

# Managing evolving seafood safety risks in the changing global environment

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## A bit about me

### Varied work history

- Researcher
- Shellfish regulator (13 years)
- Researcher

### Research

- Applied focus
- Favourite hazard: marine biotoxins
- Favourite theme: translating science into policy



# The Australian Seafood Industry



## Australian fisheries and aquaculture production



Aquaculture GVP increased by 10% to \$1.60 billion, accounting for 51% of total GVP



Wild-catch GVP decreased by 12% to \$1.58 billion, accounting for 49% of total GVP

Aquaculture volume increased by 11% to 106,139 tonnes, accounting for 38% of total volume

Wild-catch volume increased by 0.3% to 179,261 tonnes, accounting for 62% of total volume

## Snapshot of Australian fisheries and aquaculture



**\$3.15b**

↓ 2%  
in 2019-20

### Production

Production value decreased largely resulting from reduced production of Rock Lobster (due to the COVID-19 outbreak restricting export demand and limiting alternative markets) and reduced production of several wild-caught species in state and territory fisheries.



**\$1.41b**

↓ 8%  
in 2019-20

### Exports

Export value decreased as a result of reduced demand for Rock Lobsters during Chinese Lunar New Year that coincided with the initial outbreak of COVID-19.



**\$2.20b**

↓ 4%  
in 2019-20

### Imports

Reduced imports was driven by a reduction in Crustaceans and Molluscs imports following subdued demand conditions as a result of COVID-19 related lock downs.



**335kt**

of seafood was consumed in 2019-20

### Consumption

Apparent seafood consumption decreased in 2019-20, imports accounted for 62% of consumption, a decrease from previous years.



**17,000**

people employed in 2019-20

### Employment

10,000 people were employed in wild-catch fisheries and 7,000 people were employed in aquaculture.

Note: 2019-20 figures are preliminary. Source: ABS, ABARES

## Apparent consumption (kg), per person, 2019-20



Source: ABARES

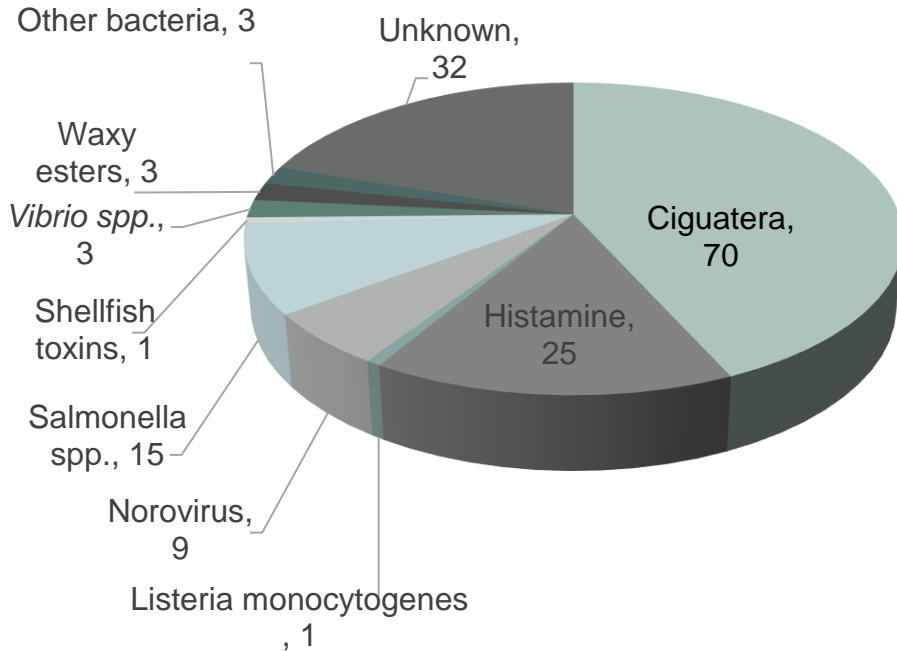
## Variety of hazard/food pairings

- Large variety of seafood – finfish, crustacea, molluscs, seaweeds
  - Grown in wide range of environments – freshwater, estuarine, coastal, ocean, polluted/clean
  - Exposed to a variety of hazards – bacteria, viruses, toxic phytoplankton, heavy metals, AgVet chemicals, other chemical contaminants
  - Processing hazards
- ⇒ **Huge variety of risks**



# Current seafood related illness in Australia

Outbreaks 2008-2017: **Total 162**



- Seafood accounts for 10% food related outbreaks
- Common causes: **ciguatera** (highest number of outbreaks), **viruses** (highest number of illnesses), *Salmonella*, histamine and recently **Vibrio**
- Common causes of recalls: microbial and undeclared allergens

Table 2 - Food safety events by food category, 2014-2021

FOOD CATEGORY	2021 N= 248 n (%)	2020 N= 127 n (%)	2019 N= 84 n (%)	2018 N= 84 EVENTS n (%)	2017 N = 44 EVENTS n (%)	2016 N = 40 EVENTS n (%)	2015 N = 37 EVENTS n (%)	2014 N = 40 EVENTS n (%)
Alcoholic beverages	4 (2%)	4 (3%)	2 (2%)	-	1 (2%)	1 (2%)	1 (3%)	-
Animal feed	-	-	-	-	-	-	-	-
Cereals and cereal-based Products	6 (2%)	6 (5%)	2 (2%)	4 (4%)	2 (4%)	3 (7%)	2 (5%)	1 (3%)
Composite food	6 (2%)	7 (6%)	2 (2%)	-	-	-	2 (5%)	2 (5%)
Drinking water	2 (1%)	-	-	-	-	-	-	-
Eggs and egg products	-	1 (1%)	-	1 (1%)	2 (4%)	1 (2%)	-	2 (5%)
Fats and oils of animal and vegetable origin	2 (1%)	-	-	-	-	-	2 (5%)	1 (3%)
Fish and other seafood	46 (19%)	19 (15%)	9 (11%)	10 (12%)	11 (25%)	9 (23%)	7 (19%)	4 (10%)
Food additive	3 (1%)	-	-	-	-	-	-	2 (5%)
Foods for infants and small Children	1 (0%)	3 (2%)	1 (1%)	6 (7%)	3 (7%)	-	-	2 (5%)
Fruit and fruit products	13 (5%)	9 (7%)	-	9 (11%)	3 (7%)	2 (5%)	5 (14%)	2 (5%)
Fruit and Vegetable Juices	3 (1%)	1 (1%)	-	-	-	-	-	-
Herbs, spices and Condiments	24 (10%)	10 (8%)	9 (11%)	8 (9%)	2 (4%)	2 (5%)	2 (5%)	1 (3%)
Legumes and pulses	4 (2%)	7 (6%)	1 (1%)	-	3 (7%)	3 (8%)	-	-
Meat and meat products	26 (10%)	10 (8%)	9 (11%)	6 (7%)	4 (9%)	3 (8%)	5 (14%)	8 (20%)
Milk and dairy products	22 (9%)	16 (13%)	15 (18%)	8 (9%)	3 (7%)	3 (8%)	1 (3%)	3 (8%)
Non-alcoholic								

## INFOSAN reports seafood related events have ranged from 10-25% of all reported events between 2014-2021.

- Seafood represents a major vector for illness reports
- Influenced by high levels of trade
- 2020 events
  - *Undeclared allergen in fish cakes, fish sticks, fish balls, fish x2, ground crayfish*
  - *L. monocytogenes in smoked salmon x6, smoked trout, trout butter, herrings x2*
  - *Canning deficiencies in pilchards, canned sardines*
  - *C. botulinum in frozen fish, prepackaged fish, dried fish, fish x2, canned tuna, tuna*
  - *Norovirus in oysters x3, frozen tellins, cockles*
  - *Histamine in tuna x11, dried anchovies, sardines, mackerel x4,*
  - *Salmonella in cooked clams x2, frozen clams, chilled seafood x2, shrimp x2*
  - *E. coli in clams x2, mussels, shellfish*
  - *Malchite green in grouper*
  - *Vibrio in shrimps x3, oysters x2*
  - *Antibiotics in fish*
  - *Glass in mackerel*

## Current situational scan

**Traditional hazards** – continued research is improving how we deal with these, but we still have some challenges

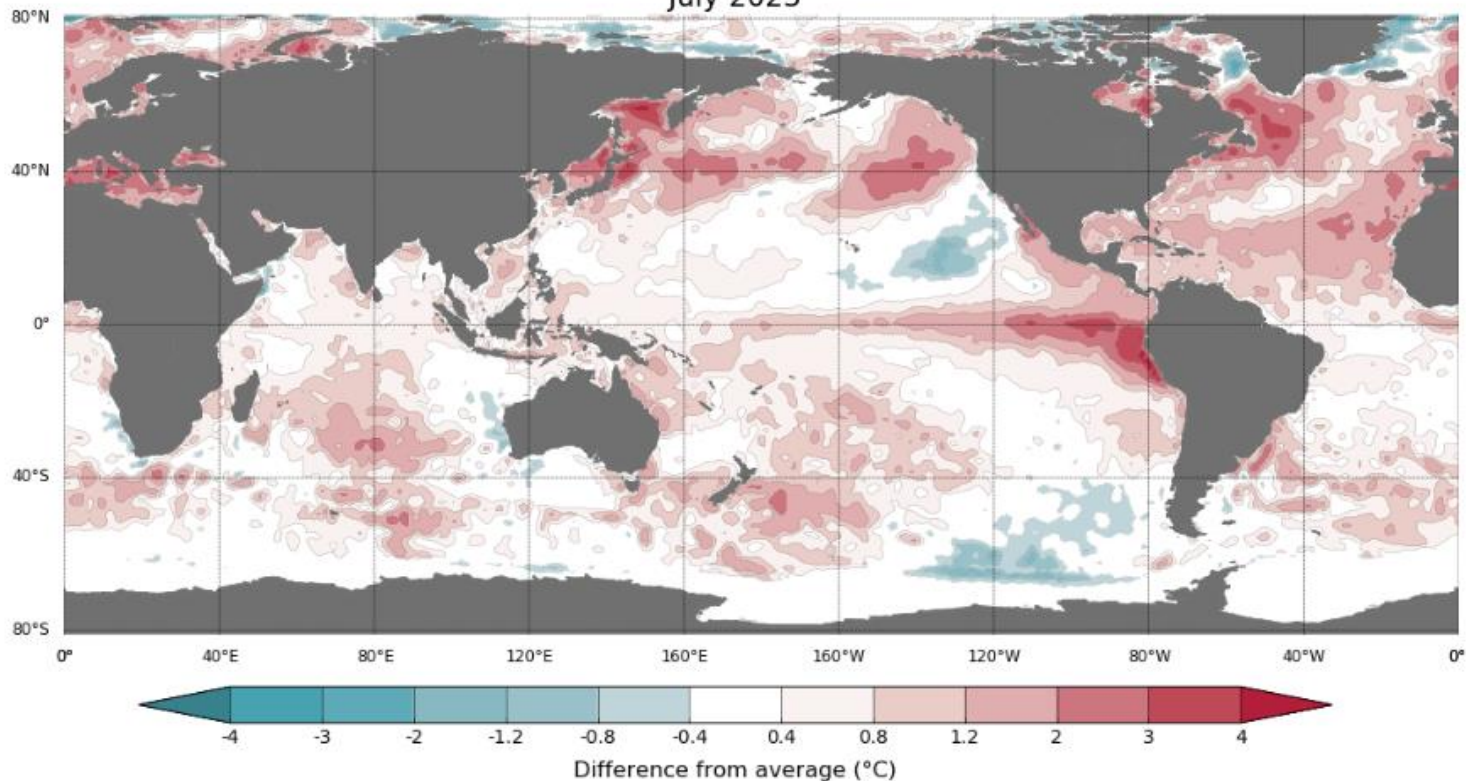


## Evolving risks

- **Novel products** e.g. seaweed, new species, new formats
- **Novel hazards** e.g. toxins, PFAS, PFOA, AMR
- **Rapidly increasing development in remote areas/developing nations** – access to labs, cold chain
- **Consumer changes** - rise in raw/minimally processed
- **Lack of experienced people**

# Overlay our changing environment

Difference from average sea surface temperature observations  
July 2023

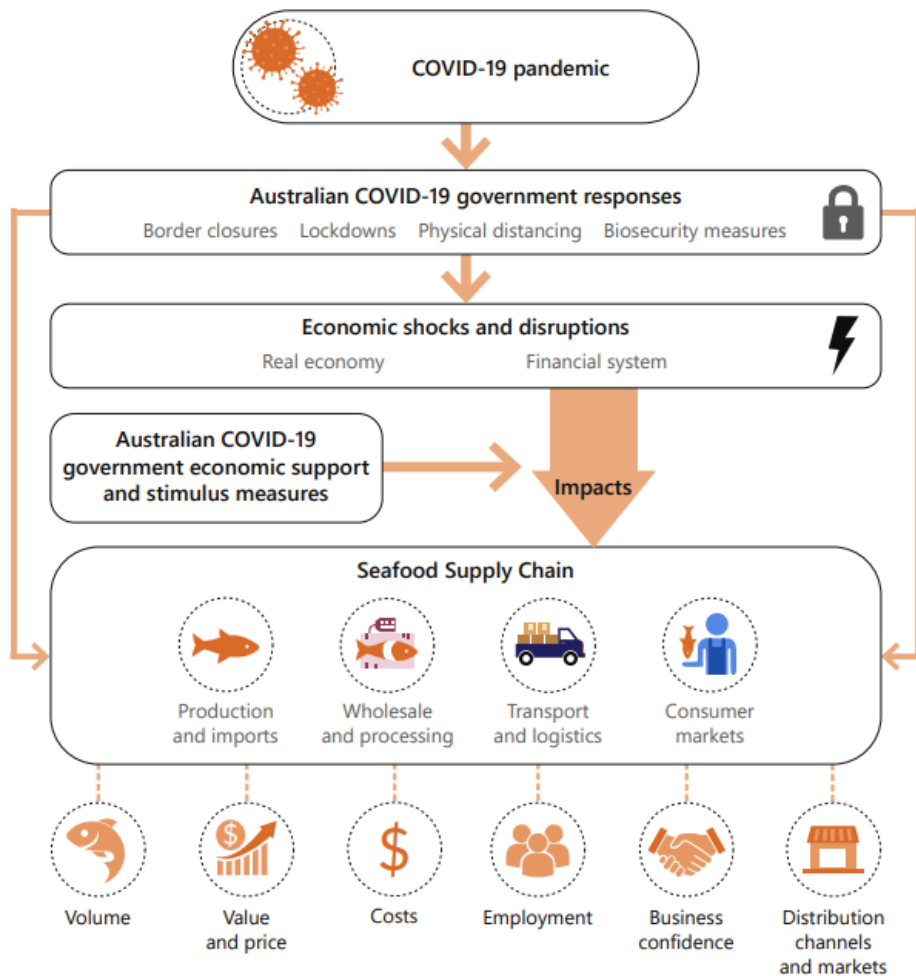


Data: BOM SST  
Climatology baseline: 1961 to 1990  
© Commonwealth of Australia 2023, Australian Bureau of Meteorology

<http://www.bom.gov.au/climate>

Monthly average: July 2023  
Created: 14/08/2023





## Overlay the current political and health environment

- Food safety staff deployments into COVID response = reduced attention to food safety
  - Reduced migration = less skilled and unskilled labour
  - Supply chain disruption = ingredients/raw material shortages, export markets declined, spare parts
  - Less visits to GP = reduced illness reporting
- 
- On-going supply chain issues e.g. war in Ukraine
    - Product substitutions
    - Labelling issues
    - Allergens
    - Food Fraud

Figure 3. Shocks, disruptions and impacts experienced by the Australian seafood supply chain.

# Draft WHO Global Strategy for Food Safety 2022-2030

<https://cdn.who.int/media/docs/default-source/food-safety/who-global-strategy-food-safety-2022-2030.pdf>



# How do we manage these evolving risks?

## Forecasting

- Data driven
- Expert opinion

## Novel tools

- Rapid screening kits
- Whole genome sequencing
- Digital innovation: remote monitoring, data sharing
- Artificial intelligence, machine learning

## Novel systems

- Flexible approaches to managing risk – is regulation the best option?
- Outcome focused
- Remote audits
- Faster reporting systems

## Build people capability

- Good understanding of risk
- Good understanding of analytical limitations
- Flexible mindset in risk management



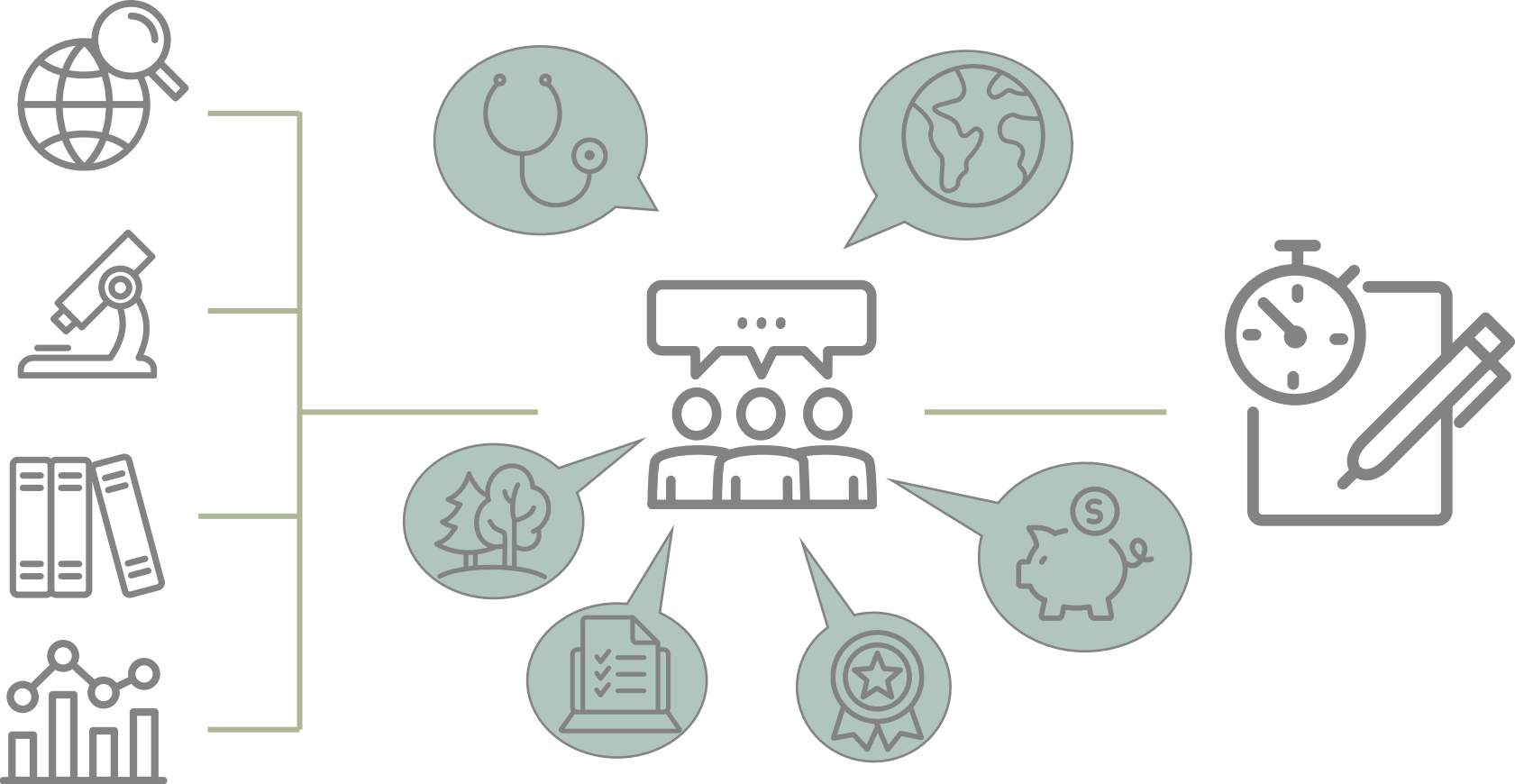


Provides technical advice to support Australia's seafood trade and market access negotiations and helps to resolve barriers to trade

[www.safefish.com.au](http://www.safefish.com.au)

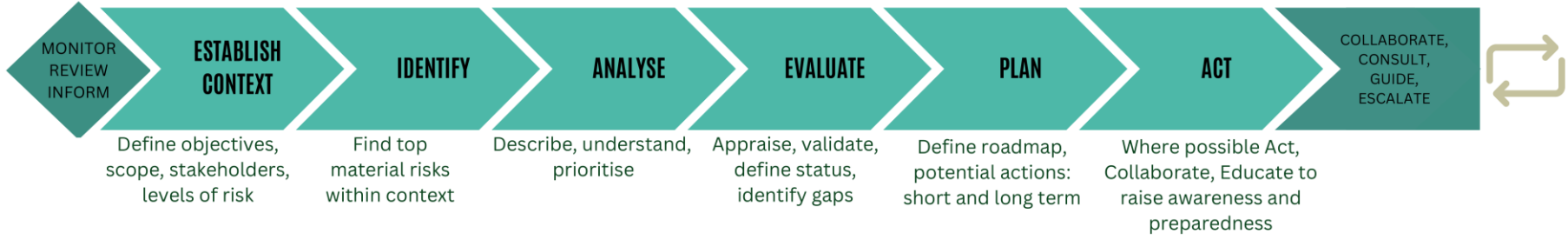


# Forecasting and prioritisation – data driven



Issues for ranking (p. 18)	Source(s)
Chemical Contaminants	Risk Register, Codex, WHO, EFSA, DAWE Import Testing, SafeFish direct enquiries
Ciguatera poisoning	Codex, EFSA-EREN, FAO OzFoodNet, Risk Register
Climate change	Codex, EFSA-EREN, FAO, SafeFish direct enquiries
Consumer driven change	Codex, EFSA-EREN, FAO, Risk Register
Environmental and industrial pollutants	Codex, DAWE, FSANZ, FAO Report, NRS
Emerging Harmful Algal Bloom issues	DAWE Import Testing, EFSA-EREN, FAO, FSANZ, OzFoodNet, SafeFish direct enquiries
Food fraud	EFSA-EREN, Codex, FAO, Risk Register
Histamine	Codex, FSANZ, DAWE, OzFoodNet
<i>Listeria monocytogenes</i>	CODEX, DAWE, FAO, FSANZ, OzFoodNet
Micro and nano plastics	EFSA-EREN, FAO, FSANZ, Risk Register
Norovirus in seafood	OzFoodNet, SafeFish Direct Enquiries, Codex
Vibrio in seafood	DAWE Import Testing, FSANZ, OzFoodNet, SafeFish direct enquiries, Risk Register, Export recalls



# SAFEFISH NATIONAL ACTIONABLE RISK REGISTER



## RESULTS

 <p><b>TOP 34 RISKS IDENTIFIED FOR THE AUSTRALIAN SEAFOOD INDUSTRY</b></p> <p><b>CRITICAL:</b></p> <ol style="list-style-type: none"> <li>1) VIBRIO</li> <li>2) CLIMATE CHANGE</li> <li>3) GEOPOLITICAL</li> <li>4) BIOTOXINS, CIGUATERA</li> <li>5) TRACEABILITY AND AUTHENTICITY</li> </ol>	 <p><b>IN DEPTH ANALYSIS OF TOP 5 CRITICAL RISKS:</b></p> <ul style="list-style-type: none"> <li>• CAUSES</li> <li>• CONSEQUENCES</li> <li>• KEY DESCRIPTORS</li> </ul>	 <p><b>ACTION: CHAMPION GROUP FORMED TO ADDRESS TOP CRITICAL RISK <i>VIBRIO</i></b></p> <p><b>EXPERT COLLABORATORS</b></p> <ul style="list-style-type: none"> <li>• INDUSTRY</li> <li>• RESEARCHERS</li> <li>• GOVERNMENT AND REGULATORS</li> </ul>	 <p><b>SITUATIONAL AWARENESS TO UNDERSTAND THE RISK:</b></p> <ul style="list-style-type: none"> <li>• RISK ASSESSMENT</li> <li>• CAUSES AND CONSEQUENCES</li> <li>• GAPS IN KNOWLEDGE</li> <li>• EXISTING EXPERTS</li> <li>• CURRENT ACTIVITIES IN <i>VIBRIO</i></li> <li>• BEST PRACTICE AVAILABLE</li> <li>• LITERATURE AND STANDARDS</li> <li>• EXISTING DETECTION METHODS</li> </ul>	 <p><b>RISK MITIGATION ROADMAP DEVELOPED:</b></p> <ul style="list-style-type: none"> <li>• MITIGATING ACTIONS IDENTIFIED</li> <li>• URGENCY AND FEASIBILITY OF ACTIONS ASSESSED</li> <li>• ADDRESSING THE HIGHEST PRIORITIES</li> </ul>	 <p><b>OUTPUT TOOLS TO HELP US NAVIGATE UNCERTAINTY:</b></p> <ul style="list-style-type: none"> <li>• RISK IDENTIFICATION AND RANKING PROCEDURES</li> <li>• TEMPLATES FOR DEVELOPING A RISK MITIGATION ROADMAP</li> <li>• COMMUNICATION MATERIALS FOR AWARENESS AND EDUCATION AROUND OUR TOP RISKS</li> <li>• SITUATIONAL AWARENESS FOR PLANNING AND FORECASTING</li> </ul>
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## OUTCOMES

 <p>Raised awareness with all stakeholders</p>	<p>Validated gaps and needs</p>	<p>Improved strategic planning and forecasting</p> <p>Identified key focus areas</p>	<p>Guided SafeFish's priorities</p> <p>Translated insights into actions</p>	<p>Built collaboration and connectivity</p> <p>Improved risk culture and tools for preparedness</p>	
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**1. VIBRIOS**

**2. CLIMATE CHANGE IMPACTS**

**3. GEOPOLITICAL UNCERTAINTY**

**4. BIOTOXINS, CIGUATERA**

**5. TRACEABILITY & AUTHENTICITY**

- 6. GAPS IN REGULATORY FRAMEWORKS
- 7. *LISTERIA* & *SALMONELLA* IN READY TO EAT SEAFOOD
- 8. LIMITED TECHNICAL CAPABILITIES/RESOURCES
- 9. LOSS OF SOCIAL LICENSE
- 10. OVER RELIANCE ON HIGH VALUE MARKETS
- 11. SEAFOOD ALLERGENS
- 12. BIOSECURITY THREATS
- 13. HEAVY METALS IN SEAFOOD
- 14. COLD CHAIN MANAGEMENT
- 15. ANIMAL WELFARE

- 16. REPUTATION LOSS DUE TO POOR QUALITY/CHEAP SEAFOOD IMPORTS
- 17. PARASITES IN FISH
- 18. LOW PREPAREDNESS FOR INCIDENTS
- 19. AG-VET CHEMICALS
- 20. POLLUTANTS IN FISH
- 21. INCIDENTS CAUSING IMPACT TO BRAND AUSTRALIA
- 22. CHEMICAL & ANTIBIOTIC OVERUSE
- 23. REDUCED GOVERNMENT SUPPORT/SPEND
- 24. REDUCED SEAFOOD CONSUMPTION
- 25. INCREASED FISHING PIRACY

- 26. CYBERSECURITY
- 27. CATASTROPHIC EVENT
- 28. IMPACT OF NEW TECHNOLOGIES
- 29. LACK OF ACCESS TO SUITABLE WATER
- 30. LOW FOOD SAFETY KNOWLEDGE
- 31. GEOPOLITICAL IMPACT OF TRADE BLOCKS
- 32. LOSS OF PREDICTABILITY OF EXISTING MODELS





# SafeFish risk register – increasing awareness within the seafood industry



Food safety and technical risks identified

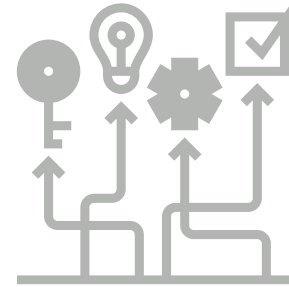


Risks are prioritized and a bullseye produced specific to the sector



Who owns these risk plans?

- YOU
- YOUR BUSINESS
- YOUR SECTOR



Some issues fed into sector or individual businesses strategic plans and R&D strategies



Some issues will be common to other sectors/industry

## We can be prepared

- In a world of increasing uncertainty, we can prepare for risk
- Information is critical – forewarned is forearmed
- Our food safety systems need to be flexible and pragmatic to enable rapid adaption
- An amazing array of tools for monitoring, communication, data sharing and analysis are emerging, and these will be key in help us to adapt
- Access to experienced personnel will be one of our biggest challenges to overcome





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TASMANIA

**Thank you**




Whole genome sequencing (WGS) offers several advantages for enhancing food safety:



1. **Precision:** WGS provides a comprehensive view of an organism's entire genetic makeup, allowing for precise identification of pathogens or contaminants in food products.
2. **Traceability:** It enables the tracking and tracing of the source of contamination, helping to identify the origin of foodborne outbreaks and facilitating targeted recalls.
3. **Early Detection:** WGS can detect pathogens at an earlier stage of contamination, reducing the risk of contaminated products reaching consumers.
4. **Differentiation:** It can distinguish between different strains of pathogens, aiding in identifying the specific source of contamination and preventing future outbreaks.
5. **Public Health Protection:** By rapidly identifying and containing outbreaks, WGS helps protect public health by preventing the spread of foodborne illnesses.
6. **Regulatory Compliance:** Some food safety regulations and agencies now require or recommend the use of WGS as a tool for monitoring and ensuring food safety compliance.
7. **Research and Development:** WGS supports ongoing research into foodborne pathogens, helping to develop improved prevention and control strategies.
8. **Global Collaboration:** WGS data can be shared internationally, promoting collaboration and a more coordinated response to global food safety challenges.

Overall, whole genome sequencing plays a crucial role in advancing food safety practices by offering a powerful tool for pathogen identification, tracking, and prevention.

 Regenerate

<https://chat.openai.com/>