develop and validate methods for the detection, quantification and confirmation of the presence of ciguatoxin contaminated specimens.

OKADAIC ACID IN MANILA CLAMS

Ecological modification of a confined habitat

- Gracilaria vermiculophilla appeared and populated a lagoon used for clam production
- Rapidly displaced the resident macro-algae Ulca lactuca.
- Unlike Ulva lactuca it shows anchoring behaviour
- Hypothesis: Gracilaria vermiculophilla favours the toxigenic microalga Prorocentrum lima which is epiphitic and bentonic

OKADAIC ACID IN MANILA CLAMS

Gracilaria vermiculophilla native to east Asia

- First appeared in the Adriatic sea in 2008 (area of Venice)
- Introduced by cruise ships to Venice?
- Gracilaria anchors to the sediment where the clams are
- Competitive advantage over Ulva lactuca (floating alga) (more difficult to manually remove)
- It appears to tolerate low salinity better than Ulva
- Intensive clam farming removes phytoplancton through filtration leaving abundant nutrients available to Gracilaria
- Removal of Gracilaria poses the problem of its disposal
- Biogas-producing plant being considered

EMERGING MARINE BIOTOXINS

EFSA's evaluation of marine biotoxins

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 BY THE CONTAM PANEL

Regulated marine biotoxins in the EU

okadaic acid
azaspiracids
yessotoxins
saxitoxins
pectenotoxins
domoic acid

Emerging marine biotoxins – not regulated in the EU

- palytoxins
- cyclic imines
- Brevetoxins
- ciguatoxins

checks are to take place to ensure that fishery product containing biotoxin such as ciguatoxin are not placed on the market

Scientific opinions adopted by the CONTAM Panel

MARINE BIOTOXINS: GENERAL OUTCOME

For all risk assessments on emerging marine biotoxins the CONTAM Panel concluded that the overall uncertainty is large and a detailed consideration of the various potential sources of uncertainty is not meaningful.

Recommendations:

- Certified reference standards and reference materials are needed
- Methods other than the Mouse Bioassay should be further developed, optimised and validated
- More information on occurrence in fish and other seafood is needed
- Due to their high acute toxicity and emerging occurrence, appropriate strategies to protect human health need to be developed
- Further information to better characterise the oral toxicity and relative potencies is needed

MARINE BIOTOXINS

toxin	Producing organism
Palytoxin-group	marine zoanthids (soft corals) of the genus Palythoa and benthic dinoflagellus of the genus Ostreopsis
ciguatoxins	dinoflagellate Gambierdiscus toxicus
spirolides	dinoflagellate Alexandrium ostenfeldii
gymnodimines	dinoflagellate Karenia selliformis
pinnatoxins	Not identified
pteriatoxins	bio-transformed from PnTXs in shellfish
brevetoxins	dinoflagellate Karenia brevis
Okadaic acid	dinoflagellate dinophysis

WHAT CAN MARINE BIOTOXINS DO TO YOU?

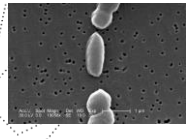
Symptoms of shellfish poisoning

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

TETRODOTOXINS – EC MANDATE TO CONTAM PANEL

- In fish of the *Tetraodontidae* family, blue-ringed octopus and gastropods

- Predominantly in tropical regions
- Linked to marine dynoflagellate Prorocentrum Minimum.
- Threat deemed negligible within the European Union, but ...
- detection of TTXs in European bivalve molluscs firstly reported by the UK in 2014 for shellfish in England harvested in 2013 and 2014
- 11 of 29 shellfish samples (Mytilus edulis and Crassostrea giggs) found to contain *V. paraheamolyticus*



- **Scientific opinion on the evaluation of the toxicity of TTX and TTX analogues in bivalve molluscs and marine gastropodes** (under development)

TETRODOTOXINS: POSSIBLE LINK WITH CLIMATE CHANGES

- Detection of TTX in all but one of the *V. paraheamolyticus* cultures provides additional evidence for the production of TTX by Vibrio spp.

- Increasingly favourable conditions for Vibrio proliferation in European waters as sea surface temperatures will possibly rise in the coming decades ⟹ potential for growth of autochthonous marine bacteria such as Vibrio??

BIOLOGICAL HAZARDS: AGENTS OF FOOD-BORNE OUTBREAKS

EU summary report on zoonoses, zoonotic agents and food-borne outbreaks 2014

(https://www.efsa.europa.eu/it/efsajournal/pub/4329)