MWH

BUILDING A BETTER WORLD

Seafood Industry Risk Assessment

March 2014

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Executive Summary

MWH Australia Pty Ltd (MWH) was engaged in October 2013 by PrimeSafe and the Department of Environment and Primary Industry (DEPI) to conduct a food safety risk assessment of the seafood industry in Victoria. This project seeks to identify and assess all food safety risks within the Victorian seafood industry, to allow PrimeSafe to increase the efficiencies and effectiveness of its inspection program by targeting higher risk areas. It also aims to assist industry to prioritise its activities and hence also increase its effectiveness.

In order to meet these objectives, MWH facilitated a series of risk workshops comprising government and industry participants to ensure the risk assessment was meaningful, practical and thorough.

Four seafood categories were identified for inclusion in this project:

1. Abalone, sea urchins & periwinkles;
2. Finfish & Cephalopods;
3. Crustaceans (comprising rock lobster, prawns, yabbies); and
4. Bivalve Molluscs (comprising oysters, clams, mussels, pipis, scallops).

The risk assessment was focussed only on those risks that can impact upon food safety and covered the entire supply chain from pre-harvest through to retail; and the Victorian harvest and pre-harvest of seafood (as this is PrimeSafe's responsibility). It is acknowledged that imported food is required to meet the same national Standards.

The risk identification and assessment process was broadly based on the International Standard for risk management (ISO 31000:2009), and in addition, the project also utilised, in part, the Victorian *State Emergency Risk Assessment Methodology* (SERAM). This allowed for an assessment of potential food safety risk scenarios associated with each seafood category to enable a high level comparison of risk between the seafood groups, as well as a Multi-Criteria Assessment (MCA) to assess some key controls generic to the seafood industry. Both current risk (i.e. with current controls in place) and residual risk (with further treatments) assessments were undertaken to highlight the benefit of introducing additional treatments. During the course of the industry workshops, it was not possible to assess inherent risk given the difficulty in assessing food safety risks in the seafood industry without any controls in place (e.g. no refrigeration). It was subsequently agreed with the project Steering Committee not to pursue this inherent risk assessment. This report presents the outcomes of these seafood risk assessments.

Attendance at industry risk workshops ranged between 2 and 8. Various reasons were provided for apologies including invitees were too busy and, due to tight project schedules, there was insufficient notice to attend sessions. Given that the industry meetings attendance was lower than expected, the following report cannot be considered to be truly representative of the seafood industry as a whole, but rather the views and opinions of those industry participants that attended the workshops. We are able to comment that the industry participants present were very engaged with the process and given their comprehensive understanding of their industry, and their commitment to it, they were able to provide an excellent contribution to the risk assessment.

The project was directed by a steering committee comprising the PrimeSafe CEO, and representatives from the PrimeSafe Board of Directors, and representatives from the DEPI and the Department of Health (DH). This steering committee was established to oversee the successful delivery of the project and to provide assistance and support to the project team as required.

In undertaking the assessment of food safety risks we considered those consequences related to health impacts to people, economic costs and losses to the State, and the ability of

government, and public administration, to operate in the event of a particular risk occurring. Most risks identified across the seafood categories were similar, and therefore, a comparative analysis of the risk assessments was possible across the categories. (see Table A).

Table A – Risk Assessments Across all Seafood Types

		Current Risk Assessment (with Existing Controls)			
Supply Chain Sector	**Risk**	**Bivalve Molluscs**	**Abalone, Sea Urchins and Periwinkles**	**Finfish & Cephalopods**	**Crustaceans**
Production - pre-harvest	Bacterial / viral contamination	**MEDIUM** *(driven by high likelihood)*			
	Contamination by biotoxins	**HIGH** *(driven by high likelihood and economic consequence)*		**HIGH** *(driven by economic impact)*	**HIGH*** *(driven by economic impacts)*
	Contamination by accumulation of heavy metals				
	Contamination by agricultural and industrial chemicals				
Production - harvest	Contamination from workers, machinery or water sources				
Processing - shucking (shelling)	Contamination (microbiological pathogens) by shuckers				
Processing	Microbiological contamination of food, food-packaging materials, and food-contact surfaces from employees			**MEDIUM** *(driven by health impacts)*	
	Microbiological contamination from environmental sources (premises and equipment)			**MEDIUM** *(driven by health impacts)*	
Canning	Contamination in canned fish (e.g. Botulism from inadequate processing, and histamine due to poor quality raw materials)	**NA**		**NA**	
Transport	Microbiological contamination and growth during transport				
Storage and packaging	Microbiological contamination and growth during storage and packaging				
Wholesale	Microbiological contamination and growth during wholesale				
Retail	Microbiological contamination and growth during retailing		**MEDIUM** *(driven equally by people, public admin and economic consequences)*		

		Current Risk Assessment (with Existing Controls)			
Supply Chain Sector	**Risk**	**Bivalve Molluscs**	**Abalone, Sea Urchins and Periwinkles**	**Finfish & Cephalopods**	**Crustaceans**
Food service	Microbiological contamination and growth during food service (e.g. restaurants)		**MEDIUM** *(driven equally by people, public admin and economic consequences)*		

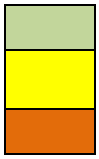
*High assessment for prawns only. Low risk assessment for non-filter feeding Crustaceans.

Legend for table above:

LOW RISK:

MEDIUM RISK:

HIGH RISK:



The 'High' risk for bivalve molluscs is associated with pre-harvest contamination by biotoxins. There are a number of controls currently in place to manage this risk including monitoring of phytoplankton, notification if an outbreak is detected, potential triggering of fishery closure, as well as traceability and recall measures. The 'High' risk for finfish and Cephalopods is associated with contamination by biotoxins in the Gippsland Lakes, and the subsequent economic impact on industry. Key controls to manage this risk are the monitoring of algal levels, and the subsequent enactment of fishing bans in certain areas. The 'High' risk for Crustaceans is associated with biotoxin contamination of prawns from growing waters. This risk is managed through monitoring, testing, buffer zones and recall protocols.

A range of existing controls were described by workshop participants, and further treatments for each risk were also identified by industry participants to potentially reduce the level of risk (residual risk).

In addition to the detailed risk assessment process, selected food safety risk scenarios were also determined and assessed, using the methodology described in the SERAM. These are presented in Figure A below (Bivalve Mollusc scenarios are abbreviated 'BV').

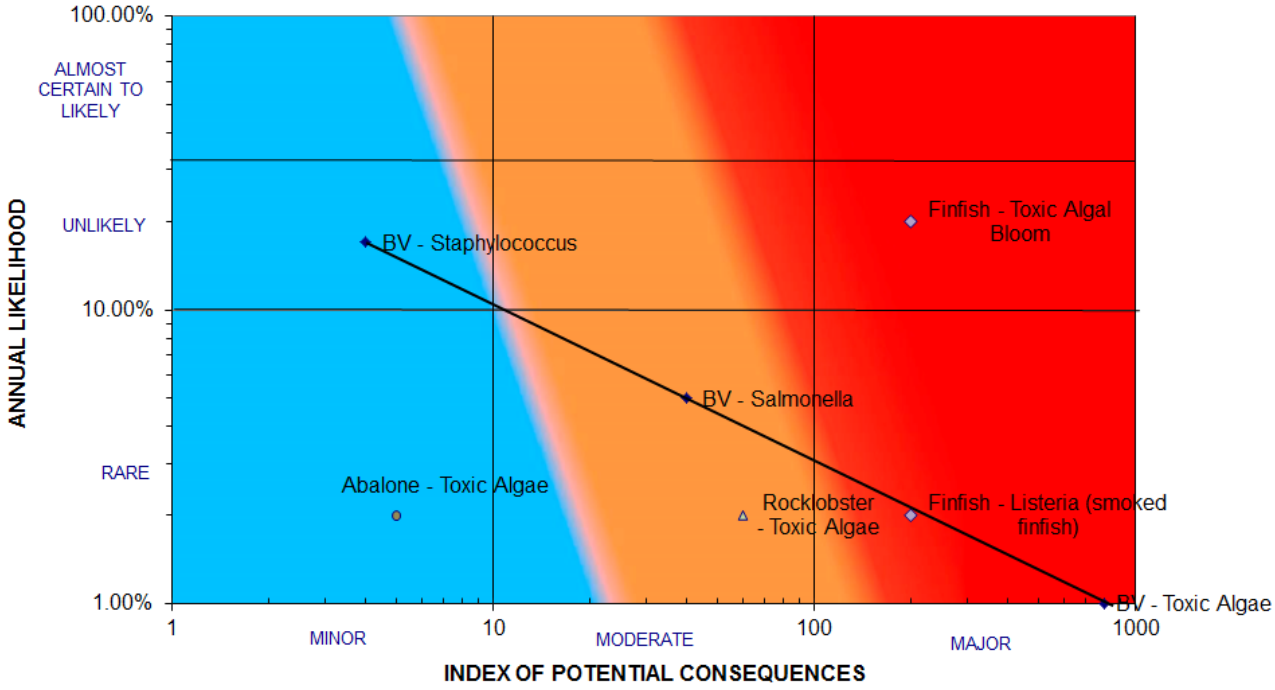


Figure A – Log-Log Matrix with All Risk Assessment Scenario Impact Points

As Figure A shows, the specific risk scenario of the finfish industry being impacted by a toxic algal bloom in the Gippsland Lakes was assessed as having the highest risk relative to other seafood categories. This is followed by bivalve molluscs (abbreviated to 'BV' in the figure). Almost all impact scenarios assessed (with the exception of the low impact scenario for bivalve molluscs, and the finfish listeria scenario) impacted predominantly on the economy, with people (health) and public administration consequence sectors being less impacted. There is no clear correlation between the risk assessment outcome and the size of the local seafood category industry.

Two key controls (Traceability and Food Safety Programs) were assessed using an MCA tool across six defined criteria. The MCA scoring shows that the workshop participants viewed the current controls for both Food Safety Programs and Traceability as overall largely effective in managing food safety risks, with only minimal improvements identified.

In summary the project identified fifty five risks spread across the four seafood sectors of finfish & Cephalopods, Crustacea, abalone, sea urchins & periwinkles, and bivalve Molluscs. A range of current controls were found to be in place to manage these risks as required by PrimeSafe in accordance with the Victorian Seafood Safety Act (2003) and associated other Standards.

This project has shown that the regulatory controls provided by the Seafood Safety Act (2003), and administered by PrimeSafe, are generally effective in managing seafood safety, and with these current controls in place, the risk is low. Furthermore, industry participants have identified some opportunities where current controls could be modified to increase the efficiency of the existing PrimeSafe quality assurance system. These opportunities will potentially ease some of the regulatory burden on industry whilst not increasing the level of risk.

There are some areas where risk has been deemed as Medium or High, or current controls are only "moderately effective" and these should be further investigated to confirm the level of risk, and to more closely scrutinise the existing controls and identify potential improvements.

The detailed multi-criteria analysis of the Food Safety Programs and traceability process, representing two major controls operating throughout the seafood industry, revealed that industry participants believe both controls are largely effective. Industry participant's acceptance of Food Safety Programs could, however, be enhanced if some of its requirements

were modified. A particular opportunity is the enhanced use of codes of practice and industry standards, however PrimeSafe would need to ensure that validation and independent verification processes were adequate before allowing an increased reliance on the codes and standards, to achieve compliance with legislated Standards. In some cases, industry codes and standards may need to be modified to ensure they meet PrimeSafe requirements.

Based on the risk assessments undertaken across the four seafood categories, and the extensive accompanying discussions, it is recommended that:

- risks rated as relatively higher risk be reviewed further to examine the effectiveness of the current controls in place to manage these risks, and agree the potential additional controls to further manage these risks;
- the feedback from industry participants for potential future improvements regarding the management of seafood safety risks be considered by relevant government departments. This includes impacts to the industry (including costs and efficiency), government administrative and cost implications, and the ultimate effect on the food safety risk level. Further to this, it is recommended that discussions be held between the State and Commonwealth Governments, and between the State Government and industry, to review the allocation of roles and responsibilities for managing specific risks identified. This will contribute to the determination and implementation of priorities and improvements, as identified during this project;
- PrimeSafe review its requirements for how Food Safety Programs are implemented to explore opportunities to reduce the regulatory burden on industry. For example, reducing some of the requirements within the Food Safety Program, with an accompanying increase in verification of the effective implementation of existing industry codes of practice and standards, will reduce regulatory burden on industry and improve their acceptance of the Food Safety Program; and
- a reassessment of the risks be undertaken in the future to understand how effective the potential improvements, identified during this project, have been in reducing the risks. The reassessment will enable an up to date risk profile to be determined, and will again highlight potential improvement opportunities to ensure there is continuous improvement in the management of health risks associated with the seafood industry.

The consultative approach used in this project not only enabled a comprehensive risk register to be developed, but also ensured extensive and constructive discussions were held between industry participants, and also between industry participants and government. This level of interaction is invaluable and would be a significant benefit to undertaking a re-assessment in the future.

PrimeSafe

Seafood Industry Risk Assessment

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Glossary

Acronym	Definition
AFMA	Australian Fisheries Management Authority
ANZUS	Australia, New Zealand, United States Security Treaty
AQIS	Australian Quarantine and Inspection Service
ASQAP	Australian Shellfish Quality Assurance Program
AVG	Abalone Viral Ganglioneuritis
BGA	Blue-Green Algae (Cyano-bacteria)
CMA	Catchment Management Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAFF	Department of Agriculture, Fisheries and Forestry
DAg	Department of Agriculture
DFSV	Dairy Food Safety Victoria
DEPI	Department of Environment and Primary Industry
DH	Department of Health
EPA	Environment Protection Authority
EVSUDA	Eastern Victorian Sea Urchin Divers Association Inc
FRDC	Fisheries Research and Development Corporation
FSANZ	Food Standards Australia New Zealand
HACCP	Hazard Analysis & Critical Control Points
LEFCOL	Lakes Entrance Fishermen's Co-Operative Society Limited
NATA	National Association of Testing Authorities
PCB	Polychlorinated Biphenyls
RTE	Ready to Eat
SIV	Seafood Industry Victoria
SRL	Southern Rocklobster Limited
WQA	Water Quality Association

1 Introduction

1.1 Background

In September 2013, the Victorian Government released its response to the *Inquiry into the impact of food regulation on farms and other business*. The response documented that "The Victorian Government supports the majority of these (16) recommendations as they reinforce the government's position that Victoria's approach to regulation should be risk based and should identify alternative methods to regulation for encouraging compliance with food safety requirements."

In accepting that many primary production and processing business are subject to a "range of commercial quality assurance requirements that duplicate, overlap or exceed state food safety regulatory requirements", the response notes that "the government recognises the need to remove any unnecessary compliance burden on primary production and processing businesses. To this end the government will continue to support the work that PrimeSafe and Dairy Food Safety Victoria (DSFV) are doing to improve the efficiency of their processes …"

The government therefore acknowledges the need to remove unnecessary compliance burden and a risk based approach is the preferred method to identify alternative compliance approaches. It is recognised that this must occur within a national agreed Food Standards Code that is required to be complied with in all states. Specifically the primary production standard for seafood is a mandatory requirement for all sectors of the seafood industry.

As a result of the government response to the Inquiry, PrimeSafe and the Department of Environment and Primary Industry (DEPI) commissioned MWH Australia Pty Ltd (MWH) in October 2013, to conduct a food safety risk assessment of the seafood industry in Victoria. This project will identify and assess all food safety risks within the Victorian seafood industry, to allow PrimeSafe to increase the efficiencies and effectiveness of its inspection program by targeting higher risk areas. It would also assist government and industry to prioritise its activities and hence increase the overall effectiveness of the management of seafood risks.

There are a range of causes of illnesses that can be associated with seafood as documented in OzFoodNet (as shown in Table 1.1). The table highlights the incidence of reported outbreaks. Note that these data are limited to outbreak notifications only (defined as "an incident where two or more persons experience a similar illness after consuming a common food or meal and epidemiological analysis implicate the meal or food as the source of illness" (OzFoodNet[1]). Sporadic cases of illness are not necessarily captured in these reports.

Table 1.1 – Seafood and foodborne illness – Outbreak summary from OzFoodNet reports

Condition	Total Number Ill (Australia, 2011)
Ciguatera	17
Scombroid (foodborne illness resulting from eating spoiled (decayed) fish	10
Unknown	87

More details on the summary of foodborne outbreaks linked to the consumption of seafood derived from OzFoodNet publications data is presented in Appendix A.

[1] http://www.ozfoodnet.gov.au/

1.2 Project Objectives

The project objectives are to identify key food safety risks within the Victorian seafood industry and as a result, allow PrimeSafe to increase the efficiencies and effectiveness of its inspection program (by targeting areas of higher risk).

This is to be achieved specifically by:

- considering a range of consequences associated with food safety risks (health impacts to people, economic costs and losses to the State, and the ability of government to operate in the event of a particular risk);
- obtaining consensus within the respective industries on the assessment of the food safety risk; and
- identifying opportunities for new or alternative mitigation strategies to reduce risk levels.

1.3 Project Scope

Four seafood categories have been identified for inclusion in this project:

1. Abalone, sea urchins & periwinkles;
2. Finfish & Cephalopods;
3. Crustaceans (comprising rock lobster, prawns, yabbies); and
4. Bivalve Molluscs (comprising oysters, clams, mussels, pipis, scallops).

The risk assessment is focussed only on:

- those risks that can impact upon food safety and will cover the entire supply chain from pre-harvest through to retail; and
- the Victorian harvest and pre-harvest of seafood (as this is PrimeSafe's responsibility). It is acknowledged that imported food is required to meet the same national Standards.

A highly consultative and collaborative approach with both government and industry participants was adopted in the delivery of the project to enable:

- a well-considered and comprehensive risk identification process;
- a consensus to be obtained on the assessment of risk, where possible;
- the identification of the 'day to day' tasks undertaken by industry participants to reduce food safety risk, in addition to those regulatory compliance requirements; and
- industry participants to be engaged in the process, with government and PrimeSafe, therefore encouraging their ownership of project outcomes, and to also share technical views and opinions with government and PrimeSafe.

A project Steering Committee was established comprising the PrimeSafe CEO, and representatives from the PrimeSafe Board of Directors, and representatives from the DEPI and the Department of Health (DH). The role of the Steering Committee was to oversee the successful delivery of the project and to provide assistance and support to the project team as required. The members of the Steering Committee are listed in Table 1.2.

Table 1.2 – Steering Committee Members

Name	Organisation
Dr Brendan Tatham	PrimeSafe CEO
Ms Margaret Darton	Department of Environment and Primary Industry
Dr Heather Haines	Department of Health
Ms Rachael Poon	Department of Health
Dr Caroline Barrett	PrimeSafe Board of Directors

Name	Organisation
Dr John Carnie	PrimeSafe Board of Directors

2 Project Methodology & Delivery

2.1 Risk Assessment Process

The risk identification and assessment process was broadly based on the International Standard for risk management (ISO 31000:2009). In addition to implementing a methodology consistent with ISO31000, the project also utilised, in part, the Victorian *State Emergency Risk Assessment Methodology* (SERAM). This allowed for an assessment of potential food safety risk scenarios associated with each seafood category to enable a high level comparison of risk between the seafood groups, as well as a Multi-Criteria Assessment (MCA) to assess some key controls generic to the seafood industry. This specifically involved:

- tailoring the consequence and likelihood assessment criteria used in the SERAM for this assessment;
- undertaking a risk scenario impact assessment for each seafood category, where appropriate, based on the residual risk curve tool described in the SERAM; and
- undertaking a detailed analysis of key food safety controls in the seafood industry, using the Controls Multi-Criteria Analysis described in the SERAM.

Figure 2.1 below shows the risk assessment methodology used within this project and the association with the processes detailed within ISO31000 risk management standard, and the SERAM.

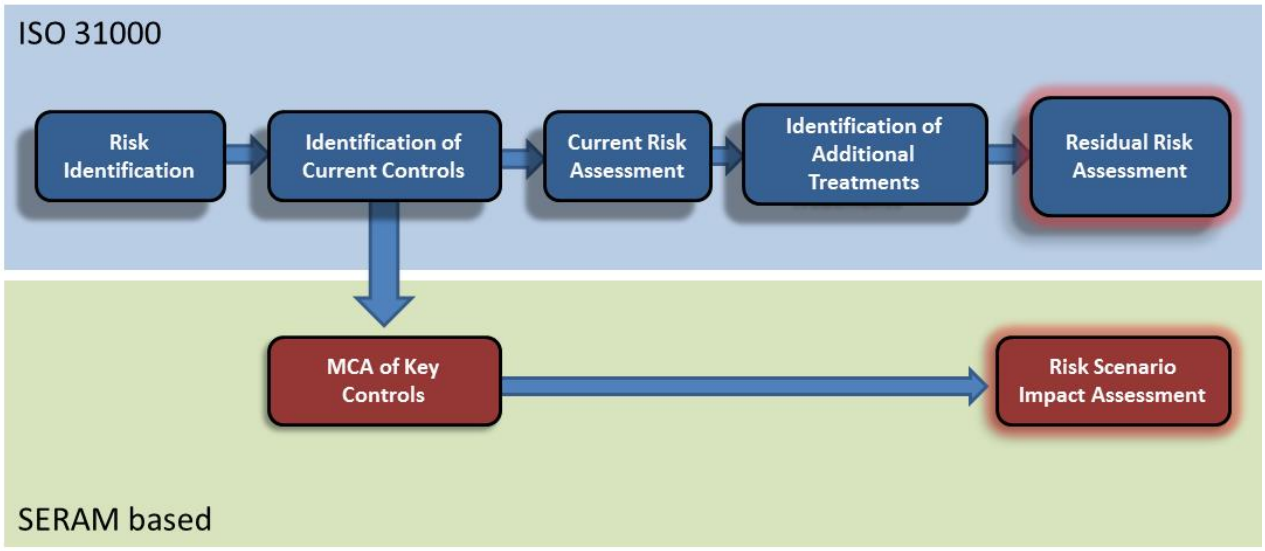

Figure 2.1 – Risk Assessment Process Illustration

The risk assessment process implemented during this project comprises two stages:

1. Assessment of the "Current Risk" determined by the consequence and likelihood values with existing controls in place. An assessment of the effectiveness of current controls was made to assist in the determination of the most appropriate consequence and likelihood ratings. Controls Effectiveness is a measure of how well controls are perceived to manage a given risk. It is not necessarily an indication of cost effectiveness or efficiency in managing that risk; and
2. Assessment of the "Residual Risk" when potential treatments are also considered ('residual' being the risk that remains after existing controls and potential treatments have been implemented). Note there is no assessment of how effective potential treatments may be (as there is 'controls effectiveness' for assessment of current risk).

It was discussed within the PrimeSafe Board of Directors and the Project Steering Committee, the need to also include an assessment of "Inherent Risk". That is, the level of risk that exists *without* any controls in place. Given the government's direction to use a risk based approach to

identify and then remove unnecessary compliance burden, an inherent risk assessment provides an indication of the level of risk that could be realised if existing controls are removed, in an effort to remove compliance burden.

After raising the task of completing an inherent assessment in numerous workshops, the overall negative response towards undertaking this type of assessment meant that the inherent assessment was not undertaken. Industry workshop participants believed the task too difficult, and impractical given the knowledge present, and that there are always controls in place (for example the use of ice in maintaining the cold temperature chain is an intrinsic part of the fishing process in most instances). In addition, during the discussions in the workshops of 'what could be done differently in the future to enhance the management of risks?' the question was always followed with the statement 'as long as it doesn't increase the current risk rating'. One workshop did make a general comment regarding inherent risk and this is captured in the Crustacean section of this report.

It is understood that risk assessment documentation referenced in this project, such as FSANZ's *Risk Ranking of Seafood in Australia (February 2005),* include controls that were in place at the time (and therefore, they could not provide a comprehensive indication of inherent risk). Controls have been further developed over time with the advent of the Victorian Seafood Safety Act, and the Australian Primary Production and Processing Standard for Seafood.

The assessment for current and residual risks was completed using tailored likelihood and consequence criteria as shown in Table 2.1 and Table 2.2 respectively. The project steering committee was consulted in developing these criteria in order to ensure a fit-for purpose assessment.

Table 2.1 - Adopted Likelihood Table

LIKELIHOOD TABLE				
Likelihood Level		**Average Recurrence Interval**	**Annual Exceedance Probability**	**Description**
A	Almost Certain to Likely	1 - 3 years	(100-33%)	Many recorded events
B	Unlikely	3 – 10 years	(33%-10%)	Some recorded events
C	Rare	10 – 100 years	(10%-1%)	Few recorded events or little indicative evidence

A logarithmic scale has been adopted to represent the ranges in likelihood as it assists to visually represent any wide ranges in likelihood recorded. This is also common practice in representing risk graphically.

Three levels of consequences were defined in the consequence assessment. These three levels of consequence each had three categories, being People, Public Administration, and Economy. These are illustrated in Table 2.2.

Table 2.2 - Consequence Levels and Descriptors

Level	People	Public Administration	$ Economy	Examples
Major	Multiple fatality and multiple hospitalisations	Governing body absorbed with managing the event. Public administration struggles to provide critical services. Loss of public confidence in governance, with serious widespread public outcry and some alarm. Media coverage State to national.	Economic costs and losses exceed $10 million. Significant disruption requiring major changes in business strategy. Multiple business failures and significant localised loss of employment.	Hepatitis A
Moderate	One fatality and / or some hospitalisations	Governing body manages the event with considerable diversion from policy. Instances of public protests with emergent alarm. Media coverage regional to State.	Economic costs and losses exceed $2 million, but less than $10 million. Disruption requiring adjustments to business strategy. Isolated cases of business failure and some loss of employment.	Bacterial illnesses such as salmonellosis, or ciguatera
Minor	Isolated cases of minor illness, No hospitalisations	Governing body manages the event under emergency regime. Public administration functions with some disturbances. Isolated expressions of public concern. Regional media coverage. Jurisdiction perceived as able to pursue business as usual despite disruptions.	Economic costs and losses less than $2 million. Generally managed within standard financial provisions. Disruptions at business level leading to isolated cases of loss of employment.	Scombroid (histamine)

The risk matrix used to calculate the risk level, based on likelihood and criteria is presented in Figure 2.2.

Likelihood \ Consequence	Minor	Moderate	Major
A - Almost Certain to Likely	MEDIUM	HIGH	EXTREME
B - Unlikely	LOW	MEDIUM	HIGH
C - Rare	LOW	LOW	MEDIUM

Figure 2.2 – Risk Matrix Adopted for the Risk Assessment

2.2 Project Delivery

A range of key steps were undertaken to successfully deliver this project. These are shown in Figure 2.3.

Figure 2.3 – Key Project Delivery Steps

Each stage is described in detail in the sections below.

2.2.1 Stage 1 – Project Establishment

This stage allowed the confirmation of the:

- project scope, including the most logical and practical way of grouping seafood categories for the purpose of the risk assessment. The seafood categories were grouped under the four categories below:
    - Abalone, Sea urchins & periwinkles;
    - Finfish & Cephalopods;
    - Crustaceans (comprising rock lobster, prawns, yabbies); and
    - Bivalve Molluscs (comprising oysters, clams, mussels, pipis, scallops).
- risk management process (including risk register template) to be used, and the likelihood and consequence criteria to be used for the purpose of the risk assessment; and
- project planning including the high level project time lines required for the purpose of the workshop planning, presentations to the PrimeSafe Board of Directors, and submission of a draft report etc.

2.2.2 Stage 2 – Pre-population of Seafood Risk Register

To enhance the efficiency and effectiveness of the government and industry (risk identification and assessment) workshops during Stage 3, the MWH project team 'pre-populated' a risk register for each of the seafood categories, based on literature provided by DEPI and PrimeSafe. Notably, the FSANZ reference: *A Risk Ranking of Seafood in Australia (February 2005)* was used as a reference, although further risks were identified in this project, detailing key risks at different points in the supply chain. These additional risks reflect the workshop attendee views, and also illustrate the increased importance of the risks of biotoxin contamination due to the more frequent incidence of algal blooms.

This provided a basis to begin discussions during the Stage 3 meetings and workshops (rather than spending significant time generating a list of risks 'from scratch'), and also allowed the project team to start becoming familiar with food safety risks, associated with the seafood industry, prior to facilitation of the workshops.

A list of the documented sources used is presented in Appendix D.

2.2.3 Stage 3 – Government and Industry Meetings

Five meetings were held in November and December 2014 with the overall objective being to finalise risks, document existing controls, and assess the existing level of current risk for each specific risks (i.e., with current controls in place). Meeting dates, together with invited participants are detailed in Appendix A.

The first was a Government meeting, held with selected government department representatives. This meeting was designed to:

- initially review the pre-populated risk register for content and accuracy, ahead of the industry meetings, and to amend the list of risks if necessary, hence producing a 'final draft';
- document known existing regulatory / industry controls in place; and
- provide a current assessment of risks using the adopted risk criteria (with controls in place).

Four subsequent meetings* were held with industry participants across the four selected seafood categories (one meeting for each category). The industry meetings reviewed the Government meeting notes and outputs (including the current risk assessment), with specific attention towards:

- validating and / or documenting any further identified food safety risks;
- identifying and documenting current 'day to day' industry controls in place; and
- reviewing / validating the current risk assessment.

*A fifth additional meeting was held at Lakes Entrance in January 2014 to ensure a more comprehensive assessment of risks related to finfish and prawns.

Overall attendance at these industry meetings was lower than expected:

- Crustacea (5 industry participants in attendance),
- Bi-valve molluscs (3),
- Abalone (2),
- Finfish – two meetings (3 Melbourne; 8 Lakes Entrance)

Some of the reasons provided by industry participants for low attendance were that invitees were too busy, insufficient notice to attend sessions due to tight project schedules.

Given industry meetings attendance was lower than expected, the following report cannot be considered to be truly representative of the seafood industry as a whole, but rather the views and opinions of those industry participants that attended the workshops. These views and opinions are expressed throughout the report and also in the comments column in the risk register.

2.2.4 Stage 4 – Risk Assessment

A risk assessment workshop, for all four seafood categories, was then held with representatives from both government and industry to:

- discuss and document what could be done differently in the future to either reduce the risk level and/or reduce the regulatory burden whilst still achieving relevant seafood safety standards and the determined risk level. This could include additional treatments, modifying existing controls, or removing selected existing controls. The basis for the discussion was driven by the current risk assessment; and
- re-assess each risk assuming the proposed treatments were in place (i.e. 'residual risk').

In undertaking the above, the workshop provided the group with an opportunity to again review and amend the list of risks, existing controls and the current risk assessment.

2.2.5 Stage 5 – Risk Scenario Impact Assessment and Assessment of Key Controls

A final workshop was held again with relevant government department and industry participants. This workshop was aimed at undertaking a:

- risk scenario impact assessment for each seafood category to enable an overview of the risk within each category and to conduct a high level comparison of risk between the seafood categories; and
- detailed assessment of the effectiveness of two key food safety controls currently operating within industry, to then identify potential improvement opportunities to these key controls.

The methodology for the risk scenario impact assessment requires three impact scenarios ('High impact', 'Medium impact', and 'Low impact') – where possible - to be described for each seafood category. These scenarios, developed from an amalgam of selected risks in the risk register represent the collective view of representative seafood safety events that could occur in Victoria. Each scenario was specifically described in detail, using either historical events as a basis, or using a plausible outcome (according to industry participants).

The impact scenarios were described in terms of consequence and likelihood, and each point was then plotted, using scaled ranges, on the risk matrix. A line of best fit between these points is then constructed (referred to as a current risk 'curve') for the relevant seafood category to give an indication of the risk profile for that category. In some cases, only one scenario was developed, in which case a single current risk 'point' was charted.
A sample risk profile is shown in Figure 2.4. This process was used for each of the four seafood categories completed as part of this project. Current risk curves closer to the top right corner of the matrix can be interpreted as being more significant compared to those current risk curves closer to the lower left corner of the matrix.

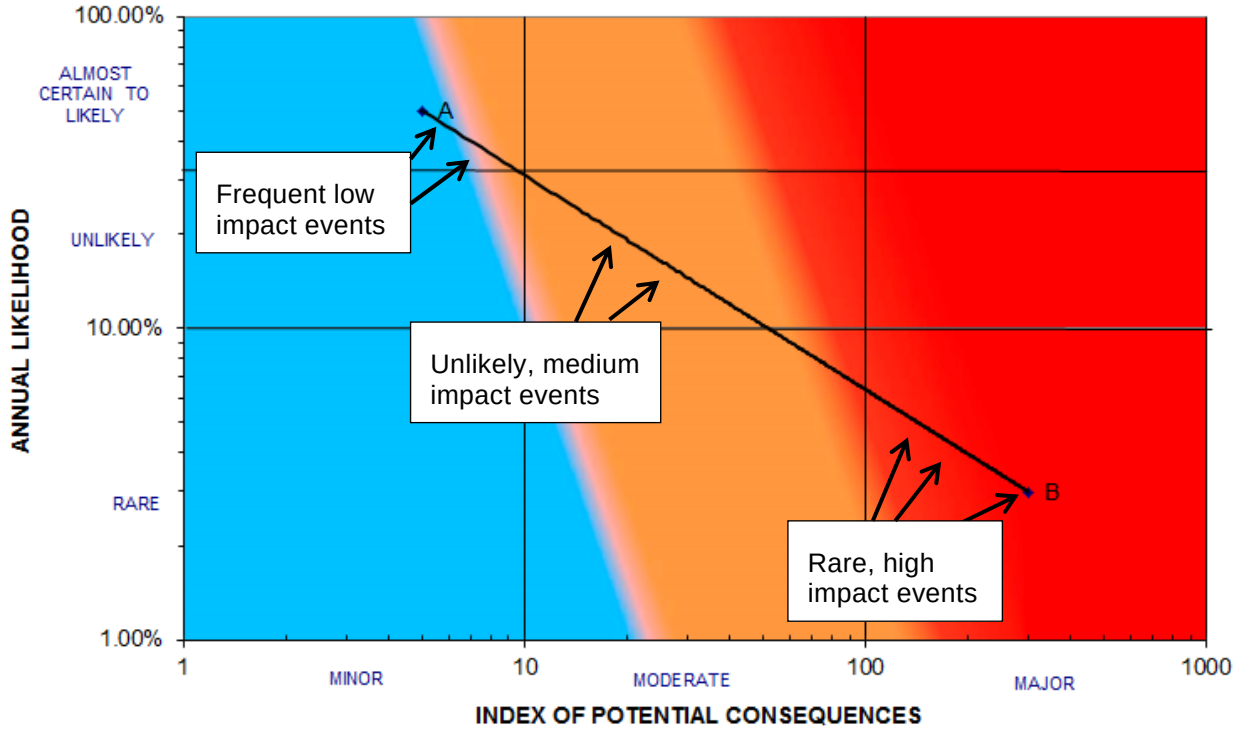

Figure 2.4 – Sample Food Safety Impacts Profile

In general, a log-log scale straight line of best fit (power law) has been provided for most risk plots for ease of comparison. A straight line on the log-log scale provides a good illustration of the risk of food safety events where escalating consequence is frequently observed as the likelihood of the event reduces sharply.

Assessment of Key Food Safety Controls

This workshop also assessed the overall effectiveness of a selection of controls that are common across the four seafood categories. The controls were selected based on their strong presence across all seafood categories, and what appears to be their relative importance in managing food safety risk. This was undertaken through a Multi-Criteria Analysis (MCA), as described in the SERAM, where the selected controls were assessed using defined criteria. As these criteria have been developed to assess a range of emergency risks, they are reasonably generic in nature, and therefore, they have not been specifically tailored for seafood safety risks. Six criteria are used as part of the MCA, and a description of the MCA scoring process is presented below.

Table 2.3 – MCA Criteria for Evaluating Controls

Criterion	Definition
Reliability	An assessment of the likelihood that the control will satisfactorily perform as intended over the time required (i.e. it will work and fulfil its designed function when called upon).
Sustainability	An assessment of the long term maintainability of the control, and its sustained performance over time with resource conservation (i.e. once in place minimal ongoing resource input is required to sustain control performance over time).
Effectiveness	An assessment of the effectiveness of the control in reducing risk, considering likelihood and/or consequence, including its impact across multiple consequence sectors.
Practicability	An assessment of the ease and speed with which the control has been/can be implemented State wide, and that the control is realistic and achievable to implement across the State.
Acceptability	An assessment of the degree to which the control has/will impact on and be accepted by stakeholders and the wider public across the State.
Replicability	An assessment of the opportunity to replicate and/or upgrade the control efficiently to all areas across the State exposed to the food safety risk being assessed.

Each criterion is rated on a scale of 1 to 5 for each identified control, with a high score (for example 4 or 5) indicating a favourable assessment of that control under that criterion. A low score indicates a poor assessment of that control under that criterion.

Once participants had scored each control across each MCA criteria using the MCA MS Excel scoring tool, participants were asked whether the controls could be improved (i.e. whether additional controls could be added and / or whether existing controls could be modified to improve their effectiveness). If the response was affirmative, the nature of the improvements was documented, and the relevant controls were re-scored based on this improvement.

2.2.6 Stage 6 – Reporting

A report was generated (herein) documenting the key outputs of the project, including the methodology, risks identified, a summary of their main controls and risk rating, potential future specific control improvements suggested by industry participants, a comparison of risk scenario assessments between seafood categories, and MCA of key controls. As a result of the highly consultative approach taken for this project, a comprehensive range of comments were also recorded during the workshops and these have been documented in the report where applicable. These often provide supporting 'evidence' for the assessment results. Finally, a list of conclusions and recommendations is presented in the report, as determined from the data, assessments and observations recorded within the report.

3 Analysis & Assessment of Food Safety Risks

3.1 Bivalve Molluscs

3.1.1 Industry and Species Background

Bivalve molluscs comprise oysters, clams, mussels, pipis, and scallops. The majority of bivalve molluscs are filter feeders, meaning they feed by straining suspended matter and food particles from water, typically by passing the water over a specialized filtering structure. This makes them more susceptible (compared to non-filter feeding organisms) to bacterial / viral contamination in growing waters.

Summarised figures of shellfish production in Victoria are presented below for background purposes.

Table 3.1 - Production summary for Major Shellfish Species in Victoria (Department of Agriculture, ABARES, Production Figures 2011-12)

Species	Type	Production (tonnes)	Value ($AUD million)
Blue mussel	Aquaculture	809	2.0
Oysters		NA	NA
Scallops	Negligible production in Victoria. Figures presented are for imported scallops to Australia in 2012-13	3,011	39.9

3.1.2 Risks Identified & Risk Assessment

Risks identified for bivalve molluscs, and their corresponding risk assessment are presented in Table 3.2. The current risk assessment shown is based on the controls that are currently in place. A summary of these controls is provided in the following section 3.1.3. An assessment of the controls' effectiveness is also shown in Table 3.2 as this assists in determining the current risk assessment rating. Control effectiveness is a measure of how well controls are perceived to reduce a given risk, and then maintain the risk at that level. It is not necessarily an indication of cost effectiveness or efficiency in managing that risk. The comprehensive risk register is presented in Appendix C.

Table 3.2 – Bivalve Molluscs Risk Assessment

Risk ID	Supply Chain Sector	Risk	Control Effectiveness	Current Risk Assessment (With Existing Controls)	Residual Risk Assessment (With Proposed Treatments)
B1	Production - pre-harvest	Contamination (e.g. Enteric pathogens (Bacteria and viruses)) in growing waters due to human activity	Very effective	**MEDIUM** *(driven by high likelihood)*	**MEDIUM** *(driven by high likelihood)*
B2		Contamination by biotoxins		**HIGH** *(driven by high likelihood and economic consequence)*	**HIGH** *(driven by high likelihood and economic consequence)*
B3		Contamination by accumulation of heavy metals		**LOW**	**LOW**
B4		Contamination by agricultural and industrial chemicals		**LOW**	**LOW**
B5	Production - harvest	Contamination from workers, machinery or water sources (including ice)		**LOW**	**LOW**
B6	Processing - shucking (shelling)	Contamination (microbiological pathogens) by shuckers		**LOW**	**LOW**
B7	Processing	Microbiological contamination of food, food-packaging materials, and food-contact surfaces from employees		**LOW**	**LOW**
B8		Microbiological contamination from environmental sources (premises and equipment)		**LOW**	**LOW**
B9	Transport	Microbiological contamination and growth during transport	Moderately effective	**LOW**	**LOW**
B10	Storage and packaging	Microbiological contamination and growth during storage and packaging	Very effective	**LOW**	**LOW**
B11	Wholesale	Microbiological contamination and growth during wholesale)		**LOW**	**LOW**
B12	Food service (e.g. supplying restaurants)	Microbiological contamination and growth during food service (e.g. restaurants)	Moderately effective	**LOW**	**LOW**
B13	Retail	Microbiological contamination and growth during retailing		**LOW**	**LOW**

The majority of the food safety risks identified for bivalve molluscs were considered low, with the exception of the risk from biotoxin contamination associated with toxic phytoplankton (assessed a High risk), and the contamination by bacteria and viruses in growing waters due to human activity (assessed as a Medium risk). The 'High' assessment was supported by the:

- observed occurrence of algal blooms – there have been a number of recorded events in Port Philip Bay in the last 12 years; and
- perceived high economic impact on the shellfish industry should a risk event occur.

Further treatments identified for this risk were not considered to reduce the residual risk level in a significant manner. The Medium risk reflects the Steering Committee's view that this risk is relatively higher than other 'Low' level risks documented for bivalve molluscs.

Other key comments based on both the industry workshop and information received during the project are listed below:

- the contamination risk during pre-harvest is considered low due to generally good water quality around Port Philip Bay and historical monitoring showing low levels of heavy metal / chemical contamination in growing waters. Contamination by biotoxins and contamination by bacteria and viruses is considered a low risk by industry participants, however this is assessed as a Medium risk by the Steering Committee due to the frequency of algal blooms, as well as the potential economic consequences on the fishing industry. Given the inconsistent assessment of this risk between industry and government representatives, it is worth further exploring the assessment of this risk;
- the risks associated with processing were all considered low. There are not many processors of bivalve molluscs, and there is a lack of data regarding the incidence of these risks. There may, however, be some possible processing facility breaches across all seafood (the residual risk of a small number of businesses not working within the system). Generally the likelihood of these risks was considered to be 'Unlikely' (not rare) due to the increased influence of human behaviours;
- transport was considered a very low risk as almost all bivalve molluscs are transported live to the point of processing. However, there is a large number of very small vehicles in use, and there may be some non-compliances with licensing requirements;
- food service was regarded to be a complex area. There have been some hospitalisations in the last 5 years associated with a range of seafood products, largely finfish (based on outbreak data published by Ozfoodnet). These outbreaks that have been linked to all seafood consumption (not just bivalve molluscs), and because of the type of pathogen detected, and the size of the outbreaks, it is likely that the outbreaks are linked with contamination or mishandling at the food service part of the chain. There are variable levels of compliance to Standards. This risk was considered of similar magnitude to that of the wholesale and retail sectors. It is noted that the workshop did not have retailer representation to comment on this section of the supply chain; and
- all documented controls were considered very effective, with the exception of 'Transport', 'Food Service' and 'Retail', with these assessed as moderately effective by industry participants, noting however, the lack of representation of these sectors at the industry workshop.

3.1.3 Current Controls & Potential Treatments

Existing controls and treatments identified by industry participants in managing the food safety risk of bivalve molluscs are presented in Table 3.3.

Table 3.3 –Bivalve Molluscs Controls & Treatments – Summary of Bivalve Molluscs Meeting of Industry Participants

Supply Chain Sector	Current Controls	Potential Treatments / Changes	Comments
Production - pre-harvest	Aquaculture • Vic shellfish Ops manual (incl. monitoring of water quality and tissue, classifications of water based on sanitary surveys, harvesting controls). • Marine Biotoxin Management Plan. Environmental monitoring of salinity, water temperature and rainfall in local area undertaken same time as phytoplankton monitoring. Notification procedures. Product recall procedures if potential biotoxin contaminated shellfish are harvested prior to closure. • New fisheries will require testing to demonstrate compliance with ASQAP	• Government (DEPI) needs to identify a policy regarding the consistent implementation of ASQAP across Vic. • Implement a governance structure for ASQAP. Add AFMA to discussions. Some policy discussions are being undertaken in this area. • Implement legislative arrangements that allow the policy and governance structures to be established • Potential depuration (recirc system to purge bivalve shellfish) or relaying (moving bivalve shellfish from one area to another for 2-8 weeks. These measures are covered in the ASQAP manual. • Perhaps a code of practice is required for pre-harvest.	• Relaying may be a viable control. This is being undertaken interstate.
	Wildcatch • Vic shellfish Ops manual for pipis. • Monitoring of toxins in shellfish, sending out of advisory notices informing of outbreak location, and potential closing of fisheries. When this reaches threshold, fisheries closed / or further measures required, product is traced, and is recalled either voluntarily or at the direction of the Chief Health Officer. ASQAP guidelines will control wildcatch through water classification and monitoring specifically for Port Philip Bay bivalve shellfish.	• Government needs to identify a policy regarding the consistent implementation of ASQAP across Vic. • Implement a governance structure for ASQAP. Add AFMA to discussions. Some policy discussions are being undertaken in this area, however for both this point and the point above; these arrangements are not yet in place. • Implement legislative arrangements that allow the policy and structures to be put in place. • Perhaps a code of practice is required for pre-harvest.	• No current monitoring of water for coliforms for scallops
Production - Harvest	Aquaculture • Food Safety Program, Individual operators may have their own codes of practice • Ensure mussels are kept under 10 degC in the first 24 hours, and then under 5 degC thereafter.	• Potentially consider a different approach on how Food Safety Programs are developed for businesses. i.e. templates/guidance/oversight etc.. This could be considered across all seafood categories.	• A code of practice is voluntary and is a useful tool used by industry. A code of practice is not required to comply with all the aspects of the standard (ASQAP), whereas the Food Safety Program is required to demonstrate compliance to the standard.
	Wildcatch • Food Safety Program in place	• Potentially consider a different approach on how Food Safety Programs are developed for businesses. i.e. templates/guidance/oversight etc.. This could be considered across all seafood categories.	
Processing	• Food Safety Program developed and implemented at premises level • HACCP plan for shucking (basis for Food Safety Program)	• No additional treatments identified.	• In relation to premise registration (as a current listed control), Operators will not stay unregistered for very long, as this

Supply Chain Sector	Current Controls	Potential Treatments / Changes	Comments
	• Export market certification require inspections in addition to Food Safety Programs • Premises must be registered		is a relatively swift process.
Transport	• Annual vehicle inspections and requirements that only licensed vehicles are used for non-live shellfish. • Only refrigerated vehicles used and these are registered with PrimeSafe • Food Safety Program developed and implemented by transport operator • Licensing process being updated, with onus on businesses to update transport details. Non-compliances are picked up via the audit process. Identification of non-compliances occurs at this stage, and then this is then acted upon. • Traceability of product and ability to subsequently investigate illegal transporters	• No additional treatments identified.	• Traceability will eventually identify illegal transporters, and the source of seafood. Industry participants are sensitive to anyone operating outside the law, and will inform authorities if unlicensed / illegal transporters are active due to loss in competitive advantage and industry protection.
Storage and packaging	• Food Safety Program developed and implemented at premises	• Monitor potential new technologies available on packaging (non-regulatory control)	• At the moment, some local oysters get initially chilled to below 2 degC, then get packaged with Modified Atmosphere Packaging (MAP) (to increase shelf life and reduce odour).
Wholesale	• Food Safety Program developed and implemented at premises	• No additional treatments identified.	
Food Service	• Food Safety Program developed and implemented at premises	• No additional treatments identified.	
Retail	• Food Safety Program developed and implemented at premises	• No additional treatments identified.	• Acknowledging the absence of retail representatives, workshop participants considered the controls to be moderately effective. However, the risk has been assessed as Low given the effective management of food safety risks up to this point, and the implementation of sufficient controls at the retail level to maintain this risk as Low.

3.1.4 Observations and Comments Relating to Controls & Treatments

It was observed and noted that:

- Food Safety Programs featured prominently across most of the supply chain as a key control;
- some clear potential treatments targeting 'Production – pre-harvest' were noted. These treatments sought to clarify and formalise governance arrangements in relation to ASQAP;
- for risks relating to Transport, the view was held that there has been significant progress made over the past few years in controlling health risks associated with transport, and in addition the food Standards code requirements were continually developing. As a result there is less focus required in managing food safety risks during transport; and
- there were only few further treatments identified, including the need to monitor and stay aware of new technologies regarding storage and packing, as this is an area where technology could "overtake" legislation in the future.

3.1.5 Impact Scenarios Risk Assessment

Three impact scenarios ('Low', 'Medium' and 'High') were developed for the purpose of constructing a current risk curve for Bivalve Molluscs. These scenarios are presented in Table 3.4. An assessment of consequence and likelihood was undertaken for each scenario to determine a risk point in order to construct the risk 'curve' (or line of best fit). Raw data from the workshop detailing the likelihood and consequence scores for each impact scenario is presented in Appendix E.

Table 3.4 – Impact Scenarios Developed for Bivalve Molluscs

Impact Level	People	Public Administration	$ Economy	Scenario / Comments
High	Could get multiple fatalities – there have been well documented cases (e.g. Wallace lakes in NSW, 1996-97, REF to be sent). Assessed as Major	Public admin assessed as Moderate	Massive impact to shellfish industry. E.g. $22 mill impact in Tasmania as a result of toxic algae (this was a managed event). Controls / steps failed drastically. Assessed as Major	• Harvesting from an area with toxic phytoplankton (toxic algae) • Harvesting in area with sewerage effluent and Hepatitis A (staying potentially undetected – no current tests for Hepatitis A). Monitoring controls failure (present at effluent control, monitoring water quality in growing environment) leading to high risk outcome. Testing for Hepatitis A is very difficult to do. Length of testing is also an issue (can run in days) – as the product then has to be stored. This was assessed as Rare.
Medium	Assessed as Moderate as product could be contaminated by a batch thereby affecting a number of people.	More resources deployed, but still Business As Usual Assessed as Minor	Assessed as Moderate. Potentially impact between $5-10 million. This will also depend on the size of businesses involved, and the supply chains involved (for recall)	• Processing contamination (e.g. Salmonella). Where someone operates outside the existing controls or something breaks down in the process, and is not picked up. This was assessed as Rare.
Low	Assessed as Minor (isolated cases of minor illness, no hospitalisations)	Business As Usual Assessed as Minor	Assessed as Minor. Retail level impact and impact on related products – Tracing back to retail outlet of bad	• People getting sick (e.g. gastro) as a result of eating bad product (from contamination such as Staphylococcus) in a small scale retail environment.

Impact Level	People	Public Administration	$ Economy	Scenario / Comments
			product. In such an outbreak, can have spill over impact to other products. Potential impact up to minor dollars.	Contamination originating mostly from people handling. • Often this goes unreported. No way of capturing numbers • This was assessed as Unlikely.

Based on the scenarios defined in Table 3.4, a current risk curve was constructed on the log-log risk matrix. This curve is shown in Figure 3.1.

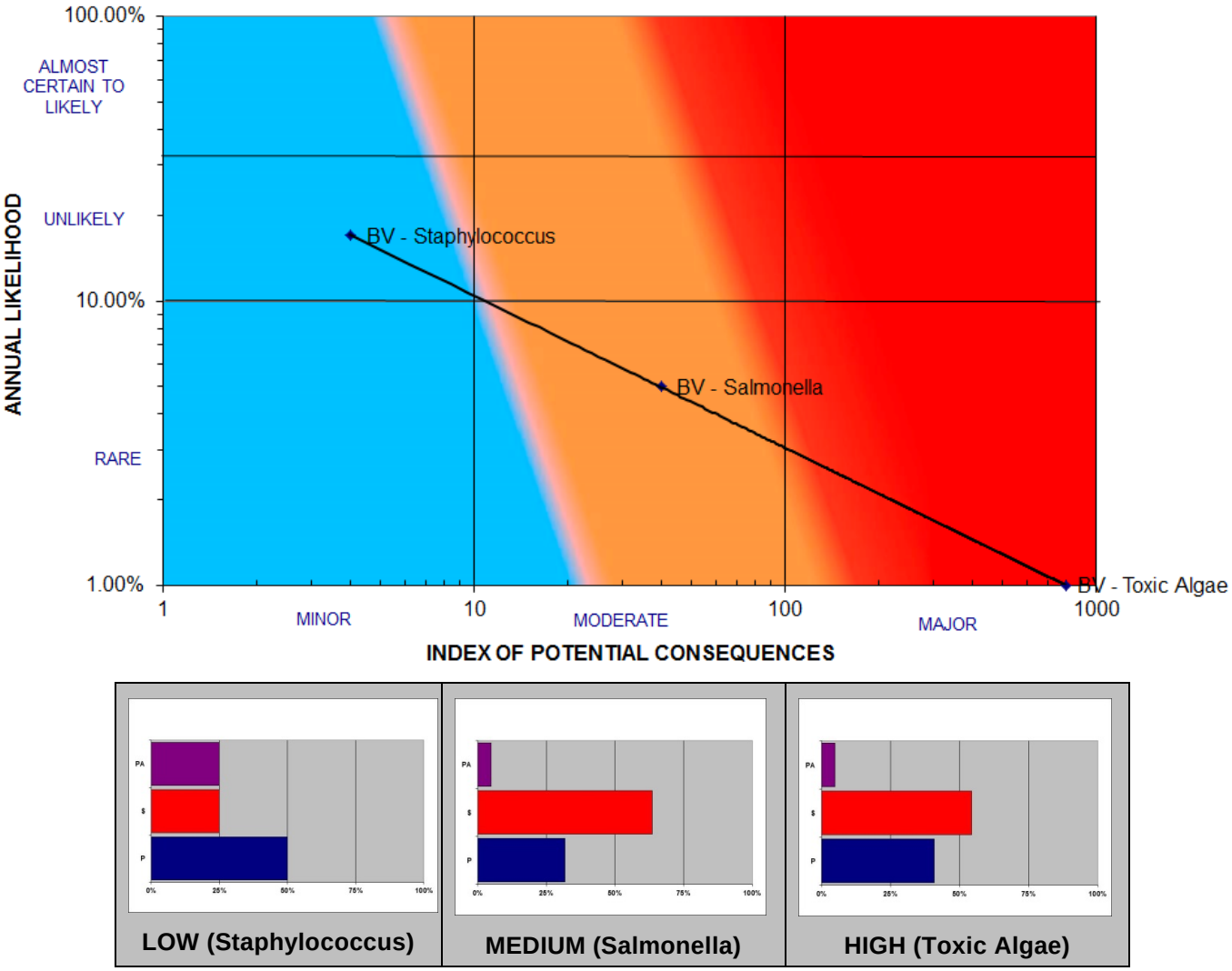

Figure 3.1 – Bivalve Molluscs log-log Risk Assessment Matrix

The current risk curve shown in Figure 3.1 illustrates the food safety risk profile of bivalve molluscs for the selected representative scenarios. The second graphic in Figure 3.1 (bar charts below the risk curve) shows the relative weight from each consequence category for each impact scenario. It shows that the Medium (Salmonella) and High (Toxic Algae) impact scenarios are driven by the potential impact to the economy (in red); whereas the low impact scenario is driven by the People impact of consequences (represented in blue).

3.2 Abalone, Sea Urchins and Periwinkles

3.2.1 Industry and Species Background

Abalone can feed on algae in the wild and farm settings. Abalone are subject to various diseases. The Victorian Department of Primary Industries reported in 2007 that abalone viral ganglioneuritis, or AVG, killed up to 90% of stock in affected regions (However AVG is not considered a food safety risk). It is generally accepted that Australian abalone are a low risk shellfish species with respect to marine biotoxins, because unlike bivalve molluscs, abalone do not filter feed.
Summarised figures of abalone production in Victoria are presented below for background purposes.

Table 3.5 - Production summary for abalone in Victoria (Department of Agriculture, ABARES, Production Figures 2011-12)

Species	Type	Production (tonnes)	Value ($AUD million)
Abalone	Aquaculture	330	9.7
	Wild-Caught	1,088	33.3

3.2.2 Risks Identified & Detailed Risk Assessment

Risks identified for abalone, sea urchins and periwinkles, and their corresponding assessment are presented in Table 3.6. The current risk assessment shown in Table 3.6 is based on the controls that are currently in place. A summary of these controls is provided in the following section 3.2.3. An assessment of the controls' effectiveness is shown in Table 3.6 as this assists in determining the current risk assessment rating.

Table 3.6 – Abalone, Sea Urchins and Periwinkles Risk Assessment

Risk ID	Supply Chain Sector	Risk	Control Effectiveness	Current Risk Assessment (With Existing Controls)	Residual Risk Assessment (With Proposed Treatments)
A1	Production - pre-harvest	Contamination (e.g. Enteric pathogens / Bacteria and viruses)	Very effective	**LOW**	**LOW**
A2		Contamination by biotoxins - WILDCATCH ONLY - EAST AND WEST ZONE		**LOW**	**LOW**
A3		Contamination by biotoxins - WILDCATCH ONLY - CENTRAL ZONE		**LOW**	**LOW**
A4		Contamination by biotoxins - AQUACULTURE ONLY - CENTRAL & WEST ZONE		**LOW**	**LOW**
A5		Contamination by accumulation of heavy metals		**LOW**	**LOW**
A6		Contamination by agricultural and industrial chemicals		**LOW**	**LOW**
A7	Production - harvest	Contamination from workers, machinery or water sources		**LOW**	**LOW**
A8	Processing - shucking (shelling)	Contamination (microbiological pathogens) by shuckers		**LOW**	**LOW**
A9	Processing	Microbiological contamination of food, food-packaging materials, and food-contact surfaces from employees		**LOW**	**LOW**
A10		Microbiological contamination from environmental sources (premises and equipment)		**LOW**	**LOW**
A11	Canning	Contamination in canned fish (e.g. Botulism from inadequate processing, and histamine due to poor quality raw materials)		**LOW**	**LOW**
A12	Transport	Microbiological contamination and growth during transport		**LOW**	**LOW**
A13	Storage and packaging	Microbiological contamination and growth during storage and packaging		**LOW**	**LOW**
A14	Wholesale, retail and food service	Microbiological contamination and growth during wholesale, retailing and food service. This applies to legal catch only (Cf. Risk A15)	Moderately effective	**LOW**	**LOW**
A15	Retail and food service (ILLEGAL COMPONENT)	Contamination of legally caught product from illegal product sources and // or direct sale of illegal product that is contaminated The illegal nature of this risk applies throughout the whole processing supply chain.	Limited effectiveness	**MEDIUM** *(driven equally by people, public admin and economic consequences)*	**MEDIUM** *(driven equally by people, public admin and economic consequences)*

As the table above shows, all risks were assessed as 'Low', with the exception of A15 – the illegal component of Retail and Food Service. Key observations and comments, from the Abalone industry workshop, regarding the assessment, are presented below:

- there have not been reports of any alleged wildcatch abalone / sea urchin food safety issues in recent years. It was noted that there was a recall including mussels and abalone in December 2012 in Tasmania (based on a DH reference);
- contamination during Production – Harvest may be possible from machinery if it was negligently maintained (e.g. fuel and oil storage) or if a deck hand inadvertently leaves a live abalone on-board;
- the Medium risk (illegal component of Retail and Food Service) may occur when retail and food service may mix legal and illegal product to mask supply sources. The risk assessment level is supported by:
    - the observed cases of illegal catching of product by Fisheries Victoria, and anecdotal evidence of illegal take of abalone fishing;
    - knowledge that local retail demand for abalone is not met by legal harvesting stimulating the occurrence of illegal sale events; and
    - the control effectiveness was assessed as even less than 'limited'.

  This risk (A15) was assessed as being the risk with the most potential to damage the industry as it could impact the reputation of industry in a significant way. The view was also held that this risk could possibly be assessed higher if an additional consequence category was adopted around food integrity and quality assurance As treatments documented are mostly associated with potential future investigations, no significant reduction in the risk assessment was determined from current to residual risk; and
- there is some illegal harvesting of periwinkles as a supplement to abalone illegal catch (this is believed not to be a significantly targeted species as yet due to its low yield value).

3.2.3 Current Controls & Potential Treatments

Existing controls and treatments identified by industry participants in managing the food safety risk of abalone, sea urchins and periwinkles are presented in Table 3.7.

Table 3.7 – Abalone, Sea Urchins and Periwinkles Controls & Treatments - Summary of Abalone, Sea Urchins and Periwinkles Meeting of Industry Participants

Supply Chain Sector	Current Controls	Potential Treatments / Changes	Comments
Production - pre-harvest	Wildcatch – East and West Zone • No fishing near sewerage outfalls. Allegedly, the Eastern zone is considered to be more less polluted than the western zone. • Public and industry observations (monitoring of water). Vessel operating practices, harvesting code of practice, incl environmental procedures - industry is proactive in adjusting these based on conditions. Both sea urchins and abalone have their own codes of practices.	• No further treatments identified	• Wild caught abalones are not perceived to be at risk of heavy metals or agricultural / chemical contamination.
	Wildcatch – Central Zone • Public and industry observations (monitoring of water)		
	Aquaculture (Central and West Zone) • Process of filtering water prior to returning water to the wild and coming in from the wild - Farms in populated areas to require testing of inlet water. Siting of the majority of farms is away from sewage outfalls and agricultural runoff. • Environment monitoring, assessment of growth rate of abalone. Periodic health checks of abalone. Farm managers proactive in notifying DEPI (this occurred in AVG instance). • Site selection such so as to avoid locating near an industrial facility (to avoid heavy metals and chemicals contamination). No opportunity for run-off from agricultural sources because of abalone structures built (as they are usually land based above ground structures, and therefore protected from run-off). • Abalone are constantly graded in order to test for sick abalone. Vets would be called in to further investigate the causes of sick abalone. It is thought that there would be a system in place for decontaminating tanks if a sickness is detected.		• No aquaculture of abalone exists in the Eastern zone currently. • In order to qualify for AQIS (DAg) certification, product has to be certified to be safe. Some operations also operate under some European code (requiring health inspection) to gain export approval.
Production - harvest	Wildcatch • Abalone harvesters must have signed on to a Food Safety Program that provides management processes to mitigate potential or perceived food safety risks. By regulation, all abalone must be landed and delivered to a Fish Receiver live. Traceability and quality control (as recorded in safety plan) are extensive (refer to risk register for notes). • Vessel is washed down with freshwater and detergent. Dive gear is washed down also. • Vessel operating manual and harvesting code of practice in place (for both sea urchins and abalone) - comprehensive coverage of a number of items - as required by the abalone and sea urchin association. The sea urchin	• There is an opportunity to simplify the data recording process to avoid duplication. As the divers' cognitive abilities reduce at the end of the day, simplification of the data recording process would make things easier. • Potentially use the industry code of practice to meet the	• Abalone are hand fished and by regulation can only be taken during daylight hours. • No ice is used as dealing with live product. No contamination is thought possible from workers. • All Abalone harvested must be sold to a licensed processor (this needs to be checked in regards to Aquaculture). This is then on sold locally or exported (as

Supply Chain Sector	Current Controls	Potential Treatments / Changes	Comments
	association has a harvesting code of practice detailing management, harvesting and environmental procedures. • Gloves are used by workers (for their protection due to abalone having inherent bacteria when taken from the ocean). • Documentation is not as stringent for periwinkle and urchins. Monthly records rather than daily records (for abalone), given their lower yield value - therefore there is no black market for Periwinkle and urchins. • Urchins are kept alive by hanging catch bags off the side of the vessel, or packing into fish bins covered with hessian or constantly watered. Any damaged urchins are discarded. Urchins may be split at sea: A salt water ice slurry is prepared, the urchins are split a few at a time, the urchin roe is placed into plastic containers and submerged in the ice slurry for return to port. For sea urchins, the fishing area is selected on weather conditions, and the fishermans' knowledge of where to find high quality urchins.	regulatory requirements. Opportunity to investigate the industry code of practice for use in validation and verification process.	determined by the processor).
	Aquaculture • Thought to have similar traceability and quality control to wildcatch (as above). All product sent to processors or customers live from boats or farms and therefore unprocessed. • Withholding period is placed on abalone prior to being sold (where anaesthetics are used).	• No further treatments identified	
Processing - shucking (shelling)	• Food Safety Program developed (as they are PrimeSafe licensed) and implemented at premises level in place • AQIS (DAg) compliance is required • Some processors must also comply to a European code relevant for export to Europe • Fish Receivers are licenced by the Commonwealth's Department of Agriculture, Fisheries and Forestry (DAFF) under the Export Control Fish and Fish Products Orders 2005. A requirement under this licence is to have all processing procedures advised to and monitored by DAFF under audit. Fish Receivers also operate under individual Food Safety Programs that require specific monitoring of output to ensure commercially sterile canned product. • Periwinkles are managed in the same way as abalone.	• Check whether an equivalence can be reached between AQIS (DAg) requirements and PrimeSafe to avoid duplication (reduce / avoid duplication). • Opportunities to reduce regulatory burden through reduction in duplication of other processes. • Investigate the possibility of exporting product with just the PrimeSafe accreditation. This will be dependent on cost and equivalence.	• DAg requirements are more stringent than PrimeSafe (e.g. Includes inspection requirements) • It is difficult to comment on removing existing controls (based on knowledge present)
Canning	• Fish Receivers are licenced by the Commonwealth's Department of Agriculture, Fisheries and Forestry (DAFF) under the Export Control Fish and Fish Products Orders 2005. A requirement under this licence is to have all processing procedures advised to and monitored by DAFF under audit. Fish Receivers also operate under individual Food Safety Programs.	• No further treatments required	
Transport	• Licensed vehicles used by the processor (vehicle used is multi-faceted): used		• Abalone, being transported from

Supply Chain Sector	Current Controls	Potential Treatments / Changes	Comments
	across the fish processing . This vehicle is refrigerated (downstream from Fish Receiver) • Food Safety Program developed and implemented by transport operator. Wetted mats used to keep Abalone cool and are also included in the Food Safety Program. • There are individual Food Safety Programs in place to ensure transport vehicles are washed and sanitized after each operation. All abalone being exported is a prescribed good under the Export Control Act 1982 and certified as being in sound condition and fit for human consumption.		place of landing to Fish Receiver, is a live product and as such transport vehicles are not required to be refrigerated (to the Fish Receiver). • Generally Processors Transport Vehicles are equipped with refrigeration units as these vehicles are used for multiple purposes.
Storage and packaging	• Food Safety Programs have been developed and implemented at premises • Fish Receivers are licenced by the Commonwealth's Department of Agriculture, Fisheries and Forestry (DAFF) under the Export Control Fish and Fish Products Orders 2005. A requirement under this licence is to have all processing procedures advised to and monitored by DAFF under audit. • Fish Receivers also operate under individual Food Safety Programs.		
Wholesale, retail and food service	Legal Component • Food Safety Programs have been developed and implemented at premises • Annual inspections at registration and at time of transfer of business by environmental health practitioners. Assessments and audits undertaken depending on the food safety program and the type of business in question. • Product traceability for abalone in place	• Targeting illegal catch	• Ideally quality integrity should be maintained from harvest to processing, as this could have an impact on beach price. • Sea urchins & periwinkles largely go directly to wholesale live.
Retail and food service	Illegal Component • Fisheries officers and regulations in place to identify illegal catching of product (through documentation checks as previously noted). Licensed operators will notify authorities if they suspect illegal fishing. • PrimeSafe licensees must show traceability and must keep records of how much they buy / sell. • Food safety issues would be raised by the Department of Health. Department of Health would then seek traceability records.	• Establish more fisheries offices to monitor fishing operations • Educate councils further about their role in regulating restaurants. It is highlighted that regulation of restaurants in this field is deficient (and not working) • Investigate the options for targeted programs to address illegal catch (maybe through multiple departments with PrimeSafe leading) • Potentially implement a health incident plan in order to have transparency about real actions that need to be	• Targeting illegal industry would enhance legal industry • Illegal product has no associated documentation. Discrepancy is mainly picked up through product weight. • Difficult to adjust risk level, given that potential treatments are based on undertaking investigations

Supply Chain Sector	Current Controls	Potential Treatments / Changes	Comments
		taken if an incident occurs. • Extend traceability through to retail in a way that does not inhibit the market • Investigate the business for tagging abalone (or similar program)	

3.2.4 Observations and Comments Relating to Controls & Treatments

It was observed that:

- most controls were assessed as being very effective, with only the wholesale, retail and food service segments assessed as moderately effective (legal catch) and limited in effectiveness (illegal catch). The view was that there were more stringent controls upstream in the supply chain than further down the supply chain. The control effectiveness assessment was made without retailer representation;
- product traceability was considered a very important control for abalone, with detailed and extensive traceability processes in place;
- treatments for the illegal component of retail and food service were not assessed as reducing the risk significantly; and
- that if more consistent application of quality assurance measures to avoid purchase and serving of illegal catch were implemented in the retail / food service, then the risk level could potentially drop.

A comment was made during the workshop that industry participants are keen to ensure that the requirements of PrimeSafe regulation is not duplicated with the existing association requirements. Codes of practices (noting that these are not legally binding documents), and the Department of Agriculture's (DAg) instruments should be reviewed from pre-harvest throughout supply chain to avoid duplication.

3.2.5 Impact Scenarios Risk Assessment

A single impact scenario was developed for the purpose of constructing a current risk curve for abalone, sea urchins and periwinkles. This scenario is presented in Table 3.8. The group found it difficult to identify additional, meaningful scenarios due to the absence of records of any sickness in humans due to consumption of abalone, and the low risk of contamination, hence no other scenarios would add value to the assessment.

Table 3.8 – Impact Scenario Developed for Abalone, Sea urchins and Periwinkles

Impact Level	People	Public Administration	$ Economy	Scenario / Comments
One point for abalone	Assessed as Minor – no health impacts	Assessed as Minor - Business as usual	Assessed as Minor - Impacts based on loss of sales and reduced international sales enquiries for a period of time. Up to $1 mill	Closing down of abalone fishing due to suspected potential toxic algae, impacting on fisheries (with no adverse health impacts). Cost impacts associated with testing to get back into the market (something like this has previously occurred in Tasmania). This could also impact on the long term product pricing.

Based on the scenario defined in Table 3.8, a current risk point was charted on the log-log risk matrix. This point is shown in Figure 3.2.

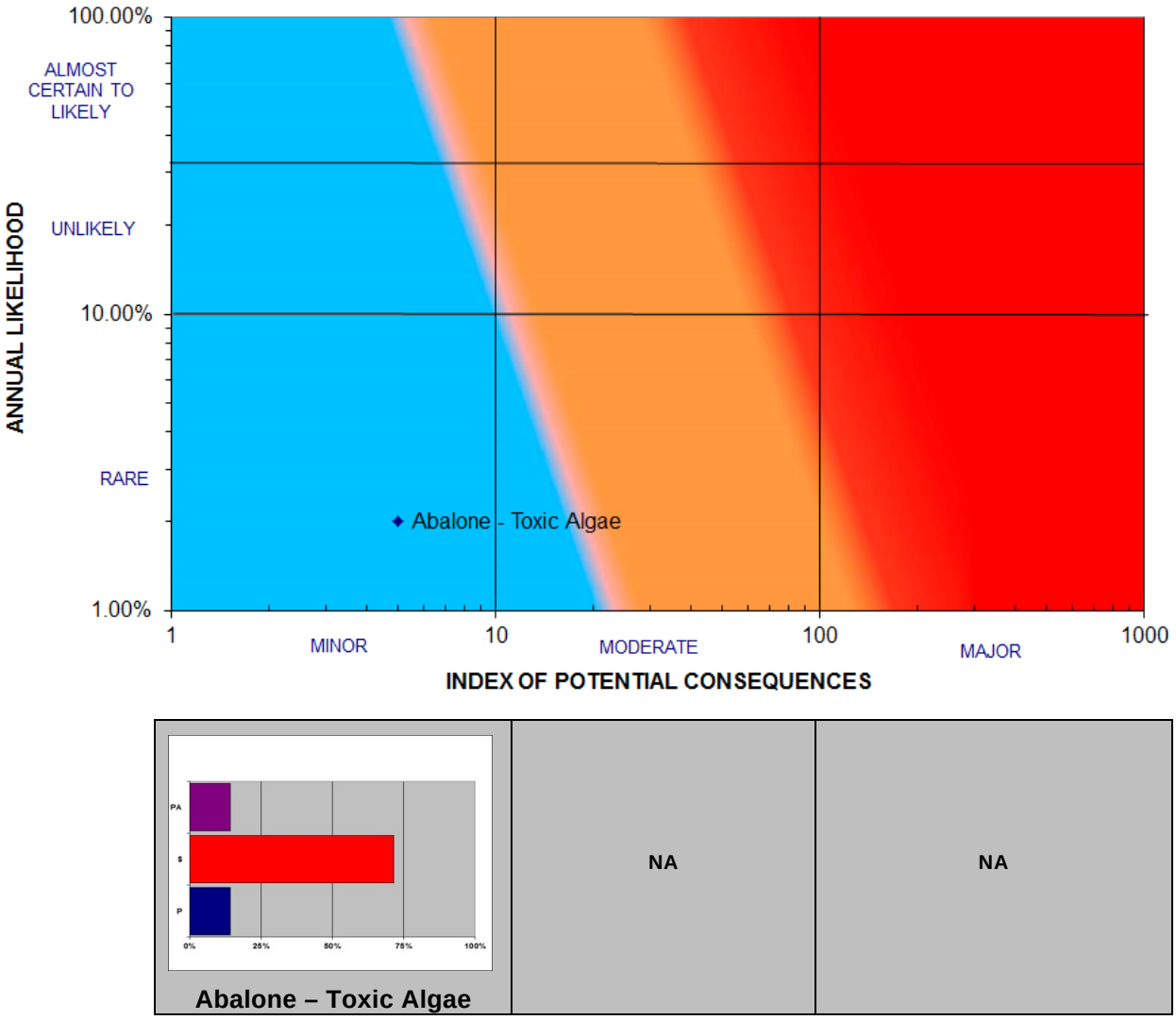

Figure 3.2 – Abalone, Sea Urchins & Periwinkles log-log Risk Assessment Matrix

The single point illustrated above demonstrates the overall low risk assessed for the representative impact scenario. The scenario is driven by the economic consequence (in red) as shown in the average spread bar chart above.

3.3 Finfish & Cephalopods

3.3.1 Industry and Species Background

Cephalopods include squid and octopus species. Summarised figures of main species for finfish and cephalopod production in Victoria are presented below for background purposes.

Table 3.9 - Production summary for Finfish and Cephalopods in Victoria (Department of Agriculture, ABARES, Production Figures 2011-12)

Species	Type	Production (tonnes)	Value ($AUD million)
Finfish	Aquaculture	663	4.8
	Wild-Caught	4607	15.7
Squid	Wild-Caught	47	0.6

3.3.2 Risks Identified & Risk Assessment

Risks identified for finfish and cephalopods, and their corresponding assessment is presented in Table 3.10. The current risk assessment shown in Table 3.10 is based on the controls that are currently in place. A summary of these controls is provided in the following section 3.3.3. An assessment of the controls' effectiveness is shown in Table 3.10 as this assists in determining the current risk assessment rating.

Table 3.10 - Finfish & Cephalopods Risk Assessment

Risk ID	Supply Chain Sector	Risk	Control Effectiveness	Current Risk Assessment (With Existing Controls)	Residual Risk Assessment (With Proposed Treatments)
F1	Production - pre-harvest	Contamination (e.g. Enteric pathogens (Bacteria and viruses)) in growing waters due to human activity – Aquaculture only	Very effective	LOW	LOW
F2		Contamination by biotoxins (estuarine and aquaculture finfish only)		HIGH *(driven by economic impact)*	HIGH *(driven by economic impact)*
F3		Contamination by accumulation of heavy metals		LOW	LOW
F4		Contamination by agricultural and industrial chemicals		LOW	LOW
F5	Production - harvest	Contamination from workers, machinery or water sources (including ice)		LOW	LOW
F5B	Processing – On-Board Gutting	Histamine production in the fish due to metabolic processes		LOW	LOW
F6	Processing	Microbiological contamination of 'non -ready to eat' finfish, food-packaging materials, and food-contact surfaces from employees		LOW	LOW
F7		Microbiological contamination of ready to eat finfish, food-packaging materials, and food-contact surfaces from employees	Moderately effective	MEDIUM *(driven by health impacts)*	MEDIUM *(driven by health impacts)*
F8		Microbiological contamination of 'non -ready to eat' finfish from environmental sources (premises and equipment)	Very effective	LOW	LOW
F9		Microbiological contamination from ready to eat finfish from environmental sources (premises and equipment)	Moderately effective	MEDIUM *(driven by health impacts)*	MEDIUM *(driven by health impacts)*
F11	Transport	Microbiological contamination and growth during transport	Very effective	LOW	LOW
F12	Storage and packaging	Microbiological contamination and growth during storage and packaging		LOW	LOW
F13	Wholesale	Microbiological contamination and growth during wholesale		LOW	LOW
F14	Retail	Microbiological contamination and growth during retailing (seafood retailers)	Moderately effective	LOW	LOW
F15	Food service	Microbiological contamination and growth during food service (e.g. restaurants)	Very effective	LOW	LOW

Table 3.10 shows that there is one risk assessed as ‘High’ associated with contamination by biotoxins (F2), and two risks assessed as ‘Medium’, with a number of corresponding

'Moderately effective' controls indicating some deficiencies in control effectiveness. The remaining risks were assessed as 'Low'. Further observations and comments from both finfish industry meetings include:

- risk F1 (Contamination (e.g. Enteric pathogens (Bacteria and viruses)) in growing waters due to human activity) was considered a very low risk. This is applicable to aquaculture only. For a related event to occur, the aqua-cultured area would have to be very small;
- risk F2 (contamination by biotoxins) was assessed as 'High' due to the likelihood of blooms occurring and the economic impact on industry should whole fish be affected by toxins (e.g. Gippsland Lakes 2011-2012 and 2012-2013). Health impacts are considered to be negligible as previous controls were to sample fish and remove toxin affected guts and gills from whole fish prior to retail sale;
- workers and machinery are not considered sources of contamination for both wildcatch and aquaculture. Comments were made that the manner in which the live seafood is handled by fishermen pose little or no risk to the consumer. The minimal risk has been identified by the wildcatch operators and mitigated through refrigeration, ice or speed to first receiver;
- histamine fish poisoning is a risk (usually best controlled by proper temperature control) that can result in nausea, vomiting and diarrhoea;
- the 'Medium' assessment for the contamination of RTE finfish (for risks F7 and F9) is driven by the view that there is increased human intervention during processing and that potential bacteria are able to grow anaerobically (when vacuum packed), hence increasing the risk levels. In addition, smoking of product can elevate the food safety risk (cold smoked salmon does not have a kill step, and can provide a good environment for Listeria to grow). The significance of listeria outbreaks associated with RTE foods is reflected in the Jindi cheese case where four fatalities occurred, associated with a listeria outbreak[2];
- the retail risk and food service risks (risks F14 and F15) were originally assessed as Medium, as vacuum packaging may be used inappropriately by some retailers in an effort to further prolong shelf life, and there is some observed variability in the quality of food service providers. However, these risks were revised to 'Low' risks in the second Finfish industry meeting, with participants assessing the consequence of these risks as 'Minor' (changed from 'Moderate'), given no known hospitalisations or deaths in these areas; and
- A significant industry participants' comment was made during the workshop that there is the perception that there is less health safety control further down the supply chain, due to the increased handling and contamination sources.

3.3.3 Current Controls & Potential Treatments

Existing controls and treatments identified by industry participants in managing the food safety risk of finfish and cephalopods are presented in Table 3.11.

[2] There are mandatory requirements to manage listeria levels in RTE fish in Standard 1.6.1: Food can only be sold when Listeria levels are below a certain level.

Table 3.11 – Finfish & Cephalopods Controls & Treatments – Summary of Finfish & Cephalopods Meeting of Industry Participants

Supply Chain Sector	Current Controls	Potential Treatments / Changes	Comments
Production - pre-harvest	Wildcatch • Historically fishermen manage risks to seafood by avoiding areas of risk (e.g. parts of Werribee). Water managers/Fisheries / EPA also monitor water quality in some water bodies where information is used by the water manager to inform whether areas are 'safe' to harvest. e.g. EPA and DEPI inform the Department of Health • Issuing advisories relating to fish harvesting when algal toxins in finfish exceed health guideline levels • Sensory checking of fish (sight, smell, touch) along the supply chain for freshness is still a key control (applies throughout seafood industry). • EPA licencing/ hazard plans for industrial facilities to control the discharge of potential contamination. Regular monitoring of water by government.	• From a Gippsland Lakes viewpoint, ensure that adequate resources can be deployed when toxic algal blooms occur for testing, monitoring, and management of incident (historically, resources have not always been available). • Adopt a comprehensive algal bloom incident management plan, which includes an appropriate cost sharing arrangement including recreational and commercial industry and government • Further research (support current research underway) is required in managing and predicting algal blooms (there are a lot of information safety gaps regarding the risk to human health from algal blooms)	It was proposed to review the existing testing programs for imported product (e.g. AQIS (DAg)) to ensure that they are identifying high risk geographic locations around the globe, and then modify the testing program, and/or sourcing of product as necessary. Work in this area would be done by the DAg in consultation with the seafood industry. This would assist with decreasing hazards of imported products in the Victoria wholesale and retail sectors. It was noted that traceability is a very important control for the toxic algae risk. It was also noted that this is not a risk that industry can easily manage as fish product has to be tested first to detect the presence of biotoxins. The detection of biotoxin will subsequently allow for the tracing of product to a given area, and the removal of product from the supply chain.
	Aquaculture • Rivers are monitored by water managers (CMAs / EPA) for algae. If a toxin producing algal bloom is detected, the water manager will advise the public against the use of that public waterway. If a public health impact, DH will advise PrimeSafe that then implements controls to prevent contaminated seafood from entering the food supply. • Testing of feed for heavy metals and PCBs, and also testing of contaminants that come through the environment • EPA licencing/ hazard plans for industrial facilities to control the discharge of potential contamination. NPVA registration of chemicals used in aquaculture (regulated and prescribed use of chemicals)	• Possibly PrimeSafe should monitor the chemicals used in aquaculture (in a databank), e.g. Malachite Green (used in aquaculture), in order to identify any problems. • There could be more time dedicated towards final product testing to then track contaminated fish back to the source, in addition to the current method of controlling the risk at the source. • Industry can monitor water quality as part of their Food Safety Program to ensure poor water quality which may impact on seafood safety can be detected. This can be a sanitary survey of the seafood collection area or water quality testing.	
Production - Harvest	Wildcatch • Water quality testing for production of ice. For the majority of ocean catch, the fish is immediately washed with seawater, and then stored below deck in either iced bines or in refrigerated brine systems. • Traceability of fish caught through regional locations.	• Strengthen and expand the VIC code of conduct to all sectors in VIC (as not all licensed holders are members)	• Traceability of product continues to be important. It is a key criteria in retail. All parts of the seafood logistics chain have a recall protocol, and traceability is part of this recall protocol).

Supply Chain Sector	Current Controls	Potential Treatments / Changes	Comments
	Aquaculture • Water quality testing for production of ice.	• Strengthen and expand the VIC code of conduct to all sectors in VIC (as not all licensed holders are members)	• Workers and machinery are not considered sources of contamination in both wildcatch and aquaculture.
Processing	Non RTE • Food Safety Program developed and implemented at premises level in place • Auditing for compliance of Food Safety Programs by external auditors. • Subsequent cooking of raw fish will kill off bacteria (education of consumers). • The best way to keep histamine at a minimum is to ensure proper temperature control during storage.	• Perhaps check whether an equivalence can be reached between AQIS (DAg) requirements and PrimeSafe to avoid duplication (reduce / avoid duplication). Opportunities to reduce regulatory burden through reduction in duplication of processes.	• Controls effectiveness will be highly dependent on the processor. This will significantly impact on shelf life (therefore risk to consumer). • The first receiver of product (processor) has the ability to identify, label & control onto the next licence category the requirements imposed during these events.
	RTE (such as smoked trout, smoked salmon, sushi) • Food Safety Programs have been developed and implemented at premises • Auditing for compliance of Food Safety Programs by external auditors. • Hard separation required between wet and ready to eat manufacturing areas; Listeria protocols required. • WQA protocols in place and followed. • Community awareness regarding raw fish being slightly higher risk • FSANZ Standards stipulate five tests, a certain number of tests have to be positive for a recall to be made. • Standard 1.6.1 – Microbiological limits for food.		• Controls effectiveness will be highly dependent on the processor. This will significantly impact the shelf life (and therefore the risk to consumer). • Cold smoked finfish are capable of supporting the growth of Listeria and contamination of these products is common (occurring predominantly in the processing environment). • Data on hot smoked fish products suggests that heating reduces the competing microbial flora. Where Listeria is introduced through post processing contamination there is the potential for the organism to grow at refrigeration temperatures to significant levels.
Transport	• Annual vehicle inspections and requirements that only licensed vehicles are used. • Food Safety Program developed and implemented by transport operator • Temperature control: additional use of ice on product in transport (in addition to refrigeration) • Temperature checks by finfish receivers as part of HACCP / Food Safety Programs	• Ensure traceability of licensed product to validate that the license category is all that is required.	• There are different requirements imposed for Council vs. PrimeSafe regulated businesses for transport. Wholesalers view that once product leaves after sale, the onus of food refrigeration on truck is up to purchaser (if purchaser collects the product). If wholesaler is delivering, onus should be on wholesaler

Supply Chain Sector	Current Controls	Potential Treatments / Changes	Comments
			transport for food refrigeration. • A refrigerated vehicle is not always necessary for transport. The real requirement is temperature control (e.g. use of an eski or foam box with ice) to maintain this temperature control.
Storage and packaging	• Food Safety Programs have been developed and implemented at premises		
Wholesale	• Food Safety Programs have been developed and implemented at premises	• Management of imported (foreign and domestic) product into VIC by using appropriately licensed businesses.	
Retail	• Food Safety Programs have been developed and implemented at premises	• Investigate the existing standards of Council regulated retailers to identify equivalence with PrimeSafe Standards • Apply the best standards available (including cost-effectiveness consideration) (PrimeSafe or Councils) across all levels of the retail supply chain selling seafood	• Despite all the controls in the growing, harvesting / processing, this can be compromised if the product is not handled well at the retailer. • There is variability across all of the retail chain, with some operators having higher levels food quality than others. The assessment considered for Lakes Entrance (regulated by PrimeSafe) is very effective with a low risk when compared to some other retailers. Every food handler comes under a Food Safety Program (PrimeSafe or Council). Council plan regulates the supermarkets.
Food Service	• Food Safety Programs have been developed and implemented at premises	• Investigate the existing standards of Council regulated food service businesses to identify equivalence with PrimeSafe Standards • Apply the best standards available (including cost-effectiveness consideration) (PrimeSafe or Councils) across all levels of the food service supply chain selling seafood Treatments above should be carefully weighed with regards to additional imposts / costs added to food service businesses, potentially detracting them from purchasing local products	• There is the perception that there is variability in the quality of food service providers (facilities, hygiene, …). Most food service businesses are not regulated by PrimeSafe but are regulated by local government authorities and must have food safety programs and be assessed, inspected or audited regularly.

3.3.4 Observations and Comments Relating to Controls

Observations and comments made, during the industry meetings, regarding controls and treatments include:

- pre-harvest sensory checking (e.g. through touch and smell) of finfish for freshness is still considered an important control. This applies throughout the seafood industry;
- the controls effectiveness of microbiological contamination of RTE products during processing is highly dependent on the processors, with this factor potentially having a significant impact on food safety;
- there is more MAP packaging occurring in the industry in the wholesale sector. There may be less sophisticated operators doing this, with less control of practices in implementing the technique, hence, potentially increasing the risk;
- the controls present in the retail sector may have variable effectiveness across retailers because of supermarket and other retailer exemptions. Some of these exemptions (allowed by the Food Safety Council) include the display of fish in ice cabinets and allowing the consumer to handle the finfish product. This could potentially increase the food contamination risk. The view was expressed that there should be more uniformity for the ability of consumers to choose their finfish across supermarkets / retailers; and
- some retailers (e.g. fish and chip shops) will not be regulated by PrimeSafe, but are instead regulated by the local Council. However, such retailers may also sell fresh fish, and there is the industry participants' perception that there may be a higher risk in retailing due to the inconsistent application of standards (supported by auditing and compliance checks); and
- a number of potential treatments were documented, ranging from improving the efficiency of regulation (through equivalency with other regulatory requirements) through to more practical treatments (such as PrimeSafe inspectors auditing businesses remotely).

It has also been referenced that[3] if food safety risks are not properly managed, such that cold-smoked seafoods do not meet the microbiological limit standard for *Listeria monocytogenes*, the relative risk ranking is High for at-risk sub-groups and Medium for the general population. This provides an indication of the inherent risk that may be present if controls were absent from the processing (RTE) risk.

3.3.5 Impact Scenarios Risk Assessment

Two impact scenarios were developed for the purpose of constructing a current risk curve for finfish and Cephalopods. This scenario is presented in Table 3.12.

[3] A Risk Ranking of Seafood in Australia (February 2005), page 198

Table 3.12 – Impact Scenario Developed for Finfish and Cephalopods

Impact Level	People	Public Administration	$ Economy	Scenario / Comments
High	Assessed as Minor Stress to industry workers	Assessed as Moderate	Assessed as Major Media attention. Impact on industry and reduction to the catch rates also, resulting in less revenue. In 2008 in Gippsland, there was a net impact on industry of ca. $18 mill (mainly finfish and prawns). This includes impact on jobs	Toxic algal bloom over summer months in the Gippsland Lakes (occurred in 97-98). Industry shut down for 19 weeks. Most recent event was in 2012 (2 week shut down). There can be a flow on effect of seafood consumption to other fish categories.
Medium	Assessed as Major 2 deaths in 97 (from smoked trout). 2 miscarriages from smoked salmon in 93 (in Australia).	Assessed as Moderate (top end)	Assessed as Moderate No data on this type of event from an economic viewpoint	Poisoning from Listeria in smoked salmon (RTE Finfish).

Based on the scenario defined in Table 3.12, two current risk points were charted on the log-log risk matrix. This point is shown in Figure 3.3.

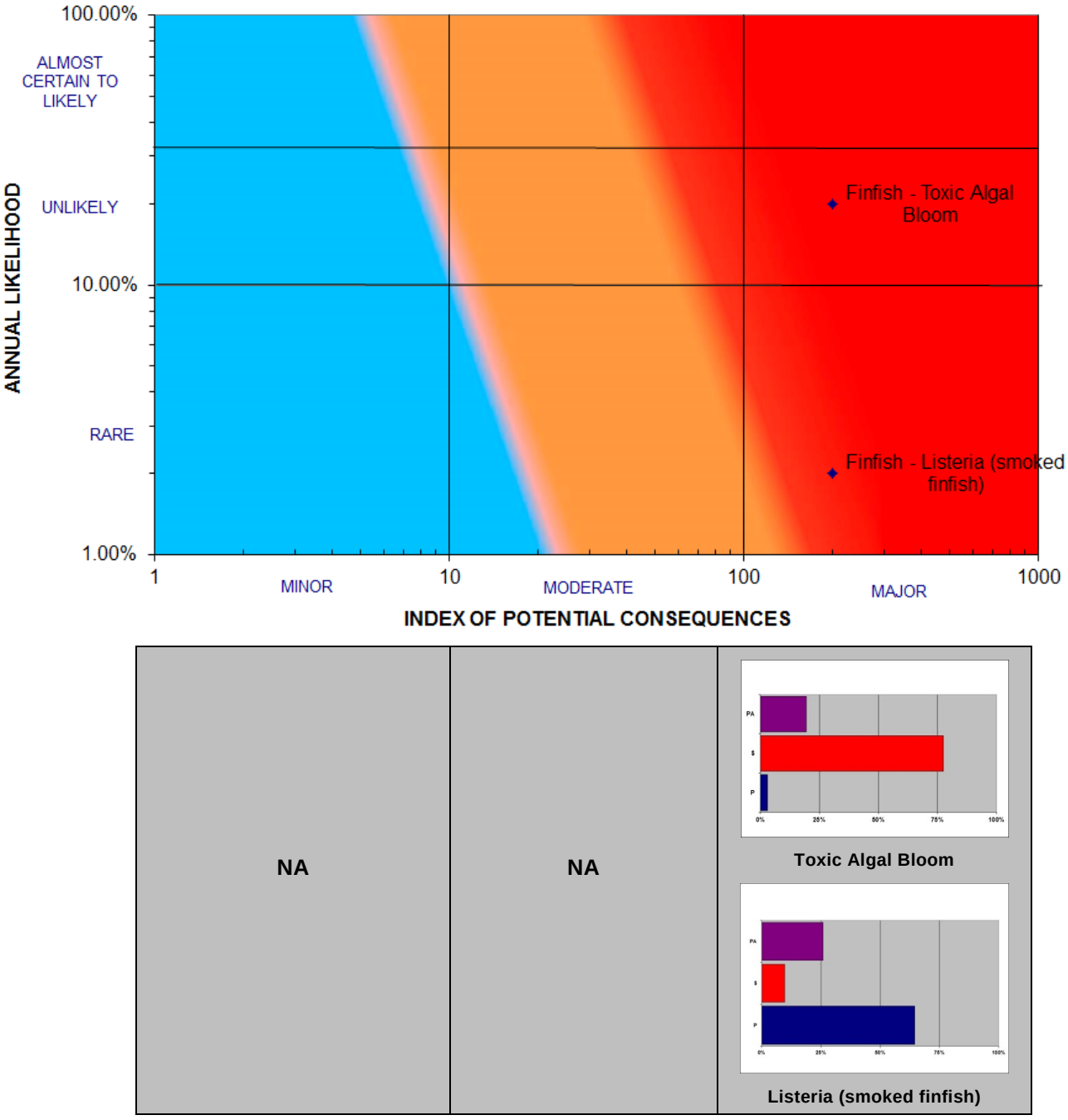

Figure 3.3 – Finfish and Cephalopods log-log Risk Assessment Matrix

The two scenarios illustrated above can both result in major consequences. However the toxic algal bloom is clearly more likely than the Listeria scenario, and impacts predominantly on the economy (shown in red in the bar chart). In comparison, the Listeria scenario has a greater impact in people (shown in blue in the bar chart).

3.4 Crustaceans

3.4.1 Industry and Species Background

Nearly all Crustaceans are suspension filter-feeders although yabbies and rock lobsters are not, hence yabbies and rock lobsters are less likely than filter feeders to become contaminated from their growing environment.

Summarised figures of main species for crustacean production in Victoria are presented below for background purposes.

Table 3.13 - Production summary for Crustaceans in Victoria (Department of Agriculture, ABARES, Production Figures 2011-12)

Species	Type	Production (tonnes)	Value ($AUD million)
Prawns	Aquaculture	0	0
	Wild-Caught	65	0.4
Yabbies	Aquaculture only	5*	0.04*
Rocklobster	Wild-Caught	301	17.9
Crab	Wild-Caught	13	0.6
Other Crustaceans	Wild-Caught	37	0.3

*These figures are all predominantly for non-human consumption. However, there are yabbies produced interstate being imported into Victoria and sold commercially for human consumption.

3.4.2 Risks Identified & Risk Assessment

Risks identified for Crustaceans, and their corresponding assessment is presented in Table 3.14. The current risk assessment shown in Table 3.14 is based on the controls that are currently in place. A summary of these controls is provided in the following section 3.4.3. An assessment of the controls' effectiveness is shown in Table 3.14 as this assists in determining the current risk assessment rating.

Table 3.14 – Crustaceans Risk Assessment

Risk ID	Supply Chain Sector	Risk	Control Effectiveness	Current Risk Assessment (With Existing Controls)	Residual Risk Assessment (With Proposed Treatments)
C1	Production - pre-harvest	Contamination (e.g. Enteric pathogens (Bacteria and viruses) in growing waters due to human activity or animal activity (e.g. agricultural run-off from dams)	Very effective	LOW	LOW
C2		Contamination by biotoxins		HIGH* *(driven by economic impacts)*	HIGH* *(driven by economic impacts)*
C3		Contamination by accumulation of heavy metals (in filter feeding Crustaceans (not yabbies))		LOW	LOW
C4		Contamination by agricultural and industrial chemicals (in filter feeding Crustaceans)		LOW	LOW
C5	Production - harvest	Contamination from workers, machinery or water sources		LOW	LOW
C6	Processing	Microbiological contamination of food, food-packaging materials, and food-contact surfaces from employees		LOW	LOW
C7		Microbiological contamination from environmental sources (premises and equipment)		LOW	LOW
C8	Transport	Microbiological contamination and growth during transport		LOW	LOW
C9	Post Harvest - Storage and packaging	Microbiological contamination and growth during storage and packaging		LOW	LOW
C10	Wholesale, retail and food service	Microbiological contamination and growth during wholesale, retailing and food service		LOW	LOW
C11	Processing - On-board vessel cooking and cooling (prawns and crays)	Opportunity for outgrowth of bacterial pathogens in Crustaceans during on-board processing due to inadequate temperature control		LOW	LOW
C11A		Biotoxin contamination of prawns during on-board cooking		LOW	LOW
C12	Processing - Fixed premises cooking and cooling (prawns and crays)	Opportunity for outgrowth of bacterial pathogens in Crustaceans during processing due to inadequate temperature control		LOW	LOW

*High assessment for prawns only. Low risk assessment for non-filter feeding Crustaceans.

All controls listed were assessed to be very effective. However there were differing views between industry and government representatives regarding the risk assessments C2 and C11A specifically relating to prawns. Industry participants assessed risk C2 (contamination by biotoxins) as 'Low' whereas DH assessed these risks as 'High'. Further, risk C11A was added by DH.

Specific comments from the crustacean industry participants regarding the assessments are detailed below:

- The yabby and rock lobster industry participants claim these seafood species were generally considered to be a low food safety risk due to them not being filter-feeders;
- for risks C2 to C4, these risks were considered negligible in relation to non-filter feeding Crustaceans such as yabbies or rock-lobster;
- there was the view that prawns ingested algae in a similar manner to finfish and shellfish, and, therefore the risk of contamination by biotoxins is similar to other seafood categories such as finfish and shellfish. Any crustacea, finfish or shellfish in contact with toxic algae can become contaminated by biotoxins, although the manner of contamination can differ between species due to differences in feeding behaviour. The risk of biotoxin contamination (C2) of prawns was assessed as 'High' by DH. It is also understood that the presence of biotoxin in prawns can manifest itself from a food safety perspective after a long period of time through chronic illness or liver cancer. . According to the industry participants, controls in place to prevent contaminated prawns entering the food supply chain (such as monitoring, testing, temporarily shutting down fisheries), result in the risk being assessed as 'Low' (from a food safety viewpoint). Industry participant's view was that this risk was well managed, and that although toxic algal blooms do occur, controls and measures in place ensure this risk remains Low from a food safety perspective, but can be high from an economic perspective. Given the inconsistent assessment of this risk between industry and government representatives it is worth further exploring the assessment of this risk;
- An additional risk was added (risk C11A - Biotoxin contamination of prawns during on-board cooking) was added by DH following the industry workshops. According to DH, there is a risk that cross-contamination may occur if biotoxin affected prawns are cooked on-board the toxins will contaminate cooking water which can result in additional food safety risks. The best measure to control this risk is frequent changing of cooking water on board. Industry participants assessed this risk as 'Low', based on the historical incidence of illnesses and the practices in place. According to industry participants, controls in place were mainly centred around monitoring, testing, the implementation of buffer zones, and recall protocols. The best suggested control according to DH would be frequent changing of on-board cooking water during the BGA season; and
- The assessed risk for transport is an aggregate view across rock lobsters, yabbies and prawns. However it was noted that the transport risk for prawns will be slightly higher as prawns will not be live once harvested, however yabbies and rock-lobster will be generally maintained live during transport (and therefore remain fresher for longer). There is however the potential for any dead yabbies to contaminate live yabbies during transport.

3.4.3 Current Controls & Potential Treatments

Existing controls and treatments identified by industry participants in managing the food safety risk of Crustaceans are presented in Table 3.15.

Table 3.15 – Crustaceans Controls & Treatments - Summary of Crustaceans Meeting of Industry Participants

Supply Chain Sector	Current Controls	Potential Treatments / Changes	Comments
Production - pre-harvest	Wildcatch (rocklobster / prawns) • Risks should be managed through Food Safety Programs. i.e. hazard identification to determine when not to harvest. Ability by Operator to recognise that there is a toxin producing blue-green algae (cyanobacteria) bloom. Monitoring water quality occurs in some water bodies across Victoria by local water managers. EPA and DEPI monitor water quality in the Gippsland Lakes for physiochemical parameters and algal species.	• Work with SRL to develop and implement emergency response protocols/procedures associated with algae blooms.	
	Aquaculture (yabbies) • Risks should be managed through Food Safety Programs. i.e. hazard identification to determine when not to harvest. Ability by Operator to recognise that there is a toxic blue-green algae (cyanobacteria) If a toxic algal bloom is suspected, then cease harvest from affected water body • DEPI education protocol for clean green yabbies specifying conditions for elevated risk of heavy metals. • If the area is subject to industrial / agricultural run-off, then controls: site selection (e.g. no septic overflow seepage into dams, minimise chemical spray drift) - if required notify crop spraying operators in the area of the presence of Yabby growers. Specific management of spray-drift comes under the jurisdiction of DEPI (managed under ChemSafe).	• Development of industry and government guidance for new entrants to the yabby industry re: site selection, guidance documents • Production of educational materials for the aquaculture industry re: identifying problem blooms (DH/DEPI) • Where applicable publicise the spraying notification process to industry • Recommended that in the future, for any new yabby growers, the government would need to inspect their property to ensure that the site is suitable for production.	• Government has commented that yabbies can accumulate heavy metals, with independent scientific advice suggesting that site selection and on-going monitoring include independent testing.
Production - Harvest	Wildcatch (Rocklobster) • Minimal handling, no contamination items on deck, detergents kept away from working conditions, maintenance of a safe area. • Visual check of every lobster before going into the well and subsequent removal of defective catch. • Clean green program • PrimeSafe inspection every 2 years • Record of every catch in a fisheries book.	• Investigate the equivalence and accreditation of Clean Green QA program with PrimeSafe requirements	• Controls are considered very effective (for wildcatch) due to factors such as quality, and grading for sale.
	Wildcatch (Prawns) Use of gloves, sorting of prawns (to take out other types of non-	• No further treatment identified.	

Supply Chain Sector	Current Controls	Potential Treatments / Changes	Comments
	commercial species), icing of prawns or cooking of prawns. Prawns are frequently cooked on board, then cooled and then iced. Time from catch to icing at processor into cool room is fairly short. Bugs are treated in the same way as prawns.		
	Aquaculture (Yabbies) • Government controls: gill washing, purging, yabbies required to be kept in cool moist environment. • PrimeSafe Guidelines for safe washing, storage and purging of Yabbies • Minimise handling . Removal of dead yabbies. Normal procedures include removal of 'waste' products (e.g. bait, grasses, string) from the yabbies during harvest.	• No further treatment identified.	• According to industry participants, other states and AQIS (DAg), purging has no food safety benefit. View that there should not be a requirement to store or purge yabbies in a shed. Yabbies are shown to safely remain in the harvest water during storage and (voluntary) purging
Processing	• Food Safety Programs have been developed and implemented at premises • Cooking harvested Crustaceans (prawns) onboard vessel - The risk exists within this control of contaminated prawns contaminating uncooked prawns through the cooking water. This risk is predominantly mitigated by good practices such as regularly changing the cooking water. • Monitoring, testing, buffer zones, and recall protocols in place to prevent biotoxic contamination of prawns • Regular (daily) changing of cooking water for prawns • Ensure cooking water (for prawns) is sourced from a potable supply	• No further treatment identified. • Where there is a risk of chemical or algal toxin affecting product, cooking will not remove the hazard. • Regular changing of cooking water should be checked as a common practice to validate as a potential control	• There is very limited processing of Crustaceans in VIC (all sold in original form - whole) as this is cost prohibitive, and traditionally, they are sold unprocessed. • DH further advises that fishers to be aware that cooking contaminated prawns with 'safe' product can cause tainting as cooking seafood affected by algal toxins will cause toxin to spread from gut/liver area to toxin throughout the organism. E.g. toxin will distribute throughout the cooking water and throughout the prawns if toxin affected prawns are cooked onboard.
Transport	Rocklobster • Transported in a refrigerated truck. Truck is dry, bag placed over containers, sent to coop, and then graded into categories. • Food Safety Program developed and implemented by transport operator, which requires regular cleaning and effective refrigeration.	• Review the potential use of tort liners for transportation (whether they remain for transportation in VIC or are excluded in VIC) • Ensure the traceability of licensed product to validate that the license category is all that is required.	• Controls are considered very effective for Rock-lobster
	Prawns • Annual vehicle inspections and requirements that only licensed vehicles are used for a product that is not live. • Food Safety Program developed and implemented by transport operator, which requires regular cleaning and effective refrigeration.		
	Yabbies • Keep live yabbies cold and moist in a clean sealed container. Various growers use different methods to achieve this		• Controls are considered very effective for yabbies if the yabbies are stored as much as possible in a natural environment (contaminant free environment).

Supply Chain Sector	Current Controls	Potential Treatments / Changes	Comments
	• Food Safety Program developed and implemented by transport operator, which requires regular cleaning and effective refrigeration.		
Storage and Packaging	Prawns / Rocklobster • Food Safety Program developed and implemented at premises	• No further treatment identified.	
	Yabbies • Food Safety Program developed and implemented at premises requiring cleaning programs, temperature control, suitable packaging, auditing for compliance of Food Safety Programs by external auditors. Keep cold and moist. For example one approach for packing / distributing yabbies is in an ice slurry (clients are taking yabbies in an ice slurry). • Packing should be undertaken in a clean area. Monitoring of yabbies if yabbies are stored in sheds. Should a shed be used, it should be clean. Foreign contaminants should be removed during packing • Raw and cooked yabbies should be stored and transported at less than 5 degC • Food Safety Program developed and implemented at premises	• Development of possible educational material for the whole supply chain	
Wholesale Retail Food Service	• Food Safety Program developed and implemented at premises requiring cleaning programs, temperature control, suitable packaging, auditing for compliance of Food Safety Programs by external auditors.	• No further treatment identified.	

3.4.4 Observations and Comments Relating to Controls & Treatments

The following additional observations and comments were captured during the Crustacean industry meeting, and the subsequent wildcatch industry workshop in Lakes Entrance regarding prawns):

- Food Safety Programs were generally a key control across a number of risks across the supply chain; and
- Biotoxin contaminants present in prawns can also contaminate cooking water used for on-board cooking of prawns. To prevent subsequent contamination, regular changing of this cooking water is a key control, and thus this activity should be checked and reinforced with industry.

3.4.5 Impact Scenarios Risk Assessment

Workshop participants from the crustacean industry determined one risk scenario in the risk assessment workshop. As a result it is not possible to construct a current risk curve for Crustaceans. A high impact scenario was not developed due to:

- no recorded food safety incidents with rock lobster or yabbies to date;
- the fact that neither yabbies and rock lobsters are filter feeders, and are normally cooked before eating. Lobsters are normally boiled, and are therefore considered very safe. They are also kept alive until boiled (so are very fresh). In most cases, they get eaten very soon after being boiled;
- industry participants viewing the food safety risk from prawns being 'Low' across the supply chain (although this assessment differs from the government view); and
- no Victorian grown yabbies being currently sold in Victoria for human consumption, so any risk is from yabbies imported from interstate.

The impact scenario is presented in Table 3.16.

Table 3.16 – Impact Scenarios Developed for Crustaceans

Impact Level	People	Public Administration	$ Economy	Scenario / Comments
One point for Rocklobster	Assessed as Minor – no reported health impacts to date	Assessed as Minor - Business As Usual	Assessed as Moderate - Impacts based on loss of sales and reduced international sales enquiries for a period of time. $6mill impact for the Tasmanian industry (figure is published with Tas government)	Closing down of rocklobster fishing due to suspected potential toxic algae, impacting on fisheries. Toxins were found in the gut of lobsters in a recent event. Cost impacts associated with testing to get back into the market (something like this occurred in Tasmania) - export market to Japan was lost. This could also impact on the long term product pricing. This scenario / impact point on the matrix is labelled ROCKLOBSTER

Based on the scenario defined in Table 3.16, one impact point was plotted on the log-log risk matrix in Figure 3.4.

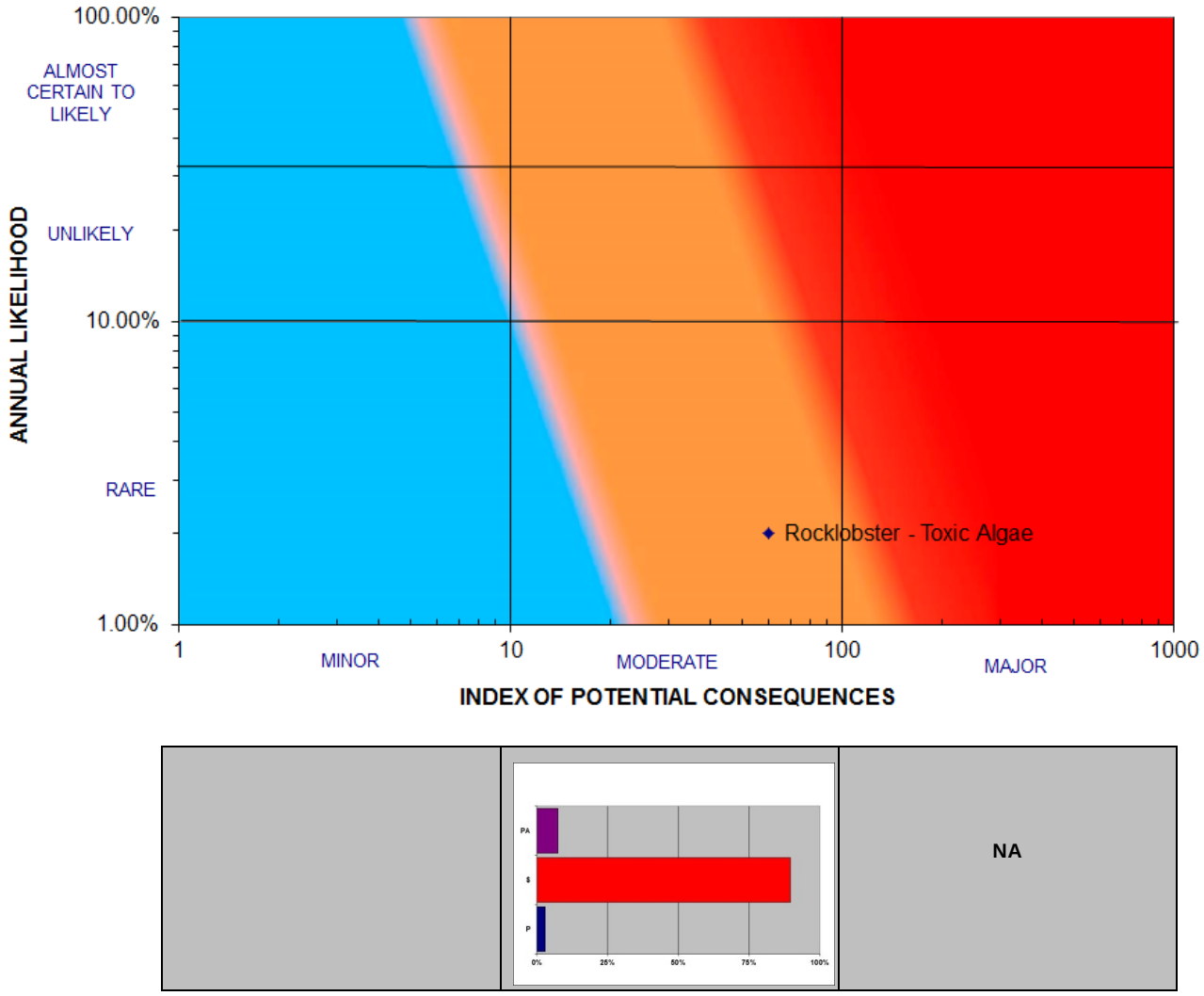

Figure 3.4 - Crustaceans log-log Risk Assessment Matrix

The above graphic clearly shows that for the rock lobster impact scenario, the 'economy' is most severely impacted, relative to 'people' and 'public administration'.

3.5 Comparative analysis across Categories

3.5.1 Comparative View of Risks Across the Supply Chain

A comparative analysis across the supply chain can be performed through the representation of individual current risk assessments across the seafood categories.

As most risks are common to all four seafood categories, Table 3.17 was developed to represent a 'map' of the higher risk areas assessed. Again, the assessment represented is based on the highest risk assessment made across sub-categories (e.g. wildcatch / aquaculture, or RTE / non-RTE).

Table 3.17 allows a high level view of the nature of the perceived higher risks across the four seafood categories analysed. The table indicates finfish & Cephalopods, bivalve molluscs and Crustaceans (prawns only) have some risks determined as 'High' with some 'Medium' risks distributed across all four seafood categories.

Table 3.17 – Common Risk Assessment 'Map' Across all Seafood Types

		Current Risk Assessment (with Existing Controls)			
Supply Chain Sector	**Risk**	**Bivalve Molluscs**	**Abalone, Sea Urchins and Periwinkles**	**Finfish & Cephalopods**	**Crustaceans**
Production - pre-harvest	Bacterial / viral contamination	**MEDIUM** *(driven by high likelihood)*			
	Contamination by biotoxins	**HIGH** *(driven by high likelihood and economic consequence)*		**HIGH** *(driven by economic impact)*	**HIGH*** *(driven by economic impacts)*
	Contamination by accumulation of heavy metals				
	Contamination by agricultural and industrial chemicals				
Production – harvest	Contamination from workers, machinery or water sources				
Processing - shucking (shelling)	Contamination (microbiological pathogens) by shuckers				
Processing	Microbiological contamination of food, food-packaging materials, and food-contact surfaces from employees			**MEDIUM** *(driven by health impacts)*	
	Microbiological contamination from environmental sources (premises and equipment)			**MEDIUM** *(driven by health impacts)*	
Canning	Contamination in canned fish (e.g. Botulism from inadequate processing, and histamine due to poor quality raw materials)	**NA**		**NA**	
Transport	Microbiological contamination and growth during transport				
Storage and packaging	Microbiological contamination and growth during storage and packaging				
Wholesale	Microbiological contamination and growth during wholesale				
Retail	Microbiological contamination and growth during retailing		**MEDIUM** *(driven equally by people, public Admin and economic consequences)*		

		Current Risk Assessment (with Existing Controls)			
Supply Chain Sector	**Risk**	**Bivalve Molluscs**	**Abalone, Sea Urchins and Periwinkles**	**Finfish & Cephalopods**	**Crustaceans**
Food service	Microbiological contamination and growth during food service (e.g. restaurants)		**MEDIUM** *(driven equally by people, public Admin and economic consequences)*		

*'High' assessment for prawns only. 'Low' assessment for non-filter feeding Crustaceans.

Legend for table above:

LOW RISK:

MEDIUM RISK:

HIGH RISK:

3.5.2 Risk Assessment Curves / Points

An overall view of all the seafood category risk assessment points / curves on the log-log matrix is shown in Figure 3.5.

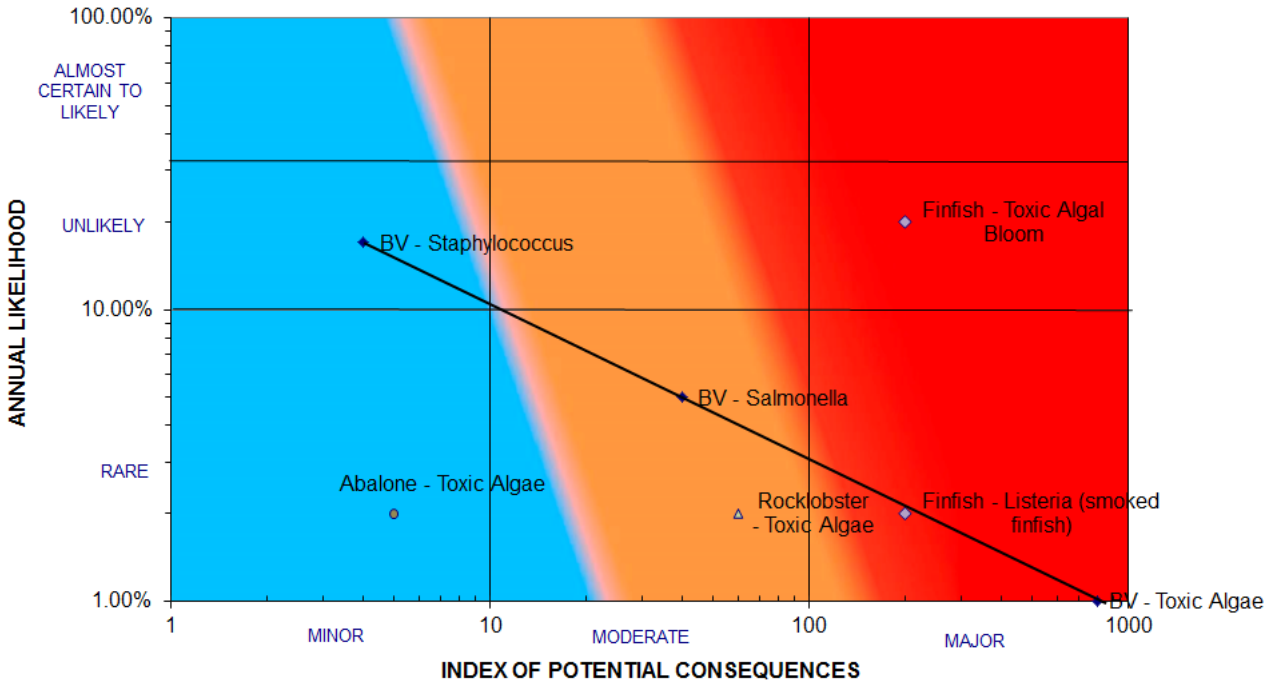

Figure 3.5 – Log-Log Matrix with All Risk Assessment Impact Points

Figure 3.5 suggests that finfish have the highest relative risk to other seafood categories (based on the impact scenarios selected). This is followed by bivalve molluscs (abbreviated to 'BV' in the figure). This is consistent with the detailed risk assessment documented in Section 3.5.1. It should be noted that the prawn assessment is not represented. Almost all impact scenarios assessed (with the exception of the low impact scenario for bivalve molluscs, and the finfish listeria scenario) impacted predominantly on the economy, with people and public administration consequence sectors being less impacted.

4 Assessment of Key Food Safety Controls

Two broad controls were identified which had an under-pinning presence across all seafood categories. Although there are other generic controls such as business registration, the group chose these controls to assess. These controls are:

1. **Food Safety Programs used by Industry**
2. **Traceability Measures and Processes along the Supply Chain**

The strength of these two controls was assessed using the MCA criteria defined in Table 2.3. The scores are presented in Table 4.1. Note that the 'Improved' Scores are based on potential improvements identified and listed in Table 4.2.

Table 4.1 – MCA Scoring of Controls

		Criteria						
Control Description	**Status**	**Reliability**	**Sustainability**	**Effectiveness**	**Practicability**	**Acceptance**	**Replication**	**Overall Assessment**
Food Safety Program	Current	4	4	4	4	2	3	**3.5**
Food Safety Program	Improved	4	4	4	4	3	3	**3.7**
Traceability	Current	4	4	4	4	4	4	**4.0**
Traceability	Improved	4	4	4	4.5	4	4	**4.1**

The MCA scoring shows that the workshop participants viewed the current controls for both Food Safety Programs and Traceability as overall reasonably effective, with only minimal improvements to the MCA score (highlighted in Figure 4.1 above). The overall current effectiveness score of 3.5 out of 5 was interpreted as being broadly consistent with the 'Very effective' assessment made against the Food Safety Program controls as documented in the risk register. However, acceptability for the Food Safety Program was considered low due to the 'onerous level of documentation that is required' of Food Safety Programs.

If there was a reduction or removal of some of the requirements of the Food Safety Program, given the commitment towards implementing the existing industry codes of practice, this could increase acceptability of the Food Safety Program (i.e. from a 2 to 3). A graphical view of the potential increase in control robustness based on the control improvements identified is shown in Figure 4.1. The light green component represents the improved score. This highlights that the group believes there is minimal opportunity to practically improve either the Food Safety Programs, or the traceability process.

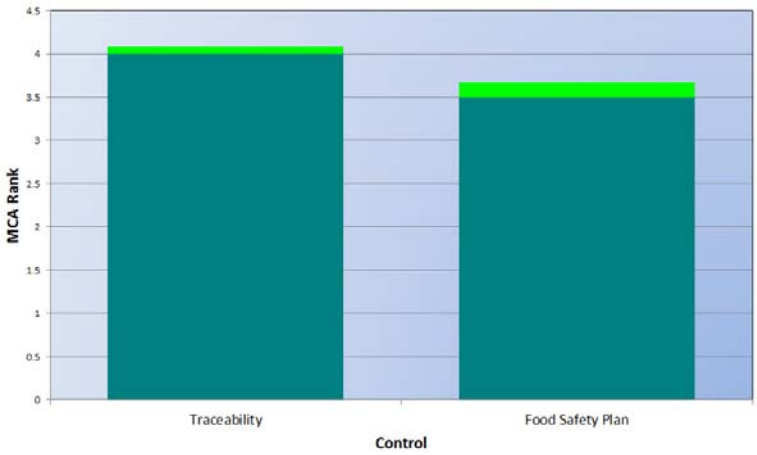

Figure 4.1 – Chart of Current and Improved MCA Scores

Specific notes and observations, as well as potential improvements to the above controls by workshop participants are presented in Table 4.2.

Table 4.2 – Notes and Potential Improvements identified by workshop Participants Regarding Selected Controls

	Control	
	Food Safety Programs	**Traceability Measures and Processes**

Notes	• All Food Safety Programs across categories are vastly different and often originated from an industry code of practice. There will be some similarities, but there will also be some big differences between safety plans present
	• The controls assessment is based on the Food Safety Program itself, not reliability of operator, as this can vary.
	• The plan may be supported by further documentation (codes of practice / conduct within industry).
	• Food Safety Programs are considered to be working. Most issues are allegedly associated at the consumer and retail end due to poor handling and the greater number of people (noting that no retailer representation was present). Producers are considered professional, and know they have controls (audits) – as food gets further away from where it has been harvested, more contamination sources may be present.
	• The level of documentation of Food Safety Programs can be onerous. Some people see the safety plan as an extra level of bureaucracy – it can be daunting to some operators. The plan is geared towards replicating what has always been done in the past (but not previously documented).
	• Codes of practice / conduct are better sources of information specific to replicating practices, as plans can vary so much from one to another.
		• Higher value products have more traceability than lower value products
		• Paper trail is present even for periwinkles, reported monthly.
		• Finfish are recorded when the fish get back (and amount caught)
		• Information is linked together between food safety data, and volume data
		• Traceability data is not normally freely available
		• GPS location of harvest for abalone is present in some zones (data logger and black box)
		• A simplified process can be described to cover
		  o Recording catch
		  o Transport
		  o Processor / Wholesaler / Retail
		  o Retail
		• There are different traceability requirements from different sources, covering 1) resource management, 2) market management 3) safety management, 4) recall.

Potential Improvements / Improvement Comments	• Additional effort could be spent by PrimeSafe on making Food Safety Programs more acceptable. However it is unlikely that significant benefits will be achieved. • Most time and effort is spent on the development, maintenance and review of codes of practice, which includes food safety and handling. • Food Safety Programs are sometimes seen as duplicating codes of practice, which have been in place for considerable time. Improvements could include investigating how to reduce, or remove some of the requirements of the Food Safety Program. This could, however have implications for business registration that will need to be explored further. • For low risk items, further investigate how to reduce / remove some of the burden of Food Safety Programs. • There are plans to combine the transport plan with the Food Safety Program. • There may be opportunities to avoid duplication between Food Safety Programs and export accreditation requirements	• Consider the use of technology to record the catch. Presently only paperwork is currently being used in fisheries wildcatch (in VIC). • Ideally micro-chip or otherwise identify individual high value seafood (e.g. abalone and rock lobster) for further traceability. • Investigate the use of technology for temperature recording through the supply chain - for supply chain management

5 Feedback from Industry for Potential Future Improvements

It was widely accepted by PrimeSafe and DEPI at the commencement of this project that the seafood industry must be engaged during the delivery of the project to ensure the seafood risk assessment is well considered and comprehensive. As a result, industry participants have identified a range of potential control improvements, risk treatments and / or control changes. These have been documented in Table 5.1 below according to the nature of the improvement and categorised based on the current risk assessment level for the associated risk.

Table 5.1 – Summary of Potential Control Improvements, risk treatments and / or control changes Suggested by Industry Participants

Nature of Proposed Control Change	Associated with High / Medium Risk	Associated with Low Risk
Additional Controls / Risk Treatments (new)	• Potentially introduce relaying (moving bivalve shellfish from one area to another for 2-8 weeks). These measures are described in the ASQAP manual. • Regarding cross-contamination of legally caught abalone with illegally caught abalone: o potentially implement a health incident plan in order to have transparency about real actions that need to be taken if an incident occurs; o extend traceability through to retail in a way that does not inhibit the market; and o investigate the business for tagging abalone (or similar program). • For finfish: o adopt a comprehensive algal bloom incident management plan, which includes an appropriate cost sharing arrangement including recreational and commercial industry and government; o extend traceability through to retail in a way that does not inhibit the market, and o further research (support current research underway) is required in managing and predicting algal blooms (there are a lot of information safety gaps regarding the risk to human health from algal blooms). • For yabbies: o produce educational materials for the aquaculture industry re: identifying problem blooms (DEPI). • For Rock lobster: o Work with SRL to develop and implement emergency response protocols/procedures associated with algae blooms affecting rocklobster.	• Monitor potential new technologies available on packaging of bivalve molluscs. • For yabbies: o develop industry and government guidance for new entrants to the yabby industry re: site selection, guidance documents; o where applicable publicise the spraying notification process to industry; and o adopt the inspection by the government of the property of new yabby growers to ensure that the site is suitable for production. • For Rock lobster: o Investigate the equivalence and accreditation of Clean Green QA program with PrimeSafe requirements for harvesting rocklobster.
Changes to existing controls (modification)	• Regarding cross-contamination of legally caught abalone with illegally caught abalone: o further target illegal catch (through	• Potentially consider a different approach for record keeping and auditing of Food Safety Programs for businesses. This could be considered across all seafood

Nature of Proposed Control Change	Associated with High / Medium Risk	Associated with Low Risk
	items listed below); o work with councils further about their role in regulating restaurants. It is highlighted that regulation of restaurants in this field is deficient (and not working); and o investigate the options for targeted programs to address illegal catch (maybe through multiple departments with PrimeSafe leading). • For finfish: o Ensure that appropriate resources (from a Gippsland Lakes point of view) can be deployed when toxic algal blooms occur for testing, monitoring and management;	categories; • For wildcaught abalone during harvesting: o simplify the data recording process to avoid duplication of paperwork for abalone; and o potentially use the industry code of practice to meet the regulatory requirements. Investigate the industry code of practice for use in validation and verification process. • Regarding abalone, sea urchins and periwinkles: o check whether an equivalence can be reached between DAg requirements and PrimeSafe to avoid duplication (reduce duplication); and o investigate the possibility of exporting product with just the PrimeSafe accreditation. • Strengthen and expand the Victorian Fisheries Code of conduct to all sectors in Victoria (as not all licensed holders are members) • For finfish: o check whether an equivalence can be reached between DAg requirements and PrimeSafe to avoid duplication (reduce / avoid duplication); o improve clarity between formal HACCP recognition and PrimeSafe certification; and o investigate the existing standards of Council regulated retailers to identify equivalence with PrimeSafe Standards, and apply the best standards available (including cost-effectiveness consideration) across all levels of the retail supply chain selling seafood. • For prawns: o Regular changing of on-board cooking water should be checked as a common practice to validate as a potential control / treatment.

Based on the MCA analysis of the Food Safety Program and Traceability controls, common to all seafood categories, potential improvements to these controls include:

- Investigate how to recognise duplicated elements between the Food Safety Programs and the existing industry codes of practice in order to potentially reduce or remove some of the requirements of the Food Safety Program because of existing industry codes of practice elements;
- For low risk items, further investigate to reduce / remove some of the burden of Food Safety Programs;
- Explore opportunities to avoid duplication between Food Safety Programs and export accreditation;
- Consider the use of technology to record the catch to enhance traceability of the product;

- Ideally micro-chip individual high value seafood (e.g. abalone and rock lobster) for further traceability; and
- Investigate technology for temperature recording through the supply chain - for supply chain management.

As the above points illustrate, there is great potential associated with new technology to support critical aspects of seafood risk management, with specific regard to traceability technology and remote temperature logging. This technology should be actively explored as it could yield efficiencies, allow for early detection and notification of issues, as well as support more robust data management.

It needs to be noted that some actions and opportunities highlighted above may apply in a broader sense to other sectors of the food industry (outside the seafood industry), and that these selected items could thus further be explored.

6 Conclusions

The project has identified fifty five risks spread across the four seafood sectors of finfish & Cephalopods, Crustaceans, abalone, sea urchins & periwinkles, and bivalve Molluscs. A range of current controls were found to be in place to manage these risks as required by PrimeSafe in accordance with the Victorian Seafood Safety Act (2003) and associated other Standards.

This project has shown that the regulatory controls provided by the Seafood Safety Act (2003), and administered by PrimeSafe, are generally effective in managing seafood safety, and with these current controls in place, the risk is low. Furthermore, industry participants have identified some opportunities where current controls could be modified to increase the efficiency of the existing PrimeSafe quality assurance system that will potentially ease some of the regulatory burden on industry whilst not increasing the level of risk.

There are some areas where risk has been deemed as Medium and High, or current controls are only "moderately effective" and these should be further investigated to confirm the level of risk, and to more closely scrutinise the existing controls and identify potential improvements.

The detailed multi-criteria analysis of the Food Safety Programs and traceability process, representing two major controls operating throughout the seafood industry, revealed that industry participants believe both controls are largely effective. Industry's acceptance of Food Safety Programs could, however, be enhanced if some of its requirements were modified. A particular opportunity is the enhanced use of codes of practice and industry standards, however PrimeSafe would need to ensure that validation and independent verification processes were adequate before allowing an increased reliance on the codes and standards, to achieve regulatory compliance.

Based on data obtained and analysis undertaken during this project we are able to make the following conclusions:

- Whilst there are some risks specific to a particular seafood category, or species, the majority of the risks identified are similar between the four categories investigated;
- There was strong agreement among both government and industry participants that current controls were very effective in managing the risks identified. 87% of controls were considered 'very effective', 11% were considered 'moderately effective' and one risk was deemed to have controls that were 'ineffective' (associated with the control of illegally caught abalone);
- Generally, there was also strong alignment among government and industry participants regarding the assessment of current risk (i.e. with controls in place). Risks were initially assessed by government representatives and following a review of the these risk ratings during the industry workshop, only few risk ratings were adjusted;
- Given the largely 'very effective' current controls in place, together with information provided on how some seafood groups and species have minimal opportunity to become contaminated (e.g. abalone, yabbies are detritus feeders and abalone eat marine algae, as opposed to the higher risk filter feeder species such as the majority of bi-valve molluscs), the current risk rating is largely 'low' across the seafood categories. That is:
    - 48 risks (87%) of risks were considered a 'low' risk,
    - four risks (7%) were considered a 'medium' risk, and:
    - three risks (6%) were rated a 'high' risk (the economic impact due to bivalve molluscs being potentially contaminated from bio-toxins, and the subsequent closure of the fishery, contamination of finfish by biotoxins, and contamination of prawns by biotoxins). Perhaps not surprisingly there is a general correlation between those risks where controls are considered less effective and their ultimate risk rating (that is, less effective controls, higher rated risks);

- Our detailed risk assessment indicates that for some risks finfish & Cephalopods, bivalve molluscs and Crustaceans have a higher food safety risk compared to abalone, sea urchins and periwinkles. There are, however, differing views regarding some risk assessments associated with prawns;
- Whilst industry participants are of the view that safety risks associated with prawns are minimal, DH representatives have expressed the view that prawns are definitely a higher risk species when compared to other Crustaceans (such as yabbies). In particular, DH determined that the risk associated with biotoxic contamination of prawns (from toxic algae in pre-harvest) was 'High'. Industry participants viewed this risk as 'Low' given the absence of historical food safety events related to prawns. In addition, the risk of biotoxin contamination through the cooking water of prawns on board was assessed as 'Low' by government representatives, whilst industry participants viewed this risk as negligible (as according to them, controls are mostly associated with the growing waters). These difference of views should possibly be investigated, given the strong alignment between industry and government representatives regarding the assessment of other risks;
- The impact scenario risk assessment shows that finfish (toxic algal bloom in Gippsland Lakes resulting in extended shutdown of the finfish industry) was assessed as having the highest risk, based on economic impact, relative to other seafood categories. This is followed by bivalve molluscs. Workshop participants could only identify one realistic impact scenario for Crustaceans (rocklobster) and abalone, and both were assessed as low risks. Almost all impact scenarios assessed (with the exception of the low impact scenario for bivalve molluscs, and the finfish listeria scenario), impacted predominantly on the economy, with people and public administration consequence sectors being less impacted. There is no direct correlation between the risk assessment outcome and the size of the local seafood category industry;
- Whilst there was considerable debate and discussion on a range of issues, the level of overall agreement from workshop participants, as indicated above, clearly indicates a consensus was largely achieved within seafood industry participants during this project;
- Despite the overall highly effective controls currently operating in the seafood industry to manage food safety risks, there has been a range of potential treatments and / or improvements to these existing controls, identified by seafood industry participants, to further minimise the food safety risk (and the subsequent potential economic impact). These include:
    - policy / regulatory measures (e.g. develop a policy and supporting governance structure for improving ASQAP implementation);
    - investigating opportunities to reduce the regulatory burden through the reduction in duplication of processes (checking whether an equivalence can be reached between DAg requirements and PrimeSafe to avoid duplication);
    - exploring ways in which technology could be used to assist some of the critical process elements in the supply chain such as traceability of products and temperature logging of products along the supply chain;
    - addressing some identified communications and cultural issues, removing duplication of export and domestic requirements (DAg and PrimeSafe) and accreditation of the codes of practice (provided that verification can be demonstrated);
    - developing education programs to provide further guidance in the management of food safety risks within local government and industry; and
    - whilst outside the scope of this seafood safety risk assessment, the abalone industry participants suggested that greater collaboration between fisheries and seafood regulators could provide synergies that manage both food safety risks and fish stock

management (in relation to contamination of legally caught abalone from illegally abalone catch).

7 Recommendations

A number of recommendations can be made from the risk assessments undertaken across the four seafood categories under this project. Specifically, it is recommended that:

- risks rated as having a higher current risk level be more closely reviewed to further examine the effectiveness of the current controls in place to manage these risks, and agree the potential additional treatments to further manage these risks;
- the feedback from industry participants for potential future improvements/treatments regarding the management of seafood safety risks be examined and thoroughly analysed by relevant government departments. This analysis should consider any impacts to the industry (including cost imposts and / or efficiency gains), government administrative and cost implications, and the ultimate effect on the food safety risk level. Further to this, it is recommended that discussions be held between the State and Commonwealth Governments, and between the State Government and industry, to review the allocation of roles and responsibilities for managing specific risks identified. This will contribute to the determination and implementation of priorities and improvements, as identified during this project;
- PrimeSafe review its requirements for how Food Safety Programs are implemented to explore opportunities to reduce the regulatory burden on industry. For example, reducing some of the requirements within the Food Safety Program, with an accompanying increase in verification of the effective implementation of existing industry codes of practice and standards, will reduce regulatory burden on industry and improve their acceptance of the Food Safety Program; and
- a reassessment of the risks be undertaken in the future to understand how effective the potential improvements, identified during this project, have been in reducing the risks. The reassessment will enable an up to date risk profile to be determined, and will again highlight potential improvement opportunities to ensure the continuous improvement in the management of health risks associated with the seafood industry. The consultative approach used in this project not only enabled a comprehensive risk register to be developed, but also ensured extensive and constructive discussions were held between industry participants, and also between industry participants and government. This level of interaction is invaluable and would be a significant benefit to undertaking a reassessment in the future.

Appendix A OzFoodNet Data

Legend: D Descriptive evidence implicating the suspected vehicle or suggesting foodborne transmission; M: Microbiological confirmation of agent in the suspect vehicle and cases; A Analytical association between illness and one or more foods.

State	Condition	Number affected/ Hospitalised (evidence)	Source
		1997	
NSW Aus.total	Hepatitis A	274 (444)	oysters
		2001	
NSW	Escolar	20 (D+M)	
Qld	Ciguatera	14/11 (D)	Spanish Mackerel
	Ciguatera	2 (D)	Spotted Mackerel
	Ciguatera	3/3 (D)	Barracuda
	Ciguatera	4 (D)	Coral trout
	Ciguatera	9 (D)	Spanish Mackerel
	Histamine poisoning	4 (D)	Mahi Mahi
Vic	Ciguatera	16 (D)	Coral trout
	Wax ester (butterfish diarrhoea)	5 (D+M)	Butterfish (sic)
		2002	
NSW	Ciguatera	7 (M+D)	Spanish Mackerel
	unknown	2 (D)	fish
Qld	Ciguatera	2 (D)	Spanish Mackerel
	Ciguatera	2 (D)	Striped Perch
	Ciguatera	3 (D)	Grunter Bream
Vic	Suspected wax ester	10 (D)	Suspected rudder fish
WA	Norovirus	60 (A+M)	Seafood salad
	Unknown	Unknown	Oyster shooters
		2003	
ACT	Unknown	3 (D)	fish
NSW	Hepatitis A	2 (D)	prawns
	Histamine	2 (D)	sardines
NT	Norovirus	48 (A+M)	Oysters (Japanese IQF)
Qld	Ciguatera	2 (D)	Coral trout
	Histamine	3 (M+D)	Dolphin fish (?Mahi Mahi)
	Ciguatera	3 (D)	Mackerel steaks
	Ciguatera	7 (D)	Coral trout
	Histamine	2 (D)	Tuna patties
	Ciguatera	3 (D)	Fish (Moololaba Bay)
	Ciguatera	2 (D)	Cod fish heads
	Ciguatera	3 (D)	Giant Trevally Fish
	Ciguatera	5/5 (D)	Barracuda
	Ciguatera	15 (D)	Spanish Mackerel
	Ciguatera	3 (D)	Fish Head Soup (Red Emperor)
	Escolar	20 (D)	Escolar fish

	Ciguatera	4 (D)	Fish species unknown
Vic	Escolar	3 (D)	Escolar fish
	Histamine	22 (A+M)	Escolar fish
WA	unknown	17 (A)	Oysters (Japanese IQF)
	Norovirus	35 (A)	Oysters (Japanese IQF)
		2004	
ACT	Unknown	16 (A)	Suspected calamari
	Salmonella Typhimurium 197	12/2 (M)	Ling fish
	Norovirus	247/? (A)	Salmon and egg sandwiches
NSW	*Salmonella* Typhimurium U290	3 (D)	Fish cakes
	Norovirus	24/1 (A)	Oysters
	Salmonella Typhimurium 135	3/2 (M)	crab
NT	unknown	5 (D)	Oysters
Qld	Norovirus	4 (D)	Oysters
	Ciguatoxin	2/2 (D)	Golden spotted trevally fish
	Ciguatoxin	4/1 (D)	Coral trout
	Ciguatoxin	2 (D)	Fish species unknown
	Ciguatoxin	5/? (D)	Spanish mackerel/trevally
	Ciguatoxin	4 (D)	Grey mackerel
	Ciguatoxin	3 (D)	Trevally
	Ciguatoxin	4 (D)	Grey Mackerel
	Norovirus	2/? (D)	oysters
Vic	Suspected toxin	9 (D)	rudderfish
	unknown	7/3 (D)	redfish
WA	Norovirus	19 (A)	Prawn and cold meats*
		2005	
NSW	Histamine	4 (M)	Tuna steak
Qld	Ciguatera	4 (D)	Mackerel
	Ciguatera	2 (D)	Black trevally
	Ciguatera	2 (D)	Yellowtail kingfish
	Ciguatera	17/2 (D)	Spanish Mackerel
	Histamine	2 (D)	Yellowfin Tuna
	Ciguatera	5 (D)	Black Kingfish
	Ciguatera	2 (D)	Spanish Mackerel
	Ciguatera	2 (D)	Trevally
	S. Typhimurium 44	23/22 (D)	Prawn soup
	Ciguatera	10 (D)	Barracuda
	Ciguatera	8 (D)	Yellowtail kingfish
Tas	Histamine	2 (D)	Yellowfin tuna
	Vibrio	2 (D)	Suspected seafood
Vic	unknown	16 (A)	Seafood platter, baked fish, octopus
	Histamine	2 (A)	Tuna
	Ciguatera	5 (D)	Fijian snapper
	unknown	11 (A)	Suspected Spanish mackerel
		2006	

NSW	Scombroid	2/1 (D)	Tuna steaks
	unknown	4 (D)	Suspected Nile perch
	Scombroid	6/6 (D)	Yellowtail kingfish fillets
	Salmonella Typhimurium 170	6 (D)	tuna and salmon sushi rolls
	Vibrio cholerae	3/2 (D)	Whitebait
NT	Ciguatera	14/4 (D)	Slate sweetlips fish
Qld	Ciguatera	2 (D)	Cod
	Scombroid	2 (D)	Blue fin tuna steaks
	Ciguatera	2(D)	Trevally fish
	Ciguatera	4/4 (D)	Spanish Mackerel
	Ciguatera	2 (D)	Spanish Mackerel
	Ciguatera	4 (D)	Black Kingfish
Vic	Scombroid	2 (D)	Kingfish
	Ciguatera	2 (D)	Coral perch or coral trout
		2007	
NSW	*Bacillus cereus*	32 (A+M)	Boiled gelfite fish
	Histamine	3/2 (M)	Tuna kebab steaks
	Histamine	2/2 (M)	Tuna steaks
	Unknown	2/2 (D)	Grilled tuna
	Unknown	19 (D)	oysters
NT	histamine	1 (D)	Tinned tuna
	Ciguatoxin	2 (D)	Reef cod
Qld	Histamine	2 (D)	Imported tuna
	Ciguatoxin	2 (D)	Mackerel
	Ciguatoxin	6 (D)	Mackerel
	Ciguatoxin	3/1 (D)	Coral trout
	Ciguatoxin	2 (D)	Mackerel
	Histamine	4 (D)	Tuna kebabs
	Ciguatoxin	5 (D)	Coral trout
	Ciguatoxin	2 (D)	Spanish Mackerel
Vic	Histamine	2 (D)	Tuna
	Histamine	2 (D)	Mahi mahi fish
		2008	
NSW	Unknown	3 (D)	mussels
	Unknown	4 (D)	oysters
	Unknown	5/1 (D)	Barramundi, lamb, salad*
	Scombroid	1/1 (D)	Tinned tuna
	Unknown	2	Mussels
	Unknown	10 (A)	oysters
Qld	Ciguatera	3 (D)	cod
	Ciguatera	4/? (D)	'Yellow king' – Samson fish
	Ciguatera	6/1 (D)	Red throat emperor/ reef snapper
	Ciguatera	6/? (D)	Black Kingfish
	Ciguatera	2 (D)	Yellowtail kingfish
		2009	
ACT	Scombroid	2/1 (D)	Tuna steak

	Escolar	3 (D)	rudderfish
NSW	Histamine	2/1 (M)	Tinned anchovies imported
Qld	Ciguatera	3/2 (D)	Spanish Mackerel
	Histamine	6 (M)	tuna
	Ciguatera	2/2 (D)	King snapper/jobfish green
Vic	Fish wax ester	27 (D)	Escolar
		2010	
Qld	Ciguatera	4/4 (D)	Mackerel
	Ciguatera	6 (D)	Fish unspecified
	Ciguatera	4 (D)	Fish head soup
	Ciguatera	2 (D)	Coral trout
	Ciguatera	4 (D)	Passionfruit trout
	Ciguatera	2 (D)	Mangrove jack fish
NSW	Unknown	5 (D)	Mehi-Mehi fillets
	Unknown	3 (D)	oysters
Vic	Scombroid	4	Tuna
		2011	
Qld	Ciguatera	3 (D)	Red bass
	Ciguatera	3 (D)	Reef fish (unknown species)
	Ciguatera	3 (D)	Coral trout
	Ciguatera	6 (D)	Spanish Mackerel
	Scombroid	3/3 (D)	Yellowtail Kingfisher
	Ciguatera	2 (D)	Coral trout
NSW	Unknown	87 (A)	Thai Salad with poached prawns*
	Scombroid	4/4 (D)	Fresh tuna salad
Vic	Scombroid	3 (M)	Tuna

Appendix B Workshop Attendees

Government Meeting #1 – Held on 7/11/2013 at DEPI offices, Level 16/1 Spring Street, Melbourne

Name	Organisation
Heather Haines	Department of Health
Rachael Poon	Department of Health
Tom Ross	(Tas)
Agnes Tan	Microbiological Diagnostic Unit - University of Melbourne
Katy Day	DEPI
Margaret Darton	DEPI
John Mercer	DEPI
Tracey Bradley	DEPI
Pradeepa Adihetty	DEPI
Ross McGowan	DEPI
Malcolm Ramsay	DEPI
Narelle Fegan	CSIRO
Brendan Tatham	PrimeSafe
Michael MacLennan	MWH
Guillaume Dussuyer	MWH

Industry Meeting #1: Crustaceans – Held on 13/11/2013 at DEPI Marine Discovery Centre, 2A Bellarine Hwy Queenscliff

Name	Organisation
Frank Chara	Otway Yabbies
Stephen Chara	Otway Yabbies
Ross Hodge	Southern Rocklobster Limited
Gerhard Wilmink	Rock Lobster Fishermen Victoria, W Zone
Renee Vajtauer	SIV
Brendan Tatham	PrimeSafe
Michael MacLennan	MWH
Guillaume Dussuyer	MWH

Industry Meeting #2: Bivalve Molluscs – Held on 27/11/2013 at DEPI offices, 475 - 485 Mickleham Road, Attwood

Name	Organisation
Leftheri Arhontogiorgis	Tim & Terry Oyster Supply
Lance Wiffen	Sea Bounty
Renee Vajtauer	SIV
Brendan Tatham	PrimeSafe
Michael MacLennan	MWH
Guillaume Dussuyer	MWH

Industry Meeting #3: Finfish & Cephalopods (1) – Held on 29/11/2013 at DEPI offices, 475 - 485 Mickleham Road, Attwood

Name	Organisation
Ed Meggitt	Goulburn River Trout
Barbara Kostas	Melbourne Seafood Centre
Renee Vajtauer	SIV
Brendan Tatham	PrimeSafe
Michael MacLennan	MWH
Guillaume Dussuyer	MWH

Industry Meeting #4: Abalone, Urchins & Periwinkles – Held on 4/12/2013 at DEPI offices, 475 - 485 Mickleham Road, Attwood

Name	Organisation
Glen Plummer	Grab an Ab
Renee Vajtauer	SIV
Brendan Tatham	PrimeSafe
Michael MacLennan	MWH
Guillaume Dussuyer	MWH

Risk Assessment Workshop – Held on 9/12/2013 (morning session: Abalone) at DEPI offices, Level 16/1 Spring Street, Melbourne

Name	Organisation
Grant Leeworthy	Fishermen Direct Pty Ltd
Geoff Ellis	Eastern Zone Abalone Industry Association
Glenn Plummer	Grab an Ab Pty Ltd
Tracey Bradley	Principal Veterinary Officer, Aquatic Species (DEPI)
Kylie Wholt	Policy Officer, Fisheries (DEPI)
Pradeepa Adihetty	DEPI
Heather Haines	Department of Health
Brendan Tatham	PrimeSafe
Michael MacLennan	MWH
Guillaume Dussuyer	MWH

Risk Assessment Workshop – Held on 9/12/2013 (afternoon session: Crustaceans) at DEPI offices, Level 16/1 Spring Street, Melbourne

Name	Organisation
Ross Hodge	Southern Rock Lobster Ltd
Trevor Domaschenz	TJ & MD Domaschenz
Stephen Chara	Otway Yabbies
Grant Leeworthy	Fishermen Direct Pty Ltd
Kylie Wholt	Policy Officer, Fisheries (DEPI)
Pradeepa Adihetty	DEPI
Heather Haines	Department of Health
Brendan Tatham	PrimeSafe
Michael MacLennan	MWH
Darren Bayfield	MWH

Controls Assessment Workshop – Held on 13/12/2013 at DEPI offices, 475 - 485 Mickleham Road, Attwood

Name	Organisation
Andrew Clarke	Manager Aquaculture, Fisheries (DEPI)
Brendan Ryan	PrimeSafe
Andrew Clarke	DEPI
Glen Plummer	Grab an Ab
Renee Vajtauer	SIV
Geoff Ellis	Eastern Zone Abalone Industry Association
Pradeepa Adihetty	DEPI
Stephen Chara	Otway Yabbies
Heather Haines	Department of Health
Brendan Tatham	PrimeSafe
Michael MacLennan	MWH
Guillaume Dussuyer	MWH

Industry Meeting #5: Finfish & Cephalopods (2) – Held on 10/01/2014 at LEFCOL, Lakes Entrance

Name	Organisation
Geoff Ellis	Eastern Zone Abalone Industry Association
Peter Clark	LEFCOL Board, Danish Seine
Dale Sumner	LEFCOL
Andrew Watts	LEFCOL Board
Arthur Allen	East Gippsland Estuarine Fishermans Association
Gary Leonard	East Gippsland Estuarine Fishermans Association
Barbara Kostas	Melbourne Seafood Centre
Renee Vajtauer	SIV
Brendan Tatham	PrimeSafe
Michael MacLennan	MWH
Guillaume Dussuyer	MWH

Appendix C Risk Register

Bivalve Molluscs (oysters, clams, mussels, pipis, scallops) Risk Register

Risk ID	Supply Chain Sector	Cause	Risk	Current Controls	Controls Effect'ess	Current Consequence	Current Likelihood	Current Risk Assessment	Suggested Treatments	Residual Consequence	Residual Likelihood	Residual Risk Assessment
B1	Production - pre-harvest	Bacterial, viral contamination by sewage, agricultural run-off or eutrophication. Note: Growing environments of wild-caught scallops are less likely to be subjected to significant levels of contamination by human sewage pollution or agricultural run-off.	Bivalve Molluscs - Contamination (e.g. Enteric pathogens (Bacteria and viruses) in growing waters due to human activity	-Aquaculture and wildcatch pipis: Vic shellfish Ops manual (incl. monitoring of water quality and tissue, classifications of water based on sanitary surveys, harvesting controls); - Wildcatch (scallops): no monitoring of water for coliforms. -Scallops (proposed to be harvested from Port Philip Bay) -Scallops from Bass Strait))) Scallops are taken from both locations. Scallops from Bass Strait considered a low risk, whilst the Port Philip Bay scallops have a higher risk of contamination by human sewage pollution or agricultural run-off.	Very effective	Minor	Almost Certain to Likely	**MEDIUM** *(driven by high likelihood)*	-Nothing further identified (as ASQAP dictate what can be done with shellfish). ASQAP manual is being updated at the moment. ASQAP Committee is seeking funding from FRDC for this update to occur	Minor	Almost Certain to Likely	**MEDIUM** *(driven by high likelihood)*
B2	Production - pre-harvest	Biotoxic contamination by toxic phytoplankton	Bivalve Molluscs - Contamination by biotoxins	-Aquaculture: Marine Biotoxin Management Plan Including: fortnightly monitoring of phytoplankton as an early warning for toxic phytoplankton. If trigger levels reached specific biotoxin monitoring undertaken - NATA labs. Environmental monitoring of salinity, water temperature and rainfall in local area undertaken same time as phytoplankton monitoring. If biotoxins are detected Harvest Area Manager notifies shellfish farmers. This could trigger harvest suspension. There is a procedure for closing harvest area (e.g. where biotoxins in shellfish tissue is confirmed. There is also re-opening criteria (e.g. when biotoxin testing proves negative). There are product recall procedures if potential biotoxin contaminated shellfish are harvested prior to closure. -Wildcatch: monitoring of toxins in shellfish, sending out of advisory notices informing of outbreak location, and potential closing of fisheries. When this reaches threshold, fisheries closed / or further measures required, product is traced, and is recalled either voluntarily or at the direction of the Chief Health Officer. Specifically for Port Philip Bay bivalve shellfish: ASQAP guidelines will control wildcatch through water classification and monitoring.	Very effective	Moderate	Almost Certain to Likely	**HIGH** *(driven by high likelihood and economic consequence)*	-Potential depuration (recirc system to purge bivalve shellfish) or relaying: moving bivalve shellfish from one area to another for 2-8 weeks. These measures are covered in the ASQAP manual. Relaying is a viable control. This is being done interstate. Pipis cannot be depurated (as they die during process)	Moderate	Almost Certain to Likely	**HIGH** *(driven by high likelihood and economic consequence)*
B3	Production - pre-harvest	Heavy metal contamination by natural or industrial sources.	Bivalve Molluscs - Contamination by accumulation of heavy metals	-Aquaculture and wildcatch pipis: Vic shellfish Ops manual (incl. testing of tissue for oysters and mussels from the harvest areas - testing is undertaken every 3 years, harvesting controls if there are elevated levels detected) - Wildcatch (scallops): not applicable to current fisheries New fisheries will require testing to demonstrate compliance with ASQAP	Very effective	Minor	Rare	**LOW**	-No additional treatments	Minor	Rare	**LOW**
B4	Production - pre-harvest	Chemical contamination by sewage, industrial or agricultural sources.	Bivalve Molluscs - Contamination by agricultural and industrial chemicals	-Aquaculture and wildcatch pipis: Vic shellfish Ops manual (incl. testing of tissue for oysters and mussels from the harvest areas - testing is undertaken every 3 years, harvesting controls if there are elevated levels detected). A bi-ennial review is required every two years. There are almost no areas where there is an industrial site nearby; - Wildcatch (scallops): not applicable to current fisheries	Very effective	Minor	Rare	**LOW**	-Perhaps a code of practice is required for pre-harvest.	Minor	Rare	**LOW**

Risk ID	Supply Chain Sector	Cause	Risk	Current Controls	Controls Effect'ess	Current Consequence	Current Likelihood	Current Risk Assessment	Suggested Treatments	Residual Consequence	Residual Likelihood	Residual Risk Assessment
B5	Production - harvest	Bacterial, viral, chemical or physical contamination during harvest	Contamination from workers, machinery or water sources (including ice)	-Wildcatch: Food Safety Program in place -Aquaculture: Food Safety Program, Individual operators may have their own codes of practice (good, clean boat, temperature control, HACCP requirements), Food safety program (temperature control and cleanliness measures through different containers / storages, Storage types can vary (e.g. use of vac bags. Choice of container and packing procedure will influence the level of shelf life applicable), Ensure mussels go to under 10 degC in the first 24 hours, and then under 5 degC thereafter. Harvester has to demonstrate that risk is being managed for each type of packaging and species.	Very effective	Minor	Rare	**LOW**	- Potentially consider a different approach on how Food Safety Programs are developed for businesses. i.e. templates/guidance/oversight etc.. This could be considered across all seafood categories.	Minor	Rare	**LOW**
B6	Processing - shucking (shelling)	Contamination by shuckers	Bivalve Molluscs - Contamination (microbiological pathogens) by shuckers	-Food Safety Program developed and implemented at premises level in place that requires food handling and personal hygiene rules, auditing for compliance of Food Safety Programs by external auditors. -HACCP plan for shucking (basis for Food Safety Program) -Export market certification require inspections in addition to Food Safety Programs	Very effective	Minor	Rare	**LOW**	-No additional treatments	Minor	Rare	**LOW**
B7	Processing	Employee with poor health and / or poor hygiene working in processing area	Bivalve Molluscs - Microbiological contamination of food, food-packaging materials, and food-contact surfaces from employees	-Food Safety Program developed and implemented at premises level in place that requires food handling and personal hygiene rules and exclude persons with poor health from any operations that may be expected to result in such contamination until the condition is corrected, auditing for compliance of Food Safety Programs by external auditors.	Very effective	Minor	Unlikely	**LOW**	-No additional treatments	Minor	Unlikely	**LOW**
B8	Processing	Environmental contamination from premises and equipment	Bivalve Molluscs - Microbiological contamination from environmental sources (premises and equipment)	-Food Safety Program developed and implemented at premises level in place requiring cleaning programs, auditing for compliance of Food Safety Programs by external auditors. -Premises must be registered	Very effective	Minor	Unlikely	**LOW**	-No additional treatments	Minor	Unlikely	**LOW**
B9	Transport	Exposure to microbiological pathogens and inadequate temperature control from transport process and vehicle.	Bivalve Molluscs - Microbiological contamination and growth during transport	-Annual vehicle inspections and requirements that only licensed vehicles are used for non-live shellfish. -Only refrigerated vehicles used and these are registered with Primesafe -Food Safety Program developed and implemented by transport operator, which requires regular cleaning and effective refrigeration. - Licensing process being updated, with onus on businesses to update transport details. Non-compliances are picked up via the audit process. Identification of non-compliances occurs at this stage, and then this is then acted upon. -Traceability of product and ability to subsequently investigate illegal transporters	Moder'y effective	Minor	Unlikely	**LOW**	-No additional treatments	Minor	Unlikely	**LOW**
B10	Storage and packaging	Exposure to microbiological pathogens and inadequate temperature control during storage & packaging	Bivalve Molluscs - Microbiological contamination and growth during storage and packaging	-Food Safety Program developed and implemented at premises level in place requiring cleaning programs, temperature control, suitable packaging, auditing for compliance of Food Safety Programs by external auditors.	Very effective	Minor	Unlikely	**LOW**	-Potential new technologies available on packaging. This is an area where technology could overtake legislation in the future. Monitoring of new technology is important	Minor	Unlikely	**LOW**

Risk ID	Supply Chain Sector	Cause	Risk	Current Controls	Controls Effect'ess	Current Consequence	Current Likelihood	Current Risk Assessment	Suggested Treatments	Residual Consequence	Residual Likelihood	Residual Risk Assessment
B11	Wholesale	Exposure to microbiological pathogens from poor handling (cross-contamination, health conditions, etc…) and inadequate temperature control	Bivalve Molluscs - Microbiological contamination and growth during wholesale)	-Food Safety Program developed and implemented at premises level in place requiring cleaning programs, temperature control, suitable packaging, auditing for compliance of Food Safety Programs by external auditors.	Very effective	Minor	Unlikely	**LOW**	-No additional treatments	Minor	Unlikely	**LOW**
B12	Food service (e.g. supplying restaurants)	Exposure to microbiological pathogens from poor handling (cross-contamination, health conditions, etc…) and inadequate temperature control	Bivalve Molluscs - Microbiological contamination and growth during food service (e.g. restaurants)	-Food Safety Program developed and implemented at premises level in place requiring cleaning programs, temperature control, suitable packaging, auditing for compliance of Food Safety Programs by external auditors.	Moder'y effective	Minor	Unlikely	**LOW**	-No additional treatments	Minor	Unlikely	**LOW**
B13	Retail	Exposure to microbiological pathogens from poor handling (cross-contamination, health conditions, etc…) and inadequate temperature control	Bivalve Molluscs - Microbiological contamination and growth during retailing	-Food Safety Program developed and implemented at premises level in place requiring cleaning programs, temperature control, suitable packaging, auditing for compliance of Food Safety Programs by external auditors.	Moder'y effective	Minor	Unlikely	**LOW**	-No additional treatments	Minor	Unlikely	**LOW**

Abalone, sea urchins and periwinkles Risk Register

Risk ID	Supply Chain Sector	Cause	Risk	Current Controls	Controls Effect'ess	Current Consequence	Current Likelihood	Current Risk Assessment	Suggested Treatments	Residual Consequence	Residual Likelihood	Residual Risk Assessment
A1	Production - pre-harvest	Bacterial, viral contamination by sewage, agricultural run-off or eutrophication.	Abalone, urchins and periwinkles - Contamination (e.g. Enteric pathogens (Bacteria and viruses)	-Wildcatch: Western & Eastern zones zone: no fishing near sewerage outfalls. Eastern zone considered to me more pristine. There is an ocean outfall at Boags rocks, but there is no harvesting that occurs nearby. In addition, level of treatment has improved at this outfall in recent years -Aquaculture: Process of filtering water prior to returning water to the wild. Use of sand filters to filter water coming in from the wild - Although most farms would not be able to filter out bacteria on aquaculture (either in or out) - It would be too onerous to do so. Cleaning of external filters. Farms in populated areas to require testing of inlet water. Siting of the majority of farms is away from sewage outfalls and agricultural runoff. Farms in populated areas to require testing of inlet water. 99% of product will eventually be cooked.	Very effective	Minor	Unlikely	**LOW**	- Filtering of water for aquaculture would be cost-prohibitive.	Minor	Unlikely	**LOW**
A2	Production - pre-harvest	Biotoxic contamination by toxic phytoplankton WILDCATCH ONLY - EAST AND WEST ZONE	Abalone, urchins and periwinkles - Contamination by biotoxins	-Public and industry observations (monitoring of water). If there is a risk to public health, health officer will advise DEPI, and then an advisory will be put out for the product not to enter the market. Vessel operating practices, harvesting code of practice, incl. environmental procedures - industry is proactive in adjusting these based on conditions. Both sea urchins and abalone have their own codes of practices.	Very effective	Minor	Rare	**LOW**	Address if problem occurs - Monitoring	Minor	Rare	**LOW**
A3	Production - pre-harvest	Biotoxic contamination by toxic phytoplankton WILDCATCH ONLY - CENTRAL ZONE	Abalone, urchins and periwinkles - Contamination by biotoxins	-Public and industry observations (monitoring of water). If there is a risk to public health, health officer will advise DEPI, and then an advisory will be put out for the product not to enter the market.	Very effective	Minor	Rare	**LOW**	-No further treatments required.	Minor	Rare	**LOW**
A4	Production - pre-harvest	Biotoxic contamination by toxic phytoplankton AQUACULTURE ONLY - CENTRAL & WEST ZONE	Abalone, urchins and periwinkles - Contamination by biotoxins	-Environment monitoring, assessment of growth rate of abalone. Periodic health checks of abalone so there is a sample regularly taken and sent to a vet for an assessment. If a problem, Farm managers proactive in notifying DEPI (this occurred in AVG instance). In order to qualify for AQIS (DAg), product has to be certified to be safe. Some operations also operate under some European code (requiring health inspection) to gain export approval.	Very effective	Minor	Unlikely	**LOW**	-No further treatments required.	Minor	Unlikely	**LOW**
A5	Production - pre-harvest	Heavy metal contamination by natural or industrial sources.	Abalone, urchins and periwinkles - Contamination by accumulation of heavy metals	-Wildcatch: Perceived not to be an issue. -Aquaculture: Site selection such so as to avoid locating near an industrial facility.	Very effective	Minor	Rare	**LOW**	-No further treatments required.	Minor	Rare	**LOW**
A6	Production - pre-harvest	Chemical contamination by sewage, industrial or agricultural sources.	Abalone, urchins and periwinkles - Contamination by agricultural and industrial chemicals	-Wildcatch: Perceived not to be an issue currently. -Aquaculture: Site selection such so as to avoid locating near an industrial facility. No opportunity for Run-off from agricultural sources is because of abalone structures built (as they are usually land based above ground structures, protected). Also, water movement is usually through pipes, so runoff cannot enter process. Abalone are constantly graded in order to test for sick abalone (based on knowledge from one aquaculture farm). Vets would be called in to further investigate the causes of sick abalone. Thought that there would be a system in place for decontaminating tanks if a sickness is detected.	Very effective	Minor	Unlikely	**LOW**	-No further treatments required.	Minor	Unlikely	**LOW**
A7	Production - harvest	Bacterial, viral, chemical or physical contamination during harvest	Contamination from workers, machinery or water sources	-Wildcatch: abalone are hand fished and by regulation can only be taken during daylight hours. Abalone harvesters have signed on to a Food Safety Program that provides management processes to mitigate potential or perceived food safety risks. By regulation, all abalone must be landed and delivered to a Fish Receiver live. Traceability and quality control (as recorded in safety plan):	Very effective	Minor	Unlikely	**LOW**	- There is an opportunity to simplify the data recording process to avoid duplication. As the divers' cognitive abilities reduce at the end of the day, simplification of the	Minor	Unlikely	**LOW**

Risk ID	Supply Chain Sector	Cause	Risk	Current Controls	Controls Effect'ess	Current Consequence	Current Likelihood	Current Risk Assessment	Suggested Treatments	Residual Consequence	Residual Likelihood	Residual Risk Assessment
				- Data logger records size, number of abalone, reef code and GPS coords of each individual abalone. -Growth on abalone is scraped off (for quality assurance purposes) - Binning: Requirement by processors for abalone to be stacked side on (stomach positioned at top). This maintains quality. Broken shells are stacked on top (quality control reasons). Bins are tagged numbered sequentially (reqt by DEPI) and lidded (so foreign objects cannot be added or removed). Mat placed on top of bin to maintain coolness. Periodically, sea water is poured over to maintain quality. -On landing, electronic recording of nominated diver, license number, net weight of abalone, location, time spent underwater collecting fish, date. Also use a DEPI black box device that records time spent in the water. Information gets relayed to DEPI periodically and used for cross-checking information. DEPI then sends a receipt,. This is received at the point of weighing. A docket book is used to record the same information. A receipt number is issued from DEPI, certifying that all information has been recorded. Four copies are made. Two are kept by the harvester, one is on-sent to DEPI. two copies are issued with the catch to the processor, of which they on-send a copy to DEPI, after completing their section. Once receipt from DEPI is received, tags are removed. This gives time to DEPI to check the product to ensure the accuracy of the data provided. Vessel is washed down with freshwater and detergent. Dive gear is washed down also. Gloves are used by workers (for their protection due to abalone having inherent bacteria when taken from the ocean). Vessel operating manual and harvesting code of practice in place (for both sea urchins and abalone) - comprehensive coverage of a number of items - as required by the abalone and sea urchin association. The vessel operations manual in place for sea urchins covers staff training, personal health and hygiene, pre/post cleaning and bio security, standard operating procedures and record keeping. The sea urchin association has a harvesting code of practice detailing management, harvesting and environmental procedures. -Aquaculture - Thought to have similar traceability and quality control to wildcatch (as above). All product sent to processors or customers live from boats or farms and therefore unprocessed. Food safety regulations need to impact further down the chain. Anaesthetics are used, but a with-holding period is placed on abalone prior to being sold. Documentation not as stringent for Periwinkle and urchins. Monthly records rather than daily records (for abalone), given their lower yield value - therefore no black market for Periwinkle and urchins. -For sea urchins, the fishing area is selected on weather conditions, and the fishermans' knowledge of where to find high quality urchins. Urchins are kept alive by hanging catch bags off the side of the vessel, or packing into fish bins covered with hessian or constantly watered. Any damaged urchins are discarded. Urchins may be split at sea: A salt water ice slurry is prepared, the urchins are split a few at a time, the urchin roe is placed into plastic containers and submerged in the ice slurry for return to port.					data recording process would make things easier. Potentially use the industry code of practice to meet the regulatory requirements. Opportunity for investigate the industry code of practice for use in validation and verification process. No antibiotics are used in Victoria in aquaculture.			
A8	Processing - shucking (shelling)	Contamination by shuckers (done at processors)	Abalone, urchins and periwinkles - Contamination(micro biological pathogens) by shuckers	-Food Safety Program developed (as they are PrimeSafe licensed) and implemented at premises level in place that requires food handling and personal hygiene rules, auditing for compliance of Food Safety Programs by external auditors. - AQIS (DAg) compliance is required -Some processors must also comply to a European code relevant for export to Europe (this is an export food safety requirement however not an Australian food safety requirement)	Very effective	Minor	Unlikely	**LOW**	-Perhaps check whether an equivalence can be reached between AQIS (DAg) requirements and PrimeSafe to avoid duplication (reduce / avoid duplication). Opportunities to reduce regulatory burden through reduction in duplication of processes. There is the potential to export with just PrimeSafe (investigate possibility) - although some requirements to investigate. This will be dependent on cost and	Minor	Unlikely	**LOW**

Risk ID	Supply Chain Sector	Cause	Risk	Current Controls	Controls Effect'ess	Current Consequence	Current Likelihood	Current Risk Assessment	Suggested Treatments	Residual Consequence	Residual Likelihood	Residual Risk Assessment
									equivalence.			
A9	Processing	Employee with poor health and / or poor hygiene working in processing area	Abalone, urchins and periwinkles - Microbiological contamination of food, food-packaging materials, and food-contact surfaces from employees	-Food Safety Program developed and implemented at premises level in place that requires food handling and personal hygiene rules and exclude persons with poor health from any operations that may be expected to result in such contamination until the condition is corrected, auditing for compliance of Food Safety Programs by external auditors. -Fish Receivers are licenced by the Commonwealth's Department of Agriculture, Fisheries and Forestry (DAFF) under the Export Control Fish and Fish Products Orders 2005. A requirement under this licence is to have all processing procedures advised to and monitored by DAFF under audit. Fish Receivers also operate under individual Food Safety Programs that requires specific monitoring of output to ensure commercially sterile canned product. Abalone meat is in itself sterile due to the animal not being a filter feeder.	Very effective	Minor	Unlikely	**LOW**	-Difficult to comment on removing existing controls (based on knowledge present) - No additional treatments deemed required	Minor	Unlikely	**LOW**
A10	Processing	Environmental contamination from premises and equipment	Abalone, urchins and periwinkles - Microbiological contamination from environmental sources (premises and equipment)	-Food Safety Program developed and implemented at premises level in place requiring cleaning programs, auditing for compliance of Food Safety Programs by external auditors. -Fish Receivers are licenced by the Commonwealth's Department of Agriculture, Fisheries and Forestry (DAFF) under the Export Control Fish and Fish Products Orders 2005. A requirement under this licence is to have all processing procedures advised to and monitored by DAFF under audit. Fish Receivers also operate under individual Food Safety Programs that requires specific monitoring of output to ensure commercially sterile canned product. Abalone meat is in itself sterile due to the animal not being a filter feeder.	Very effective	Minor	Unlikely	**LOW**	-Difficult to comment on removing existing controls (based on knowledge present) - No additional treatments deemed required	Minor	Unlikely	**LOW**
A11	Canning	Historically, the major concern would have been the risk of botulism from inadequately processed canned fish, in particular, salmon. However rigorous control of canning facilities worldwide has reduced this risk to very low. Other hazards potentially present in canned fish include histamine, due to poor quality raw materials, and staphylococcal enterotoxin due to contamination. Both of these hazards may survive the canning process.	Abalone, urchins and periwinkle - Contamination in canned fish (e.g. Botulism from inadequate processing, and histamine due to poor quality raw materials)	-Fish Receivers are licenced by the Commonwealth's Department of Agriculture, Fisheries and Forestry (DAFF) under the Export Control Fish and Fish Products Orders 2005. A requirement under this licence is to have all processing procedures advised to and monitored by DAFF under audit. Fish Receivers also operate under individual Food Safety Programs that requires specific monitoring of output to ensure commercially sterile canned product.	Very effective	Moderate	Rare	**LOW**	-No further treatments required.	Moderate	Rare	**LOW**
A12	Transport	Exposure to microbiological pathogens and inadequate temperature control from transport process and vehicle.	Abalone, urchins and periwinkles - Microbiological contamination and growth during transport	-Licensed vehicles used by the processor (vehicle used is multi-faceted): used across the fish processing . This vehicle is refrigerated. Processors, if collecting live product are not required to be licensed, or refrigerated. Vehicle used by the harvester transports live product and is not required to be licensed -Food Safety Program developed and implemented by transport operator, which requires regular cleaning and effective refrigeration. Abalone, being transported from place of landing to Fish Receiver, is live product and as such transport vehicles are not required to be refrigerated. There are individual Food Safety Programs in place to ensure transport vehicles are washed and sanitized after each operation. All abalone being exported is a prescribed good under the Export Control Act 1982 and certified as being in sound condition and fit for human consumption .	Very effective	Minor	Unlikely	**LOW**	-No further treatments required.	Minor	Unlikely	**LOW**

Risk ID	Supply Chain Sector	Cause	Risk	Current Controls	Controls Effect'ess	Current Consequence	Current Likelihood	Current Risk Assessment	Suggested Treatments	Residual Consequence	Residual Likelihood	Residual Risk Assessment
A13	Storage and packaging	Exposure to microbiological pathogens and inadequate temperature control during storage packaging	Abalone, urchins and periwinkles - Microbiological contamination and growth during storage and packaging	-Food Safety Program developed and implemented at premises level in place requiring cleaning programs, temperature control, suitable packaging, auditing for compliance of Food Safety Programs by external auditors. -Fish Receivers are licenced by the Commonwealth's Department of Agriculture, Fisheries and Forestry (DAFF) under the Export Control Fish and Fish Products Orders 2005. A requirement under this licence is to have all processing procedures advised to and monitored by DAFF under audit. Fish Receivers also operate under individual Food Safety Programs that requires specific monitoring of output to ensure commercially sterile canned product.	Very effective	Minor	Unlikely	**LOW**	-No further treatments required.	Minor	Unlikely	**LOW**
A14	Wholesale, retail and food service	Exposure to microbiological pathogens from poor handling (cross-contamination, health conditions, etc…) and inadequate temperature control	Abalone, urchins and periwinkles - Microbiological contamination and growth during wholesale, retailing and food service. This applies to legal catch only (Cf. Risk A15)	-Food Safety Program developed and implemented at premises level in place requiring cleaning programs, temperature control, suitable packaging, auditing for compliance of Food Safety Programs by external third party auditors. Annual inspections at registration and at time of transfer of business by environmental health practitioners. Assessments and audits undertaken depending on the food safety program and the type of business in question. Product traceability for abalone in place	Moderately effective	Minor	Unlikely	**LOW**	-Targeting illegal catch (ref. A15)	Minor	Unlikely	**LOW**
A15	Retail and food service (ILLEGAL COMPONENT)	-Retail and food service outlets mixing legal and illegal products to reduce their costs. Illegal products do not have the consistency of quality control throughout the supply chain.	Abalone, urchins and periwinkles - Contamination of legally caught product from illegal product sources and // or direct sale of illegal product that is contaminated The illegal nature of this risk applies throughout the whole processing supply chain.	-Fisheries officers and regulations in place to identify illegal catching of product (through documentation checks as previously noted). Illegal product has no associated documentation. Discrepancy is mainly picked up through product weight. -Licensed operators will notify authorities if they suspect illegal fishing. -PrimeSafe licensees must show traceability and must keep records of how much they buy / sell. -Food safety issues would be raised by the Department of Health. DH would then seek traceability records. Investigations would be carried out.	Limited effectiveness	Moderate	Unlikely	**MEDIUM** *(driven equally by people, public admin and economic conseqs)*	-Establish more fisheries offices to monitor fishing operations; -Educate councils more about their role in regulating restaurants. It is highlighted that regulation of restaurants in this field is deficient (and not working). -Investigate the options for targeted programs to address illegal catch (maybe through multiple departments with PrimeSafe leading) -Potentially implement a health incident plan in order to have transparency about real actions that need to be taken if an incident occurs. -Extend traceability through to retail in a way that does not inhibit the market -Investigate the business for tagging abalone (or similar program) Targeting illegal industry would enhance legal industry	Moderate	Unlikely	**MEDIUM** *(driven equally by people, public admin and economic conseqs)*

Finfish & Cephalopods Risk Register

Risk ID	Supply Chain Sector	Cause	Risk	Current Controls	Controls Effect'ess	Current Consequence	Current Likelihood	Current Risk Assessment	Suggested Treatments	Residual Consequence	Residual Likelihood	Residual Risk Assessment
F1	Production - pre-harvest	Bacterial, viral contamination by sewage, agricultural run-off or eutrophication.	Finfish (Aquaculture only) - Contamination (e.g. Enteric pathogens (Bacteria and viruses) in growing waters due to human activity	-Aquaculture: Rivers are monitored by CMAs / EPA for contaminants. If algal bloom detected, Dept of Health will enact bans if contamination detected. One instance where this happened (hot stagnant water).	Very effective	Minor	Rare	**LOW**	-No further treatments identified	Minor	Rare	**LOW**
F2	Production - pre-harvest	Biotoxic contamination by toxic phytoplankton	Finfish (Estuarine and aquaculture finfish only) - Contamination by biotoxins	-Wildcatch: Historically fishermen know not to fish in certain areas (e.g. parts of Werribee) and avoid these. Fisheries / EPA monitor water for algal levels, passed to Dept of Health if levels are high and advisories are put in place if contamination detected. This can happen fairly frequently. Sometimes fishing stopped based on smell of fish (historical).. Introduction of temporary ban on fish harvesting until the bloom has passed through the system. -Aquaculture: Rivers are monitored by CMAs / EPA for contaminants. If algal bloom detected, Dept of Health will enact bans if contamination detected. One instance where this happened ('hot' stagnant water). Introduction of temporary ban on system until the bloom has passed through the system. If biotoxins are present in finfish, there is the opportunity to salvage product (cf. bacterial contamination as in the risk above) **Sensory checking of fish (sight, smell, touch) along the supply chain for freshness is still a key control (applies throughout seafood industry)**	Very effective	Major	Unlikely	**HIGH** *(driven by economic impact)*	Whilst current controls are very effective, they could be made more flexible and more coordinated by adopting the following treatments: -From a Gippsland Lakes viewpoint, ensure that adequate resources can be deployed when toxic algal blooms occur for testing, monitoring, and management of incident (historically, resources have not always been available). - Adopt a comprehensive algal bloom incident management plan, which includes an appropriate cost sharing arrangement including recreational and commercial industry and government -Further research (support current research underway) is required in managing and predicting algal blooms (there are a lot of information safety gaps regarding the risk to human health from algal blooms)	Major	Unlikely	**HIGH** *(driven by economic impact)*
F3	Production - pre-harvest	Heavy metal contamination by natural or industrial sources.	Finfish - Contamination by accumulation of heavy metals	EPA monitors heavy metal presence. -Wildcatch: Control above -Aquaculture: Testing of feed for heavy metals and PCBs, and also testing of contaminants that come through the environment	Very effective	Minor	Rare	**LOW**	-No further treatments identified	Minor	Rare	**LOW**
F4	Production - pre-harvest	Chemical contamination by sewage, industrial or agricultural sources.	Finfish (Estuarine and Aquaculture)- Contamination by agricultural and industrial chemicals	EPA monitors water quality for contaminants. If contaminants detected, Health Dept would notify PrimeSafe. Once notified, PrimeSafe would direct fishermen not to harvest in relevant area. Any contaminated product would be traced. -Wildcatch: EPA licencing/ hazard plans for industrial facilities to control the discharge of potential contamination. Regular monitoring of water by government (?). -Aquaculture: EPA licencing/ hazard plans for industrial facilities to control the discharge of potential contamination. NPVA registration of chemicals used in aquaculture (regulated and prescribed use of chemicals)	Very effective	Minor	Rare	**LOW**	-No additional treatments identified	Minor	Rare	**LOW**

Risk ID	Supply Chain Sector	Cause	Risk	Current Controls	Controls Effect'ess	Current Consequence	Current Likelihood	Current Risk Assessment	Suggested Treatments	Residual Consequence	Residual Likelihood	Residual Risk Assessment
F5	Production - harvest	Bacterial, viral, chemical or physical contamination during harvest	Contamination from workers, machinery or water sources (including ice)	-Wildcatch: Tested water quality for production of ice. If water comes from known clean source (e.g., MW), then no testing is required. For the majority of ocean catch, the fish is immediately washed with seawater, and then stored below deck in either iced bins or in refrigerated brine systems. Traceability of fish caught through regional locations. Fish is maintained in this way until they return to Port to offload to processor. Estuarine fisheries manage harvest between either: 1) Live seafood returning with live catch to base immediately, or 2) Store fish in ice slurries on board prior to returning to processor. The fishers that utilise the Ice slurry storage may take a 24 hour period before they offload at processor location PPE used (e.g. gloves) for hygiene and fish welfare reasons. Wildcatch code of conduct in place (for VIC Bays and inlets) Water (used for the production of ice) is tested and ice samples are also tested for any contaminants / bacteria. All surfaces and utensils coming into contact with fish are kept clean. -Aquaculture: Tested water quality for production of ice. If water comes from known clean source (e.g., MW), then no testing is required. Traceability of product has historically been important (for the last 15 years), and continues to be important. It is a key criteria in retail. All parts of the seafood logistics chain have a recall protocol, and traceability is part of this recall protocol). THIS APPLIES TO ALL SEAFOOD	Very effective	Minor	Rare	**LOW**	-Strengthen and expand the VIC code of conduct to all sectors in VIC (as not all licensed holders are members)	Minor	Rare	**LOW**
F5B	Processing - On-board gutting	Contamination of fish through histamine production in the fish	Finfish - Histamine production in the fish due to metabolic processes	-Vessels following Food Safety Programs. Normal operations on board vessels control the process to manage histamine levels, as this is in the commercial interest of fishermen to follow these operations to ensure optimal return and maintain a good reputation. These controls are very closely linked to the quality of the product sold. Fisheries control of sharks that have to be trunked. Washing done in seawater. Processing is done straight away. The best way to keep histamine at a minimum is to ensure proper temperature control.	Very effective	Minor	Rare	**LOW**	-No additional treatments identified. Histamine is not destroyed by cooking	Minor	Rare	**LOW**
F6	Processing	Employee with poor health and / or poor hygiene working in processing area NON-READY TO EAT	Finfish (Shore-based or aquaculture farms)- Microbiological contamination of 'non - ready to eat' finfish, food-packaging materials, and food-contact surfaces from employees	-Not Ready to Eat (e.g. raw trout): Food Safety Program developed and implemented at premises level in place that requires food handling and personal hygiene rules and exclude persons with poor health from any operations that may be expected to result in such contamination until the condition is corrected. Auditing for compliance of Food Safety Programs by external auditors. Subsequent cooking of raw fish will kill off bacteria (education of consumers). This cooking process is why this risk is lower that the RTE risk below.	Very effective	Minor	Unlikely	**LOW**	-No additional treatments identified	Minor	Unlikely	**LOW**

Risk ID	Supply Chain Sector	Cause	Risk	Current Controls	Controls Effect'ess	Current Consequence	Current Likelihood	Current Risk Assessment	Suggested Treatments	Residual Consequence	Residual Likelihood	Residual Risk Assessment
F7	Processing	Employee with poor health and / or poor hygiene working in processing area READY TO EAT (Secondary processing: smoking, drying, pickling…)	Finfish (Shore-based or aquaculture farms) - Microbiological contamination of ready to eat finfish, food-packaging materials, and food-contact surfaces from employees	-Ready to Eat (e.g. smoked trout, smoked salmon, sushi): Food Safety Program developed and implemented at premises level in place that requires food handling and personal hygiene rules and exclude persons with poor health from any operations that may be expected to result in such contamination until the condition is corrected, auditing for compliance of Food Safety Programs by external auditors. Hard separation required between wet and ready to eat manufacturing areas; Listeria protocols required (e.g. employees working down the hygiene gradient - starting day in the ready to eat area; all equipment designated to certain areas) If a listeria test comes back positive, this is notified to the Dept of Health. WQA protocols in place and followed. Community awareness regarding raw fish being slightly higher risk (e.g. pregnant women not eating certain fish) FSANZ stds stipulate five tests, a certain number of tests have to be positive for a recall to be made.	Moderately effective	Major	Rare	**MEDIUM** *(driven by health impacts)*	-No additional treatments identified	Major	Rare	**MEDIUM** *(driven by health impacts)*
F8	Processing	Environmental contamination from premises and equipment NON-RTE	Finfish - Microbiological contamination of 'non - ready to eat' finfish from environmental sources (premises and equipment)	-Food Safety Program developed and implemented at premises level in place requiring cleaning programs, auditing for compliance of Food Safety Programs by external auditors. -Non-RTE product has a relatively short shelf life (under controlled conditions).	Very effective	Minor	Unlikely	**LOW**	-Perhaps check whether an equivalence can be reached between AQIS (DAg) requirements and PrimeSafe to avoid duplication (reduce / avoid duplication). Opportunities to reduce regulatory burden through reduction in duplication of processes. -PrimeSafe is not necessarily recognised by some customers as the appropriate certification. Improve clarity between HACCP recognition and PrimeSafe certification.	Minor	Unlikely	**LOW**
F9	Processing	Environmental contamination from premises and equipment READY TO EAT (Secondary processing: smoking, drying, pickling…)	Finfish - Microbiological contamination from ready to eat finfish from environmental sources (premises and equipment)	-Food Safety Program developed and implemented at premises level in place requiring cleaning programs, auditing for compliance of Food Safety Programs by external auditors.	Moderately effective	Moderate	Unlikely	**MEDIUM** *(driven by health impacts)*	-No additional treatments identified at meeting #2. Other discussions are required with these sectors	Moderate	Unlikely	**MEDIUM** *(driven by health impacts)*
F10	Transport	Exposure to microbiological pathogens and inadequate temperature control from transport process and vehicle.	Finfish - Microbiological contamination and growth during transport	-Annual vehicle inspections and requirements that only licensed vehicles are used. -Food Safety Program developed and implemented by transport operator, which requires regular cleaning and effective refrigeration. -Temperature control: additional use of ice on product in transport (in addition to refrigeration) -Temperature checks by finfish receivers as part of HACCP / Food Safety Programs	Very effective	Minor	Unlikely	**LOW**	-Ensure traceability of licensed product to validate that the license category is all that is required.	Minor	Unlikely	**LOW**
F12	Storage and packaging	Exposure to microbiological pathogens and inadequate temperature control during storage and packaging	Finfish - Microbiological contamination and growth during storage and packaging	-Food Safety Program developed and implemented at premises level in place requiring cleaning programs, temperature control, suitable packaging, auditing for compliance of Food Safety Programs by external auditors.	Very effective	Minor	Unlikely	**LOW**	No additional treatments identified	Minor	Unlikely	**LOW**
F13	Wholesale	Exposure to microbiological pathogens from poor handling (cross-contamination, health conditions, etc…) and inadequate	Finfish - Microbiological contamination and growth during wholesale	-Food Safety Program developed and implemented at premises level in place requiring cleaning programs, temperature control, suitable packaging and including staff inductions and training, and auditing for compliance of Food Safety Programs by external auditors.	Very effective	Minor	Unlikely	**LOW**	-Management of imported (foreign and domestic) product into VIC by using appropriately licensed businesses.	Minor	Unlikely	**LOW**

Risk ID	Supply Chain Sector	Cause	Risk	Current Controls	Controls Effect'ess	Current Consequence	Current Likelihood	Current Risk Assessment	Suggested Treatments	Residual Consequence	Residual Likelihood	Residual Risk Assessment
		temperature control										
F14	Retail	Exposure to microbiological pathogens from poor handling (cross-contamination, health conditions, etc…) and inadequate temperature control	Finfish - Microbiological contamination and growth during retailing (seafood retailers)	-Food Safety Program developed and implemented at premises level in place requiring cleaning programs, temperature control, suitable packaging, auditing for compliance of Food Safety Programs by external auditors.	Moderately effective	Minor	Unlikely	**LOW**	-Investigate the existing standards of Council regulated retailers to identify equivalence with PrimeSafe Standards -Apply the best standards available (including cost-effectiveness consideration) (PrimeSafe or Councils) across all levels of the retail supply chain selling seafood	Minor	Unlikely	**LOW**
F15	Food service	Exposure to microbiological pathogens from poor handling (cross-contamination, health conditions, etc…) and inadequate temperature control	Finfish - Microbiological contamination and growth during food service (e.g. restaurants)	-Food Safety Program developed and implemented at premises level in place requiring cleaning programs, temperature control, suitable packaging, auditing for compliance of Food Safety Programs by external auditors.	Very effective	Minor	Unlikely	**LOW**	-Investigate the existing standards of Council regulated food service businesses to identify equivalence with PrimeSafe Standards -Apply the best standards available (including cost-effectiveness consideration) (PrimeSafe or Councils) across all levels of the food service supply chain selling seafood Treatments above should be carefully weighed with regards to additional imposts / costs added to food service businesses, potentially detracting them from purchasing local products	Minor	Unlikely	**LOW**

Crustaceans (rock lobster, prawns, yabbies) Risk Register

Risk ID	Supply Chain Sector	Cause	Risk	Current Controls	Controls Effect'ess	Current Consequence	Current Likelihood	Current Risk Assessment	Suggested Treatments	Residual Consequence	Residual Likelihood	Residual Risk Assessment
C1	Production - pre-harvest	Bacterial, viral contamination by sewage, agricultural run-off or eutrophication.	Crustaceans - Contamination (e.g. Enteric pathogens (Bacteria and viruses) in growing waters due to human activity or animal activity (e.g. agricultural run-off from dams)	-Wildcatch (Rocklobster / prawns): N/A (run-off is not local to Rock lobster or prawns) -Aquaculture (Yabbies) - If the area is subject to industrial / agricultural run-off, then controls: site selection (e.g. no septic overflow seepage into dams, minimise chemical spray drift, no problems with livestock depositing fresh manure directly into dams). Specific management of spray-drift comes under the jurisdiction of DEPI (managed under ChemSafe).	Very effective	Minor	Unlikely	**LOW**	Industry and government guidance for new entrants to the yabbie industry re: site selection, guidance documents	Minor	Unlikely	**LOW**
C2	Production - pre-harvest	Biotoxic contamination by toxic phytoplankton / BGA	Crustaceans - Contamination by biotoxins	-Wildcatch : Department of Health monitoring and control of fishing if biotoxins detected. Industry relies on government and scientists when it can start fishing in an area again. Completely out of the control of the Operator -Aquaculture (Yabbies): Ability by Operator and Operator experience to recognise that there is a toxic bacteria (algae) issue. If a toxic algal bloom is suspected, then closure of relevant pond if necessary (if there is any doubt) due to cyano bacteria	Very effective	Moderate	Almost Certain to Likely	**HIGH** *(driven by economic impacts)*	-Production of educational materials for the aquaculture industry re: identifying problem blooms (DH/DEPI) -Work with SRL to develop and implement emergency response protocols/procedures associated with algae blooms.	Moderate	Almost Certain to Likely	**HIGH** *(driven by economic impacts)*
C3	Production - pre-harvest	Heavy metal contamination by natural or industrial sources.	Crustaceans - Contamination by accumulation of heavy metals	''-Wildcatch (Rocklobster / prawns): N/A (run-off is not local to Rock lobster or prawns). -Aquaculture (yabbies): Uniform approach - DPI education protocol for clean green yabbies specifying conditions for elevated risk of heavy metals. (new tool to assist the production of clean green yabbies, 2004 Gus Fabris)	Very effective	Minor	Rare	**LOW**	-Production of educational materials for the seafood industry (aquaculture industry) re: identifying problem blooms (DH/DEPI)	Minor	Rare	**LOW**
C4	Production - pre-harvest	Chemical contamination by sewage, industrial or agricultural sources.	Crustaceans - Contamination by agricultural and industrial chemicals	-Wildcatch (Rocklobster / prawns): N/A (run-off is not local to Rock lobster or prawns) -Aquaculture (Yabbies) - If the area is subject to industrial / agricultural run-off, then controls: site selection (e.g. no septic overflow seepage into dams, minimise chemical spray drift. -if required notify crop spraying operators in the area of the presence of Yabbie growers. Specific management of spray-drift comes under the jurisdiction of DEPI (managed under ChemSafe).	Very effective	Minor	Unlikely	**LOW**	-No further treatments identified -where applicable publicise the spraying notification process to industry -Recommended that in the future, for any new yabby growers, the government would need to inspect their property to ensure that the site is suitable for production.	Minor	Unlikely	**LOW**
C5	Production - harvest	Bacterial, viral, chemical or physical contamination during harvest	Contamination from workers, machinery or water sources	-Wildcatch (Rocklobster): Minimal handling, no contamination items on deck, detergents kept away from working conditions, maintenance of a safe area. Visual check of every lobster before going into the well and subsequent removal of defective (e.g. legs missing) catch. Clean green program, checklist of items in a clean green program, PrimeSafe inspection every 2 years (and completion of PrimeSafe Food Safety Program book). Record of every catch in a fisheries book. As soon as lobsters have left the well, a bag is placed in a perforated dark and moist packing crate with a bag placed on top to keep dark to reduce stress on the animal, & keep moist. SRL Clean and Green Program -Wildcatch (prawns): use of gloves, sorting of prawns (to take out other types of non-commercial species), icing of	Very effective	Minor	Unlikely	**LOW**	-Rock Lobster - investigate equivalence and accreditation of Clean Green QA program with PrimeSafe requirements -Gill washing not a food safety issue -Controls not consistent for all operators	Minor	Unlikely	**LOW**

Risk ID	Supply Chain Sector	Cause	Risk	Current Controls	Controls Effect'ess	Current Consequence	Current Likelihood	Current Risk Assessment	Suggested Treatments	Residual Consequence	Residual Likelihood	Residual Risk Assessment
				prawns or cooking of prawns. Prawns are frequently cooked on board, then cooled and then iced. Time from catch to icing at processor into cool room is fairly short. Bugs are treated in the same way as prawns. -Aquaculture (yabbies): Govt controls: gill washing purging, yabbies required to be kept in cool moist environment. Primesafe Guidelines for safe washing, storage and purging of Yabbies Industry controls: Minimise handling . Removal of dead yabbies. One operator is able to store Yabbies in the water they came from in dams designated for human consumption. other operators have alternative requirements. Normal procedures include removal of 'waste' products (e.g. bait, grasses, string) from the yabbies during harvest.							
C6	Processing	Employee with poor health and / or poor hygiene working in processing area	Crustaceans - Microbiological contamination of food, food-packaging materials, and food-contact surfaces from employees	-Food Safety Program developed and implemented at premises level in place that requires food handling and personal hygiene rules and exclude persons with poor health from any operations that may be expected to result in such contamination until the condition is corrected, auditing for compliance of Food Safety Programs by external auditors. There is very limited processing of Crustaceans in VIC (all sold in original form - whole) as this is cost prohibitive, and traditionally, they are sold unprocessed.	Very effective	Minor	Rare	**LOW**	No further treatment identified	Minor	Unlikely	**LOW**
C7	Processing	Environmental contamination from premises and equipment	Crustaceans - Microbiological contamination from environmental sources (premises and equipment)	-Food Safety Program developed and implemented at premises level in place requiring cleaning programs, auditing for compliance of Food Safety Programs by external auditors.	Very effective	Minor	Unlikely	**LOW**	No further treatment identified	Minor	Unlikely	**LOW**
C8	Transport	Exposure to microbiological pathogens and inadequate temperature control from transport process and vehicle.	Crustaceans - Microbiological contamination and growth during transport	-Rocklobster: Coop or buyer would normally be responsible for transport. Normally transported in a refrigerated truck. Truck is dry, bag placed over containers, sent to coop, and then graded into categories. -Yabbies: Keep live yabbies cold and moist in a clean sealed container. Various growers use different methods to achieve this -Prawns: Similar controls to finfish. Some slightly different controls between live and cooked prawns. For a live prawn, need to keep cool to keep live, but cooked prawns need to be kept below 5 degC. -Annual vehicle inspections and requirements that only licensed vehicles are used for a product that is not live. -Food Safety Program developed and implemented by transport operator, which requires regular cleaning and effective refrigeration.	Very effective	Minor	Unlikely	**LOW**	-Rock Lobster: no additional transport treatment needed -Yabbies: no additional treatments required	Minor	Unlikely	**LOW**

Risk ID	Supply Chain Sector	Cause	Risk	Current Controls	Controls Effect'ess	Current Consequence	Current Likelihood	Current Risk Assessment	Suggested Treatments	Residual Consequence	Residual Likelihood	Residual Risk Assessment
C9	Post Harvest - Storage and packaging	Exposure to microbiological pathogens and inadequate temperature control during storage packaging	Crustaceans - Microbiological contamination and growth during storage and packaging	-Yabbies: for live yabbies keep cold and moist. For example one approach for packing / distributing yabbies is in an ice slurry (clients are taking yabbies in an ice slurry). Most accepted practice for killing yabbies is to drop temperature of yabby (ice or ice slurry). Yabbies are deemed best stored in the original dam, once they have been checked for health and size. Select the best to ensure a premium price. Packing should be undertaken in a clean area. Monitoring of yabbies if yabbies are stored in sheds. Should a shed be used, it should be clean. Foreign contaminants should be removed during packing Yabbies raw and cooked: stored and transported at less than 5 degC -Rocklobster: Lobsters are killed in an ice slurry, then boiled. -Food Safety Program developed and implemented at premises level in place requiring cleaning programs, temperature control, suitable packaging, auditing for compliance of Food Safety Programs by external auditors.	Very effective	Minor	Unlikely	**LOW**	Rock Lobster - no additional treatments Possible educational material, see above for the whole supply chain	Minor	Unlikely	**LOW**
C10	Wholesale, retail and food service	Exposure to microbiological pathogens from poor handling (cross-contamination, health conditions, etc…) and inadequate temperature control	Crustaceans - Microbiological contamination and growth during wholesale, retailing and food service	-Food Safety Program developed and implemented at premises level in place requiring cleaning programs, temperature control, suitable packaging, auditing for compliance of Food Safety Programs by external auditors.	Very effective	Minor	Unlikely	**LOW**	Rock Lobster no additional treatments Yabbies no additional treatments	Minor	Unlikely	**LOW**
C11	Processing - On-board vessel cooking and cooling (prawns and crays)	Inadequate temperature control	Crustaceans - Opportunity for outgrowth of bacterial pathogens in Crustaceans during on-board processing due to inadequate temperature control	-Applicable to prawns and crays: Food Safety Programs (temp control, cleanliness) -Wildcatch (prawns): use of gloves, sorting of prawns (to take out other types of non-commercial species), icing of prawns or cooking of prawns. Prawns are frequently cooked on board, then cooled and then iced. Time from catch to icing at processor into cool room is fairly short. Bugs are treated in the same way as prawns.	Very effective	Minor	Rare	**LOW**		Minor	Rare	**LOW**
C11A	Processing - On-board vessel cooking and cooling (prawns only)	Biotoxic contamination during cooking	Crustaceans - Opportunity for algal toxin to spread during on-board cooking	-Regular (daily) changing of cooking water -Cooking water is sourced from a potable supply	Very effective	Minor	Rare	**LOW**	Regular changing of cooking water should be checked as a common practice to validate as a potential control / treatment	Minor	Rare	**LOW**
C12	Processing - Fixed premises cooking and cooling (prawns and crays)	Contamination during cooking	Crustaceans - Opportunity for outgrowth of bacterial pathogens in Crustaceans during processing due to inadequate temperature control	Applicable to rock lobster and prawn cooking. Food Safety Programs (temp control, cleanliness)	Very effective	Minor	Rare	**LOW**		Minor	Rare	**LOW**

Appendix D Documents Referenced

Document Title	Document Description
Inquiry into the Impact of Food Regulation on Farms and Other Businesses – Victorian Government Response, Sept 2013	A response from Government in response to the 16 recommendations from the inquiry into food safety regulation on farm and other businesses.
Department of Health Validation of economic Modelling Tool: Economic impacts of Foodborne illness in Victoria, PWC	Indicative costs of food borne illnesses (input into the consequence criteria used in this project)
Identification and Characterisation of food-borne hazards in the Australian seafood industry; John Sumner	Background information on the food born hazards (used as an input into the pre-population of the risk register)
Standard 4.2.1 – Primary Production and Processing Standard for Seafood	Standard detailing the key obligations to manage seafood safety from pre-harvest production up to (but not including) manufacturing operations.
A Risk Ranking of Seafood in Australia (February 2005) - FSANZ	Risk ranking providing a scientific basis for the development of a Primary Production and Processing Standard for seafood.
The annual cost of foodborne illness in Australia, Australian Government Department of Health and Ageing, March 2006	Report on the Annual costs of foodborne illness in Australia
Foodsafe Plus Food Safety Program Initiative – WA Rocklobster report	Process description and hazard assessment of rocklobster fishing in WA
Department of Agriculture (ABARES), Online seafood production figures, 2011-12 for Aquaculture and wildcaught seafood	Production and $ Value figures for Victoria seafood industry
Listeria risk assessment & risk management strategy; FSANZ Proposal P239, published November 2002	Document presenting a detailed analysis of the risk of Listeria for smoked finfish
Seafood and foodborne illness –outbreak summary from OzFoodNet reports	Listing of foodborne illnesses Australia wide

Other communications received with specific attached supporting information:

- Letter dated 6th December from Dale Sumner (Lefcol / Lakes Entrance Fishermans Coop) providing further information on the food safety risk of wildcatch;
- Statement - In relation to PrimeSafe's requirements for Domo's Yabbies licence and Food Safety Program by Jeremy Draper, 19 February 2013;
- Independent submission dated 22nd November 2013, 22.11.13, Domo's Cultured Yabbies, detailing the company's food safety risk view of yabbies;
- Background information regarding the risk assessment and current controls for sea urchins: Eastern Victorian Sea Urchin Divers Association Inc. (EVSUDA), sent 8th December 2013
- Abalone docket template provided as evidence by Glenn Plummer

Appendix E Raw Risk Assessment Data

Seafood Category	Impact / Descriptor	Likelihood (%)	People	Economy	Public Administration
Bivalve Molluscs	*Low - Staphylococcus*	17	4	2	2
	Medium - Salmonella	5	20	40	3
	High – Toxic Algae	1	600	800	70
Abalone, Sea Urchins & Periwinkles	*Low – Toxic Algae*	2	1	5	1
Crustaceans	*Rocklobster – Toxic Algae*	2	2	60	5
Finfish & Cephalopods	*Toxic Algal Bloom*	20	8	200	50
	Listeria (smoked finfish)	2	200	30	80