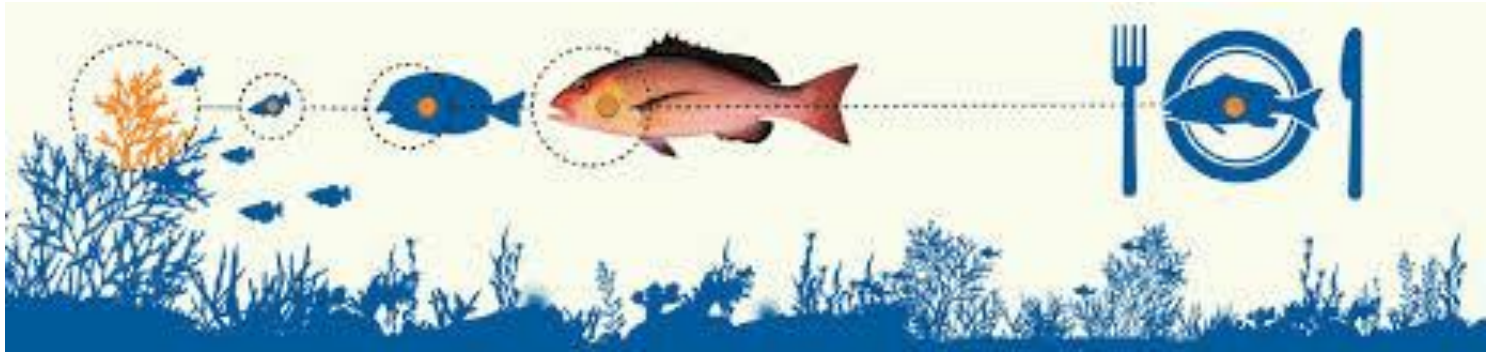
TECHNICAL ASSISTANCE TO BUILD FOOD SAFETY CAPACITY

FOR THE FISHERIES SECTOR

MODULE 1

Hazards associated with Caribbean fish and fishery products

Training for TIBU Impex, Guyana



Prepared by: Megapesca Lda Portugal
Trainer: Kelly Brathwaite (PhD)

Learning Outcomes

At the end of this session, you should be able to:

- Understand potential species-related hazards for Caribbean fish:
  - Histamine
  - Ciguatera
  - Heavy metals: Mercury, Cadmium, Lead
  - Additives
  - Veterinary Drug Residues


WARNING
FISH CONTAMINATED
DO NOT EAT

Hazard category: Biogenic amines

Histamine

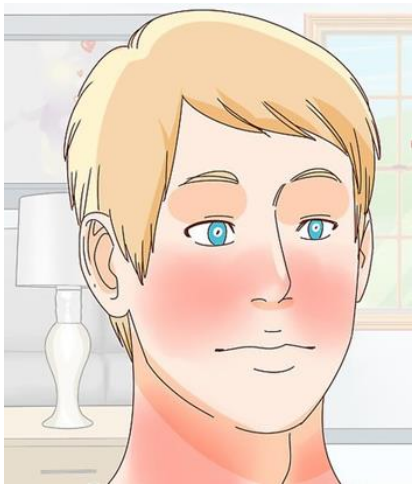
- Bacteria that naturally occur in gills and gut of salt water fish break down histidine → histamine
- Develops due to high temperature spoilage

Once histamine is formed…

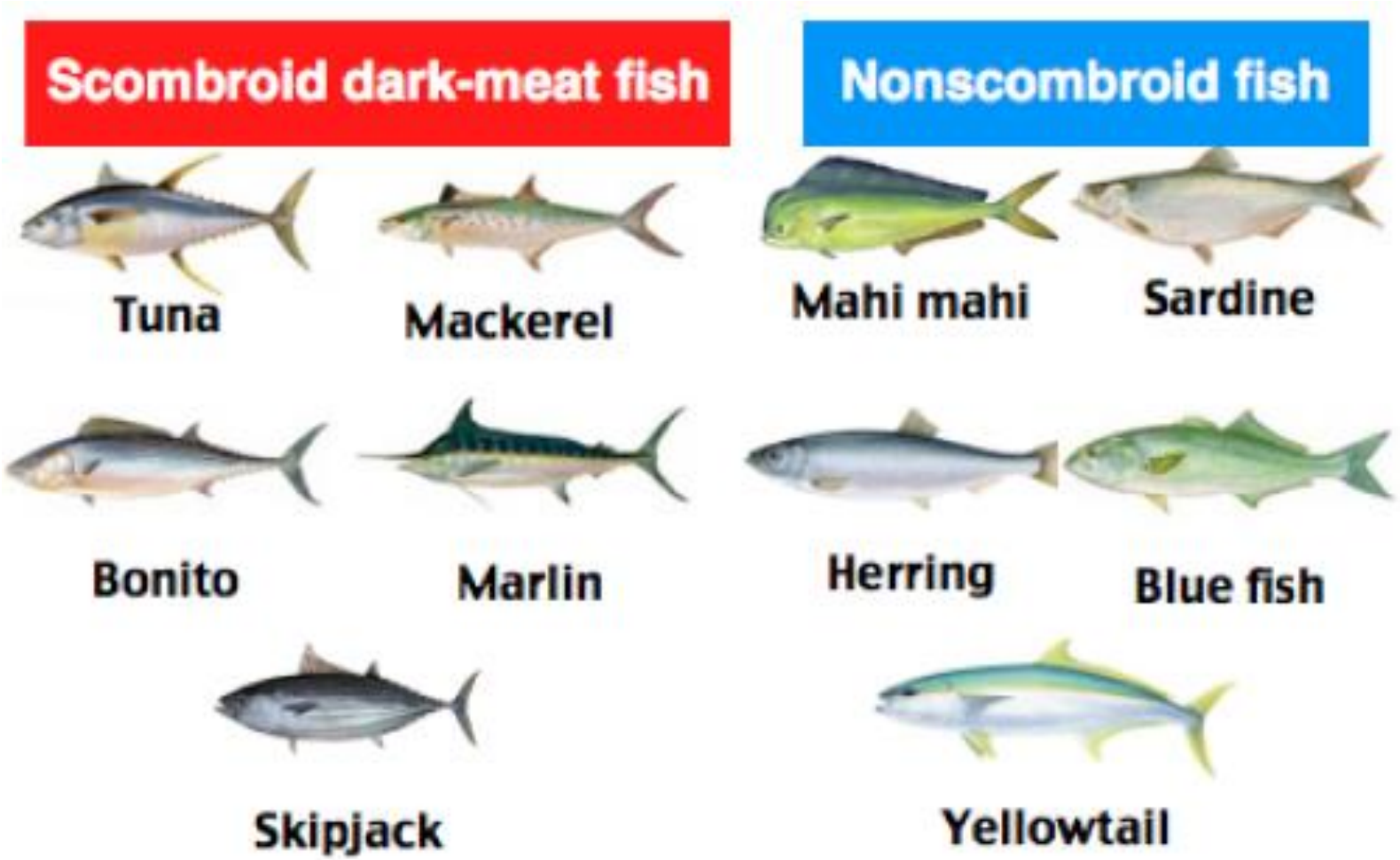
- It cannot be eliminated by heat (cooking) or by freezing.
- Freezing inactivates the enzyme-forming bacteria but they can re-commence multiplication on thawing.

Symptoms of histamine poisoning

- Tingling and burning sensations around the mouth
- Facial flushing
- Sweating
- Nausea
- Vomiting
- Headache
- Palpitations
- Dizziness
- Rash
- Peppery or metallic taste



Histamine-producing fish species



What can seafood processors do to prevent development of histamine?

- ✓ Make sure through harvest vessel records that incoming fish were properly handled on-board the harvest vessel.
- ✓ Rapidly chill the fish immediately after death e.g. by proper icing.
- ✓ Controlling temperatures in storage and distribution thereafter.
- ✓ Controlling the amount of time that the product is exposed to temperatures that would permit histamine formation during processing.

Monitoring activities

- Check temperature records after capture
- Check incoming fish to ensure that they are not at an elevated temperature at time of receipt
- Check incoming fish to ensure that they are properly iced or refrigerated at time of receipt
- Perform sensory examination on incoming fish to ensure that they do not show signs of decomposition
- Sample and test incoming fish for levels of histamine

Temperature limits

- In the Caribbean region (with ambient temperatures mostly >21°C) the maximum exposure above 4.4°C should be less than 4 hours.

Histamine limits

The results of the analysis need to meet the following:

- The mean value shall not exceed 100 ppm
- No more than two samples may each have a value of more than 100 ppm, but less than 200 ppm
- No sample may have a value exceeding 200 ppm

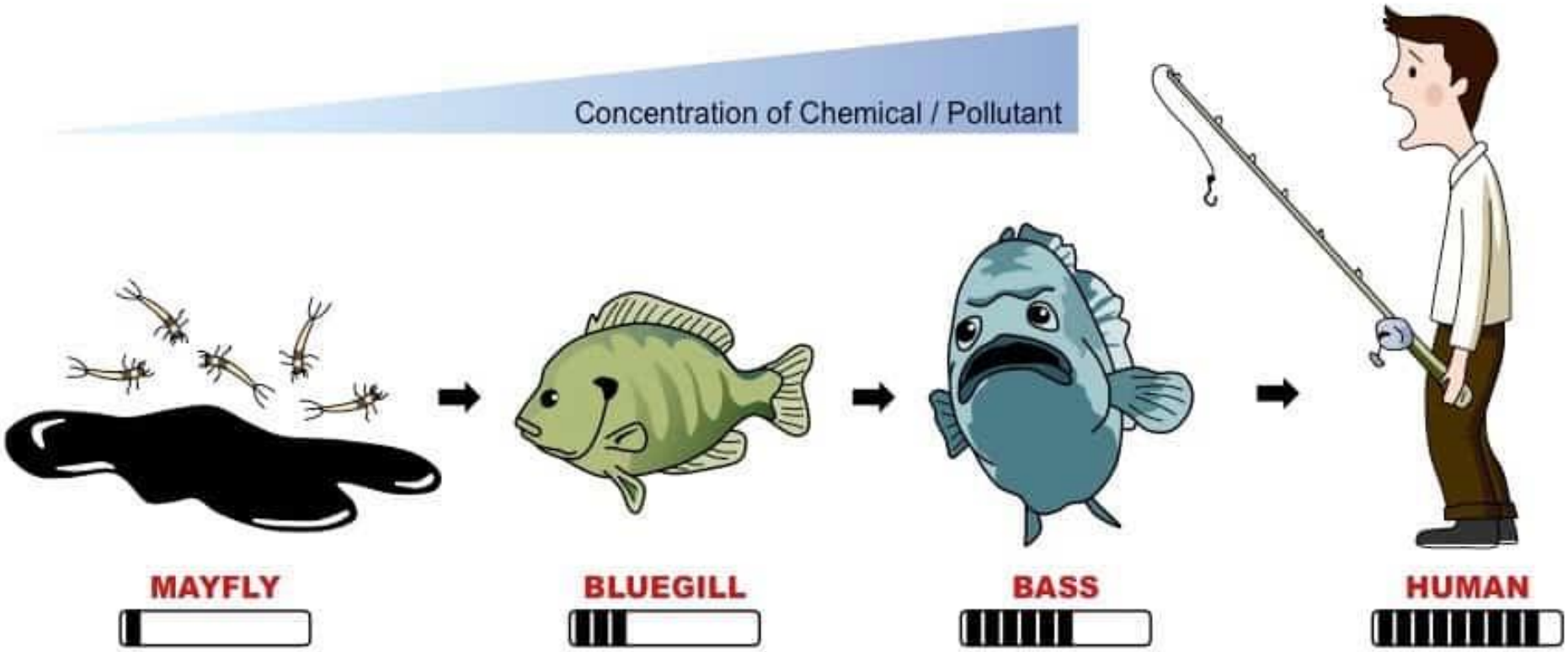
Hazard category: Marine biotoxins

Ciguatera

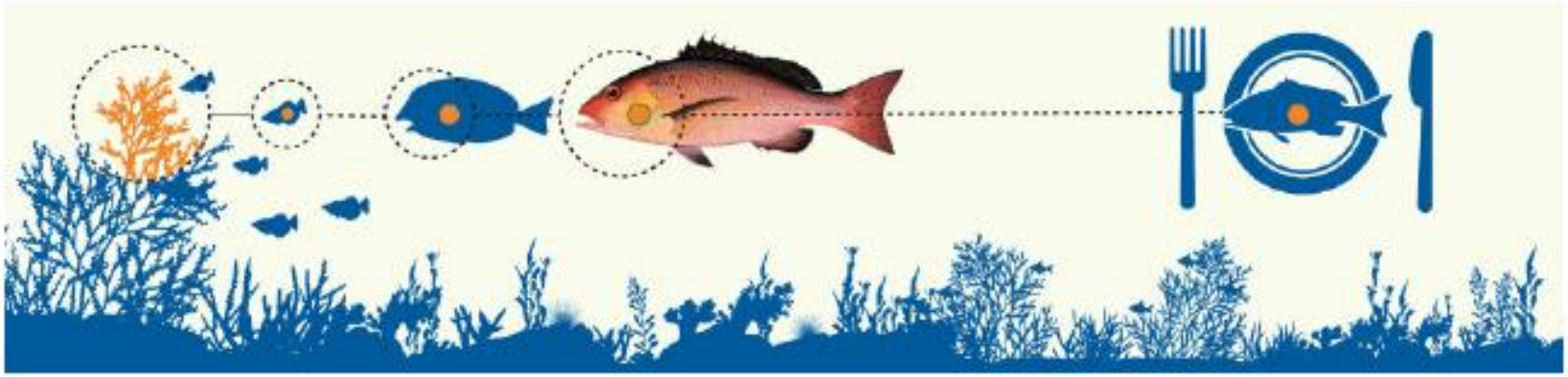
“Ciguatera fish poisoning (CFP) is one of the most common foodborne illnesses related to finfish consumption. It has been known for centuries. Its true incidence is not known, but it is estimated that 10,000–50,000 people per year suffer from this illness, making it one of the most common types of marine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

(FAO, 2017)

Bioaccumulation



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)

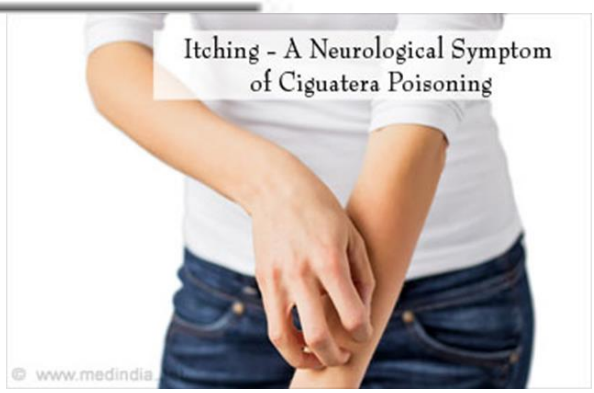
Ciguatera fish poisoning (CFP)

Ciguatoxin

- Mainly associated with consumption of predatory species at the top of the food chain like **barracudas, moray eels, parrotfishes, groupers, triggerfishes** and **amberjacks** that have accumulated **ciguatoxin** in the body.
- Larger fish will have higher amounts of the toxin.
- **Contaminated fish cannot be identified by appearance and the toxin cannot be destroyed by cooking or freezing.**

Table 1: Symptom patterns associated with Ciguatera poisoning

Gastrointestinal	Neurological
Nausea or vomiting	Numbness
Profuse, watery diarrhoea	Paraesthesias
Abdominal pain	Vertigo
	Ataxia
Cardiopulmonary	Severe weakness or lethargy
Bradycardia	Severe myalgia
Hypotension	Decreased vibration and pain sensations
Dyspnoea	Diffuse pain
Cough	Cold sensation reversal
	Coma



Some Fish associated with Ciguatera

Black Grouper

Blackfin Snapper

Cubera Snapper

Barracuda

Greater Amberjack

Horse eye Jack

King Mackeral

Yellowfin Grouper

Dogfish Snapper

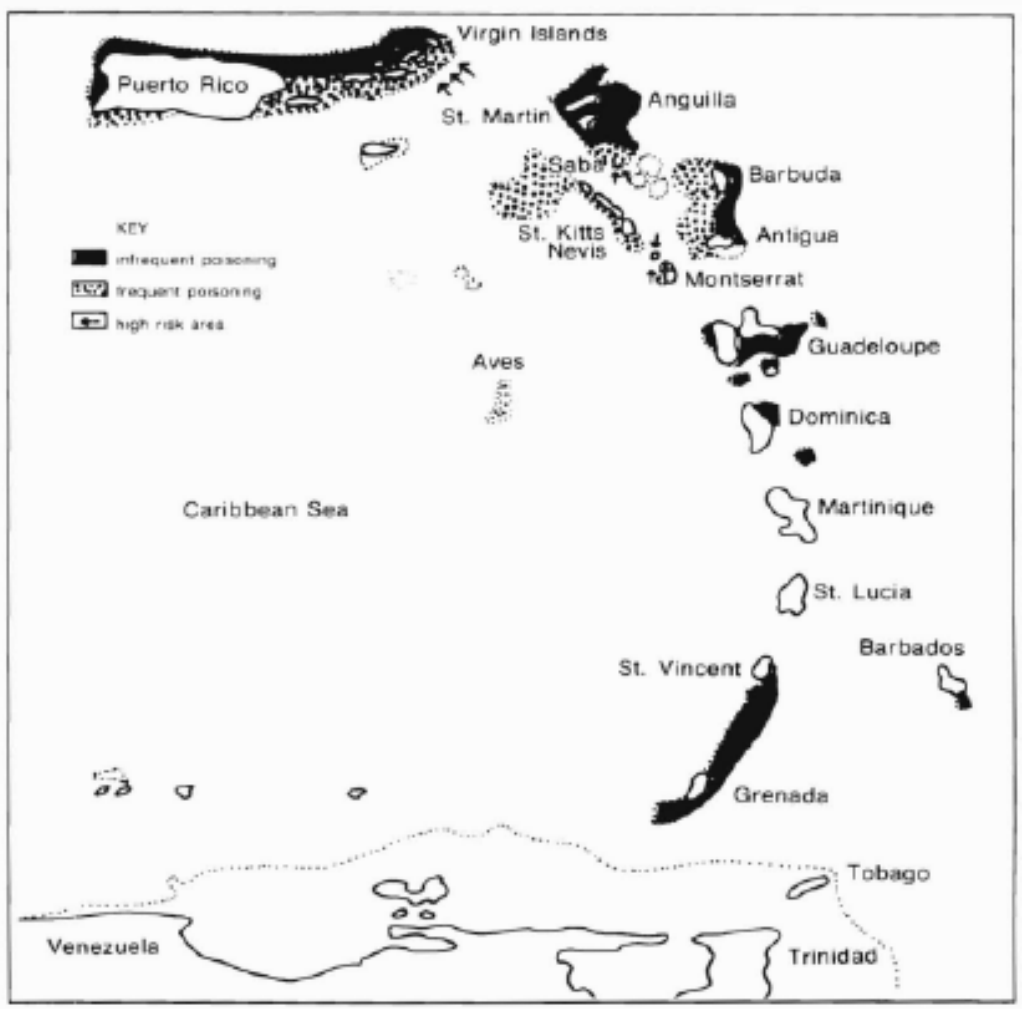


FIGURE 2: DISTRIBUTION OF CIGUATERA IN THE CARIBBEAN

Source: Ciguatera in the Eastern Caribbean David A. Olsen, David W. Nellis, And Richard S. Wood, Marine Fisheries Review, 46(1), 1984

Reproduced from: Guide to Food Safety Hazards in Caribbean Fishery Products CRFM Special Publication. No.11. 34pp.

What can seafood processors do to control ciguatera?

- ✓ Obtain information from fishermen about harvest locations to determine the potential for ciguatoxic fish based on knowledge of the regions where ciguatera occurs.
- ✓ Monitoring programmes can be set up to monitor ciguatera levels in all susceptible species and locations.

Ciguatera increase prompts alert in British Virgin Islands

By News Desk on June 16, 2021

Authorities in the British Virgin Islands have issued a warning after a surge in Ciguatera fish poisoning (CFP) within the past few weeks.

Cases until the week of June 6 were sporadic, but within three weeks there have been eight confirmed infections with other suspected cases also being investigated.

National Epidemiologist Harmony Massiah said CFP is not uncommon in tropical and sub-tropical areas and is mainly associated with consumption of big coral reef fish like snapper, bass and perch that have accumulated ciguatoxin in the body.


PATRICK
NOLAN
AMY
WEGMANN
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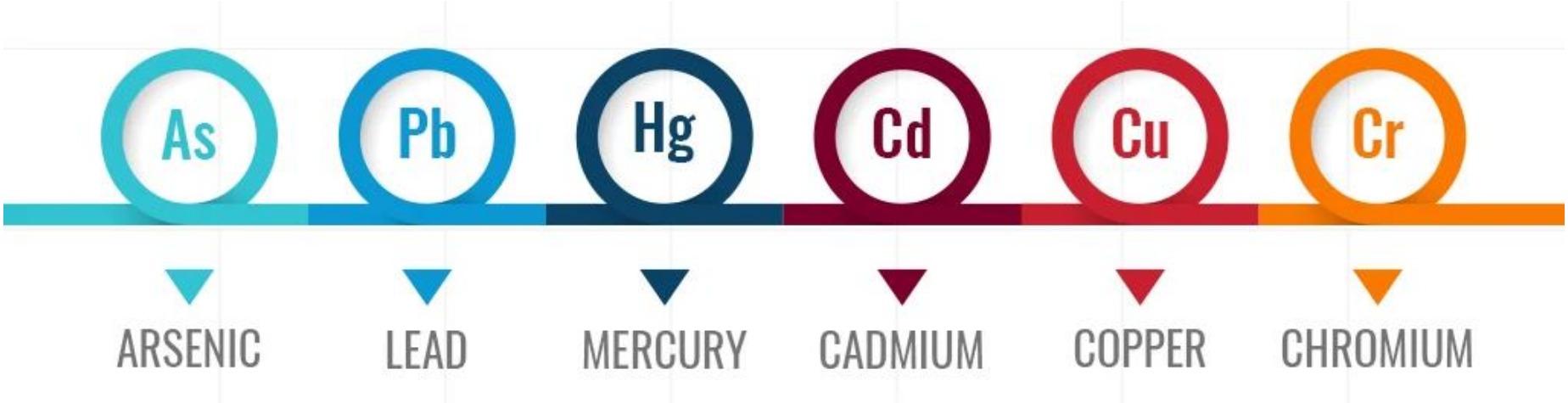
Hazard category: Heavy metals

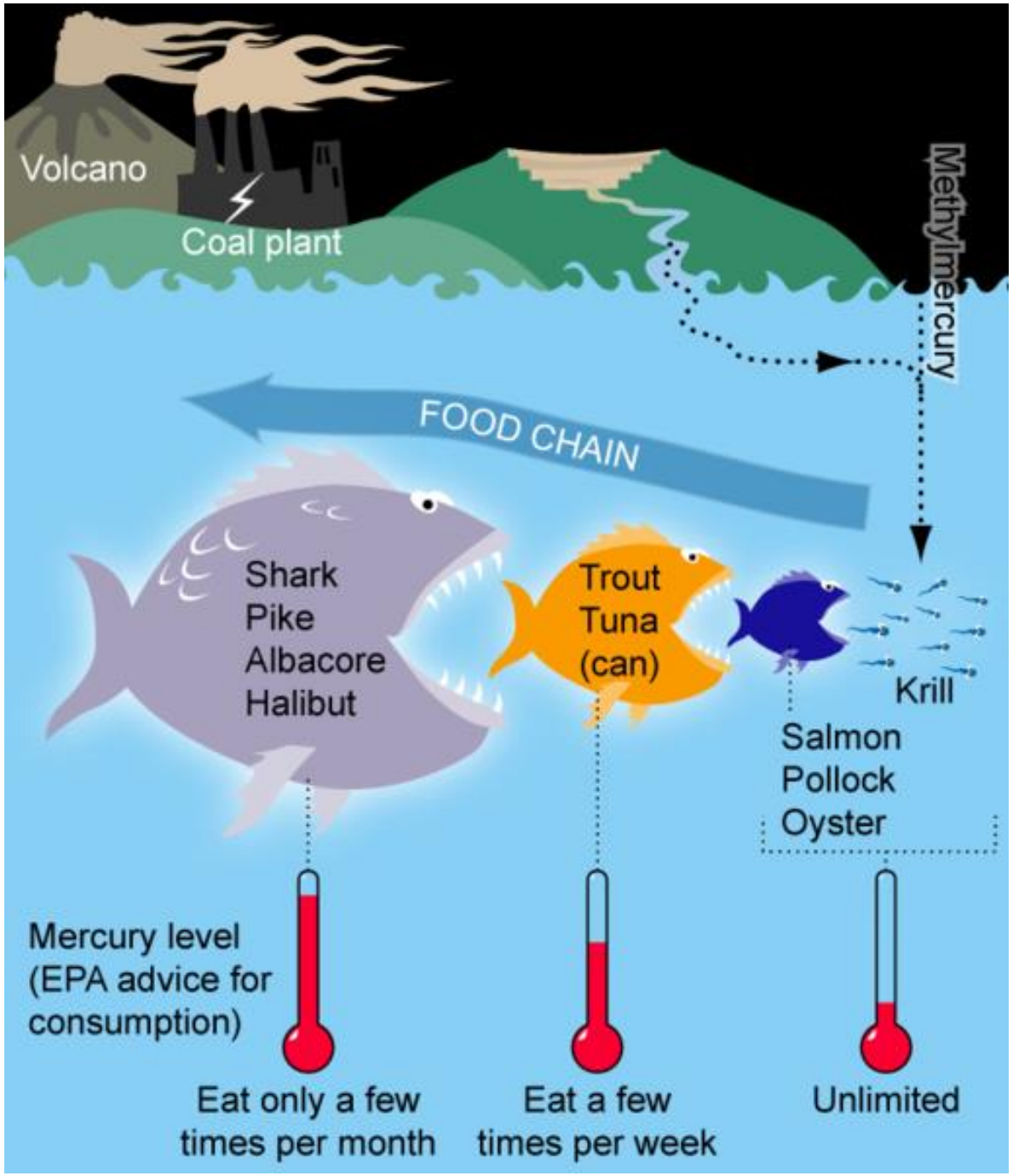
What is a heavy metal?

- A metallic chemical element that has relatively high density and is toxic/poisonous at low concentrations



Heavy metals of concern in the Caribbean:

- Mercury
- Cadmium
- Lead


Volcano
Coal plant
Methylmercury
FOOD CHAIN
Shark
Pike
Albacore
Halibut
Trout
Tuna
(can)
Krill
Salmon
Pollock
Oyster
Mercury level
(EPA advice for
consumption)
Eat only a few
times per month
Eat a few
times per week
Unlimited

What can seafood operators do to control heavy metal levels in fish?

- ✓ Fishing operators should ensure that specimens with a high risk of excessive heavy metal content (based on variables such as species, location, size, season) are not targeted, or that if they are caught they are subject to a sampling and testing regime.

Monitoring activities

- When taking samples, a higher proportion should be taken from the species most susceptible to contamination
- Information should be collected to allow operators to get an idea of general distribution
  - species, size/age of fish, catch location, and season

Frequency in the Caribbean

- Tuna, shark, swordfish and large demersal fish (groupers and snappers) may be associated with heavy metal contamination
- No data available

TABLE 6: EU MAXIMUM LIMITS OF MERCURY ALLOWED IN FISH FOR HUMAN CONSUMPTION

Substrate	Maximum Limit (ppm) Mercury
Muscle meat of all fish except where indicated below:	0.5
Little tuna (*Euthynnus* spp.) Marlin (*Makaira* spp.) Sail fish (*Istiophorus platypterus*) Rays (*Raja* species) Shark and dogfish (all species) Tunas (*Thunnus* spp, and *Katsuwonus pelamis*) Bullet tuna *(Auxis species)* Swordfish (*Xiphias gladius*)	1.0
Crustaceans (excluding brown meat of crabs and thorax meat of lobsters of the genus *Palinuridae*)	0.5
Bivalve Molluscs	0.5
Cephalopods (without viscera)	0.5

Source: Commission Regulation (EC) No 1881/2006 of 19 December 2006

TABLE 7: MAXIMUM LIMITS OF CADMIUM ALLOWED IN FISH FOR HUMAN CONSUMPTION

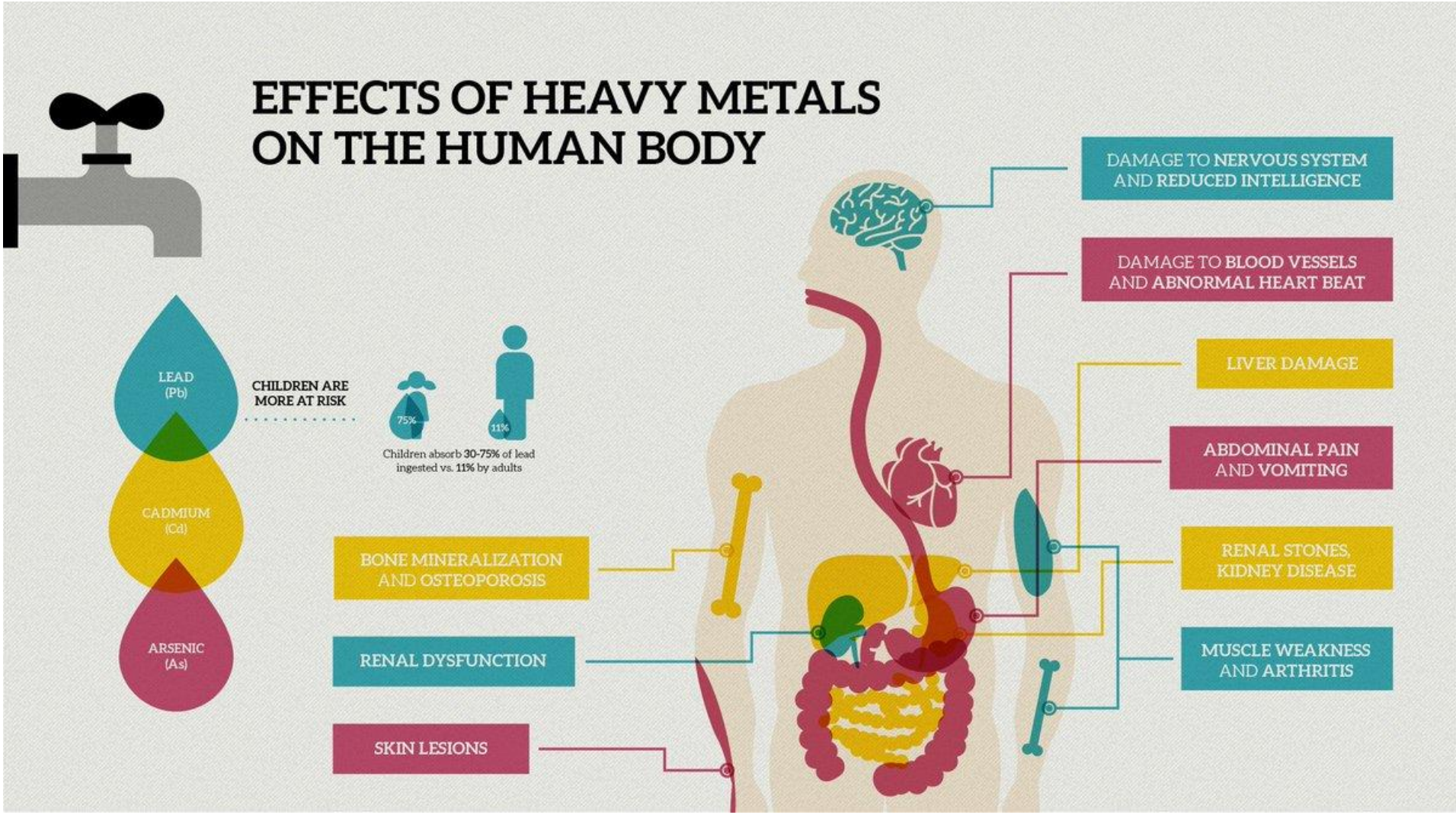
Substrate	Maximum Limit (ppm) Cadmium
Muscle meat of all fish except where indicated below:	0.05
Mackerels (Scomber spp) (*Thunnus species*, *Katsuwonus pelamis*, *Euthynnus species*),	0.1
Bullet tuna *(Auxis species)*	0.15
Swordfish (*Xiphias gladius*)	0.25
Crustaceans (excluding brown meat of crabs and thorax meat of lobsters of the genus *Palinuridae*)	0.5
Bivalve Molluscs	1.0
Cephalopods (without viscera)	1.0

Source: Commission Regulation (EC) No 1881/2006 of 19 December 2006

TABLE 8: MAXIMUM LIMITS OF LEAD ALLOWED IN FISH FOR HUMAN CONSUMPTION

Substrate	Maximum Limit (ppm) Lead
Muscle meat of all fish except where indicated below:	0.3
Crustaceans (excluding brown meat of crabs and thorax meat of lobsters of the genus *Palinuridae*)	0.5
Bivalve Molluscs	1.5
Cephalopods (without viscera)	1.0

Source: Commission Regulation (EC) No 1881/2006 of 19 December 2006


EFFECTS OF HEAVY METALS ON THE HUMAN BODY
LEAD (Pb)
CADMIUM (Cd)
ARSENIC (As)
CHILDREN ARE MORE AT RISK
75%
11%
Children absorb 30-75% of lead ingested vs. 11% by adults
DAMAGE TO NERVOUS SYSTEM AND REDUCED INTELLIGENCE
DAMAGE TO BLOOD VESSELS AND ABNORMAL HEART BEAT
LIVER DAMAGE
ABDOMINAL PAIN AND VOMITING
RENAL STONES, KIDNEY DISEASE
MUSCLE WEAKNESS AND ARTHRITIS
BONE MINERALIZATION AND OSTEOPOROSIS
RENAL DYSFUNCTION
SKIN LESIONS

Hazard category: Additives

Sodium/potassium metabisulphite

- Sulphite salts are used to control melanosis (grey/black discolouration) in raw crustacea such as shrimp and lobster

TABLE 9: PERMITTED ADDITIVES IN FISHERY PRODUCTS

Permitted additives	Products	Maximum concentration
Sulphur dioxide Sodium sulphite Sodium hydrogen sulphite Sodium metabisulphite Potassium metabisulphite Calcium sulphite Calcium hydrogen sulphite Potassium hydrogen sulphite	Fresh, frozen crustacean and cephalopods	150 mg/kg (as SO_2)
	Cooked crustacean	50 mg/kg (a SO_2)
Triphosphates of sodium and potassium Polyphosphates of sodium, potassium and calcium	Frozen fishery products	5 g/kg

Source: EU Directive 2006/52/EC of 5 July 2006 amending Directive 95/2/EC on food additives other than colours and sweeteners

What can seafood operators do to control sulphite levels in shrimp/lobster?

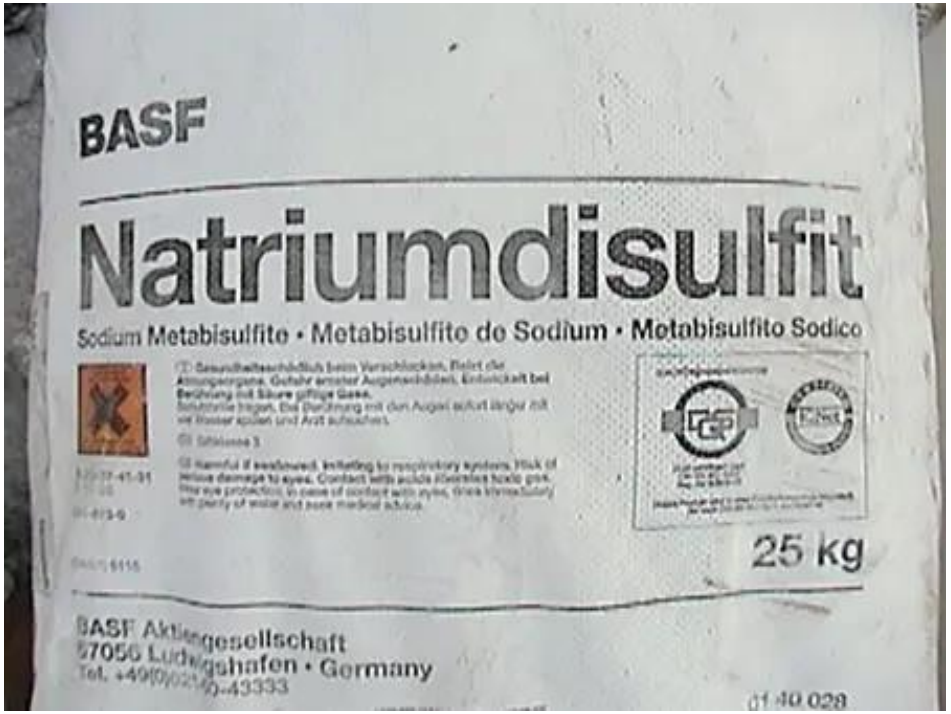
- ✓ When product is dipped in treatment bath, the process conditions should be controlled so the product does not contain excessive concentrations of the additive.

Monitoring activities

- Monitoring of sulphite levels to ensure they do not exceed the regulatory limits for these products.

Frequency in the Caribbean

- All species which are treated with sulphites are at risk from excessive levels of this additive.



Hazard category:
Veterinary drug residues

Veterinary Drug Residues

- Farmed fish may require veterinary medicines to reduce/eliminate infections or parasites
- Residues of these medicines may be present in the final fish/fish product → may be harmful to the consumer → toxicity/impact on human medicine

The following are regarded as food safety hazards:

a) chloramphenicol and derivatives e.g. thiamphenicol (TAF)

b) dimetridazole

c) metronidazole

d) compounds which produce a nitrofuran metabolite

e) anabolic substances for growth promotion purposes

f) malachite green and leucomalachite green

What can seafood operators do to control drug residue levels in fish?

- ✓ Ensure that unauthorised/prohibited drugs are not used in the production of aquaculture fish
- ✓ Authorised drugs should be applied in such a way that residue level limits are not exceeded

Monitoring activities

- A monitoring programme should be established to monitor substances and residues in live fish and fishery products
  - For unauthorised substances, the presence of any above the detection limits will render the product unfit, and such consignments should be destroyed.
  - For permitted substances, excess levels in the final product will render the product unfit.

Frequency in the Caribbean

- **Only associated with aquaculture production**
- Guyana has a substantive intensive aquaculture production system

TABLE 11: RISK AND SEVERITY OF HAZARDS IN CARIBBEAN FISHERY PRODUCTS.

		Severity of hazard		
		High	Medium	Low
Probability of occurrence	High	1,2	4,5	
	Medium	3	6	7
	Low			8

1	Histamine in *Scomber, Decapterus* spp., Spanish mackerel *Scomberomorus* spp. *Coryphaena* spp., Carangids, Tunas: *Auxis spp. Thunnus* spp & *Euthynnus* spp
2	Ciguatera in reef fishes
3	Marine biotoxins in shellfish (conch)
4	Mercury in grouper/tunas/sharks
5	Cadmium in demersal fish/lobsters/swordfish
6	Bisulphites in shrimp and lobster
7	Residues of veterinary medicines in farmed shrimp/tilapia
8	Lead in tuna

Any questions?