CODEX 60
CODEX ALIMENTARIUS 1963-2023

Food and Agriculture Organization of the United Nations

World Health Organization

CODEX ALIMENTARIUS
INTERNATIONAL FOOD STANDARDS

Climate Change and Food Safety

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Enhancing International Partnership in Food Safety,
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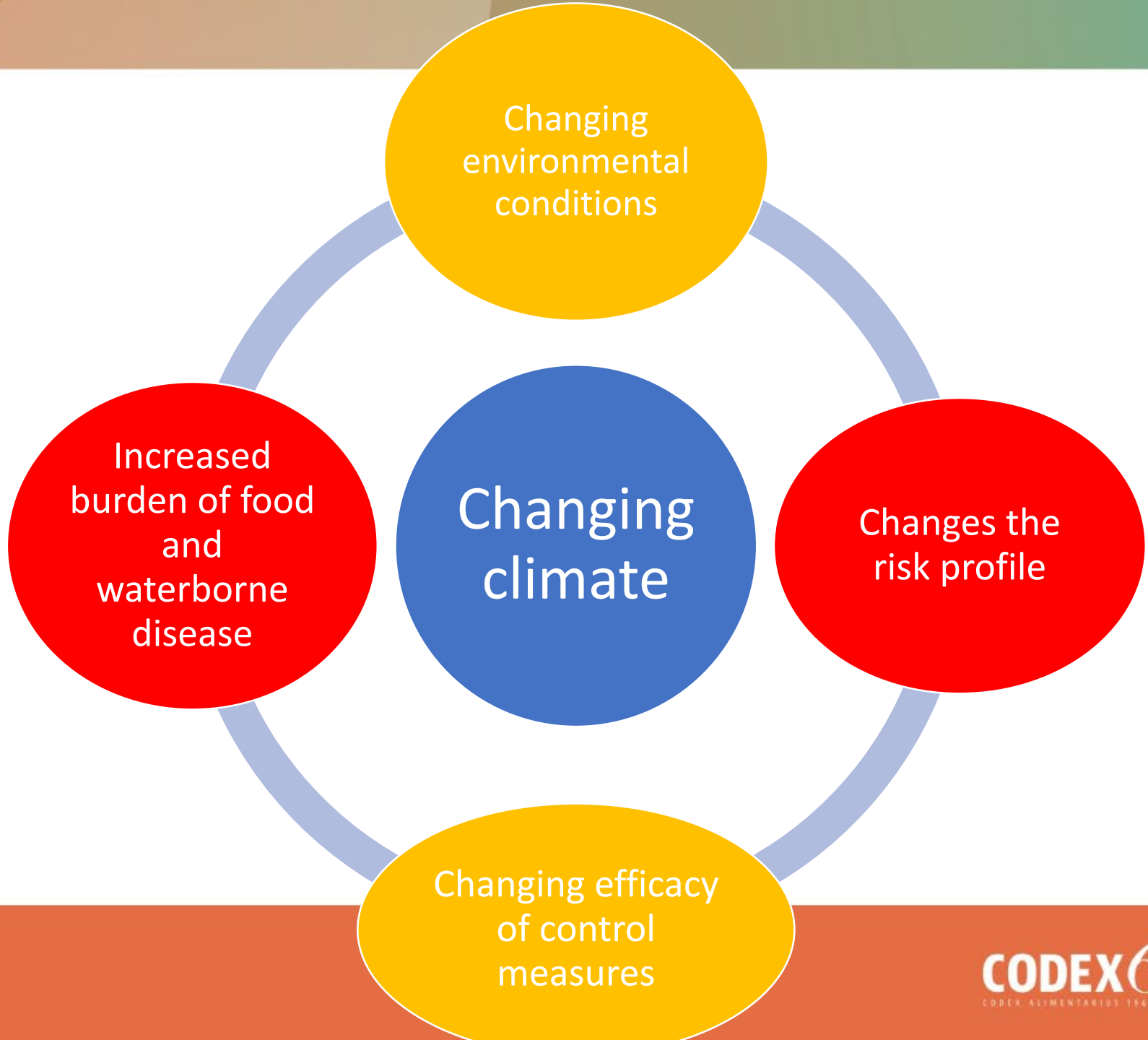
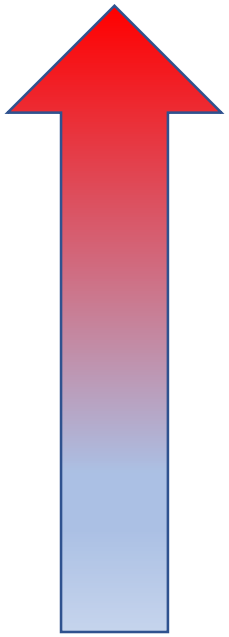
Why should the food safety community be concerned?

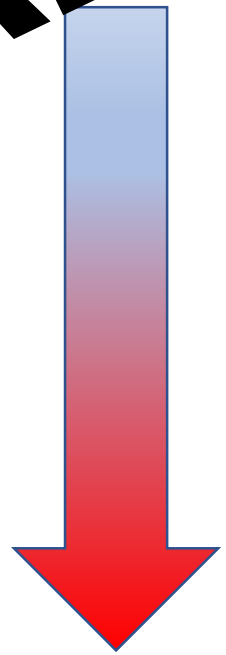


Climate change – changing environmental conditions

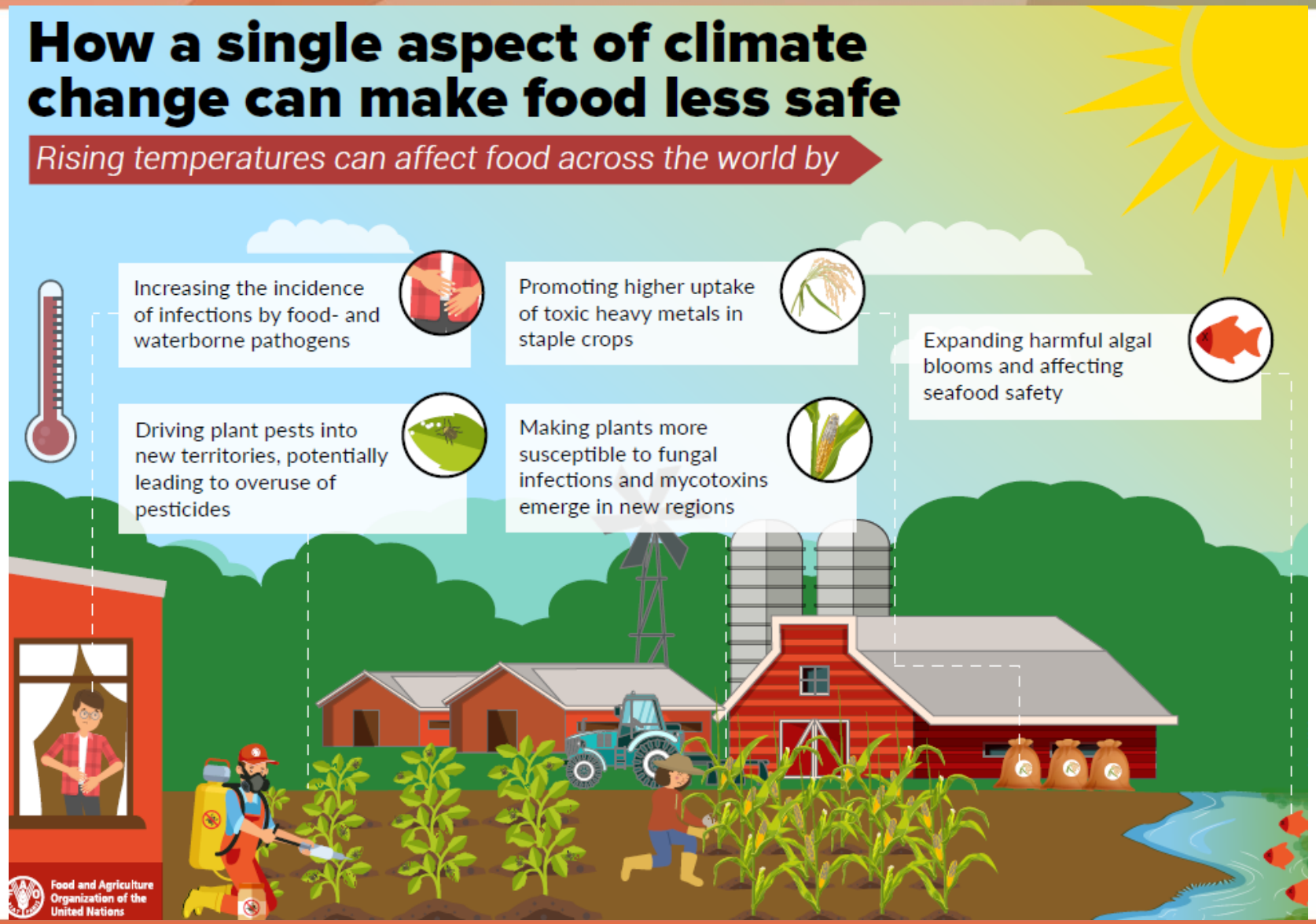


- Temperature
- Extreme weather events
- Sea levels
- Ocean acidification
- Precipitation

UNCERTAINTY



- Precipitation
- Water availability
- Water quality
- Soil quality
- Salinity, pH



Direct effects – increase in existing hazard

Indirect effects – actions to mitigate a problem e.g. plant pest or animal disease lead to a food safety risk

FAO, 2021

Foodborne pathogens

Nontyphoidal *Salmonella*

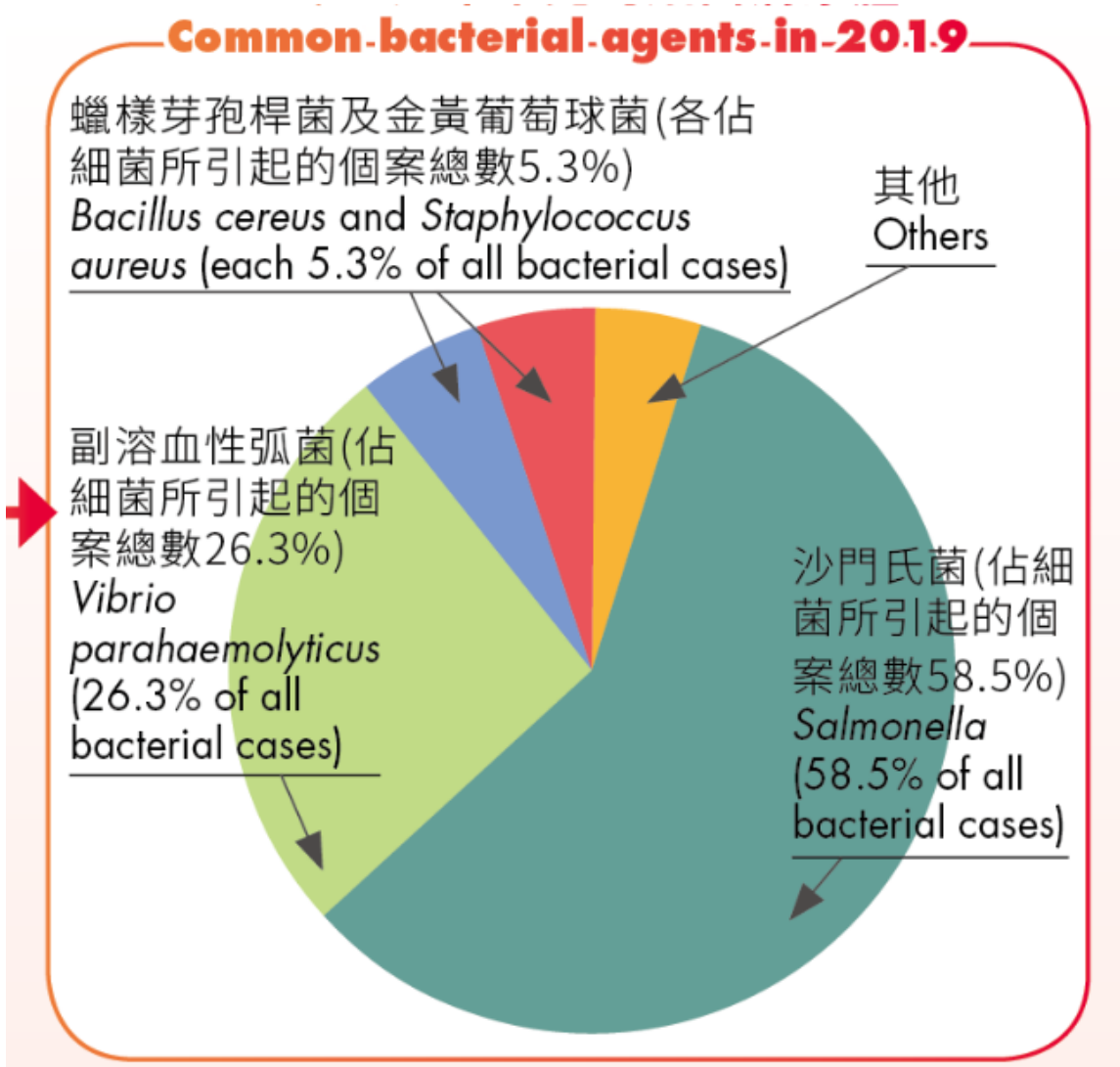
- High human health impact
- estimated 93.8 million illnesses, of which an estimated 80.3 million are foodborne annually
- estimated 155,000 deaths each year.

Majowicz et al, 2010

- Persistence and adaptability
- Associate with a wide range of foods

Vibrio spp

- responsible for the majority of human diseases attributed to the natural flora of aquatic environments and seafood
- Raw and undercooked seafood
- Temperature plays an important role



Examples of foodborne pathogens of concern in Hong Kong

Choi, L. 2020. Review of food poisoning outbreaks related to food premises and food businesses in 2019; Food Safety Focus – Incident in Focus, 164. Available at https://www.cfs.gov.hk/english/multimedia/multimedia_pub/multimedia_pub_fsf_164_01.html

Salmonella and increasing temperature – examples of some of the findings in this area

Association between increasing temperature and Cases of salmonellosis

European study

- An increase of 1 °C in the weekly ambient temperatures resulted in a 5 to 10 percent increase in salmonellosis cases (Kovats et al., 2004).

US study

- Each degree (°C) rise in temperature increased the risk of reporting a case by 1.3 to 5.9 percent (Uejio, 2017)

Australian study

- higher daily mean temperature and precipitation increase the risk of contracting salmonellosis. (Stephan & Barnett, 2016)
- Increasing disease notifications with increasing temperatures (Robertson et al 2022)

Association between increasing precipitation and/or extreme events and cases of salmonellosis

US study

- for every 1 unit increase in extreme temperature events there was an increase of 4.1 percent in risks related to Salmonella infections; (Jiang et al 2015)
- 5.6 percent increase in the salmonellosis risk was associated with a 1 unit increase in extreme precipitation events (Jiang et al 2015)
- Extreme precipitation event linked to increase in cases of some Salmonella serotypes (Morgado et al, 2021)

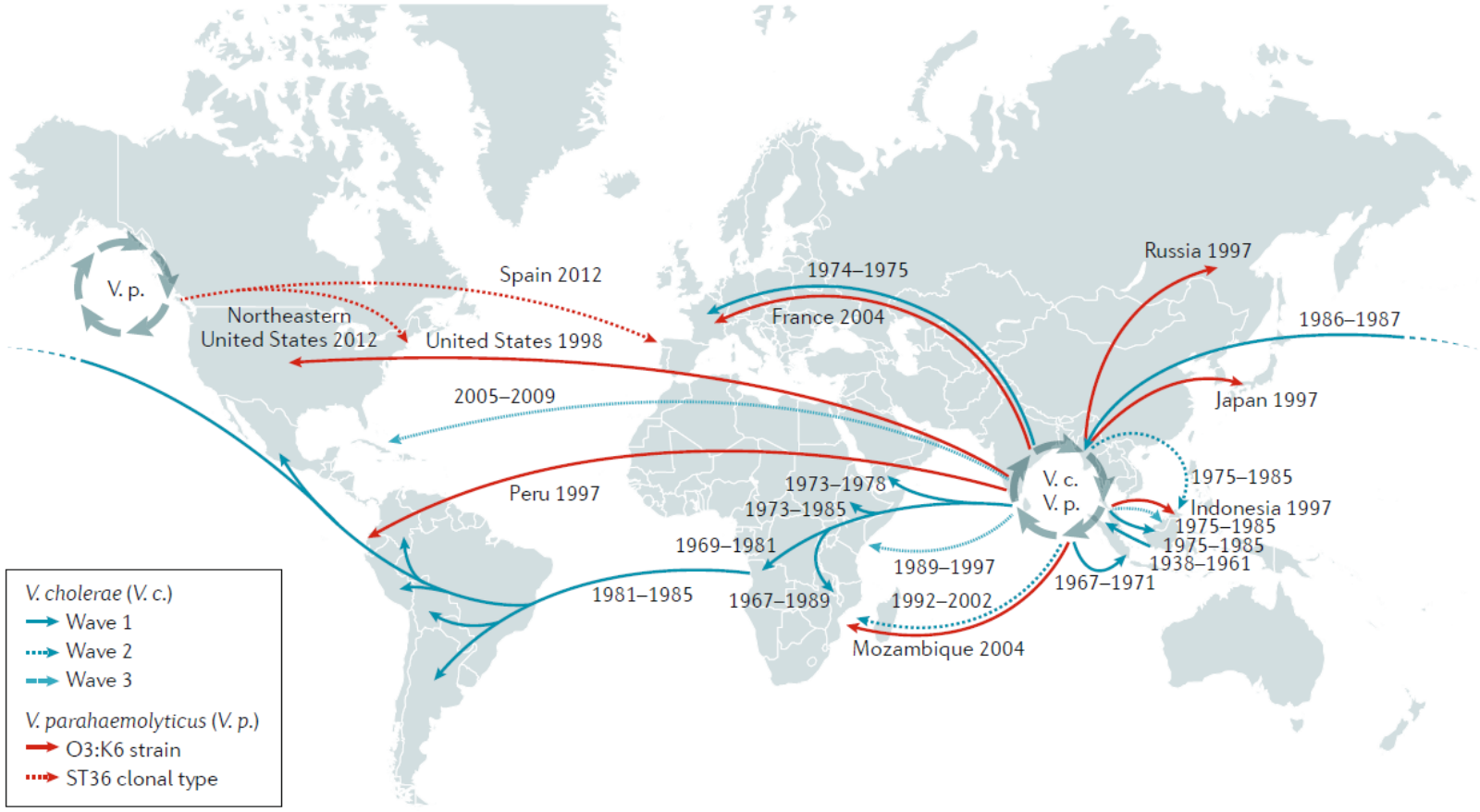
Australian study

- Without mitigation, increasing temperatures will lead to an increase of approximately 50 percent in the morbidity burden (calculated as Years Lost due to Disabilities or YLDs) of Salmonella infections by 2030 in Australia (Zhang, Bi and Hiller, 2012).

Why this is a real concern for Salmonella

- Increasing temperature, precipitation, extreme weather events can lead to increase in proliferation and prevalence of Salmonella serotypes
- Salmonellosis associated with an increasingly broad range of foods of animal (meat, eggs, dairy (infant formula) and plant origin (spices, nuts, sprouts, fresh fruits and vegetables)
- Ability to persist in challenging environmental conditions
- Can cause illness at low doses
- Already a high disease burden – could increase – greater challenges for control

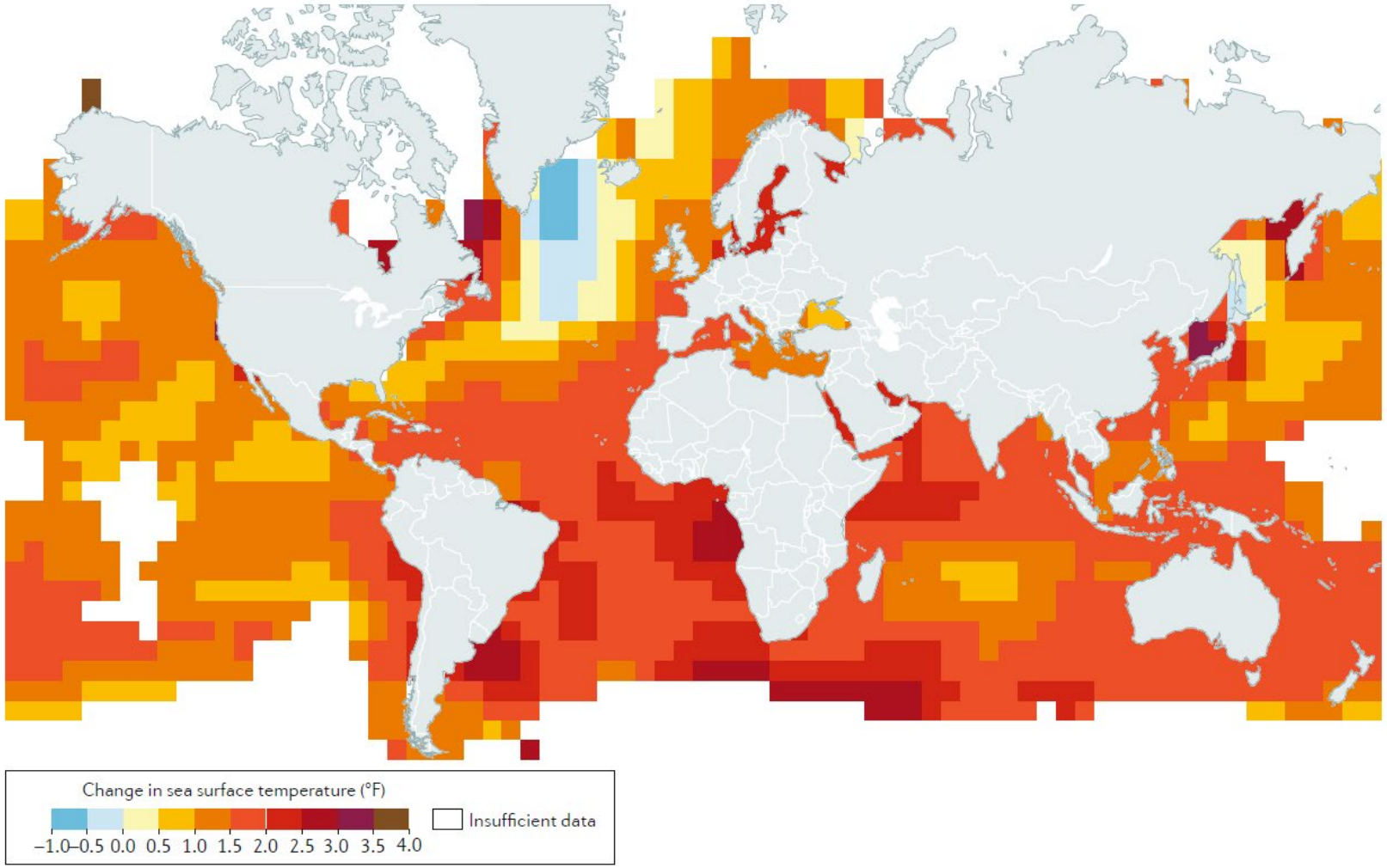
Spread of *Vibrio* spp.



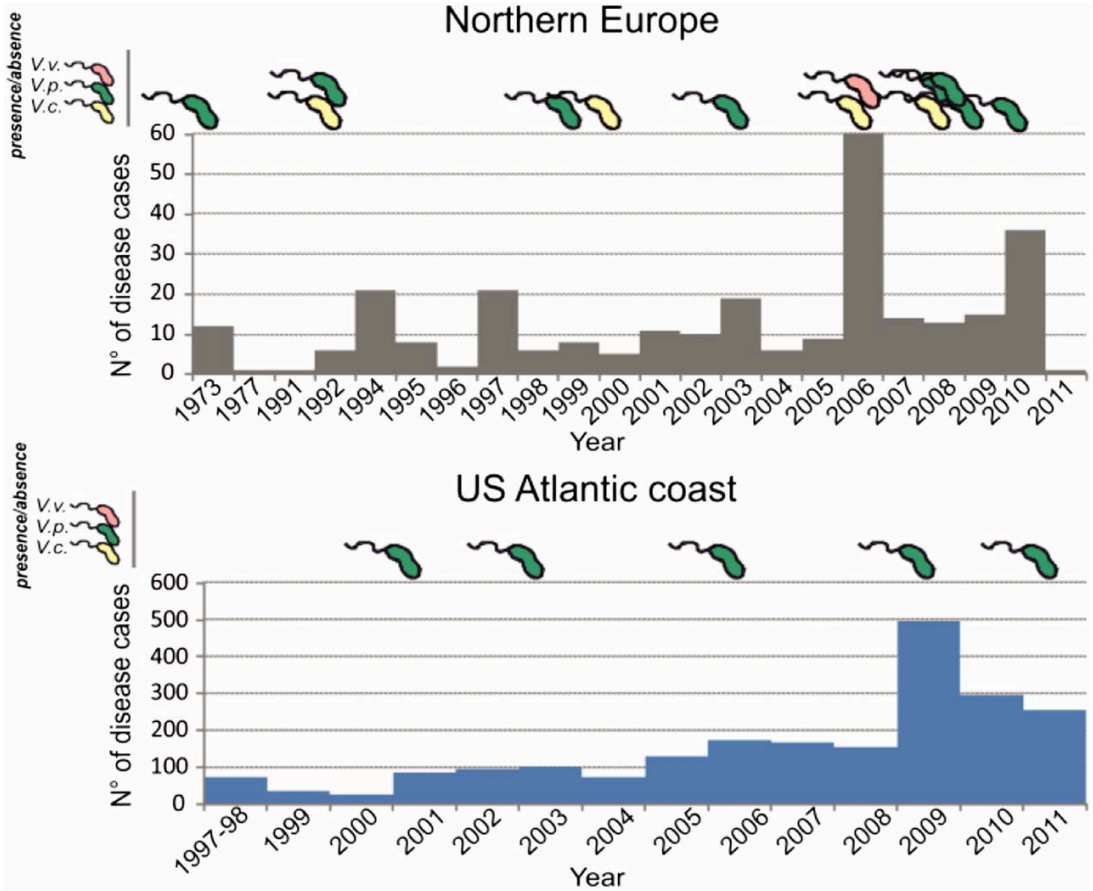
Baker Austin et al 2018

Increase in seawater temperatures 1901 – 2015

Baker-Austin et al 2018



Foodborne vibriosis



Vezzuli et al 2016

Future scenarios of risk of *Vibrio* infections in a warming planet (Trinanes & Martinez-Urtuza, 2021)

At risk areas

- increase in coastal areas suitable for Vibrio could cover 38000 km of new coastal areas by 2100 under the most unfavourable scenario

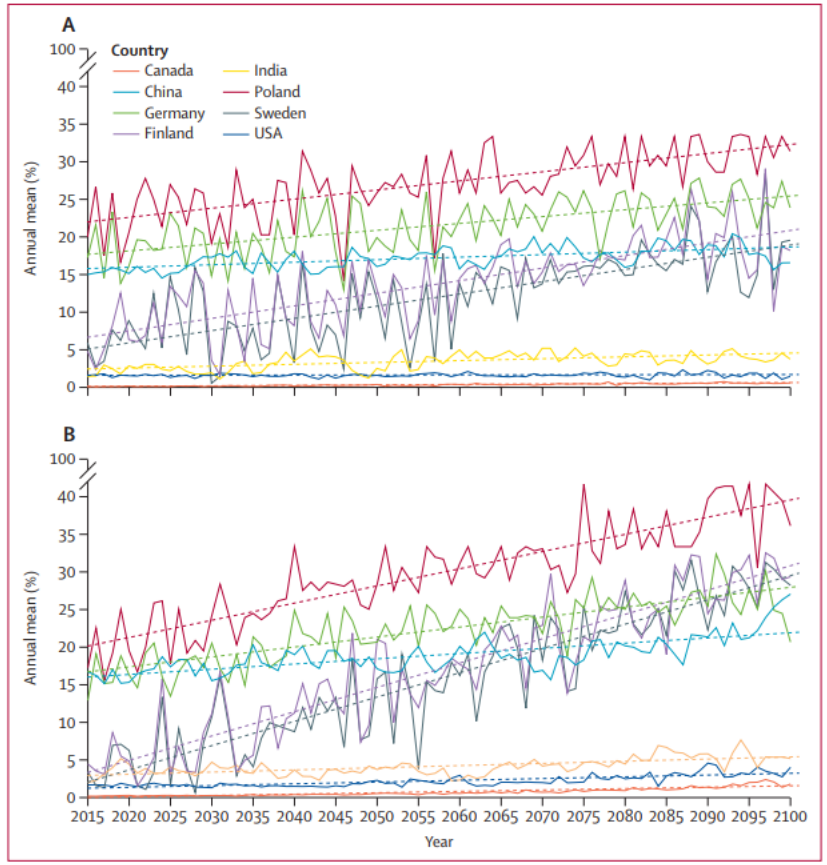


Figure 2: Time series showing the variation of shoreline with suitable conditions for *Vibrio* for a selection of countries

Future scenarios of risk of *Vibrio* infections in a warming planet (Trinanes & Martinez-Urtuza, 2021)

At risk population

- Population at risk in suitable regions almost doubled from 1980 to 2020 (from 610 million to 1100 million under the scenario of medium challenges to mitigation and adaptation)
- Increment will be more moderate in the future and stabilises after 2050 at 1300 million.

Future scenarios of risk of Vibrio infections in a warming planet (Trinanes & Martinez-Urtuza, 2021)

Disease burden estimates and predictions

- the major increase of reported *Vibrio* cases to date, particularly in those areas reported in this study with the highest risk:
  - the north of Europe
  - Atlantic northeast
  - Pacific northwest
  - southeastern China

- First global estimate for *Vibrio* infections - around half a million of cases worldwide in 2020.
- Anticipated expansion of both the temporal and spatial disease burden for Vibrio infections, in particular at high latitudes of the northern hemisphere.
- Largest increase from 1980 to 2020 so more moderate increase is expected for the future.

Risk assessment

- Aiming to make more use of environmental data (satellite, remote sensing)
- Research to establish correlations

- Supports development of predictive models – only as good as the data

- BUT provide new insights that can support risk management

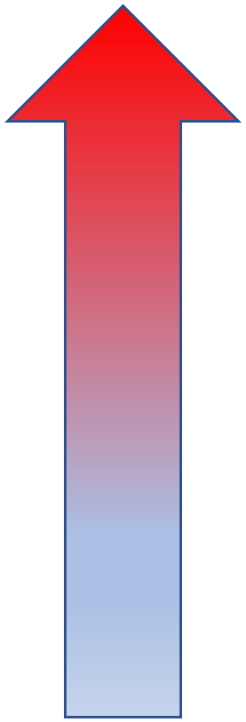
Risk management - Codex work and *Vibrio* spp.

- Guidelines on the Application of General Principles of Food Hygiene to the Control of Pathogenic Vibrio Species in Seafood (CXG 73-2010)

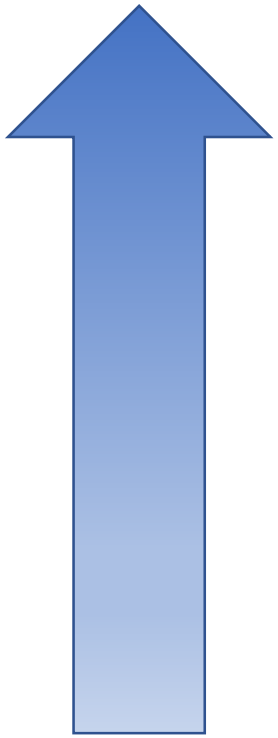
  Since then: emergence of highly pathogenic strains, geographical spread of infections of *Vibrio* spp. in association with climate change, and potential demographic effects on increased risk in densely populated coastal regions

  Changes to be made
  - updated microbiological monitoring methods including molecular-based approaches;
  - latest data on new pathogenic strains, their geographical spread and clinical incidence;
  - detection and characterization of *Vibrio* species;
  - novel methods including remote sensing-based techniques, satellite imagery and whole genome sequencing which would facilitate predicting periods of elevated risk and better control the viruses; and
  - practical interventions, including pre-harvest interventions (e.g. relaying at harvest such as reduced cooling times), and post-harvest treatments (e.g. high-pressure processing, freezing and pasteurization), contributing to the reduction of risks of vibriosis associated with the consumption of seafood.

Other foodborne pathogens



- Increased occurrence of parasites in freshwater fish and plants
- Increase pathogen shedding
- Increase in mastitis, animal disease (use of medicine, AMR)
- Decrease in some viruses

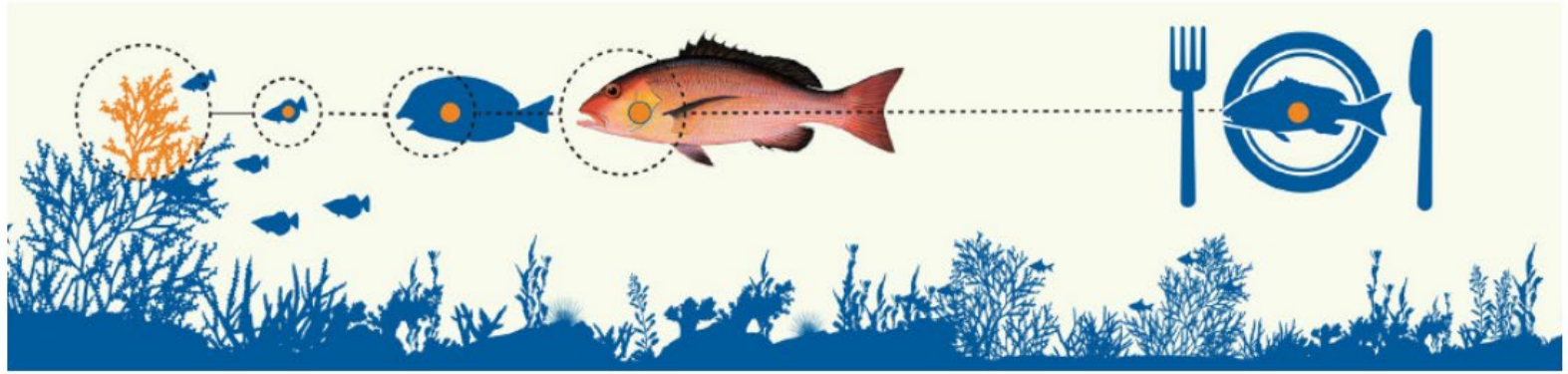


- Internalization of pathogenic *E. coli* and *Salmonella* in leafy green vegetables
- Increased faecal contamination due to run-off
- Contamination due to splash, flooding

Algal blooms

- Algae are a natural component of the aquatic ecosystem - algal blooms occur when certain algae grow out of control due to various environmental and anthropogenic conditions
- Some produce toxins - can bioaccumulate in fish and shellfish and induce toxic syndromes in humans when consumed.
- Climate change: harmful algal blooms expanding to new areas, most of which are not prepared to address the challenges of detection and surveillance, risk to public health and trade

Algal blooms – Ciguatera in fish



Algal blooms – geographic spread of Gambierdiscus (ciguatera)

FAO, 2018

Mycotoxins

- Already a big problem in tropical areas in particular
- Temperature, relative humidity, and crop damage by pests - influence fungal growth and mycotoxin production in crops.
- With cooler temperate zones becoming warmer and more conducive to agriculture – potential new habitat - fungal species producing mycotoxins are now quite established in other geographical zones and regions.
- Inadequate storage and transportation infrastructure, especially under climate change conditions and lengthening food chains - increase the risk of production and dissemination of mycotoxins

Heavy metals

- Warmer water and acidification - Increase in bioaccumulation of methylmercury in fish
- Extreme weather conditions – rainfall, flooding – spread of toxic metals eg form mining areas to food production areas
- Increasing soil temperature – uptake of arsenic

Its not only about the hazards!





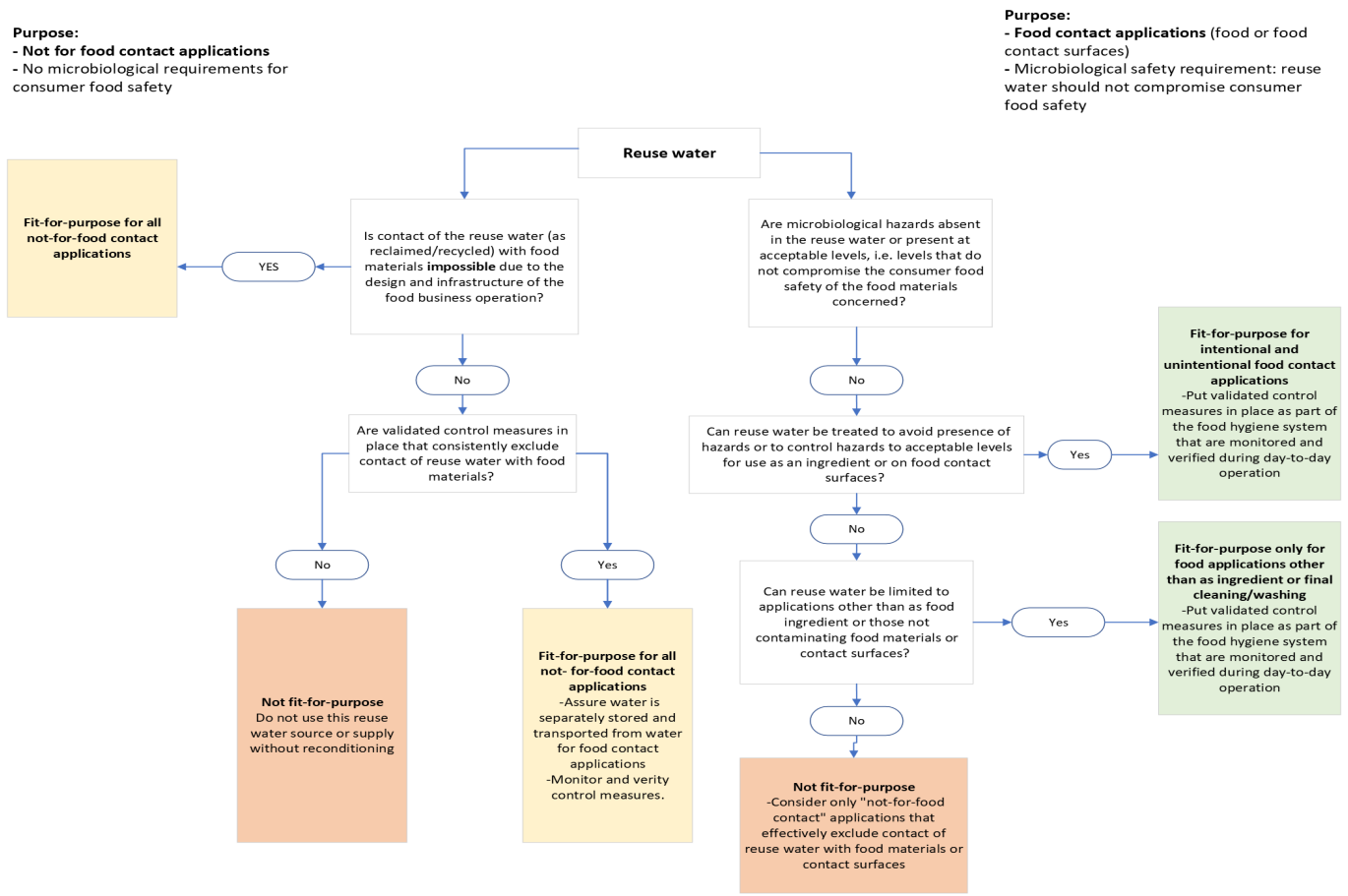



Use and re-use of water

- Access to clean water
- Cost of dealing with waste water
- Maintaining safe food through a risk based approach

Fit-for-purpose water

Science to Codex Guidelines on safe use and re-used of water



Take action

- Be **aware**
- **Invest** in surveillance and monitoring
- Promote data **sharing**
- **Engage** with stakeholders
- Avoid complacency – **assess**/re-assess risk
- Strengthen food safety **management** – application/enforcement
- Advance knowledge though **research** (identifying the issues and improving solutions – they should not be re-inforcing the problem)
- Be **forward** thinking

Take action – what is Codex doing

- Encouraging FAO, WHO and Members to flag emerging/re-emerging issues
- Review/ revise Codex texts
- Looking to the future - what needs to change to address new challenges
- Increasing awareness and accessibility of current texts (Food Hygiene, Codes of practice for mycotoxins)

Thank you

- Email: codex@fao.org
- Webpage: http://www.fao.org/fao-who-codexalimentarius/en/
- Twitter: @FAOWHOCodex

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