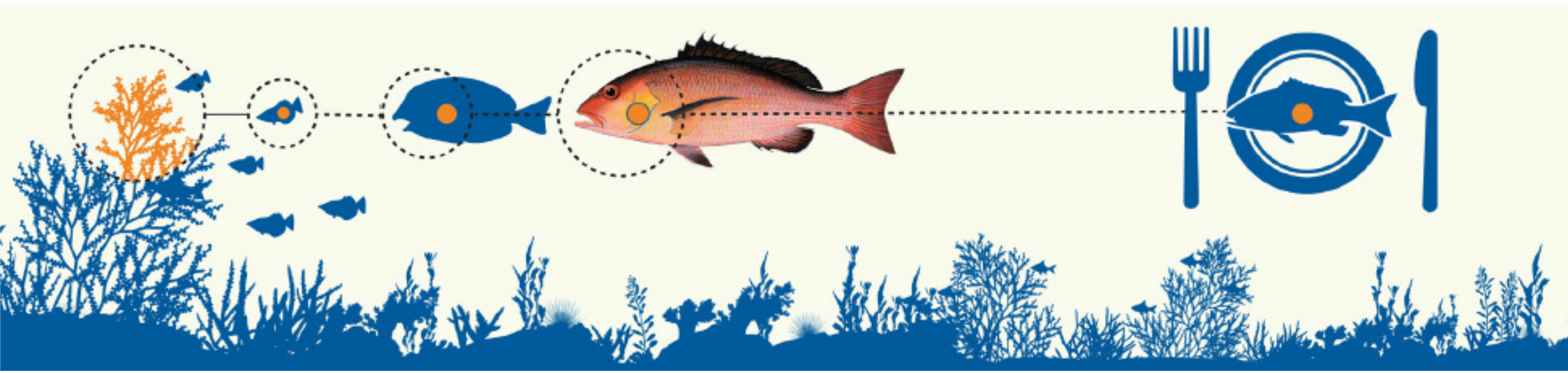
Food and Agriculture Organization of the United Nations

FAO-WHO work on ciguatera and current challenges

Side Event CCCF11, 5th April 2017, Rio de Janeiro, Brazil



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1. Introduction

Ciguatera fish poisoning (CFP) is one of the most common food-borne illnesses related to finfish consumption. It has been known for centuries. Its true incidence is not known, but it is estimated that 10,000–50,000 people per year suffer from this illness, making it one of the most common types of marine food-borne poisoning worldwide.

FAO, 2014. *Assessment and management of seafood safety and quality.* Fisheries Technical Paper 574.

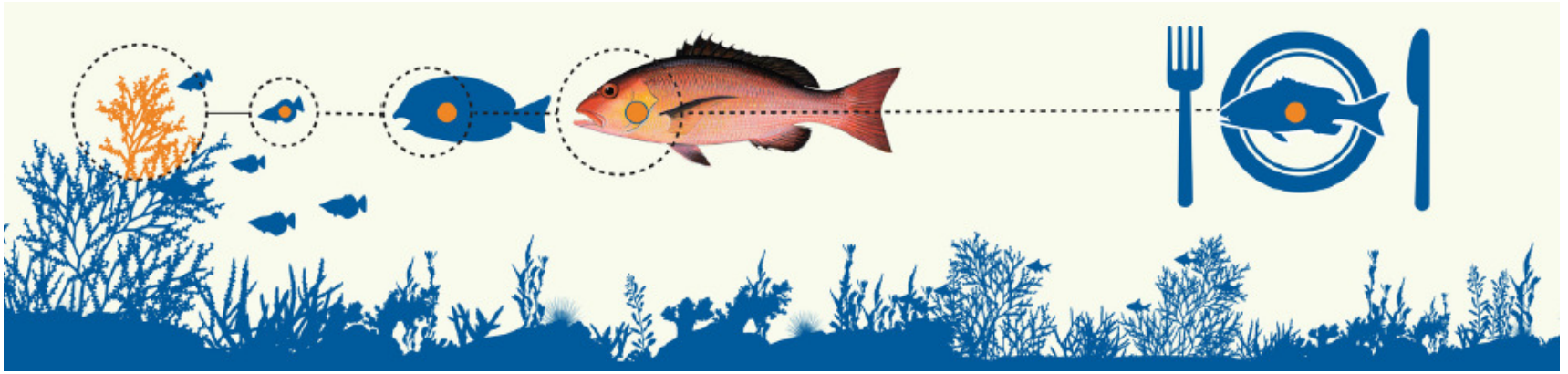
1. Introduction

- It is caused by the consumption of herbivorous fish that have become toxic from feeding on toxic benthic dinoflagellates (*Gambierdicus toxicus*) or from carnivorous fish that have consumed toxic herbivorous fish that have fed on the dinoflagellate.
- *Gambierdicus toxicus* is found primarily in the tropics in association with macro algae usually attached to dead corals.
- More than 400 species of fish are known to be vectors of ciguatera.

FAO, 2014. *Assessment and management of seafood safety and quality.* Fisheries Technical Paper 574.

1. Introduction

Changes in coral reefs



Proliferation of toxic dinoflagellates → Toxic dinoflagellates eaten by small herbivorous fish → Small fish eaten by larger carnivorous fish → Fish eaten by human

The toxic dinoflagellates, mainly *Gambierdiscus*, can produce Ciguatoxins (CTXs)

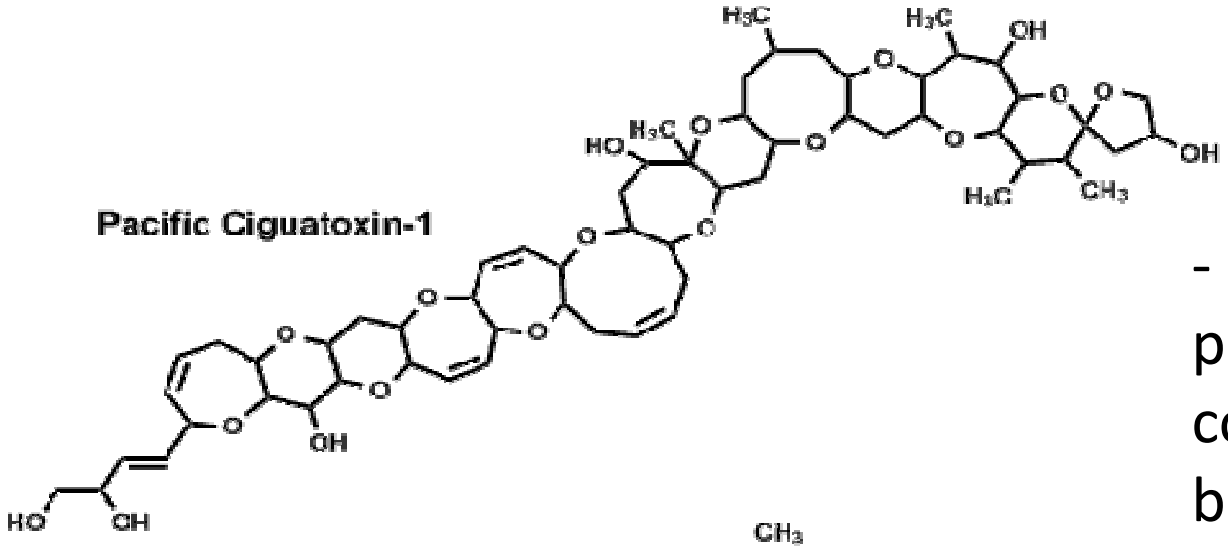
Ciguatera fish poisoning (CFP)

1. Introduction

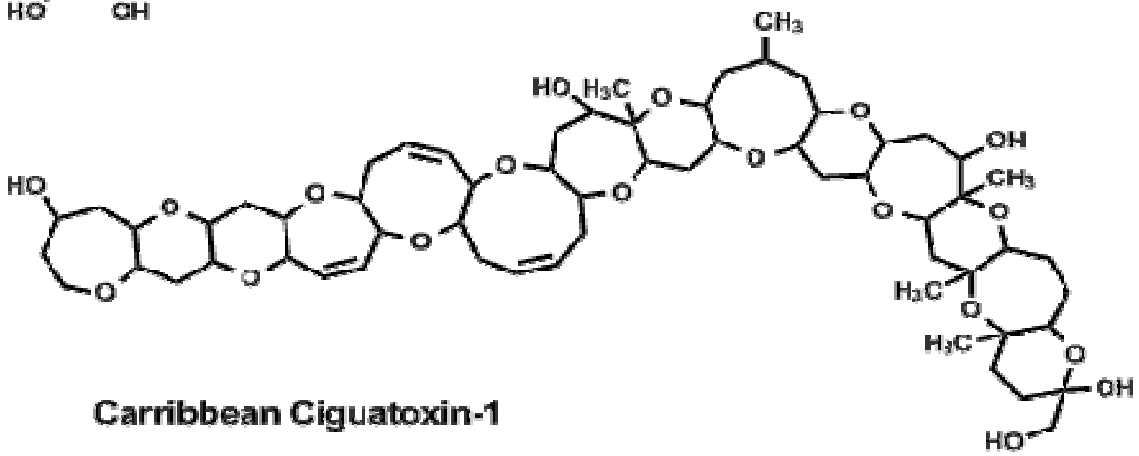
Examples of fish associated with ciguatera

Species	Distribution
Lined surgeonfish (Acanthurus linearis)	Indo-Pacific
Bonefish (Albula vulpes)	Worldwide inwarm seas
Gray triggerfish (Balistes carolinensis)	Atlantic, Gulf of Mexico
Gaucereye porgy (Calamus calamus)	Western Atlantic
Horse-eye jack (Caranx latus)	Atlantic
Whitetip shark (Carcharinus longimanus)	Worldwide
Humphead wrasse (Cheilinus undulatus)	Indo-Pacific
Heavybeak parrotfish (Chlorurs gibbus)	Indo-Pacific
Red groupper (Epinephelus morio)	Western-Atlantic
Giant moray (Gymnothorax javanicus)	Indo-Pacific
Hogfish (Lachnolaimus maximus)	Western Atlantic
Northern red snapper (Lutjanus campechanus) Tarpon	Western Atlantic, Gulf of Mexico
(Megalops atlanticus)	Eastern Atlantic
Narrowhead gray mullet (Mugil capurri)	East CentralAtlantic
Yellowtail snapper (Ocyurus chrysurus)	Western Atlantic
Spotted coralgrouper (Plectropomus maculatus)	Western Pacific
Blue parrotfish (Sparus coeruleus)	Western Atlantic
Spanish mackerel (Scomberomorus maculatus)	Western Atlantic
Lesser amberjack (Seriola fasciata)	Western Atlantic
Great barracuda (Sphyraena barracuda)	Indo-Pacific,Western Atlantic
Chinamanfish (Symphorus nematophorus)	Western Pacific

1. Introduction



Pacific Ciguatoxin-1



Carribbean Ciguatoxin-1

- CTXs are lipid-soluble polyether compounds consisting of 13 to 14 rings bonded by ether linkages into a most rigid ladder-like structure.

Source: U.S. Food and Drug Administration (FDA), 2012

1. Introduction

- Ciguatoxic fish cannot be identified by appearance, smell, or taste. The toxin is heat stable, and remains after freezing. Its presence can only be determined by analytical methods.
- Human symptoms after consuming ciguatoxic fish include abdominal cramps; nausea; diarrhoea; numbness in lips, tongue, fingers, toes; joint pain; muscle pain; headaches; and in severe cases cardiovascular complications.

2. Ciguatera and climate change

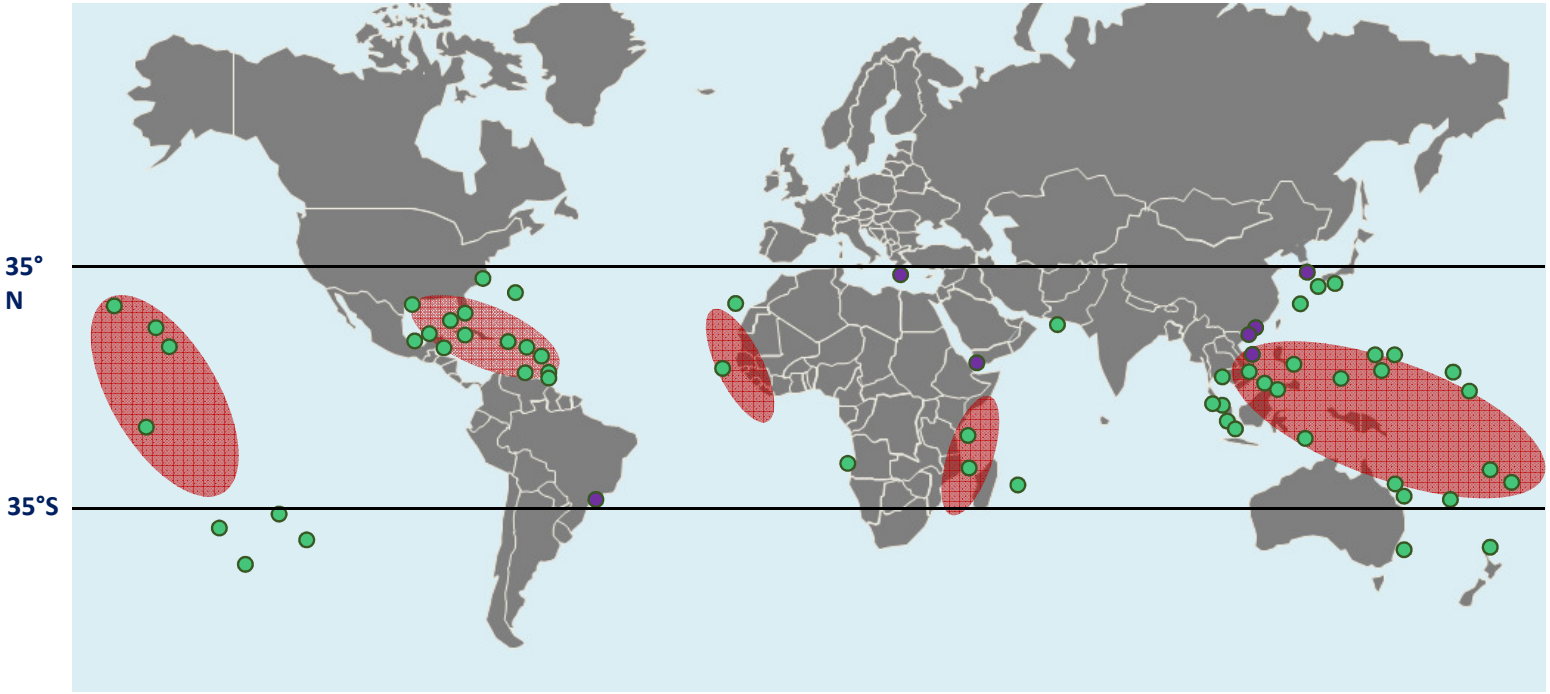
- These species are usually found in the tropical and subtropical Pacific and Indian Ocean regions and the tropical Caribbean.

- Due to climate change, the frequency of storms and hurricanes and sea surface temperature (SST) increases, which has an impact on the distribution and proliferation of ciguatera-toxins (CTX) making the occurrence of CFP less predictable.

FAO, 2014. *Assessment and management of seafood safety and quality.* Fisheries Technical Paper 574.

2. Historical distribution of toxins

2. Current distribution of toxins



Known distribution of Gambierdiscus

Locations where Gambierdiscus are newly discovered in the past 15 years

Ciguatera endemic areas

Graph is created based on the data from FAO (2014) and Richlen et al (2012)

2. Ciguatera and climate change

- As a result of recent CFP events, the capture of many species has been banned for sustained periods of time in affected areas, which may have major implications for food security and trade for these coastal communities.
- In addition to climate change, globalization of trade might also contribute to the spread of CTX. As such, further guidance might be needed for those countries that did not consider ciguatoxins in their risk management programs in the past.
- For example, the RASFF portal of the EU notified the presence of CTXs in four occasions during 2016 and in one occasion during 2015 while there were no CTX notifications over the last decade.

3. Analytical methods for detection and quantification of CTXs

- CTXs are odorless, tasteless.
- Bioassays, with the use of vivo animals such as mouse, chicken, mongoose, cat, mosquito, have traditionally been used to detect ciguatoxic fish.
- Many native tests for toxicity of fish have been examined including the discoloration of silver coins or copper wire, or the repulsion of flies and ants, but they were all rejected as invalid methods (Park, 1994). Though simple and relatively sensitive, most of these methods were criticized burdensome and not quantitative, and have a common disadvantage – the lack of specificity for individual toxins (FAO, 2004).

3. Analytical methods for detection and quantification of CTXs

- Other analytical methods use thin layer chromatography to detect and quantify CTXs or other related toxins.
- Alternative assays using immunochemical technology have been developed, and regarded a great progress in the field of fish safety monitoring (Caillaud, 2010).

3. Analytical methods for detection and quantification of CTXs

- Although there are several biological, immunological, and chemical methods available for detecting CTXs in fish tissue, including a traditional mouse bioassay, radio ligand binding, high performance liquid chromatography (HPLC), and mass spectrometry, none of them have been found economically feasible for routine large scale screening of fish samples.
- This has been challenging for import inspection sectors for detecting any suspicious CTX-contaminated seafood shipments.

4. FAO-WHO work on ciguatera

- The FAO Food and Nutrition Paper 80 “Marine Biotoxins” was published in 2004 and provides basic information about ciguatera, including: chemical structures and properties of ciguatoxins, methods of analysis, source, habitat and distribution, occurrence and accumulation in seafood, toxicity, prevention of intoxication, a summary of cases and outbreaks of Ciguatera Fish Poisoning (CFP) and regulations.

- The paper concluded that the available animal data on ciguatoxin were not suitable for risk assessment.

4. FAO-WHO work on ciguatera

- The FAO Fisheries and Aquaculture Technical Paper 574, “Assessment and management of seafood safety and quality” was published in 2014 and Ciguatera dinoflagellates were predicted to become one of the increasing food safety threats due to climate change.

4. FAO-WHO work on ciguatera

- In 2015, FAO organized an interagency meeting with the WHO, UNESCO-IOC, and the IAEA to discuss ciguatera fish poisoning as an increasing food safety threat.
- It was agreed that the most effective way to address this concern is to bring together international experts on fisheries, public health and climate change, since the issue touches upon all of these areas.
- During the meeting a plan of action was defined and the need of international level guidance was identified.
- One of the planned actions assigned to FAO was to have a side event on ciguatera during a relevant Codex Committee to define the way forward.

4. FAO-WHO work on ciguatera

- At the 32nd Session of the Committee on Fisheries (2016), CFP was raised by the Pacific Nations as an issue that increasingly affects the tropical and subtropical regions of the Pacific Ocean, Indian Ocean, and Caribbean Sea, between the latitudes 35°N and 35°S.

5. Current challenges

- The General Standard for Contaminants and Toxins in Food and Feed (CODEX STAN 193-1995), the Code of Practice for Fish and Fishery Products (CAC/RCP 52-2003) and other Codex standards for fishery products, currently do not provide any guidance on ciguatera management and control.
- Analytical methods for detection and quantification of CTXs are not harmonized.
- Maximum limits for Pacific (P) and Caribbean (C) CTXs are not stablished.

6. Relevance to this committee

- CCCF has the mandate to establish maximum levels for contaminants in food and feed to assure the safety for consumers, or to develop other alternative management measures to contain contamination of food and feed with contaminants in compliance with the mandate of the Commission.
- Ciguatera is a natural occurring toxin in fish and CCCF will be the relevant subsidiary body of CAC to recommend measures to reduce contamination to safe levels to ensure public health and facilitate trade.

6. Relevance to this committee

The Committee is invited to consider:

- the establishment of maximum limits for C-CTX-1 and P-CTX-1;
- And/or the development of risk management guidelines;

To facilitate this work, the committee is invited to consider requesting FAO/WHO for scientific advice, in particular to:

- Carry out a risk assessment of CTXs and based on this provide guidance for the development of risk management options.
- Review existing analytical methods for CTX detection and quantification, with a view to recommend those useful for routine analysis and surveillance.

6. Relevance to this committee

FAO and WHO would like to use the side event as a platform to share experiences, ideas and explore possibilities to face current challenges and undertake further work.

Food and Agriculture Organization of the United Nations

Thank you for your attention