Environmental Management System Framework

Tasmanian Salmonid Industry

FRDC Project 2004/096

Environmental Management System Framework

Instruction for Template Use

PhycoTec
Environmental Management

Tasmanian Salmonid Growers

Tasmania

Australian Government
Fisheries Research and Development Corporation

FRDC Project 2004/096

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Environmental Management System

Instruction for Template Use

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Contents

The Environmental Management System Framework: Compliance Guide and Risk Assessment of Ecologically Sustainable Development for the Tasmanian Salmonid Industry is a living document subject to periodic review to capture regulatory changes and Industry's adaptive management.

This document is uncontrolled, and therefore freely available to industry representatives, regulatory authorities and other stakeholders as requested.

Introduction

The Environmental Management System (EMS) Framework for the Tasmanian Aquaculture Industry is part of a national initiative to assist the seafood sector in the uptake of Environmental Management Systems. The project has been funded by the Tasmanian Salmonid Growers Association (TSGA), the Tasmanian Fishing Industry Council (TFIC), Department of Primary Industries and Water (DPIW), Tasmania, and the Fisheries Research and Development Corporation (FRDC) as Project 2004/096.

The EMS Framework Templates link the Ecologically Sustainable Development (ESD) compliance documents based on the National *ESD Framework 'How To' Guide for Aquaculture, Version 1.1* (Fletcher et al. 2004) and EMS. The templates have been developed and specifically tailored to the salmonid industry. However, it is recognised that the larger Industry businesses may need to adopt a more comprehensive management system to correspond with their staffing and production levels. It is envisioned that by adopting the EMS in Industry facilities, cost savings will occur through the efficient use of resources, streamlined processes and access to information and will be data useful for improving future farm management practices.

The aim of the EMS Templates is to assist the Tasmanian salmonid industry in its move towards environmental sustainability. The templates provide the basis for the implementation of a systematic approach to environmental management. Within this framework are suggested possible actions and performance criteria for the EMS. These actions and performance criteria may give direction to how compliance with the law may be achieved; however they should not be read as a substitution for current amended law.

The EMS Templates take into account the processes developed by Seafood Services Australia (SSA) in the "Take your pick! – The Seafood EMS Chooser" (referred to as the Green Chooser) that is recommended as background reading prior to implementation of your EMS. Reference to the relevant parts of the Green Chooser is made in the introduction to each template.

Regular updating of the information in the document will take place. While the views in this document reflect the general views of the Industry, it should not be taken as the view of any individual in Industry or the Steering Committee for the project.

References.

ISO 14001:2004. Australian/New Zealand Standard. Environmental management systems – Requirements with guidance for use. Standards Australia 23pp.

SSA (2005) Take your pick! – The Seafood EMS Chooser, 2nd edition. Seafood Services Australia Ltd, Qld. Available on www.seafoodservices.com.au

Fletcher WJ, Cheeson J, Fisher M, Sainsbury KJ, Hundloe TJ (2004) National ESD Reporting Framework: The 'How To" Guide for Aquaculture. Version 1.1, FRDC, Canberra, Australia, 88pp.

Why do I Need an EMS?

The EMS aims to provide practical tools to enable marine farmers to:

- Improve work practices and reap the profits
- Reduce costs by avoiding fines and making the most of resources by
    - Avoiding environmental damage and clean-up costs
    - Reducing the amount of waste generated on the lease
    - Reducing consumption of resources
    - Increasing the usage of recycled materials
- Meet environmental requirements in Federal and State laws, and council by-laws
- Reduce insurance premiums
- Implement the relevant industry standards and protocols
- Encourage confidence in the community and clients by demonstrating an ability to prevent and respond to environmental accidents
- Formalize work practices to protect workers and the environment by making it easier for the staff to know, or quickly find out, what is expected
- Reduce the risk of damage to the environment
- Demonstrate self-regulation and retain access to the marine resource.

The Structure of the Template Documents

The EMS Templates consist of 3 parts:

Part 1: Working Form Templates - for identifying the risks and the developing the objectives and targets.

- Form SAL 100: Workplace Environmental Policy
- Form SAL 200: Environmental Hazard Identification Checklist
- Form SAL 300: Environmental Risk Assessment
- Form SAL 400: Environmental Objectives and Targets
- Form SAL 500: System Improvement Report
- Form SAL 600: Environmental Management Review

Part 2: Register Templates - to maintain your system.

- Form SAL 700: Environmental Monitoring
- Form SAL 800: Chemical Register
- Form SAL 900: Legal and Other register
- Form SAL 1000: Training Register

Part 3: Manual Templates - to document how your system works and the procedures that you use. (Note: This step, although recommended, may not be necessary for small operators with few staff and simple operations)

- Systems Manual -to consolidate your EMS into one document for audit.
- Procedures Manual – to record the procedures that you have developed to reduce your environmental impact.

Implementing an EMS

The steps to implementing an environmental management system always include a commitment, a risk assessment, monitoring of progress and a review of the system on a regular basis. This provides a cycle that allows adaptive management and demonstration of environmental improvements. You may have noticed that other EMS documents have different names on the cycle (e.g. The Green Chooser has eight steps). The steps in this system have been developed to be in a logical, easy to understand sequence and provide a simple useable and effective system.

The Essential Steps of an EMS

The major elements of an auditable EMS are included as templates in this document. There are 6 Working Form Templates, each with associated notes for use and reference to other documents. The use of this EMS will not necessarily provide the user with an ISO 14001 standard 3rd party auditable system, but will provide the basis that such a system can be based upon. It may be appropriate that consideration could be given to integrating this system into any existing system used in the management of the facility such as ISO 9001: Quality Assurance, HACCP or AS/NZS 4801: Occupation Health & Safety.

Step 1: Environmental Policy.

Commit

- Appoint a person to be responsible for the EMS
- Establish the scope of the EMS
- Develop a Workplace Environmental Policy

Covered by Template SAL100

Step 2: Process Planning.

Plan

- Develop a plan to implement the EMS
- Develop a plan to review the process

This is the outline of how the EMS will be developed and how to ensure that the EMS will continue to work in the future.
Documents like the "Green Chooser" may assist with this process

Step 3: Risk Assessment Process.

Assess

- Follow the risk assessment process to identify potential risks
- Determine current management controls and assess the need for further controls

This demonstrates that the facility/group have systematically identified the potential risks, along with the current management controls and quantified them accordingly.

Covered by Templates SAL200 & SAL300

Step 4: Setting Objectives and Targets

Develop

- Develop and document risks
- Set objectives and targets

A critical step in being able to continue onto steps 5 and 6. Will need to be feed back into the planning stage through review of the management system

Covered by Template SAL400

Step 5: System Improvement Reports and Registers

Monitor

- Manage environmental incidents
- Monitor performance

The reporting of environmental incidents or ways to improve you system is the critical part of your adaptive management strategy. The System Improvement Report (SIR) form will allow all members of the workplace to have input and ownership of environmental issues. The form ensures that the business is responding to all issues and demonstrates their adaptive management.

Covered by Template SAL500 plus Register Templates

Step 6: Review Process

Review & Report

- Demonstrate the performance of your EMS is by:
    - Re-evaluating the high risks
    - Comparing your monitoring data to recognise change
- Report to management
- Promote the outcomes to staff and clients

A management system requires a review process to be able to demonstrate continual improvement of the system. This also allows for adaptive management of your environmental impacts

Covered by Template SAL600

Step 1: Environmental Policy.

Commit

The most import part of the EMS is to ensure that there is a commitment of all people involved or affected by the EMS. Without this commitment, the likelihood of success is limited.

Management should:

- Endorse the Environmental Policy,
- Provide and supporting all the resources necessary for the business to effectively implement its environmental objectives and targets,
- Appoint a person responsible for implementing and maintaining the EMS,
- Delegate and recording each staff members responsibility towards the EMS,
- Ensure staff are equipped, capable, trained and appropriately supervised to be able to participate in the EMS process,
- Implement procedures that ensure good practice is achieved and maintained, particularly where it is identified that work habits, facilities, equipment, systems or training are deficient,
- Observe the common practice of employees and compare what people usually do against known good practices,
- Be prepared to inform themselves, staff, contractors about the requirements of the EMS and take appropriate action to reduce any potential risk to themselves, their staff, the public or the environment.

The policy should:

- Define your framework for meeting environmental responsibilities of your company/region,
- Express an overall objective to protect the environment,
- Demonstrate commitment to continual improvement or adaptive management,
- Outline your commitment to complying with relevant environmental legislation, regulations and guidelines and apply best practice standards.

Once established, your policy should be:

- Communicated to all staff so they understand the intentions of the policy and commit themselves to working in according to its objectives,
- Authorized by the most senior management members of the business(es) involved,
- On permanent display in clear view of clients, customers and staff,
- Freely available to anyone whom requests a copy.

Further information on policy development is provided in Steps 1, 2 and 4 of the Green Chooser.

Template SAL100_Policy is available on the accompanying CD-ROM in a word format for you to adapt to your specific requirements.

"Your Salmonid Company"

Replace with the name of your business or regional group

Delete this picture and add your company logo using Edit – Paste Special - Picture

TASMANIAN SALMONID GROWERS

(your logo)

WORKPLACE ENVIRONMENTAL POLICY

Edit text (in Word) as you feel fitting with your environmental objectives

It is the policy of this company that we manage all aspects of our opera environmentally responsible manner, appropriate to the nature and scale of our

Our aim is to ensure that our activities do not cause environmental pollution rse impacts on the environment, and that we operate under the pri ogically sustainable development.

Summary statement

We are committed to complying with the relevant environmental legislation program of continual improvement through adaptive management.

Commitment to continual improvement

The aims of this policy will be achieved by implementing an environmental mana system that will include:

- Planning of environmental aspects and impacts, legislative requirements, objectives and targets.
- Implementation and operation including specified responsibilities, appropriate training and awareness, communicated to all relevant parties and with appropriate document control.
- Monitoring and corrective action
- Structured management review
- Continual improvement through regular reviewing and revising of objectives and targets.

Objectives

Scope (or limits)

policy is applicable to the company and all its operations and functions either on marine leases or land based facilities.

Policy authorized by:…………………………………… Date:………

(Managing Director)

Date of review:……….

Ensure that it is signed by the most senior management person(s). Adapt where necessary

Both date of signing and date of review should be provided to demonstrate commitment to review.

Plan

Step 2: Process Planning.

1. Appoint an Environmental Representative.

The Environmental Representative must become familiar with all the procedures in the EMS. It is important that the representative has the resources and authority to organize, implement and maintain the EMS.

The responsibilities of the Environmental Representative are:

- Familiarize themselves with the requirements of the environmental management system and the ESD compliance document, and attend relevant training where necessary.
- Seek information and professional advice and assistance to maintain the environmental management system
- Lead the business through the EMS process
- Liaise with regulators, authorities or non-governmental organisations about environmental issues where necessary,
- Develop, authorize and maintain documents and records of the EMS to ensure that they are always relevant and properly controlled,
- Coordinate the process of adaptive management of the EMS over time
- Plan and conduct site reviews, environmental audits and environmental management review meetings,
- Report to senior management about the EMS

2. Develop an EMS Implementation Plan.

-Review the Environmental Policy

- What are the stated Objectives
- Identify the Scope

-Seek advice about the risk assessment process

- Who will be involved
- When will it take place

-Develop a plan to review the process

- How often will you meet to discuss the EMS
- How often will you review the EMS

At this stage you may like to assess the Systems Manual for suitability to your Company. The Systems manual is provided in an easily adaptable word format. See Systems Management Manual on the accompanying CD-ROM

Assess

Step 3: Risk Assessment Process.

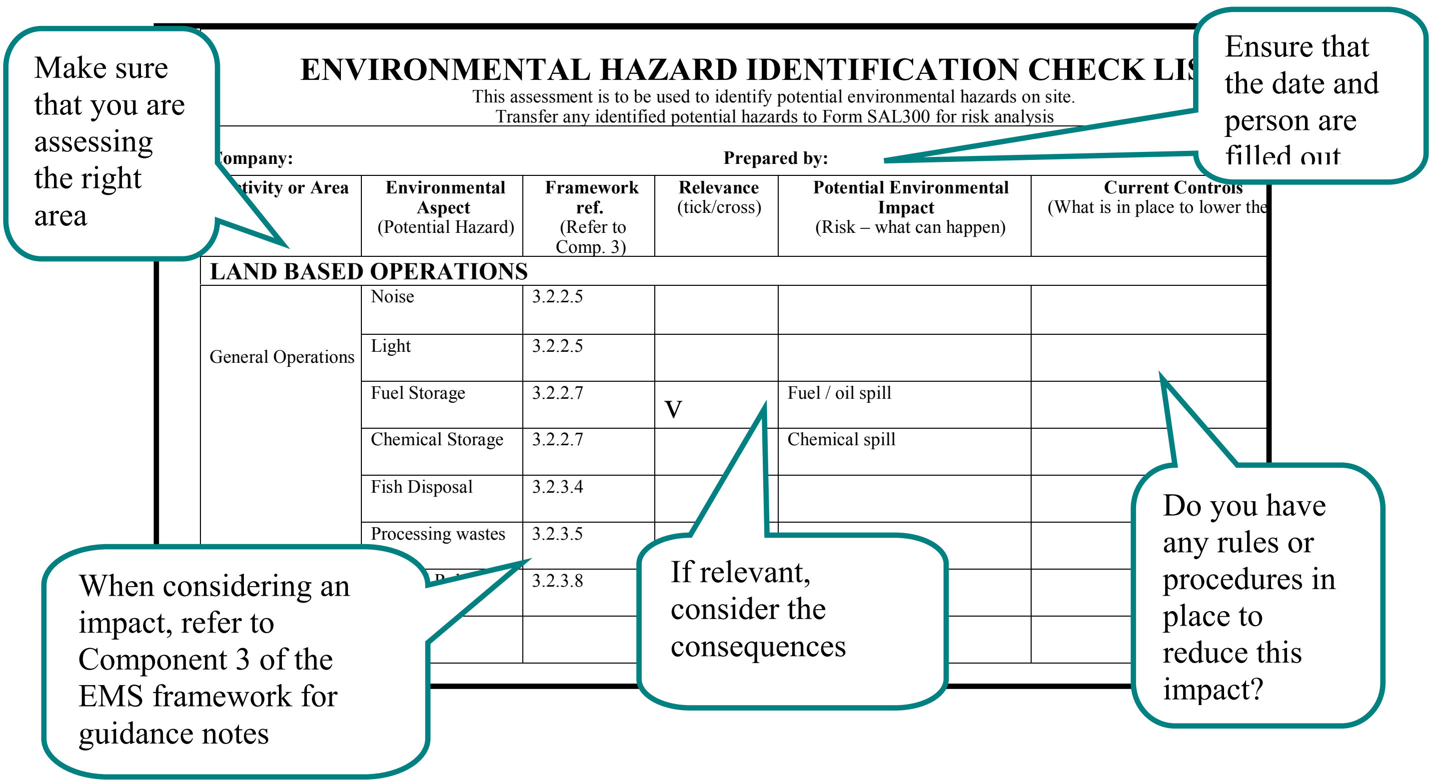
Template SAL200 is a checklist of any potential environmental impacts that may occur around your land based facility or on the marine lease. To complete the checklist you will need to refer to Component 3 of the ESD compliance document that deals with environmental impacts at a facility level.

Component 3 provides you with the possible impacts, plus the potential threat. It also gives suggested control measures that may assist in you reducing your impact if apparent.

When you initially run through the list on Template SAL200, you should consider the potential impacts of your operation as if there were no controls. Then list the control measures (rules, protocols etc.) that you already have in place. This allows you to take into consideration these controls in the risk assessment. You will be surprised at the number of impacts that become low risk solely due to the management controls that you already have in place but do not automatically think about.

The benefit of this method is to give you a list of all the controls you use that have a positive impact in reducing your environmental risk. You can use this information to demonstrate that you are already promoting good environmental practice.

Where impacts are identified, they should be transferred to Template SAL300 for the risk assessment.



ENVIRONMENTAL HAZARD IDENTIFICATION CHECK LIS

This assessment is to be used to identify potential environmental hazards on site.
Transfer any identified potential hazards to Form SAL300 for risk analysis

ompany: Prepared by:

tivity or Area	Environmental Aspect (Potential Hazard)	Framework ref. (Refer to Comp. 3)	Relevance (tick/cross)	Potential Environmental Impact (Risk – what can happen)	Current Controls (What is in place to lower the
LAND BASED OPERATIONS					
General Operations	Noise	3.2.2.5			
	Light	3.2.2.5			
	Fuel Storage	3.2.2.7	V	Fuel / oil spill	
	Chemical Storage	3.2.2.7		Chemical spill	
	Fish Disposal	3.2.3.4			
	Processing wastes	3.2.3.5			
	P	3.2.3.8			

The risk assessment process is described in detail in the introduction chapter of the ESD Compliance Document with extra risk tables provided in Appendix 1.0

When conducting the risk assessment, you need to be honest when considering the consequence. A high or extreme consequence does not necessarily mean a high risk. The consequence is the potential impact upon the environment.

Consequence

The consequence of an issue is the effect or outcome a particular issue will have. Consequence relates to the importance of an issue.

Consequence table for the general environment.

Consequence	Score	Definition
Negligible	**0**	Very insignificant impacts. Unlikely to be measurable at the scale of the stock/ecosystem/community against natural background variability
Minor	**1**	Possibly detectable but minimal impact on structure/function or dynamics
Moderate	**2**	Maximum acceptable level of impact – recovery measurable in months or years
Severe	**3**	This level will result in wider and longer term impacts – recovery measurable in years
Major	**4**	Very serious impacts with relatively long time frame likely to be needed to restore to an acceptable level – recovery measurable in decades
Catastrophic	**5**	Widespread and permanent irreversible damage or loss will occur – unlikely to ever recover (eg causing extinctions)

The likelihood of occurrence may or may not take into account the frequency of an event.

Likelihood

The likelihood is the conditional probability of an event occurring. It relates directly to the impact of the event, not the activity surrounding the event.

Likelihood table

Likelihood	Score	Definition	Indicative frequency
Remote	**1**	Never heard of, but not impossible.	One in 1,000 years
Rare	**2**	May occur in exceptional circumstances.	Once every 100 years
Unlikely	**3**	Uncommon, but has been known to occur	Once every 30 years
Possible	**4**	Some evidence to suggest this may possibly occur	Once every 10 years
Occasional	**5**	May occur	Once every 3 years
Likely	**6**	It is expected to occur	Once a year or more

In some circumstances, only the definition may be relevant

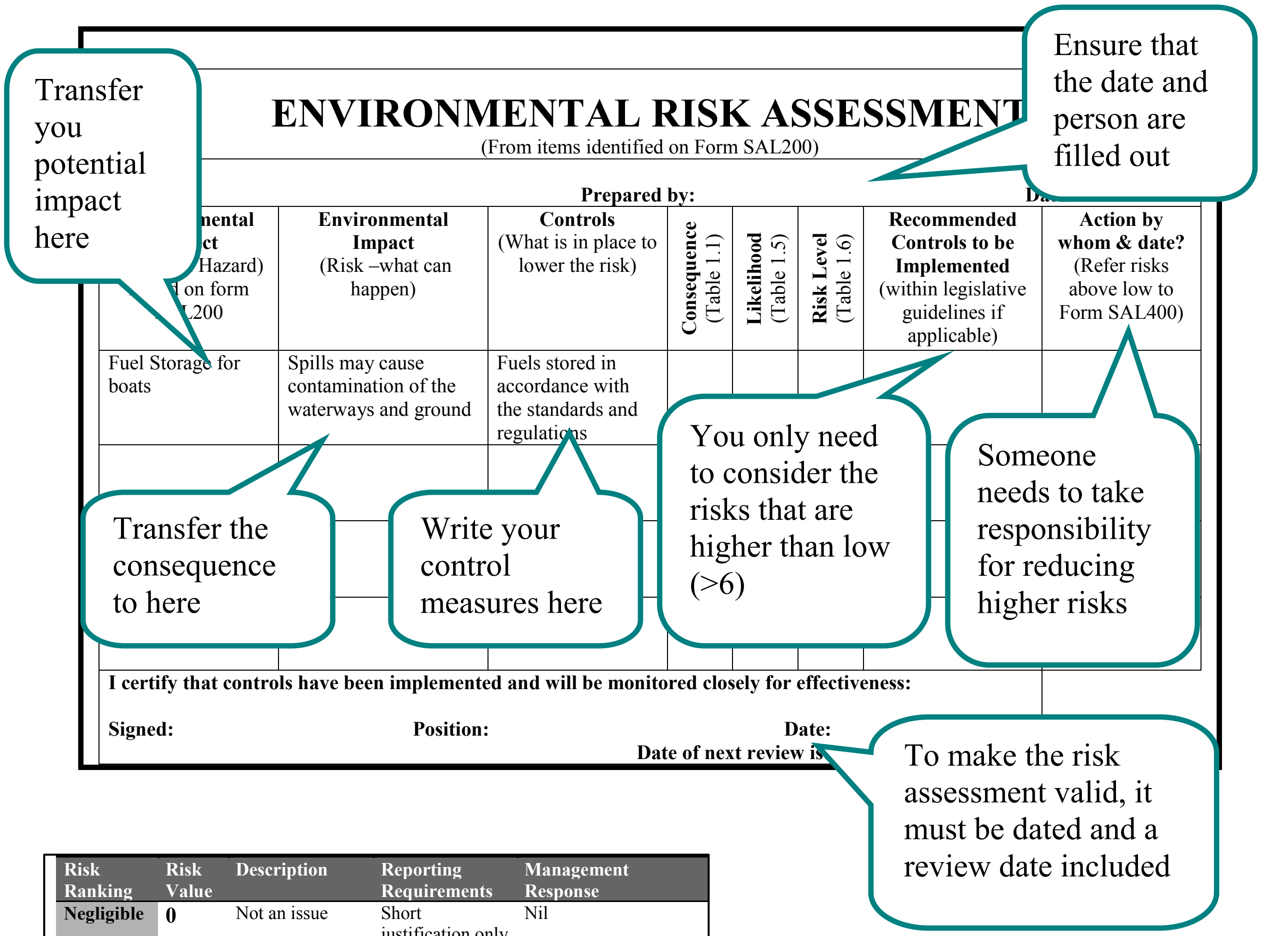
The likelihood multiplied by the consequence gives the risk value. A risk less than 6 is considered as low and requires no further action.

Risk matrix – numbers in cells indicate risk value, the shade indicates risk ranking

		Consequence					
Likelihood		**Negligible**	**Minor**	**Moderate**	**Severe**	**Major**	**Catastrophic**
Remote	**1**	0	1	2	3	4	5
Rare	**2**	0	2	4	6	8	10
Unlikely	**3**	0	3	6	9	12	15
Possible	**4**	0	4	8	12	16	20
Occasional	**5**	0	5	10	15	20	25
Likely	**6**	0	6	12	18	24	30

The risks valued within the green lines require action

For more examples of risk assessments, refer to the ESD Compliance document and examine how the risks were determined on an Industry wide basis. Keep in mind that your impacts will be more localized and therefore the risk may be greater,



Risk Ranking	Risk Value	Description	Reporting Requirements	Management Response
Negligible	**0**	Not an issue	Short justification only	Nil
Low	**1-6**	Acceptable – no specific control measures needed	Full justification needed	No specific action needed to achieve acceptable performance
Moderate	**8-12**	Specific management needed to maintain acceptable performance	Full performance report	Review current arrangements
High	**15-18**	Not desirable – continue strong management action. Further or new risk control measures may need to be introduced in the near future	Full performance report	Produ... current manageme... needed
Extreme	**>20**	Unacceptable – major changes required to management approach in near future	Full performance report	Substantial additional management controls needed.

The risk ranking and outcomes table will provide the level of risk that you are dealing with. Refer to Table 5 (page 11) of your ESD compliance document

Further information on risk assessment is provided in the Introduction chapter of the ESD compliance document and Step 3 of the Green Chooser.

Templates SAL200 and SAL300 are available on the accompanying CD-ROM in a word format for you to adapt to your specific requirements.

Step 4: Setting Objectives and Targets.

Develop

The objectives and targets are the critical part of your environmental management system. They demonstrate a plan to achieve better environmental outcomes and improve environmental performance.

Environmental Objective

An overall environmental goal that is consistent with your environmental policy, which you wish to achieve

An environmental objective can be descriptive, without placing a value on it, or it can be a desired target that defines numerically what you wish to achieve. For example, your environmental objective may be to increase the recycling of unused materials in your operation, where as the target may be reducing your waste output by 50% by recycling wastes. Targets are sometimes referred to as key performance indices (or KPI's).

Points to take into consideration when setting objectives and targets are:

- Be realistic. It is better to try for a small improvement and demonstrate that you can achieve this rather than put forward a large improvement that will set you up for failure in the short term. You can always increase your target at the next review if your progress is good.
- If you have records, look at you past performance before setting any targets.
- It is sometimes better to work with targets based on production units (e.g. waste per kg abalone produced) rather than % waste. The greater production may lead to greater % waste, even though recycling has increased.

For each objective you also need to consider the economic feasibility of the achieving outcome. By considering the following costs, you can determine the financial benefits of the objective.

Costs and/or savings from:

- Raw materials
- Packaging
- Energy and water
- Storage of product
- Labour
- Capital costs
- Training costs
- Productivity and production disruptions.

You will need to balance the environmental and social advantages against the cost of the change and/or the potential cost savings, and the time to recoup your outlay. You may outlay a sum of money initially, but this will be recouped through savings made by the change. This is referred to as the payback period.

Payback Period

Payback Period = $\dfrac{\text{Capital Investment and Production Costs}}{\text{Net Savings in Operating Costs (\$/year)}}$

Use the information from the risk assessment (Form SAL200) to assist in developing your objectives and targets. The higher the risk, the greater the priority should be for the objective. All environmental risks greater than 6 (Low) should be investigated to determine whether you can reduce these risks through better procedures, new controls, alternative technology or just making the staff aware of the problem. There may be other non-risk objectives such as annual clean ups that may also be included in this plan.

ENVIRONMENTAL OBJECTIVES AND TARGETS

(Items identified as above low risk on Form SAL300 and through staff meetings, to be reviewed at regular intervals)

Company: **Date:**
Prepared by: **Date of next review:**

No.	**Objective:** the overall long-term objectives (big picture) that you are aiming to achieve relating to the management of this impact. **LONG TERM**	**Target**: the short-term targets (specific and measurable) that will together make sure that you meet your long-term objectives. **SHORT TERM**	**Actions required or already undertaken:** the actions you are willing to commit to doing in your business to ensure that the short and long-term objectives and targets are met. This might include actions you have already done but still need to be maintained and monitored if they are to remain effective. **HOW YOU ARE GOING TO GET THERE**	**Responsible person** **WHO IS GOING TO DO IT**
1	Maintain and Review the Environmental Management System to ensure it up to date and effective.	Review the Workplace Environmental Policy (Form SAL100) and EMS requirements. Identify objectives, targets and assign responsibilities		
2				

The first objective relating to maintaining your EMS is already added. You will need to complete this section as determined from your Process Planning (Element 2).

It is important to delegate responsibility to a willing person

Further information on Objectives and target setting is provided in Step 5. Action Plan from the Green Chooser.

Template SAL400 is available on the accompanying CD-ROM in a word format for you to fill in.

Monitor

Step 5: System Improvement Reports and Registers

The Systems Improvement Report (or SIR) is the mechanism in which your staff can participate in and take ownership of the EMS. The SIR is a simple form in which any aspect of the business can be recorded at any time.

Many successful organisations use this type of form in their EMS and it is usually considered as one of the main communication pathways for a business.

The SIR is valuable to the whole business because it:

- Provides the manager with a record of what operational problems may be present on the farm
- Gives the staff an avenue to pass on important information to the management without confrontation
- Gives the manager a record of what needs to be done, who is responsible for doing it and when it is due for completion.
- Provides information for the EMS review to update objectives and targets
- May be used as a record to demonstrate the improved environmental performance of the company.

System Improvement Reports (SIRs)

The number of SIRs produced indicates how well system is working.
A lack of SIRs raised most likely indicates that staffs are not engaged in the EMS or communicating with management, NOT that your operation is clean and green.

The form is designed so that it can be used to record ANY problems from sprained ankles or stock mortalities, customer complaints to broken storm water pipes.

Other forms for monitoring are also provided in your EMS. These are included in the Part 2: Registers on the CD-ROM:

- Form SAL 700: Environmental Monitoring Records
- Form SAL 800: Chemical Register
- Form SAL 900: Legal and Other register
- Form SAL 1000: Training Register

SYSTEM IMPROVEMENT REPORT

Company…………………………………………. **Date:**…………………….

Submitted by: ………………………………………………….

These tick boxes can refer to any problem on the farm.

Issue

☐ Environmental ☐ OH&S ☐ Quality

☐ Public Complaint ☐ Customer Complaint ☐ Other

Description

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

Potential impact

……………………………………………………………………………………

……………………………………………………………………………………

Suggested Solution

Staff may be able to provide simple and effective suggestions for reducing your environmental impact or cost/time/labour savings

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

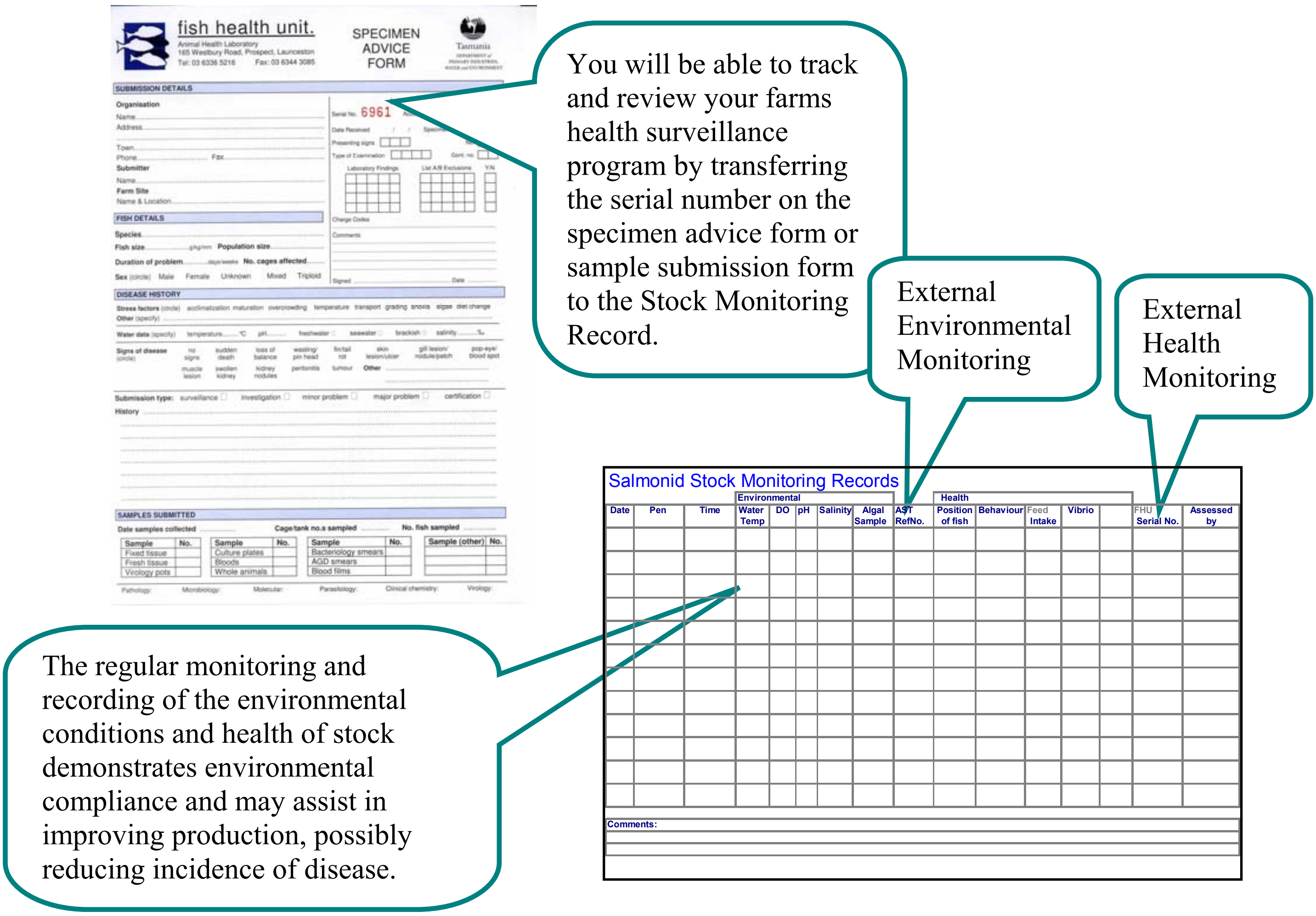
Considered by…………………………… Date ………..Addressed ☐Yes ☐No

Addressed by the following action:	**Not addressed because:**
………………………………………	………………………………
………………………………………	………………………………
………………………………………	………………………………
………………………………………	………………………………
………………………………………	………………………………
To be completed by	………………………………
…………………………………..(person) ☐Informed	………………………………
…………………………………..(date of completion)	………………………………

This part of the form is a check for management to ensure that all issues are considered and effectively dealt with if necessary

Using the Salmonid Stock Monitoring Register

The Salmonid Stock Monitoring Register (SAL700) is an interim form which incorporates the existing DPIW Fish Health Unit monitoring forms and DPIW Analytical Services Tasmania water quality monitoring forms. To get copies of these submission forms, contact the relevant DPIW branch. The register assists you in keeping track or your compliance to the regular environmental monitoring and health surveillance requirements. A more relevant form will be designed in the near future through the Tasmanian Salmonid Health Surveillance Program (TSHSP).



By adopting the use of this form, you will be able to track:

- If stock are being regularly assessed by staff for health and environmental wellbeing.
- If the required environmental or health surveillance samples have been collected for analysis.
- If mortalities occur, what conditions environmental or health conditions where present leading into the event.
- Determine annual and inter-annual variability relating to fish health or production issues.

Review & Report

Step 6: Review Process

The review process allows you to assess the performance of your EMS is by taking into account the information gathered by the system over the past period of time. The review process can be rigorous or simple, depending upon the level of credibility you are seeking. It is suggested that you review your system at least every 12 months, preferably 6 months if you have the time available.

Where to start
Gather all the information that is relevant to the EMS, especially the System Improvement Reports (SIRs) and the Registers.

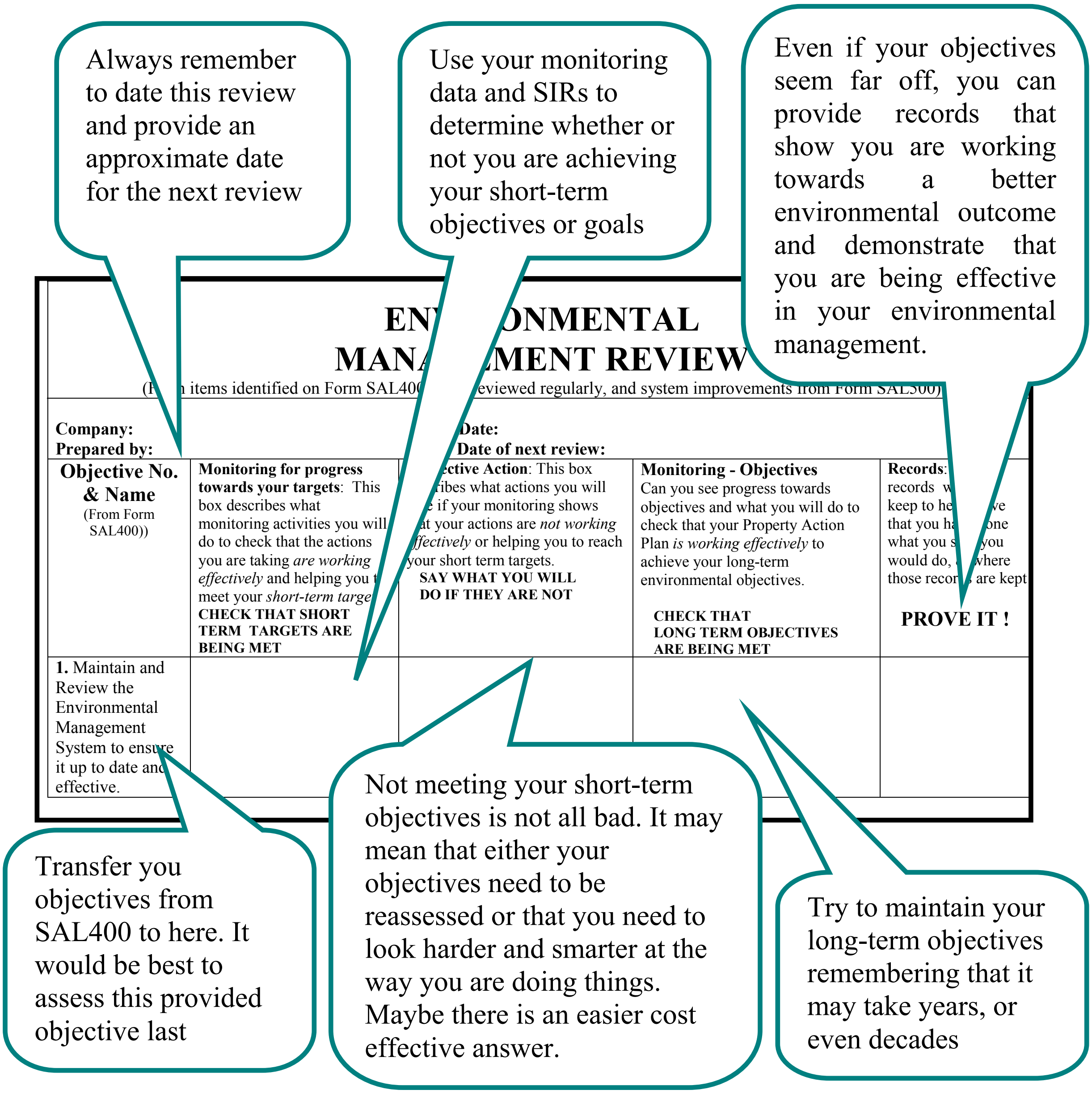
Examine the current objectives set out on Form SAL400: Environmental Objectives and Targets.

Transfer the Objectives to the Environmental Management Review Form: SAL600. (It is suggested that you review the provided Objective 1 last).

From your chosen Objective consider:

- What was the environmental risk associated with this objective?
- Are monitoring sheets available that relate to this objective?
- Are there SIRs that relate to this objective?
- Does the data provided in these sheets or from another source demonstrate any change in your environmental performance (e.g. is the number of incidences lower for the reviewed period that previous period? Has the level of waste decreased or recycling increased? How many problems reported by the SIR were responded to in an appropriate amount of time? Have you complied with the required environmental and health monitoring?)

Using this information, complete the Form SAL600 as shown below and determine whether you have reduced your risk. If so, you may then like to declare that this objective has been achieved for the short term. You may still need to monitor the progress of the short-term objective over a number of reviews before satisfied that the long-term objective is being achieved.



The results of your review should be reflected in a new set of objectives and targets. You can use Form SAL400 to record these.

The results (both positive and negative) should be reported to management, staff and shareholders and the public if desired. The most successful EMS' are those which all staff are involved in achieving the objectives and receive timely feedback on their efforts. The review may also result in development of new methods for doing things – these must be communicated back to the staff.

Further information on Audit, certification and review is provided in Step 7 of the Green Chooser.

Template SAL600 is available on the accompanying CD-ROM in a word format for you to fill in.

Audit and Certification

Congratulations! You now have a working Environmental Management System in place.

From here you have a number of options:

Maintain a simple system
Maintain the EMS as is, with regular (6-12 month) reviews. Don't forget to audit your system by making sure that staffs are aware of their environmental responsibilities and performing their duties as required by the EMS.

Develop the system further
Develop the EMS further to include a Systems Management Manual and a Procedures Manual which documents how the system operates. This is particularly important if you wish to invite a second party Auditor (outside your business but in the Industry) or third party Auditor (Certified Auditor) to assess your EMS. The following documents are provided on the CD-ROM to assist in the development of your system:

- Form SAL 700: Environmental Monitoring
- Form SAL 800: Chemical Register
- Form SAL 900: Legal and Other register
- Form SAL 1000: Training Register
- Systems Manual
- Procedures Manual

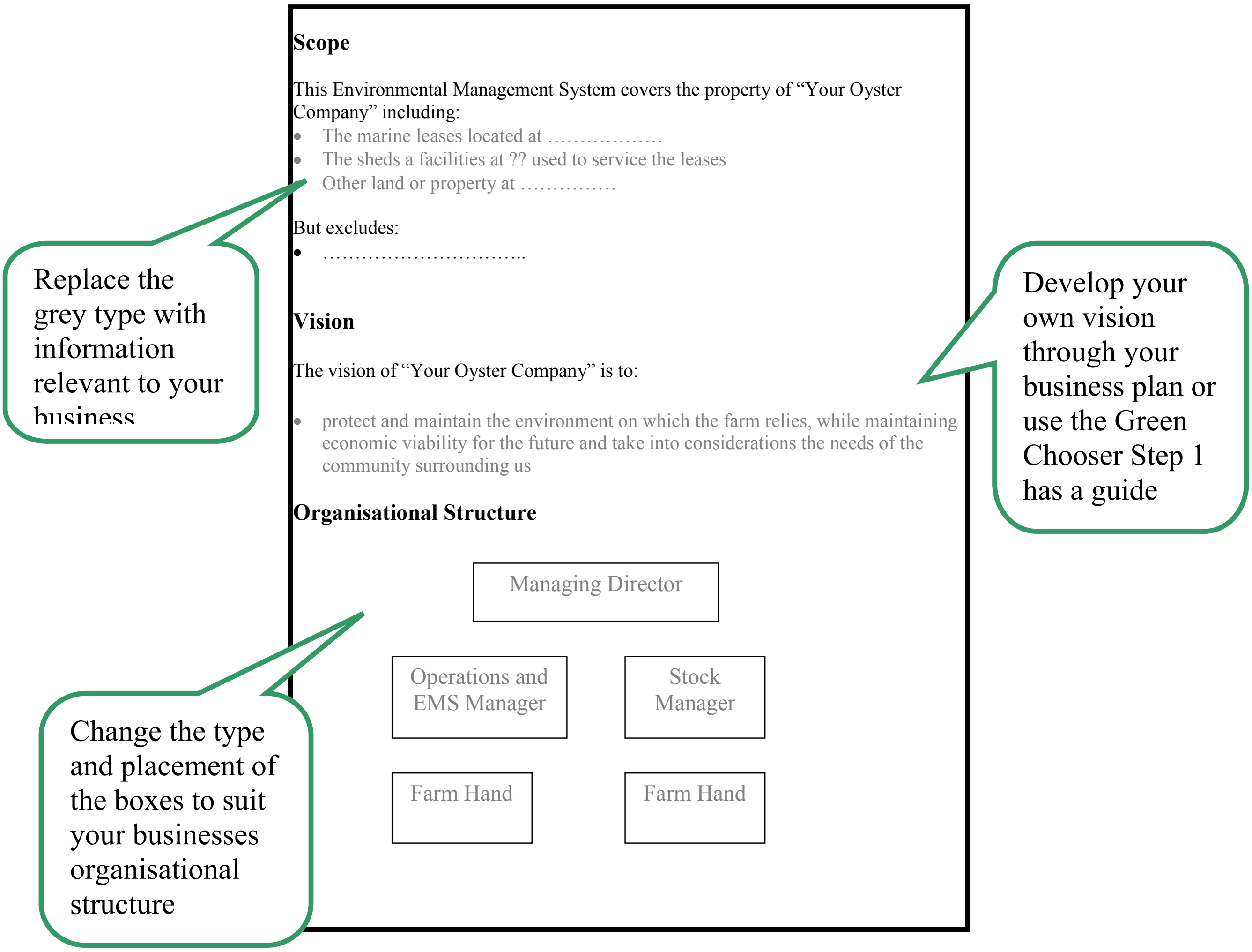
Obtain a recognised 3rd party certification
There is a substantial commitment required to produce an EMS that is ready for certification to an international standard such as ISO:14001. However, many business in many industries have found that this type of certification provides not only more efficiencies within a business but also provides financial opportunities in the form of markets, insurance premiums and protection from environmental prosecution. To take this further step is recommended that you consult with a certified Environmental Auditor/Consultant registered with the governing auditing body RABQSA International (http://www.rabqsa.com/).

The Tasmanian Aquaculture Council in collaboration with the National Aquaculture Council and Seafood Services Australia is currently working towards providing an EMS certification for the seafood industry in the future.

Developing the system further

It is recommended that the Systems Management and Procedure Manuals be adopted by those businesses wishing to develop their EMS further as a 2nd or 3rd party auditable system.

The Systems Management Manual template is designed to provide the basic criteria required for a management manual for a small business. Each business will need to adapt the manual to their requirements by replacing the grey type cues with information relevant their business. Most larger businesses will have far larger and more complex management manuals already in place and will not utilise this system.



Scope

This Environmental Management System covers the property of "Your Oyster Company" including:

- The marine leases located at ………………
- The sheds a facilities at ?? used to service the leases
- Other land or property at ……………

But excludes:

- …………………………..

Vision

The vision of "Your Oyster Company" is to:

- protect and maintain the environment on which the farm relies, while maintaining economic viability for the future and take into considerations the needs of the community surrounding us

Organisational Structure

By defining the businesses organisational structure, position descriptions and methods for system review, your business should run smoothly as each member of your team will know their role both within the EMS and the business.

The Procedure Manual records the methods that you have developed and adopted to reduce your environmental risks. It can also become a valuable training and reference tool for staff. The ability to be able to demonstrate recorded procedures provides some protection against potential environmental non-compliance fines and litigation, and may assist as a bargaining tool in reducing liability insurance premiums.

Some of the procedures have been or are in the process of being developed at a State and national Industry level as provided in the ESD Compliance document of the EMS Framework. You are encouraged to develop other protocols yourself for activities which have a high frequency or (likelihood) of risk such as refueling boats and tractors, or those which have a severe consequence.

Procedure Number	Name of Procedure or Protocol	Version number/date	Location
P001	Re-fuelling of pumps, boats or tractors		Procedure Manual/ Fuel Store
P002	Disposal and Recycling of Waste		Procedure
P003	Grading of Stock		
P004			
P005			
P006			
P007			
P008			
P009			
P0010			
P0011			
P0012			
P0013			
P0014			
P0015	Translocation of abalone stock and equipment between regions	In development	Refer to TAGA
P0016	Protocol for abalone farmers in the presence of listed threatened, marine or migratory birds		Appendix 2.2.3.1 (In development)
P0017			

This operational procedure is important to demonstrate environmental responsibility. You can adapt the document, as you need

You may wish to record other operational procedures to ensure that operation is correctly adhered to. This is important when considering emergency response procedures.

These protocols have been developed or are being developed at a State and National level and are contained in the ESD Compliance document.

It is important to develop procedures that demonstrate your emergency response and preparedness, especially to critical environmental impacts such as fuel spills, fire and disease outbreaks. These emergency responses are ideally located as their own section in the Procedure Manual.

The appropriate sections in the ESD Compliance document will assist you in developing some of these protocols. If assistance is required to develop these protocols, you may consider asking for requesting generic protocols to be developed through the Tasmanian or Australian Abalone Growers Associations (TAGA and AAGA), or engaging an Environmental Consultant.

Environmental Management System Framework

Part 1

EMS Working Form Templates

SAL100 Workplace Environmental Policy
SAL200 Environmental Hazard Identification Checklist
SAL300 Environmental Risk Assessment
SAL400 Environmental Objectives and Targets
SAL500 System Improvement Report
SAL600 Environmental Management Review

PhycoTec
Environmental Management

Tasmanian Salmonid Growers

Tasmania

Australian Government
Fisheries Research and Development Corporation

FRDC Project 2004/096

"Your Salmonid Company"

(your logo)

WORKPLACE ENVIRONMENTAL POLICY

It is the policy of this company that we manage all aspects of our operation in an environmentally responsible manner, appropriate to the nature and scale of our activities.

Our aim is to ensure that our activities do not cause environmental pollution of any other adverse impacts on the environment, and that we operate under the principles of ecologically sustainable development.

We are committed to complying with the relevant environmental legislation and to a program of continual improvement through adaptive management.

The aims of this policy will be achieved by implementing an environmental management system that will include:

- Planning of environmental aspects and impacts, legislative requirements, objectives and targets.
- Implementation and operation including specified responsibilities, appropriate training and awareness, communicated to all relevant parties and with appropriate document control.
- Monitoring and corrective action
- Structured management review
- Continual improvement through regular reviewing and revising of objectives and targets.

This policy is applicable to the company and all its operations and functions either on marine leases or land based facilities.

Policy authorized by:…………………………………… Date:…………….
(Managing Director)

Date of review:…………….

ENVIRONMENTAL HAZARD IDENTIFICATION CHECK LIST

This assessment is to be used to identify potential environmental hazards on site.
Transfer any identified potential hazards to Form SAL300 for risk analysis

Company: **Prepared by:** **Date………**

Activity or Area	**Environmental Aspect** (Potential Hazard)	**Framework ref.** (Refer to Comp. 3)	**Relevance** (tick/cross)	**Potential Environmental Impact** (Risk – what can happen)	**Current Controls** (What is in place to lower the risk)
LAND BASED OPERATIONS					
Infrastructure (Buildings and carparks)	Habitat Effect	3.1.1			
	Erosion	3.1.2			
	Shading	3.1.3			
	Rehabilitation	3.1.4			
	Soil Quality	3.1.5			
	Noise	3.1.6			
	Dust	3.1.6			
	Maintenance of infrastructure	3.1.7			

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LAND BASED OPERATIONS					
Infrastructure (Buildings and carparks)	Water Flow	3.1.9			
	Energy efficiency	3.2.2.4			
	Alienation of public	3.1.11			
	Proximity to Sensitive Fauna/Regions	3.1.12			
	Visual impact	3.2.2.2			
	Water table	3.1.13			
	Sewerage	3.2.3.7			
	General rubbish	3.2.3.8			

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LAND BASED OPERATIONS					
Infrastructure (Buildings and carparks)	Waste	3.1.8			
	Storm water runoff	3.2.3.6			

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LAND BASED OPERATIONS					
General Operations	Noise	3.2.2.5			
	Light	3.2.2.5			
	Fuel Storage	3.2.2.7	√	Fuel / oil spill	
	Chemical Storage	3.2.2.7		Chemical spill	
	Fish Disposal	3.2.3.4			
	Processing wastes	3.2.3.5			
	General Rubbish	3.2.3.8			

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LAND BASED OPERATIONS					
Operational Activities	Health of salmonid stocks	3.2.1.1 3.2.1.3			
	Stocking density	3.2.1.2			
	Predator/pest control	3.2.1.4			
	Fresh Water Usage	3.2.2.1			
	Light & Noise	3.2.2.5			
Net Maintenance	Biofouling waste	3.2.3.9 3.2.3.2			
	Water use	3.2.2.1			
	Waste water	3.2.3.1			
	Antifoulant application	3.2.2.7			

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LAND BASED OPERATIONS					
Refuelling Boats and Vehicles	Fuel Storage	3.2.2.7	√	Fuel/oil spill	
	Bowser siting and condition				
	Emergency response plans and equipment				
Waste	Disposal of unused culture equipment	3.2.3.5			
	Disposal of Bloodwater	3.2.3.5			
	Disposal of feed Bags	3.2.3.8			

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MARINE BASED OPERATIONS					
Fish Husbandry	Animal Welfare	3.2.1.3			
	Health Surveillance	3.2.1.1			
	Water Quality	3.2.3.1			
	Stocking Density/Biomass	3.2.1.2			
	Fish Disposal	3.2.3.4			
	Escapement	3.2.2.9			

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MARINE BASED OPERATIONS					
Feed Management Strategies	Animal Welfare/health Surveillance	3.2.1.3 3.2.1.1			
	Predation/pest control	3.2.1.4			
	Sedimentation	3.2.3.2			
	Waste Feed & Faeces	3.2.3.3			
	Impact on sensitive habitats	3.2.2.6			
	Theraputants	3.2.2.7			

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MARINE BASED OPERATIONS					
Pens and marine Infrastructure	Habitat Effect	3.2.2.6			
	Rehabilitation	3.1.4			
	Maintenance of infrastructure	3.1.7			
	Water Flow (seawater)	3.1.9			
	Navigation	3.1.10			
	Visual impact	3.2.2.2			
	Entanglement Interactions	3.2.2.8			
	Escapement	3.2.2.9			

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Activity or Area	**Environmental Aspect** (Potential Hazard)	**Framework ref.** (Refer to Comp. 3)	**Relevance** (tick/cross)	**Potential Environmental Impact** (Risk – what can happen)	**Current Controls** (What is in place to lower the risk)
MARINE BASED OPERATIONS					
Operational activities on boats	Hydrocarbon usage and refueling	3.2.2.7			
	Impact on sensitive habitats	3.2.2.6			
	Noise & Light	3.1.7 3.2.2.5			
	Waste	3.1.9			
	Alienation of other users	3.1.12			
	Air emissions	3.2.2.3			
	Energy efficency	3.2.2.4			

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Company: **Prepared by:** **Date**

Activity or Area	**Environmental Aspect** (Potential Hazard)	**Framework ref.** (Refer to Comp. 3)	**Relevance** (tick/cross)	**Potential Environmental Impact** (Risk – what can happen)	**Current Controls** (What is in place to lower the risk)
MARINE BASED OPERATIONS					
Net Cleaning	Chemicals	3.2.2.7			
	Sedimentation	3.2.3.2			
	Water Quality	3.2.3.1			
	Biofouling	3.2.3.9			

ENVIRONMENTAL HAZARD IDENTIFICATION CHECK LIST

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Transfer any identified potential hazards to Form SAL300 for risk analysis

Company: **Prepared by:** **Date**

Activity or Area	**Environmental Aspect** (Potential Hazard)	**Framework ref.** (Refer to Comp. 3)	**Relevance** (tick/cross)	**Potential Environmental Impact** (Risk – what can happen)	**Current Controls** (What is in place to lower the risk)
MARINE BASED OPERATIONS					

PhycoTec Environmental Management

ENVIRONMENTAL RISK ASSESSMENT

(From items identified on Form SAL200)

Company: **Prepared by:** **Date:**

Environmental Aspect (Potential Hazard) Listed on form SAL200	**Environmental Impact** (Risk –what can happen)	**Controls** (What is in place to lower the risk)	**Consequence** (Table 1.1)	**Likelihood** (Table 1.5)	**Risk Level** (Table 1.6)	**Recommended Controls to be Implemented** (within legislative guidelines if applicable)	**Action by whom & date?** (Refer risks above low to Form SAL400)
Fuel Storage for boats	Spills may cause contamination of the waterways and ground	Fuels stored in accordance with the standards and regulations					

I certify that controls have been implemented and will be monitored closely for effectiveness:

Signed: **Position:** **Date:**

Date of next review is:

ENVIRONMENTAL RISK ASSESSMENT

(From items identified on Form OY200)

Company: **Prepared by:** **Date:**

Environmental Aspect (Potential Hazard) Listed on form SAL200	**Environmental Impact** (Risk –what can happen)	**Controls** (What is in place to lower the risk)	**Consequence** (Table 1.1)	**Likelihood** (Table 1.5)	**Risk Level** (Table 1.6)	**Recommended Controls to be Implemented** (within legislative guidelines if applicable)	**Action by whom & date?** (Refer risks above low to Form SAL400)

I certify that controls have been implemented and will be monitored closely for effectiveness:

Signed: **Position:** **Date:**

Date of next review is:

ENVIRONMENTAL OBJECTIVES AND TARGETS

(Items identified as above low risk on Form SAL300 and through staff meetings, to be reviewed at regular intervals)

Company: **Date:**
Prepared by: **Date of next review:**

No.	**Objective:** the overall long-term objectives (big picture) that you are aiming to achieve relating to the management of this impact. **LONG TERM**	**Target**: the short-term targets (specific and measurable) that will together make sure that you meet your long-term objectives. **SHORT TERM**	**Actions required or already undertaken:** the actions you are willing to commit to doing in your business to ensure that the short and long-term objectives and targets are met. This might include actions you have already done but still need to be maintained and monitored if they are to remain effective. **HOW YOU ARE GOING TO GET THERE**	**Responsible person** **WHO IS GOING TO DO IT**
1	Maintain and Review the Environmental Management System to ensure it up to date and effective.	Review the Workplace Environmental Policy (Form SAL100) and EMS requirements. Identify objectives, targets and assign responsibilities		
2				

No.	**Objective**	**Target**	**Actions**	**Responsible Persons**
3				
4				
5				
6				

No.	Objective	Target	Actions	Responsible Persons
7				
8				
9				
10				

SYSTEM IMPROVEMENT REPORT

Company…………………………………………. **Date:**……………………

Submitted by: ………………………………………………..

Issue

☐	Environmental	☐	OH&S	☐	Quality
☐	Public Complaint	☐	Customer Complaint	☐	Other

Description

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

Potential impact

………………………………………………………………………………………

………………………………………………………………………………………

Suggested Solution

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

Considered by……………………………. Date …………Addressed ☐Yes ☐No	
Addressed by the following action: …………………………………………………………… ………………………………………………………… ………………………………………………………… …………………………………………………………… …………………………………………………………… To be completed by …………………………………...(person)☐ Informed …………………………………...(date of completion)	Not addressed because: …………………………… …………………………… …………………………… …………………………… …………………………… …………………………… …………………………… ……………………………

ENVIRONMENTAL MANAGEMENT REVIEW

(From items identified on Form SAL400, to be reviewed regularly, and system improvements from Form SAL500)

Company: **Date:**
Prepared by: **Date of next review:**

Objective No. & Name (From Form SAL400))	**Monitoring for progress towards your targets**: This box describes what monitoring activities you will do to check that the actions you are taking *are working effectively* and helping you to meet your *short-term targets* **CHECK THAT SHORT TERM TARGETS ARE BEING MET**	**Corrective Action**: This box describes what actions you will take if your monitoring shows that your actions are *not working effectively* or helping you to reach your short term targets. **SAY WHAT YOU WILL DO IF THEY ARE NOT**	**Monitoring - Objectives** Can you see progress towards objectives and what you will do to check that your Property Action Plan *is working effectively* to achieve your long-term environmental objectives. **CHECK THAT LONG TERM OBJECTIVES ARE BEING MET**	**Records**: What records will you keep to help prove that you have done what you said you would do, & where those records are kept **PROVE IT !**
1. Maintain and Review the Environmental Management System to ensure it up to date and effective.				

Objective No.	Monitor	Corrective Action	Monitoring Objective	Records
2				
3				
4				
5				

Objective No.	**Monitor**	**Corrective Action**	**Monitoring Objective**	**Records**
6				
7				
8				
9				

Environmental Management System Framework

Part 2

EMS Manual Register Templates

SAL700 TSEC Oyster Health Monitoring Report
SAL800 Chemical Register
SAL900 Legal and Other Requirements Register
SAL1000 Training Register

PhycoTec Environmental Management

Tasmanian Salmonid Growers

Tasmania

Australian Government
Fisheries Research and Development Corporation

FRDC Project 2004/096

Salmonid Stock Monitoring Records

			Environmental						Health						
Date	Pen	Time	Water Temp	DO	pH	Salinity	Algal Sample	AST RefNo.	Position of fish	Behaviour	Feed Intake	Vibrio		FHU Serial No.	Assessed by

Comments:

OR USE YOUR EXIDITNG FISH HEALTH MONITORING SHEETS

CHEMICAL REGISTER

Company: **Date:**
Prepared by: **Date of next review:**

Substance	Use	Storage and Compatibility Requirements	Reference (eg MSDS or Australian standard)
Hydrocarbons (petrol and diesel)	Boat and tractor fuel	**Outside**: 1. Liquids shall be kept at least 1 m away from any boundary, workshop, dwelling or protected place, body of water, watercourse or environmentally sensitive area. 2, The ground around the store shall be kept clear of combustible vegetation or refuse for a distance of at lease 3 m. 3. Any potential flow of spillage shall be prevented from reaching a protected place, watercourse or property boundary by such means as the use of natural ground slop, or the provision of a diversion channel, kerb or bund. **Inside:** 10L per 50m2 of floor space, but 5 L for any tenancy of less than 50m2 area.	AS 1940:2004 Dangerous goods Act 1982 www.thelaw.tas.gov.au
Cleaning Liquids	Cleaning floors and work spaces	Store in appropriate receptacle away from processing areas.	MSDS

Substance	Use	Storage and Compatibility Requirements	Reference (eg MSDS or Australian standard)

LEGAL AND OTHER REQUIREMENTS

(Relate to items identified on Form SAL200)
Correct as of June 2006

Company: **Date:**
Prepared by: **Date of next review:**

Legislative requirement	Relationship to Activity	Reference to ESD Compliance Document
Commonwealth Legislation Reference: http://www.comlaw.gov.au		
Quarantine Act 1908	Import & Export of viable and non-viable uncooked salmonid products.	1.1.2: Transfer of Disease overseas and Interstate
Export Control Act 1982	Export of salmonids for human consumption	1.1.2.2: Export
Export Control Act 1982 (Proscribed Goods-General) Order 2005	Export of salmonids for human consumption. Provision of certification by AQIS	1.1.2.2: Export
Export Control Act 1982 (Fish and fish Products) Order 2005	Export of salmonids for human consumption	1.1.2.2: Export

Legislative requirement	**Relationship to Activity**	**Reference to ESD Compliance Document**
Tasmanian Legislation **Reference: http://www.thelaw.tas.gov.au**		
Resource Management and Planning System	Promote the principles of sustainable development.	Appendix 8.2.3.1
Living Marine Resources Management Act 1995	Resource allocation. Broodstock allocation	Appendix 8.2.3.1 Comp 1.1.1: Broodstock
Marine Farming Planning Act 1995	Zoning and location of marine leases. Stocking density. Marine farming license conditions relating to environmental management.	Appendix 8.2.3.1 1.3.4: Threatened & Endangered Species 2.2.4: Threatened/ Endangered / Protected sp. 2.4.1: Regional Carrying Capacity 7.1.1 Responsible government. 1.2.2: Escape of cultured species
Marine Farm Environmental License Conditions and Requirements	Impact outside the lease boundaries. Stocking density and feed input.	Appendix 8.2.3.1 Appendix 8.3.2.2 1.3.5: Sensitive habitats 2.1.2: Sedimentation. 2.4.1: Regional Carrying ca[pacity
Public Health Act 1997	Harvesting of oysters. TSQAP	1.2.2: Import and Export 1.2.4: Quality Assurance
Pollution of Waters by Oil and Noxious Substances Act 1987	Pollution of waters by hydrocarbons	1.2.4: Hydrocarbons
Threatened Species Protection Act 1995	Protection of protected species	Appendix 8.2.3.1 2.2.4: Threatened, Endangered & Protected Species. Appendix 2.2.4
Environmental Protection and Biodiversity Conservation Act 1999	Export of flat oysters for consumption. Protection of migratory birds. Protected habitats	Appendix 8.2.3.1 1.2.2.1: Export. 2.2.3: Listed Migratory Birds. Appendix 2.2.5: Protected Habitats.
Nature Conservation Act 2002	Conservation and protection of the fauna, flora and geological diversity of the State	2.2.5: Protected habitats

Legislative requirement	**Relationship to Activity**	**Reference to ESD Compliance Document**
Tasmanian Legislation **Reference: http://www.thelaw.tas.gov.au**		
Marine and Safety Authority Act 1997 and the Marine and Safety (Mooring) By-Laws 1998 Section22	Exhibit approved daymarks and navigation marks in respect of moorings used to mark the boundaries of leases or permit areas.	2.3.4: Navigation Appendix 2.3.4: Navigation
Environmental Management and Pollution Control Act	Noise Disposal of waste	Appendix 8.2.3.1 2.3.6: Noise 2.4.3 Disposal of Harvesting Waste (Bloodwater)
Agricultural and Veterinary Chemicals (Control of Use) Act 1995, and the Poisons Act 1971.	Supply and use of veterinary chemicals. Use and control of antifoulants	2.4.5 Aquavet Chemicals 2.1.2.2: Antifoulants – water 2.2.2.2: Antifoulants - benthic
Crown Lands Act 1976	Construction and use of infrastructure on Crown Land leases. Protection of habitat on Crown land	Appendix 8.2.3.1 2.3.1: Terrestrial Habitat Removal 2.3.5: Infrastructure
Local or State Government regulations	Waste Disposal	Appendix 8.2.3.1 2.4.2: Disposal of unmarketable waste
National Parks and Reserves Management Act 2002	Development of management plans of marine farms developed within the boundaries of a National Park or reserved land.	Appendix 8.2.3.1
Aboriginal Relics Act 1975.	Protection of aboriginal relics on surrounding foreshore.	Appendix 8.2.3.1 Component 6
State Coastal Policy Validation Act 2003	*Sustainable development of marine farming consistent with the State Coastal Policy.*	Appendix 8.2.3.1

Legislative requirement	Relationship to Activity	Reference to ESD Compliance Document
Tasmanian Legislation **Reference: http://www.thelaw.tas.gov.au**		
Land Use Planning and Approvals Act 1993	Land based facilities	Appendix 8.2.3.1 7.1.2.1: Local Government
State Policy on Water Quality Management 1997		Appendix 8.2.3.1
Dangerous Goods Act 1998	Storage of hydrocarbons and other chemicals	1.2.4: Chemicals (Hydrocarbons) 2.4.5: Chemicals (Aquavet)
Rivers and Water Supply Commission Act 1999	Extraction and use of freshwater for bathing	2.1.4: Water Extraction
Animal Health Act 1995	Translocation of fish stocks between regions. Fish disposal	2.4.2: Disease 2.4.4: Disposal of Mortalities
Animal Welfare Act 1993	Humane treatment and reduction of stress in cultured animals	1.1.4: Animal Welfare Aquatic Animal Welfare Guidelines

Legislative requirement	**Relationship to Activity**	**Reference to ESD Compliance Document**
Other Requirements		
Tasmanian Salmonid Growers Association Code of Practice (in draft)	Voluntary code to assist Industry to maintain sustainable practices	Code of Practice
DAFF (2006). Operational procedures manual: Decontamination	Disinfection of equipment prior to translocation	1.1.2: Transfer of Disease 1.1.3: Translocation of Invasive Marine Species. 2.4.2 Disease (in production) 8.1.3.1: Disease Identification and Response
National Translocation Policy	Translocation of fish around the state addressing disease and IMS	1.1.3: Translocation Overseas and Interstate Appendix 2.2.6 *1.2.3.2: Transfer of IMS*
Code of Conduct for Australian Aquaculture (*Voluntary*)	To maintain the Australian aquaculture industries clean green image	Appendix 7.2.1
Occupational Health and Safety Management Plan	Required by each business under the OH&S Act 1995	5.1.2.3: Work related injuries
Tasmanian Salmonid Health Surveillance Program (DPIW)	Maintenance of disease free status for market access and regional biosecurity.	2.4.2: Disease
Liability cover		
Hazard & Critical Control Point (HACCP) Certification	Maintenance of product quality and food safety	4.2.1.2: Quality
Insurances		

TRAINING REGISTER

Company: **Date:**
Prepared by: **Date of next review:**

Employee	EMS Induction	OH&S Induction	Boat Handling	Coxswains (Restricted)	Master V	Manual handling	Remote communications	Hazard material handling/storage	First Aid	Dive Protocols	Waste Disposal	Use of theraputants	Stock Containment			

Environmental Management System Framework

Part 3

EMS Manual Templates

Systems Manual
Procedures Manual

Tasmania

Australian Government
Fisheries Research and Development Corporation

FRDC Project 2004/096

Environmental Management System

Systems Management Manual

for

"Your Salmonid Company"

(Your Logo)

Version Number……………….

Revision Date…………………..

Contents

Scope

This Environmental Management System covers the property of “Your Salmonid Company” including:

- The marine leases located at ………………
- The sheds a facilities at ?? used to service the leases
- Other land or property at ……………

But excludes:

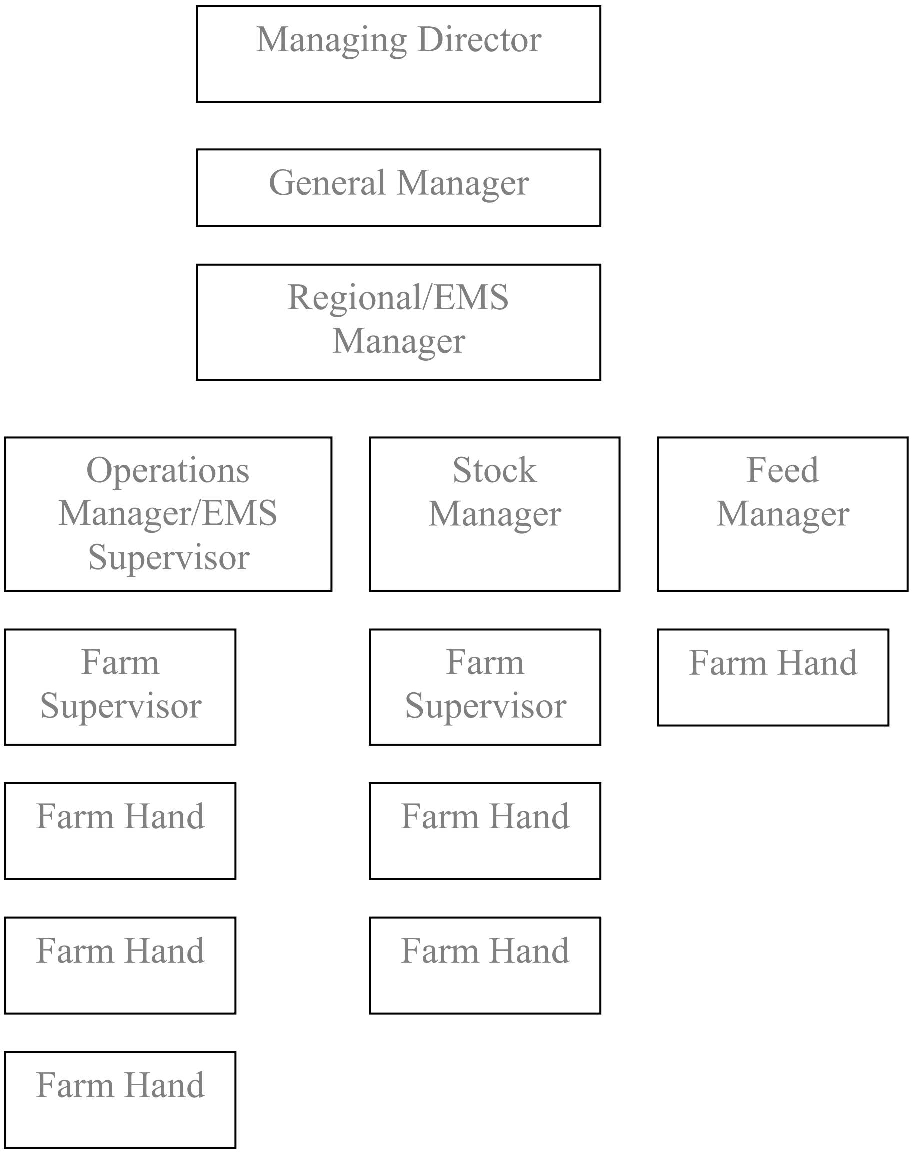
- …………………………..

Vision

The vision of “Your Salmonid Company” is to:

- protect and maintain the environment on which the farm relies, while maintaining economic viability for the future and take into considerations the needs of the community surrounding us

Organisational Structure



Workplace Environmental Policy

"Your Salmonid Company"

(your logo)

WORKPLACE ENVIRONMENTAL POLICY

It is the policy of this company that we manage all aspects of our operation in an environmentally responsible manner, appropriate to the nature ad scale of our activities.

Our aim is to ensure that our activities do not cause environmental pollution of any other adverse impacts on the environment, and that we operate under the principles of ecologically sustainable development.

We are committed to complying with the relevant environmental legislation and to a program of continual improvement through adaptive management.

The aims of this policy will be achieved by implementing an environmental management system that will include:

- Planning of environmental aspects and impacts, legislative requirements, objectives and targets.
- Implementation and operation including specified responsibilities, appropriate training and awareness, communicated to all relevant parties and with appropriate document control.
- Monitoring and corrective action
- Structured management review
- Continual improvement through regular reviewing and revising of objectives and targets.

This policy is applicable to the company and all its operations and functions either on marine leases or land based facilities.

Policy authorized by:…………………………………… Date:…………….
(Managing Director)

Date of review:…………….

Responsibilities

The Managing Director is responsible for:
- Reviewing for EMS outcomes on an annual basis
- Providing the resources and training to implement and maintain the EMS where appropriate
- Other?

The General Manager is responsible for:
- Overseeing the production for the EMS
- Providing the resources and training to implement and maintain the EMS where appropriate
- Other?

The Regional/EMS Manager is responsible for:
- regular review and maintenance of the EMS
- regular auditing of the EMS
- reporting to the managing director on EMS issues
- Annual updating of the Legal and Other Requirements Register (ENV005) and reassessment of the environmental risks in conjunction with staff.
- Other?

The Operations Manager/EMS Supervisor is responsible for:
- daily maintenance of the EMS
- holding regular meetings with staff about EMS issues (or tool box meetings)
- ensuring staff comply with their environmental responsibilities
- Other?

The Stock Manager is responsible for:
- ensuring that the stock is maintained under conditions as described in the EMS
- Other?

The Farm Hands are responsible for:
- maintaining a work ethic in compliance with the EMS principles
- reporting an EMS issues to the EMS manager at regular meetings
- providing feedback to help maintain and improve the EMS
- Other?

Environmental Monitoring

The Operations/EMS Manager shall ensure that the following environmental monitoring is completed and is logged by the responsible person where necessary.

Daily
- Observing the marine farming lease is tidy and in good repair
- Ensuring stock are in good health

Weekly/Fortnightly
- Disposal of Rubbish and recycling
-

Monthly
- Algal sampling
-

Biannual
- Servicing of vehicles and boats
-

Training and Competency

The EMS Manager/Managing Director will ensure that all staffs are inducted to EMS and OH&S procedures within one month of commencement of work. All staff will be required to provide proof of training to ensure that the Staff training Register is complete.

The EMS Manager/Managing Director will review and determine opportunities and requirements for staff training on a 6 monthly/annual basis.

Safety

All Staff are required to be familiar and comply with the safety procedures as outlined in the EMS Procedures Manual.

System Improvements Records

The system will be maintained and updated through the use of System Improvement Records (SIRs).

- The SIR forms will be available to all staff at all times and located in the office at a designated place.
- Completed SIR forms are to be handed to the Secretary/ EMS Manager for consideration.
- If the impact is of an urgent nature, the staff is directed to inform the EMS Manager/Managing Director verbally at the time, as well as providing a completed SIR.

It is the responsibility of the EMS Manager/Managing Director to review all SIR forms raised by staff within one or two week (s). All the items raised by SIRs relevant to the working staff will be discussed at regular (daily/weekly/fortnightly/monthly) workplace meetings on how the issues are to be dealt with (if at all).

System Review

The EMS will be reviewed with staff at regular intervals through:

- Routine work briefing meetings
- OH&S meetings
- Morning tea the first Monday of the month
- Other?

The information discussed at these meetings will be taken to:

- Quarterly management meetings
- 6 monthly stock review
- Other?

The EMS manager will audit the system annually/6- monthly and the outcomes reported to the Managing Director.

Reporting

The results of the annual system review, including our environmental performance and adaptive management strategies will be reported to:

- Our farm staff
- Marine farms in the regional area
- Other members of the Tasmanian Salmonid industry
- Annual Report
- TSGA Meetings
- DPIW Marine Farming
- Members of the community through pamphlet drops
- Local member of Government
- Local/Regional/National Newspapers
- Local Natural Resource Management (NRM) Council
- Seafood Services Australia (SSA)
- Fisheries Research and Development Corporation (FRDC)

GO ON! – SPREAD THE GOOD NEWS

Complete by adding your own methods for ensuring that the EMS will be maintained.

Larger companies may incorporate ideas presented in this template in their already existing system.

Environmental Management System

Procedures Manual

for

“Your Salmonid Company”

(Your Logo)

Version Number……………….

Revision Date…………………..

Procedure Number	Name of Procedure or Protocol	Version number/date	Location
P001	Re-fuelling of boats or tractors		Procedure Manual/ Fuel Store
P002	Disposal and Recycling of Waste		Procedure Manual
P003	Grading of Stock		
P004			
P005			
P006			
P007			
P008			
P009			
P0010			
P0011			
P0012			
P0013			
P0014			
P0015	Translocation of salmonid stock and equipment between regions		Refer to Disinfection Manual
P0016	Protocol for salmonid farmers in the presence of listed threatened, marine or migratory birds		Appendix 2.2.3.1 (In development)
P0017			

Procedure 001: Re-fuelling of boats or vehicles on site

1. Operators will store and use chemicals controlled under the Dangerous Goods Act in an approved manner.

2. Operators should only carry the chemicals, fuels or oils necessary for the day to day running or maintenance of the boat in for work to be undertaken in the immediate future.

3. Operators shall store chemicals, oils or fuels in appropriate containers that will not result in a discharge to the environment if containers are spilled or leak.

4. Operators will not refuel boats or vehicles in areas where a possible spill or leak will lead to contamination of the waterway.

5. If a spill occurs, the operator shall use the facilities spill control kit to contain or mop up the spill.

6. If the spill has/has potential to:
    - Contaminate the waterway
    - Cause major contamination of the land

The operator will contact the relevant agency (DPIW) for advice on remediation.

Procedure 002: Disposal and Recycling of Waste

Environmental Management System Framework

Compliance Guide and Risk Assessment for Ecologically Sustainable Development

PhycoTec
Environmental Management

Tasmanian Salmonid Growers

Tasmania

Australian Government
Fisheries Research and Development Corporation

FRDC Project 2004/096

Environmental Management System Framework

Tasmanian Salmonid Industry

Compliance Guide and Risk Assessment for Ecologically Sustainable Development

Version 1.0
June 2007

FRDC Project 2004/096

ENVIRONMENTAL MANAGEMENT SYSTEM FRAMEWORK

Compliance Guide and Risk Assessment of Ecologically Sustainable Development for the Tasmanian Salmonid Industry

Version 1.0

AUGUST 2006

This document is part of a national initiative to assist the seafood sector in the uptake of Environmental Management Systems. The document is based on the National ESD Framework 'How To' *Guide for Aquaculture, Version 1.1 (Fletcher et al. 2004). Regular updating of the information in the document will take place. While the views in this document reflect the general views of the Industry, it should not be taken as the view of any individual in Industry or the Steering Committee for the project.*

The project has been funded by the Tasmanian Salmonid Growers Association (TSGA), the Tasmanian Fishing Industry Council (TFIC), the Tasmanian Department of Primary Industries and Water (DPIW) and the Fisheries Research and Development Corporation (FRDC) as Project 2004/096.

Correct Citation
Marshall JA (2007). Environmental Management System Framework: Compliance Guide and Risk Assessment of Ecologically Sustainable Development for the Tasmanian Salmonid Industry. Compliance Guide and Risk Assessment. Version 1.0, FRDC, Canberra, Australia. 152pp.

Document Control

The Environmental Management System Framework: Compliance Guide and Risk Assessment of Ecologically Sustainable Development for the Tasmanian Farmed Salmonid Industry. The Compliance Guide and Risk Assessment is a living document subject to periodic review to capture regulatory changes and Industry's adaptive management.

This document is representative of the Industry's assessment of its risks relating to ecologically sustainable development (ESD). The information contained in this document has been assessed by the EMS Steering Committee as being representative of the current scientific information and control measures used by the regulators.

Document	Version	Date of revision	Signature
ESD Farmed Salmonid Compliance and Risk Assessment	1.0	June 2007	
		June 2010	

Signed ……………………………………………… Date …../……/……
(Chief Executive - Tasmanian Salmonid Growers Association)

Signed ……………………………………………… Date …../……/……
(General Manager – Primary Industries)

Copy Number ………………………………………..

Issued to …………………………………………

Date of Issue …………………………………………

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Executive Summary

The Environmental Management System (EMS) Framework for the Tasmanian Salmonid Industry is a document developed after consideration of the environmental, social and economic impacts of the Industry in terms of sustainability. This process has enabled the identification and documentation of critical issues that will assist the industry, researchers and regulators to pursue and develop mitigation strategies to ensure long-term sustainability.

The Tasmanian EMS Framework is an Industry initiative embraced by the Tasmanian Salmonid Growers Association (TSGA) and the Tasmanian Department of Primary Industries and Water (DPIW), supported by the Tasmanian Fishing Industry Council (TFIC) and the Tasmanian Aquaculture Council (TAC) and co-funded by the Federal government through the Fisheries Research and Development Corporation (FRDC). Similar documents are being produced through the Tasmanian Abalone Growers Association (TAGA) and the Tasmanian Oyster Research Council (TORC).

This document has been modelled on *The National ESD Framework "How To" Guide for Aquaculture Version 1.1* (Fletcher et al. 2004). The marine farming industry is committed to incorporating ESD into their management processes and the principles of sustainable development is enshrined in all to Tasmania's natural resource management legislation. A direct outcome of this commitment has been the development of the ESD framework for aquaculture that was generated by a FRDC subprogram in conjunction with the Aquaculture Committee of the Australian Fisheries Managers Forum (AFMF) working in association with the National Aquaculture Council (NAC).

Each aspect of the components from the ESD Framework for Aquaculture was assessed for relevance to the Tasmanian Salmonid Industry. Current management controls were examined in the context of valid scientific data and regulatory requirements. Qualitative risk assessments were validated, taking into account these current management practices and regulatory controls, by a local committee with relevant expertise. It should be noted that the environmental risks assessed in this document are considered at a whole of industry and a regional level, and not at a farm level.

The results found that the majority of the Industry's operational aspects were of low risk to the environment outside the 35m compliance point from the lease area. This was due to the effectiveness of the current DPIW management controls, Industry Code of Practice, and the Industry's willingness to support world-leading research to reduce their environmental impact. The translocation of disease and invasive marine species into the state and between regions provided a moderate risk to the environment. The Industry currently employs a number of protocols developed at a regional and national level to reduce this risk as far as practicable. Current industry research is monitoring the pattern of antifoulant and antibiotic residues in the fauna and benthos in the immediate vicinity of fish cages, and research investigating the risk posed by such residues is under active consideration.

The Industry regards itself as an important participant in some regional communities by providing substantial economic support to those communities. The Industry's impact to these communities' sustainability was considered as a moderate economic risk which requires strategic business planning, effective consultation between Industry, State Government and the community and the continued use of sustainable farming practices to reduce economic risk.

The rise in sea temperature in the medium to long term (30 years) was regarded as an extreme risk to the Industry's sustainability. Industry is addressing this risk through current research programs on selective breeding, feed manipulation, use of technology and alternative farming methods.

Competing uses, catchment wide land use changes and associated water quality issues also presented a moderate risk that may be mitigated through the effective consultation and representation at Local, State and Federal Governments, and participation in catchment wide programs such as those addressed by the natural resource management (NRM) programs.

The risk assessment process produced a number of key recommendations to address the identified risks in the Industry. These recommendations are included as risk management options below each risk assessment box.

The key recommendations (not in any priority order) relating to medium to extreme risks includes:

- Continuation with vaccine development and implementation programs to reduce prevalence of disease and the Industry's reliance on veterinary chemicals
- Mandate the adoption of the DAFF disinfection manual to reduce the risk of translocation of both disease and invasive marine species through the movement of marine farming equipment
- Strict adherence to transfer controls for disease as stipulated by DPIW and continued support for the Tasmanian Salmonid Health Surveillance Program (TSHSP)
- Continued compliance with MFPA license conditions and management controls, and further development of the Industry Code of practice to incorporate the management controls identified through the EMS framework
- Continued strategic business planning to incorporate sustainable farming practices to ensure the future viability of the Industry
- Ensure effective, ongoing consultation with the DPIW Marine Farming Branch, the Australian Government and Non-Governmental Organisations to ensure that Industry interests are taken into account in policy decision making
- Targeted ongoing monitoring of environmental changes and continued development of adaptive husbandry methods, such as selective breeding, to enable Industry to maintain production under future environmental conditions
- Raising community awareness of potential impacts of land use change to Industry
- Promoting the socio-economic value of Industry, and the quality of product being sustainably produced from our marine farming environment

In summary, through the consideration of environmental, social and economic aspects in regard to the comprehensive guidelines produced for ESD, the Industry has been able to rank the risks to its sustainability using a qualitative risk analysis matrix. The identification of critical issues through this process will provide Industry with strategic guidance to ensure the long-term sustainability of the Tasmanian salmonid industry.

Table A. Summary of risk assessments. * Consequences may be greater at a regional level.

Objective	Activity	Aspect	Consequence	Likelihood	Numerical Risk	Descriptive Risk	Target Risk
Component 1: Impacts of Industry on the Environmental							
Component 1.1 Cultured Stocks / Businesses							
EO 1.1.1	1.1.1 Genetics		3	2	6	LOW	
	1.2.2 Transfer of Disease						
EO 1.1.2.1		1.1.2.1 Import of disease	4	2	8	**MOD**	**LOW**
EO 1.1.2.2		1.1.2.2 Export of disease	3	3	9	**MOD**	**LOW**
EO 1.1.3	1.1.3 Translocation (Invasive Marine Species)		4	2	8	**MOD**	**LOW**
EO 1.1.4	1.1.4 Animal Welfare		2	2	4	LOW	
Component 1.2 Other Species/Community Processes							
EO 1.2.1	1.2.1 Disease		3	2	6	LOW	
EO 1.2.2	1.2.2 Escape of Cultured Species		2	2	4	LOW	
EO 1.2.3	1.2.3 Feed Composition		2	2	4	LOW	
EO 1.2.4	1.2.4 Chemicals (Hydrocarbons)		1	4	4	LOW	
EO 1.2.5	1.2.5 Behavioral Changes and Food Chain Impacts		1	5	5	LOW	
	1.2.6 Sensitive Habitats						
EO 1.2.6.1		1.2.6.1 Seagrass beds	1	2	2	LOW	
EO 1.2.6.2		1.2.6.2 Macroalgal Communities	1	2	2	LOW	
EO 1.2.6.3		1.2.6.3 Invertebrate Communities	1	2	3	LOW	
Component 2: Regional Impact of Industry on the Environment							
Component 2.1 Water Use Quality/Quantity							
EO 2.1.1	2.1.1 Nutrients		2	3	6	LOW	
EO 2.1.2	2.1.2. Other wastes	2.1.2.1. Antifoulants	3	2	6	LOW	
EO 2.1.3.	2.1.3 Flow (hydrology/oceanography)		1	2	2	LOW	
EO 2.1.4	2.1.4 Water Extraction		2	1	2	LOW	
Component 2.2 Ecological Community Structure and Biodiversity							
EO 2.2.1	2.2.1 Plankton (eg blooms)		2	3	6	LOW	
	2.2.2 Benthic Communities						
EO 2.2.2.1		2.2.2.1 Nutrients	3	2	6	LOW	
EO 2.2.2.2		2.2.2.2. Antifoulants	3	2	6	LOW	
EO 2.2.3	2.2.3 Listed Migratory Birds		1	2	2	LOW	
	2.2.4 Threatened, Endangered & Protected Species.						
EO 2.2.4.1		2.2.4.1 Other than seals	1	2	2	LOW	
EO 2.2.4.2	.	2.2.4.2 Seals	1	6	6	LOW	
EO 2.2.5	2.2.5 Protected Habitats		1	2	2	LOW	
EO 2.2.6	2.2.6 Translocation Between Regions		4	2	8	**MOD**	**LOW**

Objective	**Activity**	**Aspect**	**Consequence**	**Likelihood**	**Numerical Risk**	**Descriptive Risk**	**Target Risk**
Component 2.3 Physical Structures and Construction & Tenure							
EO 2.3.1	2.3.1 Number and Size of Farms (IMS and Disease)		2	5	10	**MOD**	**LOW**
EO 2.3.2	2.3.2 Terrestrial Habitat Removal		1	1	1	LOW	
EO 2.3.3	2.3.3 Heritage Values		1	1	1	LOW	
EO 2.3.4	2.3.4 Navigation		1	4	4	LOW	
EO 2.3.5	2.3.5 Infrastructure		2	2	4	LOW	
EO 2.3.6.	2.3.6 Noise		1	3	3	LOW	
Component 2.4 Production							
EO 2.4.1	2.4.1 Regional Carrying Capacity		3	2	6	LOW	
EO 2.4.2	2.4.2 Disease		3	4	12	**MOD**	**LOW**
EO 2.4.3	2.4.3 Disposal of Processing and Harvesting Waste (bloodwater)		1	3	3	LOW	
EO 2.4.4	2.4.4 Disposal of Mortalities		2	2	4	LOW	
EO 2.4.5	2.4.5 Use of Aquavet Chemicals		2	2	4	LOW	
Component 4: National Social and Economic Wellbeing							
Component 4.1: Economic							
SEO 4.1.1	4.1.1: State Economy		1	2	2	LOW	
SEO 4.1.2	4.1.2: National Economy		3	2	6	LOW	
Component 4.2: Social							
SEO 4.2	4.2: Contribution to social wellbeing		2	2	4	LOW	
Component 5: Community Wellbeing							
Component 5.1: Industry Community							
SEO 5.1	5.1 Economic & Social support		4	2	8	**MOD**	**LOW**
Component 5.2: Dependant Communities							
SEO 5.2	5.2 Economic & Social support		3	2	6	LOW	

Objective	Activity	Aspect	Consequence	Likelihood	Numerical Risk	Descriptive Risk	Target Risk
Component 6: Indigenous Community Wellbeing							
Component 6.1 Income							
SO 6.1	6.1 Income		1	1	1	LOW	
Component 6.2 Employment							
SO 6.2	6.2 Employment		1	1	1	LOW	
Component 6.3 Community Viability							
SO 6.3	6.2 Community Viability		1	1	1	LOW	
Component 6.4 Cultural Values							
SO 6.4.1	6.4.1 Traditional Fishing		2	1	1	LOW	
SO 6.4.2	6.4.2 Access to land		3	1	3	LOW	
SO 6.4.3	6.4.3 Heritage Sites		3	1	3	LOW	
Component 7: Governance							
Component 7.1: Intergovernmental Coordination							
SEO 7.1.1	7.1.1. Management Agency		2	4	8	**MOD**	**LOW**
SEO 7.1.2	7.1.2. Local Government		2	3	6	LOW	
SEO 7.1.3	7.1.3. Australian Government		4	3	12	**MOD**	**LOW**
Component 7.2: Industry							
SEO 7.2	7.2: Industry representation		1	2	2	LOW	
Component 7.3: Others (NGOs)							
SEO 7.3	7.3: Community representation		2	4	8	**MOD**	**LOW**
Component 8: External Impacts of the Environment on Industry							
Component 8.1: Impacts of the Environment on the Industry							
	8.1.1: Climate Induced Changes						
EO 8.1.1.1		8.1.1.1: Temperature rise	4	6	24	**EXT**	
EO 8.1.1.2		8.1.1.2: Rainfall	2	6	12	**MOD**	
EO 8.1.1.5		8.1.1.3:Sea-level Rise	1	6	6	LOW	
EO 8.1.1.3		8.1.1.4: Storms	1	6	6	LOW	
	8.1.2: Human Induced Changes						
EO 8.1.2.1		8.1.2.1: Water Quality	2	4	8	**MOD**	**LOW**
EO 8.1.2.2		8.1.2.2: Land Use Changes	2	4	8	**MOD**	**LOW**
EO 8.1.2.3		8.1.2.3: Environmental Flows	1	4	4	LOW	
EO 8.1.2.4		8.1.2.4: Exotic species and weeds	2	3	6	LOW	

Objective	Activity	Aspect	Consequence	Likelihood	Numerical Risk	Descriptive Risk	Target Risk
	8.1.3: Biological Changes						
EO 8.1.3.1		8.1.3.1: Disease	3	2	6	LOW	
EO 8.1.3.2		8.1.3.2: Predators	1	6	6	LOW	
Component 8.2: Impacts of other external drivers							
	8.2.1: Politics						
SEO 8.2.1.1		8.2.1.1: Sovereign Risk	3	2	6	LOW	
SEO 8.2.1.2		8.2.1.2: Competing Uses	2	4	8	**MOD**	**LOW**
	8.2.2: Economics						
SEO 8.2.2.1		8.2.2.1: Domestic.	2	3	6	LOW	
SEO 8.2.2.2		8.2.2.2: International	2	2	4	LOW	
SEO 8.2.3	8.2.3. Regulations		2	3	6	LOW	

Acknowledgments

The Author wishes to thank the Environmental Management System Steering Committee and those who have been part of the Salmon Working Group. These people have freely given up their time for numerous meetings and workshops to keep the project on track. I also thank my Principal Investigator Neil Stump who took over the helm half way through the project and provided support while the Tasmanian Fishing Industry Council (TFIC) underwent changes and Col Dyke who chaired the steering committee.

This project was funded through the TFIC by the Fisheries Research and Development Corporation (FRDC) with cash contributions from the Tasmanian Salmonid Growers Association (TSGA), Tasmanian Oyster Research Council (TORC) and the Tasmanian Abalone Growers Association (TAGA), and in-kind contribution from TFIC and the Department of Primary Industries and Water (DPIW) Marine Farming Branch. Assistance for travel to meetings was also provided by the ESD sub-programs, and by Seafood Services Australia (SSA).

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Note to the Reader

The EMS Framework for the Tasmanian Salmonid Industry has been designed to follow the structure provided by the National ESD Framework: 'How To' Guide for Aquaculture (Fletcher et al 2004). The National ESD Framework consists of a series of components structured into a **Generic Component Tree.** There are three branches on this Generic Component Tree: ecological, social wellbeing and ability to achieve. Each branch contains either 2 or 3 **Components** as shown in Figure i.

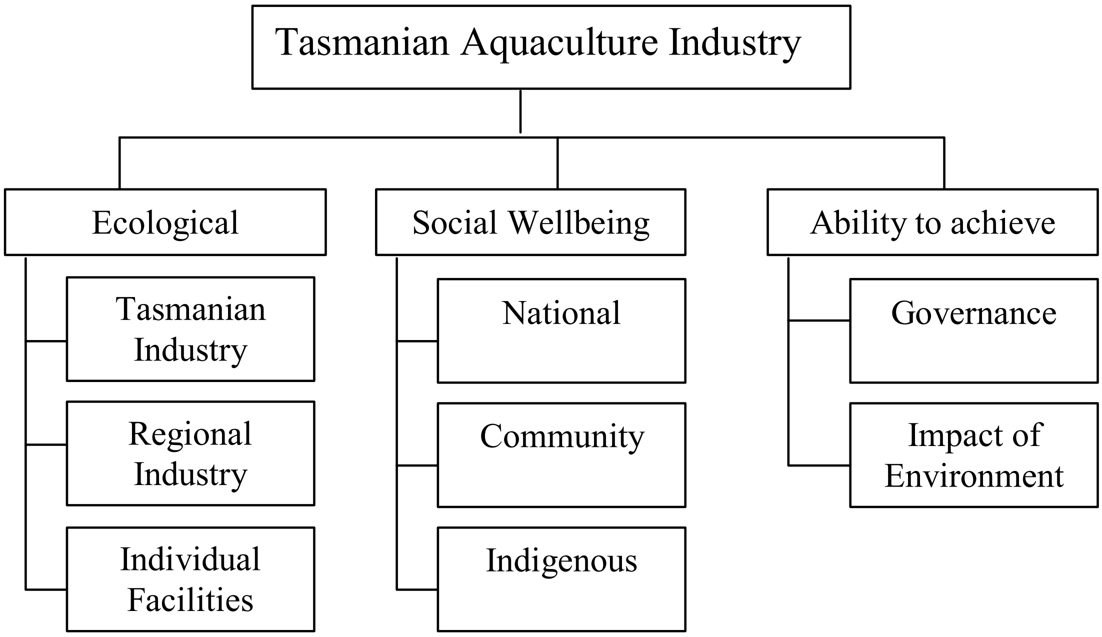


Figure i. Generic component tree from the national ESD framework (adapted from Fletcher et al 2004)

Each numbered **Component** is assessed as a chapter and has an individual **Component Tree.** Each numbered Component Tree has **Sections** (numbered 1.1, 1.2, 1.3 etc.) which describe a particular activity; each Section contains a number of relevant **issues or aspects**, as demonstrated in Figure ii.

The document will refer to the relevant Component tree as a **component**, and the numbered Sections within the component tree as **Sections, issues or aspects**.

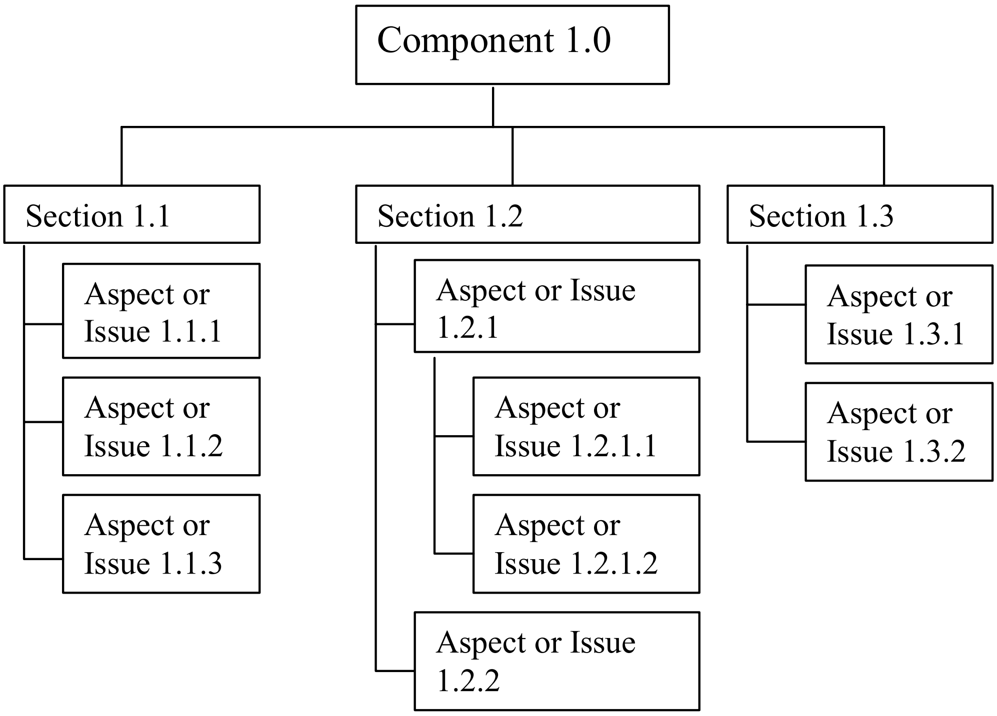


Figure ii. The construction of the component trees

The document repeatedly contains a number of acronyms. Please refer to the attached **Glossary of Acronyms and Terms** at the back of the document for clarification. Throughout the document, the Tasmanian salmonid marine farming industry will be referred to as the **Industry**.

Introduction: Environmental Management System Framework and ESD Objectives

Background

The gross value production (GVP) of Tasmanian marine farming is approximately $185 million a year and is one of the states most significant industries. Salmonid farming is the most valuable Tasmanian aquaculture enterprise, worth over M$115 in 2003-2004 (ABARE 2005). The Tasmanian Salmonid Industry recognises that under the Tasmanian *Resource Management and Planning System* (RMPS) the Industry is required to promote sustainable development and use of the environment. The Environmental Management System (EMS) Framework for the Tasmanian Salmonid Industry has been developed to assist the industry to achieve and improve its sustainability.

The Tasmanian Salmonid Growers Association (TSGA) has long recognised its responsibilities in regard to "sustainable development" (as defined under the Objectives of the *Resource Management and Planning System* of Tasmania) (RMPS) of natural and physical resources for the purposes of finfish farming. The industry, through the Tasmanian Aquaculture Council (TAC) worked pro-actively with Government in the drafting of both the *Living Marine Resources Management Act 1995* (LMRMA), and the *Marine Farming Planning Act 1995* (MFPA). Simultaneously, industry worked pro-actively with the regulators, the Marine Farming Planning Review Panel (MFPRP), research organizations and the community to develop appropriate mandatory management controls under Marine Farming Development Plans, and mandatory license conditions under the LMRMA, in compliance with the sustainable development objectives of RMPS. The key objectives of the Environmental Management System (EMS) Framework for the Tasmanian Industry has been to achieve and improve the Industry's sustainability under current conditions, and to identify the external threats (which are beyond the Industry's control) to the Industry's longer term sustainability.

The Industry is committed to further developing environmentally sustainable management practices that reflect the requirements of sustainable use and development of natural resources, from the social, economic and environmental perspective. These practices are being achieved by basing the EMS Framework on the principles of Ecologically Sustainable Development (ESD). The EMS Framework reflects the criteria for ESD from the *National ESD Framework: 'How To' Guide for Aquaculture*, produced by FRDC (Fletcher et al. 2004), which facilitates the analysis of the Industry's environmental impacts against the principles of ESD.

The ESD Framework consists of eight major components in a generic component tree. The generic component tree is structured into three branches: contribution to ecological wellbeing, contribution to human wellbeing, and ability to achieve; as described in the Note to the Reader (Fig i).

The ecological wellbeing branch is structured into 3 spatial levels:

- Whole of Industry issues
- Catchment and regional issues
- Within facilities issues

The document provides validation for the aspects arising in the first two levels and guidance notes for the third level. Individual facilities will need to validate their own practices for issues arising in the third level (Component 3).

What are ESD and SD?

Ecologically Sustainable Development (ESD) is:

> "*Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased*" (COAG 1992).

It includes three key objectives;

- To enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;
- To provide equity within and between generations; and
- To protect biological diversity and maintain essential ecological processes and life-support systems.

Tasmanian legislation, including the *Marine Farming Planning Act 19*95, is based on the objectives of Sustainable Development (SD).

Sustainable Development means

> "managing the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural wellbeing and for their health and safety while –
>
> **(a)** sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations; and
>
> **(b)** safeguarding the life-supporting capacity of air, water, soil and ecosystems; and
>
> **(c)** avoiding, remedying or mitigating any adverse effects of activities on the environment."

The social wellbeing branch is also structured into 3 spatial levels;

- National/State
- Community
- Indigenous

All three components are discussed, but there is limited data available for the Community social impacts.

The third branch reflects the impacts that may affect Industry's sustainability including political and environmental issues.

How the EMS/ESD Framework operates

Five key elements have been identified to demonstrate that the Industry is compliant with the principles of ESD (adapted from Fletcher et al 2004):

1. Identify the issues relevant to the Industry/sector;
2. Prioritise these issues;
3. Complete a suitably detailed report/ management strategy for each issue
4. Compile a summary of background material on the Industry, the major species affected and the environments that the Industry operates within;
5. Use the generated material to assist individuals or Industry to demonstrate that outcomes are being obtained through the development of EMS's, Codes of Practices or agency reports.

This document covers the first 4 elements of the ESD principles, which will assist Industry in completing the fifth element.

The Benefits of an EMS for Industry

Implementing an EMS can deliver a number of benefits to the Industry, individual businesses, the community and the environment including:

- Retained access to the marine resource
- Improved business performance and efficiency
- Increased profits
- Reduced resource use and waste generation
- Improved environmental performance
- A better understanding of operations
- Demonstrated good public image
- Reduced environmental liabilities.

THE NATIONAL ESD FRAMEWORK

Contribution to Ecological Wellbeing

1. **Impacts on the General Environment (Whole of Industry)**
   Deals with ecological impacts on a state-wide basis.

2. **Impacts within the Catchment/Region**
   Deals with the cumulative impacts that may occur from multiple facilities in one region or catchment.

3. **Impacts within Facility**
   Provides guidance notes for individual facilities to implement the principles of ESD.

Contributions to Human Wellbeing

4. **National Wellbeing**
   Deals with the contribution of the industry to the national economy, employment, supply of fish, trade deficit etc.

5. **Community Wellbeing**
   Includes the potential social and economic impacts of the industry on the local or regional community.

6. **Indigenous Wellbeing**
   How the industry affects and integrates with the indigenous community. This component also includes regional aspects.

Ability to Achieve

7. **Governance**
   Ensures that legal, institutional, economic and policy frameworks underpin the principles of ESD and allocate appropriate resources.

8. **Impacts of the Environment**
   Determines issues that may reduce or improve performance of the industry that are outside of the direct control of the management agency.

Scope of the EMS Framework

This EMS framework assesses environmental risk at a whole of industry and regional level for marine salmonid farming leases and associated land based support facilities in Tasmania. All environmental components defined by the National ESD Framework are covered, except those justified as not relevant for the Industry. Those components omitted from the document are explained at the beginning of each component chapter.

Issues covered by the scope of this EMS include, but are not limited to:

- Environmental quality of the growing area
- Environmental aspects of marine farming operations
- Actions taken by all stakeholders, including the marine farmers that may affect the environmental quality and productivity of the catchment area used by the Industry.

Development of the EMS Framework

The EMS framework was developed by Phycotec Aquaculture Environmental Management under contract to the Tasmanian Fishing Industry Council (TFIC) with assistance from the Fishing Research Development Corporation (FRDC), the Department of Primary Industries and Water (DPIW) and Seafood Services Australia (SSA). The development of the EMS framework was directed by a steering committee of industry, research and government advisers including:

Judith-Anne Marshall (Phycotec) – Project Officer
Neil Stump (TFIC) – Project Manager
Colin Dyke (Little Swanport EMS Pilot Project / TAC) - Chair
Christine Crawford (Tasmanian Aquaculture and Fisheries Institute)
Miles Cropp (Tasmanian Abalone Growers Association)
Pheroze Jungalwalla (Tasmanian Salmon Growers Association)
Andrew Febey (TFIC)
Richard Pugh (TSEC)
Barry Ryan (TORC)
Colin Shepherd (DPIWE)
Ed Smith (TFIC)

Note: Although members of this committee have been involved in the development of this document, the content and risk assessments are not necessarily a reflection of the opinions of the individual members of the committee.

Risk assessment procedures as developed by Fletcher et al. 2004 (Appendix 1.0) were used to identify and assess all aspects or issues in the EMS Framework. Current management controls and evidence from the scientific literature are considered for each aspect. This information is taken into account in the risk analysis. The EMS Framework is designed to complement the large number of existing policies and regulations that the Industry already complies with, and to integrate these into the daily management regimes of an organisation.

The format of this EMS is to allow ongoing updating of the information it contains. The document will require periodic review to ensure that the objectives are still relevant and should take into account:

- changing environmental regulations
- changes in technology and management
- feedback from the community
- emerging issues in environmental management.

The document may also be used as a consultation instrument with stakeholders, and to promote the Industry's environmental awareness.

What is Risk?

"*Risk is the chance of something happening that will have an impact on objectives*." (AS/NZS 4360 – 1999)

What is Risk Analysis?

"*Risk analysis involves consideration of the sources of risk, their consequences and the likelihood that these consequences may occur*." AS/NZS 4360-1999

Risk Assessment Process

By identifying the relative level of risk, the Industry can determine the appropriate level of management response. The risk relates to both impacts from Industry on the environment and impacts to industry from external factors, as identified through the eight component trees. Examples may include:

- the risk associated with the Industry's ability to perform against the relevant legislation
- the potential impacts upon the long term profitability of the Industry
- the risk associated with possible impact on the ability of the community to enjoy the marine/coastal environment
- the risk to the integrity of the ecosystem in which the Industry operates.

The major objective of using the risk assessment technique is to separate the minor and acceptable risks from the major and unacceptable risks. This assessment requires the determination of two factors in each issue – the potential consequence arising from the activity on an aspect, and the likelihood that this consequence will occur. A risk value is calculated by combining values from the consequence and likelihood. Suitably qualified persons as listed in Table 1 conducted the risk assessments. Please note that although the risk assessments were achieved by general consensus of opinion, the assessment does not necessarily represent the opinion of any individual.

Table 1. The Salmonid Working Group incorporating relevant personnel from industry, research and government conducted the risk assessments.

Person	Relevant experience	Component 1	Component 2	Component 4	Component 5	Component 6	Component 7	Component 8
Dr Judith-Anne Marshall PhD. Dip. Ed. MEIANZ	Tasmanian EMS Project Officer; Principle Consultant, Phycotec Environmental Management; ISO 14001 Environmental Auditor	X	X	X	X	X	X	X
Neil Stump B App Sci (BSc.Hons) (Fisheries)	Principal Investigator, Tasmanian EMS Framework project; CEO, Past President and Director, TFIC.	X	X					X
Pheroze Jungalwalla	Executive Officer TSGA	X	X	X	X	X	X	X
Dr Domonic O'Brien PhD,	Environmental Consultant, Huon Aquaculture Company.	X	X	X	X	X	X	X
Mick Hortle	Production Manager, Van Diemen Aquaculture P/L, ISO 9002 Auditor.	X	X	X	X	X	X	X
Craig Selkirk	Special Projects Manager, Tassal Group.							
Barry McClure	Sea Farms Manager SEVRUP Fisheries Strahan (subsidiary Petuna Seafoods Pty Ltd)							
Dr Christine Crawford Ph D.	Program Leader-Natural Resource Management, TAFI; EMS Steering Committee member							
Colin Shepherd B Sc. (Hons)	Principal Marine Environmental Officer, DPIW Marine Farming Branch; EMS Steering Committee member	X	X	X	X	X	X	X
Dr Kevin Ellard BSc BVMS Dip Agric MACVSc(Aquat Hlth)	DPIW Senior Veterinary Officer (Aquatic Health)	X	X					X
Mr Nick Pretracca	Risk Manager, Tassal Group	X	X					X

The risks that are assessed will differ in values depending upon current management controls. If no management controls were in place, the risk assessment would define the *potential risk*. However, the aim of this exercise is to take into account the current management controls to determine the *managed* or *residual risk*. Where the risk assessment identifies issues which need the risk reduced, a *target risk* would be incorporated: where Industry, over a period of time, may wish to develop techniques/management options to reduce the *potential or managed risk* to the *target risk*. For the purposes of this document, unless otherwise stated, all further risk referred to will be the *managed* or *residual risk*.

Consequence

The consequence of an issue is the effect or outcome a particular issue will have. Consequence relates to the importance of an issue.

Likelihood

The likelihood is the conditional probability of an event occurring. It relates directly to the impact of the event, not the activity surrounding the event

Consequence and Likelihood Tables

The risk assessment methodology used for the Industry employs the use of consequence and likelihood tables. More than one consequence table is used for risk assessment due to the variety of issues, and possible outcomes, within and between the component trees. A general consequence table has been developed to assess most environmental issues (Table 2). However, a series of alternative consequence tables, each with 6 levels, has been developed by the National ESD Framework to assess specific issues including:

1. Protected Species
2. Habitat Issues
3. Ecosystem trophic level effects
4. Social Political issues

All consequence tables are provided in Appendix 1.0 with notes for use. All referrals to the consequence table will mean the general consequence table (Table 2), unless otherwise specified.

Table 2. The general consequence table for use in ecological risk assessments related to Industry

Consequence	Score	Definition
Negligible	**0**	Very insignificant impacts. Unlikely to be measurable at the scale of the stock/ecosystem/community against natural background variability
Minor	**1**	Possibly detectable but minimal impact on structure/function or dynamics
Moderate	**2**	Maximum acceptable level of impact – recovery measurable in months or years
Severe	**3**	This level will result in wider and longer term impacts – recovery measurable in years
Major	**4**	Very serious impacts with relatively long time frame likely to be needed to restore to an acceptable level – recovery measurable in decades
Catastrophic	**5**	Widespread and permanent irreversible damage or loss will occur – unlikely to ever recover (eg causing extinctions)

Table 3. Likelihood table showing definitions.

Likelihood	Score	Definition	Indicative frequency
Remote	**1**	Never heard of, but not impossible.	One in 1,000 years
Rare	**2**	May occur in exceptional circumstances.	Once every 100 years
Unlikely	**3**	Uncommon, but has been known to occur	Once every 30 years
Possible	**4**	Some evidence to suggest this may possibly occur	Once every 10 years
Occasional	**5**	May occur	Once every 3 years
Likely	**6**	It is expected to occur	Once a year or more

Table 4. Risk matrix – numbers in cells indicate risk value (see Table 4 for details).

		Consequence					
Likelihood		**Negligible**	**Minor**	**Moderate**	**Severe**	**Major**	**Catastrophic**
Remote	**1**	0	1	2	3	4	5
Rare	**2**	0	2	4	6	8	10
Unlikely	**3**	0	3	6	9	12	15
Possible	**4**	0	4	8	12	16	20
Occasional	**5**	0	5	10	15	20	25
Likely	**6**	0	6	12	18	24	30

There is one likelihood table only, which has qualitative criteria that range from 'remote' to 'likely' as shown in Table 3. Information from the consequence and likelihood tables are combined in a risk matrix table (Table 4) to provide an arithmetical value on the calculated risk using consequence multiplied by the likelihood. The risk values have been ranked into five risk ranking categories (Table 5). Any risk ranked greater than low (6) in the EMS Framework requires a full performance report and management plan (Figure 1).

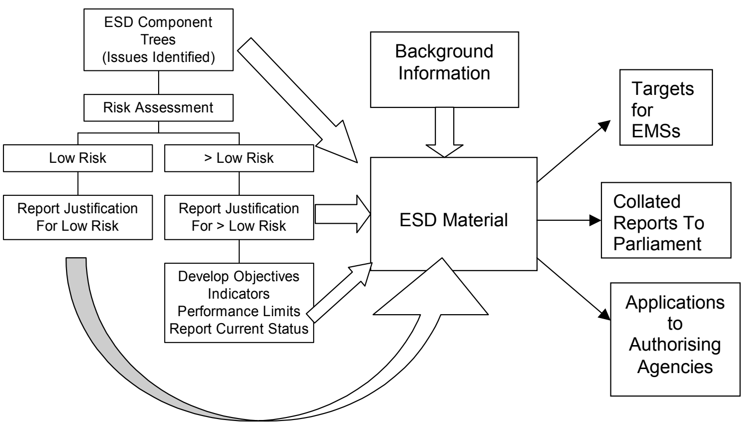


Figure 1. Summary of the National ESD Reporting Framework process for aquaculture (Adopted from Fletcher et al 2004).

Table 5. Risk Ranking and Outcomes.

Risk Ranking	Risk Value	Description	Reporting Requirements	Management Response
Negligible	**0**	Not an issue	Short justification only	Nil
Low	**1-6**	Acceptable – no specific control measures needed	Full justification needed	No specific action needed to achieve acceptable performance
Moderate	**8-12**	Specific management needed to maintain acceptable performance	Full performance report	Review current arrangements
High	**15-18**	Not desirable – continue strong management action. Further or new risk control measures may need to be introduced in the near future	Full performance report	Probable increases to management needed
Extreme	**>20**	Unacceptable – major changes required to management approach in near future	Full performance report	Substantial additional management controls needed.

Document Structure

The document comprises two introductory chapters: EMS Framework and ESD Principles, and Description of the Industry.

The following eight chapters cover each of the components in the ESD generic component tree. Complementary to this document are the Appendices that contain reference material pertinent to the aspects and issues in the component trees.

Description of the Industry

Background

Salmonid farming has expanded rapidly in Tasmania since the 1990s and is now a major industry in the State. Other secondary industries have also grown up around salmonid farming, creating additional economic and employment benefits for the State.

High quality and minimal disease problems ensure the Tasmanian product attracts a premium price in overseas markets. Tasmania is a very small player in the world Atlantic salmon market, but has built the industry on the basis of its quality advantage and the consequent ability to develop its own niche in the market.

Tasmania is the main state in Australia where environmental conditions are suitable for mariculture of Atlantic salmon, though South Australia has some minor commercial operations. Strict quarantine controls on the importation of salmonid products and the quarantine protocols developed during the introduction of salmon into Tasmania, have protected the industry from almost all the serious diseases which have affected salmon producers in other countries.

Introduction of Salmonids into Tasmania

Tasmanian does not have naturally occurring salmonid species (species within the Family Salmonidae), all salmonids having originally been introduced from Northern Hemisphere stocks. Tasmania does however have a number of native species contained within the family Galaxiidae, also belonging to the Order Salmoniformes.

Salmonids (brown trout) were originally introduced to Tasmania during the 1860's and represented the first introduction of this species to the Southern Hemisphere. The species quickly became established in Tasmanian inland waters and formed the basis of a recreational trout fishing industry.

The present Tasmanian salmonid industry has its origins in the establishment of a freshwater trout farm at Bridport in 1964. A second farm was established in 1978 at Russell Falls. It was not until 1980 that the first successful seawater rainbow trout trial was conducted at Nubeena as a result of collaboration between Japanese experts, the Tasmanian Fisheries Development Authority and a local company.

Atlantic salmon eggs were introduced into Tasmania from the New South Wales freshwater hatchery at Gaden in 1984, and further transfers took place during the following two years. All introductions were made under strict quarantine controls and the hatched fingerlings were held in quarantine at the Taroona Fisheries Research Laboratory.

The Atlantic salmon industry was established as a joint venture project between the State Government, the Norwegian company Noraqua, and a group of private Australian companies. This led to the establishment of Salmon Enterprises of Tasmania Pty Ltd (SALTAS). SALTAS initially had responsibility for the production of all smolt (the juvenile fish) as well as the running of a sea farm site at Dover. The latter was sold to private operators in 1987. SALTAS has been responsible for the conduct of the freshwater hatchery at Wayatinah, and for providing research and extension services to industry through the lease of facilities at Dover. Most trials on feed formulations, growing techniques and disease control have been carried out at Dover.

The agreements which led to the setting up of SALTAS were incorporated into the *Salt-Water Salmonid Culture Act 1985* which provided SALTAS with a monopoly on Atlantic salmon smolt production for ten years until 1995. With the expiry of the moratorium, the way was opened for further hatcheries to be established.

Salmonids Species Farmed in Tasmania

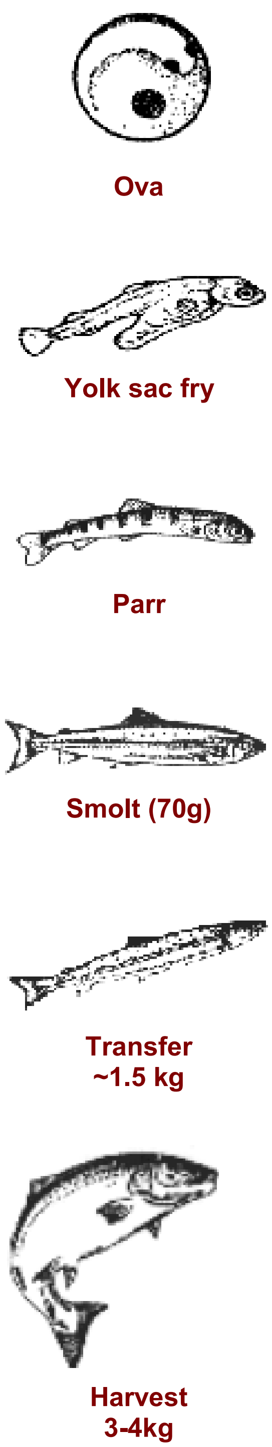
Rainbow Trout, *Oncorhynchus mykiss*
The first reported introduction of rainbow trout to Tasmania was in 1898 using ova obtained from New Zealand. This was followed by further New Zealand shipments up until 1964. The last ova importations occurred in 1970 from a hatchery at Ballarat in Victoria, Australia. Self-maintaining populations are not common in rivers and natural 'sea-run' rainbow trout are not regularly caught in Tasmania. Several lakes have naturally reproducing populations, and many farm dams are also stocked.

Commercial rainbow trout farms are well established in the State with the first commercial enterprise being established at Bridport on the north coast of Tasmania in 1964. A second freshwater farm followed this at Russel Falls in the south during the early 1978. Seawater culture of rainbow trout was first attempted on the Tamar River in the early 1970’s; however this met with little success. The farming of rainbow trout is largely restricted to the brackish waters of Macquarie Harbour and the Tamar River where the species is also grown in sea cages. Some freshwater culture to harvest size does occur but is minimal.

Atlantic Salmon, *Salmo salar*
Atlantic salmon were first introduced to Tasmania in April 1864 following a shipment of eyed ova from the United Kingdom. Several further imports were made in the period up to 1885 resulting in up to 40 000 parr and smolt being released into State’s rivers. No Atlantic salmon populations established from this initial introduction.

Due to a total ban on import of all salmonid products into Australia since 1975, Atlantic salmon was reintroduced into Tasmania in 1984 using stock from mainland Australia. Ova from a landlocked population in the Snowy Mountains of New South Wales were maintained as a quarantined population with only progeny released for commercial purposes. Salmon broodstock were extensively tested prior to spawning to ensure no disease was introduced to Tasmania that could adversely affect the sport fishery and commercial trout farms.

Life Cycle of the Atlantic Salmon



Each year in March the maturing parent fish (called broodstock) are moved from a seawater farm to the hatchery. At the beginning of May the broodstock start to spawn. Eggs are collected, fertilised and laid out in special incubator trays in the hatchery building. The eggs are supplied with a constant flow of fresh, well oxygenated water which is heated to enhance fish development. It is also filtered to minimise silt settlement on the eggs and gill damage in young fish.

The eggs start hatching in July, with the young fish initially absorbing nutrients from a large yolk-sac attached to their bodies. When they are ready to eat for the first time, they are moved into small tanks and provided with a specially prepared food, broken up into particles which are small enough for the fish to eat. The feed contains a balanced package of all of the nutrients the fish need, consisting mainly of fish meal, vegetable matter, added vitamins and minerals.

The fish eventually become too big for the hatchery tanks and are transferred to large tanks in the on-growing area, where they spend the majority of their lives before being transferred to sea. In the warmer months the salmon use more oxygen than the river can provide, which means that the oxygen levels have to be artificially boosted using specialised equipment.

During the 8-16 months following hatching the salmon become smolts and are transferred to sea. Transfer is achieved by using pumps to load the fish into tanks of water on trucks. At this point they are also electronically counted. Oxygen is added to the tank water so that the fish can be safely transported. This occurs when the fish is approx 15 months old and weigh approximately 70g

Once transferred from the hatchery, most of the fish are held in fish cages at "nursery" sites in brackish water (although in some cases this stage is skipped and the fish are placed directly into a full saltwater site). During this time, they are held in large cages, and grow quickly. After 6 to 9 months they have reached around 1.5kg, and are then transferred to marine sites for grading and on-growing to harvest size. The nursery sites are then rested (in much the same way as a farmer might fallow a field) prior to being used for the next intake of smolt.

Once transferred to the grow out site, the fish are held for up to 15 months. They continue to grow rapidly in the cages in the sea water, until they are ready to be harvested. The typical harvest size is between 3kg and 4 kg. Once harvested, most fish farms again rest the site prior to using it again.

After harvesting

Figure 2. Life Cycle of the Atlantic Salmon

Salmon Production Systems in Tasmania

Salmonid production within Tasmania is based on the traditional method of smolt and parr production in freshwater hatcheries with grow-out in marine cage systems.

All freshwater aquaculture establishments in Tasmania must be licensed under the *Inland Fisheries Act 1995*. Freshwater aquaculture operations conducted on these licensed premises are subject to conditions specified within the relevant licence. All freshwater finfish aquaculture establishments are located on separate waterways.

There are currently eight commercial hatcheries in operation throughout the state producing salmonid ova. Of these, seven produce Atlantic salmon; five produce rainbow trout in addition to Atlantic salmon and one spawns only trout. In addition to these, there are four commercial freshwater sites that buy in ova for grow-out to smolt or parr for sale to marine farms. At the present time there are only two freshwater facilities growing salmonids (rainbow trout) to harvest size.

The Inland Fisheries Service operates a small hatchery for the purpose of restocking natural waterways. This hatchery, Salmon Ponds, is the oldest hatchery in the State and undertakes spawning of brown trout and rainbow trout collected from natural waterways. The establishment also maintains a small breeding population of brook trout. These fish are intensively tested as part of the Tasmanian Fish Health Surveillance Program (TFHSP) and are used as sentinels for wild salmonid populations.

Production cycle

The industry produces mixed sex stock, all-female stock and triploid female populations in both salmon and trout. Salmon smolt production begins in April as S0's (Out-of – season smolts), through July for S0+'s (marine presmolt) and finishes in November with the production of physiological normal S1's (spring smolt).

Out-of-season smolt are manipulated using artificial lighting to bring forward both winter and spring lighting patterns whilst marine presmolt only have the spring lighting pattern advanced.

Hatchery reared juveniles or "smolts" are introduced to the marine environment where they are farmed for approximately two years before final harvesting (Fig 2). During that time, the fish are contained in pens that consist of a floating structure with a cup shaped net suspended underneath. These structures may consist of individual pens make from polyethylene pipe called polar circles, or a number of netted pens joined together in a raft primarily made from drums attached to a steel frame (Fig 3). Each pen or raft has stanchions extending above the water line to support a handrail and the nets. This assists with the servicing of the nets and prevents fish from jumping out of the cage. For small fish, predation is prevented from birds by netting covering the pens from above and supported by poles. Predation from the marine environment is minimised by suspending heavier netting around the perimeter of the cage.

Figure 3. Salmonid farming systems in Tasmania. a. Polar circles (Source. G. Woods); b. Raft system

Regional growing areas

There are 14 regional areas for marine farms identified by DPIWE through the Marine Farm Development Plans. Five of these areas are currently being used for salmonid farming as described in Table 6.

Table 6. Geographical location of salmonid leases and lease area details as provided by the relevant DPIW Marine Farm Management Plans (* production included in Huon/Esperance data).

Area	Number of zones	Maximum leasable area (ha)	Existing finfish lease area (ha)	Number of finfish leases	Percentage of Industry Production
1. Macquarie	10	327	6.4	1	4.0%
2. Tamar	5	24.5	56.7	4	*
3. Tasman	6	102	388.3	13	16.3%
4. Channel	34	870	421.8	17	64.7%
5. Huon/Esperance	15	380	554.4	10	15.0%

Processing and Markets

Most of the larger producing companies also incorporate processing into their operations. At present, there are eight processors, the largest one being Tassal, which is located at Huonville, in the State's south.

Most of the salmon produced in Tasmania (over 90%) is consumed by the domestic Australian market. However, there is also an important overseas export market, particularly to Japan, with lesser amounts to Indonesia, Hong Kong and Singapore.

Component 1: Impact of the Industry on the Environment

Introduction

This component reviews the issues or aspects covered in the first ESD generic component tree for the Industry (Fig 1.0) that require management outcomes at the whole of Industry level.

The two areas covered by the Component tree include the potential impact that the Industry may have on:
(i) the husbandry of cultured species
(ii) other species that could be affected in all areas

The impact of the Industry on the General Environment generic component tree has been adapted from the National ESD Framework through the addition or exclusion of issues, depending upon their relevance to the Industry.

Additional topics include:
- Transfer of Diseases (Section 1.1.2) covers the overseas and interstate importation and exportation of live salmonids or their genetic material and non-viable uncooked salmonid and other marine finfish products.
- Translocation of Invasive Marine Species (Section 1.1.3) at a national and international level.

Combinations of topics include:
- Food Chain Impacts has been incorporated into Behavioural Changes (Section 1.2.5: Behavioural Changes and Food Chain Impacts) as most behavioural changes relate to the higher food chain.

Excluded topics include:
- Wildstock of Cultured Species. Tasmania does not have naturally occurring salmonid species (species within the family Salmonidae), all salmonids having originally been introduced from the Northern Hemisphere stocks (DPIWE 2003) Refer to Industry description for further detail.
- Water Quality (under Section 1.2: Other Species Community Processes) is dealt with on a regional basis in Section 2.1: Water Use Quality/Quantity.

The risk assessment for all issues (or aspects) has used the General Consequence Table (Appendix 1.0; Table 1.1), except for Section 1.2.6: Sensitive Habitats where Table 1.2, Appendix 1.0 has been used.

1.0 Impacts of Industry on the Environment

- 1.1 Cultured Stocks/businesses (Husbandry)
  - 1.1.1 Genetics
  - 1.1.2 Transfer of Disease
    - 1.1.2.1 Import
    - 1.1.2.2 Export
  - 1.1.3 Translocation (Invasive Marine Species)
    - 1.1.3.1 Import
    - 1.1.3.2 Export
  - 1.1.4 Animal Welfare
- 1.2 Other Species/Community Processes
  - 1.2.1 Disease
  - 1.2.2 Escape of Cultured Species
  - 1.2.3 Feed Composition (Source & Sustainability)
  - 1.2.4 Chemicals (Hydrocarbons)
  - 1.2.5 Behavioural Changes and Food Chain Impacts
  - 1.2.6 Sensitive Habitats
    - 1.2.6.1 Seagrass Beds
    - 1.2.6.2 Macroalgal Communities
    - 1.2.6.3 Invertebrate Communities

Fig 1.0. Component Tree 1: Impact of the Tasmanian Salmonid Industry on the Environment

1.1: CULTURED STOCKS / BUSINESSES (HUSBANDRY)

This section describes how Industry practices have an impact on the stocks being cultured within facilities.

1.1.1: Genetics

Scope

To assess the risk of introducing undesirable characteristics through cultured stock breeding programs.

Current Management Controls

Up to 2004, the Industry had a deliberate policy of non-selection of salmonid stocks through the Industry/Government based salmon breeding company Saltas. The industry consciously maintained a broad genetic base within the Tasmanian population of salmonoids, adequate to support a selective breeding program (Elliot et al 2003). More recently, the Industry has implemented a selective breeding program aimed at selection of desirable traits to improve the sustainability of the Industry through production efficiency. The new selective breeding program is operated by Saltas in collaboration with the CSIRO who have jointly invested more than $500,000 in 2005 to get the research running (ABC 2005). The selective breeding program is focused on improving the following traits while ensuring there is minimal narrowing of the gene pool or selection of undesirable traits:

- Growth performance in seawater prior to maturation;
- Resistance to Amoebic gill disease; and
- Selecting for carcass quality traits.

The Industry does not engage in the production of genetically modified organisms (GMOs). The Industry does produce triploid fish, a condition where newly fertilised fish eggs are induced to retain a third set of chromosomes. Triploid fish are produced, as they are sterile and do not mature, and therefore are marketable all year round. Triploids are not considered as GMOs under the *Gene Technology Bill 2000* or the *Tasmanian Gene Technology Act 2001*.

<table>
<tr><td colspan="4">Risk Assessment 1.1.1: What is the risk of introducing undesirable characteristics into the cultured stocks of salmonids?</td></tr>
<tr><td colspan="4">Environmental Objective 1.1.1: To improve the genetic characteristics of cultured stock through breeding programs.</td></tr>
<tr><td>Consequence
C=3</td><td>Likelihood
L=2</td><td>Risk Rating
C x L =6
Low</td><td>Target Risk Rating
NA</td></tr>
<tr><td colspan="4">Risk Management Options
• Continued review and development of the genetic selection programs.</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Periodic testing of genetic diversity in Tasmanian salmonid stocks
• Measuring of performance of stock</td></tr>
</table>

1.1.2: Import and Export of Disease (Overseas and Interstate)

Scope

To assess the risk on the environment of aquatic disease transfer through export or import of cultured salmonids to or from Tasmania.

Current Management Controls

1.1.2.1: Import

Import into Australia of live salmonids is controlled by Biosecurity Australia in the Department of Agriculture, Fisheries and Forestry (Department of Agriculture Forestry and Fisheries) and would require a permit under the *Quarantine Act 1908* and the EPBCA. At present import of viable salmonids into the country for marine farming purposes is not allowed. The import of non-viable uncooked salmonids from other countries must fulfil a series of risk management strategies to provide an acceptable level of protection (ALOP) and prevent Group 1 priority disease agents from entering the country. These Group 1 disease agents are listed in Appendix 1.1.2.1.

The Import Risk Analysis (IRA) for salmon is located at the following web site. http://www.daff.gov.au/content/publications.cfm?ObjectID=0DC8C04A-098F-4E52-B27B197A1C933C96

The Tasmanian government has also conducted an IRA of the quarantine risks associated with the importation of non-viable salmonids and non-salmonid marine finfish from all countries and mainland Australia into Tasmania. This IRA provides stringent guidelines requiring exporting countries, States or Territories of Australia to provide an official statement of freedom from one or more of the diseases(s) of concern based on the results of a program of monitoring and surveillance of the health of fish (DPIWE 2000).

Tasmanian import of non-viable & viable salmonids together with a range of fish species is banned under regulations issued under the Tasmanian *Animal Health Act 1995* by the Chief Veterinary Officer**.** Details relating to Tasmanian state barrier quarantine may be found at www.dpiwe.tas.gov.au/inter.nsf/WebPages/RPIO-52B2A3?open

Salmonids have not been re-introduced in Tasmania since 1986, as described in the Industry Description. The Industry has no plans to introduce additional stock at the present time. Any further introductions into Tasmania would require a Special Permit, issued by the Chief Veterinary Officer (CVO). The CVO would set testing and quarantine conditions commensurate with Tasmania's protected status with regard to major salmonid diseases of international concern. This is unlikely to occur in the foreseeable future (DPIWE 2003).

1.1.2.2: Export

The export of non-viable Tasmanian salmonids for consumption overseas is managed through the Fish Exports Program. This program manages and facilitates exports according to legislation, most important of which are the *Export Control Act 1982* (ECA), the *Export Control (Prescribed Goods - General) Order 2005* and the *Export Control (Fish and Fish Products) Orders 2005*.

In order to export, land based establishments and vessels which undertake processing (as defined in the *Export Control (Processed Food) Orders*) are required to be registered with AQIS as per the *Prescribed Goods (General) Orders*, and have a quality assurance system in place, as per the *Export Control (Processed Food) Orders*. Export to certain countries may also require a Health Certificate issued by AQIS under the ECA.

Aquatic Animal Health officers from the DPIW Fish Health Unit (FHU), in addition to roles in routine diagnosis and health surveillance, undertake certification testing and inspection on behalf of AQIS, as authorised officers under Section 20 of the (Commonwealth) *Export Control Act 1982* (ECA). In this capacity they also provide export certification on behalf of AQIS.

The translocation interstate of viable Tasmanian salmonids for ongrowing does not occur. However, live salmonid eggs cultured in freshwater are exported from a Tasmanian hatchery interstate and overseas to the United Kingdom, Ireland, Poland Italy and the United States of America (Biosecurity Australia 2003). Live exports of salmonids and their genetic material are conducted under the supervision of an appropriately authorised DPIW officer under the ECA. There is no export of viable salmonids from the marine ecosystem.

Further information can be found at the AAFA website http://www.affa.gov.au.

Risk Assessment 1.1.2.1: What is the risk of importing exotic disease into the state through Industry activities?			
Environmental Objective 1.1.2.1: To ensure that salmonid diseases exotic to Tasmania do not enter the state.			
Consequence **C=4**	**Likelihood** **L=2**	**Risk Rating** **C x L =8** **Mod**	**Target Risk Rating** **Low**
Risk Assessment 1.1.2.2: What is the risk of exporting exotic disease from the state through Industry activities?			
Environmental Objective 1.1.2.2: To ensure that salmonid diseases are not translocated from the state through export of salmonids and/or non-viable products.			
Consequence **C=3**	**Likelihood** **L=3**	**Risk Rating** **C x L =9** **Mod**	**Target Risk Rating** **Low**
Risk Management Options • Import guidelines as set out by the OIE, AQIS and relevant State Agencies • Compliance with translocation protocols and policies • Following export guidelines as set out by the OIE, AQIS, ECA and relevant State Agencies • Industry compliance with license conditions • Continue with vaccination programs to reduce prevalence of disease			
Suggested Performance Measures • Annual reports of disease outbreaks from the Chief Veterinary Officer • Written report provided to TSGA by the DPIW Fish Health Unit			

1.1.3: Import and Export of Invasive Marine Species (Overseas & Interstate)

Scope

To assess the risk of invasive marine species being translocated overseas and interstate through Industry activities. This risk at a regional scale is assessed in Section 2.2.6: Translocation between regions.

Current Management Controls

1.1.3.1: Import

Import into Australia of live finfish from overseas or interstate does not occur, except for ornamental fish, as described in Section 1.1.2.1. Any used marine farming equipment imported into the state is recommended to be disinfected and dried as per the Operational Procedures Manual: Decontamination (DAFF 2006) to prevent the import of exotic diseases. This process also acts as a treatment for the potential import of invasive marine species (Section 2.2.6).

1.1.3.2: Export

There is no export interstate or overseas of live Tasmanian salmonid juveniles or adults or their genetic material from the marine environment. However, live salmonid eggs from the freshwater environment are exported overseas and interstate, and are covered by controls as described in 1.1.2.2: Export. Some trading of used aquaculture equipment between states occurs, including nets and pumps. Industry encourages that that all equipment is washed, disinfected and dried prior to translocation as per the DPIW Disinfection Manual (DAFF 2006). A protocol for the translocation of equipment between Tasmanian catchment regions is being developed (Section 2.2.7). This protocol will also be adopted for the translocation of equipment interstate and overseas.

<table>
<tr><td colspan="4">Risk Assessment 1.1.3: What is the risk of translocating invasive marine species overseas and interstate through Industry activities?</td></tr>
<tr><td colspan="4">Environmental Objective 1.1.3: To ensure that invasive marine species do not enter or leave the state through translocation of Industry equipment.</td></tr>
<tr><td>Consequence
C=4</td><td>Likelihood
L=2</td><td>Risk Rating
C x L =8
Mod</td><td>Target Risk Rating
Low</td></tr>
<tr><td colspan="4">Risk Management Options
• Mandate the adoption of the DAFF (2006) disinfection manual
• Following disinfection guidelines outlined in the DAFF disinfection manual
• Following translocation guidelines currently being developed through NIMPCG
• Following export guidelines as set out by AQIS and relevant State Agencies
• Inspect product and equipment prior to dispatch
• Following export guidelines as set out by the OIE, AQIS and relevant State Agencies</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Annual reports of marine species outbreaks from DPIW</td></tr>
</table>

1.1.4: Animal Welfare

Scope

To assess the risk of salmonid farming practices not meeting contemporary animal welfare standards.

Current Management Controls

The Industry is regulated under the *Animal Welfare Act 1993*. All vertebrates are animals for the purposes of this Act, therefore management and staff must take all reasonable measures to ensure the welfare of the fish stock.

The Industry also complies with the Aquatic Animal Welfare Guidelines as developed for the National Aquaculture Council (Johnston and Jungalwalla 2004). These guidelines were developed in response to the international scrutiny of aquatic animal welfare bodies. Adoption of the guidelines are seen as a positive approach for Industry as they:

- Increase market acceptance of salmonid farming practices
- Reduce the chronic stress in the cultured animals, leading to better growth rates and less susceptibility to disease
- May lead to indirect increases in production through improvements in stock health and quality.

The guidelines include the monitoring of water quality (inclusive of oxygen, metabolites, suspended solids, salinity and other biological parameters such as jellyfish and phytoplankton), temperature, feed rates, stocking density, equipment, handling practices, health and humane slaughter.

The Industry Code of Practice (COP) states that when harvesting fish, physical activity and stress of the fish should be kept to a minimum ensuring controls on the fish densities and the time frames when crowding and use of anaesthesia for immobilisation, slaughter and bleeding. All fish must be sedated and/or stunned prior to bleeding. For further details see the COP.

Risk Assessment 1.1.4: What is the risk of the Industry not meeting contemporary animal welfare standards?			
Environmental Objective 1.1.4: To ensure that salmonids farmed in the Industry are maintained and harvested considering contemporary animal welfare standards.			
Consequence **C=2**	**Likelihood** **L=2**	**Risk Rating** **C x L =4** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • Adherence to the Aquatic Animal Welfare Guidelines and Industry COP			
Suggested Performance Measures • Non-conformance notices from the DPIW Animal Health Unit			

1.2: OTHER SPECIES / COMMUNITY / PROCESS

The impact of salmonid farming on marine ecosystem processes is potentially serious in uncontrolled conditions. The following topics cover the impacts of the salmonid farming on ecological community processes and species within the marine community.

1.2.1 Disease

Scope

To assess the risk of disease from farmed salmonids being passed to other marine fauna in the region.

Current Management Controls

Native fish species of the family Galaxiidae belong to the Order Salmoniformes which includes all trout and salmon species. Some of these species are listed as endangered or vulnerable. Some galaxid species migrate between fresh and salt water such as *Galaxias maculata*, *G. truttaceus, G. brevipinnis*, whitebait (*Lovettia sealii*) as does the Australian Grayling (*Prototroctes maraena*). These fish could potentially transport a disease inland or vice versa. Tasmanian whitebait runs up most of our estuaries to fresh water spawning grounds. Sea-run trout follow them up and could provide a host for transferring disease to the unprotected wild fishery.

Despite the fact that introduced salmonids have co-existed with native species in Tasmanian waters for the past 100 years (P Jungalwalla pers comm.), and despite passive surveillance being in operation for at least 20 years, there have never been any reports of salmonid diseases occurring within native species of the Galaxid family (DPIWE 2003). The extent to which trans-species spread of disease among salmoniform species can occur is not known at this stage, however, the existence of significant biomass of Atlantic salmon and trout in the both marine and fresh water must increase the risk.

There is some evidence that the high densities of fish in sea cages may amplify the presence of endemic disease agents such as *Vibrio*, *Aeromonas*, *Rickettsia*-like organisms and amoebic gill disease (AGD). However, it is not known if this phenomenon transposes to wild populations of fish. Detection of reoviral pathogens have been obtained from native fish (jack mackerel) sampled from within salmon sea pens during a disease outbreak (Ellard pers comm.), but it is yet to be ascertained whether transfer of disease from farmed stock had occurred, or the mackerel were acting as reservoir hosts. There is no evidence that AGD has increased in native fish populations since the inception of salmonid farming (Douglas-Helders et al 2000).

The risk of serious disease transfer to the marine community is potentially higher through the import of commercially harvested salmonids into Australia than from Tasmanian farmed salmonids.

Risk Assessment 1.2.1: What is the risk of the disease from farmed salmonids being passed onto other marine fauna?			
Environmental Objective 1.2.1: To minimise the risk of disease being transferred from farmed salmonids to other marine fauna.			
Consequence **C=3**	**Likelihood** **L=2**	**Risk Rating** **C x L =6** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • Surveillance of native fauna at lease sites as part of licence conditions • Continuation of the Tasmanian Salmonid Health Surveillance Program • Investigation of native fish kills by DPIW and DTAE			
Suggested Performance Measures • Changes in marine fauna population or disease status • Annual reports from the CVO • Number of native fish kills related to salmonid farming			

1.2.2: Escape of Culture Species

Scope

To assess the risk of escaped farmed salmonids causing significant impact on other marine species.

Current Management Controls

The escape of salmonids from marine farms has potential to lead to a number of problems. The potential of genetic pollution is not a problem in Tasmania as the farmed fish are introduced and genetically selected to avoid maturation. However, predation of native species, and competition for food and habitat may produce a potential problem.

In recognising this potential, Industry in collaboration with Government initiated a program to net escaped salmonids and analyse their gut contents. The pilot study designed to investigate the impact of an escape of farmed salmon in Macquarie Harbour concluded that escaped salmonids could be effectively gill netted with minimal by-catch. Results also indicate that during the course of the study both Atlantic salmon and ocean trout did not successfully feed on natural prey items and were losing condition suggesting that escapees did not appear to thrive in the wild (Steer & Lyle unpublished). Recommendations were made that monitoring should extend over larger temporal scales to incorporate potential seasonal effects in prey availability and fish behaviour and dispersal patterns, including the potential movement of escapees out of Macquarie Harbour.

Reports on escaped farmed salmonids in Chile found similar results for Atlantic salmon, but highlighted the potential for rainbow trout (*Onchorynchus mykiss*) to naturalise and establish wild populations (Soto et al 2001).

The Industry is currently investing in developing technology to mitigate the escape of fish from farms rather than being reactive to farm escapee events. The design and maintenance of fish cage equipment has been steadily improving at significant cost to industry (estimated M$1-3 per annum). In addition individual company/regional protocols have been developed for management practices to mitigate escapes (see 5.2.12 of COP).

Marine farming license conditions state that the licence holder must report to the DPIW General Manager any significant incident of fish escapes within 24 hours of becoming aware of the escape. A significant escape is defined as any loss of licensed species to the marine environment in excess of 1000 individuals at any one time. Licensees must make every effort to recover escaped fish.

There is a public perception of environmental damage by escaped Atlantic salmon that the Industry recognises. This perception is often based on reports from the Northern Hemisphere, which are not relevant to the Southern Hemisphere ecology. Research providers are presently preparing research proposals, with Industry support, to further investigate any potential impacts.

The Industry have recognised that there is a need to develop a state-wide “Contingency plan for recovery treatment of escaped stocks” as shown in Appendix 1.2.2.

Risk Assessment 1.2.2: What is the risk of escaped farmed salmonids having significant impact on other marine fauna?			
Environmental Objective 1.2.2: To minimise the impact of escaped salmonids on other marine fauna.			
Consequence **C=2**	**Likelihood** **L=2**	**Risk Rating** **C x L =4** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • Surveillance of native fauna at lease sites • Research into the impact of escaped salmonids on marine fauna			
Suggested Performance Measures • Recorded changes in marine fauna population or disease status			

1.2.3: Feed Composition (Source & Sustainability)

Scope

To assess the risk of feed source for salmonids not being sustainable.

Current Management Controls

Raw material sources for aquaculture feeds have historically been derived largely from fishmeal and fish oil. The aquaculture industry is growing globally leading to an increasing demand for these products and for alternative feed strategies to be developed. The selection of feed types by the Industry is based on quality, feed performance, supplier service as well as sustainability criteria.

The composition of salmonid feed includes fish meal and fish oil products as shown in Table 1.2.3.1. The source of the fishmeal and oil may be from:

- Low value fish
- Reduction fisheries (fish species unsuitable for use for human consumption)
- Fish by products produced from trimmings, offal and/or by-catch.

The vast majority of fish meal and fish oil utilised by the Tasmanian salmonid industry is from reduction fisheries in South America (Chile and Peru) including Peruvian anchovy (*Engraulis ringens)* and Chilean jack mackerel (*Trachurus murphyi*). The Peruvian anchovy, at 6.2 million tonnes in 2003, accounts for the biggest feed fish catch. In general, feed fish are short-lived and fast growing and therefore less vulnerable to overfishing or to climatic stress. Such fish are generally small, bony and unsuitable for human consumption; continuing efforts to upgrade them commercially to food grade products have had limited success despite value adding incentives to fishermen and processors (Shepherd et al. 2006).

Table 1.2.3.2. Typical ingredients in pellets used for salmon aquaculture in Australia. *Variation occurs with the growth phase of the fish. [1]Shepherd et al 2005.

INGREDIENT	APPROXIMATE PERCENTAGE*	SOURCE
Fish meal	20-55%	Sustainably managed South American fisheries[1]
Oils	7-8%	50% from Sustainably managed South American fisheries[1] 50% from poultry by-products
Poultry by-products	15%	AQIS approved poultry suppliers
Wheat products	15-25%	Australian Farmers
Vitamins and Minerals	<1%	Various

The feed grade fish stocks from Peru and Chile are regarded as sustainable through using internationally recognised procedures and the United Nations Food and Agriculture organisation's (FOA) Code for Responsible Fisheries, which includes the principles of ecosystem management. Government agencies, in particular the International Council for the Exploration for the Sea (ICES), Institute of Fisheries Research, Peru (IMARPE) and Institute of Fisheries Research, Chile (IFOP) are carefully monitoring these fisheries. The management controls for the Peruvian and Chilean fisheries are outlined in Appendix 1.2.3.

Approximately 24-26,000 tonne per annum of formulated fish feed was used in 2005 by the Industry in Tasmania, of which approximately 30% is made from fish products.

None of the Australian aquaculture feed companies who supply the Industry use growth promoters, or hormones in their products. Where antibiotics are used, a registered veterinarian prescribes them for the specific purpose of treating sick fish (see Section 2.4.5: Chemicals - Aquavet).

Further information on both companies' quality assurance programs is available at the following websites for Skretting (http://www.skretting.com.au) and Ridley Aquafeeds (http://www.agriproducts.com.au/agri/aq_quality.html).

Feed management plays a pivotal role in salmonid farming, impacting on production, economic feasibility, stock welfare, stock health and the environment. Best practice is required to optimise all these aspects.

The Industry COP encourages that feed and feeding strategies should aim to:

- Optimise growth at the lowest possible feed conversion rate (FCR)
- Maximise quality in harvested fish (*eg*. flesh colour and firmness)
- Minimise environmental impacts
- Optimise fish health

<table>
<tr><td colspan="4">Risk Assessment 1.2.3: What is the risk of the feed source for salmonids not being sustainable?</td></tr>
<tr><td colspan="4">Environmental Objective 1.2.3: To use aquafeeds that contains raw materials sourced from a sustainable fishery.</td></tr>
<tr><td>Consequence
C= 2</td><td>Likelihood
L= 2</td><td>Risk Rating
C x L = 4
Low</td><td>Target Risk Rating
N/A</td></tr>
<tr><td colspan="4">Risk Management Options
• Ensuring that feed suppliers purchases raw materials from sustainable sources
• Effective and ongoing communication with feed suppliers on dietary requirements of salmonid stocks</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Monitoring FCR of stock
• Monitoring quality of stock</td></tr>
</table>

1.2.4: Chemicals (Hydrocarbons)

Scope

To assess the risk of hydrocarbons impacting on the marine environment

Current Management Controls

Boats and tractors used in marine farming utilise hydrocarbon fuels that have a potential cumulative impact on the marine environment. The majority of vessels run on outboard engines used for a short duration in localised areas. The likelihood of impact is considered minimal.

Where outboards are used, the Industry has been encouraged to use synthetic oils, fuel-injected outboard motors (Appendix 1.2.4) and fuel/oil bunds to collect any accidental leakage. At present there are no Australian regulations or standards limiting air or water pollutant emissions from marine outboard engines. However, many products sold in Australia are imported from the USA or Japan, where products are manufactured primarily to USA standards for sale in that market.

Under Section 8 of the *Pollution of Waters by Oil and Noxious Substances Act 1987*, no oil originating from ships, boats or any equipment can be disposed of into the marine environment. Each facility should have refuelling protocols as set by guidelines in Section 3.2.2.7: Chemical Use. All hydrocarbon fuels must be stored in compliance with the *Dangerous Goods Act 1998*.

The Industry COP encourages that farms prevent and mitigate the release of fuels and oils into the marine environment through response plans and key staff training.

<table>
<tr><td colspan="4">Risk Assessment 1.2.4: What is the risk of hydrocarbons from Industry impacting on the marine environment?</td></tr>
<tr><td colspan="4">Environmental Objective 1.2.4: To minimise the impact of hydrocarbon pollution from salmonid farming activities.</td></tr>
<tr><td>Consequence
C= 1</td><td>Likelihood
L= 4</td><td>Risk Rating
C x L = 4
Low</td><td>Target Risk
Rating
NA</td></tr>
<tr><td colspan="4">Risk Management Options
• Use of synthetic oils
• Encouragement for Industry to use fuel-injected four stroke outboard motors where practicable
• Bunding for fuel and oil containers on boats
• On-site hydrocarbon spill kits and business emergency response plan</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Regionally reported hydrocarbon spills</td></tr>
</table>

1.2.5: Behavioural Changes and Food Chain Impacts

Scope

To assess the risk of salmonid farming causing significant behavioural changes or impacts in the higher food chain.

Current Management Controls

The fish farms provide an environment rich in prey items for marine predators, and may attract predators to a marine farm lease area. Predator species noted in salmonid marine farming environments include the Australian and New Zealand fur seal, the white-bellied sea eagle, cormorants (Wiersma 2001) and the silver gull.

1.2.5.1: Australian and New Zealand Fur Seal

Seals are opportunistic predators, consuming a variety of fish and squid. Seals are naturally attracted to finfish farms, and, the impact of their predation on a salmonid aquaculture can be devastating (Nash 2000). Most interactions between marine farming activities and seals involve the Australian fur seal *Arctocephalus pusillus* and the New Zealand fur seals (*Arctocephalus forsteri*), both which are protected wildlife and as such are afforded protection under various Acts administered by the Department of Primary Industries and Water (DPIW).

Seal interactions are a significant issue for the salmonid farming industry causing a range of negative effects as described in Section 8.1.3.2: Predators. Seals have adapted to take fish from pens through a variety of learnt behaviours.

Marine farming activities also have the potential to negatively impact on seals through entanglement in predator or stock netting resulting in injury or death. The Industry invests heavily in both structural and non-structural deterrents to keep away marine mammals, including aversion conditioning (see Section 8.1.3.2).

1.2.5.2: White bellied sea eagle

In Tasmania, the white bellied sea eagle, *(Haliaeetus leucogaster),* is a "species of special interest" under the *Threatened Species Protection Act 1995* (TSPA). An Honors project by the University of Tasmania in collaboration with Tassal Pty Ltd. found that sea eagles frequent waters where marine farming leases are established. The eagles associated with fish farms tend to forage over a larger distance in an elliptical, rather than circular foraging pattern when compared to eagles from non fish farming areas. However, availability of prey and energetic gain were found to be much greater in areas surrounding fish farms. Therefore, the eagles preferentially include sea-cage fish farms in their daily foraging behaviour (Wiersma 2001). No negative effects of salmonid farming were found in the study.

1.2.5.3: Cormorant

Cormorants (*Phalacrocorax spp.)* are common around Tasmanian coastal waters. The birds cause a problem for the Industry by indiscriminate striking of smaller fish in the pens without capture. The cormorants have the capability to cause large numbers of fish losses through damage wounds that lead to infection and death. The Industry mitigates fish losses through the use of antipredator nets that exclude the birds from the fish pens.

Management controls under the MFDP specify that efforts to mitigate negative interactions between birds and marine farming operations including:

- Where bird netting is deployed lessees must ensure that nets are made of netting of a maximum 115mm square mesh and conform to the visual controls at section 3.8. Existing marine farming lease areas must conform to this requirement by 1 January 2008.
- Lessees must ensure that avifauna entangled in bird netting is removed as soon as is practicable following entanglement.

1.2.5.4: Silver gull

The silver gull (*Larus novaehollandiae)* is attracted to marine finfish farms by the pelleted food fed to the fish. On larger cages, the industry uses aerial blowers or water cannons to distribute the feed, ensuring efficient uptake of the feed by the fish. Gulls become habituated to these feed dispersion methods and compete with the fish for the food as well as putting the fish off feeding. Sea birds potentially act as vectors for disease transmission.

1.2.5.5: Native fish

There have been few studies identifying the impact of fish farms on native fish. Native fish in the Tasmanian environment do not appear to fill the scavenger niche provided by fish farms, to the extent found in other finfish aquaculture areas such as in South Australia (C Crawford pers comm.). However, anecdotal information from Tasmanian fish farmers notes an increase in the number and diversity of native fish around fish farms over the years. Finfish farms may provide shelter to support juvenile fish through the provision of an artificial reef.

<table>
<tr><td colspan="4">Risk Assessment 1.2.5: What is the risk of salmonid farming causing significant behavioural changes or impacts in the higher food chain?</td></tr>
<tr><td colspan="4">Environmental Objective 1.2.5: To minimise impacts of salmonid farming in disrupting natural behavioural and feeding patterns.</td></tr>
<tr><td>Consequence
C=1</td><td>Likelihood
L=5</td><td>Risk Rating
C x L =5
Low</td><td>Target Risk Rating
NA</td></tr>
<tr><td colspan="4">Risk Management Options
• Adhere to the DPIW Marine Farming licence management controls on carrying capacity</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Annual marine farming compliance inspections
• Number of transfers/removals of seals
• Number of deaths of birds</td></tr>
</table>

Aspect 1.2.6: Sensitive Habitats

Scope

To assess the impact of the Industry on sensitive habitats.

Current Management Controls

The location of marine finfish leases is controlled by MFPA, which makes provision for zones where marine farming operations may occur. An environmental impact assessment (EIA), which identifies sensitive habitats, is carried out prior to the zones being allocated. The MFPA allows for license conditions to be imposed controlling marine farming activities over sensitive marine flora and fauna, if considered appropriate. Every farm undertakes a marine environmental baseline survey prior to marine farm operations commencing that ensures that no sensitive habitats are impacted upon.

Directly beneath salmonid farming operations, it is expected that the impacts will be to a degree where most marine flora and fauna will not survive. Management controls proscribe that there will be no significant impact 35 metres from the lease boundary of salmonid farming operations. Initial and ongoing environmental surveys (as described in Appendix 8.2.3.2) are correlated to ensure that the licence conditions are adhered to and considered appropriate. The results of monitoring to date show that the impacts to marine biota are localised to within the boundary of salmonid farming operations (DPIWE 2005).

1.2.6.1: Seagrass beds

Seagrass beds are considered to be critical to the marine environment in providing food, protection from predators for marine species and contributing to shoreline stabilisation. Benthic communities of seagrass such as paddleweed (*Halophila australis)*, strapweed (*Posidonia australis)*, and eelgrass (*Heterozostera tasmanica* and *Zostera meulleri)* have been observed in and around marine farming zones. Human induced changes such as increased nutrients and turbidity are most likely to impact upon the distribution and abundance of seagrass beds (Jordan et al 2002) and changes have been observed close to centres of population and human activity (Rees 1993).

The Industry is aware of the importance of seagrass for the productivity of the marine environment. A baseline study on the level of epiphyte growth on seagrasses in North West Bay found that there was no significant difference between the level of epiphytes at the control site (Norfolk Bay) and in North West Bay near the salmon marine farms (C Crawford pers comm.). Salmonid farming may cause some impact where operations occur directly over seagrass vegetation. These impacts are normally limited to directly beneath and adjacent to fish cages (DPIWE 2002a).

Risk Assessment 1.2.6.1: What is the risk of salmonid farming causing significant impact on seagrass beds?			
Environmental Objective 1.2.6.1: To ensure that salmonid industry does not cause a negative impact on seagrass beds.			
Consequence **C=1** **(Table 1.2)**	**Likelihood** **L=2**	**Risk Rating** **C x L =2** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • Minimising physical contact with seagrass, including avoiding substrate compression and scouring by moorings and other physical structures • Continuation of TAFI's environmental impact assessment			
Suggested Performance Measures • Comparison with TAFI mapping of seagrass beds around marine farming zones • Continued assessment against the original DPIW baseline studies			

1.3.6.2: Macroalgal Communities

Macroalgal communities provide a complex habitat that supports important fish and large invertebrate communities. Barrett et al (2001) identified key macroalgal habitats in bioregions. This research allows regulators and scientists to identify ecologically important areas for marine protected areas (MPAs) or reserves. No marine farming zones are located in these areas under the MFPA.

Nutrient loads from fish farms may be expected to increase the nutrient available to intertidal macroalgae in an extended mixing zone around lease sites. However, no consistent near-field or far-field effect of farms was detected in intertidal macroalgae (Volkman et al 2006) or subtidal macroalgae by the Tasmanian Aquaculture and Fisheries Institute (C Crawford pers comm.).

Risk Assessment 1.2.6.2: What is the risk of salmonid farming causing significant impact on macroalgal communities?			
Environmental Objective 1.2.6.2: To ensure that salmonid industry does not cause a negative impact on macroalgal beds.			
Consequence **C=1** **(Table 1.2)**	**Likelihood** **L=2**	**Risk Rating** **C x L =2** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • Minimising physical contact with macroalgal communities • Monitoring localised algal biomass			
Suggested Performance Measures • TAFI mapping of macroalgal communities around outfalls and ongoing assessment against the original baseline studies where applicable			

1.3.6.3: Invertebrate Communities

The tannin stained waters associated with the outflow of the Huon River produce a distinct habitat of sensitive sponge and seawhip communities in the Bruny bioregion. In areas where there is moderate to strong current flow and where reefs extend below 5 m, a fragile community of sponges and seawhips dominates the marine benthos. On shelly substrates in these high current areas, sponge and seawhip communities can be found in quite shallow waters, often less than 10m depth. Particularly notable areas are 100 m North West of Simpsons Point, Butts Reef, Nine Pin Point and Arch Rock (Barrett et al 2001). No research into the impact of marine farming on these areas of invertebrate communities has been reported to date.

<table>
<tr><td colspan="4">Risk Assessment 1.2.6.3: What is the risk of salmonid farming causing significant impact on invertebrate communities?</td></tr>
<tr><td colspan="4">Environmental Objective 1.2.6.3: To ensure that salmonid industry does not cause a negative impact on sensitive invertebrate communities.</td></tr>
<tr><td>Consequence
C=1
(Table 1.2)</td><td>Likelihood
L=2</td><td>Risk Rating
C x L =2
Low</td><td>Target Risk
Rating
N/A</td></tr>
<tr><td colspan="4">Risk Management Options
• Adherence to current management controls on nutrient inputs</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Monitoring of changes in the seawhip community over time</td></tr>
</table>

Component 2: Regional Impact of Industry on the Environment

Introduction

The combination of a number of aquaculture facilities may cause localised impacts on a catchment area or growing region. This component examines the potential cumulative impacts of all facilities in a region, taking into account the regulations that the Industry has to comply with, which are set by local and state authorities.

The regional areas defined in this document reflect those set by the DPIW Marine Farming Development Plans. Each region is numbered in a consistent manner in the tables, figures and appendices as described in the Industry Description.

The Regional Effect of Industry component tree (Figure 2.0) identifies the potential impact that Industry may have:
(i) on water quality/quantity
(ii) on ecological community structure and biodiversity
(iii) from physical structures, construction and tenure
(iv) from production

This component tree has been adapted from the National ESD framework to be relevant to the Industry by additions, exclusions or combinations of topics, as follows;

Additions:
- Chemicals (Aquavet) have been added to Section 2.4: Production as the use and subsequent environmental impact of antibiotics was considered a regional production issue.

Combinations:
- World Heritage Areas, Marine Protected Areas and Ramsar sites have all been combined in Section 2.2.5 Protected Habitats.
- Sedimentation (under Section 2.1: Water Use Quality/Quantity) has been combined with Benthic Communities (under Section 2.2 Ecological Community Structure & Biodiversity).

Exclusions:
- Seepage (under Section 2.1 Water Quality/Quantity). Land based ponds are not used by the Industry on marine leases, but may be utilised on land-based facilities. However, this issue is considered to be an individual facility issue and therefore delivered as Guidance Notes Component 3.
- Soil Quality (under Section 2.3: Physical Structure and Construction and Tenure) is considered to be a local aspect and therefore delivered as Guidance Notes in Component 3.

- Water Table (under Section 2.3: Physical Structure and Construction and Tenure) is considered to be a local aspect and therefore delivered as Guidance Notes in Component 3.
- Behavioural Changes in Species and Scavengers has been discussed on an Industry wide basis under Section 1.2.5: Behavioural Changes and Food Chain Impacts in Component 1.
- Sensitive Habitats (under Section 2.2: Ecological Community Structure and Biodiversity) has previously been covered under Section 1.3.8: Sensitive Habitat

The risk assessments for all issues (or aspects) have used the General Consequence Table (Appendix 1.0; Table 1.1).

- 2.0 Regional Impact of Industry on the Environment
  - 2.1 Water use Quality/Quantity
    - 2.1.1 Nutrients
      - 2.1.1.1 Industry Inputs
      - 2.1.1.2 Nutrient Removal
    - 2.1.2 Other Wastes Pollutants (net cleaning)
    - 2.1.3 Flow (hydrology/oceanography)
    - 2.1.4 Water Extraction Ground or Surface
  - 2.2 Ecological Community Structure & Biodiversity
    - 2.2.1 Plankton (eg blooms)
    - 2.2.2 Benthic Communities
      - 2.2.2 1 Nutrients
      - 2.2.2.2 Antifoulants
    - 2.3.3 Listed Migratory Birds
    - 2.2.4 Threatened/ Endangered / Protected sp.
    - 2.2.5 Protected Habitats
    - 2.2.6 Translocation between Regions
  - 2.3 Physical Structures and Construction & Tenure
    - 2.3.1 Number and Size of Farms
    - 2.3.2 Terrestrial Habitat Removal
    - 2.3.3 Heritage Effects
    - 2.3.4 Navigation
    - 2.3.5 Infrastructure
    - 2.3.6 Noise
  - 2.4 Production
    - 2.4.1 Regional Carrying Capacity
    - 2.4.2 Disease
    - 2.4.3 Disposal of Processing and Harvesting Wastes
    - 2.4.4 Disposal of Mortalities
    - 2.4.5 Aquavet Chemicals

Figure 2.0. Component Tree 2: Regional Impact of the salmonid Industry on the Environment

2.1: WATER USE QUALITY/QUANTITY

Bacteria, viruses, phytoplankton blooms, organic enrichment, low dissolved oxygen, suspended sediments and introduced species may affect water quality and subsequently marine farming operations. It is of fundamental concern to farmers to conduct their activities in such a way so that it does not have a negative impact on the quality of the water on which they rely. This component assesses the potential water quality issues within a region from the cumulative impact of caged finfish culture.

2.1.1: Nutrients

This issue assesses the impact on water quality from nutrients associated with salmonid farming activities. This can be broken down into nutrient input and nutrient removal.

Scope

To assess the impact of nutrient input and removal by Industry on the marine environment

Current Management Controls

2.1.1.1: Industry Inputs

The release of nutrients into the environment from finfish culture facilities is largely associated with exogenous feed input and fish wastes. The level of environmental impact is a combination of the interaction between the site and the marine farming operation, particularly stocking density and feed input (Ackerfors & Enell 1994). Solid organic enrichment associated with salmonid farming may result from both uneaten food pellets and faecal pellets. Soluble wastes that are released into the marine environment include ammonia, phosphorus and dissolved organic carbon (DOC). The main concern with an increase in nutrients is the stimulation of both harmful and non-harmful algal blooms, which may result in eutrophication.

A study on the Huon Estuary assessing the sources, distribution and cycling of nutrients (including those from salmonid farming) estimated that of the total nitrogen (N) contained in fish feed, 36% is assimilated into the fish and 64% is released into the marine environment. However, the level of input of N into the estuary was no more than that entering the estuary through agricultural run-off (Butler et al 2000). Salmonid farming must comply with a number of regulator controls on nutrient input, not imposed on the agriculture sector.

Some of the Huon Estuary Study (HES) conclusions were that;

- The water quality of the Huon Estuary is good and that of its two principal sources in the Huon River and the D'Entrecasteaux Channel is very high.
- Nitrogen distributions and algal production in the Huon Estuary under present-day conditions are supported primarily by inputs from coastal seawaters, and in that sense algal blooms should be regarded as natural. However, available

nitrogen from either fish farms, or washed off the lower catchment from agricultural activities, may play a role in stimulating algal blooms.
- Solid waste from fish cages is largely restricted to the area beneath the cages.
- Fallowing, or resting fish farms sites, allows sediment conditions to recover, but some of the added organic matter still remains one year after the cages have been removed.
- 1997/98 levels of nutrient input from salmonid farming were small compared with naturally occurring sources of nutrients. However, in a scenario with twice that number of farmed fish, environmental changes are predicted to occur.

The Aquafin CRC project 2001-097 (Volkman et al 2006) has built on this research to determine suitable parameters for adaptive management of salmonid farming outputs:
- It has supported the establishment of an adaptive management framework for system-wide impacts of salmon aquaculture in the Huon estuary, including an interim monitoring program that has provided managers and fish farmer's reassurance that the cap on salmonid farming in the Huon has prevented any major wide-scale environmental problem. Measurements of dissolved oxygen, chlorophyll and bottom water ammonia have been trialled as potential monitoring tools for system-wide effects.
- The hydrodynamic modelling has been substantially refined, calibrated and validated. This has enabled a range of outputs including the fate of releases at particular farm sites, the role of off-shore forcing, flushing times (and hence sensitivity to environmental effects) and most recently fine-scale modelling of proposed chloramine-T releases. These model outputs clearly show the interconnected nature of the system and have revealed to farmers and managers that environmental effects must be examined on a system-wide basis. Farms cannot be considered as single units unconnected to other farm units. There are potential applications of these results for understanding movement of parasites or disease as well as nutrients between sites.
- The biogeochemical modelling has advanced considerably and now provides a very good simulation of spring and summer phytoplankton blooms. Further refinement is needed to properly represent the autumn dinoflagellate blooms. A comparison of model outputs with and without farm loads confirms the earlier HES study conclusion that nutrients from salmonid farming make a significant contribution to phytoplankton abundance in summer, but not at other times of the year when nutrients are mainly sourced from natural upwelling events. Moreover, the models allow industry and managers to disentangle the effects of oceanic and terrestrial nutrient loads from those of aquaculture. This provides the industry with a scientific basis for attribution of environmental impacts, and for management of catchment loads where these adversely impact on aquaculture.

The management controls under the MFDP relating to nitrogen outputs take into account this current research. The Governments may determine the total permissible dissolved nitrogen output, within specified periods, attributable to marine farming operations within a specified area covered by any MFDP. This determination uses the proportion of expected dissolved nitrogen output from a unit of feed as determined in Butler et al. (2000) at section 10.2.5; or any other equivalent method.

The Industry COP encourages farmers to reduce nutrient inputs by the:

- Use of appropriate feeds, feeding systems and strategies that minimise the possibility of overfeeding.
- Regularly monitoring the seabed characteristics and water quality at appropriate intervals

2.1.1.2: Nutrient Removal

Research through the Aquafin CRC project (Volkman 2006) has demonstrated that there is no significant effect of nutrients from salmonid farming on the marine environment. The research allows for the quantification of the present performance of Industry in relation to nutrient inputs from the marine environment to ensure future environmental sustainability.

Environmental Risk 2.1.1. What is the risk of Industry sourced nutrient input impacting on the marine environment?			
Environmental Objective 2.1.1: To minimise any negative impact of salmonid farming activities on nutrient cycling in the marine ecosystem.			
Consequence **C= 2**	**Likelihood** **L= 3**	**Risk Rating** **C x L = 6** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • Adherence to the DPIW Marine Farming licence conditions and MFDP management controls on carrying capacity • Investment into integrated marine farming technologies			
Suggested Performance Measures • Fish growth and health • Future nutrient analysis around marine farms on a regional basis			

2.1.2: Other wastes/pollutants

Scope

To assess the impact of pollutants (eg. Hydrocarbons, antifoulants) at the entire catchment/regional scale.

2.1.2.1: Antifoulants

Current Management Controls

The use of antifoulants on nets can significantly improve the rearing environment for farmed fish, reduce handling (*eg*. net changes) and increase the effectiveness of predator control measures (*eg*. seals). Monitoring is currently taking place in Southern Tasmania by the Industry to determine the effectiveness of cuprous oxide, zinc oxide or zinc pyrithine at different concentrations as antifoulants and their potential to accumulate in the sediment (Section 2.2.2.2). The impact of antifoulants on water quality is also considered as antifoulants impregnated on nets can impact locally on phytoplankton abundance (Lunven et al 2001). DPIW is currently using sentinel oysters to assess the potential impact of soluble metals from the antifoulant being used by Industry.

Only approved antifoulants are used on farms in accordance with requirements of the *Agriculture and Veterinary Chemicals (Control of Use) Act 1995*. Monitoring programs are conducted as required by the Australian Pesticides and Veterinary Medicines Authority or DPIW.

Controls by the DPIW marine farming licenses stipulate that

> "The threshold levels listed in the following table must not be exceeded within the Lease Area, by reason of the conduct of marine farming operations in the Lease Area".

Contaminant	**Water Column (µg/L)**
Copper	1.3
Zinc	15

The Industry COP encourages efficient application of antifoulant on nets to be used only at appropriate sites and includes controls on appropriate net cleaning and disposal of net wastes.

<table>
<tr><td colspan="4">Environmental Risk 2.1.2: What is the risk of antifoulants from Industry impacting on the marine environment?</td></tr>
<tr><td colspan="4">Environmental Objective 2.1.2: To ensure that antifoulants from salmonid farming activities do not significantly impact on the environment.</td></tr>
<tr><td>Consequence
C= 3</td><td>Likelihood
L= 2</td><td>Risk Rating
C x L = 6
Low</td><td>Target Risk Rating
N/A</td></tr>
<tr><td colspan="4">Risk Management Options
• Use of natural antifoulants
• Adherence to DPIW controls on antifoulant use
• Assessment of copper and zinc impact on the benthic fauna and fallowing recovery
• Risk assessment of current antifoulants</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Monitoring of Cu and Zn levels in sediments around marine leases</td></tr>
</table>

2.1.3 Flow: (hydrology / oceanography)

Scope

To assess the collective impact of salmonid facilities on the flow of water within the embayment.

Current Management Controls

The location of marine farming zones for salmonid farming is controlled by Marine Farming Development Plans. These plans determine if a location has adequate flow to support a salmonid farm. Tasmanian salmonid farms are generally located in areas of low water current (average 3.34 cm s-1: Woods et al. 2005) compared to sites overseas (Crawford 2003). However, farming practices are modified to ensure adequate flow occurs between and around pens to ensure health of both the salmonid stock and the marine environment. Pens may cause an insignificant localised decrease in flow or increase in turbulence (John Volkman pers comm.).

<table>
<tr><td colspan="4">Environmental Risk 2.1.3. What is the risk of Industry causing significant changes to flow of water in the marine environment?</td></tr>
<tr><td colspan="4">Environmental Objective 2.1.3: To ensure that salmonid farming leases do not impact upon the natural hydrology of the catchment regions.</td></tr>
<tr><td>Consequence
C= 1</td><td>Likelihood
L= 2</td><td>Risk Rating
C x L = 2
Low</td><td>Target Risk
Rating
NA</td></tr>
<tr><td colspan="4">Risk Management Options
• Compliance with DPIW management control</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Observation of significant changes in hydrology around marine leases</td></tr>
</table>

2.1.4: Water Extraction

Scope

To assess the impact of freshwater use/extraction at the entire catchment/regional scale.

Current Management Controls

Fresh water is used by the Industry to bathe the fish to reduce the prevalence of amoebic gill parasites. The industry generally uses freshwater, usually sourced from local councils or private suppliers, to fill a pool liner for bathing fish. All other freshwater sources are obtained through permits from the Rivers and Water Supply Commission in accordance with the *Rivers and Water Supply Commission Act 1999.*

Environmental Risk 2.1.4: What is the risk of freshwater use by Industry causing significant impacts on the marine environment?			
Environmental Objective 2.1.4: To ensure that freshwater use by salmonid farming does not negatively affect environmental flows of the catchment.			
Consequence **C= 2**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 2** **Low**	**Target Risk Rating** **NA**
Risk Management Options • Compliance with Rivers and Water Supply Commission licence conditions			

2.2: ECOLOGICAL COMMUNITY STRUCTURE AND BIODIVERSITY

This component addresses the potential direct and indirect impacts on the regional ecosystem from the operation of Industry. In many cases, this could be an ecological manifestation of the effects identified in the previous component (Component 2.1)

2.2.1: Plankton Blooms

Scope

To assess the impact of salmonid farms in changing the frequency, intensity or composition of plankton blooms (algal, zooplankton or both, including toxic species) in a region.

Current Management Controls

One of the concerns in salmonid farming is hypernutrification of the water column. The combination of high stocking density and food inputs may lead to high and imbalanced levels of nitrogen and phosphorous in the water. This potentially could enhance phytoplankton production and lead to blooms, which may impair fish health and amenity of an area. The Industry has not been shown to be the sole contributor to nutrients in the marine environment and is working through adaptive management strategies to minimise their input (see Section 2.1.1: Nutrients).

Generally, there are few problems with phytoplankton blooms in areas where flushing rates and tidal exchange are adequate to dilute the nutrient load (Pearson 1995). A system-wide environmental study of the Huon Estuary and D'Entrecastreaux Channel showed that phytoplankton growth was seasonally dependent and linked to nutrient availability. This study found there was no evidence in the Channel of a problem with summer phytoplankton blooms. It does not seem likely that any of the sites surveyed have sufficient nutrients available to produce a bloom of problem species such as *Gymnodinium, Karenia, Heterosigma,* and *Noctiluca.* Cell densities high enough to be a considered a problem (eg. a harmful algal bloom) seem likely to occur only through advection and other physical processes that can result in concentration (Thompson et al. 2005). Other regions such as the Tamar, Tasman Peninsula and Macquarie Harbour have not been assessed.

The biogeochemical modelling developed by Volkman et al (2006) provides a very good simulation of spring and summer phytoplankton blooms. A comparison of model outputs with and without farm loads confirms the earlier Huon Estuary study conclusion (Butler et al 2000) that nutrients from salmonid farming do make a significant contribution to phytoplankton abundance. Moreover, the models allow industry and managers to disentangle the effects of oceanic and terrestrial nutrient loads from those of aquaculture. This provides the industry with a scientific basis for attribution of environmental impacts and for management of catchment loads where these adversely impact on aquaculture.

The Industry is regulated by license conditions from the DPIW Marine Farming Branch. These conditions include:

- Algal blooms or fish death associated with such blooms should be reported to DPIW within 24 hrs of detection.

The Industry COP requires farms to monitor the water column for phytoplankton and jellyfish abundance with species identification on a regular basis as appropriate to the individual site.

Environmental Risk 2.2.1: What is the risk of Industry causing significant changes to frequency intensity or composition of plankton blooms?			
Environmental Objective 2.2.1: To ensure that salmonid farms in a region do not significantly alter plankton bloom frequency, intensity or composition.			
Consequence **C= 2**	**Likelihood** **L= 3**	**Risk Rating** **C x L = 6** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • Ongoing monitoring of phytoplankton and zooplankton species			
Suggested Performance Measures • Comparison of the productivity of salmonids from previous years • Comparison of the productivity of local waters from previous years			

2.2.2: Benthic Communities (including Sedimentation)

Scope

To assess the impact of salmonid farming activities on to the benthic community on a regional level.

2.2.2.1: Nutrient Enrichment

Current Management Controls

Deposition of aquaculture waste from finfish cages can result in organic enrichment of the marine sediment (Macleod et al 2004). If organic enrichment of the sediments is uncontrolled, irreversible affects on the sediments and benthic communities may result. Indicators of serious impacts on the benthic environment include significant decreases in the diversity of benthic species or azoic sediments, the development of anoxic sediments and the production of hydrogen sulphide or methane gas (outgassing). Previous studies have found that the impact at the cages diminishes rapidly with both time and distance from the cage (Crawford et al., 2002) and after 2 months of fallowing the benthic conditions were markedly improved (Macleod et al. 2004).

Through the Aquafin CRC the Industry has co-funded projects to develop techniques to prevent unsustainable impact upon the benthos and develop a farm management protocol for benthic recovery using fallowing practices. The research demonstrated that finfish marine farming significantly affected sediments, under certain production scenarios (dependent on stocking level and baseline environmental condition) the sediments recovered after 3 months fallowing to a degree that enabled cages to be restocked. However, under intensive production regimes, the results indicated that there was potential for progressive sediment degeneration, consequently environmental status should be considered as part of production planning. The model described by Macleod et al. (2004) identifies a range of farm-based approaches, including video assessment, that enable farmers to characterise benthic condition and to determine if recovery of the sediments is sufficient enough to allow restocking of an area (Appendix 2.2.2). Base line parameters were established by the Aquafin project in certain areas.

This study established a clear relationship between farm management practices and level of impact and characterised a series of 9 distinct stages of sediment condition (Figure 2.2.2). Macleod et al. (2004) recommended several field-based approaches that will enable farmers to easily classify sediment condition (Appendix 2.2.2). With this information farmers will be able to gauge the environmental status of the sediments within their lease and make appropriate management decisions. However, changes in the status of the benthic environment through change in antibiotic or antifoulant use may compromise the model of benthic impact and recovery.

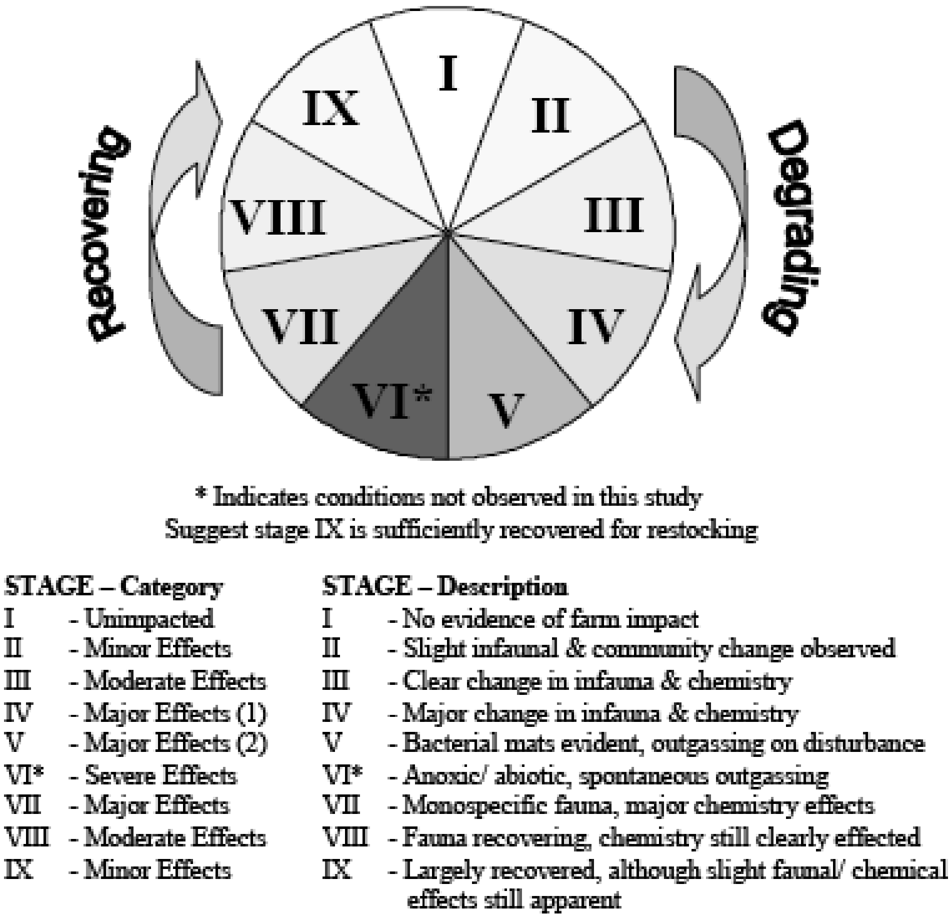


Figure 2.2.2. Impact and recovery stages of the benthos affected by salmonid farming activities in Tasmania as identified by Macleod et al (2004).

Marine farming license conditions from the DPIW require that there must be no significant visual, physio-chemical or biological impacts at or extending beyond 35 m from the boundary of the Lease Area. The following visual impacts should generally be regarded as significant:

- Presence of fish feed pellets;
- Presence of bacterial mats (eg. Beggiatoa spp.);
- Presence of gas bubbling arising from the sediment, either with or without disturbance of the sediment;
- Presence of numerous opportunistic polychaetes (eg *Capitella* spp., *Dorvilleid* spp.) on the sediment surface.

Licence conditions also state that there must also be no significant visual impacts within the Lease Area. These include but are not limited to:

- Excessive feed dumping;

- Extensive bacterial mats (eg. Beggiatoa spp.) on the sediment surface prior to restocking;
- Spontaneous gas bubbling from the sediment.

Fallowed areas within the Lease Area shall not be restocked until, having regard to visual evidence, the sediments have recovered to the satisfaction of the General Manager.

DPIW licence controls also require Industry undertake annual surveys and report on the benthic condition. The results of these surveys over a six year period (1997-2002) have been summarised by Woods et al. (2003) and found that benthic impacts from Industry are much localised, with solid particulate impacts forming distinct footprints directly under the pens. No unacceptable visual, chemical or biological impacts on the benthos were detected at 35 metre compliance points, except when cages had been incorrectly positioned outside the lease area.

The Industry COP additionally requires that:

- Farming operations and equipment (eg. moorings) must not be allowed to cause significant disturbance of the seabed in and around the lease area.
- Farm debris should not be disposed of in the marine environment.
- There should be no detectable levels of antibiotics, or chemical residues derived from therapeutic use, present in sediments within or outside the lease area.

<table>
<tr><td colspan="4">Environmental Risk 2.2.2.1: What is the risk of Industry causing significant impacts to the benthic community through nutrient enrichment?</td></tr>
<tr><td colspan="4">Environmental Objective 2.2.2.1: To ensure that the Industry does not result in localised changes to the benthic community.</td></tr>
<tr><td>Consequence
C= 3</td><td>Likelihood
L= 2</td><td>Risk Rating
C x L = 6
Low</td><td>Target Risk
Rating
N/A</td></tr>
<tr><td colspan="4">Risk Management Options
• Adherence to current stocking density controls
• Continue with adequate fallowing practices</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Changes in the benthic ecology of the catchment outside the boundaries of the marine lease area at 35m as shown by research and monitoring.</td></tr>
</table>

2.2.2.2: Antifoulants

Current Management Controls

The use of antifoulants on nets can significantly improve the rearing environment for farmed fish, reduce handling (*eg*. net changes) and increase the effectiveness of predator control measures (*eg*. seals), as described in Section 2.1.2.1: Antifoulants (in relation to water quality). However, the use of metal-based antifoulants may cause a negative impact to the benthic communities and effect the recolonisation and recovery rate of the benthos during fallowing.

Research is currently taking place by the Industry to determine the effectiveness of cuprous oxide, zinc oxide or zinc pyrithine at different concentrations as antifoulants is being accompanied by monitoring the sediment for copper and zinc.

Preliminary results of the monitoring have found that there are localised intermittent peaks in Copper (Cu), however the general results are within internationally acceptable standards. The Industry is now considering assessing the impact of the antifoulants on the benthic community structure.

Controls by the DPIW marine farming licenses stipulate that

> "The threshold levels listed in the following table must not be exceeded within the Lease Area, by reason of the conduct of marine farming operations in the Lease Area".

Contaminant	**Sediment (mg/kg dry wt)**
Copper	270
Zinc	410

<table>
<tr><td colspan="4">Environmental Risk 2.2.2.2: What is the risk of Industry causing significant impacts to the benthic community through antifoulant use?</td></tr>
<tr><td colspan="4">Environmental Objective 2.2.2.2: To ensure that antifoulants from salmonid farming activities do not significantly impact on the benthic environment.</td></tr>
<tr><td>Consequence
C= 3</td><td>Likelihood
L= 2</td><td>Risk Rating
C x L = 6
Low</td><td>Target Risk
Rating
N/A</td></tr>
<tr><td colspan="4">Risk Management Options
• Use of natural antifoulants
• Adherence to DPIW controls on antifoulant use
• Assessment of copper and zinc impact on the benthic fauna and fallowing recovery
• Risk assessment of current antifoulants</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Monitoring of Cu and Zn levels in sediments around marine leases</td></tr>
</table>

2.2.3: Listed Migratory Birds

Scope

> To assess the impact of salmonid farming activities on migratory bird refuges protected under international agreements and the EPBCA.

Current Management Controls

The location of marine farming leases is carefully considered through the MFPA to ensure that salmonid farming activities have minimal impact upon migratory bird species (Section 1.2.5: Behavioural Changes and Food Chain Impacts; Section 2.2.4: Threatened/Endangered/Protected sp; Section 8.2.3.1: Regulations). The location of salmonid leases is usually adjacent to deep water sites, rather than the intertidal habitats where most migratory bird species may be found.

The Industry recognises the importance of protecting migratory bird species, including their nesting sites and foraging areas. Important migratory shorebirds are listed in Appendix 2.2.3: Table 2.2.3.

Environmental Risk 2.2.3: What is the risk of Industry causing significant impacts to listed migratory birds?			
Environmental Objective 2.2.3: To ensure that the salmonid farming activities do not impact upon listed migratory bird species in a detectable or significant manner.			
Consequence **C= 1**	**Likelihood** **L= 2**	**Risk Rating** **C x L = 2** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • MFPA controls over the location of farms			
Suggested Performance Measures • Yearly comparison of number of migratory bird mortalities			

2.2.4: Threatened, Endangered & Protected Species

Scope

To assess the impact of the Industry on threatened, endangered or protected species.

Current Management Controls

Many salmonid marine farming leases are located in areas rich in species diversity and include species that are protected under the LMRMA. The location of marine finfish leases is controlled by MFPA, which makes provision for zones where marine farming operations may occur. An environmental impact assessment (EIA), which identifies threatened and endangered species, is carried out prior to the zones being allocated. The process of allocating marine farming zones also allows for public and stakeholder consultation and for expert advice from DPIW. This process ensures that, prior to their establishment, new marine farms are placed away from threatened species populations.

Each marine farm must undertake and submit a baseline survey as part of their lease arrangement prior to being issued a marine farming license. These baseline surveys (see Appendix 8.2.3.2) are set by the Marine Farming Branch of DPIW and allow for an additional check of the proposed lease area for rare and endangered species or significant habitats.

The licence holder must immediately report to the manager, Nature Conservation Branch, DPIW any incidence of mortality in protected wildlife (within the meaning of the *Wildlife Regulations 1999*) which arises in connection with the marine farming operations to which this licence relates. (Phone: 6233 6556 or e-mail: NatureConservationEnquiries@dpiwe.tas.gov.au)

Seals are the most common threatened species that interact with Industry. The Industry operates within the *Wildlife Regulations 1999* through the approval of the manager of the Nature Conservation Branch of the DPIW using relevant seal interaction management protocols (Section 8.1.3.2: Predators and Appendix 8.1.3.2). A very insignificant number of the seal population interact with marine farming activities (less than 0.2 of 1 % of New Zealand fur seals in 2005), with the number of relocations of seals by industry reducing significantly in the last 3 years (Fig 2.2.4) due to improved technologies for seal exclusion developed by Industry.

Figure 2.2.4. The decrease in the number of required seal relocations by Industry over the last 3 years has occurred, includes a trend in the decrease of repeat offender seals.

The Industry is also required to monitor for the threatened species of Gunn's Screw Shell (*Gazameda gunnii)* as part of their licence conditions. *Gazameda* is a native screwshell of the order Mesogastropoda that may have been displaced by the introduced New Zealand screw shell (*Maoricolpus roeus*). Research is underway looking at the distribution and impacts on this species.

Threatened, protected and endangered species that occur in salmonid growing regions are listed in Appendix 2.2.4: Table 2.2.4. with associated environmental management protocols suggested by Bryant et al (1999).

Environmental Risk 2.2.4.1: What is the risk of Industry causing significant impacts to populations of protected species other than seals?			
Environmental Objective 2.2.4.1: To ensure that the Industry maintains minimal interaction with any threatened, endangered or protected species other than seals.			
Consequence **C= 1**	**Likelihood** **L= 2**	**Risk Rating** **C x L = 2** **Low**	**Target Risk Rating** **NA**
Environmental Risk 2.2.4.1: What is the risk of Industry causing significant impacts to populations of seals?			
Environmental Objective 2.2.4.2: To ensure that the Industry maintains minimal interaction with seals.			
Consequence **C= 1**	**Likelihood** **L= 6**	**Risk Rating** **C x L = 6** **Low**	**Target Risk Rating** **NA**
Risk Management Options • MFPA controls over the location of farms • Development of a protocol for emergency response to marine mammal entanglement • Educational sessions for farm workers by stakeholder groups • Regular updates on the status of threatened or protected species by DPIW			
Suggested Performance Measures • Awareness of threatening processes • Proactive engagement by Industry to assist in the assessment of long term population changes of endangered or protected species			

2.2.5: Protected Habitats

This aspect also considers whether a development is a referable action under the *EPBCA 1999*. Detail on specific sensitive habitat such as seagrass beds and macroalgal communities are provided in Section 1.2.6: Sensitive Habitats.

Scope

To assess the impact of Industry on protected habitats e.g. designated zones that may be classified as a World Heritage Area, RAMSAR wetland, Marine Protected Area, or a sensitive habitat.

Current Management Controls

There is consideration of protected habitats through the MFDP process. One salmonid growing region is located adjacent to areas listed as a World Heritage Area (WHA) under the *Convention Concerning the Protection of the World Cultural and Natural Heritage*. The broad aim of the World Heritage Convention is to ensure the identification, protection, conservation, and presentation of World Heritage Areas.

The marine farming zone at Macquarie Harbour is adjacent to the Southwest Conservation Area, which is part of the WHA, and administered by Parks and Wildlife Service of the Department of Tourism, Arts and the Environment, Tasmania.

Further information on the Southwest Tasmanian WHA can be found at http://www.deh.gov.au/heritage/worldheritage/sites/tasmania/index.html

Salmonids farming marine leases are not located in any World Heritage sites, or marine protected areas (MPA). Further information is provided in Appendix 2.2.5: Protected Habitats. Some farms are adjacent to MPAs at Tinderbox and Nine Pin Point

The Nine Pin Point Marine Reserve consists of approximately 60 hectares and is a no take zone. The reserve was declared for its unusual aquatic environment produced by tannin rich waters flowing from the Huon River, resulting in reduced light levels which facilitate the growth of invertebrates, fish and red seaweeds normally found in much deeper water in Tasmanian's east coats. The closest finfish lease is more than 4 km from this site.

The Tinderbox Marine Reserve is approximately 45 hectares and was declared to provide a safe, sheltered marine study area for education, research and recreation. The reserve protects a great variety of seaweeds, fish and invertebrate animals and is a no take zone. The closest finfish lease is 1 km away. There is no scientific evidence that the finfish leases have impacted upon either of these reserves.

Environmental Risk 2.2.5: What is the risk of Industry causing significant impacts to protected habitats?			
Environmental Objective 2.2.5: To ensure that the Industry does not impact upon any protected habitats.			
Consequence **C=1**	**Likelihood** **L=2**	**Risk Rating** **C x L =2** **Low**	**Target Risk Rating** **NA**
Risk Management Options • Marine farm inspections by DPIW			

2.2.6: Translocation between Regions

National and State requirements are described in Section 1.1.3: Translocation of Invasive Marine Species (Export & Import).

Scope

To assess the impact of the Industry on the translocation of invasive marine species between catchments.

Current Management Controls

Numerous marine species have been introduced into Tasmanian waters accidentally through vectors such as ballast water from shipping, and movement of commercial fishing and recreational vessels, as well as natural dispersal. Only a small percentage of the invasive marine species are considered to be marine pests. These species are the focus of the Aquaculture Industry's Translocation Policy (Appendix 2.2.6).

There is potential for translocation of invasive marine species (IMS) through the movement of salmonid farming equipment (nets and pumps) around the state. The Industry is currently developing a protocol for the movement of farming equipment between regions in collaboration with the South Australian Research Development Institute (SARDI). This protocol takes into account the differing ecology between sensitive areas such as Macquarie Harbour and more homogenous areas such as the Channel, Huon Estuary and Tasman Peninsula. The movement of live stock between regions is regulated by the Chief Veterinary Officer (section 2.4.2: Disease).

Through marine farming licence conditions, the licence holder must notify the DPIW General Manager in writing of the presence of any unusual or uncharacteristic marine flora or fauna found within the Lease Area (including any introduced marine pests). Industry must advise DPIW marine farming if they plan to move equipment from one region to another.

The Industry COP also encourages that measures should be undertaken to minimise the risk of translocating marine pests by farm operations through good farm hygiene (see COP section 5.3.3 – Farm Hygiene). Marine pests removed from marine farming equipment must not be returned to the water.

Environmental Risk 2.2.6: What is the risk of Industry contributing to the translocation of invasive marine species?			
Environmental Objective 2.2.6: To ensure that the Industry does not contribute to the translocation between regions of invasive marine species through salmonid farming activities.			
Consequence **C= 4**	**Likelihood** **L= 2**	**Risk Rating** **C x L = 8** **Mod**	**Target Risk Rating** **Low**
Risk Management Options • Education of Industry staff on Invasive Marine Species (IMS) protocols • Regular review of the management protocols by Industry for translocation of IMS • Continued advise to DPIW on equipment movements			
Suggested Performance Measures • DPIW surveys for IMS.			

2.3; PHYSICAL STRUCTURES, CONSTRUCTION & TENURE

This component describes issues relating to the impacts from the physical structures that are associated with marine farming.

2.3.1 Number and size of farms

Scope

To ensure that the size and number of farms in a region does not cause significant loss of amenity.

Current Management Controls

The number and size of farms is controlled through the *Marine Farming Planning Act 1995* (MFPA). The MFPA prescribes that an environmental impact statement (EIS) must accompany any draft Marine Farming Development Plan (MFDP). The MFDP determines the size and location of the zones in which marine farming activities may occur, taking into account the objectives of the Resource Management Planning System (RMPS), including impacts on the natural environment, as well as public amenity issues. The draft MFDP is provided for public consultation prior to being accepted by the minister of the day.

Management controls on visual amenity are stipulated through licence conditions and include:

- All fish cages, buoys, netting and other floating marine farming structures and equipment on State waters, other than that specified for navigational requirements, must be grey to black in colour, or be any other colour that is specified in the relevant marine farming licence
- Marine farming structures and equipment must be low in profile and be of a uniform size and shape
- The positioning and brightness of security and spotlights should not cause unnecessary adverse effects on the amenity of residential property and must not interfere with navigation
- The lease are must be kept neat and tidy
- Floating storage huts, grading facilities and shelters must not be located within a lease area without authorisation under the relevant Marine Farming Licence.

The Industry COP also requires that all structures and equipment on the lease area should be kept in good repair and condition. The number and visual impact of such structures should be minimised wherever practicable and farm debris must not be disposed of in the water. Farms should undertake regular cleanups of adjacent foreshores, including non-farm-related rubbish. Records of cleanups, including an assessment of farm vs. non-farm debris should be kept.

Environmental Risk 2.3.1: What is the risk of Industry causing significant impacts to public amenity?			
Environmental Objective 2.3.1: To ensure that salmonid farms do not causes significant impact to pubic amenity.			
Consequence **C= 2**	**Likelihood** **L= 5**	**Risk Rating** **C x L = 10** **Mod**	**Target Risk Rating** **Low**
Risk Management Options • Compliance with the MFPA management controls • Compliance with the Industry COP			
Suggested Performance Measures • Annual variation in the number of non compliance records or public complaints • Comparison of the amount on Industry debris compared to non-industry debris found on foreshore cleanups			

2.3.2: Terrestrial Habitat Removal

Scope

To assess the impact of land based facilities on the surrounding terrestrial habitat in a region.

Current Management Controls

Crown Lands manage the removal of vegetation under their jurisdiction and may involve the Parks Branch of the Department of Tourism, Arts and the Environment for specific advice. In the course of this approval, aspects relating to the preservation of sensitive habitats would be identified and appropriately dealt with. Guidance notes on Habitat Effects relating to individual facilities are covered in Section 3.1.12.

Environmental Risk 2.3.2: What is the risk of Industry causing significant impacts to terrestrial habitats?			
Environmental Objective 2.3.2: To ensure that land based Industry facilities do not cause significant impact to terrestrial habitat.			
Consequence **C= 1**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 1** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • Adherence to state conditions and local planning scheme.			
Suggested Performance Measures • Number of non compliance records.			

2.3.3: Heritage Effects

The protection of indigenous heritage values is covered in detail in Component 6 of this document.

Scope

To assesses the impact of Industry on heritage values that may be affected by the construction of Industry facilities.

Current Management Controls

Significant heritage areas and buildings are protected by the *Australian Heritage Commission Act 1975*. A register of heritage buildings or areas of state significance is listed and protected by the *Historic Cultural Act 1995* and administered by the Tasmanian Heritage Council. All considerations of heritage buildings and areas are dealt with by this council and address the objectives of the RMPS and LUPAA. Local Governments usually carry a schedule of heritage buildings for each area.

Environmental Risk 2.3.3: What is the risk of Industry causing significant impacts to heritage values?			
Environmental Objective 2.3.3: To ensure that land based Industry facilities do not cause significant impact to heritage areas or buildings.			
Consequence **C= 1**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 1** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • Adherence planning scheme guidelines.			
Suggested Performance Measures • Number of non compliance records.			

2.3.4: Navigation

The level of impact will depend upon the siting of the equipment and the size of the vessel potentially involved.

Scope

To assess the impact of marine farms on the safe navigation of vessels.

Current Management Controls

The development of the MFDP requires wide consultation with identified local stakeholders such as yacht clubs and boating groups. Consideration is given to the location of safe anchorages. While vessels often will not be able to navigate through a lease area, it is ensured that there is adequate navigational room for vessels to navigate around lease areas.

Marine farmers are required to comply with the conditions of licence for navigation markers and structures. Marine and Safety Tasmania (MAST) maintains the responsibility for the regulation of navigation within Tasmanian waters and specify the requirements for marine farming operations under the *Marine and Safety Authority Act 1997* and the *Marine and Safety (Mooring) By-Laws 1998* Section 22: Approved lights and day marks for finfish farm boundaries, as follows:

> *A person must exhibit approved daymarks and navigation marks to the satisfaction of the Authority in respect of moorings used to mark the boundaries of leases or permit areas.*

Specifications for fish farm markers are shown in Appendix 2.3.4.

<table>
<tr><td colspan="4">Environmental Risk 2.3.4: What is the risk of Industry causing significant navigational hazards regionally?</td></tr>
<tr><td colspan="4">Environmental Objective 2.3.4: To ensure that the marine farming structures do not pose a navigation hazard regionally.</td></tr>
<tr><td>Consequence
C= 1</td><td>Likelihood
L= 4</td><td>Risk Rating
C x L = 4
Low</td><td>Target Risk
Rating
N/A</td></tr>
<tr><td colspan="4">Risk Management Options
• Adherence to MAST controls and regulations and DPIW license conditions
• Maintain regular formal consultation with MAST</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Number of DPIW licence non-compliance</td></tr>
</table>

2.3.5: Infrastructure

Scope

To assess the impacts on the environment from Industry infrastructure, such as roads, power, wharves etc., including the impacts of construction of these items if required.

Current Management Controls

Local government controls infrastructure development under the local planning scheme. However, they are also consulted with regard to the development of marine farming plans under the MFPA. The local government have the opportunity to comment on the level, type and location of a marine farming zones, and identify the appropriate infrastructure that would be needed to support any development zone through the consultation process of the MFPA. Guidance notes on infrastructure for individual facilities are provided in Section 3.1.8. Infrastructure

The Industry must also adhere to controls on marine infrastructure as stated by the *Crown Lands Act 1976* and the *Marine and Safety Authority Act 1997*

Environmental Risk 2.3.5: What is the risk of Industry infrastructure causing significant impacts to the environment?			
Environmental objective 2.3.5: To ensure that Industry infrastructure is not impacting upon the environment.			
Consequence **C= 2**	**Likelihood** **L= 2**	**Risk Rating** **C x L = 4** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • Compliance with management controls under licence conditions from Crown Lands, Local Government and Marine and Safety Tasmania			
Suggested Performance Measures • Monitor number of non compliance notices			

2.3.6: Noise

Scope

To assess the impact of noise pollution from the Industry on the environment.

Current Management Controls

The main source of noise is from the use of boats servicing the farms and incidental noise from personnel working on the site. Noise conditions attributable to marine farming will vary depending upon the equipment used, weather conditions and background noise. However, the perception of noise may be increased due to sound travelling greater distances over water. All marine farmers are aware of the responsibility of noise control particularly when working outside normal daytime hours.

The main source of noise from land based facilities is from pumps, compressors, forklifts and other equipment. Noise emissions in Tasmania are controlled by guidelines and regulations from the *Environmental Management and Pollution Control Act 1994 (*EMPCA). Local government may stipulate noise level controls for land based facilities under EMPCA.

The Industry COP encourages that farm workers should aim to minimise the noise created from farming operations, farm staff and farm equipment, particularly early in the morning and late at night.

Environmental Risk 2.3.6: What is the risk of Industry causing significant noise impacts to the environment?			
Environmental Objective 2.3.6: To ensure that noise levels from the Industry do not impact upon the local environment.			
Consequence **C= 1**	**Likelihood** **L= 3**	**Risk Rating** **C x L = 3** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • Adherence to controls stipulated by EMPCA, DPIW and local government			
Suggested Performance Measures • Number of non-conformance notices and complaints.			

2.4: PRODUCTION

The optimal production of the cultured species for the region is an important part of environmental management. Environmental management on a regional basis reduces the potential for collective impacts of the individual operations. This component looks at regional aspects which are directly affected by production levels in the region.

2.4.1: Regional Carrying Capacity

Scope

To assess the impact of annual regional production on other marine fauna or flora within the region.

Current Management Controls

The Industry has invested heavily in research to ensure that the maximum carrying capacity of a region is determined on the basis of sustainable development, and is aware that overstocking of a water body is detrimental to productivity and health of stock in a region.

Research results from the CSIRO designed to estimate the assimilative capacity of the Huon estuary-D'Entrecasteaux Channel region indicates that this area is not being exceeded with current Industry practices. The model used by the CSIRO shows that some expansion of salmonid farming will be possible, but it will be necessary to monitor its effects to ensure that healthy environmental conditions are maintained (Volkman et al 2006).

Management controls on stocking density are prepared by DPIW in accordance with section 24 of the *Marine Farming Planning Act 1995*, and include regional variation as shown Table 2.4.1, unless specified by licence conditions. Other management controls include:

- Maximum permissible stocking densities for other finfish species may be specified in licence conditions
- Lessees must ensure that farmed areas are fallowed as soon as practicable if bubbles of hydrogen sulphide and/or methane gas form in the sediment and rise to the surface without physical disturbance of the seabed
- Stocked finfish cage nets must be at least 1 metre clear of the seabed at low tide under normal growing conditions unless otherwise specified in the relevant marine farming licence.

Table 2.4.1. Stocking density as determined by the regional Marine Farming Development Plans.

Region	MFDP Date and Status	Specified regional carrying capacity
1. Macquarie	2005, Draft	15 kg/m^3
2. Tamar	2000	25 kg/m^3
3. Tasman	2006, Draft	15 kg/m^3
4. Channel	2002	25 kg/m^3
5. Huon	2002	25 kg/m^3

In addition, each leaseholder must record on a monthly basis the stock biomass within the lease area, and the type, origin and dry weight of feed placed into some regions.

The Industry also has a Memorandum of Understanding with the DPIW Marine Farming Branch on the level of stocking on farms, and the amount of feed input to an area.

The Industry recognises through its COP that fish stocked too densely within cages are prone to stress, injury and disease. The COP states that:

- Appropriate stocking densities will vary according to stage of the production cycle (*eg*. smolt vs. harvest size fish), time of year (*i*.e. winter vs. summer) and between sites according to different site characteristics (*eg*. currents, depth), however as a general rule stocking densities should not result in undue fish stress or compromise fish health, and quality
- It is recommended that "normal" maximum stocking density be kept as low as practicable, but should not exceed 15 kg/m^3 and must not exceed 18 kg/m^3, unless the conditions in the previous point are met.

Environmental Risk 2.4.1: What is the risk of Industry causing significant environmental damage through exceeding regional carrying capacity?			
Environmental Objective 2.4.1: To ensure that annual regional production levels is sustainable with no significant impacts on other marine fauna or flora.			
Consequence **C= 3**	**Likelihood** **L= 2**	**Risk Rating** **C x L = 6**	**Target Risk Rating** **N/A**
Risk Management Options • Adherence to controls stipulated by DPIW.			
Suggested Performance Measures • Decreased productivity of a region • Stock growth, survival and health.			

2.4.2: Disease

Scope

To assess the impact of disease management between regions

Current Management Controls

The Industry contributes significantly towards the Tasmanian Salmonid Health Surveillance Program (TSHSP) delivered by the Department of Primary Industries, Water & Environment (DPIW) 'Fish Health Unit'. This program incorporates key aspects of strategic testing, routine sampling collection and disease investigations. Revised objectives for the 2005/2006 program are as follows:

Objective I: demonstrate freedom of disease for the purpose of market access, restriction of product entry or the establishment of a recognised disease free zone for Tasmania.

Objective II: the maintenance of regional biosecurity within Tasmania for endemic diseases.

Objective III: the investigation of significant or unusual disease events in order to rule out exotic or new pathogens.

Objective IV: active surveillance for endemic diseases of concern to monitor their distribution so that effective regional biosecurity measures can be implemented.

In addition to the TSHSP program, the *Animal Health Act 1995* also allows restriction of movement of fish based on disease criteria. As part of measures to support regional biosecurity, movement restrictions are currently in place for 2 areas within Tasmania, which include between Macquarie Harbour and the south-eastern region of Tasmania.

Licence conditions from DPIW require that:

- Lessees must notify the Department of Primary Industry, Water and Environment of any suspicion of a notifiable disease in accordance with the *Animal Health Act 1995*.
- Lessees must remove dead fish from cages in accordance with any direction from the Secretary.
- Lessees must ensure that all salmonid fish species introduced into the plan area by leaseholders are vaccinated in accordance with any vaccination protocol plan as specified by the Secretary.

The Industry COP advises that farms should always aim to prevent or control disease incidents through the application of best practice in farm management, stock husbandry and equipment deployment. Industry should facilitate open communication between farms and with the Fish Health Unit (FHU) veterinarian when disease incidents occur. Industry should be familiar with the operational procedures for the "Tasmanian Fish Health Surveillance Program".

Specifically, the COP states that smolt must not be transferred to Macquarie Harbour without having been vaccinated against *Vibrio anguillarum*. Salmon should also be vaccinated against *Vibrio anguillarum* prior to transfer to other regions in Tasmania. Trout must not be transferred to any region in Tasmania without having been vaccinated against *Vibrio anguillarum*.

More information on the objectives of the TSHSP is provided in Appendix 2.4.2.

<table>
<tr><td colspan="4">Environmental Risk 2.4.2: What is the risk of Industry causing transfer of diseases between regions?</td></tr>
<tr><td colspan="4">Environmental Objective 2.4.2: To ensure that management practices minimise the risk of disease transfer between regions</td></tr>
<tr><td>Consequence
C= 3*</td><td>Likelihood
L= 4</td><td>Risk Rating
C x L = 12
Moderate</td><td>Target Risk
Rating
Low</td></tr>
<tr><td colspan="4">Risk Management Options
• Adherence to transfer controls stipulated by DPIW
• Adherence to the Industry COP</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Decreased productivity of a region
• Changes in disease status in regions as provided by annual reports provided from the CVO
• Recorded changes to stock growth, survival and health.</td></tr>
</table>

* Consequence may vary regionally

2.4.3: Disposal of Harvesting Waste (Bloodwater)

Scope

To ensure that harvesting waste from industry does not impact upon the environment.

Current Management Controls

The most significant waste from harvesting fish in the Industry is the production of bloodwater. The release of bloodwater into the environment may result in decreased water quality, increased bacterial loads and nutrification, potential pathogen (disease) transfer and decreased amenity value. The harvested fish are required to be bled out effectively to minimise the occurrence of blood spotting in fish products for human consumption.

The MFDP specify that bloodwater resulting from harvesting of produce must not be released into the marine environment unless it has been managed in accordance with the requirements of the DPIW Chief Veterinary Officer, as specified in Schedule 1 of the MFDP (Appendix 8.1.3.2). Industry must also meet guidelines and regulations produced by local councils in the collection and disposal of bloodwater.

The Industry COP states that all bloodwater associated with the harvest of fish should be fully contained during the harvesting process for later treatment and/or appropriate disposal. Any bloodwater not contained (*eg*. accidental spillage, wash down water) must be treated with an appropriate disinfection method wherever possible. Further conditions to reduce the potential for untreated bloodwater entering the marine environment are stipulated. Importantly, bloodwater must not be transported to other farming regions for disposal/treatment unless the transport and disposal/treatment method is completely biosecure.

<table>
<tr><td colspan="4">Environmental Risk 2.4.3: What is the risk of Industry impacting upon the marine environment through the release of harvesting waste?</td></tr>
<tr><td colspan="4">Environmental Objective 2.4.3: To ensure that disposal of harvesting waste does not impact upon the region.</td></tr>
<tr><td>Consequence
C= 1</td><td>Likelihood
L= 3</td><td>Risk Rating
C x L =3
Low</td><td>Target Risk Rating
NA</td></tr>
<tr><td colspan="4">Risk Management Options
• Disposal as under DPIW and local government licence conditions
• Alternative markets for recycling</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Number of non-conformance notices</td></tr>
</table>

2.4.4: Disposal of Mortalities

Scope

To assess the impact of disposal of fish mortalities on the environment.

Current Management Controls

The Industry aims to have minimal fish mortalities during its production cycle. However, occasionally environmental incursions such as disease, jellyfish or harmful algal blooms occur which may lead to higher than normal mortalities.

The Industry COP requires that the removal and disposal of mortalities must be carried out in a timely and proper manner in order to minimise disease transmission risks and the potential for fish escapes due to scavengers creating holes in nets (*eg.* dogfish sharks and seals). Where changes in fish behaviour or feed response occur, which may indicate an increase in mortality, the Industry increases inspections to ensure the removal of any mortality.

When mortalities occur they must not be disposed of, or be present in the marine environment outside cages. Mortalities should be disposed of on land sites where there is no risk of leaching back into waterways. Disposal techniques must meet local government guidelines. This should include burial to eliminate the potential for birds and vermin to gain access to the material. Further processing under biosecure conditions (eg. fertiliser, silage, rendering, composting) is also a favourable option.

The DPIW licence conditions stipulate that the lessee must take all reasonable steps to ensure that no dead fish of the species authorised by their licence are found on the lease area outside cages. The licence holder must report any suspected or known incidents of disease or mortality affecting > 0.25 % of fish per day for three consecutive days in any individual cage. Such reports are to be provided as soon as possible to the DPIW assigned fish veterinarian or an inspector under the *Animal Health Act 1995*.

<table>
<tr><td colspan="4">Environmental Risk 2.4.4: What is the risk of Industry impacting on the environment through disposal of mortalities?</td></tr>
<tr><td colspan="4">Environmental Objective 2.4.4: To ensure that disposal of mortalities does not impact upon the region.</td></tr>
<tr><td>Consequence
C= 2</td><td>Likelihood
L= 2</td><td>Risk Rating
C x L =4
Low</td><td>Target Risk
Rating
NA</td></tr>
<tr><td colspan="4">Risk Management Options
• Disposal as under licence conditions and local government regulations
• Alternative markets for recycling.</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Number of non-conformance notices</td></tr>
</table>

2.4.5: Use of Aquavet Chemicals

Scope

To assess the risk of aquavet chemical contamination of the marine environment from Industry activities.

Current Management Controls

The Tasmanian salmonid industry has always considered itself relatively disease free when compared to similar industries within Europe and the American continent. Current freedom from exotic disease pathogens is largely attributable to strict quarantine and surveillance programs that have operated in Tasmania for many years. Recent detections of disease, in particular Rickettsia-like organisms (RLO) and marine aeromonas of salmonids (MAS), are considered to be endemic diseases that have increased in prevalence and thus incidence with the development of salmonid farming over time (Ellard pers comm.).

The *Agricultural and Veterinary Chemicals (Control of Use) Act 1995*, and the *Poisons Act 1971* regulate the supply and use of veterinary chemical use in the Industry.

The use of veterinary chemicals in Australia is controlled by the *Australian Pesticides and Veterinary Medicines Authority* (APVMA) who registers products for use only if they meet the following 4 criteria:
- human and animal health and safety;
- efficacy – that the product works;
- environmental safety and
- that it will not affect international trade.

The chemicals used by Industry include
- Antibiotics
- Disinfectants
- Anaesthetic agents
- Hormones
- Vaccines and others.

Of these chemical agents, the moderate risk chemicals used by the industry include antibiotics and hormones. (See Appendix 2.4.5: Veterinary chemical use in the Tasmanian salmonid industry).

The Industry COP and MFPA requires that each farm keep a list specifying the quantities, and date of use, of all chemicals which have been used on the Lease Area. This includes, but is not confined to, therapeutants, anaesthetics, antibiotics, hormones, pigments, antifoulants, disinfectants and cleansers.

The Industry developed COP guidelines on the use of pharmaceutical and chemical treatments encourage that treatments are only to be used in disease or animal welfare issues, not on a routine basis and strict compliance with regulatory control measures including record keeping, withdrawal periods and disposal. Prescriptions of any medications within salmonids are undertaken according to guidelines outlined within the DPIW “Code of Practice for the supply and use of veterinary products, 2000”.

Further information can be found at http://www.apvma.gov.au.

2.4.5.1: Antibiotics

The use of antibiotics within the Industry is monitored through licence conditions. It is a requirement of all marine farming license conditions that a record of any antibiotic use is kept by the farm. The DPIW licence conditions also stipulate that:

> "level of antibiotic or chemical residues derived from therapeutic use, present in sediments within or outside the Lease Area, is not to exceed levels specified to the licence holder by prior notice in writing by either the Director or the Chief Veterinary Officer, DPIW."

Some impact on the benthos and other native fish is accepted. Industry and DPIW are currently investigating the potential impact of therapeutic use of antibiotics on the benthos and other native fish to assist with developing any mitigative strategies if necessary.

Antibiotics are only used in the case of significant disease events, where the welfare and survival of large numbers of fish are threatened and always used under veterinary prescription. Within Tasmania, antibiotics are currently used to treat clinical outbreaks of Yersiniosis, Vibriosis, MAS, RLO and Cutaneous Ulcerative Disease in marine sites (Ellard 2006; Appendix 1.2.4). Of these, the use of antibiotics to control Yersiniosis, MAS and Vibriosis is anticipated to decline with the introduction of vaccination strategies and revised management. Results of the first year of vaccine use for Yersiniosis (2006) is not yet available, however successful usage of Anguimas for Vibrio and MAS demonstrates the Industry's' adaptation to using alternatives to antibiotics.

There are currently no antibiotics registered with APVMA for use in fish within Australia. Antibiotic use is therefore considered to be "off-label' and can only be undertaken following prescription by an authorised veterinarian. The DPIW actively assists in reducing any long-term need for use of antibiotics within the Industry through the development of vaccines and disease management strategies.

No antibiotic residues have been reported in salmon through the National Residue Survey. Monitoring of residue levels in the marine environment are being implemented by DPIW.

2.4.5.2: Hormones.

The Industry only uses minute quantities of hormones (< 1 gram per year) to induce broodstock kept at freshwater land based facilities. No hormones are used in fish destined for market.

<table>
<tr><td colspan="4">Environmental Risk 2.4.5: What is the risk of Industry impacting on the marine environment through contamination with aquavet chemicals?</td></tr>
<tr><td colspan="4">Environmental Objective 2.4.5: To minimise the impact of Industry veterinary chemical use in upon the marine environment.</td></tr>
<tr><td>Consequence
C= 2</td><td>Likelihood
L= 2</td><td>Risk Rating
C x L = 4
Low</td><td>Target Risk
Rating
N/A</td></tr>
<tr><td colspan="4">Risk Management Options
▪ Use veterinary chemicals only as directed
▪ Compliance with MSDS
▪ Register of veterinary chemicals on site
• Adhering to the DPIWE “Code of practice for the Supply and Use of Veterinary Chemical Products”
• Maintaining a register of chemical usage
▪ Reference to a Material Safety Data Sheet (MSDS)
▪ Development of MUP’s
▪ Development of vaccines and disease management strategies</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Comparison of veterinary chemical usage over time</td></tr>
</table>

* Consequences may vary regional

Environmental Management System Framework

Component 3 : Impact of Individual Facilities on the Environment

PhycoTec
Environmental Management

TASMANIAN SALMONID GROWERS

Tasmania

Australian Government
Fisheries Research and Development Corporation

FRDC Project 2004/096

Component 3: Impact of Individual Facilities on the Environment

Introduction

The following component outlines potential issues an operator (and any consent authority) needs to consider when assessing environmental issues related to a specific facility. These issues include the construction phase/site selection and the operation of the facility once it is in production. A facility includes the building or complex of buildings, plus the associated infrastructure on the marine leases built for the specific purpose of farming salmonids.

This component provides guidance notes only for each issue. Individual facilities will have to assess the potential risk of each issue. Some issues will be influenced by objectives developed in components 1 and 2. The component tree 3 (fig 3.0) is not guaranteed to be comprehensive or inclusive and it is recommended that each individual facility reviews and identifies its own set of issues. This component is linked into the EMS Framework Templates, which are designed to assist operators determine their environmental risk.

The areas covered by the component tree 3 include the potential impact of an individual facility during:
(v) Site Construction; and
(vi) Operation

The Individual Facility component tree has been adapted from the National ESD framework to be relevant to the industry by the following means.

Exclusions:
- Proximity to Users. This aspect refers to the proximity of the facility to the end markets and would be considered to part of a business plan analysis rather than an environmental risk analysis;

The current management controls that may occur and relate to the aspects can be found tabulated in Appendix 3.1 (Commonwealth and Tasmanian legislation matrix relevant to Component 3.1) and Appendix 3.2 (Commonwealth and Tasmanian legislation matrix relevant to Component 3.2). These matrixes are only a guide, and while comprehensive, may not be inclusive.

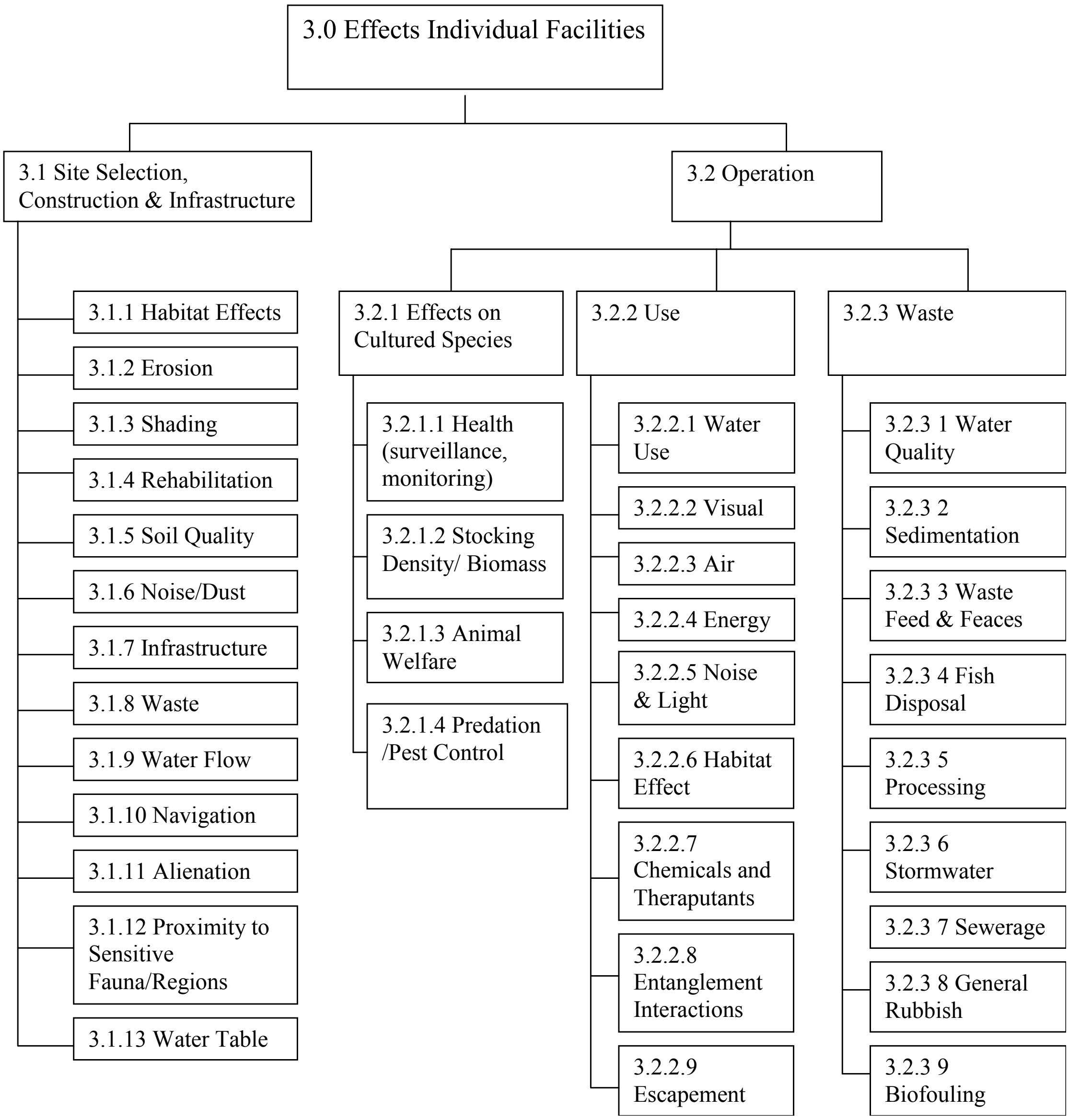


Figure 3.0. Component tree 3: Impact of individual facilities on the environment

3.1: SITE SELECTION, CONSTRUCTION AND INFRASTRUCTURE

This component covers the issues of the initial building, construction and development of an aquaculture facility. It can also be used as a checklist for proponents (and assessors) in their submission for approvals when determining the suitability for a potential site. Some of these aspects should be addressed co-operatively with the contractor responsible for the construction works. A guide to some of the legislative requirements for these aspects is provided in Appendix 3.1.

3.1.1: Habitat Effects

Scope

To assess the impact of construction and use of an aquaculture facility on the surrounding habitat.

Environmental Objective 3.1.1: To reduce the impact of the facilities on the habitat.
Potential Impact: Degradation of the surrounding environment.
Suggested Control Measures • Environmental Management Plan (EMP) for the construction, development, or expansion of the facilities to include ponds, cages, buildings, wharves, roads, offices, labs, work spaces, car parks etc. • Identification of ecologically important or protected, endangered or threatened flora or fauna • Assessment of removal of vegetation for the facility on a regional scale • Replanting disturbed areas with native plants • Minimisation of run-off from roads and work areas into waterways
Related Aspects: • 1.2.6: Sensitive Habitats • 2.2.4 Threatened/Endangered/Protected species • 2.2.5: Protected Areas • 2.3.2: Habitat Removal

3.1.2: Erosion

Scope

To assess the impact of erosion on the environment as a result of the construction and use of an aquaculture facility.

Environmental Objective 3.1.2: To reduce the impact of erosion, where practicable, in the construction and use of facilities.
Potential Impact: Erosion of the surrounding environment. Decreased water quality.
Suggested Control Measures • Identify potential erosion problems prior to the construction of the facility • Environmental Management Plan for erosion • Ensure guttering is installed and pipe work is effective at directing effluent into stormwater systems or tanks
Related Aspects: • 1.2.6: Sensitive Habitats • 2.3.2: Habitat Removal

3.1.3: Shading

Scope

To assess the impact of construction of use of an aquaculture facility on shading of marine and terrestrial vegetation.

Environmental Objective 3.1.3: To reduce the long-term and short-term impact of shading on the environment.
Potential Impact: Degradation of the marine and terrestrial.
Suggested Control Measures • EIS on the potential impact of the facility on any sensitive habitats • Adhere to DPIWE controls on cage rotation • Regular benthic monitoring
Related Aspects: • 1.2.6: Sensitive Habitats • 2.2.2: Benthic Communities • 2.2.4: Threatened/Endangered/Protected Species • 2.3.2: Habitat Removal

3.1.4: Rehabilitation

Scope

To assess the requirement for environmental rehabilitation after construction of an aquaculture facility.

Environmental Objective 3.1.4: To plan rehabilitation of the site to remove ongoing impacts when construction or production is ended.
Potential Impact: Degradation of the surrounding environment.
Suggested Control Measures • Removal of uncommissioned equipment including building equipment and unused racks or moorings • Removal any construction waste • EMP for rehabilitation of degraded areas
Related Aspects: • 8.2.3 Regulations

3.1.5: Soil Quality

Scope

To assess the impact of construction and use of an aquaculture facility on soil quality.

Environmental Objective 3.1.5: To ensure that problems with soils are managed to reduce impact on the environment.
Potential Impact: Activation of acid sulfate soils. Siltation and contamination of the waterways.
Suggested Control Measures • Identify any potential acid sulfate soils (PASS) and develop and EMP if necessary • Control potential erosion
Related Aspects: • 8.1.2.6 Land Use Changes • 3.1.2: Erosion

3.1.6: Noise /Dust

Scope

To assess the impact of noise and dust from the construction and use of an aquaculture facility on the environment.

Environmental Objective 3.1.6: To maintain minimal dust and noise impact where practicable.
Potential Impact: Displacement of local wildlife, decreased public amenity. Degradation of the environment.
Suggested Control Measures • Identify and measure potentially unacceptable levels noise and dust to surrounding areas • Identify sensitive habitats in the surrounding area that may be impacted on by increased noise/dust levels eg. bird nesting sites • Produce guidelines for noise made outside normal working hours.
Related Aspects: • 2.3.3 Listed Migratory Birds • 2.2.5 Protected Habitats • 2.3.6 Noise • 5.2.7 Public Amenity

3.1.7: Infrastructure

Scope

To assess the impacts on the environment of the use of infrastructure in the construction and operation of an aquaculture facility.

Environmental Objective 3.1.7: To reduce the impact of facility infrastructure on the environment.
Potential Impact: Decreased public amenity.
Suggested Control Measures • Determine the adequacy of the current infrastructure for supporting the construction and use of the facility (eg roads, power, transport, sewerage) • Adherence to regulatory requirements in the construction and maintenance of infrastructure such as sheds and trestles • Maintain and clean infrastructure on a regular basis
Related Aspects: • 2.3.5 Infrastructure

3.1.8: Waste

Scope

To assess the environmental impact of waste from the construction and use of an aquaculture facility.

Environmental Objective 3.1.8: To ensure that waste produced from the construction of the facility is dealt with in an appropriate manner.
Potential Impact: Degradation of the surrounding environment. Wildlife entanglements. Public amenity. Visual pollution.
Suggested Control Measures • No dredging or dumping of any waste • Maximisation of recycling of material generated through the construction of the facility eg. plastic wraps, package casing, and land-fill • Environmental Management Plans for construction waste
Related Aspects: • 2.4.3: Disposal of processing waste

3.1.9: Water Flow

Scope

To assess the environmental impact a facility in diverting water flow.

Environmental Objective 3.1.9: To ensure water flow is not significantly changed through the construction or use of a facility.
Potential Impact: Changed environmental conditions for flora/fauna. Contamination of the waterways.
Suggested Control Measures • Consideration must be given to both the effects on the flow of seawater as well as the flow of freshwater • Ensure flushing/tidal exchange rates around farm infrastructure are not impacted upon • Adhere to licence conditions on cage spacing • Maintain guttering and silt traps to prevent uncontrolled stormwater run-off • Ensure appropriate guttering/drains to collect water from car parks and roadways. Install silt traps to remove solids • Divert excess water into storage tank for reuse/recycling or constructed wetlands
Related Aspects: • 2.1.3 Flow (hydrology/oceanography) • 2.1.4 Water Extraction, Ground or Surface

3.1.10: Navigation

Scope

To assess the impact of the facility on navigation of vessels.

Environmental Objective 3.1.10: To ensure the facility complies with navigational legislation.
Potential Impact: Obstruction of waterways for other users and potential collisions.
Suggested Control Measures • Identify all facility structures that may pose a navigational hazard • Document MAST requirements for navigational markers • Staff training
Related Aspects: • 2.3.4. Navigation • Appendix 2.3.4

3.1.11: Alienation

Scope

To assess the impact of alienation of other users in the area in the construction of use of an aquaculture facility.

Environmental Objective 3.1.11: To ensure that other users of an area are not alienated through construction and use of the facility.
Potential Impact: Alienation of local community**.** Amenity loss.
Suggested Control Measures • Maintain relationship and involvement with community and local groups • Maintain a clean and tidy lease • Public education program • Ensure operation meets with ESD guidelines • Ensure access to the public is available between lease sites and access to foreshore
Related Aspects: • 5.2.7 Public amenity

3.1.12: Proximity to Sensitive Fauna/Regions

Scope

To assess the impact of construction and use of a facility on nearby sensitive fauna or regions.

Environmental Objective 3.1.12: To ensure that the construction and use of the facility do not impact upon sensitive fauna/regions.
Potential Impact: Impact on wildlife breeding, roosting and feeding areas.
Suggested Control Measures • Identify sensitive fauna, habitat or other regions of particular value in the area • Production of an Environmental Management Plan for sensitive fauna relating to the construction and use of the facility
Related Aspects: • 2.2.4: Threatened/Endangered/Protected Species • 2.2.5: Protected Habitats • 1.2.6: Sensitive Habitats • 2.2.3: Listed Migratory Birds • 2.3.2: Habitat Removal

3.1.13: Water Table

Scope

To assess the impact on the water table from the construction and use of the facility.

Environmental Objective 3.1.13: To ensure that construction and use of the facility does not impact upon the water table.
Potential Impact: Contamination or significant reduction of the water table.
Suggested Control Measures • Assess the use of water drawn from the water table and determine whether the use is sustainable • Develop alternative water use strategies if necessary • Identify potential contamination of the water table (eg seepage from ponds)
Related Aspects: • 2.1.4: Water extraction

3.2: OPERATION

This component is a set of three branches designed to identify the issues that may occur during the operation of the facility; Effect on cultured species, Use and Waste. A guide to some of the legislative requirements for these aspects is provided in Appendix 3.2.

3.2.1: Effect on Cultured Species

These issues relate to the impacts on stocks being cultivated within an individual facility.

3.2.1.1: Health (surveillance, monitoring)

Scope

To assess the impact of fish health monitoring within a facility.

Environmental Objective 3.2.1.1: To monitor and respond to fish health issues within the facility.
Potential Impact: Loss of stock. Spread of disease within Industry.
Suggested Control Measures • Participation and knowledge of -Tasmanian Salmonid Health Surveillance Program (TSHSP) -AQUAVETPLAN -*Quarantine Act 1908* -DAFF (2006) Operational Procedures manual - Decontamination • Protocols, schedules and staff training for fish health related issues • Staff training in algal identification
Related Aspects: • 1.1.2: Transfer of Disease • 1.2.1: Disease (other species/communities/processes) • 2.4.2: Production Related Disease • 8.1.3.1: Disease Identification and Response

3.2.1.2: Stocking Density / Biomass

Scope

To assess the impact of inappropriate stocking density within a facility.

Environmental Objective 3.2.1.2: To ensure that an appropriate stocking density is maintained within the facility.
Potential Impact: Reduced productivity of the region and/or food chain impacts.
Suggested Control Measures • Monitoring stocking density or biomass on the lease/facility • Maintaining stocking density within regulatory guidelines • Monitoring growth and health of stock • Monitoring phytoplankton levels of region
Related Aspects: • 2.4.1 Regional Carrying Capacity • 1.2.5 Behavioural Changes and Food Chain Impacts • 2.2.1: Phytoplankton • 2.2.2: Benthic Communities • 2.4.2: Disease • 2.1.1: Nutrients

3.2.1.3: Animal Welfare

Scope

To assess the impact of facility operations on animal welfare.

Environmental Objective 3.2.1.3: To ensure that animals (fish) are treated using contemporary animal welfare guidelines
Potential Impact: Poor fish health. Stock losses.
Suggested Control Measures • Regular monitoring of fish stocks • Familiarisation with the Aquatic Animal Welfare Guidelines • Familiarisation with the Industry COP • Staff training on animal welfare and potential impacts
Related Aspects: • 1.2.4: Animal Welfare

3.2.1.3: Predation/Pest Control

Scope

To assess the impact of predators/pests on the facility

Environmental Objective 3.2.1.3: To ensure that predators/pests are dealt with in an appropriate manner in the facility.
Potential Impact: Wildlife injuries or mortalities. Stock losses. Staff safety.
Suggested Control Measures • Identification of problematic predators/pests on the lease such as birds, seals and fish • Identification and management plan for potential predators, which are also protected species • Following non-lethal seal deterrent methods as per protocols (Appendix 8.1.3.2) • Protocol for management and disposal of Invasive Marine Species that may be pests • Adherence to controls relating to the translocation of stock and equipment between regions (and interstate) • Staff training in predator deterrence and potential impacts
Related Aspects: • 1.2.5 Behavioural Changes and Food Chain Impacts • 8.1.3.2: Predators • Appendix 8.1.3.2: Protocol for the negative conditioning of seals • 2.2.4 Threatened, Endangered and Protected Species • 2.2.6 Translocation between Catchments

3.2.2: Use

This issue looks at the use of resources whilst the facility is operational.

3.2.2.1: Water Use

Scope

To assess the impact on the environment of fresh water usage from the facility.

Environmental Objective 3.2.2.1: To maintain freshwater usage in the facility at an environmentally responsible and sustainable level.
Potential Impact: Restricted fresh water availability.
Suggested Control Measures • Identify risks to the availability of water (fresh water, river water, ground water), eg seasonal variation, drought, infrastructure • Produce a water budget • Reduce, reuse, and recycle where practicable
Related Aspects: • 2.1.4 Water Extraction, Ground or Surface

3.2.2.2: Visual

Scope

To assess the visual impact of facility structures on the surrounding environment.

Environmental Objective 3.2.2.2: To ensure that the visual impacts and aesthetics are acceptable to the regulators and the community.
Potential Impact: Decreased amenity value of the surrounding environment.
Suggested Control Measures • Use of appropriate and subdued building materials • Well maintained grounds and facilities • Replant disturbed areas with native plants • Regular inspection and maintenance of marine lease structures
Related Aspects: • 2.4.1 Regional Carrying Capacity • 2.3.4: Navigation • 8.3.2.3: Regulations • 5.2.1.7 Public Amenity

3.2.2.3: Air

Scope

To assess the impact of air emissions from facility equipment.

Environmental Objective 3.2.2.3: To ensure that the appropriate air pollution environmental controls are in place.
Potential Impact: Poor air quality.
Suggested Control Measures If a facility is classed as having Level I activity (produces less than 100 tonnes annually), air pollution is regulated by local government under the Local Government Act 1993. However, if the local government deems that a facility is producing excessive air pollution, they may prosecute the facility under the EMPCA. • Produce a greenhouse gases budget • Ensure emissions from tractors or vessels been tested to comply with legislative requirements • Regular maintenance of equipment • Plan to replace equipment through attrition with the most affordable environmentally friendly technology
Related Aspects: • 2.1.2. Other wastes/Pollutants • 5.2.7: Public Amenity

3.2.2.4: Energy

Scope

To assess the energy reduction potential or conversion to more environmentally friendly energy technology.

Environmental Objective 3.2.2.4: Reduce energy consumption where possible and /or convert to environmentally friendly technology, where affordable.
Potential Impact: Use of non-renewable energy sources.
Suggested Control Measures • Produce an energy budget • Assess the energy efficiency rating of equipment and plan for replacement with through natural attrition where needed • Develop protocols to ensure energy use is minimised eg. last out turns the lights off, outside lights switched to sensors rather than on all night • Identify environmentally friendly energy efficient fuels and technology
Related Aspects: • 2.1.3 Other Wastes/Pollutants • Appendix 1.2.4

3.2.2.5: Noise & Light

Scope

To assess the impact excessive noise or bright light on the environment.

Environmental Objective 3.2.2.5: To ensure that the appropriate controls are in place to minimise nuisance noise and light.
Potential Impact: Impact on bird life and other users. Loss of local amenity.
Suggested Control Measures • Protocol for the use of noisy machinery (eg pumps, outboard motors) to include time and place of appropriate use • Replacement (when required) of outboard motors to comply with California EPA Noise Regulations (Appendix 1.2.4: Cleaner outboard motors) • Regular maintenance program for outboard motors and other machinery • Orientation of lights to cause minimal impact to neighbours and wildlife • Staff education, especially for night workers
Related Aspects: • 2.3.6 Noise • 2.3.3. Listed Migratory Birds • 2.2.4 Threatened/Endangered/Protected species • 5.2.7 Public Amenity • Appendix 1.2.4. Cleaner outboard motors

3.2.2.6: Habitat Effect

Scope

To assess the impact of the facility on the surrounding marine and terrestrial habitat, including marine and terrestrial.

Environmental Objective 3.2.2.6: To ensure that the facility has appropriate environmental controls to reduce habitat impacts.
Potential Impact: Degradation of the surrounding environment.
Suggested Control Measures • Identification of nearby conservation areas or species listed under the EPBCA • EMP for surrounding habitat, including riparian zone • Protocols or codes of conduct to reduce habitat impacts • Clearly planned access routes to farm lease sites when crossing sensitive habitats such as the foreshore vegetation • Controlled driving on beaches • Protocols on outboard use to prevent erosion • Staff training
Related Aspects: • 3.1.1: Habitat Effects • 2.3.3. Listed Migratory Birds • 2.2.4 Threatened/Endangered/Protected species • 5.2.7 Public Amenity

3.2.2.7: Chemicals and Theraputants (including hydrocarbons)

Scope

To assess the impact on the environment from the use of chemicals and theraputants in the facility.

Environmental Objective 3.2.2.7: To ensure that the facility has appropriate controls on chemicals and therapeutants.
Potential Impact: Contamination of the water and decreased water quality.
Suggested Control Measures • Appropriate bunded storage systems for hydrocarbons • Appropriate disposal protocols of chemicals and therapeutants • Appropriate storage for chemical therapeutants • Material Safety Data Sheets available for all chemicals in the facility • Fuel/Oil and chemical containment kits at all storage areas • Staff training on fuel/oil spill response • Regular maintenance program for boats and vehicles • Use of biodegradable detergents for cleaning • Minimise use of fertilisers, pesticides and chemicals on facility gardens • Minimise chemical use on lease generally

Related Aspects: • 2.1.2: Other wastes, pollutants eg chemicals • 1.3.3: Chemicals • 1.2.4: Chemicals

3.2.2.8: Entanglement Interactions

Scope

To assess the impact of entanglement interactions from facility infrastructure

Environmental Objective 3.2.2.7: To ensure that the facility infrastructure does not significantly impact upon wildlife through entanglement interactions
Potential Impact: Reduction of wildlife populations. Animal welfare issues.
Suggested Control Measures • Routine inspections of marine equipment for possible entanglements by marine mammals, fish or birds. • Maintaining a tidy marine lease with no trailing ropes of equipment which could potentially cause entanglement • Development of appropriate emergency response plans in the event of a mammal entanglement • Familiarisation with the appropriate personnel to respond with a mammal entanglement • Use of appropriate net size to reduce the incidence of bird entanglement • Staff training on methods of releasing and care for entangled wildlife
Related Aspects: • 1.2.5: Behavioural Changes and Food Chain Impacts • 2.2.4: Threatened, Endangered and Protected Species

3.2.2.9: Escapement

Scope

To assess the impact on the environment of escapees from a facility.

Environmental Objective 3.2.2.7: To ensure that the facility has appropriate controls to prevent escape events.
Potential Impact: Release of introduced fish into the environment. Predation of native species. Environmental degradation..
Suggested Control Measures • Ensure that the facility has submitted an appropriate plan to DPIW Marine Farming for an salmonid escapement event • Investment of technology to prevent the likelihood of escapements • Familiarisation with the industry COP
Related Aspects: • 1.2.2: Escape of Cultured Species

3.2.3: Waste

This activity looks at the waste products generated by the facility and how they are dealt with.

3.2.3.1: Water Quality

Scope

To assess the impact of the facility on water quality.

Environmental Objective 3.2.3.1: To ensure that the facility or lease does not impact upon water quality.
Potential Impact: Contamination of the water. Degraded water quality.
Suggested Control Measures • Compliance with regulatory requirements of water released from a facility (including storm water) • Water treatment or recycling where appropriate • Schedule for water quality monitoring • Control stocking densities on leases • Rack cleaning on outgoing tide
Related Aspects: • 2.1.1: Nutrients (water quality) • 2.1.2: Other wastes/Pollutants (chemicals) • 2.4.1: Regional Carrying Capacity • 2.4.3: Disposal of Processing Wastes

3.2.3.2: Sedimentation

Scope

To assess the impact of the facility on sedimentation in the area.

Environmental Objective 3.2.3.2: To ensure the facility has sedimentation minimisation strategies, if required.
Potential Impact: Degradation of the marine environment.
Suggested Control Measures • Identify actions that result in sedimentation of the local marine habitat or physical environment • Develop management plans or alternative strategies such as silt traps to deal with sedimentation
Related Aspects: • 2.2.2: Benthic Communities • 2.4.1 Regional Carrying Capacity

3.2.3.3: Waste Feed & Faeces

Scope

To assess the impact of waste feed and faeces generated from a facility.

Environmental Objective 3.2.3.3: To ensure waste feed and faeces and their by-products do not enter the environment.
Potential Impact: Contamination of the water and surrounding marine environment.
Suggested Control Measures • Adherence to DPIW license conditions and management controls on stocking density • Using feed minimisation strategies • Monitoring the feed conversion rates
Related Aspects: • 2.1.1: Nutrients • 1.2.3: Feed Composition • Appendix 1.2.3: Trends in changes of fishmeal and fish oil supply and usage in the salmonid industry

3.2.3.4: Fish Disposal

Scope

To assess the impact of fish waste generated from a facility.

Environmental Objective 3.2.3.4: To ensure fish waste disposal and by-products do not enter the environment.
Potential Impact: Contamination of the water and surrounding environment.
Suggested Control Measures • Adequate disposal facilities for mortalities of the cultured species • Emergency disposal management plan for mass or incidental mortality • Self draining shed floors with settlement traps and appropriate run-off disposal
Related Aspects: • 2.4.3: Disposal of Fish Processing Wastes • 2.4.4 Disposal of Mortalities • 2.1.2 Other Wastes/Pollutants

3.2.3.5: Processing

Scope

To assess the impact of processing waste generated from a facility.

Environmental Objective 3.2.3.5: To ensure processing waste disposal by-products do not enter the environment.
Potential Impact: Contamination of the water and surrounding environment.
Suggested Control Measures • Following protocols and adherence to DPIW license conditions relating to the treatment of bloodwater
Related Aspects: • 2.4.3: Disposal of Fish Processing Wastes • 2.4.4: Disposal of Mortalities • 2.1.2: Other Wastes/Pollutants (chemicals)

3.2.3.6: Storm Water Run-off

Scope

To assess the impact of storm water run-off from the facility.

Environmental Objective 3.2.3.6: To ensure that storm water from facility structures does not contaminate waterways.
Potential Impact: Decrease in water quality.
Suggested Control Measures • Maintain guttering and silt traps • Collection tanks, where applicable
Related Aspects: • 2.1.3: Flow (hydrology/oceanography) • 1.3.6: Sensitive habitats • 5.1.2.7: Public amenity

3.2.3.7: Sewerage

Scope

To assess the impact on the environment of sewerage generated from a facility.

Environmental Objective 3.2.3.7: To ensure that sewerage is adequately managed at the facility.
Potential Impact: Contamination of water with coliforms.
Suggested Control Measures • Ensure the facility has appropriate sewerage treatment that complies with license conditions • On site treatment plant • Regular maintenance program
Related Aspects: • 2.4.4 Disposal of Mortalities • 2.1.2 Other Wastes/Pollutants (chemicals)

3.2.3.8: General Rubbish

Scope

To assess the impact of general rubbish generated from a facility.

Environmental Objective 3.2.3.8: To reduce, reuse, recycle where possible, and dispose of rubbish in an appropriate manner.
Potential Impact: Degradation of the surrounding environment. Habitat disturbance. Wildlife entanglement.
Suggested Control Measures • All vessel derived rubbish material and unusable marine farming equipment to be returned to shore base for disposal • Protocols for management of general rubbish within the facility • Recycling policy and facility • Regular inspection of racks and baskets to ensure soundness and need for repair. • Daily inspection of rubbish on site • Annual regional foreshore clean-ups
Related Aspects: • 2.4.4 Disposal of Unstable Products • 2.1.3 Other Wastes/Pollutants (chemicals)

3.2.3.9: Biofouling

Scope

To assess the impact of biofouling from the facility on the environment.

Environmental Objective 3.2.3.9: To ensure that biofouling removal from facility structures does not impact upon the environment.
Potential Impact: Decreased water quality.
Suggested Control Measures • Protocols on net cleaning • Monitor the impact of waste on the benthos
Related Aspects: • 2.1.1: Nutrients • 3.2.3.1: Water Quality • 2.1.2: Other Wastes/Pollutants

Component 4: National Social and Economic Wellbeing

Introduction

The National Social and Economic Wellbeing component tree (Fig 4.0) looks at the broader, non-regional, social and economic costs and/or benefits associated with the Industry.

The risk assessments of the Social and Economic Wellbeing aspects have been undertaken on preliminary basis only due to the lack of detailed information for the Industry. What is reported in this component reflects the information that is available. Industry bodies such as the Tasmanian Aquaculture Council (TAC) will periodically revise the following information and the National Aquaculture Council (NAC) will provide updated risk assessments for the Industry.

Risk assessment of these components have used the social/political consequence Table (Table 1.5; Appendix 1.0)

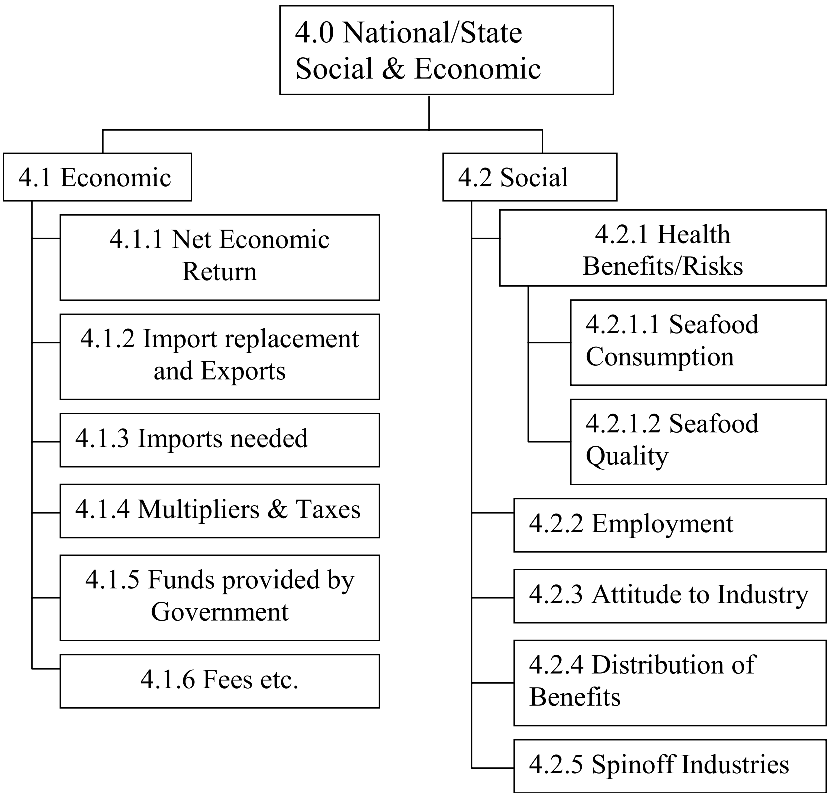


Figure 4.0. Component Tree4: Impacts of the Industry on national/state economic outcomes

4.1: ECONOMIC OUTCOMES

This aspect covers economic issues including the value and contribution of the Industry to the national economy.

Scope

To assess the impact of the industry on national economic outcomes

4.1.1: Net Economic Return

The Tasmanian salmonid industry produced the majority of the Australian production of Atlantic salmon and ocean trout. Production in Tasmania has increased at an average rate of 5.3 percent per annum from 1999 to 2004 (Fig 4.1.1). The economic return of salmonid farming is high in respect to the growing regions, with some communities highly dependant upon the industry (see Component 5).

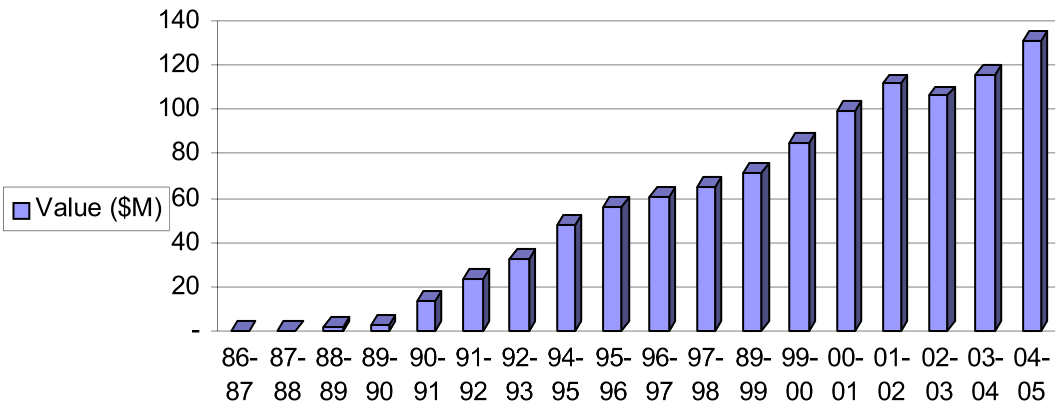


Figure 4.1.1. The annual gross value of salmonids grown in Tasmania over 6 years.

4.1.2: Import replacement/exports

Tasmanian salmonids are primarily marketed in the east Australian states, particularly in Sydney and Melbourne where market demand is high. Demand for product in the Asian markets is increasing, with around 10-15% of current production being exported. Most exported salmon are sent to Japan.

The focus of the Tasmanian market has been on national consumption, but with a reviewed emphasis on developing export markets. There has been a recent decline in exports due to strong domestic consumption and the strength of the Australian dollar.

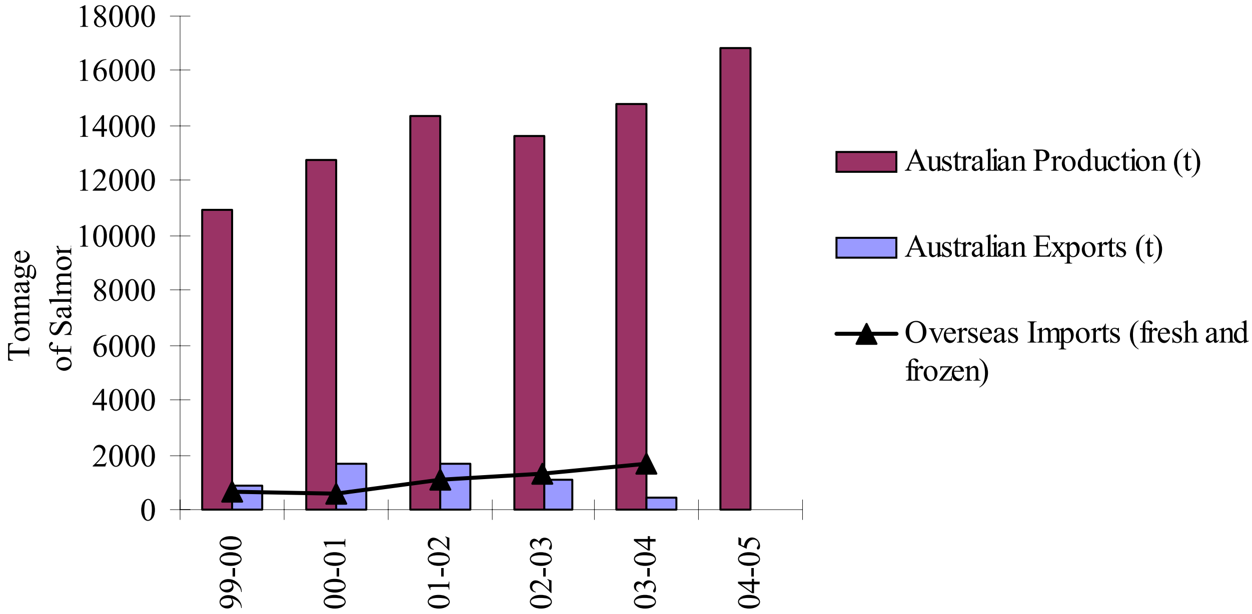


Figure 4.1.2. Australian production of salmon (in tonnage) showing the strong domestic consumption compared to salmon imports and exports (Source TSGA).

Import of fresh salmon products into Tasmania is restricted (Section 1.2.2.3.1). However, imports of fresh salmon into the Australian market are causing market pressures for the industry. Canned salmon products to the value of approximately $46.5M per annum are also imported into Australia, primarily from the US and Canada. The Tasmanian industry concentrates on producing high quality product for the fresh or smoked markets rather than for the cannery market.

4.1.3: Imports needed

The industry imports polystyrene to produce boxes for packaging fish products. Alternative packaging types have been investigated by the industry through the CRC, but no viable alternative has yet to be found.

4.1.4: Multipliers and taxes

Aquaculture generally has a high "economic multiplier" effect. For every full time equivalent (FTE) job created by the industry there are two FTE indirect jobs estimated to be provided (TSGA pers comm.).

4.1.5. Funds Provided by Government

There is limited funding for research provided after extensive project development by the Australian Government through the Fisheries Research and Development Corporation (FRDC). The Australian Government provides funds matchable to Industry contribution, capped at 0.25% of average gross value production (GVP). Contributions by industry to the FRDC are by jurisdiction in the form of memoranda of understanding. The FRDC provides policy and advice to Government and stakeholders, prioritise research proposals and distributes the collective funding (Commonwealth, State and Industry) to relevant research providers. The salmonid aquaculture industry has exceeded the 0.25% of AGV contribution in current years and provided $313,000 in 2003-2004 (FRDC 2004).

In 2003-2004 the Commonwealth Government contributed $1.65M to Tasmanian salmonid research. This funding was used for new and ongoing research in the Aquafin Cooperative Research Centre

The Tasmanian State Government provides funding to the fishing and aquaculture industries with research funding directed through the Tasmanian Aquaculture and Fisheries Institute (TAFI; approximately $800,000 in 2004/2005).

A function is also provided by the State Government who provides services to the whole of the Tasmanian aquaculture industry in the form of governmental regulation and administration ($169,152 in 2005/06), compliance and planning ($497,566 in 2005/06), and environmental monitoring ($344,003 in 2005/06) by the DPIWE Marine Farming Branch. Additional support is provided by the Biosecurity Branch through the Tasmanian Salmonid Health Surveillance Program (TSHSP), and by the Environment Branch.

4.1.6: Fees etc

Fees paid to the Australian and State Governments are indexed to inflation, adjusted over time and influenced by social and economic policy/political factors.

Table 4.1.6.2. Annual licence fees paid to the State Government by the Tasmanian salmonid industry.

Licence	Fees salmonids
Tasmanian Fishing Industry Council (TFIC) Compulsory Levy	$350.00
Atlantic salmon	$1942.50
Rainbow trout	$111.00
Total fees for one species	$2,403.50

Licence fees are paid to the State Government by leaseholders and industry participants. There are 6 operators with 42 licences for Atlantic salmon farming and 18 licenses for rainbow trout in Tasmania who paid $92,138 in license fees in 2005/06, from the schedule shown in Table 4.1.6.2. Other State Government fees included $320,350 in marine farming lease rental fees, which comprise a base fee of $1,750, plus a fee per hectare (currently $200). The State Government collected over M$1 from the salmonids industry in the financial year 2005-2006. Public liability insurance is also compulsory for marine farming license holders and licence holders who require Crown land for their operations pay a fee of 9% of the land value per year. The Industry also pays payroll tax to the State government.

The Industry provides $150,000 per annum as contribution to the DPIW Fish Health Unit at Mount Pleasant, Launceston, and the provision of an Industry field veterinarian and assistant.

4.1.7: National Product Supply

Over 95% of the Tasmanian product from the Tasmanian salmonid industry is sold in Australia. However, the Industry increasingly has to compete with product imported into Australia from Chile, Canada and Europe.

Risk Assessment 4.1.1: What is the risk of Industry negatively impacting upon the National economy?			
Economic Objective 4.1.1: To ensure that the Industry continues to contribute to the National economy.			
Consequence (Table 1.4) C=1	**Likelihood L= 2**	**Risk Rating C x L =2 Low**	**Target Risk Rating N/A**
Risk Assessment 4.1.2: What is the risk of Industry negatively impacting upon the State economy?			
Economic Objective 4.1.2: To ensure that the industry continues to contribute to the State economy.			
Consequence (Table 1.4) C=3	**Likelihood L=2**	**Risk Rating C x L =6 Low**	**Target Risk Rating N/A**
Risk Management Options • Strategic business planning • Sustainable farming practices • Risk Management			
Suggested Performance Measures • Industry profitability and sustainability			

4.2: NATIONAL SOCIAL ISSUES

This aspect covers social issues important at a national level such as the provision of seafood for the community. Generally there is a high level of support for Industry at a national level.

Scope

To assess the impact of industry on the social wellbeing of the Australian community.

4.2.1: Health Benefits and Risks

Seafood is known to contain omega-3-fatty acids, which have beneficial effects when included in the human diet. The best source of the most beneficial "long-chain" omega-3 –polyunsaturated fatty acids (PUFA) occurs in seafood, especially Atlantic salmon.

Farmed Tasmanian Atlantic salmon has been found to be an excellent source of the beneficial long-chain omega-3 PUFA. The average content of long-chain omega-3

PUFA in fish is 210 ml/100g, with levels in fresh Tasmanian Atlantic salmon between 700 and 2300 mg/100g (Nichols et al 1999).

Having insufficient omega-3 fatty acids in the diet is associated with a wide range of health problems which include cardiovascular disease, diabetes, certain cancers, osteoporosis; and disorders of the central nervous system, which include depression in some instances, and impaired cognition (leading to dementia).

Seafood is also the best food source of iodine; salt-water seafood contains about twice the iodine found in freshwater varieties. It also provides an excellent source of selenium and fluoride. Other minerals that are provided in moderate amounts are iron, zinc and magnesium. The iron content is about a third to a half that in red meat.

4.2.1.1: Consumption

Consumption of seafood increased 12.7% between 1991 and 1999 in Sydney. In-home consumption rose by 8.4%, while out-of–home consumption increased by 19% (Ruello 2002). This increase in consumption has led to seafood production becoming Australia's fourth most valuable food-based industry after beef, wheat and milk (FRDC 2004). Retailers frequently referred to aquaculture as offering the best solution to rising fish prices, which suggests that there is a strong acceptance of aquaculture product in the market (Ruello 2002).

Atlantic salmon has been a leading species for out-of-home consumption in Sydney since 1991 and is highly regarded by consumers with over 82% of Sydney consumers aware of the product and 90% liking the product (Ruello 2002).

Table 4.2.1.1. FSANZ recommendations for the number of serves of seafood that can be eaten safely (adopted from FRDC 2004).

<table>
<tr><th>Pregnant women and women planning pregnancy</th><th>Children up to 6 years</th><th>Rest of population</th></tr>
<tr><td>1 adult serve = 150 grams (equivalent to approximately 2 frozen crumbed fish portions)</td><td>1 serve for this age group = 75 grams (equivalent to approximately 3 fish fingers)</td><td>1 serve = 150 grams (equivalent to approximately 2 frozen crumbed fish portions)</td></tr>
<tr><td colspan="3">2-3 serves per week of any fish and seafood not listed in the column below</td></tr>
<tr><td colspan="2">OR</td><td>OR</td></tr>
<tr><td colspan="2">1 serve per week of orange roughy or catfish – and no other fish that week</td><td rowspan="3">1 serve per week of shark (flake) or billfish (that is, swordfish and marlin) – and no other fish that fortnight</td></tr>
<tr><td colspan="2">OR</td></tr>
<tr><td colspan="2">1 serve per fortnight of shark (flake) or billfish (that is, swordfish and marlin) – and no other fish that fortnight</td></tr>
</table>

Over 90% of the Australian population consume seafood, with the majority of these people relying on the commercial sector, including aquaculture, to provide fish for consumption. The evidence is now largely unequivocal that, provided a person has no individual sensitivity, some fish each week is an advantage to health and longevity (FRDC 2004).

4.2.1.2: Quality

The Tasmanian industry produces a premium product renowned Australia wide and overseas. Consumers identified 'reputation of quality' in seafood as an important factor when selecting seafood for home consumption (Ruello et al 2002). Stringent quality testing has been adopted by Industry to produce export quality standard product. The high level of quality control is a requirement of AQIS for the export of fish products under the ECA *Proscribed Goods General Orders 2005* and the *Export Fish Orders 2005*. In addition, the industry has participated in the National Residue Survey to determine levels of residue, and bacterial contamination in their products, and operate under a certified Codex Alimentarius - Hazard & Critical Control Point (HACCP) Certification. The development of a code of practice within the industry helps to reassure consumers about the quality and safety of Tasmanian salmon products.

4.2.2: Employment

The Industry directly employs around 1000 full time equivalent (FTE) people in Tasmania. Estimated 2000 FTE indirect jobs have been created by the industry (TSGA pers comm.).

4.2.3: Attitudes to Industry

The Australian public recognises the socio-economic benefits of aquaculture, especially its contribution to local economies in rural and remote regions. The public rate the environmental impacts as the most important issue facing aquaculture, followed by the Industry's economic contribution and its impacts on other users of coastal and marine resources. The public believes that information about aquaculture should be accessible and credible and the community values the chance to participate in aquaculture planning management decisions (Mazur et al 2005).

There are no independent formal studies about the public attitudes to the Tasmanian salmonid industry, but most people are accepting of the industry as beneficial to the Tasmanian economy and well managed, as long as public amenity is not significantly impacted on.

4.2.4: Distribution of Benefits

Tasmanian grown salmon products are consumed with relish both locally, interstate and overseas. The Industry is a large employer of local residents in regional areas and is a major contributor to these local economies by supporting the local businesses. This assists in providing a cohesive social structure within these regional communities. Further information on the economic distribution of benefits is provided in Component 5.2.

4.2.5: Spin-off Industries

The industry supports a number of spin-off industries including seafood processing, polyethylene products, equipment supplies, fabricators, computer software, boat building, engine supply, fuel, hardware, engineering companies, refrigeration and transport companies.

Risk Assessment 4.2: What is the risk of Industry negatively impacting upon the National social wellbeing?			
Social Objective 4.2: To ensure that the industry contributes to National social wellbeing.			
Consequence **C=2** **(Table 1.4)**	**Likelihood** **L=2**	**Risk Rating** **C x L =4** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • Strategic business planning • Sustainable farming practices • Risk Management			
Suggested Performance Measures • Industry profitability and sustainability			

Component 5: Community Wellbeing (Social and Economic Impacts)

Introduction

There has been a growing recognition of the importance of local industries to rural communities. The community wellbeing component considers the local importance of the Industry to the social and financial viability of those communities located near the Industry. While the role of income and employment opportunities to local communities is obvious, other impacts could include attracting or maintaining services and contributions to social capital. Other values such as the contributions of the Industry to the broader community and the attitudes and beliefs of the community associated with the Industry are taken into consideration.

The risk assessments of the Community Wellbeing aspects have been undertaken on preliminary basis only due to the absence of suitable detailed information for the Industry. What is reported in this component reflects the information that is available.

Industry bodies such as the Tasmanian Aquaculture Council (TAC) will periodically revise the following information and the National Aquaculture Council (NAC) will provide updated risk assessments for the Industry.

The Community Wellbeing tree (Fig 5.0) covers the potential economic impacts of the Industry on the wellbeing of local or regional communities associated with the Industry. The tree is divided into two main branches; one dealing with the Industry community; and the other dealing with local communities affected by the Industry.

Only dependant communities were considered in the risk assessment as most communities were considered to have a low dependency on the Industry.

Risk assessments of these components have used the Social/Political consequence Table (Table 1.5: Appendix 1.0)

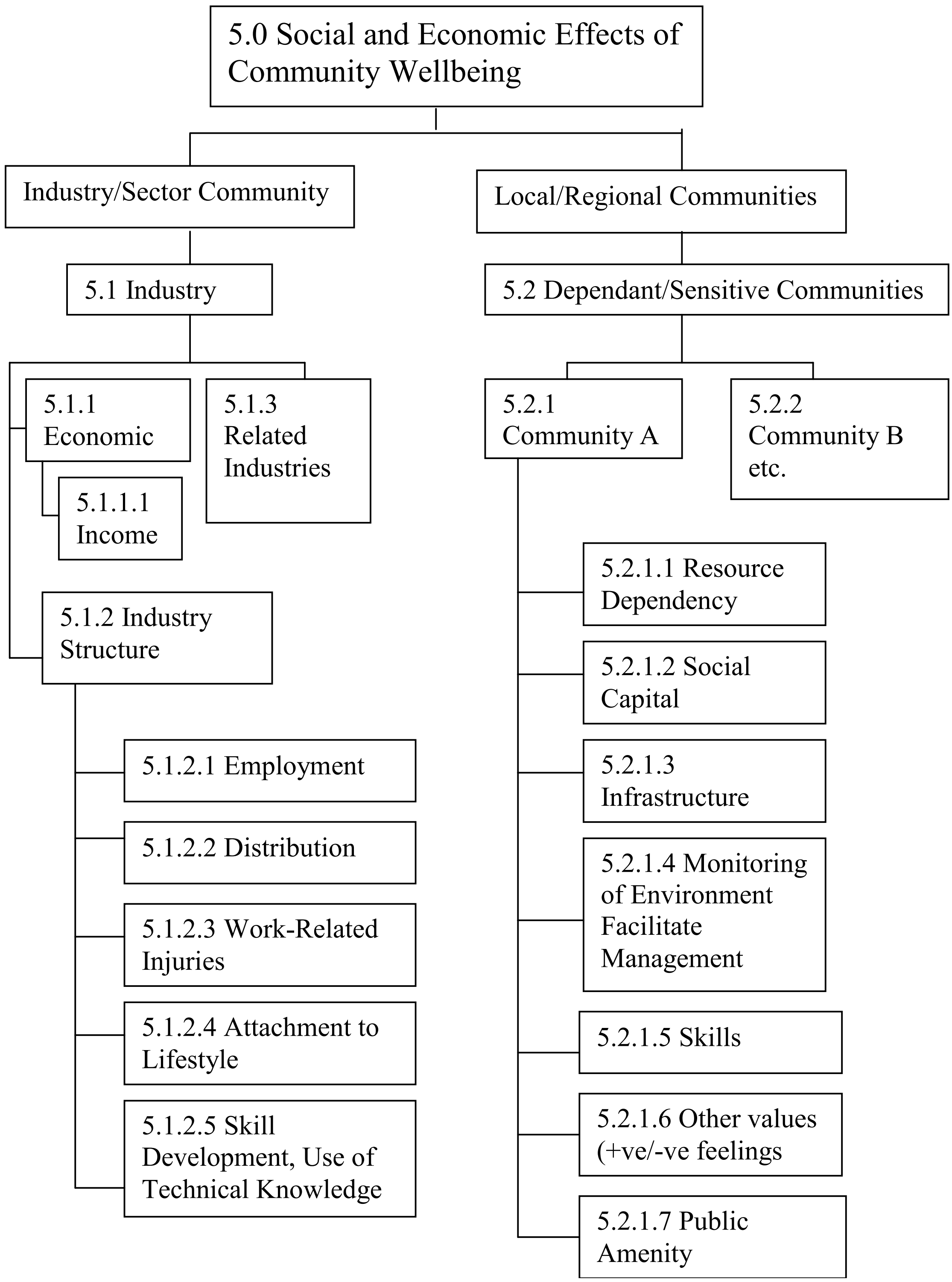


Figure 5.0. Component tree 5: Contribution of Industry to social and economics effects of community wellbeing.

5.1: INDUSTRY/SECTOR COMMUNITY

The industry community component is constructed from a range of issues that affect the people directly employed by the Industry or their families. The issues are covered on a state-wide basis and look at income, employment, locally based processing, contribution to lifestyle, family involvement to industry and occupational health and safety. Regional and/or local groups will need to collect appropriate information on their own local community. Both social and economic vectors are considered.

Scope

To assess the economic benefits and costs to the Industry community from regional salmonid farming.

5.1.1: Economic

5.1.1.1: Income

The salmonid industry is the most valuable aquaculture industry in Tasmania. The average gross value product (GVP) of salmonids at market is $112,000 per hectare per annum in 2005/06. Much of this value is returned to the community in the form of employment, and support of local businesses. There has been an increasing growth in value per hectare in recent years due to increasing production using more efficient production practices. This has lead to increased employment and income to regional communities (Section 4.1.4: Multipliers and Taxes). The number of hectares utilised by Tasmanian salmonid farms is shown in Table 5.1.2.2.

5.1.2: Industry Structure

5.1.2.1: Employment

The Industry is a significant regional employer, currently employing around 800 full-time employees directly employed on and supporting over 350 full time employees in the processing industry (P Jungalwalla pers comm.). The location of salmonid farms in regional remote locations means that the employment is often vital for the local community.

5.1.2.2: Distribution

The distribution of finfish marine farming leases is controlled through the zoning system of the *Marine Farming Planning Act 1995*. The marine farming development plans use zoning principles to identify specific areas where marine farming may occur while taking into consideration other users and values of the region. An important principle of the marine farming development plan is that the industry operates in an environmentally sustainable way (Section 2.4.1: Regional Carrying Capacity). The current distribution of the Industry is shown in Table 5.1.2.2.

Table 5.1.2.2. Distribution and productivity of finfish marine leases in Tasmania. Sourced from DPIWE 2004. * Production for the Tasman region is harvested at Dover therefore production data is included with the Huon & Esperance data.

Region	Number of leases	Number of operators	Lease area for finfish * (ha)	Percent of Industry Production
Tamar	1	1	6.4	4.0%
Tasman	4	1	56.7	*
D'Entrecastreaux Channel	13	2	388.3	16.3%
Huon & Esperance	17	2	421.8	64.7%
Macquarie Harbour	10	3	554.4	15.0%

5.1.2.3: Work-related Injuries

The Industry operates under the *Workplace Health and Safety Act 1995* and each business is required to have its own Occupation Health and Safety (OH&S) management plan. The agriculture, fishing and hunting sector (which incorporates aquaculture) has average workplace accident rates when compared to all other industries. Of all workers compensation claims for reportable incidents in the sector, none were related to marine farming for the year ending June 2003 (DIER 2004). Individual statistics for industry injuries are not available but marine farming has not been classified as a high health risk industry.

5.1.2.4: Attachment to Lifestyle

Aquaculture, being a primary industry, has been recognised as a socio-cultural practice rather than just a technical activity (Vanclay 2004). Farming is a way of life as well as a way of earning a living and acquires a deep occupational identity. The salmonid aquaculture industry attracts people who are excited to be part of a rural sunrise industry and have a passion for farming and creating wealth. Most workers are attracted by the marine environment and lifestyle on the water. The industry tends to include individuals who enjoy meeting challenges, are innovative and readily adapt to the unique work environment. Sustainability is recognised as a major factor by individuals wishing to stay in the Industry and maintain the current lifestyle.

5.1.2.5: Skill Development, Use of Technical Knowledge

A number of sectors provide training for the Industry, including Seafood Training Tasmania, the University of Tasmania and the Australian Maritime College. Seafood Training Tasmania delivers training to the catching, aquaculture and processing sectors of the Tasmanian seafood industry and the marine operations sector of the transport industry. The University of Tasmania provides training and research expertise through the School of Aquaculture and TAFI, as well as microalgal identification training through the School of Plant Science. The Australian Maritime College provides a variety of marine-based courses from Certificate II to post-graduate studies. The Industry is actively engaged in industry development.

5.1.3: Related Industries

Related industries that support salmonid farming include equipment supplies, fabricators, transport companies, engineering companies, wholesale and retail seafood outlets, marketers, restaurants, chandleries and fuel depots.

The Industry is reliant on local industries to maintain production and will often support businesses in the local/regional area.

<table>
<tr><td colspan="4">Risk Assessment 5.1: What is the risk of Industry not providing economic support to the Industry community?</td></tr>
<tr><td colspan="4">Social and Economic Objective 5.1: To ensure that industry provides economic and social support to the industry sector/community.</td></tr>
<tr><td>Consequence
C= 4*
(Table 1.4)</td><td>Likelihood
L= 2</td><td>Risk Rating
C x L =8
Mod</td><td>Target Risk Rating
Low</td></tr>
<tr><td colspan="4">Risk Management Options
• Strategic business planning
• Sustainable farming practices
• Risk Management
• Training
• Minimum wages and conditions be maintained in accordance with enterprise agreements or state awards</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Industry profitability and sustainability
• Staff turnover and ability to attract suitably qualified personnel
• Communication between the Tasmanian salmonid industry and community</td></tr>
</table>

* may vary regionally

5.2: LOCAL/REGIONAL COMMUNITY DEPENDANT COMMUNITIES

Dependant communities are communities that the Industry contributes to economically as measured in terms of jobs and added value. Any reduction in the Industry sector would result in less economic contribution (eg. job losses) which could seriously undermine the socio-economic fabric of the community. However, dependant communities may also be seen as those that rely on Industry to maintain community bonds, values, knowledge and language in which traditions are established, confirmed and passed on (Brookfield et al 2005). There is little information available for Industry-dependant communities in Tasmania.

Scope

To assess the impact of Industry on the welfare of (regional) communities reliant upon the Industry.

Current Evaluation

5.2.1 Resource Dependency

In general terms, the income generated by the Industry is $112,300 per hectare of leased water per annum (TSGA pers comm.). The Industry is wholly reliant on the access to the marine environment to be able to sustain this level of income. Some smaller regional communities such as Strahan, and the Tasman Peninsula, the Huon and Channel areas are highly dependent upon the Industry for employment, income and trade (as in Component 5.1). However, data are not available for all communities.

5.2.2 Social Capital

Social capital represents the degree of social cohesion that exists in communities. It includes mechanisms such as networks, shared trust, norms and values The Industry is a large employer in regional areas, and therefore contributes significantly to social capital by providing a stable income for families.

The Industry also invests in the local communities by sponsoring State and community organisations. Examples include:

- Dover skate park ($10,000)
- Regional football teams
- Friends of the Soldier walk ($25,000)
- Hobart United Soccer Club ($10,00 pa)
- Australian Football League, Tasmania ($25,000 pa)
- University of Tasmania Scholarships from Tassal and Skretting
- Huonville Rotary Club
- Diabetes Australia
- Cancer council ($12,000 in 2006)
- Huon netball teams

- Kermandie football club

5.2.3 Infrastructure

The infrastructure installed by the Industry of benefit to local communities includes wharves, navigational aids, data loggers, boat ramps and jetties in some locations. Increased refrigeration and transport to regional areas also increases services to the community.

The Industry also provides services to regional communities such as 24hr radio patrol for nearshore coastal waters, marine search and rescue, assistance with whale stranding and aiding firefighting.

5.2.4 Monitoring of the Environment

Salmonids are considered ideal indicators to changes in the marine environment due to their sensitivity to environmental change. A decline in the health of salmonids may present an early warning system of marine and estuarine environmental problems. The Industry therefore plays an important role in monitoring the environment of our estuaries and coastlines through their very existence.

The industry is also active in environmental monitoring of the coastal and estuarine environments. The industry COP requires daily monitoring of physical parameters such as temperature, salinity and dissolved oxygen. In addition, MFPA licence conditions require that farms conduct annual environmental monitoring surveys at a cost in excess of $150,000 per annum to Industry. This information may be assimilated into regional research programs to assess and maintain the health of the marine ecosystem.

5.2.5 Skills

Skills taught to Industry employees are often transferable through the community and to other occupations. These skills include stock husbandry and management, food handling, construction, boat handling and maintenance, time management, environmental management, and occupational health and safety. Activities in the Industry often teach employees multi-tasking skills. Many of the skills provided by the salmon industry are directly transferable to the fishing industry.

5.2.6 Other values (feelings)

The Industry provides an identity in regional communities, with some communities regarding salmonid farming as iconic. The Tasmanian Atlantic Salmon branding has penetrated into almost every catering premises in Tasmania and is well recognised nationally. Some communities are now recognised as “salmon growing regions” by the tourism industry, and attract boat tours where visitors can view a working salmon farm.

5.2.7 Public Amenity

The aspect of public amenity is difficult to quantify as attitudes, perceptions and expectations vary considerably between people. The Marine Farming Development Plans take into account issues of public amenity through the public consultation process (Section 2.3: Physical Structures, Construction and Tenure). These issues include visual impacts, foreshore amenity, navigation, commercial and recreational fishing, aboriginal heritage, recreation, noise, odour and tourism.

The maximum area for marine farming leases is defined by the Marine Farming Development Plans (MFDP) in accordance with the MFPA. The MFDP takes into consideration other users and values in the region, and identifies zones in which marine farming may take place, including other aquaculture uses.

The MFDP EIS identifies maritime uses including commercial fishing and navigation, as well as recreational activities such as boating, swimming, fishing etc. Other values such as forestry, agriculture and tourism are also taken into consideration.

Marine farming activities will result in visual impacts to water and land users. This is an unavoidable impact of marine farming operations. Management controls for salmonid leases have been developed to reduce the visual impact by requiring low profile, uniform structures on the leases (detailed in Appendix 5.2.7) through the MFDP and are regularly inspected by DPIW for compliance.

Each plan is released for a period of public consultation. Legislation covering the MFPA is outlined in Appendix 8.2.3.1: Regulations. Further information can be found at http://www.thelaw.tas.gov.au.

<table>
<tr><td colspan="4">Risk Assessment 5.2: What is the risk of Industry not providing social support to the dependant communities?</td></tr>
<tr><td colspan="4">Social and Economic Objective 5.2: To ensure that industry provides economic and social support to the dependant communities.</td></tr>
<tr><td>Consequence
C=3
(Table 1.4)</td><td>Likelihood
L=2</td><td>Risk Rating
C x L =6
Low</td><td>Target Risk
Rating
N/A</td></tr>
<tr><td colspan="4">Risk Management Options
• Strategic business planning
• Sustainable farming practices
• Compliance with management controls
• Risk Management
• Community education through EMS
• Participation community business organisation
• Providing mechanisms to address community concerns</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Monitoring Industry profitability and sustainability
• Increased communication between the Tasmanian salmonid industry and community.</td></tr>
</table>

Component 6: Indigenous Community Wellbeing

Introduction

The Indigenous Community Wellbeing component tree (Figure 6) demonstrates the issues involving Industry's influence if any on Aboriginal community sustainability. Aboriginal people's relationship with the marine environment can be defined in terms of culture, site protection, access and usage, and sustainable distribution of resources. These issues have been reviewed by sectors of the Tasmanian Aboriginal community, and care has been taken to consider the Tasmanian Aboriginal community's views and cultural beliefs. It must be recognised that there are many different Aboriginal groups with different backgrounds and perspectives in Tasmania. These views may not incorporate the beliefs of all groups. Further background for Indigenous community wellbeing is provided in Appendix 6.0.

The risk assessment for the Indigenous Community Wellbeing component utilises the Social/Political Consequence table as provided in Appendix 1 (Table 5). The minimisation of social impacts cannot be assumed to be made at the expense of ecological considerations.

All salmonid farming leases have been assessed through the *Marine Farming Planning Act* 1995, which takes into account the *Aboriginal Relics Act* 1975. This Act states that to damage, destroy, remove, conceal or interfere with an Aboriginal relic requires a permit from the Minister of National Parks and Wildlife. Relics need not have been formally identified in order to be covered by the provisions of this Act, which apply to all land tenures.

The *Aboriginal Relics Act* 1975 under section 2 identifies that a relic includes:

a) any artefact, painting, carving, engraving, arrangement of stones, midden, or other object made or created by any of the original inhabitants or descendants of any such inhabitants
b) any object, site or place that bears sign of the activities of any such original inhabitants or their descendants.

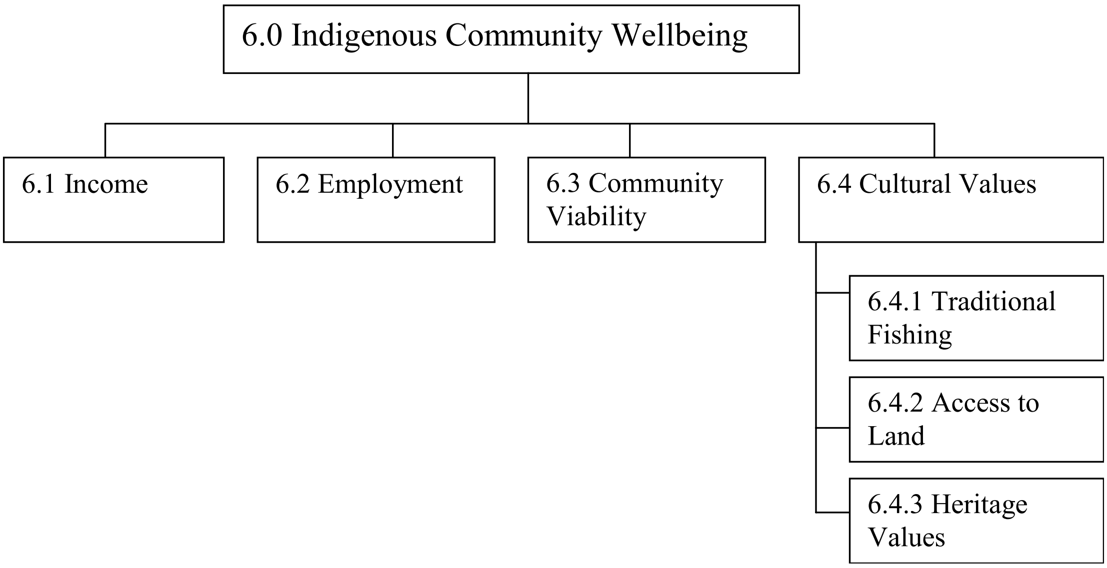


Figure 6. Component Tree 6: Indigenous Community Wellbeing in relation to the Industry.

In addition, the *State Coastal Policy* 1996 states that:

1.2.1. Areas within which Aboriginal sites and relics are identified will be legally protected and conserved where appropriate.

1.2.2. All Aboriginal sites and relics in the coastal zone are protected and will be identified and managed in consultation with Tasmanian Aboriginal people in accordance with relevant State and Commonwealth legislation

2.6.3. Agreements between landowners, landholders and councils or State Government to grant public access to the coast, and Aboriginal access to Aboriginal sites and relics in the coastal zone over private and public land will be encouraged and shall be considered when preparing plans or approving development proposals.

6.1: INCOME

This component looks at the opportunities provided by the industry in terms of income to the Tasmanian Aboriginal community.

Scope

To assess the opportunity for investment by the Tasmanian Aboriginal community in the salmonid farming industry

Current Management Controls

The Tasmanian salmon industry operates successfully on a competitive free market and provides investment opportunity for the community as a whole, including the Tasmanian Aboriginal community. State and Federal regulations, including the

Resource Management and Planning System (RMPS), which is based on the principles of sustainable development, govern the industry.

Risk Assessment 6.1: What is the risk of Industry not providing the Aboriginal community the opportunity for investment?			
Social Objective 6.1: To ensure that the Tasmanian Aboriginal community has equal opportunity to investment in the Industry, as part of the wider community.			
Consequence C= 1	**Likelihood L= 1**	**Risk Rating C x L = 1 Low**	**Target Risk Rating N/A**
Risk Management Options • Maintenance of sustainable practices, strategic and financial management by companies.			
Suggested Performance Measures • Return on investment.			

6.2: EMPLOYMENT

Scope

To assess the contribution of industry in providing employment to the Tasmanian Aboriginal community, as part of the wider community.

Current Management Controls

The Tasmanian salmonid farming industry is bound under the *Anti-Discrimination Act 1998*, Section 14 and 15, to not discriminate either directly or indirectly against any person, including Aboriginal people. The industry must not treat another person on the basis of any prescribed attribute, less favourably than a person without that attribute or characteristic, or disadvantage a member of a group of people who share an attribute. The characteristics or attributes include aboriginality.

The Industry is encouraged to provide stable and continuing employment for all employees, based on the employee's competence and willingness to work rather than other attributes, which may be considered discriminatory.

Risk Assessment 6.2: What is the risk of Industry not providing the Aboriginal community with equal opportunity of employment?			
Social Objective 6.2: To ensure that the Aboriginal community has equal opportunity for employment in Tasmanian salmonid marine farming industry.			
Consequence **C=1**	**Likelihood** **L=1**	**Risk Rating** **C x L =1** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • Compliance with the Anti-discrimination Act • Industry award or enterprise agreement clauses for discrimination and grievances			
Suggested Performance Measures • Complaints to the Tasmanian Anti-discrimination Commission • Monitoring employment statistics			

6.3: COMMUNITY VIABILITY

Scope

To assess the contribution of industry to Tasmanian Aboriginal community viability.

Current Management Controls

Initiatives by the National Aquaculture Council promote the interests of Aboriginal communities within the National Aquaculture Strategy; leading to the development of the AFFA funded National Framework for Aboriginal Aquaculture Development (DAFF 2001). The opportunity for the Tasmanian Aboriginal community to participate in marine farming is governed by the DPIW under the LMRMA 1995 and the MFPA 1995.

Risk Assessment 6.3: What is the risk of Industry not providing the Aboriginal community the opportunity for participation in the Industry?			
Social Objective 6.3: To ensure that the Aboriginal community has opportunities equal to the wider community for participating in the local industry.			
Consequence **C=1**	**Likelihood** **L=1**	**Risk Rating** **C x L =1** **Low**	**Target Risk Rating** **N/A**

6.4: CULTURAL VALUES

This component covers the contribution of industry in maintaining cultural values of the Tasmanian Aboriginal community and to identify whether the cultural values of the Aboriginal community are positively or negatively impacted by operations of the industry.

6.4.1: Traditional Fishing

Scope

To assess the impact of the Industry on the traditional fishing rights of the Tasmanian Aboriginal community.

Current Management Controls

The sea has great importance to the domestic economies of many Aboriginal households. While this "subsistence" use of resources is part of a non-cash economy, its contribution in dollar equivalent terms to household budgets may be significant. This continuing economic dependence on marine resources does not readily fit within the category of "recreational "fishing. Tasmania has separate Aboriginal fishery legislation and licences granted by DPIW through the Tasmanian Aboriginal Council. Marine Aboriginal activities assist in maintaining links with the coast, passing on skills, knowledge and language to younger people and providing public demonstration of continuing cultural rights and responsibilities.

Aboriginal people do not hold traditional fishing rights over farmed salmonids, which are an introduced species.

Risk Assessment 6.4.1: What is the risk of Industry impacting on Aboriginal traditional fishing rights?			
Social Objective 6.4.1: To ensure that traditional fishing rights of the Tasmanian Aboriginal community are not negatively impacted on by operations of the industry.			
Consequence **C=2**	**Likelihood** **L=1**	**Risk Rating** **C x L =2** **Low**	**Target Risk Rating** **N/A**

6.4.2: Access to Land

Scope

To assess the impact of the industry on the Tasmanian Aboriginal community through the restriction of access to land for cultural activities.

Current Management Controls

Through consultation with the Tasmanian Aboriginal community and private land stakeholders on the siting and activities of a marine farming lease under the MFPA, the Marine Farming Planning process ensures that access to culturally sensitive sites are not impeded. Land based facilities undergo a similar process through local Council, or Crown Land Services in each respective area.

Risk Assessment 6.4.2: What is the risk of Industry restricting the Tasmanian Aboriginal community's access to land for traditional activities?			
Social Objective 6.4.2: To ensure that activities of the Tasmanian Aboriginal community are not negatively impacted on through restricted access to land caused by the operations of the industry.			
Consequence **C=3**	**Likelihood** **L=1**	**Risk Rating** **C x L =1** **Low**	**Target Risk Rating** **N/A**

6.4.3: Heritage Sites

Scope

To assess the impact of the industry on Tasmanian Aboriginal heritage sites.

Current Management Controls

Heritage sites are viewed by Aboriginal people as a link between land, sea and resources over time. The shell middens dotted along the Tasmanian coast tell of the unbroken temporal connection between people and marine resources. The *Historical Cultural Heritage* Act 1995, *National Parks and Wildlife* Act 1970, and *Aboriginal Relics* Act 1975 govern access and preservation of Aboriginal heritage sites in Tasmania.

Risk Assessment 6.4.3: What is the risk of Industry impacting upon Aboriginal heritage sites?			
Social Objective 6.4.3: To ensure that Tasmanian Aboriginal heritage sites are not impacted upon by the industry.			
Consequence **C= 3**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 3** **Low**	**Target Risk Rating** **N/A**

Component 7: Governance

Introduction

The Governance tree covers the legislative, administrative and bureaucratic processes that are the basis of many issues in the previous six component trees. These issues are governed at three levels:

- Government, including the responsible management agency, be it either Federal, State or Local;
- Industry; and
- Other interest groups (Non-Governmental Organisations)

All Australian Governments commit to working in partnership with the aquaculture industry to achieve maximum sustainable growth, whilst also meeting national and international expectations for environmental, social and economic performance (DAFF). The Tasmanian Government has been a leader nationally and internationally in facilitation of effective, efficient, timely and transparent planning processes for marine farming. The State Government also supports and recognises the continual improvement of ecologically sustainable aquaculture practices within the industry.
The Industry has taken a proactive role in regulatory and compliance issues, to ensure that cost effective and practicable processes are in place

Additions and exclusions from Fletcher et al (2004) ESD tree are:

Exclusions

- OCS (offshore commonwealth sector) arrangements: The salmonid industry does not operate in offshore waters.
- Legal Framework: Resource Access and Allocation has been covered under Section 7.1.1.1.1.7: Allocation.
- Economic Instruments (under Section 7.1.2.3. Australian Governments) is covered adequately in Component 8, Section 8.2.2: Impacts of Other External Drivers, Economic)

Additions

- Seafood Health is considered as Seafood Safety under Section 7.2: Industry.

All risk assessments refer to the social/political consequence table in Appendix 1.0.

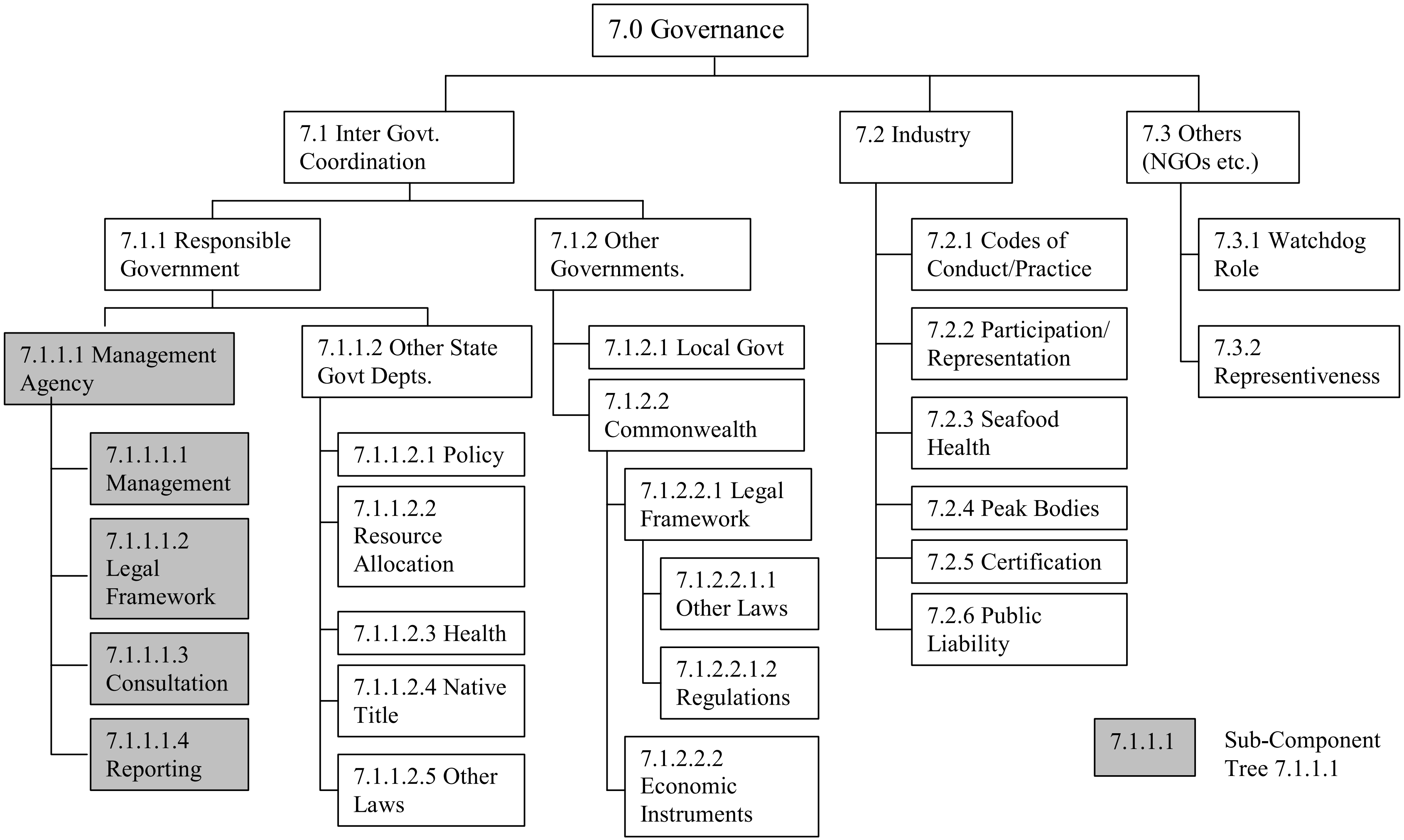


Figure 7.0. Component Tree 7: Governance (inclusive of Sub-Component Tree 7.1.1.1)

7.1: INTERGOVERNMENTAL COORDINATION

The information in this component has been completed through consultation with DPIW Marine Farming Branch, as the responsible management agency, with assistance from Industry. A sub-component (Fig. 7.1.1.1) covering the responsibilities of the management agency is included in this component.

7.1.1: Responsible Government

Scope

To assess the impact of the State Government's management on the sustainability of Industry.

7.1.1.1: Management Agency

The governance structure of the management agency responsible for marine farming is complex. The structure is presented in Sub-Component Tree 7.1.1.1: Governance of the Management Agency (Figure 7.1.1.1). This sub-component tree should be interpreted as part of Component Tree 7: Governance.

7.1.1.1.1: Management

7.1.1.1.1.1: Effectiveness

The Tasmanian MFPA has been a forerunner of both International and National Aquaculture policy. The proclamation of the MFPA in 1996 has provided statutory processes that deliver certainty, transparency and consistency in the planning and allocation of State waters for the purposes of marine farming. Systematic growth of industry has followed with an increase in the number of marine farming leases from 142 leases covering 1888 ha in 1994/95 to 189 leases covering 3500 ha in 1999/2000 (DPIW Marine Farming personal communication). The increase in marine farming leases has been attendant with an increase in the farm gate value of the Tasmanian aquaculture industry from $M65 (employing 400 people) in 1994/95 to an estimated $M180 (employing 850 people) in 2006 (P Jungalwalla pers comm.).

7.1.1.1.1.2: Marine Farming Development Plans

The marine farming development planing process was instigated in response to dissatisfaction from Industry and the community with how water for marine farming was allocated. Prior to the *Marine Farming Planning Act 1995* (MFPA), water for marine farming leases was allocated on an *ad hoc* basis. A person could apply for a lease anywhere in State waters with no formal planning processes. Decisions on lease applications were appealable through the court system. Problems occurred when appeals against Industry applications caused extended delays in the allocation of water.

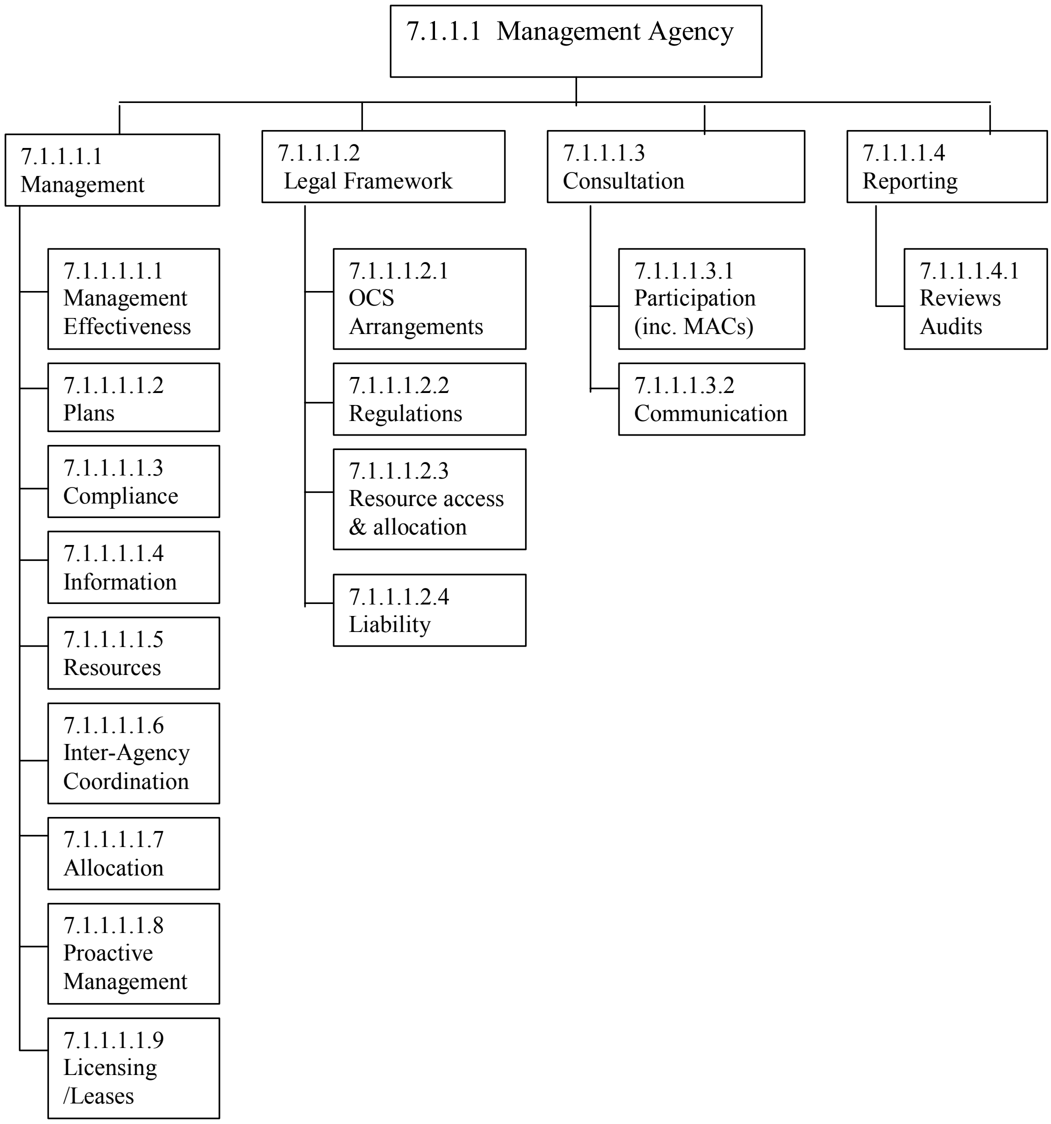


Figure 7.1.1.1. Sub-Component 7.1.1.1: Governance of the management agency

The introduction of the MFPA allowed for the development of marine farming development plans using regional based planning and involving a statutory public consultation process. Marine farming development plans zone areas that have been identified as appropriate for marine farming activities. A thorough assessment is made of existing uses and values of a region in determining what waters will or will not be zoned as suitable for marine farming activities. Each zone is assessed through an Environmental Impact Statement (EIS) and each plan contains management controls to regulate marine farming activity in the plan area. Draft plans are endorsed by the independent and expert based Marine Farming Planning Review Panel. Once approved by the Minister they have the effect of law. The statutory planning process is shown in Fig 7.1.1.1.1.2.

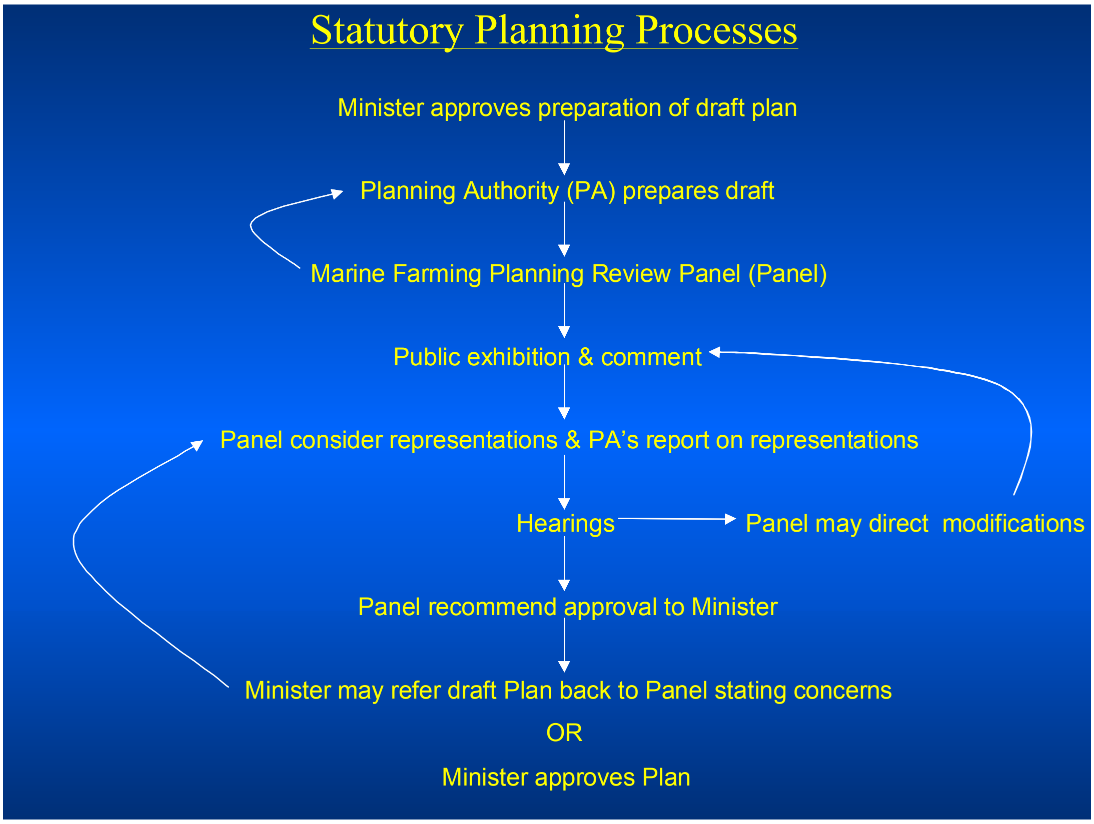


Fig 7.1.1.1.1.2. The statutory planning process for the Tasmanian DPIWE Marine Farming Development Plans (adopted from T Thomas).

7.1.1.1.1.3: Compliance

DPIW employs two full-time Marine Farming Inspectors to ensure compliance with marine farming development plan management controls, marine farming licence conditions and the provisions of the MFPA and LMRMA. This includes the location of marine farming equipment and navigational markers. There are also two full-time Environmental Officers who monitor compliance with marine farming development plan environmental management controls and licence requirements.

The level of environmental compliance for zones covered by the MFDP is described in Appendix 8.2.3.2 and has been reported for the period 1997-2002 (Woods et al. 2004). Finfish marine farming leases are subject to baseline environmental surveys upon granting or when a lease area is expanded or varied by greater than 10 percent. An initial environmental survey is undertaken for existing lease areas at the commencement of the environmental monitoring program. An additional requirement is ongoing environmental monitoring of the benthic condition as specified in the schedules (Appendix 8.2.3.2). Further information on the impact of marine farming on the benthos is covered in Section 2.2.2: Benthic Communities. Monitoring requirements are moving towards measurement of dissolved wastes as part of adaptive management in broadscale monitoring.

7.1.1.1.1.4: Information

The dissemination of information from the management agency to the Industry is through regular inspection reports (a letter with an accompanying map) and environmental assessment reports. A benthic report summary is generated which includes findings on the DPIW's ongoing environmental monitoring program.

7.1.1.1.1.5: Resources

The DPIW Marine Farming Branch consists of a Branch Manager and two Senior Managers. One Senior Manager is responsible for Planning and Operations with 6 staff including the Marine Farming Inspectors. The other Senior Manager is responsible for the Marine Environment with a staff of 4 including Environmental Officers.

7.1.1.1.1.6: Inter-agency coordination

The Marine Farming Branch consults with other Sections of DPIW and other Government agencies in the development of each of the MFDPs including: Department of Tourism, Arts and the Environment, Environment Division; Marine and Safety Tasmania (MAST); Resource Management and Conservation Division; Information and Land Services; and Strategic Policy and Planning.

7.1.1.1.1.7: Allocation

The identification of zones for marine farming occurs through the marine farming planning processes (Section 7.1.1.1.1.2). The allocation of leases occurs pursuant to Part 4 of the MFPA that involves a competitive application process. Leases are generally granted for a period of 30 years, with the leaseholder having the right to make application to renew their lease within 15 years before the lease expires. Once a lease is allocated, the leaseholder is responsible for complying with the provisions of the MFPA and LMRMA, marine farming development plan management controls and marine farming licence conditions.

The Minister may grant an application to renew a lease if satisfied that:

- the leaseholder has complied with the condition of a lease;
- the leaseholder does not hold 200 or more demerit points, to do so is consistent with the objectives of resource management;
- the application is consistent with the appropriate MFDP; and
- the applicant has not been convicted of an offence related to marine farming in another state or territory.

7.1.1.1.1.8: Proactive Management

The Marine Farming Branch consults with the peak bodies for the Industry which includes the Tasmanian Salmonid Growers Association (TSGA), the Tasmanian Fishing Industry Council (TFIC) and the Tasmanian Aquaculture Council (TAC) on matters of policy. These bodies are represented on the Marine Farming Environmental Advisory Committee.

7.1.1.1.1.9: Licensing and Leases

Marine farming leases are granted pursuant to the MFPA. A lease provides the leaseholder with the authority to occupy the water. The boundaries of a lease are determined by way of a registered survey attendant to the lease. Marine farming activities are authorised through the issue of a marine farming licence to a leaseholder, pursuant to the provisions of the LMRMA.

The management of marine farming activities is based upon adaptive management principles, which provide the scope to modify operational constraints on marine farming activities to reflect the results of monitoring.

7.1.1.1.2: Legal Framework

7.1.1.1.2.1: Regulations

Marine farming is primarily regulated under the MFPA and the LMRMA. The statutory planning processes provided by the MFPA is shown in Fig 7.1.1.1.1.2 and described in Appendix 7.1.1.1. Regulations relating to the MFPA are detailed in Appendix 8.2.3.1. Policy may change with the Government of the day.

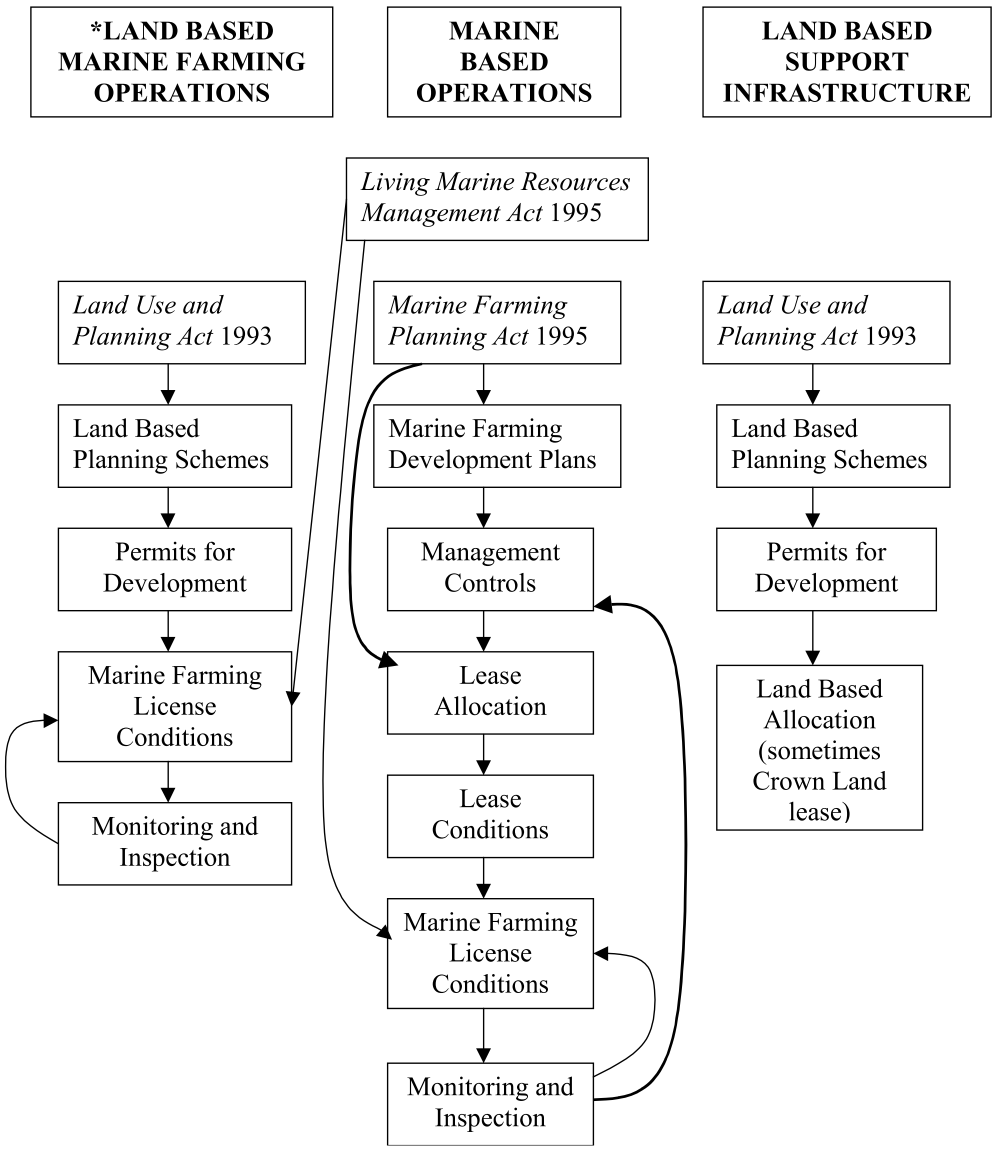


Figure 7.1.1.1.2.1. Regulatory requirements governing the establishment of marine farming operators. * no land based marine salmonid production occurs at present

7.1.1.1.2.2: Liability
The Crown accepts no liability that the water in which marine farming leases are allocated will be suitable for the purposes of marine farming. Persons considering marine farming within a zone contained in a MFDP are solely responsible for establishing the suitability or otherwise of the zone for that purpose.

7.1.1.1.3: Consultation

7.1.1.1.3.1: Communication
In the preparation of draft marine farming development plans the Planning Authority consults with the public, other major stakeholders and Industry. Marine farming development plans are released for a statutory two-month period of public exhibition and comment. The provisions of the MFPA establish an independent and expertise based panel, known as the Marine Farming Planning Review Panel. The Panel considers representations in relation to draft plans and is required to hold a hearing if requested to do so by a representor. A person may request an amendment to a plan after it has been implemented for 2 years.

7.1.1.1.4: Reporting

7.1.1.1.4.1: Reviews & Audits
The Marine Farming Branch can review licensing conditions as part of the adaptive management framework. These processes may result in the variation of licence conditions at any time in response to changing circumstances and subject to consultation with the leaseholders.

<table>
<tr><td colspan="4">Risk Assessment 7.1.1: What is the risk of the State Government’s management impacting on the sustainability of the Industry?</td></tr>
<tr><td colspan="4">Social and Economic Objective 7.1.1: To ensure that State Government policies and processes do not impact on the sustainability of Industry.</td></tr>
<tr><td>Consequence
C= 2</td><td>Likelihood
L= 4</td><td>Risk Rating
C x L = 8
Mod</td><td>Target Risk
Rating
Low</td></tr>
<tr><td colspan="4">Risk Management Options
• Ensure effective, ongoing Government/Industry consultation
• Effectively engaging State Government and participating in the political process to ensure that Industry interests are taken into account in policy decision making</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Continued Industry profitability and sustainability</td></tr>
</table>

7.1.1.2: Other State Government Departments
In the preparation of the MFDP, consultation occurs with all relevant State Government departments as listed in Appendix 7.1.1.1 and is covered in Risk Assessment 7.1.1.1.

7.1.2: Other Governments

Scope

To assess the impact of the Local and Australian Government's management on the sustainability of Industry.

7.1.2.1: Local Government

The MFPA requires a coordinated approach with Local Government, who is consulted in the preparation of marine farming development plans. This allows Local Government to have input on such aspects as infrastructure and integration with council planning schemes. Any application for land based facilities is dealt with by local government through the local planning scheme and pursuant to the provisions of the LUPA Act as shown in Fig 7.1.1.1.2.1.

7.1.2.2: Federal Government

Draft MFDP's are sent to the Department of Environment and Heritage (DEH) for consideration.

7.1.2.2.1: Legal Framework

Once approved, marine farming development plans have the affect of law. However, leaseholders must consider their development against the provisions of the Federal Government EPBCA. Should a leaseholder's development proposals trigger a matter of national environmental significance (prescribed by the Act) then the proposals must be referred to the Commonwealth Minister for Environment. Australian regulations such as the *Quarantine Act 1908* may impact upon the Industry's ability to compete on the international market.

Risk Assessment 7.1.2: What is the risk of the Local Government's management impacting on the sustainability of the Industry?			
Social and Economic Objective 7.1.2. To ensure that Local Government's policy and processes do not impact on the sustainability of Industry.			
Consequence **C= 2**	**Likelihood** **L= 3**	**Risk Rating** **C x L =6** **Low**	**Target Risk Rating** **N/A**
Risk Assessment 7.1.3: What is the risk of the Australian Government's management impacting on the sustainability of the Industry?			
Social and Economic Objective 7.1.3: To ensure that Australian Government's policy and processes do not impact on the sustainability of Industry.			
Consequence **C= 4**	**Likelihood** **L= 3**	**Risk Rating** **C x L = 12** **Mod**	**Target Risk Rating** **Low**
Risk Management Options • Ensure effective, ongoing Government/Industry consultation • Effectively engaging State Government and participating in the political process to ensure that industry interests are taken into account in policy decision making			

Suggested Performance Measures
- Continued Industry profitability and sustainability

7.2: INDUSTRY

Industry representatives have completed the information in this branch.

Scope

To assess the impact of the Industry's management on the sustainability of the Industry.

7.2.1: Codes of Conduct / Codes of Practice

The Industry is presently developing an EMS Framework that incorporates a substantive code of practice (See separate Code of Practice document). The Industry is working towards using management systems that allow for adaptive management rather than prescriptive regimes. The Industry has adopted the Code of Conduct for Australian Aquaculture developed by the National Aquaculture Council (NAC) as shown in Appendix 7.2.1.

7.2.2: Participation & Representation

The Industry's peak representative bodies are the TSGA, TAC and TFIC in liaising with Government at both a National and State level. The Industry also has representatives on National Aquaculture Council (NAC) and the Australian Seafood Industry Council (ASIC).

7.2.3: Seafood Safety

The post-harvest regime for finfish includes a food safety program based on time/temperature protocols under the Primary Producers Processing Standard (PPPs 2006) developed by the Food Standards of Australia and New Zealand (FSANZ). All seafood is harvested under PPPS guidelines, which meets the requirements of domestic and international customers and food safety authorities.

Industry may also adopt additional voluntary quality standard monitoring systems such as ISO 9001.

7.2.4: Peak Bodies

The peak representative bodies for the Industry are Tasmanian Salmonid Growers Association (TSGA), the Tasmanian Aquaculture Council (TAC) and the Tasmanian Fishing Industry Council (TFIC). A number of other bodies play vital roles in the management of the industry and have direct links to the TSGA, TFIC and TAC, as shown in Figure 7.2.4.

TSGA has representation of one seat on TAC. Both TAC and TSGA have representatives on the National Aquaculture Council (NAC).

In addition there are a number of marine farming bodies associated with the Industry, both in Tasmania and interstate. See glossary for the acronyms.

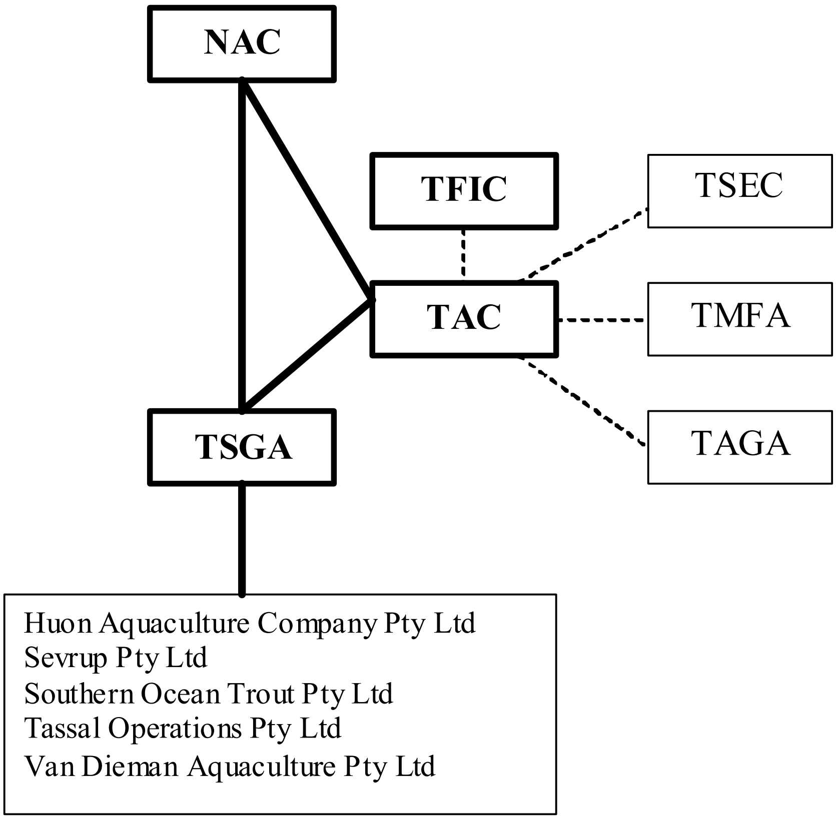


Figure 7.2.4. Tasmanian Salmonid Industry Structure and Links. See Glossary for acronyms. Solid lines represent structured methods of communication.

7.2.5: Certification

The Industry is subject to disease free certification if involved in the export market, as covered in Section 8.1.3.1: Disease. Parts of the Industry are working towards EMS certification.

7.2.6: Public Liability

As a condition of the marine farming lease, each leaseholder is required to take out public liability insurance of $5 million dollars.

<table>
<tr><td colspan="4">Risk Assessment 7.2: What is the risk that Industry will impact on its own sustainability through Industry governance practices?</td></tr>
<tr><td colspan="4">Social and Economic Objective 7.2: To ensure that Industry representation does not impact on the sustainability of Industry.</td></tr>
<tr><td>Consequence
C= 1</td><td>Likelihood
L= 2</td><td>Risk Rating
C x L = 2
Low</td><td>Target Risk Rating
N/A</td></tr>
<tr><td colspan="4">Risk Management Options
• Effective coordinated Industry representation
• Ensure effective, ongoing Government/Industry consultation
• Effectively engaging State Government and participating in the political process to ensure that industry interests are taken into account in policy decision making
• Adherence to Industry Codes of Practice
• Investment in development of human capital
• Good governance practices of Industry representative groups</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Continued Industry profitability and sustainability</td></tr>
</table>

7.3: NON-GOVERNMENTAL ORGANISATIONS

Industry and management agencies take on board concerns of non-governmental organisations (NGOs) in addressing issues. Often NGOs play an important role in representing the community sector. However, it is important to ensure that these influences do not override the sustainability practices already used by the Industry.

Scope

To assess the impact of the Non-Governmental Organisations (NGOs) on the sustainability of Industry.

7.3.1: Watchdog Role

Any individual or group can make representation in relation to a draft Marine Farming Development Plan through the marine farming planning process. The Planning Authority is required to report on written representations received in response to the public exhibition of a Marine Farming Development Plan. This report requires an assessment of the issues raised in representations. The Marine Farming Planning Review Panel must consider the report and representations in its deliberation on a draft plan. Any person in making a representation may request a hearing in relation to that representation. The panel must hold a public hearing if requested by the representative.

7.3.2: Representativeness

Community environmental interests are represented on the Marine Farming Environmental Advisory Committee by the Tasmanian Conservation Trust. The member of the Tasmanian Conservation Trust represents the community and conservation groups.

Risk Assessment 7.3: What is the risk that NGO's will impact on the sustainability of Industry?			
Social and Economic Objective 7.3: To ensure that legitimate community environmental interests are addressed in the management of a sustainable Industry.			
Consequence **C= 2**	**Likelihood** **L= 4**	**Risk Rating** **C x L = 8** **Mod**	**Target Risk Rating** **Low**
Risk Management Options • Provide a transparent and open planning process • Effective consultation between Industry, State Government and NGOs • Effective communication between Industry and community interest groups • Effective promotion of the Industry EMS to the wider community			
Suggested Performance Measures • Absence of unnecessary delays in the planning process			

Component 8: External Impacts of the Environment on Industry

Introduction

Threats to the sustainability of Industry include external impacts that are not a result of marine farming activities and occur outside Industry's control. These are impacts that may affect the performance of Industry, but are generally beyond the scope of the relevant legislation of the main management agencies. The analysis of Component 8 allows Industry to identify the issues most likely to impact upon them, and provide a mechanism to assist the Industry in mitigating potential risk.

There are two major branches in Component Tree 8 (see Fig. 8.0). The first branch is the impacts that arise from environmental changes, including natural, anthropogenic and biological changes. The second branch covers the impact of other external drivers such as political and economic activities on the performance of Industry. Some aspects of the second branch are also covered in Components 4 and 5.

Component Tree 8 has been modified from Fletcher et al (2004) ESD Framework by the following means:

Additions
- Sea Level Rise under Section 8.1.1: Climate Induced Change
- Sovereign Risk under 8.2.1: Politics

Combinations
- Rainfall and Flows (under 8.1.1: Climate Induced Changes) were combined as they are inter-related.
- Land Use Changes with Habitat Modification (under 8.1.2: Human Induced Changes) as one results in the other.
- Exotics with Weeds (under 8.1.2: Human Induced Changes).

Exclusions
- Zoning (under 8.2.1: Politics) as the Marine Farming Planning Process provides allocated zones for marine farming, protected from other uses.

The risk assessments covered by this chapter use a number of consequence tables, as described in each risk assessment and shown in Appendix 1.0

- 8.0 External Impacts on the Industry
  - 8.1 Impacts of the Environment on the Industry
    - 8.1.1 Climate Induced Changes
      - 8.1.1.1 Temperature
      - 8.1.1.2 Rainfall and Flows
      - 8.1.1.3 Sea-level Rise
      - 8.1.1.4 Storms
    - 8.1.2 Human Induced Changes
      - 8.1.2.1 Water Quality
      - 8.1.2.2 Land Use Changes & Habitat Modification
      - 8.1.2.3 Environmental Flows
      - 8.1.2.4 Air Quality
      - 8.1.2.5 Weeds & Exotics
    - 8.1.3 Biological
      - 8.1.3.1 Disease
      - 8.1.3.2 Predators
  - 8.2 Impacts of Other External Drivers
    - 8.2.1 Politics
      - 8.2.1.1 Sovereign Risk
      - 8.2.1.2 Competing Uses
      - 8.2.1.3 Zoning
    - 8.2.2 Economic
      - 8.2.2.1 Incentives
      - 8.2.2.2 Exchange Rates
      - 8.2.2.3 Interest Rates
      - 8.2.2.4 Competition
      - 8.2.2.5 Markets
      - 8.2.2.6 Taxation
    - 8.2.3 Regulations

Component Tree 8: External Impacts of the Environment on the Industry

COMPONENT 8.1: IMPACTS OF THE ENVIRONMENT ON THE INDUSTRY

Impacts from the environment may occur from broad scale ecosystem changes such as climate change. Industry has no influence over climatic change and therefore has to demonstrate mechanisms to cope with these phenomena. Human induced changes, such as activities of upstream users, cannot be controlled by industry. If these risks are high, the Industry may be able to influence conditions surrounding these activities through research and sound management practices to reduce their impact.

8.1.1: CLIMATE INDUCED CHANGES

Climate change is comprised of primary effects such as higher air temperatures and CO_2 concentrations, secondary effects such as sea temperature warming and lower-order effects such as sea-level rise. The ecological consequences of these changes are uncertain, but will involve changes to the structure and function of biological populations and assemblages. The Industry needs to consider future management options regarding changes to environment. Climate change may also indirectly impact upon Industry through impacting upon the source and availability of the food source. All risk assessments in this component are considered on the moderate to long term of 30 years.

Scope

To assess the impact of climate change on the sustainability of Industry.

8.1.1.1: Temperature

Increased sea temperatures will significantly impact on marine species living close to their upper thermal limit. The impact on salmonids may be lowered growth rate and increased incidence of disease such as amoebic gill disease. The upper thermal limit of salmon is linked to oxygen availability. In highly oxygenated waters, salmon are capable of growth at temperatures of 20°C and above. In general the industry has a preference for sea temperatures lower than 17°C.

The sea temperature of Tasmanian coastal waters has been reported to increase 0.6 to 3 °C per 100 years (Crawford et al 2004). It is expected for this temperature rise to either continue or increase in the future. The industry is investigating the potential impacts on productivity through studies on diet, aeration, hydrodynamics, selective breeding and site selection of higher energy sites with greater water exchange.

A secondary potential impact of sea temperature rise may be an increase in the incidence of harmful algal blooms or zooplankton blooms such as blue-bottle jellyfish, or the introduction of new species of pelagic plankton through the extension of the East Australian Current.

8.1.1.2: Rainfall and Environmental Flows

Rainfall on the East Coast of Tasmania has declined substantially in the last 20 years (Graham Harris, University of Tasmania, pers comm.). Winter rainfall is predicted to increase by up to 20% by 2030. Spring, summer and autumn rainfall are predicted to decrease by up to 10% by 2030 (DPIWE 2005). The north and east of the state are more likely to experience less rain in summer months, with a slight increase in winter. The west of the State is likely to receive more rain. However, evapotranspiration is expected to significantly increase across the state during summer and autumn, leading to a maximum of 12.2% decrease in soil moisture (Nunez 2005). Increased drought frequency and intensity are a probable consequence of climate change and will have serious implications for riverine systems and wetland environments. Climate change may result in decreased riverine run-off and increased major storm events affecting the biological dynamics of estuarine and coastal ecosystems and hence may impact upon the Industry.

Climate change may result in altered flow regimes leading from changes in rainfall patterns, temperature, precipitation, evaporation and seasonal cycles. Decreased water availability from natural sources may also lead to increased water extraction resulting in human induced changes to flow regimes (Section 8.1.2.4). These changes may impact on salmonid culture in estuaries and bays by altering the nutrient input and increasing turbidity and salinity, affecting productivity and water quality.

The decrease in environmental flows may lead to increasing disease management problems for the Industry in South East Tasmania. An increase in environmental flows would be beneficial to the industry in general.

8.1.1.3: Sea-Level Rise

Sea level is presently increasing at about 1.8mm ± 0.3 mm per year (Church et al 2006). Physical changes resulting from sea-level rise on soft sandy shores and in low-lying coastal areas are likely to be significant in some areas over future decades, causing changes to coastal landform process systems and biological communities (Sharples 2004). In general this will not greatly affect the salmonid Industry.

The Intergovernmental Panel on Climate Change (IPCC) has projected that sea level will rise a further 0.09 and 0.88 metres between the years 1990 and 2100, and that the frequency of extreme sea-level events will result in significant increase in storm damage (Church et al 2006). Industry may be required to relocate or provide greater protection to on-shore facilities to cope with the increased storm frequency. Long-term sea-level rise will most likely be taken into account in replacement of equipment through natural attrition.

8.1.1.4: Storms etc.

If, as predicted, storms become more intense and frequent (Church et al 2006), the Industry may be required to redesign and re-engineer their mooring structures. This is not regarded as a major problem as the Industry is continually working towards the improvement of their farming systems

Land structures would be more susceptible to increasing flooding and damage. Servicing farm operations such as feeding may be temporarily hindered in the event of storms. The Industry may need to adapt their culture techniques to accommodate increased storm frequency.

Risk Assessment. 8.1.1.1. What is the risk of predicted sea temperature rise impacting upon the sustainability of Industry?		
Environmental Objective 8.1.1.1: To ensure that the Industry is seeking mechanisms to adapt to sea temperature rise.		
Consequence **C= 4***	**Likelihood** **L= 6**	**Risk Rating** **C x L = 24** **Extreme**
Risk Assessment. 8.1.1.2. What is the risk of predicted changes in rainfall patterns and environmental flow impacting upon the sustainability of Industry?		
Environmental Objective 8.1.1.2: To ensure that the Industry is seeking mechanisms to adapt to changes in rainfall patterns and environmental flow.		
Consequence **C= 2***	**Likelihood** **L= 6**	**Risk Rating** **C x L = 12** **Moderate**
Risk Assessment. 8.1.1.3. What is the risk of predicted seal level rise impacting upon the sustainability of Industry?		
Environmental Objective 8.1.1.3: To ensure that the Industry is seeking mechanisms to adapt to sea-level rise.		
Consequence **C= 1***	**Likelihood** **L= 6**	**Risk Rating** **C x L = 6** **Low**
Risk Assessment. 8.1.1.4. What is the risk of predicted storm frequency impacting upon the sustainability of Industry?		
Environmental Objective 8.1.1.4: To ensure that the Industry is seeking mechanisms to deal with storm events.		
Consequence **C= 1***	**Likelihood** **L= 6**	**Risk Rating** **C x L = 6** **Low**
* Consequence may vary regionally **Risk Management Options** • Monitoring for environmental change • Variable systems for salmonid culture • Adaptive husbandry management • Monitoring of phytoplankton community change • Selective breeding of salmonids • Industry representation at legislative and policy review levels of Government • Targeted research of climate change impacts on the Industry • Collect baseline marine farming information on which effects of climate change can be measured.		

Suggested Performance Measures
- Comparative information to determine impacts of climate change on productivity

8.1.2: HUMAN INDUCED CHANGE

Scope

To assess the impact of human induced change to the environment and its effect on the sustainability of Industry.

8.1.2.1: Water Quality

Commercial and recreational marine activities may impact on water quality through the release of waste from vessels, resuspension of bottom sediments in the water column by movement of large vessels, potential oil (or hydrocarbon) spills, introduction of exotic species (Section 8.1.2.3) and the use of toxic antifoulants. Salmonid harvesting operations may also be threatened by an increase in bacterial levels from human faecal contamination.

8.1.2.2: Land Use Changes & Habitat Modification

Modification of the upstream habitat through primary production activities such as agriculture and forestry can lead to large-scale habitat and ecosystem changes and result in elevated chemical inputs from fertilisers and pesticides. Catchment disturbance, such as urban development, is known to affect turbidity and suspended sediment concentration of estuarine waters (Paterson et al 2003). Increased turbidity may taint the fish flesh quality resulting in a lower grade product or delays in harvesting operations.

No integrated catchment management legislation exists in Tasmania. There is very limited monitoring of the downstream impacts of land use changes. The Industry is also concerned with the social impact of rural development causing changes in values and the requirements for amenity preservation.

8.1.2.3: Human Induced Changes to Environmental Flows

Changes in environmental flows can be caused by upstream land use changes or habitat modification (as covered in Section 8.1.2.2) or through extraction of water for use in irrigation. Environmental flows in estuarine sites are significant to salmonid farming activities, and a decrease may impact on both fish health and production.

An example of this impact is the potential change in flood events through damming of the King River by the Basslink hydro-electricity scheme, leading to resultant increased copper levels in the King River and into Macquarie Harbour. The review panel for the Basslink project has recognised that the most significant changes to waterways from Basslink would be downstream of Great Lake and Lake Gordon, and in the King River (Basslink 2006).

The lack of remediation at the Mt Lyell copper mine has also created a world-scale acid drainage problem. Between one and two tonnes of copper per day is pumped into the Queen and King Rivers, leading to destruction of nearly all aquatic life in the lower reaches of the rivers and substantial effects on Macquarie Harbour (DPIWE 2001). Flood events followed by calm weather have previously resulted in a toxic plume from the King River causing the mortality of substantial numbers of farmed fish (Col Shepherd pers comm.).

8.1.2.4: Weeds & Exotics

Activities such as commercial vessel movement and recreational boating have been identified as some of the vectors that can lead to the introduction or spread of invasive marine species (IMS). Management systems are currently being developed at a national level to address the problems of translocation of exotic species. (NIMPCOG). Further information on IMS can be found in Section 2.2.6 and Appendix 2.2.6.

The marine farming surveys conducted by the Industry under their license conditions had found that the majority of epibenthic species within bays occupied by salmonid farming are established introduced species (G Edgar in Draft.). The Industry actively promotes the use of a protocol to reduce the risk of new IMS being introduced or translocated into salmon growing areas (Appendix 2.2.6).

Risk Assessment. 8.1.2.1. What is the risk that declining water quality will impact upon the sustainability of Industry?			
Environmental Objective 8.1.2.1: To ensure that declining water quality does not impact upon the Industry.			
Consequence **C= 2***	**Likelihood** **L= 4**	**Risk Rating** **C x L = 8** **Mod**	**Target Risk Rating** **Low**
Risk Assessment. 8.1.2.2. What is the risk that land use change will impact upon the sustainability of Industry?			
Environmental Objective 8.1.2.2: To ensure that land use change does not impact upon the Industry.			
Consequence **C= 2***	**Likelihood** **L= 4**	**Risk Rating** **C x L = 8** **Mod**	**Target Risk Rating** **Low**
Risk Assessment. 8.1.2.3. What is the risk that human induced change will impact upon the sustainability of Industry?			
Environmental Objective 8.1.2.3: To ensure that human induced changes to environmental flows do not impact upon the Industry.			
Consequence **C= 1***	**Likelihood** **L= 4**	**Risk Rating** **C x L = 4** **Low**	**Target Risk Rating** **N/A**
Risk Assessment. 8.1.2.4. What is the risk that invasive marine species will impact upon the sustainability of Industry?			
Environmental Objective 8.1.2.4: To develop mechanisms such that invasive marine species do not impact upon the Industry.			
Consequence **C= 2***	**Likelihood** **L= 3**	**Risk Rating** **C x L = 6** **Low**	**Target Risk Rating** **N/A**

*Consequence may vary regionally

Risk Management Options

- Monitoring of environmental and chemical parameters in the water
- Monitoring land use change
- Monitoring for exotic species
- Targeted research
- Awareness raising of community on potential impacts and the need for change
- Industry representation at legislative and policy review levels of Government

Suggested Performance Measures

- Measurement for presence of exotic species
- Salmonid health

8.1.3: BIOLOGICAL

8.1.3.1: Disease

Scope

To assess the risk of disease on cultured salmonids.

Current Management Controls

8.1.3.1.1: Identification

The Industry operates under the Tasmanian Salmonid Health Surveillance Program (TSHSP) as outlined within this document in Section 2.4.2: Disease. The TFHSP objectives include the active surveillance for specific exotic pathogens and endemic diseases of concern to monitor their distribution so that effective regional biosecurity measures can be implemented. More information on the TSHSP is available in Appendix 2.4.2.

8.1.3.1.3: Response

Effective control of disease pathogens can in some cases be difficult to maintain due to the 'open systems' associated with marine cage culture and the fluid nature of water. The enterprise type, closed; semi-closed; semi-open or open' generally determines how effective initial control measures will be and whether spread will occur from a specific site. Effective responses to emergency disease outbreaks require emergency disease planning at national, State/Territory and district level, and the involvement of both animal health authorities, industry, fisheries personnel and emergency management organisations. The basis for this planning is contained in the AQUAVETPLAN being developed by the Office of the Chief Veterinary Officer (Aquatic Health) within the Department of Agriculture, Fisheries and Forestry (DAFF). The AQUAVETPLAN comprises a series of manuals outlining national emergency preparedness and response and control strategies for aquatic animal disease emergencies in Australia. The manuals provide guidance based on sound analysis, linking policy, strategies, implementation, coordination and emergency management plans. AQUAVETPLAN manuals are working documents and will be updated as required, to take account of research, experience and field trials, and to cover emerging disease threats.
These documents are available at http://www.affa.gov.au/content/publications.

The Tasmanian Operational Plans and Logistics Manual (TOM manual) is the Tasmanian State plan for emergency animal disease response and is available from http://tod.dpiwe.tas.gov.au/tod.nsf/WebPages/CPAS-5VL3YA?open.

The DPIW AQUAVETPLAN Implementation Team (AQVPIT) has been established to be a central group in the development and implementation of fish health emergency plans. The AQVPIT consists of representation from various DPIW branches and forms part of the Biosecurity Emergency Preparedness Program. Industry has nominated members to sit on various advisory groups assisting the Biosecurity Emergency Preparedness Program. The AQVIT has also developed contact lists for a range of stakeholders that may be affected by emergency disease control programs. The terms of reference for the AQVPIT are:

- To assist the Chief Veterinary Officer (CVO) in relation to fish health emergencies by the provision of technical, practical, management and commercial advice
- To plan for fish health emergencies
- To provide a forum for information exchange on fish health issues.

Risk Assessment. 8.1.3.1. What is the risk that current disease surveillance and emergency response will allow disease to impact upon the sustainability of Industry?			
Environmental Objective 8.1.3.1: To ensure that the current disease surveillance and emergency response will be effective in reducing disease incursions.			
Consequence **C= 3**	**Likelihood** **L= 2**	**Risk Rating** **C x L = 6** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • Maintenance of the Tasmanian Salmonid Health Surveillance Program (TSHSP) • Provision of staff by Industry and DPIW with the appropriate level of expertise • Development of plans for emergency response by Government and Industry • Development of biosecurity protocols within Industry • Maintaining current Tasmanian import border controls			
Suggested Performance Measures • Annual reports of disease outbreaks from the Chief Veterinary Officer • Written report provided to TSGA by the DPIW Fish Health Unit on the TSHSP			

8.1.3.2: Predators

Scope

To assess the risk of predators impacting on the Industry

Current Management Controls

The Industry is impacted upon by a number of predators, including seals and sea birds as described in Section 1.2.5: Behavioural Changes and Food Chain Impacts.

8.1.3.2.1: Birds

Predation by birds (e.g. cormorants, gulls) can be a significant problem for finfish culture while fish are small. Similar problems may also exist with the consumption of feed pellets by birds. The birds compete for feed and impact upon fish feeding rates through distracting and scaring fish. If these situations are not effectively managed they have the potential to cause a significant economic impost to marine farming operations over time (DPIWE 2005).

Efforts to mitigate negative interactions between birds and marine farming operations include management controls within the MFDP which specify that;

- where bird netting is deployed lessees must ensure that nets are made of netting of a maximum 115mm square mesh and conform to the visual controls at section 3.8. Existing marine farming lease areas must conform to this requirement by 1 January 2008;
- lessees must ensure that avifauna entangled in bird netting is removed as soon as is practicable following entanglement; and
- lessees must ensure that any predator control of protected wildlife (within the meaning of the *Wildlife Regulations 1999*) is conducted with the approval of the Manager of the Nature Conservation Branch of the Department of Primary Industries and Water.

8.1.3.2.2: Seals

Seal interactions are a significant issue for the Industry causing a range of negative effects including:

- predation of farmed stock - seals damage and kill fish by biting fish through netting;
- causing stress in fish - ongoing attacks on fish within pens causes stress to fish and a concomitant reduction in feeding rates;
- significant increases in the cost of production - seal defence systems such as predator netting and seal trapping/removal and damage to nets caused by seals, incur a significant financial impost on industry. Overall cost to industry has been estimated to be approximately 10% of the total cost of production (MMIC 2002); and
- occupational health and safety issues - aggressive seals may cause injury to personnel employed on marine farms.

Trapping and relocation has been successful where there has been a breach or failure of predator systems (predator nets or corrals), where seals are within a fish pen, or where seals are exhibiting aggressive behaviour. However, the effectiveness of this method is limited for some seals cannot be trapped and some seals may return to farms after being relocated. Trapping and relocation of problematic seals was not recommended as a broad scale management tool (MMIC 2002).

Industry uses a variety of methods to control seals in Tasmania, including the use of predator nets, brass cages and heavily weighted nets. The industry is currently experimenting with the use of net stiffening agents such as antifoulants that reduce the ability of seals to manipulate nets and allows better tensioning to occur. One company is trialling brass compound mesh cages for predator protection (Fig 8.1.3.2.2). Farms may also implement electric fences to exclude seals from climbing into the water between pen and predator nets (MMIC 2002).

Fig 8.1.3.2.2. The installation of a brass cage to prevent seal predation of salmonids in the Tamar River.

Efforts to mitigate negative interactions between marine mammals and marine farming operations include management controls within the MFDP which specify that;

- lessees must notify the Nature Conservation Branch of the DPIW in the event that any marine mammals are found entangled in marine farming equipment;
- lessees must ensure that any predator control of protected wildlife (within the meaning of the Wildlife Regulations 1999) is conducted with the approval of the Manager of the Nature Conservation Branch of the DPIW or any other person acting on that person's behalf and in the case of seals in accordance with relevant seal interaction management protocols of the DPIW,
- feeding of seals must not occur in any marine farming zones or marine farming lease areas; and,
- baited trap lines or "tease lines" may only be deployed by an officer employed in the Nature Conservation Branch of DPIW or a person(s) who holds a permit to do so under the *Wildlife Regulations 1999*.

Protocols for the negative conditioning of seals using non-lethal seal control devices are provided in Appendix 8.1.3.2.

Risk Assessment. 8.1.3.2. What is the risk that predators will impact upon the sustainability of Industry?			
Environmental Objective 8.1.3.2: To ensure that the Industry can remain sustainable in the presence of predators			
Consequence **C= 1**	**Likelihood** **L= 6**	**Risk Rating** **C x L =6** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • Adherence to non-lethal translocation protocols • Staff education • Exclusion of predators through appropriate equipment			
Suggested Performance Measures • Report any significant predation to DPIWE			

COMPONENT 8.2: IMPACTS OF OTHER EXTERNAL DRIVERS

Political, economic and regulatory drivers may influence an industry capacity to compete in the market place. This component assesses those risks and their influence upon industry sustainability.

8.2.1: POLITICS

Scope

To assess the impact of politics on the sustainability of the Industry.

8.2.1.1: Sovereign Risk

The sovereign risk is the capacity of the Government of the day to be able to develop and promote policies that are not in keeping with the concept of sustainability. This is a risk for which the industry cannot be insured against. However, the MFPA allows for the continued use of the marine resource for leaseholders, as long as they comply with all regulatory requirements.

8.2.1.2: Competing Uses

The Industry's opportunity to expand is subject to government policy. There is little risk under the current MFDP from competing uses as zones have been allocated through the MFPA to ensure the viability of the Industry and protect the Industry from other uses. New marine farming zones may be applied for under the MFPA but require the preparation of an Environmental Impact Statement.

Risk Assessment. 8.2.1.1. What is the risk that the current sovereign risk will impact upon the sustainability of Industry?			
Socio-Economic Objective 8.2.1.1: To ensure that the Industry can remain sustainable with the current sovereign risk.			
Consequence **C= 3**	**Likelihood** **L= 2**	**Risk Rating** **C x L = 6**	**Target Risk Rating** **Low**
Risk Assessment. 8.2.1.2. What is the risk that current competing uses will impact upon the sustainability of Industry?			
Socio-Economic Objective 8.2.1.2: To ensure that the Industry can remain sustainable with the current competing uses.			
Consequence **C= 2**	**Likelihood** **L= 4**	**Risk Rating** **C x L = 8** **Mod**	**Target Risk Rating** **Low**
Risk Management Options • Industry representation at legislative and policy review levels of Government • Raising community awareness of the socio-economic value of the Industry and quality of the product			
Suggested Performance Measures • Monitoring proposed changes to present legislation			

8.2.2: ECONOMICS

Scope

To assess the impact of economics on the sustainability of the Industry.

8.2.2.1: Incentives

The Australian Government has become a signatory to the International agreement AGENDA 21, which includes economic incentives as part of determining ecological sustainability.

8.2.2.2: Exchange Rates

Free market trade is a part of the Australian Government policy that has resulted in the Australian market competing against countries with trade barriers still in existence. The availability of non-subsidised assistance for the Industry would assist its ability to compete in the existing market.

8.2.2.3: Interest Rates

The Industry has access to finance under similar conditions to other Australian industries.

8.2.2.4: Competition

The introduction of the Competition Policy in Australia has allowed for more equitable competition between market players within the Industry. The Australian Competition & Consumer Commission (ACCC) administers the *Trade Practices Act 1974* (TPA) to ensure that cartels that cause high prices, high costs, inefficiency and unfairness in all parts of Australia do not become established.

8.2.2.5: Markets

The Industry must compete both domestically and internationally under global free trade agreements. This may create problems where Tasmanian produce must be cost competitive with countries that have lower wage structure and overheads. The majority of the Tasmanian produce sold overseas is aimed at the premium market to obtain better prices.

8.2.2.6: Taxation

The Industry receives tax incentives similar to other primary industries.

<table>
<tr><td colspan="4">Risk Assessment. 8.2.2.1. What is the risk that the current domestic business climate will impact upon the sustainability of Industry?</td></tr>
<tr><td colspan="4">Socio-Economic Objective 8.2.2.1: To ensure that the Industry can remain sustainable under the current domestic business climate (eg economic incentives, interest rates, competition policy and taxation)</td></tr>
<tr><td>Consequence
C= 2</td><td>Likelihood
L= 3</td><td>Risk Rating
C x L =6
Low</td><td>Target Risk Rating
N/A</td></tr>
<tr><td colspan="4">Risk Assessment. 8.2.2.2. What is the risk that the current international business climate will impact upon the sustainability of Industry?</td></tr>
<tr><td colspan="4">Socio-Economic Objective 8.2.2.2: To ensure that the Industry can remain sustainable under the current international climate (eg market share and exchange rates)?</td></tr>
<tr><td>Consequence
C=2</td><td>Likelihood
L= 2</td><td>Risk Rating
C x L =4
Low</td><td>Target Risk Rating
N/A</td></tr>
<tr><td colspan="4">Risk Management Options
• Diversity of product
• Industry marketing strategy
• Industry training
• Quality assurance
• Supply chain assurance</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Profitability</td></tr>
</table>

8.2.3: REGULATIONS

Scope

To assess the potential impact of regulations on the sustainability of the Industry.

Current Regulatory Controls

The Industry is principally governed by the *Marine Farming Planning Act 1995* (MFPA) and the *Living Marine Resources Management Act 1995* (LMRMA), but is expected to comply with a suite of associated Acts and controls listed in Appendix 8.2.3.1. The MFPA was developed in collaboration with industry to ensure an equitable process for allocation of water was in place (described in Section 7.1.1.1: Management Agency). The plans are reviewed on a regular basis (every 10 years) and include consultation with Industry, other State government departments and the community. Once the Marine Farming Review Panel and the Minister of the day approve a reviewed plan it becomes law. The general management controls from the Marine Farming Development Plans state:

> "*There must be no unacceptable environmental impact, to the satisfaction of the Secretary, 35 metres outside the boundary of the marine farming lease area. Relevant environmental parameters must be monitored in the lease area, 35 metres from the boundary of the marine farming lease area and at any control site(s) in accordance with the requirements specified in the relevant marine farming licence*".

<table>
<tr><td colspan="4">Risk Assessment. 8.2.3. What is the risk that the current regulatory framework will impact upon the sustainability of Industry?</td></tr>
<tr><td colspan="4">Socio-Economic Objective 8.2.3: To ensure that the Industry can remain sustainable within the current and future regulatory framework</td></tr>
<tr><td>Consequence
C=2</td><td>Likelihood
L= 3</td><td>Risk Rating
C x L =6
Low</td><td>Target Risk Rating
N/A</td></tr>
<tr><td colspan="4">Risk Management Options
• Industry representation at legislative and policy review levels of Government</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Monitoring proposed changes to present legislation</td></tr>
</table>

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List of Appendices

Provided as extra references in folder

Glossary of Acronyms and Terms

Acronyms

AFFA	Australian Forestry Fisheries and Agriculture
APVMA	Australian Pesticides and Veterinary Medicines Authority
AQIS	Australian Quarantine Inspection Service
AUSVETPLAN	Australian Veterinary Emergency Plan
AWA	*Animal Welfare Act 1993*
CAMBA	China-Australia Migratory Bird Agreement
COP	Code of Practice
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CVO	Chief Veterinary Officer
DAFF	Department of Agriculture, Fisheries and Forestry, Australia
DEH	Department of Environment and Heritage
DIER	Department of Infrastructure, Energy and Roads, Tasmania
DPIF	Department of Primary Industries and Fisheries, Tasmania
DPIW	Department of Primary Industries and Water, Tasmania
DPIWE	Department of Primary Industry Water and Environment, Tasmania
DSF	Department of Sea Fisheries, Tasmania
DTAE	Department of Tourism, Arts and Environment, Tasmania
ECA	*Export Control Act* 1982
EIS	Environmental Impact Statement
EMPCA	*Environmental Management and Pollution Control Act 1995*
EPBCA	*Environmental Protection and Biodiversity Conservation Act 1999*
ESD	Ecologically Sustainable Development
FHU	Fish Health Unit
FRDC	Fisheries Research and Development Corporation
FSANZ	Food Standards Australia and New Zealand
IMS	Invasive Marine Species
JAMBA	Japan-Australia Migratory Bird Agreement
LMRMA	*Living Marine Resources Management Act 1995*
LUPAA	*Land Use Planning and Approvals Act 1993*
MAS	Marine aeromonas of salmonids
MAST	Marine and Safety Tasmania
MFPA	*Marine Farming Planning Act 1995*
MFDP	Marine Farming Development Plans
MSDS	Material Safety Data Sheet
NAC	National Aquaculture Council
NIMPCG	National Introduced Marine Pests Co-ordination Group
NPRMA	*National Parks and Reserves Management Act 2002*
OIE	Office International des Epizooties
OH&S	Occupational Health and Safety
PEV	Protected Environmental Values
Ramsar	Convention on Wetlands (Ramsar, Iran, 1971)
RLO	Rickettsia-like organism
RMPS	Resource Management Planning System
SPWQM	State Policy on Water Quality Management 1997

TAC	Tasmanian Aquaculture Council
TAFI	Tasmanian Aquaculture and Fisheries Institute
TFHAG	Tasmanian Fish Health Advisory Group
TFIC	Tasmanian fishing Industry Council
TMFA	Tasmanian Marine Farmers Association
TORC	Tasmanian Oyster Research Council
TOM	Tasmanian Operational Plans and Logistical Manual
TPAA	Timber Preservation Association Australia
TSEC	Tasmanian Shellfish Executive Council
TSGA	Tasmanian Salmonid Growers Association
TSPA	*Threatened Species Protection Act 1995*
TSQAP	Tasmanian Shellfish Quality Assurance Program
USFDA	United States Food and Drug Administration

Terms

Aspect (Environmental)
Elements of an organisation's activities or products or services that can interact with the environment. (ISO 14001:2004).

Bloodwater
Blood products mixed with water derived from the bleeding of fish during harvesting.

Broodstock
Animal collected and maintained for the purpose of breeding.

Carrying capacity
The stock density at which production levels are maximised without negatively affecting growth rates. (Carver and Mallet 1990).

Community
Groups of people who share particular social characteristics such as occupation or place of residence.

Component
A module or constituent part of the EMS Framework that describes an affect on the environmental, (social, political or economic) sustainability of the Industry.

Component Tree
The structure on which aspects or issues involving impacts on Industry or from Industry is described for each component (see Note to the Reader).

Consequence
The consequence of an issue is the effect or outcome a particular issue will have. Consequence relates to the importance of an issue.

Disease
A condition resulting from exposure to or infection with a biological agent such as a bacterium, a virus, a protozoan or a parasite.

Diseased
Affected with disease.

Environment
Surroundings in which an organisation operates, including air, water, land natural resources, flora, fauna, humans and their interrelation. (ISO 14001:2004).

Environmental Management System (EMS)
Part of an organisation's management system used to develop and implement its environmental policy and manage its environmental aspects.
A management system is a set of interrelated elements used to establish policy and objectives and methods to achieve those objectives. A management system includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources. (ISO 14001:2004).

Environmental Objective
Overall environmental goal, consistent with the environmental policy, that an organisation sets itself to achieve. (ISO 14001:2004).

Environmental Performance
Measurable results of an organisations management of its environmental aspects. (ISO 14001:2004).

Environmental Policy
Overall intentions and direction of an organisation related to its environmental performance.

Environmentally Sustainable Development
Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased (COAG 1992).

Facility
A facility includes the building or complex of buildings, plus the associated infrastructure on the marine leases built for the specific purpose of farming salmonids.

Generic Component Tree
The structure which is the basis of the National ESD Framework and the EMS Framework, comprising of 8 components (see Note to the Reader).

Genetically Modified Organism (GMO)
An organism whose genome has been artificially modified by the addition of genetic material from another species. (Beaumont & Hoare 2003).

Impact
Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisations environmental aspect. (ISO 14001:2004).

Invasive Marine Species
Invasive marine species are organisms (usually transported by human activities) which successfully establish themselves in, and then overcome, otherwise intact, pre-existing native ecosystems.

Industry
Industry refers to the Tasmanian land-based salmonid farming industry.

Likelihood
The likelihood is the conditional probability of an event occurring. It relates directly to the impact of the event, not the activity surrounding the event.

Managed or Residual Risk
The level of risk, taking into account current management arrangements.

Risk
The chance of something happening that will have an impact on objectives (AS/NZS 4360: 1999).

Risk Analysis
Risk analysis involves consideration of the source of risk, their consequences and the likelihood that these consequences may occur. (AS/NZS 4360: 1999)

Risk Matrix
A table that combines the likelihood and consequence of an event happening, to quantify a risk.

Sensitive habitats
An area in which plant or animal life or their habitats are either rare or especially valuable because of the unique role they play in the environment. Sensitive species and their ecological systems are plants and animals in danger of dying out due to low numbers of individuals per population, a limited number of populations, or a limited, fragmented or vulnerable habitat.
Sensitive habitats include:

- The areas where these species live.
- The areas necessary for the survival of these species (such as breeding, migration or feeding grounds).
- Any location where disturbance is likely to lower the population numbers.

Sustainable Development
Managing the use development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural well-being and for their health and safety while:

- Sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations; and
- Safeguarding the life-supporting capacity of air, water, soil and ecosystems; and
- Avoiding, remedying or mitigating any adverse effects of activities on the environment. (RPMS).

Sustainability
The ability to be able to operate in the future under current conditions.

Target Risk
The level of risk that the Industry is working towards achieving.

Environmental Management System Framework

Appendices Accompanying Guide and Risk Assessment for Ecologically Sustainable Development

PhycoTec
Environmental Management

Tasmanian Salmonid Growers

Tasmania

Australian Government
Fisheries Research and Development Corporation

FRDC Project 2004/096

Environmental Management System Framework

Tasmanian Salmonid Industry

Appendices Accompanying Guide and Risk Assessment

for

Ecologically Sustainable Development

Version 1.0

June 2007

FRDC Project 2004/096

ENVIRONMENTAL MANAGEMENT SYSTEM FRAMEWORK

Compliance Guide and Risk Assessment of Ecologically Sustainable Development for the Tasmanian Salmonid Industry

APPENDICES

Version 1.0

AUGUST 2006

This document is part of a national initiative to assist the seafood sector in the uptake of Environmental Management Systems. The document is based on the National ESD Framework 'How To' *Guide for Aquaculture, Version 1.1 (Fletcher et al. 2004). Regular updating of the information in the document will take place. While the views in this document reflect the general views of the Industry, it should not be taken as the view of any individual in Industry or the Steering Committee for the project.*

The project has been funded by the Tasmanian Salmonid Growers Association (TSGA), the Tasmanian Fishing Industry Council (TFIC), the Tasmanian Department of Primary Industries and Water (DPIW) and the Fisheries Research and Development Corporation (FRDC) as Project 2004/096.

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Document Control

The Environmental Management System Framework: Compliance Guide and Risk Assessment of The Environmental Management System Framework: Compliance Guide and Risk Assessment of Ecologically Sustainable Development for the Tasmanian Salmonid Industry: Accompanying Appendices is a living document subject to periodic review to capture regulatory changes and Industry's adaptive management.

This document is uncontrolled, and therefore freely available to industry representatives, regulatory authorities and other stakeholders as requested.

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APPENDIX 1.0: RISK ASSESSMENT TABLES FOR AQUACULTURE ESD COMPLIANCE.

ADAPTED FROM THE NATIONAL ESD FRAMEWORK

Consequence Tables

1.1 General

The general consequence table was developed as the basic template for all assessments of consequence. The levels of this table are generic and the interpretation of the definitions will need to be adapted to the issue being assessed.

Table 1.1. The General Consequence Table for use in ecological risk assessments related to aquaculture

Consequence	Score	Definition
Negligible	**0**	Very insignificant impacts. Unlikely to be measurable
Minor	**1**	Possibly detectable but minimal impact on structure/function or dynamics
Moderate	**2**	Maximum acceptable level of impact – recovery measurable in months or years
Severe	**3**	This level will result in wider and longer term impacts – recovery measurable in years
Major	**4**	Very serious impacts with relatively long time frame likely to be needed to restore to an acceptable level – recovery measurable in decades
Catastrophic	**5**	Widespread and permanent irreversible damage or loss will occur – unlikely to ever recover (eg causing extinctions)

1.2 Habitat Issues

Habitat issues look at the direct affect of aquaculture activities on the ecosystem. Habitat (eg seagrass) should be assessed at the regional level, defined as the entire habitat equivalent to that occupied by the exploited stock. The extent of the impact should be judged on the best estimate of the original extent of the habitat. Some habitats are more fragile than others, which will affect the level of disturbance that they can withstand sustainably. Furthermore, some habitats will form more important functions such as juvenile fish habitats and this will need to be included in the determination.

Table 1.2. Suggested consequence levels for the impact of aquaculture on habitats (Three levels – non-fragile, fragile, critical)

Consequence	Score	♦ Definition
Negligible	**0**	♦ Insignificant impacts to the habitat or populations of species making up the habitat. Unlikely to be measurable. ♦ Activity only occurs in a very small area of the habitat *(eg. <1% of the original habitat*) ♦ If impacting a larger area, the impact is unlikely to be measurable against the background.
Minor	**1**	♦ Measurable impact on habitat(s) but these are very localised compared to total habitat area *(eg. <5% of the original habitat*)
Moderate	**2**	♦ More widespread but acceptable impact on the habitat, but the levels are still considerable given the % of the area affected, the types of impact occurring and the recovery capacity of that habitat (*eg. <50% of non-fragile habitats, < 20% of fragile habitats, < 5% of critical habitats*)
Severe	**3**	♦ The level of impact on habitat is greater than the habitats ability to recover adequately in the long term (years) (*eg. impact area results in >25-50% of habitat being removed, >10% for critical habitats*) ♦ The level of impact results in strong downstream effects from loss of function
Major	**4**	♦ Substantial amounts of habitat being affected, which may endanger its long-term survival and result in severe changes to the ecosystem function. (*eg. 70-90% of the non-fragile habitat being affected; >30% of fragile habitats; 10-20% of critical habitats*).
Catastrophic	**5**	♦ The entire habitat is in danger of being affected of removed in a major way. (*eg. >90% of the non-fragile habitat being affected; >50% of fragile habitats; 30% of critical habitats*).

1.3 Ecosystem Issues

The indirect impacts due to flow-on affects of food chain interactions should be assessed at a regional/bioregional level, rather than just the area where the industry/sector operates, unless industry covers the extent of the community/bioregion. The changes to the ecosystem from the addition or removal of nutrients may be difficult to predict. It is important to address the scale of the impact and to recognise that is not possible to have no effect. The level of acceptable change needs to be determined.

Table 1.3. Suggested consequence levels for the impact of aquaculture on the general ecosystem/trophic levels.

Consequence	Score	Definition
Negligible	**0**	General - Insignificant impacts to habitat of populations, unlikely to be measured against background variability Interactions may be occurring with ecosystem but it is unlikely that there would be any change outside of natural variation.
Minor	**1**	None of the affected species play a keystone role in ecosystem – only minor changes in relative abundance of other constituents.
Moderate	**2**	Measurable changes to the ecosystem components without there being a major change in function (no loss of components)
Severe	**3**	Ecosystem function altered measurable and some function or components are locally missing/declining/increasing outside of historical range &/or allowed/facilitated new species to appear. Recovery measured in years
Major	**4**	A major change to ecosystem structure and function (different dynamics now occur with different species/groups now the major components of the region) Recovery measurable in decades.
Catastrophic	**5**	Total collapse of ecosystem processes. Long-term recovery period may be greater than decades

1.4 Social/Political Consequences

The social political consequence table considers the affect of aquaculture on the community that derives a significant proportion of employment and/or income from the industry, either directly or indirectly. The understanding of the social impacts of management decisions does not assume that either aquaculture management decisions will be made to minimise the social impacts at the expense of ecological considerations. The management agency should be made aware that if a management action will have severe or worse social impacts on a local community, this should be bought to the attention of the relevant local, state or Australian Government agencies.

Table 1.4. Possible consequence levels for impacts of aquaculture management at a socio-economic level.

Consequence	Score	Definition
Negligible	0	No impact – would not have any flow-on impact to the local community. No agency staff would need to make a statement.
Minor	**1**	May have minor negative impact on the community (e.g. minor job losses), but these would be easily absorbed.
Moderate	**2**	Some increase in unemployment and decrease in overall income to which the community would adjust to over time. Some community concern about the loss of amenity, which may translate to some political action or other form of protest.
Severe	**3**	Significant reductions in employment and income associated with the fishery. Significant employment and income flow-on effects to other community businesses, as reduced income and increased unemployment affects the local community.
Major	**4**	High level of community impact which the community could not successfully adapt to without external assistance. Significant level of protest and political lobbying likely. Large-scale employment and income losses in the seafood sector of the local economy. Significant flow-on effects in therms of unemployment and income reductions as a consequence to changes in the fishery. Decline in population and expenditure-based services (eg. Schools, shops, bank).
Catastrophic	**5**	Large-scale impacts well beyond the capacity of the community to absorb and adjust to. Likely to lead to large-scale rapid decline in community income and increase in unemployment in areas directly related to industry. May lead to large-scale and rapid reduction in population. Likely to lead to high levels of political action, protest and conflict. Significant reduction in access to private and public sector services, as businesses become unviable. Government and commercial services decline below threshold levels. Total change in community from eg. rural to industrial.

Likelihood Tables

Table 1.5. Likelihood table showing definitions.

Likelihood	Score	Definition	Indicative frequency
Remote	**1**	Never heard of, but not impossible.	One in 1,000 years
Rare	**2**	May occur in exceptional circumstances.	Once every 100 years
Unlikely	**3**	Uncommon, but has been known to occur	Once every 30 years
Possible	**4**	Some evidence to suggest this may possibly occur	Once every 10 years
Occasional	**5**	May occur	Once every 3 years
Likely	**6**	It is expected to occur	Once a year or more

Risk Tables

Table 1.6. Risk matrix – numbers in cells indicate risk value, the shade indicates risk ranking (see Table 1.7 for details).

		Consequence					
Likelihood		**Negligible**	**Minor**	**Moderate**	**Severe**	**Major**	**Catastrophic**
Remote	**1**	0	1	2	3	4	5
Rare	**2**	0	2	4	6	8	10
Unlikely	**3**	0	3	6	9	12	15
Possible	**4**	0	4	8	12	16	20
Occasional	**5**	0	5	10	15	20	25
Likely	**6**	0	6	12	18	24	30

Table 1.7. Risk Ranking and Outcomes.

Risk Ranking	Risk Value	Description	Reporting Requirements	Management Response
Negligible	**0**	Not an issue	Short justification only	Nil
Low	**1-6**	Acceptable – no specific control measures needed	Full justification needed	No specific action needed to achieve acceptable performance
Moderate	**8-12**	Specific management needed to maintain acceptable performance	Full performance report	Review current arrangements
High	**15-18**	Not desirable – continue strong management action. Further or new risk control measures may need to be introduced in the near future	Full performance report	Probable increases to management needed
Extreme	**>20**	Unacceptable – major changes required to management approach in near future	Full performance report	Substantial additional management controls needed.

APPENDIX 1.1: PRINCIPLES AND OBJECTIVES OF ECOLOGICALLY SUSTAINABLE DEVELOPMENT (ESD) AND SUSTAINABLE DEVELOPMENT (SD). By Colin Dyke.

Background

- Australia's involvement in international law and being signatory to international treaties and agreements are the responsibility of the Australian Government.
- Australia has committed to the concept of ecologically sustainable development (ESD) (more commonly known as "sustainable development") through such international agreements and activities.
- The Australian Constitution, through the division of constitutional powers between Australian, State and Territory governments, prevents the Australian Government directly making law for the States and Territories.
- To enable demonstration that Australia's international obligations are being met across all of Australia equitably and consistently, and to ensure on-ground outcomes, various arrangements/mechanisms are used by and between the Australian, State and Territory Governments. These include:
    - **Council of Australian Governments** (COAG), and subsequent agreements reached.(COAG is the peak intergovernmental forum in Australia, comprising the Prime Minister, State Premiers, Territory Chief Ministers and the President of the Australian Local Government Association – three tiers of government.)
      COAG agreements (often) require States and Territories to enact legislation (which may be peculiar to each) demonstrable of meeting Australia's international obligations.
    - **Ministerial Councils**
      Over 40 Commonwealth-State Ministerial Councils and fora facilitate consultation and cooperation between the Australian Government and state and territory governments in specific policy areas. The councils initiate, develop and monitor policy reform jointly in these areas, and take joint action in the resolution of issues that arise between governments. In particular, Ministerial Councils develop policy reforms for consideration by COAG, and oversee the implementation of policy reforms agreed by COAG.

  The **NRM Ministerial Council** was established in 2001 by COAG agreement. The Council is the peak government forum for consultation, coordination and, where appropriate, integration of action by governments on natural resource management issues (for example, through the Intergovernmental Agreements on the 'National Action Plan for Salinity and Water Quality' and the 'National Policy for the Translocation of Live Aquatic Organisms').

Principles of Sustainable Development

A formal description of the 'principles of ecologically sustainable development can be found at Section 3.5 of the *Intergovernmental Agreement on the Environment, May 1992* They are as follows:

3.5.1 **Precautionary Principle**

Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:

i. careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and
ii. an assessment of the risk-weighted consequences of various options.

3.5.2 **Intergenerational Equity**

The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

3.5.3 **Conservation of Biological Diversity and Ecological Integrity**

Conservation of biological diversity and ecological integrity should be a fundamental consideration.

3.5.4 **Improved Valuation, Pricing and Incentive Mechanisms**

- Environmental factors should be included in the valuation of assets and services.
- Polluter pays – i.e. those who generate pollution and waste should bear the cost of containment, avoidance or abatement.
- The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes.
- Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.

Objectives of the Resource Management and Planning System of Tasmania

“SCHEDULE 1 - Objectives of the Resource Management and Planning System of Tasmania

1. The objectives of the resource management and planning system of Tasmania are –

(a) to promote the sustainable development of natural and physical resources and the maintenance of ecological processes and genetic diversity; and

(b) to provide for the fair, orderly and sustainable use and development of air, land and water; and

(c) to encourage public involvement in resource management and planning; and

(d) to facilitate economic development in accordance with the objectives set out in paragraphs (a), (b) and (c); and

(e) to promote the sharing of responsibility for resource management and planning between the different spheres of Government, the community and industry in Tasmania.

2. In clause 1(a) –

"sustainable development" means managing the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural wellbeing and for their health and safety while –

(a) sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations; and

(b) safeguarding the life-supporting capacity of air, water, soil and ecosystems; and

(c) avoiding, remedying or mitigating any adverse effects of activities on the environment."

Relationship Between the Principles of Sustainable Development and the Objectives of the Resource Management and Planning System of Tasmania

The principles of sustainable development are effectively enshrined in the objectives.

APPENDIX 1.1.2.1: RISK MANAGEMENT MEASURES FOR NON-VIABLE SALMONIDS ENTERING AUSTRALIA.

(Adapted from Kahn et al 1999)

Risk management measures

For salmonids, the group 1 priority disease agents that do not meet Australia's acceptable levels of protection (ALOP) were identified as:

- infectious haematopoietic necrosis virus;
- infectious pancreatic necrosis virus — for juveniles only;
- infectious salmon anaemia virus — for Atlantic salmon only;
- *Aeromonas salmonicid*a; typical and atypical strains — all salmonids except for wild ocean-caught Pacific salmon;
- *Renibacterium salmoninaru*m;
- *Yersinia ruckeri* (Hagerman strain) — for juveniles only; and
- *Myxobolus cerebralis* — for rainbow trout and for juveniles of all salmonid species.

In the case of each disease, AQIS considered risk management measures that would be required if the importation of salmonid or non-salmonid marine finfish was to be permitted while meeting the ALOP. These measures include pre-export requirements for the country of origin and post-import measures that could be imposed in Australia Finally, the group 2 priority diseases were assessed to ensure that with the implementation of measures required for group 1 disease agents, risks associated with the group 2 disease agents would also meet Australia's ALOP.

Policies for Import of Non-Viable Uncanned Salmonids

Based on the above procedures, the following risk management measures will apply to the import of non-viable, uncanned salmonid finfish from any country:

- the fish must be eviscerated;
- the fish must be derived from a population for which there is a documented system of health surveillance and monitoring administered by a competent authority;
- the fish must not be derived from a population slaughtered as an official disease control measure;
- the fish must not be juvenile salmonids;
- the fish must not be sexually mature adults (spawners) (not for New Zealand);
- the fish must be processed in premises approved by and under the control of a competent authority;
- the head and gills must be removed and internal and external surfaces thoroughly washed (not for New Zealand, see below);
- the fish must be subjected to an inspection and grading system supervised by a competent authority;
- the product must be free of visible lesions associated with infectious disease;

- consignments exported to Australia should be accompanied by official certification confirming that the exported fish fully meet Australia's import conditions.
- for countries in which infectious salmon anaemia (ISA) occurs, Atlantic salmon should not come from a farm known or officially suspected of being affected by an outbreak of ISA.

In recognition of the health status of New Zealand, salmonids including Pacific salmon but excluding rainbow trout would be permitted import without head and gills removed. The measures outlined above apply to rainbow trout from New Zealand. Salmonid product (other than Pacific salmon from New Zealand) meeting these policies will be released from quarantine if imported in consumer-ready form. For the purpose of these policies, the following products are considered to be 'consumer-ready':

- cutlets — including central bone and external skin but excluding fins — of less than 450g in weight;
- skinless fillets — excluding the belly flap and all bone except the pin bones, of any weight;
- skin-on fillets — excluding the belly flap and all bone except the pin bones — of less than 450g in weight;
- eviscerated, headless 'pan-size' fish of less than 450g in weight; and
- product that is processed further than the stage described above.

Imported head-off, gilled and gutted salmonids of greater than 450g weight (ie, not consumer-ready) should be processed to consumer-ready form in premises approved by AQIS before release from quarantine.

In considering whether to approve commercial processing plants for processing imported salmonid products, AQIS will consider the location of the plant, the type of product processed and other factors. Commercial processing will not be permitted in regions where there are economically significant populations of salmonid fish. This will reduce the probability of susceptible fish being exposed to imported fish or derived waste.

AQIS will also require that premises approved for the further processing of imported salmonids are located to allow quarantine inspectors and auditors ready access and to facilitate regular announced and unannounced inspection. It is likely that most, if not all, approved processing plants would be located in metropolitan centres of mainland Australia. AQIS is reviewing pre-existing policies for the importation of salmonid roe, smoked salmon and smoked trout; further advice will be provided shortly.

References

Kahn SA, Beers PT, Findlay VL, Peebles IR, Durham PJ, Wilson DW, Gerrity SE (1999). Import Risk Analysis on Non-viable Salmonids and Non-salmonid Marine Finfish. Australian Quarantine and Inspection Service, Canberra Australia, 427pp.

APPENDIX 1.2.2: INDUSTRY CONTINGENCY PLAN FOR THE RECOVERY OF ESCAPED SALMONIDS.

To be Developed

APPENDIX 1.2.3: TRENDS IN CHANGES OF FISHMEAL AND FISH OIL SUPPLY AND USAGE IN THE SALMONID INDUSTRY.

Adapted from Tacon AGJ (2006). State of information on salmon aquaculture feed and the environment.

Trends in fish landings destined for reduction

The quantities of landed fish and shellfish from capture fisheries destined for reduction into meals and oils and other non-food purposes has increased over seven-fold from 3 million tonnes in 1950 (representing 16.1% total capture fisheries landings) to 21.37 million tonnes in 2003 or 23.4% total capture fisheries landings (FAO, 2005). With the exception of the El Nino year of 1998, the proportion of the fisheries catch (whole fish) destined for reduction into fishmeal and fish oil has fluctuated between 20 and 30 million tonnes (Figure 2.1.1).

However, this figure only refers to whole fish destined for reduction, and so excludes other fish scraps and processing wastes. In fact, industry estimates for the total quantity of whole fish and trimmings reduced into meals and oils in 2002 have been given as 33 million tonnes (includes 27.4 million tonnes of whole fish caught by dedicated fishing fleets and 5.6 million tonnes of trimmings and rejects from food fish; FIN, 2004). For example, within the European Union (EU) it is estimated that in 2002 about 33% of the fishmeal produced in the EU-15 was manufactured from trimmings from food fish processing (Huntington et al. 2004). At present no information is available from FAO concerning the total global production of fishmeals and oils produced from fishery and aquaculture trimmings and offal.

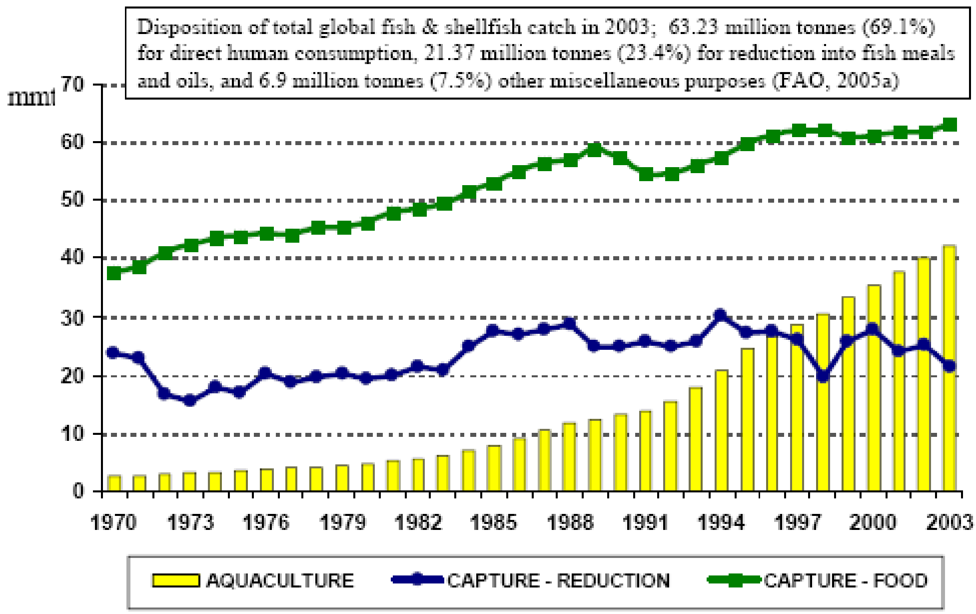

Figure 2.1.1. Total finfish and shellfish production from capture fisheries & aquaculture

Since 1970, the amount of reduction fish used for aquaculture feed has not significantly increased globally, despite a 100-fold global increase in aquaculture production (Figure 2.1.1).

Trends in percentage of fishmeal & fish oil used in salmon feeds

In the past two decades there has been a dramatic decrease in the level of fish meal inclusion in salmon feed diets from an average level of 60% in 1985, to 30-35% at present. The decrease in dietary fishmeal and dietary protein level has been accompanied by an equivalent increase in dietary lipid levels. The rationale behind these changes has been to increase the dietary energy density of the feeds, with a consequent improvement in fish growth and feed conversion efficiency (Tacon 2006; see Appendix 1.2.3). Fish pellets now typically manufactured using higher percentages of alternative protein sources, as shown in Table 1.2.3.1. Global feed conversion efficiencies for salmon has improved 150% over the last two decades (Figure 1.2.3.2) and is the lowest of all major cultured (fed) aquaculture species.

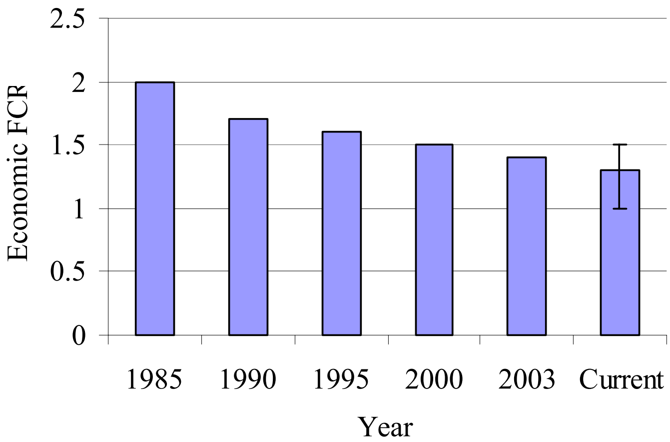

Figure 1.2.3.2. The decrease in the Economic Feed Conversion Rate (FCR) for the salmon industry globally (adapted from Tacon 2006). Economic FCR is calculated as the total feed fed ÷ total live fish produced.

Tacon (2004) estimates use of fishmeal by 2010 will fall from an inclusion level of 25-30% to only 8% inclusion in salmon feeds as a result of increased inclusion of vegetable oils. This would result in the production of 1 tonne of salmon from only 1.3 tonne of wild fish, resulting in a high eco-efficiency of farmed salmon when compared to other forms of aquaculture and land based stock production.

The decrease in dietary fishmeal and dietary protein level has been accompanied by an equivalent increase in dietary lipid levels, increasing from a low of 10% in 1985, 15% in 1990, 25% in 1995, 30% in 2000, to a high of 35-40% in 2005 (Figure 1.4.1).

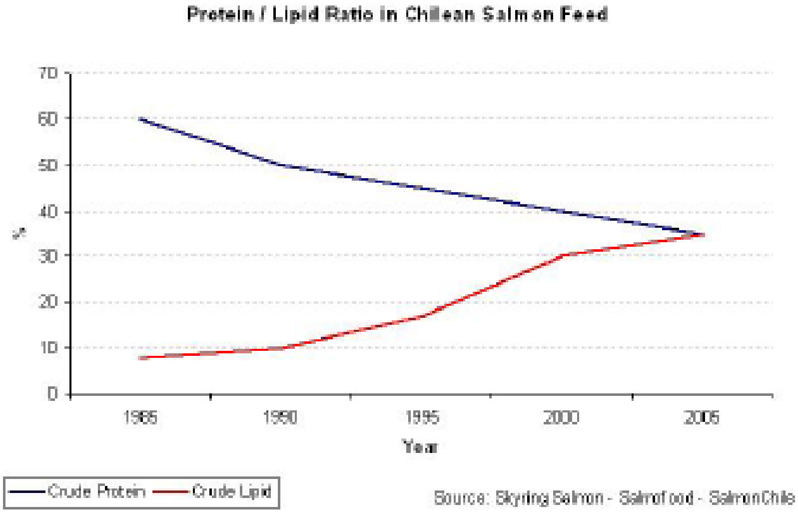

Figure 1.4.1 Reported changes in salmon feed dietary protein and lipid levels from 1985 to the present day (Source: from Larrain et al. 2005).

The rationale behind these changes has been to increase the dietary energy density of the feeds, with a consequent improvement in fish growth and feed conversion efficiency; salmon production cycles in Chile being at least 20-25% shorter today than they were 10 years ago due to the use of higher energy and lower protein feeds (Larrain et al. 2005).

Trends in use of other feed ingredients in salmon feeds

Trends regarding the current dietary replacement of fishmeal and fish oil substitution vary from country to country, depending upon feed ingredient market availability and cost, transportation/importation and processing costs prior to usage, and the intended market where the salmon is to be sold (and the specific requirements and constraints of these markets).

A number of feed ingredients were being considered for use of dietary fishmeal and fish oil replacers within the major salmon producing countries, namely: canola meal, pea meal, soybean meal, canola (rapeseed) oil, maize gluten meal, soybean protein concentrate, feather meal, poultry byproduct meal, poultry oil and the crystalline amino acids lysine and/or methionine; lupin.

Trends in salmon feed manufacturing techniques

The changes observed in the level of fishmeal and fish oil within salmon feeds over the past two decades would not have been possible if it were not for the changes which occurred in feed manufacturing technology over this period (Kearns, 2005).

Initially, in the early eighties salmon feeds consisted essentially of farm-made semi-moist pelleted feeds composed of a blend of minced sardines/low-value feed fish mixed with wheat flour and a vitamin/mineral premix. Although these semi-moist feeds were usually readily consumed by the salmon, their manufacture depended upon a regular daily supply of fresh `top quality' sardines/lower-value fish, with the diets generally exhibiting poor water stability and feed conversion ratios (FCR: total feed fed ÷ total weight gain, typically ranging from 4 to 6). However, between the mid eighties to the early nineties these farm-made feeds were gradually replaced with dry commercially manufactured steam pelleted feeds, characterized by their high protein and low fat (<18-20%) content, and much improved feed efficiency (FCR 1.6-1.8).

From 1993 to the present conventional steam pelleted feeds have been replaced with extruded salmon feeds. Extrusion feed processing has resulted in salmon feeds with improved durability (less fines and wastage), increased carbohydrate and nutrient digestibility (due to the increased starch gelatinization and/or destruction of heat-labile plant anti-nutrients), and with improved physical characteristics (including altered density and adjustable pellet buoyancy/sinking characteristics); the latter in turn has facilitated the addition of higher dietary fat levels (and the consequent formulation of higher energy diets) through spraying or top coating. These modern lower protein and higher lipid (up to 40% by weight) salmon feeds typically yield economic FCRs (total feed input ÷ total live fish output, thus allowing for fish mortality) from 1.3 to under 1 (Larrain et al. 2005). The main reason for the lower FCRs with these extruded feeds has been due to the ability of raising dietary lipid levels, with the consequent increase in dietary energy levels and consequent improved protein and energy nutrient utilization.

Extrusion cooking became the production method of choice due to the advantages these systems offer. It is generally accepted that the major reasons for extruded feeds in the salmon industry is the ability to expand the product so that it accepts the high oil levels to achieve the present growth rates, greatly reduced degradation of the ocean floor under the cages, stronger pellets for the automatic feeders and the ability to use a wider ranges of raw materials for the overall formulation adjustments for new and future possible protein sources (Kearns, 2005). The net result of these continuing improvements in feed formulation and feed manufacture is that over the years fish growth has been steadily increasing, feed conversion ratio has been steadily decreasing, and as a result and more importantly fish production costs have been decreasing (Figure 1.8.1).

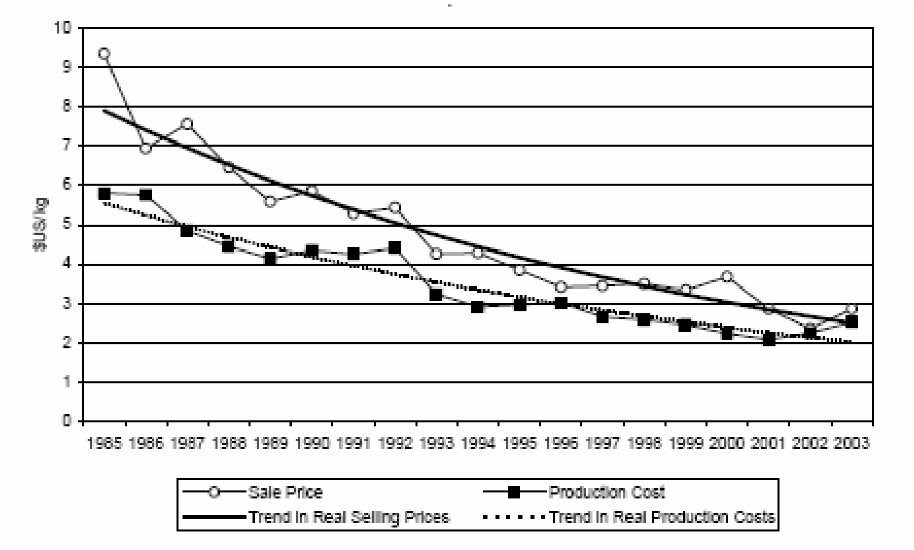

Figure 1.8.1. Farmed Atlantic Salmon: real production costs and selling prices (Source: LMC International Ltd).

International Government Management Controls for Reduction Fisheries (adopted from FIN 2004)

This section lists some of the steps that are taken by national governments to strictly monitor and control commercial fishing in Peru and Chile.

Peru

- • A major development in Peru is that all fishing boats operating outside the 5 mile limit are now fitted with a satellite tracking system which allows the government to monitor the position of all boats at any given time.
- • The Peruvian government imposes closed fishing seasons, closed entry of new fishing boats, and vessel licenses to fish within the 200 mile limit.
- • Limits on the minimum size of fish that can be landed with local short term fishing closures if the level of small fish exceed the number allowed.
- • Fishing stops during February and March to protect the growth of anchovy and sardine juveniles.
- • A fishing ban from August to October to protect the spawning stock.
- • To assess the environmental status of fish stocks (mainly anchovy) IMARPE launched a hydro-acoustic evaluation of pelagic resources along the entire Peruvian coastline in February 2002.

Chile

- • The Chilean Government undertakes regular monitoring surveys to establish the state of the fishery resources, and uses the results of these surveys to set the control measures required to protect the stocks.
- • The Chilean Government has introduced legislation to establish a maximum annual total catch limit for each species declared in full exploitation for each owner of a boat or group of boat owners.
- • Closed seasons for anchovy and sardine are set on an annual basis to protect the spawning stocks between August and September of each year in the northern part of the country. Closed seasons are also imposed during December to mid January to protect the recruitment process of anchovy.
- • In the central-southern part of the country closed seasons are set for anchovy and sardine to protect the spawning period (usually July and August) and also from mid-December to mid-January.
- • For jack mackerel several fishing bans have been imposed during the year to protect small-sized fish. Although minimum landing sizes are applied, these measures reinforce controls to protect stock recruitment.
- • All fishing boats are fitted with a Satellite Tracking System to assure that boats do not operate outside non-prohibited areas (such as designated areas of recovery) or the zone reserved for small artisanal fisheries (first five miles offshore).

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APPENDIX 1.2.4: MEASURES TO ENCOURAGE THE UPTAKE OF CLEANER OUTBOARD MOTORS.

Small engines, particularly conventional two-stroke engines used in applications such as marine outboard motors and personal watercrafts (PWC) are high polluters relative to their engine size and usage[1]. These small engines emit volatile organic compounds (VOCs) which contribute to ozone (photochemical smog) formation in summer. They also emit particles, carbon monoxide and a range of air toxics such as benzene.

There are four types of spark-ignition engines used in outboard motors and personal watercraft:

- two-stroke with carburettor (2c)
- two-stroke with fuel injection (2i)
- four-stroke with carburettor (4c)
- four-stroke with fuel injection (4i)

Two-stroke carburettor engines are inherently more polluting than the other three types. This is due to their inability to completely separate the inlet gases from the exhaust gases, resulting in up to 30% of the fuel being left unburnt, and the need to add oil to the fuel to lubricate the engine (four-stroke engines have separate reservoirs for fuel and oil). However, two-stroke carburettor engines typically weigh less than a four-stroke engine of the same power and this tends to make them attractive for smaller outboards. They also tend to have fewer components and are generally cheaper to purchase than four-stroke motors.

Direct fuel injection, where fuel is injected directly into the combustion chamber, overcomes the unburnt fuel problem and some two-stroke outboard engines are available in Australia that meets the stringent regulated exhaust emission limits that apply in the USA. It is therefore important to distinguish between carburettor and fuel injected two-stroke engines when considering environmental performance. In addition, fuel injected models can be divided into direct injection and conventional fuel injection, where the fuel is added to the intake air supply. Although new technologies are available, or are under development, to improve the environmental performance of two-stroke carburettor engines, few marine engines appear in Australia to use this technology at present.

Carburettor and fuel-injected four-stroke outboard engines are available in Australia which also meet USA regulated emission limits. Four-stroke engines are generally quieter, more fuel efficient, have separate reservoirs for fuel and oil, are less polluting and have a longer product life than conventional two-stroke engines. Furthermore, four-stroke and fuel-injected two-stroke outboard motors are promoted as having better low speed performance than two-stroke carburettor motors.

In 2002, Environment Canada's Environmental Technology Centre tested outboard engine exhaust for total hydrocarbons (or volatile organic compounds-VOCs), nitrogen oxides, carbon monoxide, carbon dioxide, oil and grease, and BTEX

[1] Outboard engines and personal watercraft covered in this report are engines up 186kW and 138KW respectively.

(benzene, toluene, ethylbenzene, xylenes - carcinogenic or mutagenic aromatic hydrocarbons formed through the combustion process). The results showed that two-stroke outboards produce 12 times as much BTEX as four-strokes, and five times as much oil and grease. Further comparisons of exhaust emissions from a light-duty van, a 9.9 horsepower two-stroke outboard and a 9.9 horsepower four-stroke outboard showed that the two-stroke produced 50 per cent more carbon monoxide than the four-stroke and nearly 60 times more than the van. The two-stroke also emitted 15 times more unburned hydrocarbons than the four-stroke, and nearly 125 times more than the van. If similar testing were to be undertaken in Australia it is likely the results would be comparable, but because of differing fuel formulations, not exactly the same.

Further studies have revealed that most hydrocarbons discharged onto the water surface as petrol evaporate to air within six hours, further adding to the air pollution load. However, heavier hydrocarbons, such as oil and grease, remain on the surface for a longer period of time and may affect the health of microscopic organisms (Environment Canada, 2002).

The NSW Metropolitan Air Quality Study (MAQS, 1992) indicated that outboard motors and personal watercraft account for around 11% of the total anthropogenic volatile organic compounds (VOCs) in the Sydney Greater Metropolitan Region (which includes the Illawarra, Sydney and the lower Hunter) during a summer time weekend. Outboards and jet skis (personal watercraft) are estimated to be responsible for over 5% of benzene emissions nationally.

Because of the combustion of oil, these engines also emit high levels of particulate matter. Although small engines only contribute a small amount to total particle emissions, the rate of particle release compared to other engines can be very high.

In Summary
Carburettor two-stroke engines used in outboard engines and personal watercraft emit proportionally more volatile organic compounds (VOCs) and other air pollutants than the other three types of engines sold on the Australian market. Direct fuel injection overcomes the problem of unburnt fuel. There are some fuel injection two-stroke outboard engines available in Australia that meet the stringent exhaust emission limits that apply in the USA (either those of the Californian Air Resources Board-CARB or of the United States the Environmental Protection Agency (USEPA)). Four-stroke engines, either carburettor or fuel injected, are generally quieter, more fuel efficient, have separate reservoirs for fuel and oil, are less polluting and have a longer product life compared to conventional two-stroke products.

At present there are no regulations or standards in Australia that limit air pollutant emissions from outboard engines and personal watercraft (two- and four-stroke). However it is estimated that 53 percent of new outboard motors and most personal watercraft now sold in Australia comply with a USA emission standards. Of outboard motors sold in Australia, only 6% of 2-stroke carburettor type outboard motors are likely to comply with any standard in the world, where 88% of 2-stroke fuel injected, 96% of 4-stroke carburettor type and 100% of 4-stroke fuel injected outboard motors comply with either US, Japanese or European standards (NSW EPA 2005).

Reference

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APPENDIX 2.2.2: CRC PROJECT 4.1 DEVELOPMENT OF NOVEL METHODS FOR THE ASSESSMENT OF SEDIMENT CONDITION AND DETERMINATION OF MANAGEMENT PROTOCOLS FOR SUSTAINABLE FINFISH CAGE AQUACULTURE OPERATIONS.

1. OBJECTIVES:

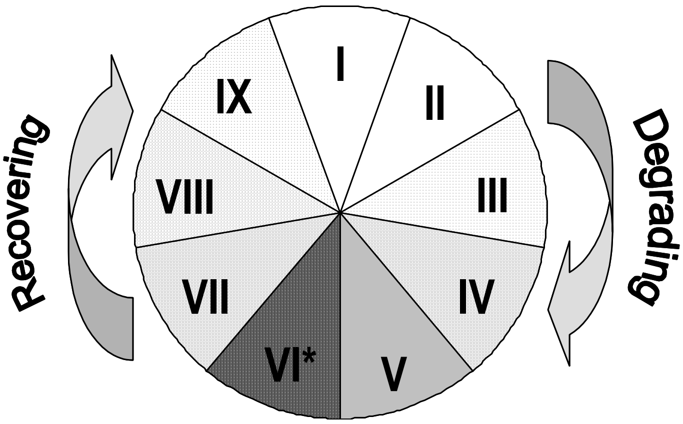
- To assess the potential for progressive degeneration of sediments in association with cage aquaculture operations.
- To adapt and develop novel combinations of monitoring techniques (identified by TAFI and CSIRO) to facilitate evaluation of sediment degradation associated with ongoing marine cage aquaculture operations.
- To incorporate these techniques into farm management protocols as tools for the evaluation and management of sediment condition in order to promote sustainable aquaculture production.

2. OUTCOMES ACHIEVED TO DATE

- • This research showed that although finfish aquaculture significantly affected sediments, under certain production scenarios (dependent on stocking level and baseline environmental condition) the sediments recovered after 3 months fallowing to a degree that enabled cages to be restocked. However, under intensive production regimes, the present results indicated that there was potential for progressive sediment degeneration, consequently environmental status should be considered as part of production planning.
- • A clear relationship between farm management practices and level of impact was established and a series of 9 distinct stages of sediment condition were characterised. Several field based techniques have been recommended which will enable farmers to easily classify sediment condition. With this information farmers will be able to gauge the environmental status of the sediments within their lease and make appropriate management decisions.
- • The value of these research findings has been acknowledged by stakeholders (industry and government) through their support for the development of a field-guide, data analysis package and associated training workshops; ensuring that the research outputs are incorporated into management practices as quickly as possible.

3 FINDINGS & RECOMMENDATIONS

The results indicate that at both sites there were clear spatial and temporal impact gradients. Initially, unimpacted conditions at each of the sites were biologically and chemically distinct, but as organic enrichment of the sediment increased the chemistry and ecology of the two systems became more similar. Although there was significant recovery at the end of the study, neither site recovered completely to pre-farming/reference conditions (i.e. some measures always differed). However, at both sites it was found that the sediment recovery was likely to be sufficient to enable re-use of the site. Although the potential for progressive deterioration of sediments to occur was identified at both sites, the duration of the project was insufficient to establish this conclusively. The rate of recovery differed both between sites and with differing stocking intensities, but clear impact levels were discernible and comparable between the sites. Benthic infaunal evaluation was the most useful indicator of both degradation and recovery and impact was classified for the sediment conditions at each of the study sites according to the benthic infaunal community changes. Nine stages were defined, encompassing both degradation and, importantly, recovery phases (Fig. 1). Potential monitoring techniques and differing farming intensities were subsequently related to this scale.



* Indicates conditions not observed in this study
Suggest stage IX is sufficiently recovered for restocking

STAGE – Category		STAGE – Description	
I	- Unimpacted	I	- No evidence of farm impact
II	- Minor Effects	II	- Slight infaunal & community change observed
III	- Moderate Effects	III	- Clear change in infauna & chemistry
IV	- Major Effects (1)	IV	- Major change in infauna & chemistry
V	- Major Effects (2)	V	- Bacterial mats evident, outgassing on disturbance
VI*	- Severe Effects	VI*	- Anoxic/ abiotic, spontaneous outgassing
VII	- Major Effects	VII	- Monospecific fauna, major chemistry effects
VIII	- Moderate Effects	VIII	- Fauna recovering, chemistry still clearly effected
IX	- Minor Effects	IX	- Largely recovered, although slight faunal/ chemical effects still apparent

Fig. 1. Impact and recovery stages.

Table 1. Summary of features characterising impact/recovery stages at the exposed/sand site based on key features for each of the techniques deemed suitable for farm based assessment. (NB. Key Biotic Indicators row: organisms identified with * are indicative in combination rather than individually)**.**

Impact Stage	I	II	III	IV	V	VII	VIII	IX
Effect Category	**No evidence of impact**	**Minor effects (Degrading)**	**Moderate effects (Degrading)**	**Major effects 1. (Degrading)**	**Major effects 2. (Degrading)**	**Major effects (Recovering)**	**Moderate effects (Recovering)**	**Minor effects (Recovering)**
Description		Small scale community change; Sediment chemistry unaffected or with only very minor effects	Significant community change; Sediment chemistry affected	Major community change; Monospecific dominance; major sediment chemistry changes	As in Stage IV; Beggiatoa/ outgassing on disturbance	Fauna returns to monospecific dominance; major sediment chemistry effects	Fauna re-establishing (zone of enhancement); Sediment chemistry still affected	Community largely recovered; Sediment chemistry recovered
Generalised Benthic Categories	Unimpacted indicator species present	Larger, long lived species & pristine indicators absent. Diversity may be greater than pristine (zone of enhancement)	Rapid change in community mix; deposit feeding polychaetes/ opportunists dominate. Filter/suspension feeders absent.	Opportunists (esp. Capitellids) characterise community	Infaunal opportunists (esp Capitellids) dominate. Patchy beggiatoa/ outgassing may be evident.	Opportunists (Capitellids) still dominate but no.s dropping & other species colonising.	Transitional species prevalent - notable increase in epibenthic opportunists.	Diversification of community but absence of climax/long lived species.
Key Biotic Indicators	*Apseudes, Ampelisca*	**Lyssianassidae, *Euphilomedes, *Polydora cf socialis,* *Phoxocephalidae	*Capitella* (dominant); *Neanthes, *Corophium, *Polydora cf socialis, *Tethygenia, *Cumacea* , *Phoxocephalidae)	*Capitella* (dominant); **Neanthes,* *Phoxocephalidae, **Dimorphostylis*	*Capitella* (greatly dominant); **Neanthes,* *Phoxocephalidae	*Capitella* (dominant), **Neanthes, *Corophium, *Nebalia* , *Phoxocephalidae	*Capitella* (lower no's), **Euphilomedes, *Polydora cf socialis, *Euchone*	Mix of species with increasing crustacea and decreasing annelids. **Apseudes, *Polydora cf socialis, *Euphilomedes, *Nephtys*
Shannon Index	>2	>2	>1<2; No. spp. >50% of ref	<1; No. spp. <50% of ref		<1; No. spp. <50% of ref	>1<2; No. spp. >50% of ref	>2
Total Abundance	Same as ref		x3 ref	x6-9 ref		x6-9 ref	x3 ref	
Redox Potential (mV)	>100mV	0-100mV (or >50% ref)	0-100mV (or >50% ref)	<0mV		<0mV	0-100mV (or >50% ref)	0-100mV (or >50% ref)
Sulphide Conc. (uM)	Below detection	Below detection	>50uM	>100uM		>100uM	>50uM	Below detection
Benthic Photo Score	Pos've	0 to -3	-4 to -3	<-4		<-4	-4 to -3	0 to -3
Video Score	>5	2.5-5	<2.5	Neg've		Neg've	<2.5	2.5-5
Video Features	Algae, Echiurans/ Sipunculans	Prevalence of burrow/ faunal track/ tubes; Echiurans/ Sipunculans	Sea slugs (Pleurobranchia)	Any evidence of Beggiatoa, Gas bubbles, Black sediments;		Any evidence of Beggiatoa, Gas bubbles, Black sediments;	Sea slugs (Pleurobranchia)	Point at which sea slugs are displaced (temporal)

Table 2. Summary of features characterising impact/recovery stages at the sheltered/mud site based on key features for each of the techniques deemed suitable for farm based assessment. (NB. Key Biotic Indicators row: organisms identified with * are indicative in combination rather than individually)**.**

Impact Stage	I	II	III	IV	V	VII	VIII	IX
Effect Category	**No evidence of impact**	**Minor effects**	**Moderate effects**	**Major effects**	**Major effects**	**Major effects**	**Moderate effects**	**Minor effects**
Description		Small scale community change; Sediment chemistry unaffected or with only very minor effects	Significant community change; Sediment chemistry affected	Major community change; Monospecific dominance; major sediment chemistry changes	As in Stage IV; Beggiatoa/ outgassing on disturbance	Fauna returns to monospecific dominance; major sediment chemistry effects	Fauna re-establishing (zone of enhancement); Sediment chemistry still affected	Community largely recovered; Sediment chemistry still slightly affected
Generalised Benthic Categories	Unimpacted indicator species present	Larger, long lived species & unimpacted indicators absent. Diversity may increase (zone of enhancement)	Rapid change in community mix; deposit feeding polychaetes/ opportunists dominate. Filter/suspension feeders absent.	Opportunists (esp. Capitellids) characterise community	Infaunal opportunists (esp Capitellids) dominate. Patchy beggiatoa/ outgassing may be evident.	Opportunists (Capitellids) still dominate but no.s dropping & other species colonising.	Transitional species prevalent - notable increase in epibenthic opportunists.	Diversification of community but absence of climax/long lived species.
Key Biotic Indicators	*Amphiura*, *Lysilla*, **Mediomastus*, **Nucula*, **Thyasira*	**Nassarius*, **Corbula*, **Echinocardium*, *Phoxocephalidae, **Nemertea*	*Capitella*, *Nebalia* (dominant); **Corbula*, **Nassarius,* Neanthes*	*Capitella*, *Nebalia* (dominant); **Corbula*, **Nassarius*, **Neanthes*	*Capitella*, *Nebalia* (extremely dominant)	*Capitella*, *Nebalia* (abundant); **Nassarius*, **Neanthes*, **Corbula*, *Phoxocephalidae	*Capitella*, *Nebalia* (decreasing abundance); **Nassarius*, **Echinocardium*, *Phoxocephalidae	*Nassarius*, *Corbula*, **Neanthes*, **Echinocardium*, *Phoxocephalidae, **Nemertea*
Shannon Index	>2	>2	>1<2; No. spp >50% of ref	<1; No. spp. <50% of ref		<1; No. spp. <50% of ref	>1<2; No. spp >50% of ref	>2
Total Abundance	Same as ref		x10 ref	x20 ref		x20 ref	x10 ref	
Redox Potential (mV)	>100mV	0-100mV (or >50% ref)	0-100mV (or >50% ref)	<0mV		<0mV	0-100mV (or >50% ref)	0-100mV (or >50% ref)
Sulphide Conc. (uM)	Below detection	Below detection	>50uM	>100uM		>100uM	>50uM	Below detection
Photo Score	Pos've	0 to -2.5	-2.5 to -4	<-4		-2.5 to -4	0 to -2.5	Pos've
Video Score	>5	2.5-5	<2.5	Neg've		Neg've	<2.5	2.5-5
Video Features	Brittlestars	Prevalence of burrow/faunal track/tubes; Brittlestars, squat lobsters, dog whelk	Squat lobsters, dog whelk	Continuous patches/mats of Beggiatoa, Gas bubbles, Black sediments;		Continuous patches/mats of Beggiatoa, Gas bubbles, Black sediments;	Squat lobsters, dog whelk	Prevalence of burrow/faunal track/tubes; Brittlestars, squat lobsters, dog whelk

4. SUMMARY OF KEY FINDINGS AND RECOMMENDATIONS

This study had three principal objectives:

1. To assess the potential for progressive degeneration of sediments in association with cage aquaculture operations.
The results from the first cycle suggested that at the end of the initial fallow period conditions at both farms, but particularly at the sheltered/mud site, had deteriorated compared to those pre-farming. Whilst this did not conclusively indicate that progressive deterioration had occurred, it was of some concern as it suggested that there was the potential for degeneration and certainly warranted further study. Unfortunately, we were unable to evaluate whether progressive deterioration would have occurred under the defined production scenario as the stocking and feed regimes at both sites were markedly reduced in the second cycle, so that it was no longer appropriate to compare the two cycles.

The changes to the stocking/feed input in the second cycle did provide some useful information, suggesting that reduction in the farming intensity could result in marked improvement in both the rate and degree of recovery. This in turn suggests that relatively minor farm management adjustments can produce substantial environmental improvements.

To effectively evaluate whether progressive deterioration is occurring it is necessary to determine whether the conditions post-farming differ from what existed pre-farming. In this study the two farm sites had very different pre-farming community structures. Consequently, in order to be able to determine the potential for progressive deterioration, it is essential to establish baseline environmental conditions.

2. To adapt and develop novel combinations of monitoring techniques to facilitate evaluation of sediment degradation associated with ongoing marine cage aquaculture operations.
Many approaches for farm-based monitoring have been assessed as part of this project. Benthic infaunal assessment was used as the standard by which the sensitivity, reliability and suitability of techniques was evaluated. Our findings suggest that visual assessment techniques are probably the most useful approach for farm-based monitoring.

We have made the visual assessment more objective by defining indices, based on easily identifiable visual criteria, which relate to specific stages of impact (Fig. 3). The proposed visual approaches can determine different levels of impact and therefore can be used to monitor both degradation and recovery. Discussions with industry stakeholders, environmental consultants and government regulators suggest that these indices would apply equally well in environments other than those included in the study. Consequently we are confident that with only minor and relatively simple modifications they would be applicable to the broader farming community.

Key faunal indicators have also been identified, and these complement the visual techniques. The indicator organisms are easy to distinguish and provide additional reliable ecological information on the sediment condition. In conjunction with the quantitative visual analysis information, this ecological information will enable farmers to obtain an understanding of their sediment condition that they could only previously have achieved with the assistance of highly trained scientific professionals.

3. To incorporate these techniques into farm management protocols as tools for the evaluation and management of sediment condition in order to maximise sustainable aquaculture production.

Although the methods described in this study could be used for a variety of monitoring purposes, the proposed protocol was developed specifically in relation to on-farm monitoring, and was not intended for regulatory or compliance purposes. The purpose of the proposed monitoring programme is to provide farmers with sufficient information to enable them to incorporate an environmental condition factor into their current farm management strategies. To this end this study has defined a range of impact stages (Fig. 1) that categorise the sediment condition, which are applicable to a range of environments, and which can be easily established by farmers using the proposed techniques.

Accordingly, it is recommended that video assessment be adopted as the main approach for farm based monitoring. Video footage should be obtained relatively frequently (at least monthly but preferably fortnightly) from cages within the farm, towards the end of the stocking cycle and over the fallow period, and this should be compared with footage from reference positions taken at the same times. Only a short (1-2 minute) video drop is necessary. Assessment can be done in the field or post-processed. If there is any uncertainty as to the classification resulting from the visual assessment the findings could be validated with infaunal grabs and subsequent evaluation of key species. Other approaches (eg. redox/sulphide, lipid analysis, microbial status) can be undertaken if a greater sensitivity or understanding of the system processes is required.

In order to ensure that the characterising features for the video assessment are relevant to a particular site it is essential to have baseline information on the benthic community structure and sediment conditions for that site. It is also recommended that infaunal grab samples be collected from representative reference and farm locations at regular intervals (every 2-3 years) to calibrate key indicators and identify any significant community changes. These samples would be quick to obtain, would not require any complex processing, their principal function being to identify and validate the key/dominant species. Photographic records should be taken of these samples to establish a baseline environmental archive, providing a pictorial record of the community structure. This can then be compared with subsequent evaluations (i.e. to identify any major community shifts, to validate indicator identifications and to validate categorisation of impact levels).

APPENDIX 2.2.3: THREATENED, MARINE OR MIGRATORY BIRDS ASSOCIATED WITH SALMONID GROWING REGIONS.

Table 2.2.3. Threatened, migratory and marine birds as classified by the EPBC act 1999. Endangered (E), vulnerable (V) and rare (R) species as listed by Bryant and Jackson (1999) listed to occur in marine farming regions. P indicates species protected under the LMRMA, N indicates not listed as E, V or R but considered of high conservation value.

Common name	Scientific name	Listed Marine Species	Listed Migratory Bird	Listed Threatened Species		Region				
				EPBCA/	TSPA	1.Maquarie Harbour	2. Tamar	3. Tasman	4. Channel	5. Huon/Esperance
Arctic jaeger	*Stercorarius parasiticus*	X	X						X	X
Bar-tailed godwit	*Limosa lapponica*	X	X				X		X	
Caspian tern	*Sterna caspia*	X	X				X		X	X
Common greenshank	*Tringa nebularia*		X				X		X	
Crested tern	*Sterna bergii*	X	X			X	X	X	X	X
Curlew sandpiper	*Calidris ferruginea*	X	X						X	
Double-banded plover	*Charadrius bicinctus*	X	X				X			X
Eastern Curlew	*Numenius madagascariensis*	X	X				X		X	
Fairy tern	*Sterna nereis*				R		X		X	
Forty spotted pardalote	*Pardalotus quadragintus*			E	E				X	X
Great crested grebe	*Podiceps cristatus*				R		X			
Grey Goshawk	*Accipiter novaehollandiae*		X		R	X	X	X	X	X
Hooded plover	*Thinornis rubricollis*	X		V		X	X	X	X	
Latham's snipe	*Gallinago hardwickii*	X	X				X		X	X
Little penguin	*Eudyptula minor*	X			N	X		X	X	X
Orange-bellied parrot	*Neophema chrysogaster*	X				X				
Pacific golden plover	*Pluvialis fulva*	X	X				X			
Red-capped plover	*Charadrius reficapillus*	X				X	X		X	
Red-necked stint	*Calidris ruficollis*	X	X			X	X	X	X	X
Ruddy turnstone	*Arenaria interpres*	X	X				X		X	X
Sharp-tailed sandpiper	*Calidris acuminata*	X	X				X			
Short-tailed shearwater	*Puffinus tenuirostris*	X	X		N	X		X	X	X
Shy albatross	*Thalassarche cauta*	X		V	V			X		X
Swift parrot	*Lathamus discolor*	X		E	V		X		X	X
Whimbrel	*Numenius phaeopus*	X	X				X			
White/Great egret	*Ardea alba*	X	X				X		X	
Wedge tailed eagle	*Aquila audax fleayi*			E	V	X	X	X	X	X
White-bellied sea-eagle	*Haliaeetus leucogaster*	X			V	X	X	X	X	X
White fronted tern	*Sterna striata*	X			R			X	X	

APPENDIX 2.2.4: NOTES ON THREATENED, ENDANGERED AND PROTECTED SPECIES:

Many salmon farming leases are located in areas rich in species diversity, which may contain threatened, endangered or protected species that are closely associated with the marine environment. A number of species in Tasmania have been listed as rare, endangered, threatened or vulnerable under the *Tasmanian Species Protection Act* 1995 (TSPA) and the *Environmental Protection and Biodiversity Conservation Act* 1999 (EPBCA). A few of these species are also protected under *the Living Marine Resources Management Act* 1995 (LMRMA). These species are listed in Table 2.2.4.

The threatened or endangered terrestrial animals that occur in finfish farming regions have specific habitats and would have been identified through the marine farm planning process (see Section 1.2.6). The key threat to many vulnerable insects is the use of chemicals and pesticides, which are not widely used in the industry, and the loss of native vegetation. The industry maintains as part of its environmental management to:

- Maintain native vegetation where possible on site locations adjacent to marine leases
- Avoid building drains or levees that alter drainage patterns or may direct fluids and waste onto sensitive areas such as saltmarsh
- Restrict vehicle movements to confined tracks to avoid habitat degradation and reduce the introduction of weeds and root-rot infection
- Fence areas to maintain habitat integrity if necessary
- Control the use of chemicals
- Control the presence of cats and dogs to reduce predation

DPIWE (2005) described four potential mechanisms where marine farming activities may impact on threatened species;

- Entanglement - marine farming equipment such as predator nets, bird netting and mooring lines have the potential to entangle marine species, particularly cetaceans, seals and birds. This may result in injury or death.
- Habitat loss - the deployment of marine farming equipment within a lease area may make habitat unsuitable for some marine species. Some examples of direct impact on habitat may include the deployment of mooring blocks (benthic species); shading from finfish pens (algae); rows of pens restricting access (pelagic species); or smothering from solid waste (benthic species);
- Indirect effects - noise, soluble wastes and vessel movements all have the potential to impact on threatened species both within and outside of lease areas. However, in most instances, indirect effects are difficult to quantify or attribute to a single source such as marine farming activity; and
- Behavioural change - the presence of marine farms may cause some threatened species to alter their behaviour, particularly foraging strategies in species such as seals and birds (*eg.* raptors) (see Section 1.2.5: Behavioural Changes and Food Chain Impacts).

Key issues to ensure that threatened and endangered marine species are maintained include:

- No habitat modification through siltation affecting the substrate, removal of rocks or substrate for the shoreline, or damming preventing movement of water upstream
- Awareness of water quality to maintain habitat
- Awareness of introduced marine pests including the New Zealand seastar (*Patiriella regularis*) and Northern Pacific seastar (*Asterias amurensis*) which may compete with and displace native threatened marine species.
- Not disturbing or removing any threatened or endangered marine species.

Gazameda gunnii (Gunns Screwshell), a Turritellid Gastropod, has been listed as vulnerable under the TSPA 1995. It has a wide habitat range and a very patchy distribution in State waters. Sampling for this species involves obtaining benthic grab samples, which are then analysed for the presence/absence of any specimens. Sampling is undertaken as part of the zone assessment process, or where relevant as a component of the baseline survey. The sampling intensity is governed by the extent and nature of the proposed marine farming activity. If sampling reveals the presence of any live specimens, then additional sampling is required to determine the extent of any population. Appropriate management of the site is then determined in consultation with the proponent and the Threatened Species Unit/Marine Resources DPIWE.

Further information on threatened and endangered species in Tasmania can be found at www.dpiwe.tas.gov.au/inter.nsf/Attachments/RLIG-5425ZR/$FILE/threatfauna.pdf or : http://www.dpiwe.tas.gov.au/inter.nsf/WebPages/SJON-58E2VD?open#ThreatenedSpeciesLis

References

Aquenel (2000) Sorell Causeway Bridge Replacement Marine Biota Survey, August 2000. In Department of Infrastructure, Energy and Resources, Tasman Highway, Sorell Causeway Bridge and Approaches, Development Proposal and Environmental Management Plan.

Bryant S, Jackson J (1999). Tasmania's Threatened Species Handbook

DPIWE (2005). Environmental impact statement to accompany the draft Macquarie Harbour Marine Farming Development Plan: October 2005. Department of Primary Industries, Water and Environment. Tasmania. 116pp.

Table 2.2.4. Endangered (E), vulnerable (V) and rare (R) species as listed by Bryant and Jackson (1999) listed to occur in regions where salmonid farming occurs. P indicates species protected under the LMRMA, N indicates not listed as E, V or R but considered of high conservation value.

Common name	Scientific name	Region					
		Status	1. Macquarie	2. Tamar	3. Tasman	4. Channel	5. Huon/Esperance
Birds							
Azure kingfisher	*Alcedo azurea*	E	+				
Fairy tern	*Sterna nereis*	R	+		+		
Forty spotted pardalote	*Pardalotus quadragintus*	E			+	+	+
Grey Goshawk	*Accipiter novohollandiae*	R	+		+	+	+
Hooded plover	*Thinornos rubricollis*	V	+		+	+	+
Little penguin	*Eudyptula minor*	N	+			+	+
Little tern	*Sterna albifrons sinensis*	E			+	+	
Short-tailed shearwater	*Puffinus tenuirostris*	N	+		+	+	+
Swift parrot	*Lathamus discolor*	V			+	+	+
Wedge tailed eagle	*Aquila audax fleayi*	V	+	+	+	+	
White-bellied sea-eagle	*Haliaeetuseetus leucogaster*	N	+	+	+	+	+
Terrestrial Invertebrates							
Burgundy snail	*Helicarion rubicundus*	R			+		
Broad-striped ghost moth	*Fraus latistria*	R				+	
Broadtoothed stag beetle	*Lissotes latidens*	E			+		
Caddisfly	*Orphninotrichia maculta*				+		
Chaostola skipper	*Antipodia chaostola*	E				+	
Mt Mangana stag beetle	*Lissotes menalcas*	V			+	+	+
Pencil pine moth							+
Marine animals							
Australian grayling	*Prototroctes maraena*	V		+	+	+	+
Live bearing seastar	*Patririella vivipara*	E			+	+	+
Mugean skate	*Raja sp.*	E	+				
Seastar	*Smilasterias tasmaniae*	R				+	
Gunn's screw shell	*Gazameda gunii*	V			+		
Spotted handfish (P)	*Brachionichthys hirsutus*	E			+	+	
White shark (P)	*Charcharodon charcharias*	V			+	+	+

Common name	Scientific name	Region					
		Status	1. Macquarie	2. Tamar	3. Tasman	4. Channel	5. Huon/Esperance
Marine Mammals							
Blue whale	*Balaenoptera musculus*	E			+	+	+
Humpback whale	*Megaptera novaengliae*	E		+	+	+	+
New Zealand fur seal	*Arctocephalus australis*	R	+	+	+	+	+
Southern elephant seal	*Mirounga leonina*	V			+		
Southern right whale	*Eubalaeba australis*	E	+	+	+	+	+
Subantarctic fur seal	*Arctocephalus tropicaliss*	E			+		
Terrestrial mammals							
Eastern barred bandicoot	*Perameles gunnii gunnii*	V		+	+	+	+
New Holland mouse	*Pseudomys novaehollandiae*	R		+			
Spotted-tail quoll	*Dasyurus maculatus*	V	+	+	+	+	+
Reptiles							
Leatherback turtle	*Dermochelys coriacea*	V	+		+	+	
Green and gold frog	*Litoria raniformis*	V		+	+	+	
Marine algae							
Brown alga	*Cystoseira trinodis*	R					

APPENDIX 2.2.5: PROTECTED AREAS: WORLD HERITAGE, RAMSAR, MARINE PARKS AND SENSITIVE HABITATS.

There are finfish marine farms are located in regions associated with environmental protect values such as the Southwest Conservation area and other marine protected areas. These areas are listed in Table 2.2.5.

Table 2.2.5. Protected habitats under the *EPBCA* 1999 adjacent to marine farming areas

Region (MFDP) Zone (MFZ)	Conservation area	Status	Significance
Macquarie			
1, 2, 3, 4, 7, 8, 9, 10,	Southwest Conservation Area	World Heritage Area. Environmental protection	Undisturbed flora and fauna listed as rare, endangered or endemic. Aboriginal relics. Glaciated landscapes
Tamar			
2	Tamar Estuary	DPIW	Shark Nursery Area
2	Four Mile Creek Wildlife Sanctuary, East Tamar	PWS	
Tasman			
14B, 14C	Coastal Protection and Public Open Space	Preservation	
15A, 15B	State Forest	Preservation	Multi use forest
Channel			
	Tinderbox Marine Reserve	DPIW	Marine diversity and ecology
2A	Conningham State Recreation Area		Public recreation
23	Green Island Reserve	DPIW	Pacific Gull breeding site
Huon			
	Tinderbox Marine Reserve	DPIW	Marine diversity and ecology
	Ninepin Point Marine Reserve	DPIW	Marine diversity and ecology
9a, 9b	Port Cygnet Conservation Area	SCA	Water birds, Igneous Rocks
17, 13	Hope Island Nature Recreation Area	SCA	Historic
8, 10, 11	Surveyors Bay Conservation Area		Natural Values
	Randall's Bay Conservation Area		Natural Values

APPENDIX 2.2.6: THE DEVELOPMENT AND ADOPTION OF BEST PRACTICE MEASURES TO MINIMISE THE INTRODUCTION OR TRANSLOCATION OF INVASIVE MARINE SPECIES (MARINE PESTS) THROUGH BIOFOULING.

AQUACULTURE AS A VECTOR

Goal

The goal is to minimise the risk of translocation of invasive marine species through the activities of aquaculture.

Background

Aquaculture industries have long recognised the threat that invasive marine species (be they endemic, naturalised or new incursions) pose to environmental, economic and social values, as aquaculture often becomes the first victim of those incursions.
Past ad hoc approaches to controlling the translocation of invasive marine species include voluntary management and translocation practices implemented by some sectors of industry, government imposition of management controls, expensive monitoring programs – e.g. for toxic dinoflagellates, and bio-toxin monitoring for food safety.

It is in this light that the aquaculture industry welcomes the Australian Government and State government authorities' implementation of a national strategy for introduced marine pest management, to minimise the risks posed to environmental, economic and social values. All parties also recognise that natural recruitment as well as vectors such as storms, currents and the effects of climate change will contribute to the expansion of marine pest populations and range.

Principles

The development and adoption of any management system should be based on a set of principles that take into consideration the needs and circumstances of different geographic regions, the biological and physical requirements of the cultured species, be outcome focused and be supported by implementation Guidelines.

1. Management options should be cost-effective, practicable, environmentally responsible and safe.
2. When appropriate, Government agencies should provide waterproof identification guides for all species of concern.
3. Governments should identify/record areas where the listed species already exist.
4. Industry should report existing/new incursions of listed species.
5. Industry should, prior to dispatch for on-growing in other areas, and on receival prior to relaying, visually inspect the product for the presence and removal of marine species of concern.
6. Industry should clean or air dry cultured species housing equipment before transfer to areas free of species of concern.
7. Industry will remove and dispose of species of concern in an appropriate manner.
8. Management options must not endanger the life, quality or safe food status of the cultured species.

Table 1. Distribution of introduced marine species in Tasmanian salmonid growing regions (sourced from the Marine Farming Development Plans). (*) indicates those species regarded as invasive marine species on the Australian Ballast Water Management Advisory Committee (ABWMAC) target species list (which is under review), (P) indicates information is not comprehensive.

Common name	Scientific name	Region: 1.Macquarie Harbour	2. Tamar	3. Tasman	4. Channel	5. Huon/Esperance
Bivalves						
Asian theora clam	*Theora fragilis*				X	
Bag mussel*	*Musculista senhousia*					
Bivalve	*Theora ubrica*					X
European clam*	*Varicorbula gibba*				X	X
New Zealand bivalve	*Venerupis largillierti*				X	
Pacific Oyster	*Crassostrea gigas*		X	X	X	X
Echinoderms						
New Zealand seastar	*Patiriella regularis*				X	
Northern Pacific seastar*	*Asterias amurensis*				X	X
Rough seastar	*Astrostole scabra*				X	
Gastropods (Univalves)						
New Zealand screwshell	*Maoricolpus roseus*				X	X
Crustaceans						
European shore crab*	*Carcinus maenas*				X	X
New Zealand cancer crab	*Cancer novaezealandiae*				X	
New Zealand half-crab	*Petrolisthes elongatus*				X	
Ascidians and Seasquirts						
Colonial ascidian	*Botryllus schlosseri*				X	
European seasquirt	*Ascidiella aspersa*				X	
Macroalgae						
Broccoli weed	*Codium fragile tomentosoides*				X	
Japanese seaweed*	*Undaria pinnatifida*				X	
Phytoplanton						
Toxic dinoflagellate*	*Alexandrium catenella*				X	X
Toxic dinoflagellate*	*Alexandrium tamarense*				X	X
Toxic dinoflagellate*	*Gymnodinium catenatum*				X	X

DESCRIPTION OF SELECTED TARGET INVASIVE MARINE SPECIES IN TASMANIAN SALMONID GROWING AREAS

Northern Pacific seastar

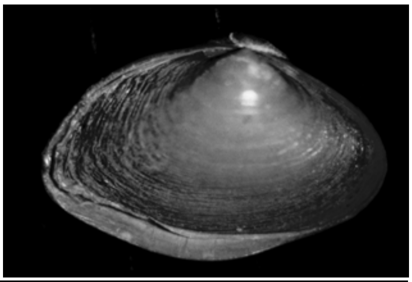
The northern Pacific seastar (*Asterias amurensis*) can grow up to 50 cm in diameter. It has 5 arms with pointed tips and is common around southeast Tasmania, particularly in the Derwent River. The seastar feeds on native species and may compete with native predators. It is also implicated in the decline of the endangered spotted handfish (Section 2.2.4).

Japanese Kelp (Wakame)

Japanese Kelp (*Undaria pinnatifida*) is a brown algae with a midrib that runs along the centre of the plant. It has a frilly structure (sporophyll) near the base of the stem. Undaria grows up to 3 m and competes with native plants and animals. It produces spores that are easily transported. It is important that boats, fishing gear and dive equipment are washed and dried before moving to other areas to prevent spread of the spores (See Appendix 3 for Tasmanian Oyster Industry Protocol).

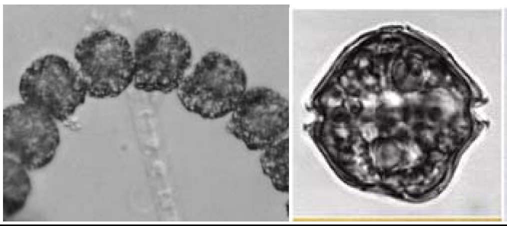
European green crab

The European green crab (*Carcinus maenas*) is a medium sized crab that grows up to 8 cm wide. It has 5 spines on either side of the eyes. Green craps do not have swimming paddles on their back legs, distinguishing them from native crabs. The crab is a voracious predator and competes with our native species. The green crab can be transported with aquaculture gear and impacts on the States' aquaculture farms (See appendix 3 for Tasmanian Oyster Industry Protocol)



European clam

The European clam (*Varicorbula gibba*) is a small bivalve reaching up to 20 mm. One shell is bigger than the other distinguishing it from native clams. The pest has a high growth rate and is tolerant of many environmental conditions. It can form extremely high population densities, excluding native species. The pest can be transported in the hulls of vessels and by the movement of aquaculture gear.



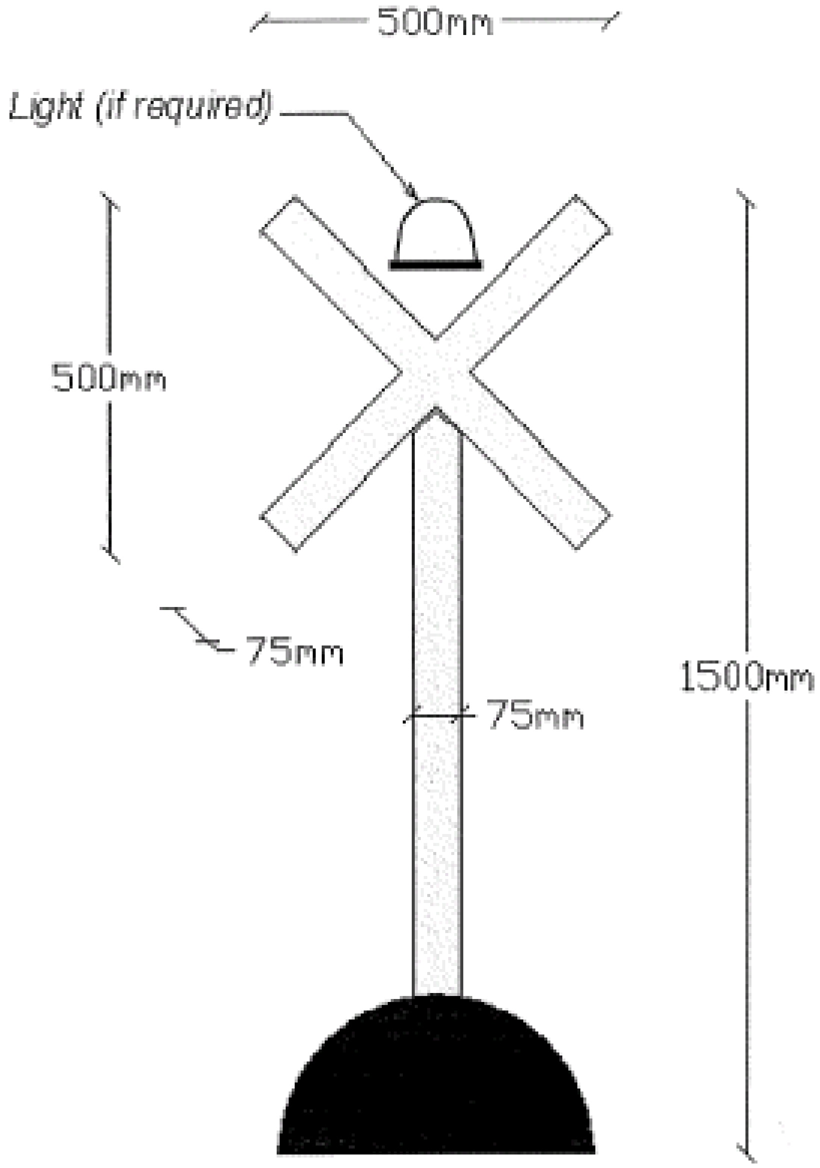
Toxic dinoflagellates

The toxic dinoflagellate (*Gymnodinium catenatum*) is a microscopic cell (60µm long) which often forms chains of 4 to 16 cells. Blooms of the dinoflagellate cause shellfish to be contaminated with paralytic shellfish toxins, causing extended closures of oyster growing areas (See Aspect 1.2.3 Quality Assurance). This species produces small, robust micro-reticulate cysts known to be transported in ship's ballast water. It is important that boats and equipment are washed down before moving to new locations. The oyster industry has strict protocols in place to avoid translocation of the dinoflagellate, particularly during a bloom (See Appendix 1.2.5).

The toxic dinoflagellate *Alexandrium catenella* and *A. tamerense* are closely related and only distinguishable through high-powered microscopy. *Alexandrium catenella* may occur in chains or single cells where as *A. tamarense* occurs as a single cell or occasionally as pairs. Blooms of this species can result in the closure of oyster leases with severe economic losses. Both species are considered toxic and a threat to the Tasmanian shellfish industry.

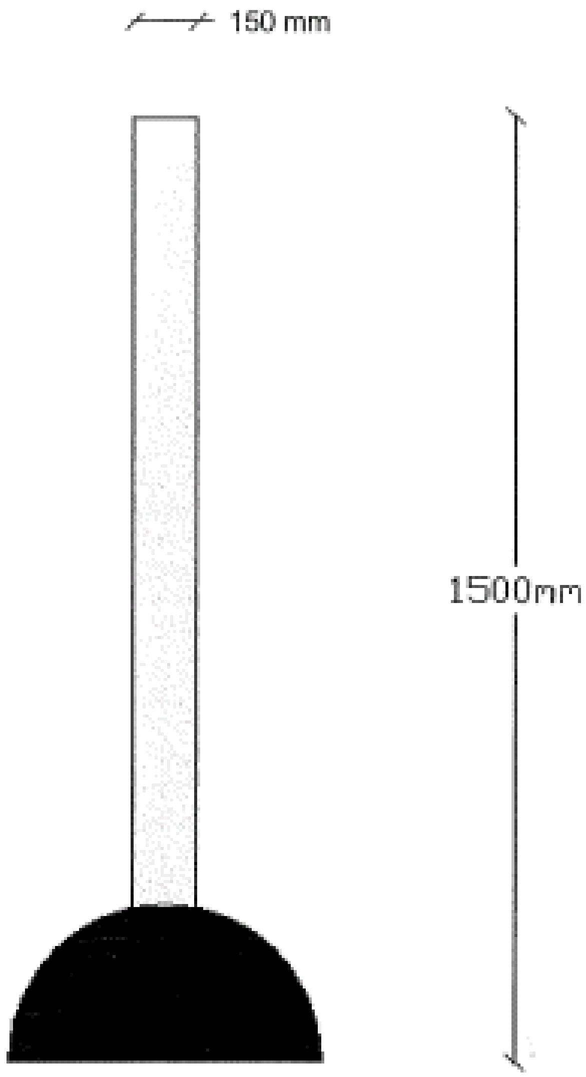
Further information on Invasive Marine Species is available from http://www.dpiwe.tas.gov.au/inter.nsf/ThemeNodes/LBUN-5KK5EP?open

APPENDIX 2.3.4: MINIMUM SPECIFICATIONS FOR MARKERS FOR FISH FARMS AS DETAILED BY MARINE AND SAFETY TASMANIA.



MINIMUM SPECIFICATIONS FOR IALA TYPE SPECIAL MARK FOR FISH FARM MARKING WHERE SPECIAL MARK WITH TOP MARK AND LIGHT SPECIFIED.

Colour of mark – YELLOW
Light – Colour YELLOW, Range 1 nautical mile, Character FLASHING (any rhythm not used by white lights)



MINIMUM SPECIFICATIONS FOR FISH FARM MARKING WHERE SPAR BUOY OR POST SPECIFIED. *NOTE; WHEN A POST TYPE MARK IS DEPLOYED MINIMUM HEIGHT OF MARK IS MEASURED FROM MEAN HIGH WATER.

Colour - YELLOW

APPENDIX 2.4.2: THE TASMANIAN FISH HEALTH SURVEILLANCE PROGRAM (TFHSP).

(Adapted from Ellard K (2005). Tasmanian Fish Health Surveillance Program 2005/2006. Internal Report, Department of Primary Industries, Water and Environment, Tasmania)

AIM:
The overall objective of the *Program* is to ensure that a coordinated health monitoring and surveillance program is operational throughout the Tasmanian salmonid industry (the *Industry*) in line with international recommendations (as outlined within the OIE Manual of Diagnostic Tests for Aquatic Animals 2003). The *Program* also incorporates investigations into endemic diseases of concern and other finfish aquaculture industries or research establishments.

Revised objectives for the 2005/2006 program are as follows:

Objective I: demonstrate freedom of disease for the purpose of market access, restriction of product entry or the establishment of a recognised disease free zone for Tasmania.

Objective II: the maintenance of regional biosecurity within Tasmania for endemic diseases.

Objective III: the investigation of significant or unusual disease events in order to rule out exotic or new pathogens.

Objective IV: active surveillance for endemic diseases of concern to monitor their distribution so that effective regional biosecurity measures can be implemented.

2. SCOPE:

The *Program* will primarily encompass surveillance and monitoring for disease states due to infectious agents, but restricts its involvement primarily to identification of the causative agent.

In certain cases disease events may be subject to detailed investigation, subject to agreement by both parties.

The *Program* will include active testing and disease investigation of all commercial enterprises involved in salmonid production within Tasmania, plus preliminary investigation of reports of disease of other finfish establishments.

3. PROGRAM OUTLINE:

Sampling and testing for the *Program* will be undertaken according to a works program and can be grouped here into one of four broad categories.

- Testing of stock to provide support for state barrier quarantine

- Routine submission of diagnostic specimens from farms & hatcheries
- Active surveillance for MAS, Tasmanian birnavirus and RLO
- Detailed investigation of significant or unusual cases

4. HATCHERIES & MARINE FARM GROUPS:

The sampling protocols are based around fish production units (FPU). A FPU is an enterprise where fish are grown in close association, originate from a common source and have stock of similar disease risk that will be tested as a single unit. As with previous programs, hatcheries are considered as separate fish production units since they are located on separate waterways, but not separate catchments. Marine farms may also be classified according to production or geographical zones on which biosecurity restrictions are based (as per Figure 1.).

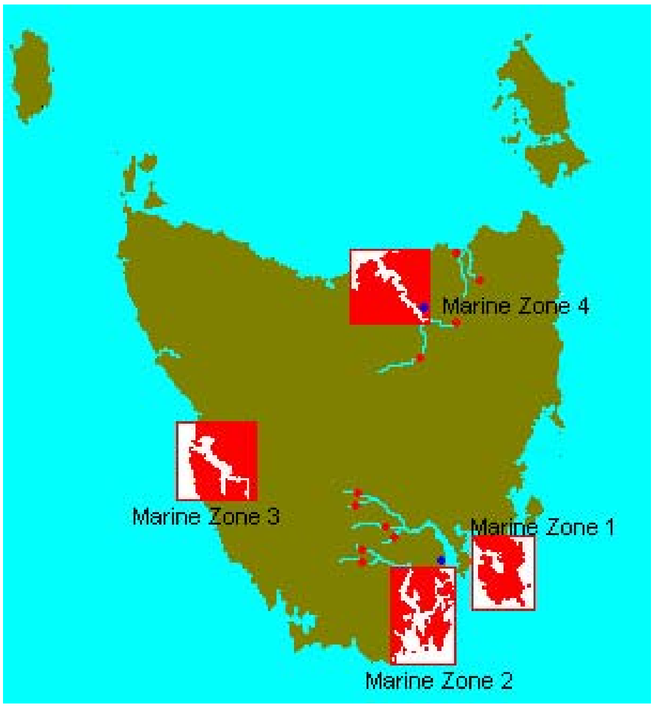


Figure 2: Marine farming production zones

5. **REPORTING OF INFORMATION:**

The results of individual farm testing, whether from a DPIW veterinary officer or from samples submitted by farmers directly to the laboratory, will be relayed back to the farm concerned as soon as possible. In the case of disease investigations or notifiable diseases, the submitter will be notified of provisional results at the earliest opportunity via the DPIW Fish Veterinarian.

There are three levels of reporting obtained through the *Program*. These may be classified as follows:

i. Notifiable or potentially serious disease

ii. Disease incidents of interest to the whole of industry

iii. Reports to the TSGA & industry

APPENDIX 2.4.5: VETERINARY CHEMICAL USE IN THE TASMANIAN SALMONID INDUSTRY.

	Species	Use	Extent of Use	Controls	Hazard risk	Estimate of amount used annually	Residue testing	Registered for use in fish	Trade Name
Antibiotics									
Oxolinic acid	S(m), S(h),	Bacterial infections	Ceased	S4 poison, prescription only. Unregistered product	Moderate	Use phased out 2005	No	No, nor any other food animal	N/A
Trimethoprim	S(m),	Bacterial infections, finfish	Limited	S4 poison, Prescription only, unregistered product	Moderate	30kg, efficacy currently under question and use needs to be re-evaluated	No	No, but trimeth/sulfur compounds are registered in food animals	N/A
Oxytetracycline	S(m),	Bacterial infections, finfish	General	S4 poison, prescription only	Moderate	3000-4000 kg	Yes	No, but registered for use in major food species	Multiple
Chlortetracycline	S (m), S (h),	Bacterial infections	General	S4 poison, prescription only	Moderate	100 kg	Yes	No, but registered for using in other major food species	multiple

	Species	Use	Extent of Use	Controls	Hazard risk	Estimate of amount used annually	Residue testing	Registered for use in fish	Trade Name
Disinfectants									
Chloramine-T	S(h)	Environmental gill disease & general disinfectant, finfish	General	None, requires vet prescription for use as vet med in fish	Low	50kg	No	No	Halasept, Halamid, generic compound
Benzalchonium chloride	S(h)	Environmental gill disease, finfish. Bacterial disinfectant	Isolated	None, requires vet prescription for use as vet med in fish	Low	Unknown considered to be extremely low.	No	No	Various
Malachite Green	S(h)	Fungal infections in hatcheries	Ceased	Voluntary withdrawl, COP	High	Under general industry agreement, use withdrawn 2004.	No	No	N/A
Formalin	S(h)	Fungal & parasite infections in hatcheries	Limited	Minor use permit	moderate	Unknown, limited to hatchery use for the control of sprolegnia in salmonids	No	MUP	N/A
Sodium hypochlorite	All	General disinfectant	General	None	Low/mod	Unknown	No	No	N/A
Ozone	S(h), R	Water disinfectant	General	None	Moderate	Unknown	No	No	N/A
Iodophors	S(h), S(m)	Egg disinfection. General disinfection	General	None	Low	Unknown	No	No	Various, eg Betadine, Buffodine, Povodine

	Species	Use	Extent of Use	Controls	Hazard risk	Estimate of amount used annually	Residue testing	Registered for use in fish	Trade Name
Anaesthetic Agents									
Benzocaine	S(h), S(m),	General sedative and anaesthetic agent.	Limited, handling of broodstock at spawning	S4 posion, supply under prescription required	Low/mod	5kg	No		None,.generic product
Iso-eugenol	S(h), S(m)	General sedative. Harvesting sedative	General	Registered for use in salmonids,to be used under veterinary direction only	Low	Data may be supplied by wholesaler.	No	Yes,salmonids	Aqui-S
Clove Oil	S(h), S(m)	General sedative.	Limited	None	Low	Unknown	No	No	N/A
CO2	S(m)	Harvesting sedative.	Common	None	Low	Unknown	No	?	Beer Gas
Hormones									
GnRHa	S(h)	Promotion of spermatogenesis.	Limited	Minor use permit	Low/mod	Refer to supplyer	No	MUP	Ovaprim
Testosterone	S(h)	Production of neomales	Limited	Restricted S4 poison, prequires veterinary prescription for supply and use	Mod	5 grams	No		Laboratory agent

	Species	Use	Extent of Use	Controls	Hazard risk	Estimate of amount used annually	Residue testing	Registered for use in fish	Trade Name
Other									
Levamisole	S(m), R	Immunostimulant	Withdrawn	None	Low	Nil	No	No, but registered for use in major food species	Various
b-glucans	S(m)	Immunostimulant	In feed additive	Nil if added to feed	Low	Unknown, refer to feed companies	No	MUP	Fin-guard
Salt	S(h)	Gill astringent Tx of external parasites and fungi	General	None	Low	5500L	No	N/R	N/A
Yersiniosis vaccine	S(h)	Yersiniosis vaccine	In developme nt, currently being trialled in feild	Minor use permit	Low	Refer to Intervet	No	MUP	Yersinivac
MAS/Vibrio vaccine						Refer to Intervet for information			
MAS vaccine						Refer to intervet for information			
Vibrio vaccine	S(h)	Vibriosis vaccine	Common	Registered product for bath and minor use permit for injectable use	Low	Refer to Intervet	No	MUP	Anguil-vac

S(h): salmonid freshwater hatcheries. S(m): salmonid marine farms.	MUP: minor use permit. N/A: not applicable N/R: not required	Estimates are made on a state-wide basis for salmonids and should only be considered rough estimates.

Document prepared by Kevin Ellard, Veterinary Officer, Animal Health & Welfare DPIWE. (Revised May, 2006).

APPENDIX 3.1: COMMONWEALTH AND TASMANIAN LEGISLATION MATRIX RELEVANT TO COMPONENT 3.1: SITE SELECTION, CONSTRUCTION AND INFRASTRUCTURE ASPECTS.

Note: The following tables are a guide only and are not determined to be comprehensive.

Table 3.1.1. Commonwealth legislation pertaining to the site selection, construction and infrastructure of a marine farming facility.

Commonwealth Legislation Matrix	3.1.1. Habitat Effects	3.1.2. Erosion	3.1.3. Shading	3.1.4. Rehabilitation	3.1.5. Soil Quality	3.16. Noise / Dust	3.1.7. Infrastructure	3.1.8. Waste	3.1.9. Water Flow	3.1.10. Navigation	3.1.11. Alienation	3.1.12. Proximity to sensitive fauna/regions	3.1.13. Water table
Aboriginal and Torres Strait Islander Heritage Protection Act 1984											X		
Australian Maritime Safety Authority Act 1990							X			X			
Environment and Heritage Amendment Act 2000	X												
Environment Protection and Biodiversity Conservation Act 1999	X												
Navigation Act 1912										X			
Protection of Movable Cultural Heritage Act 1986												X	
Resource Assessment Commission Act 1989	X											X	
Sea Installations Act 1987										X			
Seas and Submerged Lands Act 1973										X			

Table 3.1.2. Tasmanian legislation pertaining to the site selection, construction and infrastructure of a marine farming facility.

Tasmanian Legislation Matrix	3.1.1. Habitat Effects	3.1.2. Seepage	3.1.3. Shading	3.1.4. Rehabilitation	3.1.5 Soil Quality	3.1.6. Noise / Dust	3.1.7. Infrastructure	3.1.8. Waste	3.1.9. Water Flow	3.1.10. Navigation	3.1.11. Alienation	3.1.12 Proximity to sensitive fauna/regions	3.1.13. Water table
Aboriginal Lands Act 1995											X		
Aboriginal Relics Act 1975											X		
Crown Lands Act 1976	X			X	X		X	X	X		X	X	X
Disposal of Uncollected Goods Act 1968				X				X					
Energy Co-ordination and Planning Act 1995							X						
Environmental Management and Pollution Control Act 1994		X				X		X					X
Farm Water Development Act 1993									X				
Fire Services Act 1979	X												X
Forest Practices Act 1985	X												
Groundwater Act 1985		X							X				X
Historic Cultural Heritage Act 1995	X											X	
Hobart Regional Water (Arrangements) Act 1996							X						

Tasmanian Legislation Matrix	3.1.1. Habitat Effects	3.1.2. Seepage	3.1.3. Shading	3.1.4. Rehabilitation	3.1.5 Soil Quality	3.1.6. Noise / Dust	3.1.7. Infrastructure	3.1.8. Waste	3.1.9. Water Flow	3.1.10. Navigation	3.1.11. Alienation	3.1.12 Proximity to sensitive fauna/regions	3.1.13. Water table
Hydro-Electric Corporation Act 1995							X						
Land Acquisition Act 1993	X												
Land Use Planning and Use Act 1993	X	X		X	X	X	X	X		X	X	X	X
Litter Act 1973								X					
Living Marine Resources Management Act 1995	X		X	X			X	X	X		X		
Local Government Act 1993 – (Planning schemes)		X		X			X	X	X			X	
Marine Farming Planning Act 1995			X				X						
Marine and Safety Authority Act 1997									X	X			
National Parks and Reserves Management Act 2002	X												
Police offences Act 1935								X					
Pollution of Waters by Oil and Noxious Substances Act 1987									X				X
Resource Management and Planning Appeal Tribunal Act 1993	X												
State Water Quality Act 1999									X				
Sewer and Drains Act 1954		X							X				
Threatened Species Protection Act 1995	X												
Water Management Act 1895		X					X	X	X				
Workplace Health and Safety Act 1995						X							

Table 3.1.2. Tasmanian legislation pertaining to the site selection, construction and infrastructure of a marine farming facility.

Table 3.1.2. Tasmanian legislation pertaining to the site selection, construction and infrastructure of a marine farming facility.

APPENDIX 3.2: COMMONWEALTH AND TASMANIAN LEGISLATION MATRIX RELEVANT TO COMPONENT 3.2: OPERATIONAL ASPECTS.

Note: The following tables are a guide only on not determined to be comprehensive.

Table 3.2. Commonwealth legislation pertaining to the operational aspects of a marine farming facility.

Commonwealth Legislation Matrix	3.2.1.1. Health Surveillance	3.2.1.2. Stocking Density	3.2.1.3. Animal Welfare	3.2.1.4. Predation	3.2.2.1 Water Use	3.2.2.2 Visual	3.2.2.3. Air	3.2.2.4. Energy	3.2.2.5. Noise & Light	3.2.2.6 Habitat Effect	3.2.2.7 Chemicals/Theraputants	3.2.2.8 Entanglement	3.2.2.9 Escapement	3.2.3.1 Water Quality	3.2.3.2. Sedimentation	3.2.3.3. Waste Feed & Faeces	3.2.3.4. Fish Disposal	3.2.3.5.Processing	3.2.3.6 Storm water	3.2.3.7 Sewerage	3.2.3.8. General Rubbish	3.2.3.9 Biofouling
Environment Protection and Biodiversity Conservation Act 1999	X			X					X	X		X	X			X						
Quarantine Act 1908	X																					
Export Control Act 1982	X																					
Export Control Act 1982 (Proscribed Goods-General) Order 2005	X																					
Export Control Act 1982 (Fish and fish Products) Order 2005	X																					

Table 3.1.2. Tasmanian legislation pertaining to the site selection, construction and infrastructure of a marine farming facility.

Tasmanian Legislation Matrix	3.2.1.1. Health Surveillance	3.2.1.2. Stocking Density	3.2.1.3. Animal Welfare	3.2.1.4. Predation	3.2.2.1 Water Use	3.2.2.2 Visual	3.2.2.3. Air	3.2.2.4. Energy	3.2.2.5. Noise & Light	3.2.2.6 Habitat Effect	3.2.2.7 Chemicals/Theraputants	3.2.2.8 Entanglement	3.2.2.9 Escapement	3.2.3.1 Water Quality	3.2.3.2. Sedimentation	3.2.3.3. Waste Feed & Faeces	3.2.3.4. Fish Disposal	3.2.3.5.Processing	3.2.3.6 Storm water	3.2.3.7 Sewerage	3.2.3.8. General Rubbish	3.2.3.9 Biofouling
Agricultural and Veterinary Chemicals(control of use) Act 1995											X											
Animal Health Act 1995	X			X								X						X				
Animal Welfare Act 1993			X									X				X		X				
Crown Lands Act 1976										X												
Dangerous Good Act 1998											X											
Environmental Management and Pollution Control Act 1994							X		X					X		X	X	X		X	X	
Health Act 1997														X			X			X	X	
Living Marine Resources Management Act 1995				X		X						X	X		X			X				X
Local Government Act 1993 – (Planning schemes)					X		X		X					X	X		X	X	X	X	X	
Marine Farming Planning Act 1995		X				X						X	X			X						
Marine and Safety Authority Act 1997						X																
National Parks and Reserves Management Act 2002										X												
Poisons Act 1971											X											
Sewer and Drains Act 1954																			X	X		
Threatened Species Protection Act 1995										X		X										
Water Management Act 1895					X																	
Workplace Health and Safety Act 1995											X							X				

APPENDIX 5.2.7: VISUAL CONTROLS ON MARINE LEASES UNDER THE MARINE FARMING DEVELOPMENT PLANS.

Lessees must ensure that all marine farming structures and equipment on marine farming lease areas conform to the following controls:

- All fish cages, buoys, netting and other floating marine farming structures and equipment on the sea, other than specified for navigational requirements, must be grey to black in colour, or be any other colour that is specified in the relevant marine farming licence.
- Marine farming structures and equipment must be low in profile and be of a uniform size and shape to the satisfaction of the Secretary.
- Posts on each section of racking on intertidal lease areas are to be of uniform height above sea level.
- Row markers on intertidal lease areas are to be of uniform height above sea level.
- The lease area must be kept neat and tidy to a standard acceptable to the Secretary.
- Floating storage huts, grading facilities and shelters must not be located within a lease area unless authorised under the relevant marine farming licence.
- Anchors and mooring lines that extend outside the lease area must be at least 5 metres below the surface at the boundary of the lease.

APPENDIX 6.0: BACKGROUND FOR INDIGENOUS COMMUNITY WELLBEING.

Background

For the past 40,000 years the Aboriginal people have lived in Tasmania and during this time have harvested the shellfish, hunted native animals, gathered plant foods and utilised many coastal areas for every day living. Evidence of this lifestyle can be seen in the Aboriginal sites and artefacts that have been found around the coastline and inland across Tasmania. The Aboriginal community believes that all Aboriginal heritage sites are important as they give meaning to the landscape within which they exist. Aboriginal heritage surveys can often be required as part of the development approval process for assessing the impact of land based developments.

The Tasmanian Aboriginal people make no distinction between the land and sea, which they view as having a connectedness. As a result, coastal environments are considered an integrated cultural landscape/seascape that is conceptually very different from the broader Australian view of the land and the sea (National Oceans Office 2002). The Aboriginal people see themselves as environmentalists with sustainability as part of their culture. As a community reliant on natural food sources, their survival required resource sustainability practices.

The Aboriginal Tasmanians today are part of a vibrant, productive community working towards self-determination. Tasmanian Aboriginal community still participate in cultural activities and festivals. This component takes into consideration the Tasmanian Aboriginal community as they exist today, but also considers the importance of their past history. Below is a brief synopsis of why particular areas have importance to the Aboriginal community. Each area below refers to that of the Marine Farming Plans, rather than boundaries recognised by the Aboriginal community.

Tamar

The North Midlands Tribe occupied the area around the Tamar River with the Leterremairrener clan residing on the banks of the Tamar near Port Dalrymple. The Tamar was a rich hunting ground allowing this tribe to settle for most of the year. Their diet consisted of shellfish, riverine and estuarine bird life, kangaroos, wallabies and possums, and vegetables. Tribes from other areas of the state had winder rights to gather shellfish and eggs from this region.

Tasman

The Pydairrerme people from the Great Oyster Bay Tribe were based on the Tasman Peninsula and moved up and down the East Coast to Little Swanport and the Eastern Marshes (Terry 1996). These bands harvested shellfish, hunted native animals, gathered plant foods and utilised the region for every day living.

The remnants of these activities can be seen in Aboriginal middens and artefact scatter around the coastlines of the Tasman Peninsula. These sites and artefacts are extremely significant to today's Aboriginal community.

Channel
The SouthEast tribe occupied the Channel area and included the Nuenonne band from Bruny Island and the Mouheneenner band from Hobart. In winter bands would congregate along the coastlines and at North West Bay to collect shellfish. These people were competent seamen, often crossing Storm Bay to visit lands on the Tasman Peninsula.

A major Aboriginal site in the Channel area is Oyster Cove. This site was an Aboriginal Station; now an Aboriginal Keeping Place returned to the Aboriginal community in early 1995 and is managed by the Tasmanian Aboriginal Centre.

Huon/Esperance
The Mellukerdee band of the SouthEast tribe occupied the Huon region which important sites and lifestyle are similar to that described for the Channel Region.

Macquarie
The Peternidic band from the North West tribe often travelled from their homeland at the Pieman River to cross Macquarie Harbour by catamaran to forage on the South West coast. They also traded with the maritime Minegin band, who resided on the southern shores of Macquarie Harbour as part of the South West Tribe. The economy of these people was focused on seafood and coastal animals, including shellfish, crayfish, wombats and, macropods.

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APPENDIX 7.1.1.1: STATUTORY PLANNING PROCESSES UNDER THE MARINE FARMING PLANNING ACT 1995 FOR A PLAN PREPARED BY THE DPIW OR AN APPROVED PERSON.

(S 16) DPIW or a person applies to the Minister for approval to prepare draft Plan.

(S 16) Minister may:

- grant approval to prepare a draft Plan; or
- refuse approval.

(S 17) Planning Authority (PA) notifies Marine Farming Review Panel that planning has commenced seeking advice as to any particular person or body that the Panel may wish the PA to consult with or any particular matter that the Panel would like the PA to consider in the preparation of a draft Plan.

(S 25) Within 12 months (or any other period the Minister allow) after approval the PA must submit a draft Plan to the Panel.

(S 25) Within 9 weeks (or any other period the Minister allows) the Panel must:

- if Plan is suitable for exhibition recommend public exhibition to the Minister;
- if not suitable: - amend the draft Plan and refer to Min for exhibition: or
  - require PA to amend draft Plan within a specified period.

(S 26) Minister may:

- give approval for exhibition, in which case the PA must advertise the draft Plan within 6 weeks (or any other period the Panel allows) of approval for a period of 2 months; or
- refuse approval and refer the draft Plan back to the Panel seeking further information or stating areas of concern.

(S 28) Within 3 months of closing date for representations the PA must submit a report as per S 28 to Panel.

(S 29) Following consideration of the PA's report the Panel may:

- accept or reject draft Plan; or
- modify the draft Plan.
- require the PA to modify the draft plan.

The Panel must notify the PA of rejection of any modification.

(S 30) If Panel modifies to a substantial extent the draft Plan then the public consultation process is repeated.

(S 31) If the Panel considers the draft Plan appropriate it recommends that draft Plan be approved. The Minister may:

- refuse to approve the draft Plan and indicate concerns to the Panel; or
- approve the draft plan by signing.

If Plan is approved the PA must advertise the approval by public notice.

INITIAL RESEARCH/CONSULTATION FOR THE DEVELOPMENT OF A MARINE FARMING DEVELOPMENT

- Marine Farmers
- MAST/ Marine Board/Recreation Boating
- Commercial fishing interests (includes discussion with DPIWE Wild Fisheries)
- Recreational fishing (includes discussions with DPIWE Recreation Fishing staff)
- General recreation
- Bureau of Meteorology
- Bureau Statistics
- Local councils re
    - -Effluent disposal (this includes discussions DTAE Environment staff)
    - -Land based planning
- National Parks Staff re significant fauna issues
- Tas Group of Birds Tasmania
- DPIW Fisheries staff re marine flora and fauna issues
- DPIW Cultural heritage staff re Aboriginal issues
- Tasmanian Fisheries Institute re initial environmental survey.
- DPIW Threatened Species Unit.

During this initial consolation some issues may arise which are specific to a region. Also certain individuals may be identified with detailed knowledge of the region. These issues and individuals are also researched and consulted during the Planning process. For example in the case of Pitt Water CSIRO have undertaken considerable research concerning the regions importance as a shark nursery. In this case ex employees with considerable knowledge were also contacted.

Numerous references are used as listed in marine farming development plan.

MARINE FARMING PLANNING APPROACH

The planning process undertaken in the development of the marine farming development plans is outlined below.

Preparation of a draft marine farming development plan

- Consultation with farmers.
- Review of marine farm files and overseas literature
- Collection and collation of environmental data.
- Identification of other users, and zone boundary restrictions.
- Initial outline of draft zones.
- Consultation with stakeholders.
- Review of zone boundaries.
- Preparation of draft plan.

Intradepartmental Consultation

- Consultation with nominated officers of the DPIW.
- Secretary's approval to release to Tasmanian Aquaculture Council.

Initial Review

- Internal review by Tasmanian Aquaculture Council.
- Comments received considered.
- Secretary sends plan to Marine Farming Planning Review Panel (Panel).

Marine Farming Planning Review Panel

- Panel considers plan. May direct changes or reject draft plan.
- Panel recommends to Minister that draft plan be released for public consultation.

Public Exhibition

- Two month period for public comment and representations.

Representations

- Representations are collated and considered by DPIW with preparation of a report to the Panel.
- The Panel considers representations and where appropriate conduct a hearing in relation to representations made.
- Draft plan modified as necessary by the Panel.
- If Draft Plan is modified public exhibition period is repeated.

Final Plan

- Panel submits plan to Minister for approval.

Implementation

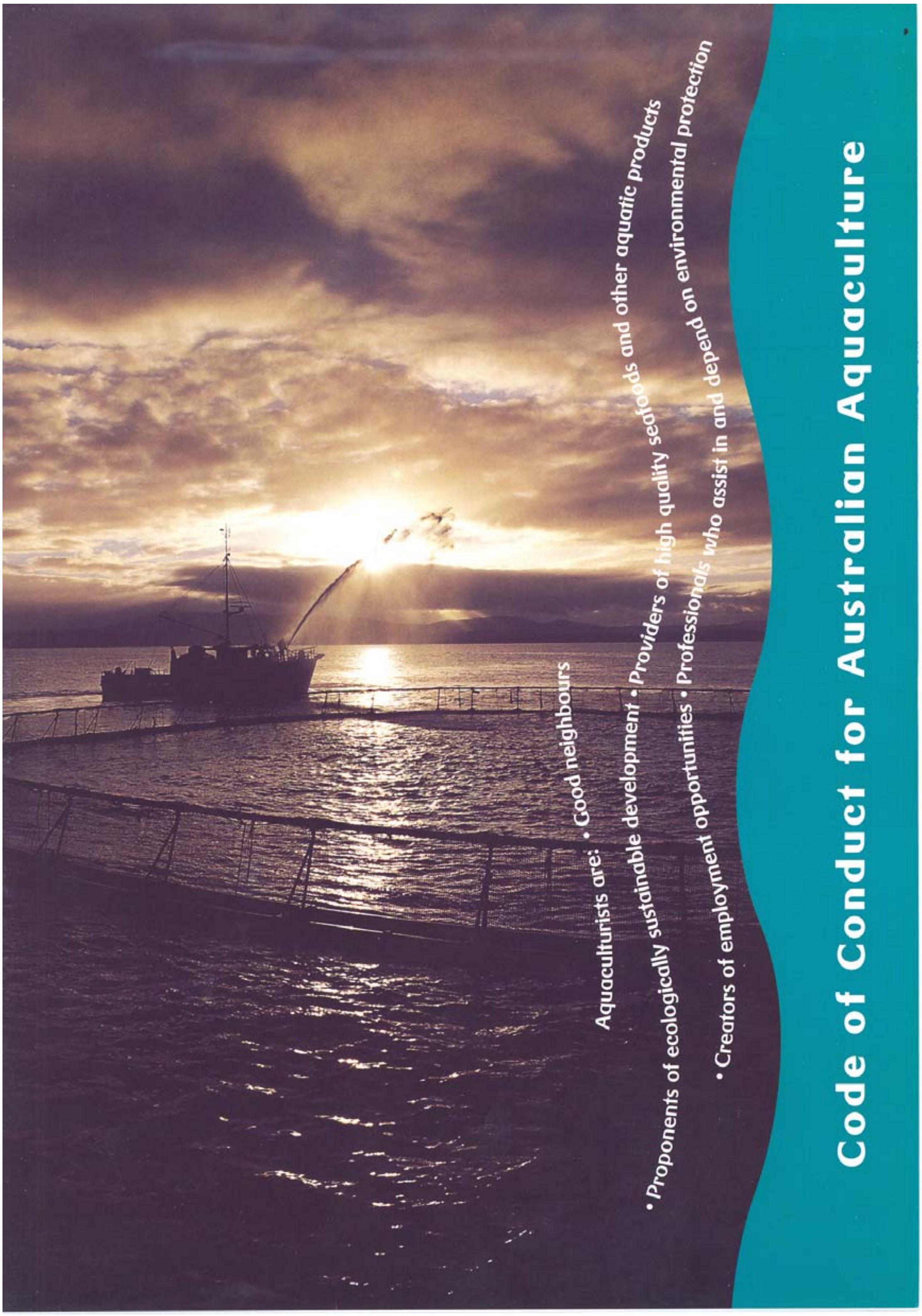
- Implementation of Marine Farming Development Plan.

Review

- The MFDP must be reviewed within 15 years of implementation to ensure primary objectives are met, and to allow for changing circumstances that may be relevant. A statutory process for alterations to the MFDP is outlined in the legislation.

Adopted from T Thomas, DPIW Marine Farming Branch

APPENDIX 7.2.1: CODE OF CONDUCT FOR AUSTRALIAN AQUACULTURE



AQUACULTURE

The Food and Agricultural Organisation of the United Nations has defined aquaculture, or fish farming, as " the farming of aquatic organisms, including fish, molluscs, crustaceans and plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators. Farming also implies individual or corporate ownership of the stock being cultivated."

In addition to the culture of edible species (such as salmon, oysters and prawns), aquaculture in Australia includes:

- Hatchery production of juveniles for use in growout operations (farms), stocking private or public waterways for recreational fishing, and restocking natural waters for conservation purposes
- Harvesting of eels, microalgae, zooplankton or other organisms from water bodies that are under some form of lease and/or management
- Culture of aquarium and ornamental fish and aquatic plants for sale
- Culture of aquatic organisms for the extraction of pigments, fine chemicals and other products such as pearls, skins and shells
- Value-adding of traditional wild caught species such as rock lobster and southern bluefin tuna

PRINCIPLES FOR THE AQUACULTURE INDUSTRY

To maintain ecological and economic sustainability, the aquaculture industry has adopted a set of principles that form the basis or underlying philosophy for the Code of Conduct:

- Ecologically sustainable development
- Economic viability
- Long term protection of the environment to ensure availability of suitable sites for aquaculture operations
- Compliance with, and auditing of adherence to, regulations and the Code of Conduct
- Resource sharing and consideration of other users of the environment
- Research and development to support the achievement of the above five priorities

These principles provide the industry with the mechanism to implement the Code of Conduct as well as providing specific sectors or regions of the industry with the necessary framework for developing their own Codes of Practice.

THE CODE

Industry will work in conjunction with government and other stakeholders to ensure that aquaculture developments are managed sustainably (ecologically and economically) and that their considerable social, economic and environmental advantages are achieved. This will be accomplished through five guiding principles for environmental best practice.

FOR THE AQUACULTURE INDUSTRY TO BE ECOLOGICALLY AND ECONOMICALLY SUSTAINABLE, AQUACULTURISTS WILL :

- Comply with regulations
- Respect the rights and safety of others
- Protect the environment
- Treat aquatic animals humanely
- Promote the safety of seafood and other aquatic foods for human consumption

To Comply With Regulations Aquaculturists Will:

- Support practical and cost effective strategies to ensure that relevant environmental performance standards are monitored and met
- Promote appropriate incentives for responsible environmental performance and advocate sanctions for non-compliance
- Promote effective consultative mechanisms with governments, the community and other users
- Expand self management and co-regulation to include industry-based codes of practice that specifically address environmental issues

To Respect The Rights And Safety Of Others Aquaculturists Will:

- Recognise the needs of other users of the waterways and promote methods to minimise user conflicts
- Recognise that the use of public resources confers responsibility on the user
- Encourage consultation with the community and other users of the waterways to enable legitimate concerns and issues to be raised and solutions proposed
- Advocate that the farm sites and infrastructure be kept clean and tidy and noise impacts minimised
- Promote goodwill in the local community and provide for farm visits and other opportunities for education and tourism
- Recognise and promote the community benefit from monitoring and reporting on the state of the aquatic environment
- Advocate the installation of appropriate navigational markers and other measures to prevent accidents

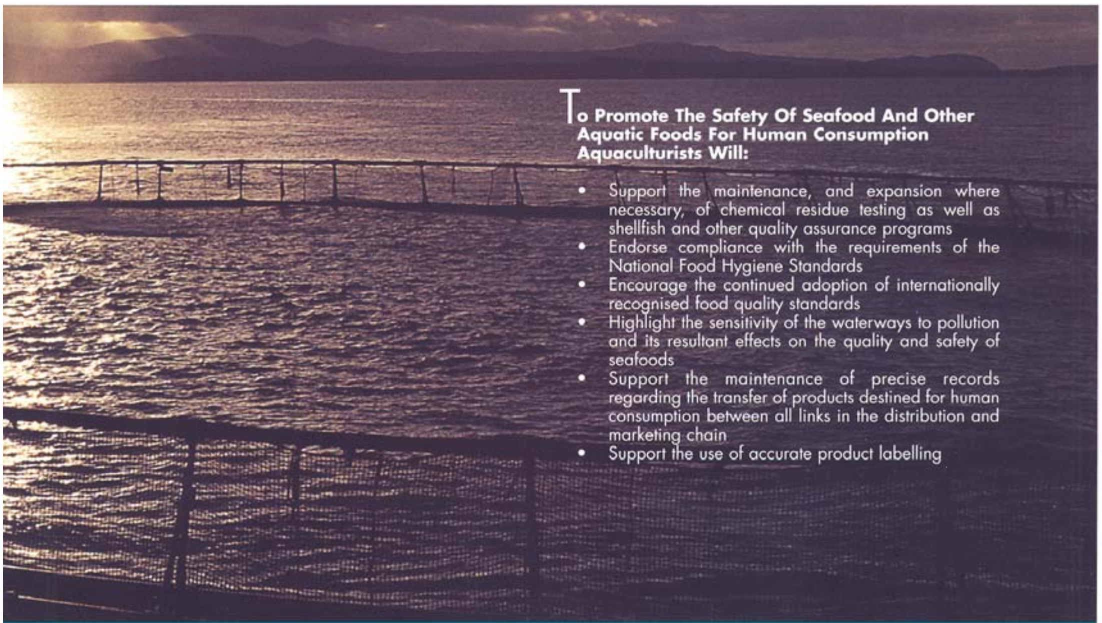
PHOTOGRAPHY (above and front cover): TASSAL

To Protect The Environment Aquaculturists Will:

- Encourage the development and operation of aquaculture in a manner and at a rate in accordance with ecologically sustainable principles
- Support a total catchment approach based on natural resources management which arrests degradation and provides improved outcomes for sustainable resource use through effective co-operation between government agencies and the community
- Promote industry training and education opportunities in environmental awareness, clean production methods and best practice
- Recognise the importance of good site selection, system design and infrastructure to minimise ecosystem changes
- Monitor and regularly review on-farm management practices to minimise the risk of ecological damage
- Minimise and, where practicable, eliminate the use of agricultural and veterinary chemicals
- Ensure the correct use and disposal of registered chemicals
- Support the development and use of diets and feeding strategies which minimise adverse impacts
- Adopt farm design and on-farm management practices that encourage integration, recycling and reuse of effluents
- Provide for disposal and/or processing of wastes to minimise the risk of ecological damage
- Continue to work with the authorities to control the spread of exotic species
- Continue the development of protocols for dealing with genetically modified material, with particular reference to the capacity of these organisms to produce progeny or genetically modified materials themselves
- Work in association with governments to develop appropriate protocols regarding the transfer and culture of exotic species and the translocation of live product within and between states
- Support the maintenance of precise records regarding the transfer or translocation of stock between areas or operators

To Treat Aquatic Animals Humanely Aquaculturists Will:

- Seek the development of on-farm expertise in health management and ecological sustainability
- Promote the maintenance of efficient and sustainable stocking densities
- Address the physical and biological requirements of the species to be farmed
- Encourage the installation of anti-predator devices designed to exclude predators without deliberately injuring them
- Seek methods to transfer and harvest which reduce stress to stock
- Endorse the use of humane slaughter methods



To Promote The Safety Of Seafood And Other Aquatic Foods For Human Consumption Aquaculturists Will:

- Support the maintenance, and expansion where necessary, of chemical residue testing as well as shellfish and other quality assurance programs
- Endorse compliance with the requirements of the National Food Hygiene Standards
- Encourage the continued adoption of internationally recognised food quality standards
- Highlight the sensitivity of the waterways to pollution and its resultant effects on the quality and safety of seafoods
- Support the maintenance of precise records regarding the transfer of products destined for human consumption between all links in the distribution and marketing chain
- Support the use of accurate product labelling

- Support the development of appropriate contingency plans to deal with unplanned releases of aquaculture species/stock, or the spread of diseases, parasites and other pathogens
- Encourage the immediate reporting of any mass mortalities of stock or other environmental problems to the relevant agencies and the containment of diseased or infected stock
- Identify responsibilities for environmental monitoring proportionate to possible environmental risk and benefits
- Provide guidelines on reporting and analysis of findings, taking into account the costs and benefits of such monitoring
- Promote the correct disposal of dead stock in a manner which will not render the likelihood of any disease or pathogen being released into natural waterways
- Encourage research and development programs that are funded and supported jointly by industry and governments to expand knowledge and understanding of aquaculture operations and their environmental interactions

PHOTOGRAPHY: CSIRO MARINE RESEARCH

THE CODE OF CONDUCT AND WHY IT IS NEEDED

With a clean environment and freedom from many of the major diseases experienced in the northern hemisphere, Australian aquaculturists have a strong competitive marketing advantage. Our 'clean and green' image has allowed many of our aquaculture products to command premium prices.

Clean water also means faster growing and healthier fish. Hence, environmental protection is a major priority for the industry, as it relies on the provision of clean waters for its livelihood. Poor site selection, insufficient capital investment, deficient farm design, inadequate public administration, or inappropriate management may mean that some aquaculture operations cause environmental change. Through the peak national body, the Australian Aquaculture Forum the industry is committed to implementing farming practices based on ecologically sustainable development principles. Recognition of the need for aquaculture to play a major role in protecting the marine, estuarine and freshwaters of Australia led to the development of this Code of Conduct.

The Code of Conduct evolved out of a 15-month consultation process involving more than 350 representatives from industry, government, environmental interest groups, Aboriginal groups and other stakeholders with a commitment to the sustainable management of Australia's aquatic environment.

This Code is voluntary, except in so far as parts of the Code may have been given, or may be given, binding legal effect by means of legislation. On behalf of the wider Australian aquaculture industry, the Australian Aquaculture Forum's national and state member associations have prepared and endorsed this Code's 43 points to provide minimum standards for environmental performance. AAF will encourage all aquaculturists to adopt this Code as a statement of the industry's commitment to ecologically sustainable development.

The preparation and distribution of this Code is one of the first steps in a strategy promoting correct environmental practices within the aquaculture industry. The guiding principles outlined in the Code of Conduct will provide specific sectors or regions of the industry with a framework in which they can develop their own Codes of Practice, with a focus on ecological and economic sustainability for their particular culture species, site or culture operation.

SPONSORS

FISHERIES RESEARCH & DEVELOPMENT CORPORATION

Environment Australia
Department of the Environment

This Code of Conduct was initiated by the Australian Aquaculture Forum and was developed with assistance and funds from the Fisheries Research and Development Corporation and Environment Australia's Coastal and Clean Seas Program. The co-operation of Recfish (the peak body for the recreational fishing industry) and the Aquaculture Committee of the Standing Committee on Fisheries and Aquaculture is also acknowledged.

Printing and distribution costs were partially funded by the Department of Primary Industry, Queensland; Primary Industry and Resources South Australia; Fisheries Victoria and the Western Australian Fisheries Department.

This Code is supported by the State and Territory Aquaculture Managers.

CONTACT

To find out more about the Code or learn about sustainable aquaculture practices, contact the Australian Aquaculture Forum at PO Box 533, Curtin, ACT 2605, Australia, or tel: 02 6281-0383, fax: 02 6281-0438, email: aaf@asic.org.au

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Australian Tuna Boat Owners Association
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Pet Industry Joint Advisory Council
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Aquaculture Council of Queensland
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APPENDIX 8.2.3.1: REGULATORY IMPACTS ON THE TASMANIAN SALMONID INDUSTRY.

Contents

8.2.3.1: Background

Marine leases have been granted under various fisheries authorities since 1853. Salmonid marine farming began in Tasmania in the early 1850’s when attempts were made to establish populations of Atlantic salmon and brown trout. The introduction of Atlantic salmon failed, however a small population of brown trout survived and formed the basis of the recreational trout fishery in this state. The commercial; freshwater trout farming industry did not develop until 1964 with marine farming starting in the 1980’s.

Atlantic salmon was first introduced into quarantine in 1984 and harvesting of pilot scale Atlantic salmon occurred in 1986. In 1986 the *Fisheries Act 1959* was amended to allow salmonid farming to occur in the marine environment under the jurisdiction of the Minister of Sea Fisheries, rather than fish farm licenses issued by the Minister of Inland Fisheries. This allowed that Department of Sea Fisheries to introduce a farm monitoring project, with the intention of developing codes of practice to ensure that pollution and disease risks were minimised. In 1987, the minister imposed an interim production limit of 150 tonnes gutted weight per annum on all marine farming permits then under consideration for the Huon Estuary.

In 1987 the Minister for Sea Fisheries announced a moratorium on new applications for marine farms due to the pace of development of marine farms exceeding Government’s expectations. A discussion paper for a new fisheries Act was released in 1990, leading to a proposal for integrated coastal zone management plans. Marine Farming Development Plans using a zoning system were then initiated.

In 1995, the Tasmanian Government supported the expansion of the salmonid industry under the *Marine Farm Planning Act 1995* (MFPA) by well-planned sustainable processes. The MFPA provides a mechanism for the preparation and approval of marine farming development plans, which takes into account all users of the estuaries and coastal waters, and identifies zones where marine farming may occur. This zoning system effectively eliminated protracted legal challenges to the establishment of marine farms that had previously stalled the development of the industry (Crawford 2001). Incorporated into the MFPA is an extensive monitoring program to ensure that the industry operates in an environmentally sustainable way. This will ensure that the Plans are consistent with "sustainable development", a key component of the State's Resource Management and Planning System.

At the present time, marine farmers are principally governed by the *Marine Farming Planning Act 1995* and *the Living Marine Resources Management Act 1995*, but are expected to comply with a suite of associated Acts and controls listed below. The following section has been adapted from the DPIW Marine Farm Development Plans.

8.2.3.2: Resource Management Planning System

A suite of laws, policies and procedures integrated under the Resource Management and Planning System (RMPS) guides Tasmania's environmental planning and management system. The RMPS is based on the principles of **sustainable development** that are set out in Schedule 1 of each of the key pieces of legislation. These objectives are as follows:

(a) to promote the sustainable development of natural and physical resources and the maintenance of ecological processes and genetic diversity; and
(b) to provide for the fair, orderly and sustainable use and development of air, land and water; and
(c) to encourage public involvement in resource management and planning: and
(d) to facilitate economic development in accordance with the objectives set out in paragraphs (a), (b) and (c): and
(e) to promote the sharing of responsibility for resource management and planning between the different spheres of Government, the community and industry in the State.

In clause 1(a), "sustainable development" means managing the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural well-being and for their health and safety while:

(a) sustaining the potential of natural and physical resources to meet the reasonable foreseeable needs of future generations; and
(b) safeguarding the life-supporting capacity of air, water, soil and ecosystem; and
(c) avoiding, remedying or mitigating any adverse effects or activities on the environment.

Further information can be located from http://www.rmpat.tas.gov.au/home.html and the act can be viewed from http://www.thelaw.tas.gov.au. The principles of the RMPS are integrated into the following Acts.

8.2.3.3: Marine Farming Planning Act 1995

The MFPA makes provision for:

- zoning areas of State waters, by the way of marine farming development plans, where future marine farming operations may occur;
- preparation of an environmental impact statement in relation to the proposed use of the Plan area for marine farming activities;
- management controls to regulate marine farming activities within marine farming zones and mechanisms for enforcement; and
- allocation of lease areas within marine farming zones.

The MFPA makes provision for the environmental, economic, recreational and social development of any region considered for marine farming, taking into consideration adjacent land uses including their regulatory requirements. Further information can be found at http://www.thelaw.tas.gov.au.

8.2.3.4: Living Marine Resources Management Act 1995

The *Living Marine Resources Management Act 1995* (LMRMA) places responsibility on the Government to manage the State's living marine resources in a sustainable manner. The legislation has clear objectives for the management of fish and their habitats in a sustainable way for the enjoyment of all "users" – such as commercial wild fishers, recreational fishers, marine farmers, divers and marine observers.

The Act contains powers to protect the marine environment and powers of enforcement. It retains the mechanism for research to be undertaken by the way of Permits. This research includes investigation into wild fisheries and habitat management and new marine farming technologies, in existing or new locations as covered in Section 12 of the Act. A scientific research permit will have its own unique set of conditions which may include some environmental conditions.

Licences for marine farming activities are allocated under this Act (together with other licences for such activities as fish processing or commercial wild fishing). Marine farming licences issued pursuant to the LMRMA and management controls contained within marine farming development plans, are the principle instruments for controlling specific marine farming activities. Licence conditions are reviewed on an annual basis, and may be subject to variation during renewal and transfers of licence (Sections 83 and 86 of the Act). DPIW have a charter of adaptive management and therefore may need to change licence conditions in specific circumstances. Licence conditions for the Tasmanian oyster industry are described in Appendix 1, Marine farming licence conditions relating to environmental management of a subtidal / intertidal shellfish farm Further information can be found at website http://www.thelaw.tas.gov.au.

8.2.3.5: National Parks and Reserves Management Act 2002

The *National Parks and Reserves Management Act* 2002 (NPRMA) closely follows the objectives of the RMPS, and provides for the reservation of land and water for the purpose of conservation and the development of management plans in those areas. Marine farms developed within the boundaries of a National Park or reserved land will have to comply with the permit conditions guided by the management objectives of the management plan for the corresponding area. Existing management policies will be covered for each relevant regional area. Individual facilities will be required to investigate their own site in relation to the NPRMA which may include such issues as the removal of trees, public access and leasing of land. Further information can be found at http://www.thelaw.tas.gov.au.

8.2.3.6: Nature Conservation Act 2002

The *Nature Conservation Act* 2002 contains provisions with respect to the conservation and protection of the fauna, flora and geological diversity of the State, to provide for the declaration of national parks and other reserved land and for related purposes.

8.2.3.7: Threatened Species Protection Act 1995

The *Threatened Species Act 1995* (TSPA) is to provide for the protection and management of threatened native flora and fauna and to enable and promote the conservation of native flora and fauna. The provisions of the Act relate to the threatened species listed in the Appendices to the Act, which are categorised according to their status as endangered, vulnerable or rare.

Once a species is listed, the Act allows steps to be taken to protect it or its critical habitat. These steps may include the development of recovery plans and threat abatement plans, or land management plans or agreements. Further regional details are listed in Section 2.2.4. Further information can be found at http://www.thelaw.tas.gov.au.

8.2.3.8: Aboriginal Relics Act 1995

All Aboriginal sites in Tasmania are protected under the *Aboriginal Relics Act 1975*. Section 14(1) of the Act states that to damage, destroy, remove, conceal or interfere with an Aboriginal relic requires a permit from the Minister for Parks and Wildlife. Relics need not have been formally identified in order to be covered by the provisions of this Act. The provisions of the Act apply to all land tenures. Further regional details are covered in Section 2.3.3. Further information can be found at http://www.thelaw.tas.gov.au.

8.2.3.9: Environmental Protection and Biodiversity Conservation Act 1999

The *Environmental Protection and Biodiversity Conservation Act 1999* (EPBCA) provides provisions for the protection of the environment and the conservation of biodiversity, and for related purposes. The Act provides the head of power for the Commonwealth to assess and approve or reject actions that are likely to have an impact on a matter of national environmental significance.

Matters of national environmental significance are listed as:

- World heritage properties (see Section 2.3.3)
- RAMSAR wetlands of international importance (see Section 2.2.5)
- listed threatened species and communities (see Section 2.2.4)
- migratory species protected under international agreements (see Section 2.2.3)
- nuclear action
- the Commonwealth marine environment.

The Act requires the person proposing to take an action which is likely to have a significant impact on a matter of national environmental significance to refer the proposal to the Commonwealth Minister for Environment. Any future marine farming proposals may need to consider the provisions of the EPBCA. Further information can be found at http://scaleplus.law.gov.au/html/pasteact/3/3295/top.htm.

8.2.3.10 State Policies and Projects Act 1993

The *State Policies and Project Act 1993* provides for the making of State Policies. State Policies are statutory documents, which are intermediate between the provisions of an Act and policies and provisions of planning schemes and other mechanisms identified in relevant legislation.

Current State Policies relevant to the development of marine farming development plans are the *State Coastal Policy 1996* and the *State Policy on Water Quality Management1997*. Further information can be found at http://www.thelaw.tas.gov.au.

8.2.3.11: State Costal Policy 1996

The *State Coastal Policy Validation Act 2003* validates the State Coastal Policy of 1996 for all State waters to a distance of one kilometre inland from the high-water mark. The outcomes of the policy are guided by three main principles: the protection of the natural and cultural values of the coast; sustainable development and use of the coast; and the shared responsibility of the management of the coastal zone.

Specific Policy Outcomes that relate to marine farming development plans state:

- "*Marine farming will be planned, developed and conducted in the coastal zone having regard to the sustainable development considerations and in accordance with the MFPA and other relevant terrestrial and marine resource management and planning legislation and consistent with this Policy.*"
- *Marine farming development plans will be prepared, approved and gazetted under the MFPA and consistent with the objectives, principles and outcomes of this policy."*

The objectives of the State Coastal Policy are governed by the sustainable objectives of the RMPS including sustainable development. Further information can be found at http://www.thelaw.tas.gov.au.

8.2.3.12: State Policy on Water Quality Management 1997

The *State Policy on Water Quality Management 1997* (SPWQM) purpose is "to achieve sustainable management of Tasmania's surface water and ground water by protecting or enhancing their qualities while allowing for the sustainable development in accordance with the objectives of Tasmania's RMPS."

The SPWQM requires that Protected Environmental Values be determined by agreement between the Board of Environmental Management and Pollution Control and the DPIW, as a Planning Authority, for marine farming zones.

Protected Environmental Values (PEV) are values or uses of the environment for which it has been determined that the environment should be protected. Following the setting of PEV for marine farming zones, the Board of Environmental Management and Pollution Control will define water quality objectives which will be used to determine if PEV are being met, over time.

The PEV are described in Component 2 for each regional area. Guidance notes relating to the environmental impact of facilities on surface and ground water are provided in Section 3.1.3 and 3.1.15. Further information on the SPWQM is available from http://www.thelaw.tas.gov.au.

8.2.3.13: Land Use Planning and Approvals Act 1993

The *Land Use Planning and Approvals Act 1993* (LUPAA) sets out the process for the preparation, approval and amendment of planning schemes. This Act requires that planning scheme:

- must seek to further the objectives of the RMPS and of the planning process established by LUPAA (Schedule 1 Objectives part 2);
- must be prepared in accordance with State policies;
- may provide for the use, development, protection or conservation of land; and
- must have regard to the strategic plan of a council.

LUPAA requires coordination between planning schemes and consideration of the region as an entity in environmental, economic, recreational and social terms. LUPAA also requires *"sound strategic planning and coordinated action by State and local government*".

The Act provides for councils to exercise planning controls over the use and development within defined areas. Planning controls may be extended below low water mark for development which is related to or affects the use of adjacent land except in the case of marine farming and fishing in State waters. Further information can be found from http://www.thelaw.tas.gov.au. Regional information is covered in Sections 2.3 and 8.2.1.

8.2.3.14: State Policy on Water Quality Management 1997

The *State Policy on Water Quality Management 1997* has been developed under the *State Policies and Project Act 1993* to allow for sustainable development of water bodies. This policy applies to all surface waters, including coastal water and ground water or water bodies which flow into the above areas accessible by the public.

The objectives of the policy, in brief, are to

- maintain or enhance water quality;
- ensure that point source pollution does not prejudice the achievement of water quality objectives and that pollutants discharged to waterways are reduced as far as it is reasonable and practical by the use of best practice environmental management;
- ensure efficient and effective water quality monitoring programs are carried out and the responsibility and cost is shared by those who use and benefit from the resource;
- facilitate and promote integrated catchment management; and
- apply the precautionary principle.

Within the *State Policy on Water Quality Management 1997*, section 42 states that:

- Areas designated for marine farming should be chosen such that marine farms are sited and can be operated to provide sustainable environmental outcomes;

- Areas designated for marine farming should be protected from adverse changes in water quality arising from adjacent land based activities or activities in the adjacent coastal area; and
- Marine farming operations should be managed and regulated as required ensuring that they do not prevent the achievement of recognised water quality objectives outside the marine farming leases.

8.2.3.15 Management Controls

The management controls enforceable under the Tasmanian Marine Farming Planning act (1995) listed in Schedules 4 and 5 (Appendix 1) are validated in the relevant sections of Components 1 and 2 of this document. The controls effectively ensure that there is no unacceptable environmental impact outside the boundary of the marine farming lease area. Further information on the Marine Farming Development Plans for Tasmania is available at http://www.dpiwe.tas.gov.au/inter.nsf/WebPages/ALIR-4YS3VE?open#CurrentMarineFarming.

References

Anon (1987) A history of marine farm management in Tasmania. Marine Farming Policy Series No.1., Department of Sea Fisheries, Tasmania.16 pp.

Anon (1987) Moratium on the issue of marine farm leases and permits. Marine Farming Policy Series No.4., Department of Sea Fisheries, Tasmania.1 pp.

Anon (1993) Future management and regulation of the marine farming industry: A discussion paper. Marine Farming Information Series, Publication No. 6. 30pp.

Crawford C (2001) Environmental risk assessment of shellfish farming in Tasmania. Internal Report. Tasmanian Aquaculture and Fisheries Institute, University of Tasmania. 47 pp.

Marine Farming Development Plans (various) prepared by the Food, Agriculture & Fisheries Division, Department of Primary Industries, Water and Environment, Tasmania.

APPENDIX 8.2.3.2: MARINE FARM LICENCE CONDITIONS & REQUIREMENTS RELATING TO ENVIRONMENTAL MANAGEMENT: SUMMARY OF SCHEDULES & PROCEDURES.

Finfish

Schedule 1	Conditions applying to the licence in accordance with Section 66 of the *Living Marine Resources Management Act 1995* (the Act).
Schedule 3	Conditions relating to environmental management of a finfish marine farm.
Schedule 3B	Salmonid Finfish Baseline Environmental Survey: Requirements for a New Lease Area, Relocation or Expansion Greater than 10% of Lease Area.
Schedule 3I	Salmonid Finfish Initial Monitoring Survey: Requirements for Salmonid Finfish Lease Areas.
Schedule 3V	Salmonid Finfish Video Survey: Requirements for Salmonid Finfish Lease Areas.
Schedule 3M	Salmonid Finfish Environmental Monitoring Survey: Requirements for Salmonid Finfish Lease Areas.

MARINE FARMING LICENCE NO. XXX

SCHEDULE 1.

Conditions applying to the licence in accordance with Section 66 of the *Living Marine Resources Management Act 1995* (the Act).

1. The licence holder shall:-

a) only harvest shellfish from the premises to which this licence relates for human consumption or for on-growing for human consumption in accordance with the Tasmanian Shellfish Quality Assurance Program.

b) not release into State waters any fish or shellfish unless authorised in this licence.

2. The licence holder in respect of marine farming operations unless otherwise required by the Secretary of the Department of Primary Industries and Water shall:

a) keep records of all fish brought onto and taken off the area to which this licence relates. Those records must show:-

i. the date of each movement;

ii. a description of each consignment of fish being moved, including species, class and quantity of fish;

iii. for fish taken off the area, the place to which each consignment of fish was sent;

iv. for fish brought onto the area, the place from which the fish came.

b) keep the records at (a) above in a manner and form that enables rapid access to the information in the event of an emergency. (A recommended format is at Attachment A to this Schedule).

c) keep the records at (a) above for not less than five years from the date of production of the record.

3. The licence holder in respect of marine farming operations unless otherwise required by the Secretary of the Department of Primary Industries and Water shall:

a) keep records summarising the amounts of fish taken off the lease area to which this licence relates for consumption, processing and/or for on-growing outside of Tasmania showing:

i. for each Australian State and Territory and for each overseas country to which fish have been consigned, the amount of fish taken off the area in the previous three month period.

b) keep the records at (a) above in the manner and form shown at Attachment B to this Schedule for not less than five years from the date of production of the record.

4. The licence holder unless otherwise required by the Secretary of the Department of Primary Industries, Water and Environment shall submit to the Secretary of the Department of Primary Industries, Water and Environment, within fourteen (14) days of the end of each three month period, a copy of records kept under 3. above, summarising:

a) the amounts of fish taken off the area to which this licence relates for consumption and for on-growing outside of Tasmania; and

b) the average number of persons employed on the area to which this licence relates in the previous three month period.

ATTACHMENT “A” (SCHEDULE 1) (page 1 of 2)

STOCK BROUGHT ONTO THE LICENSED AREA
(Record each transfer as a separate entry)

Write in the date of transfer	Write in the name of the species	Type of stock (year class, size)	Enter the quantity	Specify units	Write in the name of the sender	Write in the address of the lease area from which the consignment was sent
Date	**Species**	**Stock**	**Quantity**	**Units**	**Name**	**Address**

ATTACHMENT "A" (SCHEDULE 1) (page 2 of 2)

STOCK SENT OFF THE LICENSED AREA
(Record each transfer as a separate entry)

Write in the date of transfer	Write in the name of the species	Type of stock (year class, size)	Enter the quantity	Specify units	Write in the name of the person to whom the consignment was sent	Write in the address of the lease area or place to which the consignment was sent
Date	**Species**	**Stock**	**Quantity**	**Units**	**Name**	**Address**

ATTACHMENT "B" (SCHEDULE 1)

Department or Primary Industries, Water and Environment
Quarterly Marine Farming Production Return

Licence No. [ ]

Living Marine Resources Management Act 1995

PRODUCTION RETURN FOR THE THREE MONTH PERIOD ENDING
(PLEASE MARK THE APPROPRIATE BOX AND ENTER YEAR)

31 MARCH	30 JUNE	30 SEP	31 DEC	YEAR

STOCK TAKEN OFF THE LICENSED AREA FOR CONSUMPTION OR PROCESSING DURING THIS QUARTER

Write in the name of the species **Species**	Write in the name of the state or country of destination **Destination** - State/Country	Enter the quantity and tick the box for the units used **Quantity**	No.	Doz	Kg	Specify other units Other units

STOCK TAKEN OFF THE LICENSED AREA FOR ONGROWING OUTSIDE TASMANIA DURING THIS QUARTER

Species	**Destination** - State/Country	**Quantity**	No.	Doz	Kg	Other units

EMPLOYMENT

Average number of persons employed directly on the licensed area during this period

permanent (include licence holder) [ ]

casual employees [ ]

CONFIDENTIALITY

The information provided on this form will remain confidential to the Department of Primary Industries, Water and Environment and only summarised statistics, not identifiable by lease or licence number, will be used in publications or in reports to industry organisations.

Please complete and deposit with the Department of Primary Industries, Water and Environment, Marine Farming Branch, GPO Box 192, Hobart 7001 or fax (03) 6233 3065 **within 14 days of the end of each three month period.**

Name: ____________________ Remarks: ____________________

Signature: ____________________ Date: ____________

CAUTION: UNDER SECTION 263 OF THE *LIVING MARINE RESOURCES MANAGEMENT ACT 1995.*
A PERSON, IN MAKING AN APPLICATION, GIVING ANY DOCUMENT OR STATING ANYTHING TO A FISHERIES OFFICER, MUST NOT
A) MAKE A STATEMENT KNOWING IT TO BE FALSE OR MISLEADING, OR
B) OMIT ANY MATTER FROM A STATEMENT THAT WITHOUT THAT MATTER THE STATEMENT IS FALSE OR MISLEADING
PENALTY - FINE NOT EXCEEDING 500 PENALTY UNITS

SCHEDULE 3 TO MARINE FARMING LICENCE: XXXX

MARINE FARMING LICENCE CONDITIONS RELATING TO ENVIRONMENTAL MANAGEMENT OF A FINFISH FARM

Conditions relating to the environmental management of finfish farms are in four parts:

1. Compliance with environmental standards
2. Requirements for Environmental Monitoring Survey(s)
3. Environmental records to be kept by licence holder
4. Environmental reports to be provided to the Department of Primary Industry and Water (DPIW)

In this Schedule, "the General Manager" means the General Manager, Primary Industries in DPIW or any person authorised to act on the General Manager's behalf.

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1 Compliance with Environmental Standards

The licence holder must comply with the following environmental standards in carrying out operations on the marine farming lease area or areas to which this licence relates (the Lease Area):

1.1 There must be no significant visual, physio-chemical or biological impacts **at or extending beyond 35 m from the boundary** of the Lease Area. The following impacts should generally be regarded as significant:

Visual impacts:

- Presence of fish feed pellets;
- Presence of bacterial mats (e.g. *Beggiatoa* spp.);
- Presence of gas bubbling arising from the sediment, either with or without disturbance of the sediment;
- Presence of numerous opportunistic polychaetes (e.g *Capitella* spp., Dorvilleid spp.) on the sediment surface.

In the event that a significant visual impact is detected at any point 35m or more outside the lease boundary, the licence holder may be required to undertake a triggered environmental survey.

Non-visual impacts:

- Physico-chemical:

A corrected redox value which differs significantly from the reference site(s) and/or is < 0 mV at a depth of 3 cm within a core sample.

A corrected sulphide level which differs significantly from the reference site(s) and/or is > 250 μM at a depth of 3 cm within a core sample.

- Biological:

A 20x increase in the total abundance of any individual family relative to reference site(s).
An increase at any compliance site of greater than 50x the total Annelid abundance at the reference site(s).
A reduction in the number of families by 50 % or more relative to reference site(s).
Complete absence of fauna.

(Note: As natural environmental variation renders some locations more susceptible to 'unacceptable' parameter values, the above thresholds will be considered in addition to baseline environmental information for determining the presence/absence of a significant impact)

1.2 There must be no significant visual impacts **within the Lease Area**. These include but are not limited to:

Visual impacts within Lease Area

- Excessive feed dumping;
- Extensive bacterial mats (e.g. *Beggiatoa* spp.) on the sediment surface prior to restocking;
- Spontaneous gas bubbling from the sediment.

1.3 Fallowed areas within the Lease Area shall not be restocked until, having regard to visual evidence, the sediments have recovered to the satisfaction of the General Manager.

1.4 The licence holder must comply with any written request from the General Manager specifying waste disposal actions for the purpose of mitigating against any effect on the ecology of the marine environment or nearby shoreline associated with marine farming operations including harvesting, processing of salmonids and the removal of fouling organisms.

1.5 All fish mortalities arising in connection with marine farming operations must be disposed of in accordance with relevant Acts and council by-laws.

1.6 The licence holder must ensure any predator control of protected wildlife (within the meaning of the *Wildlife Regulations* 1999) is conducted with the approval of the manager of the Nature Conservation Branch of the

DPIW or any person acting on that person's behalf and in accordance with relevant seal interaction management protocols of the DPIWE.

1.7 Where bird netting is deployed, the nets must be made of netting of a maximum 115mm square mesh and conform to visual management controls specified in the relevant Marine Farming Development Plan (MFDP). *Existing marine farming lease areas have three years to conform (i.e January 2008). All new marine farming leases must conform immediately upon licensing*.

1.8 The licence holder must ensure all aerial bird netting is maintained free of holes and remove any dead or entangled birds from the netting as soon as practicable.

1.9 Feeding of seals must not occur in any marine farming zone (within the meaning of the *Marine Farming Planning Act* 1995) or the Lease Area.

1.10 Baited trap lines or “tease lines” may only be deployed by an officer employed in the Nature Conservation Branch of DPIWE or a person(s) who holds a permit to do so under the *Wildlife Regulations 1999*.

1.11 The licence holder must report any entanglement of protected marine species (including birds and mammals) to the Nature Conservation Branch contact officers as listed in the Seal Interaction management protocols.

1.12 Levels of antibiotics, or chemical residues derived from therapeutic use, present in sediments within or outside the Lease Area, are not to exceed levels specified to the licence holder by prior notice in writing by either the General Manager or the Chief Veterinary Officer, DPIWE.

1.13 Bloodwater resulting from harvesting of produce must not be released into the marine environment unless it has been managed in accordance with the requirements of the Chief Veterinary Officer DPIWE, as specified in Schedule 1.

1.14 The threshold levels listed in the following table must not be exceeded within the Lease Area, by reason of the conduct of marine farming operations in the Lease Area.

Contaminant	**Sediment (mg/kg dry wt)**	**Water Column (μg/L)**
Copper	270	1.3
Zinc	410	15

1.15 The Licensee must take all reasonable steps to ensure that no dead fish of the species authorised by this licence are found on the Lease Area outside cages.

2 Requirements for Environmental Monitoring Survey(s)

2.1 The licence holder must undertake environmental monitoring surveys in accordance with the requirements of Schedule(s) 3B and/or 3V to this licence, and duly report on those surveys in accordance with those Schedules.

3 Environmental records to be kept by the Licence holder

The following records shall be kept by the licence holder for a period of five years and provided to the General Manager on request.

3.1 A list specifying the quantities, and date of use, of all chemicals which have been used on the Lease Area. This includes, but is not confined to, therapeutants, anaesthetics, antibiotics, hormones, pigments, antifoulants, disinfectants and cleansers.

3.2 Records, on a monthly basis, of the stock biomass within the Lease Area, and of the type, origin and dry weight of food placed into the Lease Area .

4 Environmental reports to be provided to the Department

Renewal of annual licence(s) will be subject to compliance with all environmental reporting requirements. Where relevant the reporting of information to the General Manager is to be made by phone (62 33 3370) or electronically (e-mail: mfarming.environment@dpiwe.tas.gov.au).

4.1 The licence holder must report any suspected or known incidents of disease or mortality affecting > *0.25 %* of fish per day for three consecutive days in any individual cage. Such reports are to be provided as soon as possible to the DPIWE assigned fish veterinarian or an inspector under the *Animal Health Act 1995*.

4.2 The licence holder must notify the General Manager in writing of the presence of any unusual or uncharacteristic marine flora or fauna found within the Lease Area (including any introduced marine pests). (e-mail: mfarming.environment@dpiwe.tas.gov.au)

4.3 Reports of any incidents of spontaneous outgassing are to be immediately reported to the General Manager.

4.4 An electronic copy of the records to which clause 3.2 refers is to be provided to the General Manager in January each year. (e-mail: mfarming.environment@dpiwe.tas.gov.au)

4.5 The licence holder must report to the General Manager any significant incident of fish escapes within 24 hours of becoming aware of the escape. A significant escape is defined as any loss of licensed species to the marine environment in excess of 1000 individuals at any one time. (e-mail: mfarming.environment@dpiwe.tas.gov.au)

4.6 The licence holder must immediately report to the manager, Nature Conservation Branch, DPIWE any incidence of mortality in protected wildlife (within the meaning of the *Wildlife Regulations* 1999) which arises in connection with the marine farming operations to which this licence relates. (Phone: 6233 6556 or e-mail: NatureConservationEnquiries@dpiwe.tas.gov.au)

4.7 The licence holder must give prior written notice to the General Manager of any proposal to move marine farming equipment from any Marine Farming Development Plan (MFDP) area to another for the purpose of the deployment of that equipment in that MFDP area. (e-mail: mfarming.environment@dpiwe.tas.gov.au)

SCHEDULE 3B TO LICENCE:

SALMONID FINFISH BASELINE ENVIRONMENTAL SURVEY

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1. Outline of Requirements

A Baseline Environmental Survey is to be conducted with respect to any new lease area or any area added to a lease area which increases that lease area by more than 10%, in accordance with the specifications in this Schedule and any requirements of the General Manager, Primary Industries, Department of Primary Industries, Water and Environment (DPIWE).

The environmental baseline survey report must be submitted to the Marine Environment Section, DPIWE by the applicant in accordance with section 2.7 of this schedule.

The sampling is to be conducted at each of the sites shown on the enclosed map. All positional requirements (prescribed control, sample site, spot dives or transect and farm dive AMG coordinates) of the survey are to be located and recorded using differential GPS (DGPS), to ensure the same sites can be revisited in subsequent years. All sample collection and filming is to be conducted on the same day, (or within one week if not practicable).

The applicant must notify the Marine Environment Section, DPIWE [ph (03) 62 333370, mob 0419 120030 or fax (03) 62 333065] of the sampling date chosen at least 48 hrs prior to conducting the survey to enable a Marine Environmental officer to be present to audit the survey.

The baseline survey for salmonid finfish must include the following components, as detailed in section 2 of this Schedule:

2.1 Current measurements
2.2 Bathymetric profile
2.3 Seabed characteristics/habitat type profile
2.4 Underwater video survey
2.5 Sediment chemistry - redox, sulphide, particle size analysis,
2.6 Biological analysis* - benthic faunal analysis
2.7 Reporting of results to Marine Environment Section

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* This component of the Baseline Environmental Survey applies only to lease areas that are new or where an existing lease has been relocated >500m from any area previously occupied by the lease to which this schedule relates. (Note that where relevant, benthic sampling for threatened species may be specified for any baseline environmental survey.)

2. Environmental Baseline Survey Specifications

2.1 Current measurements

Current speed and direction are to be measured at a maximum of 30 minute intervals continuously over a 6 week period at one site within the lease area, at a location to be specified by the General Manager of the Primary Industries. The current meter should be located two metres above the bottom and its exact location defined by Australian Mapping Grid (AMG) co-ordinates.

The current meter should be accurate to within 5%, and capable of detecting a current of 2.5 cm/sec. The current meter should be regularly maintained to ensure correct operation, including cleaning of fouling organisms.

Data must be presented graphically in the following format:

- Frequency of speed records – frequency (%) vs current speed interval (cm/sec), (bar chart);
- Frequency of direction records - frequency (%) vs current flow direction (^{0}mag), (bar chart);
- Current flow direction (^{0}mag) vs current speed (cm/sec), (scatter plot);
- Raw data plot including direction, temperature and salinity vs time, and
- Raw data plot including direction and speed vs time.

Where possible the scale on each axis should be the same. All raw data must also accompany the final baseline report in the form of excel files.

2.2 Bathymetric profile

Depths (m) accurate to 0.5m are to be measured across the lease area and for an area extending 50m beyond the boundaries of the lease area. Measurements should be made by a boat with echosounder and by differential GPS (or log measuring distance). The records of depth should be made by soundings every 100m .

The approximate position of depth contours are to be presented on a map of the lease area.

2.3 Seabed Characteristics and habitat profile

Location of major habitat type(s) must be detailed on a map of the lease area. The map of significant seabed features is required as an overlay for the bathymetric map. The data for the sketch map can be collected by echo or side-scan sonar, diving, or underwater video to classify the major habitat types on the seabed in the lease area. These may include, but are not limited to:

- hard bottom - rock, limestone reef, boulders, rubble

- soft bottom - sand, mud/silt
- marine plants- composition of dominant species present

2.4 Underwater Video Survey

The survey is to include an underwater video survey, made using external and internal spot dives. An internal spot dive is one made within the lease area and an external spot dive is one made outside the lease area.

External spot dives:
The spot dives are to be carried out in the locations specified on the attached map.

Each set of 35m external spot dives will consist of:

- a minimum of one upstream and one downstream set of spot dives located parallel to the lease boundary. Each set of spot dives will consist of a minimum of 3 spot dives at least 20 metres apart parallel to the lease boundary at a distance of 35m from the lease boundary or one parallel transect 40 metres in length. Each spot dive must record a minimum of 60 seconds of video footage. AMG coordinates of each spot dive must be recorded. If current flow is not known or variable, additional spot dives/transects may be required off the remaining lease boundaries.

In addition, spot dives must be conducted at 6 control sites with a sediment particle size similar to that found at the 35m compliance points. These spot dives must be at least 20m apart or consist of 2 transects 40m long.

Where a transect line is used it shall consist of a weighted line of known diameter with clearly marked tags 5m apart. The transect line must be removed after each filming.

Internal habitat dives:
In addition to the external dives, spot dives must also be performed inside the lease area to show habitat within the lease area. AMG co-ordinates of each within lease spot dive must be recorded. The number of habitat dives required will be dependent on the lease area to be surveyed and should be determined in accordance with the following:

Lease area to be surveyed (Ha)	*Number of habitat dives*
0-5	2
6-10	4
11-20	6
21-40	8
41-100	10

2.4.1 Filming Procedure

For external spot dives filming must be conducted slowly to ensure clear images of the seabed in the vicinity of the anchor marking the spot dive are recorded. Each spot dive must be clearly identified on the video footage with the approved dive number. Footage must show a minimum of sixty seconds of clear footage. Stationary footage recorded with the camera lens pointing vertically down must be taken. The sediment must be disturbed and video footage recorded to assess presence of outgassing.

Where a transect is used, filming is to be conducted with the transect line in view. Each transect must be identified on the film with the appropriate transect number e.g. T1, T2 etc. Filming must be conducted slowly along the transect line to ensure clear images of the transect line and sea bed are recorded. For the 40m transect, stationary video footage must be obtained at the 3 points specified on the survey map with the camera lens pointing vertically downward with the transect line in view. The sediment must be disturbed and filmed at each specified site along the transect including vertical footage to check for the presence of outgassing on disturbance.

2.4.2 Equipment

All video footage is to be colour Hi-8 or digital format (or equivalent), for computerised image analysis to be conducted by DPIWE. Clear, well lit images on high quality tapes are required. The camera / ROV must be capable of operating at a minimum of 3 lux. A record of the date, time and type of filming (control/transect/farm dive, etc) must be provided at the start of each filming sequence.

Underwater housing to suit the camera must be used and fitted with a minimum of 2 x 50W lights.

Original tapes must be submitted with the report.

The report must include comments on the following:

- Sediment colour (e.g. from brown/ grey to black),
- Texture of sediments (e.g. sand, silt mud)
- Seaweed cover
- Visibility near cages/longlines etc.
- Variety and density of animals living on and in the seabed
- Presence of bacterial mats (e.g. *Beggiatoa* spp.)
- Outgassing from the sediment (including any outgassing upon disturbance)
- Presence of finfish faeces and/or feed pellets,
- Any other relevant features.

2.5 Sediment chemistry

2.5.1 Visual assessment, redox and sulphide

One undisturbed sediment core is to be taken using a perspex corer with an internal diameter of at least 50 mm at each sample site specified in the survey. A written description of each core recording the following parameters is required:

- length of core measured in millimetres with a ruler;
- sediment colour, from the surface to deeper layers;
- visible animal and plant life;
- gas vesicles if present and the size and position of the vesicles in the sediment;
- any sediment smell indicating for example, the presence/absence of hydrogen sulphide;

2.5.2 Redox and sulphide

The following protocols for redox and sulphide measurement have been drawn from Macleod *et al.* (2004). Redox potential and sulphide concentration measurements are to be taken from each sediment core. Both redox and sulphide should be measured at 3cm depth. There are a variety of redox probes available; single cell and combination electrodes. For ease of sampling the combination electrodes are recommended. Prior to each set of measurements being taken the probe should be calibrated. Pre-packaged calibration solutions can be purchased. As calibration is sensitive to temperature it is important to note the temperature of both the calibration solution and the sample at the time of sampling. It is best if these temperatures are comparable.

To obtain a redox measurement, the probe is inserted into a port in the side of the core tube. This port must be positioned at 3cm below the sediment water interface. Redox potential values should be allowed to stabilise prior to recording. Depending on the sediment condition the measurement may settle quickly or it may take a few minutes. Redox measures the oxidation/reduction potential of the sediments by determining the availability of free hydroxyl ions. Measurement will itself affect this level and therefore the reading on the meter will continue to decline (albeit slowly) whilst the measurement is being made. Consequently it is not necessary for the probe to stabilise completely before taking a reading, simply ensure that the rate of decline has steadied. Note that an error level of +/- 10-20mV in the final reading is acceptable. Corrected redox results and raw data are to be reported in millivolts at 3cm depth.

There are a variety of different probes available for the measurement of sulphide concentration, but again a combination electrode is recommended. Each manufacturer will have slightly different specifications regarding use, sensitivity and calibration and these should be followed carefully. Prior to each sampling occasion, a Sulphide Anti-Oxidant Buffer (SAOB) must be prepared (see technique below) and standard curves should be established for calibration.

A sediment sub-sample (2ml) is extracted from the port in the side of the core tube using a 5ml syringe, and placed in a glass vial. SAOB (2ml) is added to each jar and sulphide concentration measured (mV) by placing the probe into the jar, and slowly stirring the sediment/buffer mix until the reading stabilises. The mV readings can be converted to sulphide concentration using the calibration curve. Samples should be collected and converted sulphide results (μM) and raw data (mV) are to be reported for 3cm depth. (TAFI, 2004).

Preparation of Sulphide Anti-Oxidant Buffer Solution (SAOB):

The SAOB solution can be purchased or it can be prepared by adding 20.0g of NaOH (Sodium Hydroxide pellets) and 17.9g of EDTA (Ethylenediaminetetra-acetic acid) in a 250ml volumetric flask and diluting to volume with distilled water. This solution should be refrigerated until required. Just prior to use add 8.75g of ascorbic acid for every 250ml of solution required. Once ascorbic acid has been added, the solution will only remain viable for 3 hours.

Calibration of the Sulphide Probe

Macleod *et al.* (2004) provides information on calibration procedures for a Cole-Parmer 27502-40 silver/sulphide electrode. If an alternative probe is to be used, it is recommended that manufacturer guidelines are referred to for specific details.

2.5.3 Particle size Analysis

A subsample of sediment from the top 100mm of each core should be placed in container of known volume (fill to top). Gently wet sieve each sample through a sieve stack of 4, 2, 1 mm, 500 μm, 250 μm, 125 μm, 63 μm either by hand or using a sieve shaker. The less than 63 μm fraction is allowed to drain away, i.e. not collected. The material remaining on each sieve is carefully removed and placed in a graduated cylinder. A known volume of water is added (this volume should remain consistent throughout the procedure). The volume of sediment from this fraction is measured as the displaced volume. Repeat this process for all sieve fractions.

The sum of all sieve fractions subtracted from the initial volume will give the less than 63 □m fraction. The data is to be provided in an Excel spreadsheet and graphed as cumulative percentages.

2.6 Biological analysis

This component of the Baseline Environmental Survey applies only to lease areas that are new or where an existing lease has been relocated

>500m from any area previously occupied by the lease to which this schedule relates. (Note that where relevant, benthic sampling for threatened species may be specified for any baseline environmental survey.)

Benthic faunal analysis:
Single Van Veen grabs or diver collected wide-diameter core samples (150mm diameter x depth 100mm) are to be taken at each of the sample sites located 35 metres from the nominated boundaries, or any other designated sampling site. Each benthic sample should be sieved through a 1 mm sieve and all threatened species identified to species level and counted. It will be necessary however, to take the identification of several taxa down to species level. These groups currently include (but are not limited to) the Family Capitellidae, Family Turitellidae and all introduced marine species.

Each benthic sample should be processed separately and identically.

Preservation/Retention of Samples:
All fauna collected must be preserved in formaldehyde solution. After identification and enumeration of the organisms, they are to be transferred to 70 % alcohol for long-term storage. Storage jars must be labelled (inside and outside) with details of date of collection, site location, collection method, and collectors' and identifiers' name. The jars are be stored for at least 5 years in a readily accessible place so that confirmation of identification can be investigated at a later date if required.

2.7 Reporting of Results to DPIWE

2.7.1 Final Baseline Report

The final baseline report must be submitted within one month of conducting the baseline survey for sites that have undergone an expansion in lease area, or have relocated to an area within 500m of the old lease site. In cases where benthic and/or current data is required as part of the baseline survey, an interim report should be submitted at one month and a final report including these parameters submitted no later than four months after the baseline survey.

All requirements for reporting of the baseline survey are to be incorporated into a single document. It is important that the document is a complete record of work undertaken.

The raw data must be provided as hard copy and electronically in the formats specified below in Annexure 1 to this Schedule or as otherwise required by the General Manager. A concise interpretation of the data should be provided for each parameter in the report. The report should comply with the requirements of Annexure 1.

All documents lodged with the Department must be *approved by and submitted in full by the applicant*.

The General Manager, Primary Industries, DPIWE must approve the assessment and interpretation of baseline information prior to issuing any written authorisation to the applicant to allow marine farming to commence.

3. Map

A map of sampling sites and their co-ordinates relating to this licence will be provided to the lessee and, if requested, to person(s) undertaking the survey.

References

Macleod, C., Forbes, S., Bisset, A., Burke, C., Crawford, C., Holdsworth, D., Nichols, P., Revill, A., and Volkman, J. (2004) Guide to the assessment of sediment condition at marine finfish farms. Aquafin CRC Project 4.1 Extension report to FRDC. Tasmanian Aquaculture & Fisheries Institute.

Annexure 1

ENVIRONMENTAL ASSESSMENT OF LEASE AREA #

Marine Farming Lease No.:

Applicant's name:

Name of Person(s) / organisation conducting environmental assessment:

Introduction: Preamble to the report indicating any previous work done relevant to this report and work done at the lease area.

Methods and results: The methods used for the assessment of each parameter and the results are to be presented in the same order as in the environmental assessment requirements.

Data must be summarised in tables and graphs and the raw data attached as appendices.

Interpretation: An interpretation of the data providing an integrated understanding of the results must be included in the report. Any unusual results should be highlighted.

Data: Original, raw data shall be provided as hard copy and in electronic form (either on IBM disc or via email) which is compatible with the database system and software currently used by the Marine Environment Section DPIWE. Results are to be provided electronically in Excel spreadsheets (Templates will be provided) and the original Hi-8 colour video tape in Pal format or Mini Digital Tapes in Pal format is to accompany the report.

The data must include:

- date, time, weather conditions of the sampling day;
- current meter results and interpretation* - electronic data must be supplied;
- an interpretation of video footage (diver's log of comments during filming, noting dive depth, type of sediment and main benthic organisms observed)
- description and interpretation of core profiles;
- interpretation (written and graphical) of redox results recorded from cores;
- interpretation (written and graphical) of sulphide results recorded from cores;
- interpretation (written and graphical) of sediment particle size analysis; and
- where relevant, an interpretation of results (written and graphical) from the benthic organisms from grab/core samples*

* Note that where current meter and/or benthic infaunal assessment is required as part of the baseline survey, an interim report covering all other parameters must be submitted within one month of the survey. Relevant data, analysis and interpretation of biological/current information is to be provided within four months of the survey date and the reporting of this information is to be consistent with the format detailed above.

SCHEDULE 3I TO MARINE FARMING LICENCE XXX

SALMONID FINFISH INITIAL MONITORING SURVEY:

REQUIREMENTS FOR AN EXISITING SALMONID FINFISH LEASE AREA.

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1. Outline of Requirements

The Initial Monitoring Survey is to be conducted in accordance with specifications determined by the Director Marine Resources Division, Department of Primary Industries, Water and Environment (DPIWE) (Section 2 below) and undertaken by person(s) or organisations approved and authorised by the Director Marine Resources Division, DPIWE to undertake the work at the sites specified. An Initial Monitoring Survey report must be submitted to the DPIWE by the applicant within 4 months of conducting the monitoring survey.

The sampling is to be conducted at each of the sites shown on the enclosed map. All sample collection and filming is to be conducted on one day, (or consecutive days if not feasible on a single day). The applicant must notify the Department [ph (03) 62 333370 fax (03) 62 333065] of the sampling date chosen at least 48 hrs prior to conducting the survey to enable a Departmental officer to be present to audit the survey.

The initial monitoring survey for marine farming salmonid finfish includes the following components:

1. Current measurements
2. Bathymetric profile
3. Seabed characteristics /habitat type profile
4. Underwater video survey
5. Sediment chemistry- particle size analysis, organic carbon, stable isotope analysis
6. Biological analysis-benthic faunal analysis
7. Reporting of results to DPIWE

Initial Monitoring Survey Specifications

2.1 Current measurements

Measurement of current speed and direction at 30 minute intervals continuously over a 6 week period at one site within the marine farming lease area, at a location to be specified by the director of the Marine Resources Division. The current meter should be located two metres above the bottom and its exact location defined by Australian Mapping Grid (AMG) co-ordinates.

The current meter should be accurate to within 5%, and capable of detecting a current of 2.5 cm/sec. The current meters should be cleaned of fouling every two weeks.

The data must be presented graphically as well as numerically, e.g. scatter plot diagrams, progressive vector plots, stick plots, cumulative diagrams, time series of the velocity components resolved along the major and minor axes (normally along-coast and coast-normal) each raw and low-pass filtered (tide removed).

2.2 Bathymetric profile

Depths (m) are to be measured throughout the marine farming lease area and for an area extending 50m beyond the boundaries of the marine farming lease area. Measurements should be made by a boat with echosounder and log measuring distance (or by differential GPS), the records of depth should be made by soundings every 100m within the marine farming lease area and for an area extending 50m beyond the boundaries of the marine farming lease area.

Depth contours are to be drawn on the map of the marine farming lease area provided.

2.3 Seabed Characteristics and habitat profile

A sketch map is required showing the approximate position of major habitat features in the marine farming lease area and any significant features on the seabed. A sketch of significant features on the seabed is required as an overlay for the bathymetric map. The data for the sketch map can be collected by echo or side-scan sonar, diving, or underwater video to classify the major habitat types on the seabed in the lease area :

hard bottom - rock, limestone reef, boulders, rubble

soft bottom - sand, mud/silt

seagrass/algae - species composition of dominant species present

Location of habitat types to be sketched on the map of the marine farming lease area povided. The map should provide an approximate position of the different habitat types within the marine farming lease area.

2.4 Underwater Video Survey

The transect positions for this marine farming lease area are shown on the attached map. An underwater transect-line is to be placed on the sea-floor at 90^{o} to the lease boundary at each position indicated on the enclosed map. A 60m transect line must be placed on the seafloor commencing 50m beyond the lease boundary and extending into the marine farming lease area by a minimum of 10m. The video transect must go directly under cage positions (intended or actual). A weighted cable with alternating black/white markers 25 cm apart (or equivalent) is to be used as a transect for each filming session. The transect cable must be removed after each filming. Where laying a transect under a cage is impractical, a ruler with distinct markings should be placed on the seafloor approximately every 5m to indicate size on the film. Transects 25m in length are also required at the control site(s) marked on the enclosed map; these will need to be located each time by distance from distinct coastal features or by differential GPS to ensure the same site is revisited in subsequent years.

Filming Procedure:

Hi-8 video filming is to be conducted by diver or a remotely operated vehicle (ROV), with the transect cable (scale) in view. Each transect must be identified on the film with the appropriate transect number e.g. T1, C1 etc. Filming needs to be conducted slowly along the transect to ensure clear images are recorded. At the start and end of each transect, and at 5m intervals along the transect, the diver should also stop and film the bottom with the camera lens pointing vertically downward with the transect cable in view. When the diver is directly under a cage a vertical picture of the cage is required. The diver should gently disturb the sediment by hand at the start and end of the transect, and when directly under a cage or in a fallowing site (if the site is already operational) while filming to reveal the sediment colour beneath the surface.

The site at which the cores are removed must also be identified clearly on the tape, and filmed vertically prior to coring.

Date and time must be visible at all times on the Hi-8 video tape.

Equipment:

- All video is to be in Hi-8 format for computerised image analysis to be conducted by DPIWE. Clear, well lit images on high quality tapes are required. The video is required to give both a general overview and quantitative data.
- Colour Hi-8 camera Blaupunkt/Sony (or equivalent) capable of operating at minimum 3 lux. Recording with date and time visible at all times. Underwater housing to suit camera fitted with minimum of 2 x 50W lights.
- Hi-8 tapes: highest quality e.g. Sony Hi-8 master tapes or equivalent.

Diver written notes should be supplied with the tape including comments on the following:

- Change in sediment colour (e.g. from brown/ grey to black),
- Change in texture of sediments, finer, flocculent mud
- Change in seaweed cover
- Change in visibility near cages/longlines etc.
- Changes in variety and density of animals living on and in the seabed
- Presence of Beggiatoa (white bacterial mat)
- Release of bubbles from the sediment
- Presence of finfish faeces or feed pellets

2.5 Sediment chemistry

2.5.1 Visual assessment and redox

Three undisturbed sediment cores are to be taken using a Craib corer with perspex inner core 50 mm diameter at each site indicated on the attached map. A written description of each core recording the following parameters is required:

- length of core measured with a ruler
- sediment colour, from the surface to deeper layers,
- visible animal and plant life,
- gas vesicles if present, size and position in the sediment,

- sediment smell including presence/absence of hydrogen sulphide,
- redox potential should be made on an undisturbed core sample at the sediment water interface, 1cm below the surface and at 4cms depth in the sediment core. The electrode should be allowed to equilibrate for 10 seconds at each depth. All redox measurements are to be calibrated against Zobells ferro/ferricyanide reference solution and corrected against a hydrogen reference. Redox results are to be reported in millivolts at each depth along the core.

2.5.2 Organic Content and Natural Stable Isotope Analysis

The top 3 cm of each core is to be oven dried at 60^{o}C prior to analysis of total organic carbon (loss on ignition at 450^{o}C in a muffle furnace for 4 hours), 0.5-1.0g of the upper 3 cm layer is to be retained for combined ^{12}C:^{13}C, ^{14}N:^{15}N stable isotope analysis and C:N analysis. The analysis of carbon and nitrogen isotopes and C:N ratios are to be conducted simultaneously by stable isotope mass spectrometry.

2.5.3 Particle size Analysis

A subsample of sediment from the top 100mm of each core should be placed in container of known volume (fill to top). Gently wet sieve each sample through a sieve stack of 4, 2, 1 mm, 500 µm, 250 µm, 125 µm, 63 µm either by hand or using a sieve shaker. The less than 63 µm fraction is allowed to drain away, i.e. not collected. The material remaining on each sieve is carefully removed and placed in a graduated cylinder. A known volume of water is added (this volume should remain consistent throughout the procedure). The volume of sediment from this fraction is measured as the displaced volume. Repeat this process for all sieve fractions.

The sum of all sieve fractions subtracted from the initial volume will give the less than 63 µm fraction. The data is to be provided in an Excel spreadsheet and graphed as cumulative percentages.

2.6 Biological analysis

Benthic faunal analysis:

Triplicate Van Veen grabs or diver collected wide-diameter core samples (150mm diameter x depth 100mm) are to be taken at a fixed point along the video transect (identified on the map). Each benthic sample should be sieved through a 1 mm sieve and all organisms identified to at least family level and counted. Each benthic sample should be processed separately and identically. The original data set together with K-dominance curves for each sample are required.

Preservation/Retention of Samples:

All fauna collected must be preserved in buffered formalin (50g sodium tetraborate in 2.5l of 40% formaldehyde solution diluted with seawater to give a 15-20% formaldehyde solution). Prior to sorting, the formaldehyde is to be removed by gently rinsing through a 500 µm sieve. After identification and enumeration of the organisms, they are to be transferred to 70 % alcohol for long-term storage. Storage jars must be labelled (inside and outside) with details of date of collection, site location, collection method, and collectors' and identifiers’ name. The jars are be stored for at least 5 years in a safe place so that confirmation of species identification can be investigated at a later date if required.

2.7 Reporting of Results to DPIWE

2.7.1 Interim Report

An initial brief report must be submitted within one month of conducting the initial monitoring survey if farming is to commence prior to submission of the complete initial monitoring report including the following:

- date, time, weather conditions of the sampling day,
- a divers log of comments during filming, noting type of sediment and main benthic organisms observed
- comments and redox results recorded from examination of the cores
- the original unedited Hi-8 video tape

This document is to be approved by and submitted by the applicant.
The Director of Marine Resources will assess this information prior to issuing any written authorisation to the applicant to allow marine farming to commence prior to the full report being submitted.

2.7.2 The Initial Monitoring Survey Report

A complete Initial monitoring report must be submitted within 4 months of conducting the survey. All requirements for reporting of the initial monitoring survey are to be incorporated into a single document. The document is to be approved by and submitted by the applicant. It is important that the document is a complete record of work undertaken. The raw data and the statistical analyses must be provided as hard copy and electronically in the formats specified by the Director of Marine Resources DPIWE. A concise interpretation of the data should be provided for each parameter in the report. The report should follow the format outlined below:

ENVIRONMENTAL ASSESSMENT OF MARINE FARMING LEASE AREA #

Lease area number:

Name of holder of applicant:

Name of Person(s) / organisation conducting environmental assessment:

Introduction: Preamble to the report indicating previous work done relevant to this report and work done at the marine farming lease area.

Methods and results: The methods used for the assessment of each parameter and the results are to be presented in the same order as in the environmental assessment requirements.

Data must be summarised in tables and graphs and the raw data attached as appendices.

Interpretation: An interpretation of the data providing an integrated understanding of the results must be included in the report. Any unusual results should be highlighted.

Data: Original, raw data shall be provided as hard copy and in electronic form (either on IBM disc or via email) which is compatible with the database system and software currently used by the Marine Farming Branch DPIWE. Results are to be provided in Excel spreadsheets on IBM formatted discs (Templates will be provided). The data must include:

- date, time, weather conditions of the sampling day,
- current meter and drogue results and interpretation
- a divers log of comments during filming,
- comments and redox results recorded from examination of the cores
- interpretation (written and graphical) of sediment particle size analysis
- interpretation of organic content of sediment
- results of isotopic analyses
- interpretation of results (written and graphical) from the benthic organisms from grab/core samples

3. Map

A map of sampling sites and their co-ordinates relating to this licence are attached. An enlargement of the lease area without the control sites in view is also provided for convenience

Initial Environmental Survey Map: MF XXX, sample sites including controls.

Initial Environmental Survey Map: MF XXX, sample sites and transect positions.

MF XXX: Initial Environmental Survey Sample Site Coordinates (AGD66, AMG Zone 55).

Baseline survey coordinates for Nortas Marine Farming Lease XXX								
Lease No	**Transect**	**Site Number**	**Bearing**	**Distance**	**Distance Relative to Lease Boundary**	**Type of sample**	**Easting**	**Northing**

SCHEDULE 3V TO MARINE FARMING LICENCE :

SALMONID FINFISH ANNUAL VIDEO SURVEY:

REQUIREMENTS FOR A SALMONID FINFISH LEASE AREA.

1 Outline of Requirements

The Video Survey is to be conducted in accordance with specifications in this Schedule and any requirements of the General Manager, Primary Industries, Department of Primary Industries, Water and Environment (DPIWE), and undertaken by person(s) or organisations authorised by the General Manager, Primary Industries, Department of Primary Industries, Water and Environment (DPIWE) to undertake the work at the sites specified.

The survey is to be conducted approximately every 12 months or in accordance with the stocking and fallowing regime employed on the marine farm. The timing of this survey is to be discussed with the Marine Environment Section of the Marine Farming Branch to fulfil the aims of the survey.

A report consisting of the original Hi-8 colour video tape in Pal format or Mini Digital Tapes in Pal format and diver's written notes must be submitted to the DPIWE by the applicant within **1 month** of conducting the video survey.

If the survey reveals any environmental problems, further video analysis and/or sampling may be required.

All filming is to be conducted on one day, (or consecutive days if not feasible on a single day). **The lease holder must notify the Department [ph (03) 62 33370, mob 0419 120 030, fax (03) 62 333065] of the filming date chosen at least 48 hrs prior to conducting the survey to enable a Departmental officer to be present to audit the survey.**

The underwater video survey for salmonid finfish marine farming includes the following components:

2. Underwater video survey
3. Reporting of results to DPIWE
4. Map

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2. Underwater Video Survey Specifications

The objective of this survey is twofold. Firstly, the survey will give an indication as to whether there has been any significant visible environmental impact (as defined in schedule 3) to the benthos 35m outside the lease boundary or at internal pen sites. Assessment of internal sites will also provide information to site managers on the condition of the benthos under stocked cages and fallowed areas within the marine farming lease area.

2.1 Spot Dives

Regulatory spot dives:

The video survey is to take place using survey spot dives as specified by DPIWE prior to the survey, and will consist of the following for a standard 20 hectare lease with current flow data:

- a minimum of one upstream and one downstream set of spot dives located parallel to the lease boundary. Each set of spot dives will consist of a minimum of 3 spot dives at least 20 metres apart parallel to the lease boundary at a distance of 35m from the lease boundary or one parallel transect 40 metres in length. One spot dive will be fixed (i.e. overly a baseline 35m site) and two spot dives will float (i.e. fall in line with pens/pen bays). Each spot dive must record a minimum of 60 seconds of video footage. AMG coordinates of each spot dive must be recorded.

These dives are referred to below as "regulatory spot dives".

Where a transect line is used it shall consist of a weighted line of known diameter with clearly marked tags 5m apart. The transect line must be removed after each filming.

Pen Bay Dives:

In addition to the regulatory spot dives, a total of 6 sites must be filmed inside the lease area (3 fallowed sites & 3 stocked sites). AMG co-ordinates of each within lease spot dive must be recorded. Spot dives within the lease area may be performed at the same time as the regulatory spot dives, or alternatively the dives may be undertaken during the current survey year as part of normal on farm monitoring practices and video footage submitted when the regulatory parallel spot dives have been completed.

Sites filmed must include those that have been subjected to the heaviest stocking pressure in the lease area. For fallowed sites this would include pen bays that received the highest feed input prior to fallowing and for stocked sites this would include sites that have received the highest cumulative feed input for the current stocking cycle.

The number of spot dives or transects and fallowed/stocked sites filmed may vary according to lease area and previous compliance with environmental licence requirements.

Information on internal pen dives is to be provided on the attached table (section 2) and submitted with the survey report. Footage provided must clearly identify filming date and pen identification number.

2.1.1 Filming Procedure

For regulatory spot dives filming must be conducted slowly to ensure clear images of the seabed in the vicinity of the anchor marking the spot dive are recorded. Each spot dive must be clearly identified on the video footage with the approved dive number. Footage must show a minimum of sixty seconds of clear footage. Stationary footage recorded with the camera lens pointing vertically down must be taken. The sediment must be disturbed and video footage recorded to assess presence of outgassing.

Where relevant, filming is to be conducted with the transect line in view. Each transect must be identified on the film with the appropriate transect number e.g. T1, T2 etc. Filming must be conducted slowly along the transect line to ensure that clear images of the transect line and seabed are recorded. For a standard 40m transect, stationary video footage must be obtained at three points specified on the survey map with the camera lens pointing vertically downward with the transect line in view. The sediment must be disturbed and filmed at each specified site along the transect including vertical footage to check for the presence of outgassing on disturbance.

When filming farm dives directly under a cage or within a fallowed pen bay within the lease area, the sediment must be disturbed and vertical footage obtained as described above.

2.1.2 Equipment

All video footage is to be colour Hi-8 or digital format (or equivalent), for computerised image analysis to be conducted by DPIWE. Clear, well lit images on high quality tapes are required. The camera / ROV must be capable of operating at a minimum of 3 lux. A record of the date, time and type of filming (control/transect/farm dive, etc) must be provided at the start of each filming sequence.

Underwater housing to suit the camera must be used and fitted with a minimum of 2 x 50W lights.

Original tapes must be submitted with the report.

The report and film must be supplied with comments on the following:

- Sediment colour (e.g. from brown/ grey to black),
- Texture of sediments (e.g. sand, silt mud)
- Seaweed cover
- Visibility near cages/longlines etc.
- Variety and density of animals living on and in the seabed
- Presence of bacterial mats (e.g. *Beggiatoa* spp.)
- Outgassing from the sediment (including any outgassing upon disturbance)

- Presence of finfish faeces and/or feed pellets,
- Any other relevant features.

3 The Video Survey Report

A final report must be submitted within **one month** of conducting the survey and include the following:

Date, time and weather conditions with respect to each episode of filming;
Interpretation of video footage, noting type of sediment and main benthic organisms observed;
The original unedited Hi-8 colour video tape;
Completed Excel template spreadsheets detailing dive descriptions and pen bay stocking information; and
A map of the lease area identifying the position of all spot dive locations, including the position of internal pen bay spot dives.

Data relating to the stocking history of internal dive sites must be input into the appropriate Excel template spreadsheet and an electronic copy of this file must be submitted with the video survey report. Information supplied in the excel template must cover the following:

For stocked sites:

(i) position of each stocked site
(ii) size of cage
(iii) feed input to pen bay
(iv) length of time each site was fallowed prior to restocking

For fallowed sites:

(i) position of each fallow site
(ii) size of cage on site prior to fallowing
(iii) date fallowing commenced at each site.
(iv) Amount of feed placed into pen bay prior to fallowing
(v) length of time each site was stocked for prior to fallowing

The report document is to be submitted by the applicant to the Environment Section of the Marine Farming Branch DPIWE.

4. Map

A map of the marine farming lease area identifying the 35 metre spot dive locations or transects will be provided to licence holders prior to the survey. A map of survey locations within the lease, including co-ordinates, must be provided after the survey has been performed. This map must be submitted with the survey report.

SCHEDULE 3M TO MARINE FARMING LICENCE XXX:

SALMONID FINFISH MONITORING SURVEY:

REQUIREMENTS FOR SALMONID FINFISH LEASE AREAS.

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1. Outline of Requirements

The Monitoring Survey is to be conducted in accordance with specifications determined by the Director Marine Resources Division, Department of Primary Industries, Water and Environment (DPIWE) (Section 2 below) and undertaken by person(s) or organisations approved and authorised by the Director Marine Resources Division, DPIWE to undertake the work at the sites specified. A monitoring survey report must be submitted to the DPIWE by the applicant within 3 months of conducting the survey.

The sampling is to be conducted at each of the sites shown on the enclosed map. All sample collection and filming is to be conducted on one day, (or consecutive days if not feasible on a single day). **The applicant must notify the Department [ph (03) 62 333370 fax (03) 62 333065] of the sampling date chosen at least 48 hrs prior to conducting the survey to enable a Departmental officer to be present to audit the survey.**

The monitoring survey for marine farming salmonid finfish includes the following components:

1. Underwater video survey
2. Sediment chemistry- particle size analysis, organic carbon, redox.
3. Biological analysis-benthic faunal analysis
4. Reporting of results to DPIWE

Monitoring Survey Specifications

2.1 Underwater Video Survey

The transect positions for this marine farming lease area are shown on the attached map. An underwater transect-line is to be placed on the sea-floor at 90^{o} to the lease boundary at each position indicated on the enclosed map. A 60m transect line must be placed on the seafloor commencing 50m beyond the lease boundary and extending into the marine farming lease area by a minimum of 10m. The video transect must go directly under cage positions (intended or actual). A weighted cable with alternating black/white markers 25 cm apart (or equivalent) is to be used as a transect for each filming session. The transect cable must be removed after each filming. Where laying a transect under a cage is impractical, a ruler with distinct markings should be placed on the seafloor approximately every 5m to indicate size on the film. Transects 25m in length are also required at the control site(s) marked on the enclosed map; these will need to be located each time by distance from distinct coastal features or by differential GPS to ensure the same site is revisited in subsequent years.

Filming Procedure:

Hi-8 video filming is to be conducted by diver or a remotely operated vehicle (ROV), with the transect cable (scale) in view. Each transect must be identified on the film with the appropriate transect number e.g. T1, C1 etc. Filming needs to be conducted slowly along the transect to ensure clear images are recorded. At the start and end of each transect, and at 5m intervals along the transect, the diver should also stop and film the bottom with the camera lens pointing vertically downward with the transect cable in view. When the diver is directly under a cage a vertical picture of the cage is required. The diver should gently disturb the sediment by hand at the start and end of the transect, and when directly under a cage or in a fallowing site (if the site is already operational) while filming to reveal the sediment colour beneath the surface.

The site at which the cores are removed must also be identified clearly on the tape, and filmed vertically prior to coring.

Date and time must be visible at all times on the Hi-8 video tape.

Equipment:

- All video is to be in Hi-8 format for computerised image analysis to be conducted by DPIWE. Clear, well lit images on high quality tapes are required. The video is required to give both a general overview and quantitative data.
- Colour Hi-8 camera Blaupunkt/Sony (or equivalent) capable of operating at minimum 3 lux. Recording with date and time visible at all times. Underwater housing to suit camera fitted with minimum of 2 x 50W lights.
- Hi-8 tapes: highest quality e.g. Sony Hi-8 master tapes or equivalent.

Diver written notes should be supplied with the tape including comments on the following:

- Change in sediment colour (e.g. from brown/ grey to black),
- Change in texture of sediments, finer, flocculent mud
- Change in seaweed cover
- Change in visibility near cages/longlines etc.
- Changes in variety and density of animals living on and in the seabed
- Presence of Beggiatoa (white bacterial mat)
- Release of bubbles from the sediment
- Presence of finfish faeces or feed pellets

2.2 Sediment chemistry

2.2.1 Visual assessment and redox

Three undisturbed sediment cores are to be taken using a Craib corer with perspex inner core 50 mm diameter at each site indicated on the attached map. A written description of each core recording the following parameters is required:

- length of core measured with a ruler

- sediment colour, from the surface to deeper layers,
- visible animal and plant life,
- gas vesicles if present, size and position in the sediment,
- sediment smell including presence/absence of hydrogen sulphide,
- redox potential should be made on an undisturbed core sample at the sediment water interface, 1cm below the surface and at 4cms depth in the sediment core. The electrode should be allowed to equilibrate for 10 seconds at each depth. All redox measurements are to be calibrated against Zobells ferro/ferricyanide reference solution and corrected against a hydrogen reference. Redox results are to be reported in millivolts at each depth along the core.
- *Redox measurements will not be required at sample sites under or immediately adjacent to stocked pens.*

2.2.3 Organic Content

The top 3 cm of each core is to be oven dried at 60^{o}C prior to analysis of total organic carbon (loss on ignition at 450^{o}C in a muffle furnace for 4 hours).

2.2.4 Particle size Analysis

A subsample of sediment from the top 100mm of each core should be placed in container of known volume (fill to top). Gently wet sieve each sample through a sieve stack of 4, 2, 1 mm, 500 µm, 250 µm, 125 µm, 63 µm either by hand or using a sieve shaker. The less than 63 µm fraction is allowed to drain away, i.e. not collected. The material remaining on each sieve is carefully removed and placed in a graduated cylinder. A known volume of water is added (this volume should remain consistent throughout the procedure). The volume of sediment from this fraction is measured as the displaced volume. Repeat this process for all sieve fractions.

The sum of all sieve fractions subtracted from the initial volume will give the less than 63 µm fraction. The data is to be provided in an Excel spreadsheet and graphed as cumulative percentages.

2.3 Biological analysis

Benthic faunal analysis:

Triplicate Van Veen grabs or diver collected wide-diameter core samples (150mm diameter x depth 100mm) are to be taken at a fixed point along the video transect (identified on the map). Each benthic sample should be sieved through a 1 mm sieve and all organisms identified to at least family level and counted. Each benthic sample should be processed separately and identically. The original data set together with K-dominance curves for each sample are required.

Preservation/Retention of Samples:

All fauna collected must be preserved in buffered formalin (50g sodium tetraborate in 2.5l of 40% formaldehyde solution diluted with seawater to give a 15-20% formaldehyde solution). Prior to sorting, the formaldehyde is to be removed by gently rinsing through a 500 µm sieve. After identification and enumeration of the organisms, they are to be transferred to 70 % alcohol for long-term storage.

Storage jars must be labelled (inside and outside) with details of date of collection, site location, collection method, and collectors' and identifiers' name. The jars are be stored for at least 5 years in a safe place so that confirmation of species identification can be investigated at a later date if required.

2.4 Reporting of Results to DPIWE

2.4.1 Report Requirements

A complete monitoring report and the original, unedited Hi-8 video tape must be submitted within 3 months of conducting the survey. All requirements for reporting of the monitoring survey are to be incorporated into a single document. The document is to be approved by and submitted by the applicant. It is important that the document is a complete record of work undertaken. The raw data and the statistical analyses must be provided as hard copy and electronically in the formats specified by the Director of Marine Resources DPIWE. A concise interpretation of the data should be provided for each parameter in the report. The report should follow the format outlined below:

ENVIRONMENTAL ASSESSMENT OF MARINE FARMING LEASE AREA #

Lease area number:

Name of holder of applicant:

Name of Person(s) / organisation conducting environmental assessment:

Introduction: Preamble to the report indicating previous work done relevant to this report and work done at the marine farming lease area.

Methods and results: The methods used for the assessment of each parameter and the results are to be presented in the same order as in the environmental assessment requirements.

Data must be summarised in tables and graphs and the raw data attached as appendices.

Interpretation: An interpretation of the data providing an integrated understanding of the results must be included in the report. Any unusual results should be highlighted.

Data: Original, raw data shall be provided as hard copy and in electronic form (either on IBM disc or via email) which is compatible with the database system and software currently used by the Marine Farming Branch DPIWE. Results are to be provided in Excel spreadsheets on IBM formatted discs (Templates will be provided). The data must include:

- date, time, weather conditions of the sampling day,

- a divers log of comments during filming,
- comments and redox results recorded from examination of the cores
- interpretation (written and graphical) of sediment particle size analysis
- interpretation of organic content of sediment
- results of isotopic analyses
- interpretation of results (written and graphical) from the benthic organisms from grab/core samples

3. Map

A map of sampling sites and their co-ordinates relating to this licence are attached. An enlargement of the lease area without the control sites in view is also provided for convenience.

Biennial Environmental Survey Map: MF XXX, sample sites including controls.

Biennial Environmental Survey Map: MF XXX, sample sites and transect positions.

MF XXX: Baseline Environmental Survey Sample Site Coordinates (AGD66, AMG Zone 55).

Baseline survey coordinates for Nortas Marine Farming Lease XXX								
Lease No	**Transect**	**Site Number**	**Bearing**	**Distance**	**Distance Relative to Lease Boundary**	**Type of sample**	**Easting**	**Northing**

APPENDIX 8.1.3.2: PROTOCOL FOR THE NEGATIVE CONDITIONING OF SEALS USING NON-LETHAL SEAL CONTROL DEVICES

ATTACHMENT 1 **Revision 030603**

Definition of MINIMUM PREDATOR EXCLUSION MEASURES

Predator exclusion measures must comply with at least the following standards:-

1. Pen netting

Pen netting material must be of at least the following minimum breaking strain (or equivalent material as agreed with NCB Manager seal program):-

- Netting of less than 15 mm square mesh, 70 kg / bar
- Netting of 15 to 25 mm square mesh, 150 kg / bar
- Netting of greater than 25 mm square mesh, 180 kg / bar

The nets must be:

- Fastened to the hand-rail in a manner to exclude entry by seals
- Appropriately tensioned by weights or other means..

Nets stiffened with antifoulants are considered to be superior to unstiffened nets in seal exclusion capability.

A system of double netting (ie an internal growout net, plus an external predator net) is considered to be superior to single nets in seal exclusion capability.

2. Corral Enclosure

A Corral enclosure (defined as a perimeter predator protection fence surrounding fish pens) must have a the capacity to stop entry by seals in normal operating conditions.

3. Bird Netting

Where bird netting is deployed the nets must be made of netting of a maximum 100 mm square mesh and, conform to the Visual Controls specified in the relevant Marine Farming Management Plan

4. Pen Structure

Stanchions supporting the hand-rail must be at least 1 m in height. The pen structure must be maintained in good repair and as near as practical to the original manufacturer specifications. Any operational or wear and tear changes from the original manufacturer's structural specifications (eg. collapsed or deformed handrails on circular pen) that creates a potential for intrusion by seals must be remedied as soon as possible.

ATTACHMENT 2 **Revision 071014**

PROTOCOL FOR THE NEGATIVE CONDITIONING 0F SEALS USING NON LETHAL SEAL CONTROL UNITS ("CRACKERS") DEVICES

1. Policy Context

Australian and New Zealand Fur Seals are Protected Wildlife and as such are afforded protection under various Acts administered by the Department of Primary Industries, Water and Environment (DPIWE).

These two species of seals are known to interact with marine farm operations. Such interactions have the potential to cause extensive losses and/or damage to valuable fish stocks, and on occasions present an unacceptable risk to human health and safety in the workplace.

The Department of Primary Industries, Water and Environment (DPIWE), in particular the Nature Conservation Branch (NCB), has in consultation with sections of the marine industry and other interest groups developed a set of specific Protocols to manage the risk posed to both wildlife and human interests. These Protocols address circumstances and procedures under which it would be appropriate to apply negative conditioning to persistent seals, or to relocate individual seals.

Such negative conditioning or relocation of Australian and New Zealand Fur seals would require the issue of a "Permit to Deter" by the specific devices being deployed.

The Secretary of DPIWE will determine when a permit for the use of negative conditioning using non-lethal seal control devices is to be issued or seals are to be relocated, after taking into account recommendations from the Manager Seal Program. The Secretary is unlikely to approve a permit in any case where inadequate management practices or equipment have, in his view, contributed significantly to the risk.

Circumstances under which negative conditioning using non-lethal seal control devices or relocation is warranted are described below.

Circumstances under which the use of Seal Control Units ("Crackers") Devices will be considered as an appropriate management response

The use of non-lethal devices for the negative conditioning of seals interacting with marine farming operations will be considered on a 'case by case' basis, and only where Minimum Predator Exclusion Measures (as defined in Attachment 1) have been deployed.

A Permit to Deter by the use of Seal Control Units ("Crackers") devices (Attachment 2) would need to be issued by the Secretary Department of Primary Industries, Water and Environment or delegate.

A Permit will be issued in cases where seals have:-

- maintained close proximity to persons or frequently threatened or injured a person, or
- damaged gear or equipment, or
- entered a properly secured and managed fish farming operation, or
- represented a danger to worker or public safety.

Crackers devices may also be used by accredited DPIWE officers, in accordance with the conditions of a Permit to Deter by use of Seal Control Units ("Crackers") devices, for the purposes of contract negative conditioning of seals, development trials, and ongoing testing.

Note that Crackers devices may be used in conjunction with Deer Thumper ("Beanbags") devices (users should refer to the Protocol for the Negative Conditioning of Seals Using Non Lethal Seal Control Devices).

Procedure for the deployment of Seal Control Units ("Crackers") Devices

Permit

Prior to the Secretary's consideration of an application for a Permit to Deter by the use of Seal Control Units ("Crackers") devices, an authorised officer will assess the documentary evidence and undertake a site inspection to verify that a continued risk to human safety continues to exist, or when fish stocks are threatened by the presence of seals, and that management and equipment standards are adequate and that all practical mitigation measures have been fully pursued.

In cases where inadequate management practice or equipment contribute substantially to the behaviour of concern, then those inadequacies should be satisfactorily remedied before a Permit will be approved.

The initial application must be accompanied by documentary evidence (in the form of an incident record log) made at the time of the incident. The log should show the date, time and circumstances of the interaction, the identity of the seal (if possible), the person(s) involved in the interaction, and the nature of the interaction. Permit holders will be required to maintain a log of the use of Crackers devices (see section on Record Keeping).

Before being issued with a Permit (Attachment 4), the applicant will be required to attend a training session ('Non-Lethal Control Devices for Australian Fur Seals') dealing with the correct, prescribed use of Crackers devices and conducted by NCB Officers.

The NCB, DPIWE will control the supply Seal Control Units ("Crackers") devices, and undertake to hold sufficient stock so as to meet industry requirements.

Use and storage

Cracker devices may only be deployed by accredited DPIWE officers or Permit Holders, on Australian and New Zealand Fur seals, and only within the boundaries of the marine farming lease area or marine farm operations defined in the Permit.

The issue and storage of Cracker devices is restricted to marine farming Operational Bases designated by marine farming management and agreed upon by the Manager Seal Relocation Program or delegate. The following possession limits will apply:-

Designated Marine Farm Operational Base
The designated marine farms Operational Base shall not hold more than 144 Seal Control Units ("Crackers") devices, at one time, regardless of the number of accredited and permitted users at that Base.

The Permit conditions for Deter by the use of Seal control Units ("Crackers") devices, are mandatory. Applicants must comply with all conditions of the permit.

Safety

Seal Control Units ("Crackers") devices, are classified as an explosive device under the Dangerous Goods Act 1998 and therefore all applicable Workplace Standards Tasmania requirements for their use and storage must be complied with. The user must keep Cracker devices in a secure safe place away from sources of ignition. A storage unit as described in the Firearms Act 1996 for Category A and B firearms would be suitable.

Users of Cracker devices should refer to the 'Non-lethal Control Devices for Australian Fur Seals: A Manual and Usage Logbook. May 2002', produced by DPIWE. In the event that the discharge of a Cracker device is seen to cause an obvious injury to a seal, then the incident must, within one hour of the event, be reported to a NCB Contact Officer (see Attachment 3).

2. Prohibitions

Cracker devices are not to be used randomly to harass seals remote from fish farming activities.

Cracker devices must not be deliberately thrown towards the head of a seal, or within four metres of a seal's last observed place of submersion.

Cracker devices must be used as single units only, and must not be modified in any way (unless specifically authorised by a Permit condition).

3. Record Keeping

In order for the DPIWE and the Marine Farm Industry to jointly develop and refine seal deterrent strategies, it is essential that a log (Attachment 5) accurately recording the usage and effectiveness of Cracker devices be kept by the accredited and permitted user.

It will therefore be a condition of the Permit that a log of the usage of Cracker devices must be kept by the permit holder. The log must record the rate of usage and the effects of the control measure. A log form will be issued with the units and collected when the next purchase is made. The Manager Seal Program or delegate will review the log prior to issuing further Cracker devices.

The agency will retain copies of any records used to support an application as well as logs submitted by permit holders on an ongoing basis, and information will be stored in a DPIWE database.

4. Cost Recovery

The DPIWE will recover the costs incurred in the negative conditioning using less - lethal seal control devices from applicants. Note that in cases of general public safety it is likely that a DPIWE officer will be the applicant and so there will not be any cost recovery.

ATTACHMENT 3 **Revision 061004**

PROTOCOL FOR THE NEGATIVE CONDITIONING OF SEALS USING NON-LETHAL SEAL CONTROL DEVICES– DEER THUMPER (“BEANBAGS”)

1. Policy Context

Australian and New Zealand Fur Seals are Protected Wildlife and as such are afforded protection under various Acts administered by the Department of Primary Industries, Water and Environment (DPIWE).

These two species of seals are known to interact with marine farm operations. Such interactions have the potential to cause extensive losses and/or damage to valuable fish stocks, and on occasions present an unacceptable risk to human health and safety in the workplace.

The Department of Primary Industries, Water and Environment (DPIWE), in particular the Nature Conservation Branch (NCB), has in consultation with sections of the marine industry and other interest groups developed a set of specific Protocols to manage the risk posed to both wildlife and human interests. These Protocols address circumstances and procedures under which it would be appropriate to apply negative conditioning to persistent seals, or to relocate individual seals.

Such negative conditioning or relocation of Australian and New Zealand Fur seals would require the issue of a permit by the specific device being deployed.

The Secretary of DPIWE will determine when a permit for the use of negative conditioning using non-lethal seal control devices is to be issued or seals are to be relocated, after taking into account recommendations from the Manager Seal Program. The Secretary is unlikely to approve a permit in any case where inadequate management practices or equipment have, in his view, contributed significantly to the risk.

Circumstances under which negative conditioning using non-lethal seal control devices or relocation is warranted are described below.

Circumstances under which the use of Deer Thumper (“Beanbags”) devices will be considered as an appropriate management response

1```

The use of non-lethal devices for the negative conditioning of seals interacting with marine farming operations will be considered on a ‘case by case’ basis, and only where Minimum Predator Exclusion Measures (as defined in Attachment 1) have been deployed.

A Permit to Deter by the use of Deer Thumper (“Beanbags”) devices (Attachment 2) would need to be issued by the Secretary Department of Primary Industries, Water and Environment or delegate.

A Permit will be issued in cases where seals have:-

- maintained close proximity to persons or frequently threatened or injured a person, or
- damaged gear or equipment, or
- entered a properly secured and managed fish farming operation, or
- represented a danger to worker or public safety.

Deer Thumper (“Beanbags”) devices may also be used by accredited DPIWE officers, in accordance with the conditions of a Permit to Deter by the use of Deer Thumper (“Beanbags”), devices for the purposes of contract negative conditioning of seals, development trials, and ongoing testing.

Note that Deer Thumper (“Beanbags”) devices may be used in conjunction with ‘Crackers’ (users should refer to the Protocol for the Negative Conditioning of Seals Using Non Lethal Seal Control Devices– Seal Control Units – (“Crackers”).

Procedure for the deployment of Deer Thumper (“Beanbags”) devices

Permit

Prior to the Secretary’s consideration of an application for a Permit to Deter by the use of Deer Thumper (“Beanbags”) devices, an authorised officer will assess the documentary evidence and undertake a site inspection to verify that a continued risk to human safety continues to exist, or when fish stocks are threatened by the presence of seals, and that management and equipment standards are adequate and that all practical mitigation measures have been fully pursued.

In cases where inadequate management practice or equipment contribute substantially to the behaviour of concern, then those inadequacies should be satisfactorily remedied before an application for a Permit to Deter by the use of Deer Thumper (“Beanbags”) devices will be approved.

The initial application must be accompanied by documentary evidence (in the form of an incident record log) made at the time of the incident. The log should show the date, time and circumstances of the interaction, the identity of the seal (if possible), the person(s) involved in the interaction, and the nature of the interaction. Permit holders will be required to maintain a log of the use of Deer Thumper (“Beanbags”) devices (see section on Record Keeping).

Before being issued with a Permit to Deter by the use of Deer Thumper (“Beanbags”) devices (Attachment 4), the applicant will be required to attend a training session (‘Non-Lethal Control Devices for Australian Fur Seals’) dealing with the correct, prescribed use of Deer Thumper (“Beanbags”) devices and conducted by NCB Officers.

The NCB, DPIWE will control the supply Deer Thumper ("Beanbags") devices and undertake to hold sufficient stock so as to meet industry requirements.

Use and storage

Deer Thumper ("Beanbags") devices may only be deployed by accredited DPIWE officers or Permit Holders, on Australian and New Zealand Fur seals, and only within the boundaries of the marine farming lease area or marine farm operations defined in the Permit.

Deer Thumper ("Beanbags") devices may only be discharged from a 12-guage shotgun with a choke-less full cylinder barrel. A Category 'A' and or 'B' Firearms Licence with a purpose 3 issued under the Firearms Act 1996 must be held by the permit holder deploying Deer Thumper ("Beanbags") devices.

The issue and storage of Deer Thumper ("Beanbags") devices is restricted to marine farming Operational Bases designated by marine farming management and agreed upon by the Manager Seal Relocation Program or delegate. The following possession limits will apply:-

Designated Marine Farm Operational Base
The designated marine farms Operational Base shall not hold more than six boxes (30 Deer Thumper units), regardless of the number of accredited and permitted users at that Base.

Marine farm Accredited and Permitted Users
The marine farm accredited and permitted user, or a person contracted to undertake marine farm operations, must not be in possession of more than five Deer Thumper units at one time within the confines of the operational lease.

No unauthorised person shall be in possession of Deer Thumper ("Beanbags") devices. This restriction includes the conveying of the Deer Thumper ("Beanbags") devices from the point of purchase to the designated marine farm operational base, and/or between marine farm operational leases.

The Permit conditions for "Deter by the use of Deer Thumper ("Beanbags") devices are mandatory. Applicants must comply with all conditions of the permit.

Safety

All applicable Workplace Standards Tasmania and Firearms Act 1996 requirements for the use and storage of Deer Thumper ("Beanbags") devices must be complied with. The user must keep Deer Thumper ("Beanbags") devices in a secure safe place away from sources of ignition. A storage unit as described in the Firearms Act 1996 for Category A and B firearms would be suitable.

Users of Deer Thumper ("Beanbags") devices should refer to the 'Less-Lethal Control devices for Australian Fur Seals: A Manual and Usage Logbook. May 2002', produced by DPIWE. In the event that the discharge/impact of a Deer Thumper ("Beanbag") device is seen to cause an obvious injury to a seal, then the incident must, within one hour of the event, be reported to a NCB Contact Officer (see Attachment 3).

2. Prohibitions

Deer Thumper ("Beanbags") devices are not to be used randomly to harass seals remote from fish farming activities.

Deer Thumper ("Beanbags") devices must not be deliberately discharged towards the head of a seal.

3. Record Keeping

In order for the DPIWE and the Marine Farm Industry to jointly develop and refine seal deterrent strategies, it is essential that a log (Attachment 5) accurately recording the usage and effectiveness of Dear Thumper ("Beanbags") devices be kept by the accredited and permitted user.

It will therefore be a condition of the Permit that a log of the usage of Deer Thumper ("Beanbags") devices must be kept by the permit holder. The log must record the rate of usage and the effects of the control measure. A log form will be issued with the units and collected when the next purchase is made. The Manager Seal Program or delegate will review the log prior to issuing further Deer Thumper ("Beanbags") devices.

The agency will retain copies of any records used to support an application as well as logs submitted by permit holders on an ongoing basis, and information will be stored in a DPIWE database.

4. Cost Recovery

The DPIWE will recover the costs incurred in the negative conditioning using less-lethal seal control devices from applicants. Note that in cases of general public safety it is likely that a DPIWE officer will be the applicant and so there will not be any cost recovery.

ATTACHMENT 4 **Revision 030603**

PROTOCOL FOR THE NEGATIVE CONDITIONING OF SEALS USING NON-LETHAL SEAL CONTROL MEASURES – TRAPPING

1. Policy Context

Australian and New Zealand Fur Seals are Protected Wildlife and as such are afforded protection under various Acts administered by the Department of Primary Industries, Water and Environment (DPIWE).

These two species of seals are known to interact with marine farm operations. Such interactions have the potential to cause extensive losses and/or damage to valuable fish stocks, and on occasions present an unacceptable risk to human health and safety in the workplace.

The Department of Primary Industries, Water and Environment (DPIWE), in particular the Nature Conservation Branch (NCB), has in consultation with sections of the marine industry and other interest groups developed a set of specific Protocols to manage the risk posed to both wildlife and human interests. These Protocols address circumstances and procedures under which it would be appropriate to apply negative conditioning to persistent seals, or to relocate individual seals.

Such negative conditioning or relocation of Australian and New Zealand Fur seals would require the issue of a "Permit to Take" by the specific means being deployed.

The Secretary of DPIWE will determine when a permit for the use of negative conditioning using non-lethal seal control methods is to be issued or seals are to be relocated, after taking into account recommendations from the Manager Seal Program. The Secretary is unlikely to approve a permit in any case where inadequate management practices or equipment have, in his view, contributed significantly to the risk.

Circumstances under which negative conditioning using non-lethal seal control measures or relocation is warranted are described below.

2. Circumstances under which trapping will be considered as an appropriate management response

An application for a Permit to Take Protected Wildlife (Live Trapping for Re-Location and Release) may be approved by the Manager, Seal Program when all Minimum Predator Exclusion Measures (as defined at Attachment 1) are deployed, and

- A seal has harassed or injured a farm employee or is posing a real and continuing danger to farm employees, or
- Fish stocks and/or marine farming equipment are threatened or damaged by seals.

Trapping of seals within fish enclosures (except corrals) will not normally be approved and the following actions are required when a seal enters a fish enclosure:

- A DPIWE Officer (contact list at Attachment 2) must be contacted as soon as practicable but within 6 hrs that it is known that a seal has entered a fish enclosure.
- Attempts are to be made, without delay, to release the seal, using the following methods;
  - In pens with a furling net the furling net will be dropped and the seal isolated from the fish and encouraged to depart over the dropped side panels, or
  - In pens without a furling net, several side panels of the pen will be dropped to the waterline, and the seal encouraged to depart.

3. Procedure for Trapping of Seals

Make application for a Permit to Take Protected Wildlife (Live Trapping for Re-Location and Release), see Attachment 3) to the Manager, Seal Program, and proceed following approval for, or issue of a ‘Permit to Take Protected Wildlife’ (see Attachment 4)

The permit holder must ensure that appropriate Occupational Health & Safety (OH&S) standards and procedures are observed during the following operations.

- Only traps previously approved as suitable by the Manager, Seal Program, may be used. Minimum trap standards must be employed which include a maximum mesh size of 90mm (bar), and a minimum 400mm air space flotation at all times (including during towing). Approval tags must be attached to the cage.

- Deployment of the trap will only be made by a ‘responsible person’ nominated by the marine farming Lease Holder, and that person is to be specified on the ‘Permit to Take Protected Wildlife’. Only persons who have successfully completed an induction training component approved by the Manager, Seal Program, will be authorised to deploy a trap.

- The trap will be used only on the lease area of the marine farming lease number specified in the ‘Permit to Take Protected Wildlife’.

- The responsible person/person authorised by the ‘Permit to Take Protected Wildlife’ is required to notify NCB, DPWIE (Contact Officer details see Attachment 2) promptly following the trapping of a seal. If a number of seals have been trapped on the same day, the seal that has been the longest in captivity should be removed first.

- **Night time capture** - If the seal has been trapped between 1800 and 0600 hrs (night time) then the trap containing the seal must, as soon as possible, but within 6 (six) hours of capture, be removed from the water and located on land and NCB Contact Officers **notified by 0700 hrs**.

- **Day time capture -** If the seal is trapped between 0600 - 1800 (day time) NCB Contact Officer must be **notified within 2 (two)**. The trap containing the seal must as soon as possible but within 6 (six) hours of capture be removed from the water and located on land. The seal should preferably be transferred to an approved Holding Cage with a maximum mesh size of 90mm (bar) and with the NCB approval tag attached.

- Only one seal at a time may be held in each compartment of a of a holding cage.

- Once on land the holding cage containing the seal must be located to an approved (by the NCB Contact Officer) quiet zone and covered with a heat reducing breathable tarpaulin in order to reduce stress and disturbance to the seal and in order to reduce familiarisation with human activities. In warm weather (ambient air temperature exceeding 24 degrees C) a stream of water (hose) should be left running on the tarpaulin and/or adequate ventilation and shade from direct sun provided in order to provide a cool environment for the seal.

- During the transfer from the approved holding cage to the approved NCB seal relocation cage, the seal must not be harassed or stressed by forceful striking or loud noise. The minimum number of people required for safe operations are to be involved in the transfer.

The maximum time to elapse between containment of a seal in an accredited trap and holding cage and collection of that seal by an authorised officer is 36 hours unless a longer period has specifically been approved by an authorised officer. Such approval will only be given in circumstances where the authorised officer is satisfied that an extension of time is necessary and the extension does not present an unacceptable risk to the welfare of the seal. If for any reason a seal is retained in the holding cage for a longer period, the seal must, after consultation with the NCB contact officer, be released locally as soon as practicable.

- The permit holder must ensure that the NCB contact officer is immediately advised if any captive seal displays unusual symptoms (eg. Regurgitation, torpor) and must comply as soon as practicable with any instruction given by that officer (eg. release the seal locally).

- Any and all conditions, specified on a ‘Permit to Take Protected Wildlife’ must be adhered to.

4. Agency response

Prior to the Secretary’s (or Delegate’s) consideration of an Application for a Permit to Take Protected Wildlife (Live Trapping for Re-Location and Release) or a Permit to Take Protected Wildlife, the delegated officer will assess the documentary evidence and if required undertake a site inspection to verify that a continued risk to human safety continues to exist or that fish stocks or marine farming equipment are threatened by the presence of seals and that management and equipment standards (as specified in Attachment 1) are adequate and that all practical mitigation measures have been fully pursued.

A permit may be issued to apply to a particular seal or for a number of seals in a particular area over a prescribed period.

Upon notification of the trapping of a seal the contact officer will promptly advise the permit holder of the prospects for relocation of that seal and the likely time of collection.

5. Prohibitions

- Free feeding of seals must not occur in Marine Farming Development Plan Zones or Lease areas.

- Baited trap lines or 'tease line' may only be deployed by authorised NCB officers or responsible person/persons authorised by the Permit to Take Protected Wildlife.

- Traps must not be deployed inside fish enclosures unless specifically authorised by the Manager, Seal Program.

In cases where inadequate management practice or equipment contribute substantially to the behaviour of concern then those inadequacies should be satisfactorily remedied before an application for a 'Permit to Take Protected Wildlife' will be approved.

For the purposes of this protocol, only an officer/employee of the State Service expressly authorised by the Secretary will be taken to be an authorised officer.

6. Record keeping

The Lease Holder or the 'responsible person' nominated by Lease Holder shall keep records and make them available to the NCB officer at the time of collection of the trapped seal by the NCB officer.

DPIWE will retain copies of any records used to support an application for a permit as well as a record of date, location of capture and physical characteristics of the seal any marking information.

7. Cost recovery

The DPIWE will recover from the permit holder reasonable relocation costs (which may include standby charges in specific cases if NCB officers are repeatedly kept waiting for the availability of seals for which relocation has been requested by that particular Permit holder).

Note that in cases involving issues of general public safety, the NCB officer may be the applicant for a 'Permit to Take Protected Wildlife' and recovery costs will be borne by DPIWE.

ATTACHMENT 5 **Revision 030603**

PROTOCOL FOR THE NEGATIVE CONDITIONING OF SEALS USING NON-LETHAL SEAL CONTROL MEASURES – RELOCATION

1. Policy Context

Australian and New Zealand Fur Seals are Protected Wildlife and as such are afforded protection under various Acts administered by the Department of Primary Industries, Water and Environment (DPIWE).

These two species of seals are known to interact with marine farm operations. Such interactions have the potential to cause extensive losses and/or damage to valuable fish stocks, and on occasions present an unacceptable risk to human health and safety in the workplace.

The Department of Primary Industries, Water and Environment (DPIWE), in particular the Nature Conservation Branch (NCB), has in consultation with sections of the marine industry and other interest groups developed a set of specific Protocols to manage the risk posed to both wildlife and human interests. These Protocols address circumstances and procedures under which it would be appropriate to apply negative conditioning to persistent seals, or to relocate individual seals.

Such negative conditioning or relocation of Australian and New Zealand Fur seals would require the issue of a "Permit to Take" by the specific means being deployed.

The Secretary of DPIWE will determine when a permit for the use of negative conditioning using non-lethal seal control methods is to be issued or seals are to be relocated, after taking into account recommendations from the Manager Seal Program. The Secretary is unlikely to approve a permit in any case where inadequate management practices or equipment have, in his view, contributed significantly to the risk.

Circumstances under which negative conditioning using non-lethal seal control measures or relocation is warranted are described below.

2. Circumstances under which relocation will be considered as an appropriate management response

The holder of a Permit to Take Protected Wildlife (by Live Trapping) may, at the time of notification (as per the Trapping Protocol), request NCB to collect and relocate the trapped seal. Such request shall usually be approved, except under circumstances where the Manager Seal Program deems the trapped animal unsuitable for relocation for reasons of animal welfare, or likelihood that relocation and release will not be achieved within a reasonable timeframe (48 hrs). Under such circumstances, animals may be required to be released as far as practicable from the Marine Farm Lease, under the direction of the Manager Seal Program.

3. Procedure for Relocation of Seals

- The responsible person/person authorised by the Permit to Trap is required to notify NCB contact officer of DPWIE (as defined in Attachment 3) as soon as possible following the trapping of a seal, and within the time-frames specified in Protocol for Trapping of Seals (as defined in Attachment 2). If a number of seals have been trapped on the same day, the seal that has been confined the longest should be removed first
- The NCB Contact Officer will advise if/when the seal is likely to be collected and advise of any further requirements regarding that seal (eg. a requirement for it's local release as soon as practicable).
- All parties must ensure that appropriate Occupational Health & Safety (OH&S) standards and procedures are observed during the following operations (see handling procedures Attachment 9)
- During the transfer from the approved holding cage to the approved NCB seal relocation cage, the seal must not be harassed. The minimum number of people required for safe operations are to be involved in the transfer.
- Any and all conditions, specified on a 'Permit to Take Protected Wildlife' must be adhered to.

4. Agency response

- All captured seals:
  - captured for the first time and/or
  - not exhibiting an identification micro chip and/or
  - not exhibiting paint markings (in the case of Leopard and Elephant seals) and/or
  - exhibiting signs of disease or injury

  must, where practicable, be examined by a Veterinarian (see Attachment 4) as soon as possible or within 24 hours of capture, in order to perform an animal welfare safety check.
- **Newly captured** Australian and New Zealand Fur seals must:
  - receive an identification micro chip, and
  - be weighed with portable trailer scales or a 'Hi-Ab' mounted scale, which must be checked and serviced at approximately 15 seal capture intervals (for alternative weighing stations see Attachment 6) and
  - be identified by qualified staff (see Attachment 3) and photographed and
  - have a blood sample taken in accordance with specific sample size, determined by NCB / Marine Conservation Branch.
- **Recaptured seals** exhibiting signs of injury or showing an established weight loss of 10% where practical, be examined by a Veterinarian within 24 hours of capture, in order to perform an animal welfare safety check.
- **Injured/sick or chronically poor conditioned seals** will either be released locally without delay or inspected as soon as possible by a Veterinarian (see Attachment 4) who will give direction to the relocating officer.

- **Leopard and elephant seals** will be released immediately outside the marine farm lease. If animal exhibiting signs of injury or other welfare concerns, contact qualified NCB officer (as per Attachment 3) for instruction.
- **New Zealand Fur seals** are to be transported individually (separately) from other species.

All seals in transit must be accompanied by a **Seal Relocation form** (see Attachment 5) provided by **NCB.**

5. Approved Relocation Sites

- **New Zealand Fur seals** to a relocation site on theWest Coast, (see Attachment 7).
- **Australian Fur seals** will be relocated to Northern Tasmania on a rotation system (see Attachment 7).
- **Alternative sites** subject to consideration of the current pressures of the relocation schedule (see Attachment 8).
- **The relocating officer** will keep NCB officers (see Attachment 3) and Industry informed of re-trap events routinely. NCB officers will consider the selection of an alternative site (see Attachment 8) in the case of seals trapped for the third time in a season.
- **see Standing Orders Handling Procedures Seal Relocation (see Attachment 9)**

6. Record keeping

The Lease Holder or the 'responsible person' nominated by Lease Holder shall keep a Seal Relocation form record (see Attachment 5) and make them available to the NCB officer at the time of collection of the trapped seal by the NCB officer.

DPIWE shall keep all completed Seal Relocation form records (see Attachment 5) and maintain them on a computerised database. This database will be accessible on a read only access to authorised marine farm staff.

7. Cost recovery

The DPIWE will recover from the permit holder reasonable relocation costs (which may include standby charges in specific cases if NCB officers are repeatedly kept waiting for the availability of seals for which relocation has been requested by that particular Permit holder).

Note that in cases involving issues of general public safety outside of marine farm leases, the NCB officer may be the applicant for a 'Permit to Take Protected Wildlife' and recovery costs will be borne by DPIWE.

ATTACHMENT 6 **Revision 030603**

Qualified Departmental Officer - CONTACT LIST

NAME	**WORK**	**HOME**	**MOBILE**
MIKE GREENWOOD	6233 6076	6248 9502	0418 123 772
JODY ADAMCZEWSKI	6233 6609	6248 7171	0418 539 171
ROSEMARY GALES	6233 3865	6267 2043	0409 002 418
ALEKS TERAUDS	6233 6182	6223 1836	0417 369 033
ANDREW IRVINE	*6233 3346*	*6225 3767*	*0427 056 196*

VETERNARIAN

NAME	*WORK*	*HOME*	*MOBILE*
BARRIE WELLS			
CHRIS LEE			
BONNIE McMEEKIN			
ANNIE PHILLIPS			
CAMERON BELL			

Environmental Management System Framework

Tasmanian Salmonid Industry

Code of Practice

PhycoTec
Environmental Management

Tasmanian Salmonid Growers

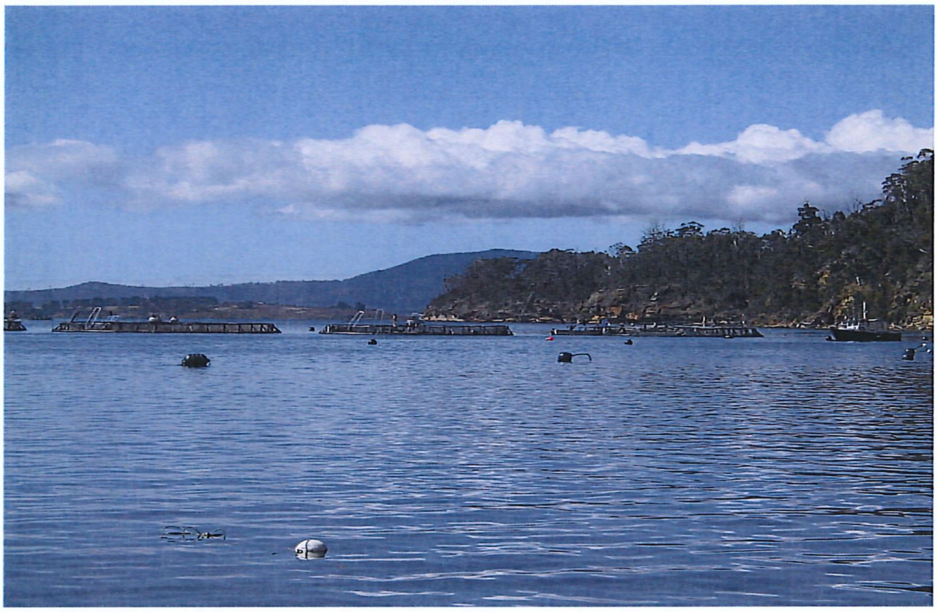
Tasmania

Australian Government
Fisheries Research and Development Corporation

FRDC Project 2004/096

Environmental Management System Framework

Tasmanian Salmonid Industry



Tasmanian Salmonid Industry

Code of Practice

Working Draft Version 1.0
June 2004

FRDC Project 2004/096

TASMANIAN SALMONID FARMING INDUSTRY

CODE OF PRACTICE

Working draft - June 2004

(Chapters on Hatcheries and on Processing to be developed)

Produced for the Tasmanian Salmonid Growers Association Ltd
by
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1. FOREWORD

The Tasmanian Salmonid Growers Association (TSGA) recognises the importance of sustainable production strategies in optimising:

- Industry profitability,
- End product quality,
- Economic benefits, including employment opportunities for the community,
- Environmental sustainability,
- Biosecurity and fish health
- Co-operation with regulatory authorities,
- Community support,
- Animal Welfare

This Code of Practice defines what is considered to be best industry practice with regard to the environment, fish husbandry, farming operations, and fish welfare. It is a working document and will periodically be subject to review and update as information becomes available and as the industry develops and evolves.

The Code has been developed by the TSGA in consultation with industry, regulatory authorities and other relevant government agencies. The Code is fully endorsed by all members of the TSGA. The development and production of this Code of Best Practice has been fully funded by the TSGA.

Responsibility for the implementation of, and adherence to the Code rests with each individual company.

2. GENERAL PRINCIPLES

This Code of Best Practice is based on the following fundamental principles.

- Environmental and economic sustainability.
- A growing environment optimised for salmonids and for the production of healthy and wholesome products.
- Recognition that farm management practices and environmental conditions have a direct effect on fish health and thus long term profitability.
- A company culture of continuously striving for improvement in all aspects of fish farming and staff management.
- A safe and healthy working environment for personnel.
- Provision of adequate equipment, resources and staff appropriate to the level of production and site characteristics.
- Compliance with all relevant legislation and regulatory requirements.
- Responsible use of veterinary therapeutics.
- Site selection appropriate for the species farmed.
- Regular and routine monitoring of stock health, with timely and thorough investigation of significant health problems.
- Regular and routine monitoring of environmental conditions and impacts.
- Use of equipment appropriate to the location, procedure and overall aims of the operation.
- Accurate and accessible record keeping to enable easy historical reference and to facilitate forward planning and ongoing improvement in performance.
- Employment of personnel with appropriate skills and/or provision of the necessary training to enable them to undertake their roles successfully.
- Adoption of appropriate fish and translocation policies to maintain appropriate levels of biosecurity.

3. HATCHERIES

(To be developed)

4. SMOLT/FINGERLING DELIVERY

4.1 Introduction

The health and quality of smolt and trout fingerlings is a critical factor in the ultimate success of ongrowing sites. Loading, transport and unloading of smolt can significantly impact on subsequent fish health and quality. Transfer operations should aim to minimise stress and physical damage.

4.2 General Principles

- Smolt/Fingerlings transferred to ongrowing sites should only come from licensed hatcheries actively involved in the Tasmanian Fish Health Surveillance Program.

- Confirmation of vaccination history and methodology must occur prior to transfer. Confirmation of health status, disease history and smoltification status (smolt) should also occur prior to transfer.

- The timing of transfer should coincide with the most appropriate conditions (*eg*. acceptable weather conditions, suitable water temperature, presence of brackish water etc.). Appropriate conditions will vary between sites, but should not represent any unacceptable risks to fish and/or staff and be conducive to good performance and health in fish following transfer.

- Any disease treatments must be completed prior to transport.

- Detailed and accurate data on all relevant information should be recorded.

4.3 Smolt/Fingerling Transfer

4.3.1 Smolt/Fingerling Loading at the Hatchery

- Feed should be withheld from fish for 24-48 hours prior to transport, as appropriate so as to minimise waste accumulation and health/welfare problems during transport.

- Stocking levels in trucks may vary according to the length of the journey, but should never be at levels high enough to compromise fish health. The stocking density in transport trucks should not exceed 75 kg/m^3 and 120 kg/m^3 for salmon and trout respectively.

- Loading of fish into trucks should be undertaken with a minimum of handling and stress.

- The integrity of all oxygen equipment on trucks must be checked and the system fully operational prior to loading and departure from the hatchery. The contents gauge must indicate sufficient oxygen in the bottles.

- Diffuser blocks should provide a fine stream of oxygen. Larger bubbles must be reported to appropriate hatchery staff.

- Dissolved oxygen (DO) must be checked in all tanks using a handheld meter or automatic DO monitoring units. Handheld meters must be accurately calibrated, set for freshwater and cross-checked with automatic DO monitoring units where present.

- Check DO levels in all tanks regularly during loading.

- The truck aeration system (either compressed air in tanks or petrol generator) should be operational prior to leaving the hatchery to control CO_2 levels during transport.

- Fish should be accurately counted onto the truck and a weight check done, in order to ensure accurate stocking levels on the truck and verify fish numbers for invoicing.

- Initial water temperature should be measured.

- Fish health should be assessed and recorded at loading. Any dead or moribund fish, signs of disease and/or unusual fish behaviour should be reported immediately to appropriate hatchery staff and to appropriate staff at the ongrowing site at or before unloading. Fish should not be loaded for transfer if there is suspicion of active disease within the stock.

- Any translocation restrictions currently in-place should be identified to the driver and an appropriate copy of the movement permit supplied.

- Non-hatchery personnel assisting with loading of fish should undergo appropriate disinfection procedures prior to entering the hatchery site, including disinfection of boots, protective clothing, DO meters etc.

- Trucks and transport equipment should be disinfected after each transfer of fish using an appropriate disinfection method. A standard operating procedure (SOP) for disinfection should be developed and documented.

- Transport vehicles should comply with relevant transport regulations and be checked for roadworthiness prior to commencement of delivery.

4.3.2 Smolt/Fingerling Transport

- Checks of DO and fish behaviour should occur at appropriate intervals. Fish behaviour should be checked especially when problems occur in maintaining appropriate DO levels in the tanks.

- Wherever possible automatic continuous DO monitoring systems should be used in fish transport trucks, in addition to appropriate handheld DO monitoring and visual checks.

4.3.3 Smolt/Fingerling Unloading at Ongrowing Site

- Unloading of fish from trucks, including use of helicopters and barges must occur with a minimum of fish handling and stress.

- Fish behaviour, DO levels and water temperature should be checked and recorded for all tanks prior to unloading.

- In Macquarie Harbour, fish must not be unloaded into cages at Strahan for subsequent towing to ongrowing sites. Alternative methods of transferring fish to ongrowing sites (*eg*. helicopters, barges) must be used.

- Fish severely damaged during transport through physical abrasion or spillage out onto the ground should be humanely destroyed and not placed into cages.

5. ONGROWING SITES

5.1 Introduction

The environmental and farming conditions (*eg.* salinity, temperature, depth, current, tides, weather, seabed characteristics, phytoplankton species and abundance, jellyfish, disease organisms, predators) vary between ongrowing sites. This variation may necessitate subtle differences in farming practices appropriate to the conditions at each specific site. However, most of the principles outlined in this Code of Practice are applicable to all ongrowing sites.

5.2 Environmental Issues

5.2.1 Introduction

The economic sustainability of salmon farms is partly dependent on the health of the aquatic environment in which they operate. Farming operations must be managed to minimise environmental impacts and ensure environmental sustainability. Fish farmers should also encourage other users of the aquatic environment to adopt environmentally sustainable practices, as salmon farming is dependant on a healthy environment for sustainable production.

5.2.2 Organic Inputs

The greatest sources of organic inputs from salmon farming into the environment are feed, faeces and respiratory wastes. The level of these organic inputs can be minimised through:

- Use of appropriate feeds that maximise the efficiency of feed utilisation by the fish. This includes factors such as nutrient composition, pellet size and pellet quality, which can all have the effect of reducing feed wastage and faecal output.

- Feeding systems and strategies that minimise the possibility of overfeeding and underfeeding.

- Regular monitoring of seabed characteristics and water quality at appropriate intervals to assess the level of organic inputs, so that remedial action can be taken early and effectively, if required.

5.2.3 Water Quality

- Key water quality parameters should be monitored and recorded on a routine daily basis. The parameters measured will vary between sites, but should include DO and water temperature, as well as salinity and turbidity where appropriate.

- Additional water quality parameters (*eg*. dissolved nitrogenous compounds and phosphorous, phytoplankton) should also be monitored as appropriate.

- Dissolved nitrogen and DO levels within the lease area and outside the lease area should remain within limits prescribed in Marine Farming license conditions.

- The release of fuels and oils into the marine environment should be prevented. Surface waters surrounding the lease area should not contain detectable levels of petroleum-derived hydrocarbons other than by normal vessel exhaust.

- Operators should have oil spill response plans in place with key staff trained to deal with spills.

- Surface waters outside the lease area should not contain measurable levels of fish oil and/or feed constituents other than that derived from routine feeding operations.

- There must be no unacceptable environmental impact 35 metres outside the boundary of the marine farming lease area. Relevant environmental parameters must be monitored in the lease area, 35 metres from the boundary of the marine farming lease area and at any control site(s) in accordance with the requirements specified in the relevant marine farming licence.

5.2.4 Benthic Conditions

- Farming operations and equipment (*eg*. moorings) must not be allowed to cause significant disturbance of the seabed in and around the lease area.

- Farm debris should not be disposed of in the marine environment. Wherever possible, any farm debris accidentally falling to the seabed should be retrieved and disposed of appropriately.

- There should be no unacceptable visual, chemical or biological impact on the seabed (benthos) 35m beyond the boundaries of the lease area. Unacceptable impacts include but are not limited to:

  - Presence of feed pellets
  - Mats of *Beggiatoa sp.*
  - Increase in organic carbon content more than 3x the levels at the control site
  - Negative redox levels 150mV less than at the control site.

- Fallowed areas must not be restocked until visual evidence shows the sediment surface is free of *Beggiatoa* mats.

- There should be no outgassing of methane or hydrogen sulphide anywhere within the lease.

- Any significant incidents of outgassing due to methane and hydrogen sulphide must be notified to the DPIWE as soon as possible, together with an action plan to eliminate the outgassing, including fallowing arrangements.

- There should be no detectable levels of antibiotics, or chemical residues derived from therapeutic use, present in sediments within or outside the lease area.

- Lessees are to ensure that underwater surveys are conducted as specified in the relevant marine farming licence to assess the extent of marine farming-derived organic sedimentation and the degree of impact on the benthic community.

- For all new lease areas being established, and for all expansions greater than 10% to existing lease areas, a baseline survey must be undertaken before marine farming operations commence. Data to be collected may include but is not limited to sediment particle size, organic carbon content of sediment, redox potentials, water flow rates, current flows and composition of the benthic community. Assessment of baseline environmental data will be used to determine future management and monitoring requirements of the lease area.

- For all new lease areas being established, and for all expansions greater than 10% to existing marine farming lease areas the composition of benthic communities will be assessed to determine whether the area to be farmed contains any rare and endangered species or any unusual habitat.

- Lessees must provide a baseline environmental survey as specified by the Secretary of DPIWE. A baseline environmental survey must be undertaken prior to the commencement of marine farming operations on those areas;

    - Where a new lease area is being established; or
    - When required as a condition of varying or expanding a lease area; or
    - Where a marine farming licence is varied to allow the farming of another species not addressed by the existing baseline survey for the lease.

- The Secretary DPIWE will use the information from the baseline environmental survey to assess whether the area to be farmed contains any rare or endangered species or any unusual habitat and to determine marine farming licence conditions.

5.2.5 Phytoplankton

The phytoplankton species present and their abundance can vary considerably between seasons and between years according to prevailing environmental conditions (*eg.* nutrient levels, water temperature, salinity and sea conditions). Certain phytoplankton species can impact on the health of farmed salmon by:

- Production of toxins that come in contact with the fish, particularly the gills
- Physical damage, particularly to the gills
- Lowering DO levels in the water through respiration and/or biological oxygen demand subsequent to the death of a phytoplankton bloom

- Farms should monitor the water column for phytoplankton abundance and species identification on a regular basis as appropriate to the individual site.

- When the particular phytoplankton species present in the water column and/or the phytoplankton abundance is of concern, monitoring should be increased accordingly. This should include other water column parameters (*eg.* DO) and fish health.

- Farm personnel who routinely work with the fish should be aware of and vigilant for fish behaviour which indicates the presence of harmful phytoplankton. Any unusual or unexplained fish behaviour should be reported to the appropriate farm staff immediately.

- Industry participants should communicate openly and rapidly in the event that a harmful algal bloom is suspected or detected. Such a collaborative approach enables more effective monitoring of regional bloom dynamics, and a more rapid response to be mounted, to the benefit of all.

- Farms should have response plans in place, in the event that a problem phytoplankton bloom occurs (*eg.* aeration systems, towing cages, cessation of feeding).

- Records must be kept of any observed algae blooms within, and in the vicinity of the lease area, including date, extent and duration.

- The level of *chlorophyll-a* within the lease area should not exceed Marine Farming licence conditions.

- Algal blooms or fish death associated with such blooms should be reported to DPIWE within 24 hrs of detection.

5.2.6 Jellyfish

The jellyfish species present and their abundance can vary considerably between seasons and between years according to prevailing environmental conditions. Certain jellyfish species can impact on the health of farmed salmon through:

- Direct toxic effects on fish
- Physical damage and stress when the fish are crowded within the cage by large numbers of jellyfish, particularly in strong currents. These incidents may also result in lowered DO levels within the cage.

- Farms should monitor the water column for jellyfish abundance and species identification on a regular basis, as appropriate to the individual site.

- Where the particular species present in the water column and/or the jellyfish abundance is of concern, monitoring should be increased accordingly. This should include other water column parameters (*eg*. DO) and fish health.

- Farm personnel who routinely work with the fish should be aware of and vigilant for fish behaviour which indicates the presence of harmful jellyfish. Any unusual or unexplained fish behaviour should be reported to the appropriate farm staff immediately.

- Industry participants should communicate openly and rapidly in the event that a harmful jellyfish swarm is suspected or detected. Such a collaborative approach enables more effective monitoring of regional swarm dynamics, and a more rapid response to be mounted, to the benefit of all.

- Farms should have response plans in place, in the event that a problem jellyfish swarm occurs.

- Records should be kept of any observed jellyfish swarms within, and in the vicinity of the lease area, including date, extent and duration.

5.2.7 Therapeutants and Chemicals

- The use of therapeutants and chemicals on farms should be kept to an absolute minimum through the implementation of appropriate farming practices.

- Where drug and chemical treatment is necessary, their use must be strictly controlled to maximise the effectiveness of the treatment, ensure staff safety and well being, and ensure no unacceptable environmental impact.

- Use of chemical therapeutics must comply with the DPIWE "Code of Practice for the supply and use of veterinary chemical products".

- For more detailed information on therapeutants see Section 5.3.6 (Treatments).

5.2.8 Wildlife

It is inevitable that interaction will occur between fish farms and wildlife. However, farms must minimise their impact on wildlife populations. Predatory species such as cormorants and seals impact on fish farms through one or more of the following:

  - Feeding on fish
  - Killing fish without feeding
  - Injuring fish without killing them
  - Causing holes in nets
  - Putting fish off feeding

Seals can in some cases also present a risk to the safety of farm staff.

- Any predator control of protected species must be conducted in accordance with the Nature Conservation Branch (DPIWE) guidelines.

- Appropriate farm staff must be aware of, and comply with all requirements as contained in the "Protocol for the negative conditioning of Seals using non-lethal seal control measures – SEAL CONTROL UNITS ("CRACKERS")" and "Protocol for the negative conditioning of Seals using non-lethal seal control measures – TRAPPING".

- As a general principle, farms should aim to prevent predators from eating fish. While, this will not always be effective in deterring predators, they may be less likely to persist if they are unable to feed. Under no circumstances should salmonids or wild fish be fed to seals in and around leases.

- Any biological debris that could attract predators or wildlife on cage sites or in and around the farm site should be minimised and routinely removed to reduce the potential for attracting predators or wildlife.

- Effective measures must be undertaken to prevent access by predatory birds (*eg.* cormorants) to fish, particularly in the period soon after smolt/fingerling transfer.

- Effective measures must be undertaken to prevent access by seals to fish. This includes ensuring that cage and predator nets (when used) are as stiff and taut as possible.

- Sea birds, especially seagulls should be excluded from cages, in particular during feeding as they consume feed, put the fish off feeding and potentially act as vectors for disease transmission.

- The characteristics, design and implementation of predator nets should aim to avoid wildlife being entangled in the net.

- With due regard to water quality parameters (*eg*. DO), the mesh size of cage nets should not be so large as to allow large numbers of wild fish to enter the cage. Wild fish can consume significant quantities of food, potentially act as vectors for disease transmission and may end up being killed during freshwater baths or at harvest.

- Farming operations should not unnecessarily result in the removal, or interference with, fish or marine or benthic flora or fauna.

5.2.9 Noise

- Farmers should aim to minimise the noise created from farming operations, farm staff and farm equipment, particularly early in the morning and late at night.

- Wherever possible noise from generators, pumps, feeding systems, tow vessels and other equipment should be minimised through shielding or enclosure.

- Noise impacts should be a consideration in boat motor selection (*eg*. 4 stroke vs. 2 stroke).

- Lessees must comply with guidelines on noise emissions made pursuant to the *Environmental Management and Pollution Control Act 1994* for marine farming operations.

5.2.10 Visual Impacts

Wherever practicable, industry should minimise the visual impacts of farm structures and equipment. Marine farms must comply with visual mitigation conditions contained in Marine Farming Licences and Marine Farming Development Plan Management Controls.

- All fish cages, buoys, netting and other floating marine farming structures and equipment on the sea, other than that specified for navigational requirements, must be grey to black in colour, or be any other colour that is specified in the relevant marine farming licence.

- Marine farming structures and equipment must be low in profile and be of a uniform size and shape.

- All structures and equipment on the lease area should be kept in good repair and condition. Redundant or dilapidated farm structures and equipment should be removed from the lease. The lease area should be kept clean and tidy.

- Floating storage huts, grading facilities and shelters must not be located within a lease area without authorisation under the relevant Marine Farming Licence. The number and visual impact of such structures should be minimised wherever practicable.

- The positioning and brightness of security and spotlights should not cause unnecessary adverse effects on the amenity of residential property and must not interfere with navigation.

- Consideration of visual impact should occur in designing shore facilities (*eg.* colour, profile). Shore based facilities must comply with local government planning requirements.

- Farm debris must not be disposed of in the water and farms must aim to minimise the amount of farm debris that inadvertently enters the water.

- If any part or parts of marine farming structures or equipment break away from the lease area, lessees must take action as soon as is reasonably possible to recover those structures and equipment and return them to the lease area or otherwise dispose of them in an appropriate manner.

- Farms should undertake regular cleanups of adjacent foreshores, including non-farm related rubbish. Records of cleanups, including an assessment of farm vs. non-farm debris should be kept.

5.2.11 Antifoulants

The use of antifoulants on nets can significantly improve the rearing environment for farmed fish, reduce handling (*eg.* net changes) and increase the effectiveness of predator control measures (*eg.* seals).

- Only approved antifoulants must be used on farms in accordance with requirements of the Agriculture and Veterinary Chemicals (Control of Use) Act 1995. Monitoring programs must be conducted as required by the Australian Pesticides and Veterinary Medicines Authority or DPIWE.

- Farms should use as little antifoulant as possible without compromising the effectiveness of the antifoulant use.

- Antifoulants must only be applied to nets at sites with appropriate facilities to apply the antifoulant effectively, ensure staff safety and wellbeing, and ensure appropriate control of all waste material.

- Unused antifoulant and empty antifoulant containers must be disposed of in an appropriate manner.

- Handling and deployment of antifouled nets must be undertaken in a manner that ensures staff safety and wellbeing.

- Antifouled nets must only be cleaned at sites with appropriate facilities to ensure staff safety and wellbeing, and ensure appropriate control of all waste material.

5.2.12 Escapees

- Farms must minimise the risk of fish escaping, particularly during handling procedures (*eg.* freshwater bathing, grading, splitting, swim throughs) or as a result of predator attack (*eg.* holes in nets) or equipment failure (*eg.* cage/mooring failure during bad weather).

- Lessees must not intentionally release into State waters fish of the species authorised in the relevant marine farming licence unless authorised to do so by that licence

- Nets must be regularly checked, maintained and repaired.

- Escape of farmed salmon greater than 1000 fish into State waters must be immediately recorded and notified to the Manager, Marine Farming Branch, providing details of how the escape occurred and an estimate of the quantity of fish involved.

- Companies should consider developing contingency plans detailing actions to recover fish in the event of a large fish escape. Such plans must be verified as acceptable to the Manager, Marine Farming Branch.

5.2.13 Introduced Marine Pests

- The presence of any introduced marine pests within lease areas should be notified to DPIWE as soon as possible. These species include, but are not limited to the: Northern Seastar (*Asterias amurensis*), European shore crab (*Carcinus maenas*) and Japanese seaweed (*Undaria pinnatifida*).

- Measures should be undertaken to minimise the risk of translocating marine pests by farm operations through good farm hygiene (see section 5.3.3 – Farm Hygiene).

- Marine farming gear can provide novel habitat that can be colonised by introduced marine pests. Marine pests should be removed from marine farming gear and disposed of at land-based facilities. See also Section 5.5

Equipment: Specification, Operation and Maintenance for recommendations regarding maintenance of marine farming equipment.

- Marine pests removed from marine farming equipment must not be returned to the water.

- Boats used to service marine farm leases should be maintained to prevent hull fouling. Vessels that remain in the water for long periods should have antifouling suitable for the type of vessel and the way the vessel is used. Antifouling should be removed and re-applied at facilities that can contain and dispose of wastes as recommended by the Code of Practice for Antifouling and In-water Hull Cleaning and Maintenance.

- Some marine pests, such as the Japanese Kelp, produce microscopic larvae, spores or cysts that can be translocated on dive gear. Diver hygiene practices should be followed to prevent the spread of these marine pests (see section 5.4.6.3 – Diving Hygiene).

5.3 Health Management and Disease Control

5.3.1 Introduction

Farm and stock management practices should always aim to optimise the health of the fish. Fish health and performance is critical to the economic and environmental sustainability of the industry.

5.3.2 General Principles

- Farms should always aim to prevent or control disease incidents through the application of best practice in farm management, stock husbandry and equipment deployment as outlined in this Code of Practice.

- Industry should facilitate open communication between farms and with the Fish Health Unit (FHU) veterinarian when disease incidents occur. This enables individual farm awareness of disease dynamics to be on a broad scale with preventative or remedial action, if required, more likely to occur at the earliest possible opportunity.

- Industry should be familiar with the operational procedures for the "Tasmanian Fish Health Surveillance Program".

- Industry should be aware of their responsibilities for reporting of disease under the Animal Health Act 1995.

- Smolt and trout fingerlings transferred to on-growing sites should only come from licensed hatcheries actively involved in the Tasmanian Fish Health Surveillance Program.

- Prior to transport, the hatchery manager should assure the farm manager that there are no known active infections and that all cases of prior disease have been reported to and investigated (where appropriate) by the Fish Health Unit. Only healthy fish in good physical condition should be transferred to on-growing sites. Fish should be of a size and smoltification status (salmon) appropriate for transfer to the marine environment.

- Vaccination history and methodology must meet current industry best practice prior to transferring smolt and trout fingerlings to on-growing sites. Smolt must not be transferred to Macquarie Harbour without having been vaccinated against *Vibrio anguillarum*. Salmon should also be vaccinated against *Vibrio anguillarum* prior to transfer to other regions in Tasmania. Trout must not be transferred to any region in Tasmania without having been vaccinated against *Vibrio anguillarum*.

- All farm staff should have a working knowledge of "normal" fish appearance and behaviour. Any unusual or unexplained appearance or behaviour observed by staff should be immediately notified to the appropriate personnel.

- The quality of the rearing environment should be optimised wherever possible, as this directly relates to the incidence of clinical disease (see section 5.5.10 – Rearing Environment).

- Handling and stress levels in farmed fish should be minimised wherever possible.

5.3.3 Farm Hygiene

- Measures must be undertaken to prevent transmission of significant disease organisms between regions, sites and cages.

- Standard Operational Procedures for disinfection should be developed and documented by each company.

- All equipment entering or leaving a farming region must first be cleaned and disinfected using an appropriate method. Decontamination protocols should include, but not be restricted to: boats, harvest bins, smolt transport trucks and protective clothing.

- Absorbent materials such as ropes and nets are prone to harbouring disease organisms. Therefore these materials should not be removed from or transferred between farming region without extensive cleaning, disinfection and drying using an appropriate method. On site maintenance of such equipment should occur to avoid movement between farming regions. Such materials should be disposed of in an appropriate manner at the end of their life. Old ropes and nets should not be used for other purposes in other farming regions without extensive cleaning, disinfection and drying using an appropriate method.

- Personnel moving between farming regions and farm leases should have clean, disinfected boots and protective clothing. The dedication of equipment that cannot be adequately cleaned and disinfected to specific sites should be encouraged.

- Hygiene procedures must also be followed by all contractors, DPIWE staff etc., with special attention given to divers and their equipment.

- Wherever possible, each lease should have dedicated equipment for daily operations (*eg*. mort bags, DO meters, boats etc).

- Diving hygiene (see section 5.4.6.3)

5.3.4 Health Monitoring

- All farms must participate fully in the Tasmanian Fish Health Surveillance Program.

- Access to fish health kits should be maintained by company group of leases. Fish health kits must be stored refrigerated.

- Farms should routinely use fish health kits on fresh mortalities at the end of each month if they have not been used in disease investigation.

- Farms in AGD prone areas should regularly monitor the health of fish gills at appropriate intervals to enable the effective planning of freshwater bathing operations.

- All farm staff should be routinely monitoring fish health during daily operations.

- Staff should take every opportunity to undertake a more detailed examination of fish health during handling operations (*eg*. AGD checks, weight checks, grading, swim throughs/splits) and at harvest.

- Suspicion of significant or notifiable disease should be promptly reported to the FHU veterinarian.

5.3.5 Disease Investigation

- Suspected problems, including unusual or unexplained fish appearance and/or behaviour should be investigated quickly and thoroughly.

- Disease investigation should include a thorough examination of the history of the fish, determination of potential predisposing factors, clinical examination of affected and unaffected populations, and laboratory testing (*eg*. histology, microbiology) as appropriate to the case.

- Application of control measures appropriate to the case (*eg*. reducing feed rates, treatment) and/or remediation of predisposing factors (*eg*. fouled nets, missing net weights) should be undertaken quickly and effectively.

- Appropriate farm staff must be aware of the listed notifiable diseases in fish for Tasmania. Suspicion of significant or notifiable disease should immediately be reported to the Fish Health Unit veterinarian.

- In clinical cases external assistance should be sought (*eg*. FHU veterinarian and laboratory staff). Even in cases not investigated by the FHU veterinarian, farms should keep the vet informed so that any trends across the industry can be uncovered as early as possible. This enables more timely response to evolving disease issues and facilitates the early development and application of preventative and/or control strategies.

5.3.6 Pharmaceutical Treatments

5.3.6.1 General Principles

- Treatments must only be used in circumstances where there is no other effective method to effectively control a disease incident or when animal welfare issues arise.

- Treatments must not be used prophylactically or on a routine basis. Treatment should only be instigated where it is necessary to control morbidity/mortality and/or to avoid the escalation of a disease outbreak.

- All chemical use must comply with the requirements of the Agriculture and Veterinary Chemicals (Control of Use) Act 1995 and in accordance with the DPIWE Code of Practice for the Supply & Use of Veterinary Chemical Products.

- Use of therapeutants to treat fish must only be undertaken with the appropriate authorisation (*eg*. veterinary prescription or minor use permit) and in accordance with the conditions of that authorisation).

- Treatment must always be undertaken in a manner that optimises the effectiveness of treatment, ensures staff safety and wellbeing, and minimises any environmental impact.

- Where treatment is indicated, it should be implemented as quickly as possible.

- Recommended withdrawal periods must be observed for all treatments to ensure there are no unacceptable residues in harvested fish.

- Wherever possible, any underlying factors contributing to disease outbreaks must be remedied in conjunction with treatments, otherwise the effectiveness of the treatment and the long-term control of the disease are likely to be significantly compromised.

- All treatments must be closely monitored throughout to ensure that the treatment is being undertaken appropriately and that there are no undue signs of stress in the fish.

- Fish must be monitored following treatment to check that the treatment was effective.

- Staff supervising and undertaking treatments must be fully aware of all safety precautions relating to the treatment product and its use.

- All medications must be stored and labelled appropriately to ensure product quality is maintained, and there is no risk to staff safety or wellbeing.

- Medications must not have passed its expiry date.

- Medication containers must be disposed of appropriately.

- Records must be kept of all chemicals used that are directly or indirectly released into the water. This includes, but is not confined to therapeutants, anaesthetics, pigments, antifoulants, disinfectants and cleansers.

5.3.6.2 IN-FEED TREATMENTS

- Wherever practicable, medications should be added to the feed at the feed mill during production. This improves the distribution of the medication through the feed. However, it is important to know whether the feed production process (*eg.* temperature) affects the efficacy of the medication incorporated.

- The feed mill mixing medicated feed must receive an appropriate authority and should follow all procedures and safety precautions outlined.

- The feed mill may require that the farm treating fish must take an appropriate amount of subsequent feed produced through the mill to ensure that no other customer receives feed with low levels of medication. The treating farm should only feed this additional feed to the cages that were treated.

- In emergencies or where only small quantities are required, the medication can be applied to the feed at the farm. In these circumstances the following apply:

    - Staff preparing medicated feed should be experienced and must strictly follow the recommended method of application and comply with all safety precautions indicated on the "Fish Medication Authority".
    - The medication must be applied evenly onto the feed pellets so that all fish receive an adequate dosage.
    - The method of application must ensure that the resulting medicated feed retains the medication on the pellet during storage, transport and feeding operations.
    - Where fish oil is used to apply medication to feed, it is essential that the fish oil is fresh otherwise the palatability of the medicated feed may be compromised.

- The relevant farm must ensure that accurate information on fish biomass and feed rates is used as the basis of calculating treatment dose rates and feed application rates.

- Medication and medicated feed must be stored in a sealed container in a cool, dry environment.

- All bags containing medicated feed, either from the feed mill or prepared on farm, must be clearly labelled as medicated feed.

- Staff handling or feeding medicated feed must be made aware that they are handling medicated feed and wear appropriate protective clothing including: overalls, gloves and face mask to avoid possible allergic reactions and prevent inhalation or swallowing of medication in feed dust.

- To ensure the fish consume the total daily allocation of medicated feed in any day, the medication must be applied to the feed at a rate that results in the daily amount of medicated feed being less than what would normally have been eaten by the fish in that day. However, the total quantity of medicated feed should not be so small that the capacity for all fish to access medication is compromised.

- Medicated feed must be administered in such a way that all fish are exposed to medication. This is generally best achieved by administering the daily quantity of medicated feed as a single large meal rather than multiple small meals. Under such circumstances the normal feed rate should be reduced by 1/3 to 1/2 and feed frequency reduced.

- When feeding medicated feed it must be distributed broadly and evenly across the cage surface to enable all fish a chance to access pellets.

- Medicated feed must be fed in such a way that no uneaten feed enters the environment. Careful feeding maximises the effectiveness of the treatment and ensures that potential environmental impacts are minimised.

5.3.6.3 Bath Treatments

Freshwater Baths

- The volume of freshwater used must be appropriate for the biomass of fish being treated and should not result in undue stress to fish during the bath.

- Feed should be withheld for at least 24 hrs prior to the bath to avoid unacceptable faecal contamination, ammonia levels or fish stress during the bath.

- Freshwater baths should not be undertaken in unacceptably rough conditions that endanger fish health and/or staff safety.

- The net on the source cage must not be excessively fouled at the time of crowding the fish.

- The net on the source cage and treatment cage should be dived prior to the bath to ensure there are no holes in the net.

- The salinity of the freshwater in the liner should be checked prior to the bath, particularly if the full liner has been on site overnight or during rough conditions.

- Farm staff should take extra care with crowded fish during periods when seals and/or high numbers of phytoplankton or jellyfish are present.

- Adequate oxygenation/aeration equipment must be available at the bath to comfortably maintain appropriate DO levels during the bath, preferably within the range 100-150% saturation. This may also be necessary in the crowd in some circumstances.

- The liner should be released if DO levels cannot be held at acceptable levels. The DO levels should not be allowed to fall below 6 ppm.

- The duration of the bath necessary for effective treatment will vary from site to site according to factors such as freshwater quality and severity of amoebic gill disease (AGD) infection, but should be at least 2 hours from the transfer of the last fish into the bath.

- Farm staff should regularly monitor the fish in the crowd, behind the crowd and in the liner throughout the bath procedure. If there are any unacceptable signs of fish stress then the problem should be fixed immediately.

- Farm staff should continuously monitor the DO level in the liner and where necessary in the crowd.

- Farms should ensure that the freshwater used in bath treatments will not adversely affect fish health (*eg.* excessively high water temperature or dissolved heavy metals)

- Fish should be crowded in the source cage and transferred into the freshwater bath as quickly as possible with a minimum of stress. An appropriate number of crowds should be used to minimise fish stress.

- The treatment cage should be dived soon after the release of the freshwater liner to check the appearance and behaviour of the fish and collect mortalities (if any).

- Fish should be bathed before the AGD has progressed to a level on the gills at which the effectiveness of the bath may be compromised.

5.3.7 Other Disease Control Measures

- Wherever possible, poor performing fish should be culled from populations (*eg*. grading, AGD baths, weight checks, gill checks), particularly prior to periods when the risk of disease outbreak is highest (*eg.* high water temperatures). These fish provide a focus for infection and an opportunity for disease to establish in a population.

- Where a particular population (*i*.e. cage of fish) has recurring disease outbreaks, consideration should be given to culling the whole population under strictly controlled hygiene conditions.

5.3.8 Fish Movements

- Farms must comply with any existing movement restrictions put in place by the Chief Veterinary Officer of Tasmania (CVO). These currently include restrictions on the movement of stock, product and equipment leaving:

    - The Huon/Channel region [for the control of a rickettsial-like organism (RLO)].

- Macquarie Harbour region [for the control of Marine Aeromonas Disease (MAS) and aquatic birnavirus].

- Wherever possible, smolt and trout fingerlings transferred to a particular ongrowing site should come from as few hatcheries as possible.

- The movement of stock between ongrowing sites should be minimised wherever possible.

- The towing of cages close to other lease areas should be avoided wherever possible.

- Broodstock should not be sourced from ongrowing sites unless having satisfied an accepted health testing protocol

5.4 Stock Husbandry and Management

5.4.1 Introduction

Good stock husbandry and management will optimise fish health and performance, and minimise environment impacts.

5.4.2 Stocking Density

Fish stocked too densely within cages are prone to stress, injury and disease.

- Appropriate stocking densities will vary according to stage of the production cycle (*eg*. smolt vs. harvest size fish), time of year (*i*.e. winter vs. summer) and between sites according to different site characteristics (*eg*. currents, depth), however as a general rule stocking densities should not result in undue fish stress or compromise fish health, and quality.

- It is recommended that "normal" maximum stocking density be kept as low as practicable, but should not exceed 15 kg/m^3 and must not exceed 18 kg/m^3, unless the conditions in the previous point are met.

- The maximum permissible stocking density of salmonid fish in marine growout cages is 25 kg/m3 of caged volume unless otherwise specified in the marine farming licence.

5.4.3 Site Management (Fallowing)

- An "all in, all out" approach to site management should be instigated, so that the whole site receives an appropriate period of fallowing before restocking. At the very least individual cage sites must receive an appropriate period of fallowing before being restocked.

- Appropriate fallowing periods will vary between sites according to factors such site characteristics (*eg*. current, water depth), feeding efficiency at the site and the biomass held. However, fallowing periods should allow some seabed recovery. A minimum of twelve weeks is recommended, while longer periods are encouraged.

5.4.4 Stock Management (Year Class/Species Separation)

- Wherever possible only a single year class should be stocked on each site.

- From a biosecurity perspective, it is preferable that only one fish species should be stocked on each site.

5.4.5 Mortalities

5.4.5.1 Management

Removal and disposal of mortalities must be carried out in a timely and proper manner in order to minimise disease transmission risks and the potential for fish escapes due to scavengers creating holes in nets (*eg*. dogfish and seals).

- During periods of "normal" mortality levels, all mortalities must be removed at least weekly.

- During periods of general increased mortality, cages should be dived as frequently as is possible, but at least three times weekly.

- In cases where there is the short-term possibility of increased mortality (*eg*. after seal attack, problem freshwater bath, jellyfish swarm), an underwater inspection should be undertaken as soon as possible.

- In cases where a significant unexplained decrease in feed response occurs, an underwater inspection should be undertaken as soon as possible.

- In cases where there is a significant change in fish behaviour, particularly where such behaviour indicates disease, an underwater inspection should be undertaken as soon as possible.

- Routine underwater inspections should occur following handling procedures (*eg*. freshwater baths, grading).

- Diving should be undertaken immediately after smolt/fingerling transfer and more regularly during the first month following transfer, or longer if indicated.

5.4.5.2 Disposal

- Mortalities must not be disposed of, or be present in the marine environment outside cages.

- Mortalities must be transported and disposed of in a manner that does not pose any unacceptable visual or odour effects. If mortalities are not transported to a disposal site immediately upon arriving ashore then they should be contained within an airtight container or treated in some other way (*eg*. application of lime) to ensure there is no unacceptable odour.

- Mortalities must be transported and disposed of in a manner that does not pose any potential risk of disease transmission.

- Mortalities should be disposed of on land sites where there is no risk of leaching back into waterways and the disposal meets local council guidelines. This should include burial to eliminate the potential for birds and vermin to gain access to the material. Further processing under biosecure conditions (*eg*. fertiliser, silage, rendering, composting) is also a favourable option. Disposal and/or treatment of mortalities must also meet DPIWE requirements.

5.4.6 Diving

5.4.6.1 Diving Operations

- Diving operations must be undertaken by appropriately qualified personnel in accordance with the relevant diving code.

- Farm divers/ diving contractors must contact the appropriate onsite personnel prior to commencing diving. This is to ensure that any special requirements or considerations are implemented.

- Where required, appropriately qualified DPIWE staff may serve as part of the farm dive team in order to comply with Australian Standards 2299 (AS/NZS 2299.1:1999 & AS/NZS 2299.2: 2002). Under such circumstances, this protocol shall satisfy points 2.1.1 & 3.1.2 outlined within AS/NZS 2299.1:1999. Paragraph 9 applies to all such on-farm diving activities.

- Divers should undertake each dive in a systematic way to ensure full coverage of the cage.

- Divers should routinely check the following during each dive unless otherwise advised: net fouling, net profile in water, status of net components (eg. missing weights), mesh/rope integrity (eg. holes), mortalities (number and assessment of cause of death), fish behaviour and appearance, and presence of uneaten feed.

- Any holes in the net should be repaired during the dive.

- In low visibility conditions (*eg*. Macquarie Harbour, upper Huon River), divers should use a torch of sufficient strength to enable an effective diving program.

- Diving should not occur in a cage during feeding of that cage.

- Divers must have a good understanding of the role they are undertaking within the farm and the expertise to fulfil that role. Divers must be able to identify abnormal behaviour and signs in fish and be able to categorise mortalities according to probable cause of death. Divers should also be capable of recognising and reporting potential problematic issues so that farm staff has the opportunity to avoid unnecessary problems.

5.4.6.2 Record Keeping

Records should be kept of all relevant parameters to ensure the safety and well being of divers, as well as provide farm staff with the information necessary to manage farm operations. Records must include:

- Cage number, date and time of dive.

- All parameters and information on the diver, diving equipment and dive profile required under the AS2299 Diving Code.

- Net fouling condition, net holes, net profile in water, status of net components (eg. missing weights).

- Fish mortality number, including some categorisation or assessment of cause of death.

- Any abnormal appearance and/or behaviour of the fish.

- Other relevant information (eg. presence of feed on bottom of net, evidence of seal predation)

5.4.6.3 Diving Hygiene

Diving equipment and mortalities are potential pathways for spreading disease organisms between cages, leases and regions. Therefore appropriate planning and hygiene practices must be followed, including:

- Wherever possible, diving tasks should be organised to minimise the potential to transfer disease organisms between year classes. For example, younger year class fish should be dived before older year class fish, preferably with a different diver for each year class or each site. Known or suspected problem cages should be dived last and preferably all dived by the one diver.

- Organic matter should be washed off dive suits (including gloves), dive equipment (including mort bags) and the dive boat between each cage and prior to leaving a lease site. These items should be routinely disinfected using an appropriate method prior to entering another lease site or diving another year class of fish. This should preferably occur before leaving the lease or year class at which the previous diving has occurred.

- All dive equipment must be fully cleaned and disinfected before being transferred between regions. Where possible dive equipment, in particular wet suits, should be dedicated to specific regions and not transferred between sites.
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- Mort bags should be at least site/year class specific.

- Morts must be contained in a leak proof and covered container.

- Mort containers must be disinfected using an appropriate method after each disposal.

- After diving a cage known to have a significant health problem, the dive suits (including gloves), diving equipment (including mort bag) and dive boat must be disinfected using an appropriate method prior to diving in the next cage.

- Wherever possible, if unexplainable and/or unexpected high numbers of morts or signs of an infectious disease are found within a cage, then the diver must immediately notify the appropriate farm personnel before proceeding. This will assist early remedial action and limit the possible spread of any disease agent (if present).

- At the end of each day, dive suits (including gloves), dive equipment (including mort bags) and the dive boat must be thoroughly cleaned, disinfected and dried using an appropriate method.

- Unless dive suits, dive equipment and dive boats are considered to have been already reliably disinfected they should be disinfected prior to use on the lease using an appropriate method. Particular attention should be paid to dive gear that has been used overseas or in areas where disease agents exotic to the lease are known to be present.

5.4.7 Feeding

5.4.7.1 Introduction

Feed management plays a pivotal role in salmon farming. It impacts on production, economic feasibility, stock welfare, stock health and the environment. Best practice is required to optimise all these aspects.

5.4.7.2 General Principles

- Feeds and feeding strategies should aim to:
  - Optimise growth at the lowest possible FCR
  - Maximise quality in harvested fish (*eg*. flesh colour and firmness)
  - Minimise environmental impacts
  - Optimise fish health

5.4.7.3 Feed composition and quality

- The nutrient composition of feeds should be appropriate to the size and life cycle stage of farmed fish, but will vary according to production strategies.

- No antibiotics (other than for treatment of disease), hormones or other growth promoters should be incorporated into the feed.

- Feed ingredients must be monitored to ensure that fish flesh meets all Australian food safety limits (*eg*. dioxins).

- Only permitted dietary pigments must be incorporated into the feed.

- The physical quality of feed should be excellent so that the proportion of uneaten feed is minimised (*eg*. pellet fragments and dust). Feed mills should aim to maximise the durability of pellets and minimise the amount of dust and chips in feed. The following specifications should be met:
  - Dust should be less than 1% as measured on a 1 mm sieve.
  - Chips should be less than 5%. A chip is defined as a feed particle that is less than half its nominated length or diameter.
  - 90% of pellets should be within a range that is +/- 20% of the nominated pellet size.

- The percentage of floating pellets within sinking feeds should be kept at a minimum.

- Feed should always be handled in a manner that preserves the physical and chemical quality. This includes:

- Rapid turnover of ordered feed
- Routine rotation of feed stocks
- Maintenance of optimum storage conditions for feed to minimise any deterioration in quality
- Careful handling of feed to minimise physical damage of pellets
- Pest exclusion from storage sites

- Feed of poor physical or nutritional quality should not be fed to fish. If feed is mouldy or contaminated (*eg.* diesel spillage on the bag) it should not be fed under any circumstances. Such feed must be disposed of appropriately. No feed should be disposed of into waterways.

- Feed samples should be kept regularly and stored appropriately to enable historical testing and reference to feed quality in the event of a health problem that may be feed related.

5.4.7.4 Feeding Operations

- Feed pellet size should be appropriate for the size of fish being fed.

- Increases in feed pellet size should be based on the average fish weight and size variation within the population. Feed pellet size should not be increased until all fish within a cage population (excluding pinheads/runts) are able to consume the larger pellet size. Where necessary, short periods when pellet sizes are mixed should be used in any transition from one pellet size to another.

- Feeding response (*eg.* pellet spitting) and daily feed rate should be monitored following an increase in feed size to assess the appropriateness of the change.

- Feed should be delivered to fish at a rate, and distributed over the water surface of a cage in a manner that allows all fish a sufficient opportunity to access their daily feed requirement.

- Fish should be fed as quickly as possible without wasting feed.

- A feedback mechanism should always be used during feeding (*eg.* camera, Aquasmart sensing cone) to prevent overfeeding and underfeeding. Careful assessment of feed wastage should occur

- Regular seabed inspections should be undertaken at appropriate intervals, by divers where possible, or with cameras, to assess bottom fouling.

- The presence of significant numbers of feed pellets on the bottom of nets or on the seabed should initiate an immediate review of feeding operations.

- A feeding strategy should be employed to ensure any pellet sizes that are prone to floating can be contained allowing the pellets to sink within the cage.

- Divers should liaise with feeders to ensure that diving operations do not interfere unnecessarily with fish appetite and feeding operations.

- Feeders should take particular care with feeding operations when fish appetite is affected by external factors (*eg*. seals).

- Feeders should monitor the ambient and within cage DO levels. If DO decreases to unacceptable levels, feeding should be stopped and the appropriate staff notified immediately.

- If feeders notice any significant unexplained reduction in fish appetite, abnormal behaviour or signs in fish (*eg*. excessive jumping, flared gill opercula, moribund behaviour) or poor water conditions (*eg*. water discoloration), feeding should be stopped and the appropriate staff notified immediately.

- Feeding staff should be kept informed regarding any factors that may impact on feeding behaviour (*eg*. disease, environmental conditions, seals) so that they are prepared for possible changes in appetite and can modify and/or monitor feeding activities accordingly.

- Information on fish biomass in cages or predicted daily feed rates should only be used as a guide by feeders. Appetite should be the primary indicator of appropriate daily feed requirements. Sometimes there can be significant errors in predicted fish numbers and average weight and/or fish health or environmental factors can reduce appetite.

- Special attention should be taken when feeding smolt in the first month after transfer to ensure all fish have easy access to feeding opportunity. This includes the broad distribution of feed across the surface of the cage and an increase in the number of feeds per day.

- Feed withholding regimes prior to harvest and before and after handling procedures should be kept as short as possible to minimise fish stress, but without having a detrimental impact on fish health or product quality.

- Maintenance of feeding equipment should occur regularly and routinely to minimise feeding equipment failure, feed wastage and feeding downtime. This is particularly the case with automatic feeding systems (*eg*. Aquasmarts) that have the potential to waste significant amounts of feed over a short period of malfunction.

- Flesh colour levels should be regularly monitored at appropriate intervals to ensure appropriate flesh colour at harvest.

5.4.8 Sample Weighing/Health Checks

- Regular weight checks and health checks should occur at appropriate intervals to monitor fish performance, assist farm and stock planning (*eg.* managing stocking density, predicting feed rates) and enable early warning of possible health problems.

- Where appropriate, weight checks may be undertaken without handling the fish (*eg.* Vaki or Vicass systems)

- Where handling is necessary, equipment and procedures should be used that do not cause abrasion, scale loss or undue fish stress. Sedation/anaesthesia of fish should be undertaken before handling fish for weight checks and health checks.

- Wherever possible, weight checks and health checks should be undertaken in conjunction with other activities (*eg.* grading) to minimise the handling of stock.

- Fish sampled for weight and health assessment (*eg.* AGD checks) should be selected using a method that enables random sampling of the population. This can probably best be achieved at the time of grading and AGD baths. Overtly poor performing fish in samples (*eg.* pinheads, runts, deformed fish) should be quantified, but should not be included in weight assessments. In some circumstances targeted selection of fish may be warranted (*eg.* moribund, poorly conditioned fish). such as in a disease investigation.

- Fish sampling for disease investigation requires targeted selection of fish most likely to exhibit sign of disease (*eg.* Moribund fish, clinically affected fish, fish behaving abnormally, poorly conditioned fish). In unusual or unexplained cases, advice should be sought from the FHU veterinarian.

- Adequate numbers of fish should be sampled (appropriate to the purpose of the check) to optimise the validity of results.

- When undertaking weight checks, the conditions (*eg.* weather) should be appropriate for determining accurate weights.

5.4.9 Grading

- Grading should be undertaken when necessary, to reduce the size variation of fish within cages or to separate out maturing fish. Grading assists future management of fish stocks (*eg.* harvesting strategy, feed size selection).

- During grading operations, all runts and fish with obvious deformity or significant gross signs of previous disease (eg. tail fin rot, skin ulcers, flesh lesions etc.) should be culled out of the population and disposed of with mortalities. These fish provide a focus for disease and an unnecessary opportunity for disease to establish within the population.

- Equipment and procedures for grading fish should not cause abrasion, scale loss or undue fish stress.

- Weight checks and health checks should occur at grading, as this is a good opportunity for easy and representative access to fish.

- Grading should not occur in unacceptably rough conditions that endanger fish health and/or staff safety.

- The net on the source cage must not be excessively fouled at the time of crowding the fish for grading.

- The net on the source cage and graded cages should be dived prior to grading and during grading as appropriate to ensure there are no holes in the net.

- Farm staff should take extra care with crowded fish during periods when seals and/or high numbers of phytoplankton or jellyfish are present.

- Farm staff should regularly monitor the fish in the crowd and behind the crowd throughout the grading procedure. If there are any unacceptable signs of fish stress then the problem should be fixed immediately. Oxygenation/aeration may be required in crowded fish.

5.4.10 Splitting/Swim Throughs

- Swimming fish from one cage to another through an underwater channel (cage nets secured together) is an effective low stress method of transferring fish to decrease stocking density.

- The net on the source cage must not be excessively fouled at the time of crowding the fish for grading.

- The net on the source cage and graded cages should be dived prior to grading and during grading as appropriate to ensure there are no holes in the net.

- Farm staff should take extra care with crowded fish during periods when seals and/or high numbers of phytoplankton or jellyfish are present.

- Swim throughs should not occur in unacceptably rough conditions that endanger fish health and/or staff safety or present an unacceptable risk of fish escape.

- Farm staff must ensure that the nets on both cages are sewn together securely before transferring fish so that there is no risk of fish escape.

5.4.11 Rearing Environment

Maintenance of optimum conditions within the cage environment is critical to stock performance, health and welfare.

- Water flow through the net should be such so as to replenish oxygen and remove wastes, but should not cause net distortion resulting in cage volume reduction.

- Net design and weighting should prevent net distortion resulting in cage volume reduction and/or fish getting caught in net pockets.

- Net mesh size should be as large as possible to assist water flow, but appropriate for the size of fish. Net mesh size should not be so large as to allow the entry of large numbers of wild fish.

- Nets must not be allowed to become unacceptably fouled.

- Stocking density must be kept within acceptable limits.

- Farms should consider aeration/oxygenation systems at sites where ambient DO levels can be relatively low at certain times of the year.

- Farms should consider systems to improve the cage environment during algae blooms or jellyfish swarms (*eg.* aeration).

- Systems should be installed to minimise predation (*eg.* seals, predatory birds).

- Mortalities must be removed on a regular basis.

- The seabed under cages should not become fouled to the extent that hydrogen sulphide or methane gas is bubbling up through the fish.

- Finfish cage nets must be at least 1 metre clear of the seabed at low tide under normal growing conditions unless otherwise specified in the relevant marine farming licence.

5.4.12 Animal Welfare

Farmers should always aim to minimise the stress and physical damage to fish associated with the growing environment and handling procedures.

- The growing environment should always be optimised for the fish and for the production of healthy and wholesome products.

- Sick, deformed or injured fish should be culled from the population and humanely destroyed wherever possible. Culling could be undertaken by dip netting such fish from the surface of cages or culling at the time of handling procedures (*eg*. weight/health checks, freshwater bathing or grading).

- Individual fish may be humanely destroyed by delivering a sharp blow to the top of the head, decapitation, or other means of rendering them rapidly insensible.

- Fish should be sedated/anaesthetised before significant handling procedures such as gill checks and weight checks.

- Where treatment of fish is indicated, the treatment should be undertaken quickly and effectively to minimise the extent of the disease problem and the chance of reinfection. Any predisposing causes should be rectified immediately.

- Fish should be slaughtered using a humane method (see section 6 – Harvesting).

5.4.13 Record Keeping

Appropriate records should be kept of all relevant operations, activities, fish performance parameters and environmental conditions to enable easy historical reference and to facilitate forward planning and ongoing improvement in performance. It should be noted that the taking and keeping of certain records for a period of 5 years is a requirement stipulated by regulation. Records should be accurate and readily accessible. Records should be kept and maintained on the following:-

- All fish brought onto and taken off each lease. These records must include date of movement, description of each consignment of fish (including species, class and quantity), destination or source.

- The amounts of fish taken off each lease to which the licence relates for consumption, processing and/or on-growing outside of Tasmania. Records must show the amount of fish for each Australian State and Territory and for each overseas country.

- Feeds and feeding operations, including feed composition, pellet size, feed quantity for each cage on each day.

- Interactions with wildlife/predators.

- Mortalities, which should include an assessment of the number and cause of mortality.

- Fish performance parameters (*eg.* food conversion ratio (FCR), growth rate).

- Environmental monitoring data appropriate to each site (*eg.* water temperature, DO, salinity, phytoplankton, jellyfish, seabed condition).

- Location and size of stocked cages on each lease area and areas being fallowed.

- Stock and rearing environment (*eg.* stock source, fish type, species, year class, number, weight, biomass, stocking density, cage size, net mesh size and depth, net fouling, holes in nets, escaped fish).

- Health monitoring (*eg.* gill checks) and disease investigation, including details of health problem, investigation strategies and results (*eg.* laboratory findings).

- Medications used, including type and quantity, as well as all veterinary prescriptions.

- Significant operational procedures (eg. net changing, freshwater bathing, grading, cage splitting, cage towing).

5.5 Equipment: Specification, Operation and Maintenance

5.5.1 Introduction

Equipment used on farms must be suitable for the intended application, properly deployed and appropriately maintained. Farms must also ensure that adequate equipment and resources are available to rear the expected biomass of fish in a manner consistent with the principles outlined in this Code of Practice.

5.5.2 General Issues

- The integrity of all farm systems should be checked and repaired as a matter of priority during (subject to ensuring staff safety) and after severe weather events.

- The lease area must be marked in a manner approved by MAST Lessees must mark the external boundaries of the lease area in whatever manner is required by the Secretary and by the relevant authority under the provisions of the Marine and Safety Authority Act 1997.

- No marine farming equipment or rope, cable or other device securing any marine farming equipment should be located outside the lease area, with the exception of mooring lines and anchors that can be located outside the lease area but within the marine farming zone if 5m or more below the surface at the boundary of the lease area.

- Any part or parts of marine farming structures that break away from the lease area must be returned to the lease area as soon as possible.

- Wastes resulting from the removal of fouling organisms from marine farming structures and equipment must be disposed in a manner that has no unacceptable adverse effect on the ecology of the marine environment or nearby shoreline.

5.5.3 Cages

- Cage design must be appropriate to the equipment it carries, including nets (even when fouled), boats that tie up to the cage, walkways, feed hoppers with feed, personnel, bird nets, seal predator nets, and the lease location, including prevailing weather conditions (wind speed and direction, sea and swell) and currents. Cage strength must possess excess capacity in order to meet the forces that occur in severe conditions (*eg.* storms with rough seas coinciding with peak currents).

- The integrity of the cage structure (including floatation) should be checked on a daily basis.

- Any problems, defects or breakages should be reported and rectified as soon as possible.

- Replacement of cage structural components (*eg.* broken stanchions) should occur before the integrity of the cage is compromised.

5.5.4 Moorings

- The mooring system design must be appropriate to the cage/net design and lease location, including prevailing weather conditions (wind speed and direction, sea and swell), currents, water depth and seabed characteristics. The system must possess excess capacity in order to meet the forces that occur in severe conditions (*eg.* storms with rough seas coinciding with peak currents).

- Anchor design including: shape, material, weight, rope strength, rope length, chain length and shackle strength are all critical factors that must be considered in mooring system design. Anchors must be appropriate to the characteristics of the seabed.

- Cages must be properly secured to moorings at all times. Tie off points and bridles should be checked on a daily basis.

- The tension on ropes holding polar circle cages in position should be consistent to assist in maintaining the integrity of cage shape. Undue pressure is placed on the cage structure if it loses it shape.

- Polar circle cage bridles should be evenly distributed around the circumference of the cage.

- Mooring system components, including underwater components must be checked at appropriate intervals to ensure system integrity.

- Replacement of mooring system components (*eg.* chaffed ropes) or the entire mooring system must occur before system integrity is compromised.

- On sites where outboard motors are used, mooring ropes should be appropriately weighted to minimise inadvertent damage to mooring ropes and boat propellers.

- Vessel moorings should be inspected frequently.

5.5.5 Nets

5.5.5.1 On Farm

- Finfish cage nets must be at least 1 metre clear of the seabed at low tide under normal growing conditions unless otherwise specified in the relevant marine farming licence.

- Mesh size must be appropriate to the size of stock, including consideration of the variation in size within the population.

- Nets should preferably be of knotless construction, but must minimise skin abrasion and scale loss.

- Nets must be tensioned or weighted to prevent distortion resulting in a reduction of net volume and therefore crowding of the fish. The effectiveness of seal predator nets requires effective tensioning and/or weighting.

- Nets should be weighted such that the net hangs evenly, with weights only being attached to the net at appropriate locations (*eg.* load lines). Weighting systems should avoid severe loading on the net during rough sea conditions.

- Special care should be taken when lifting or winching weights so as to avoid net damage.

- Net integrity should be checked and repaired routinely during dives, after cleaning and prior to pumping or swimming fish into an empty cage net. Repairs undertaken by divers in situ should be properly repaired after net cleaning.

- Only approved antifoulants must be used to control fouling on nets. Antifoulants on nets add strength, reduce net and fish handling, increase net longevity, improve resistance to predator damage and assist in maintaining the nets profile in the water.

- Sweep nets and dip nets used to crowd or handle fish should be as soft as possible and of the knotless type. The net ply and mesh size should be chosen to minimise accidental gilling or kyping of fish.

5.5.5.2 Net Cleaning

Several methods of net cleaning exist, including: washing in a revolving drum and drying either hung up on poles or spread over the ground. Nets can also be cleaned in situ on cages using vacuums, brushes or by manipulating the position of nets on steel cages to enable drying of fouled nets on the cage system itself.

- Nets should be changed and/or cleaned before biological fouling unacceptably reduces water quality within the cage.

- Fouled nets removed from cages and brought ashore must only be cleaned at sites where wastes can be effectively contained.

- Wastes from shore based net cleaning operations must be disposed of in an appropriate manner. Strict adherence to secure waste disposal must occur where nets have been antifouled.

- Odour and visual impacts should be minimised at net cleaning sites and as a minimum meet statutory requirements.

- The integrity of nets should be routinely checked after cleaning and all defects repaired before the net is used.

5.5.6 Feeding Equipment

- Regular monitoring and maintenance of feeding equipment (*eg.* spinners) must occur, particularly with fully automated systems (*eg.* Aquasmarts) where feeding occurs without necessarily having a staff member in attendance.

- Feedback systems (*eg*. cameras, Aquasmart laser sensors) must be in place at all times to prevent overfeeding or underfeeding, even where visual observation of feeding behaviour by staff occurs.

- Any defects, malfunctions or breakages should be notified to the appropriate personnel and rectified as soon as possible.

- All feeding equipment should be calibrated regularly to ensure accurate recording of the amount of feed fed to each cage.

- Feeding dispensers (*eg*. spinners, blowfeeders, water cannons) must be capable of spreading the feed across the whole surface of the cage.

5.5.7 Oxygen Monitoring and Application Equipment

- All oxygen storage, monitoring and application equipment should be regularly checked and maintained.

- Oxygen probes should be regularly calibrated to ensure accurate readings.

- All oxygen storage and application equipment should be used according to manufacturers instructions.

- When using oxygenation/aeration during farm procedures (eg. freshwater baths) there should always be excess capacity in the system or a backup system available.

- Oxygen application systems should be as efficient as possible.

5.5.8 Fish Pumps

- Fish pumps must be operated in accordance with the manufacturers instructions.

- Hose diameters and flap doors must be appropriate to the size of fish being pumped.

- Pump settings should not cause any physical damage or undue stress to fish being pumped.

- Hoses and connections, must not have sharp edges or protrusions which can cause eye damage, skin abrasion or scale loss.

- Hose runs, including suction must be kept as short and straight as possible and be free of kinks.

- Pressure relief valves must operate correctly and efficiently.

5.5.9 Boats/Motors

- All boats must have a current MAST Certificate of Survey and be operated by qualified personnel.
- Boats and motors must be regularly maintained.
- Boats must carry prescribed MAST safety equipment at all times.
- Boat operators should take special care to avoid damaging cages, mooring ropes and propellers.
- Noise impacts should be considered in selecting motors (*eg*. 4 stroke vs. 2 stroke).
- Boats must not be used for purposes that are not appropriate for that particular boat (*eg*. towing cages) and must not be overloaded.
- Any defects, problems or breakdowns should be notified to the appropriate staff and rectified as soon as possible.
- Movement of boats between sites should be minimised wherever possible. Where boats do move between sites, appropriate disinfection procedures should be used to prevent the potential spread of disease organisms.

5.5.10 Lease/Boundary Markers

- The external boundaries of lease areas must be marked in accordance with requirements by the Secretary (DPIWE) and by the relevant authority under the provisions of the *Marine and Safety (Moorings) By-Law 1998.*
- Lease areas must be identified in a manner specified by the Secretary (DPIWE).
- Boundary markers and lights must be regularly maintained, and routinely inspected with any defects being remedied immediately.
- Boundary markers must be checked regularly to ensure they are in the correct location. If not, markers must be returned to the correct location as soon as possible.

5.5.11 Other Equipment

- Lights used in production strategies (eg. reducing maturation, improving growth) should be mounted under the water surface to reduce visual impacts.

6. HARVESTING

6.1 Introduction

Poor harvest methods and procedures can significantly impact on the quality of fish and fish products such that all the effort put in to implementing best practice over the growing cycle can be wasted over a few hours.

6.2 Harvesting Operations

- Physical activity and stress in fish should be kept to a minimum at harvest.
- Crowding of fish at harvest should not create excessive stress. Therefore fish should not be crowded too hard or for extended periods of time.
- Feed should be withheld for an appropriate period prior to harvest to ensure that the gut is empty. Starvation periods should not be excessive.
- The net on the harvest cage must not be excessively fouled at the time of crowding the fish for harvest.
- Farm staff should take extra care with crowded fish during periods when seals and/or high numbers of phytoplankton or jellyfish are present.
- Harvests should not occur in unacceptably rough conditions that cause excessive fish stress, jeopardise staff safety and/or present an unacceptable risk of fish escape.
- When fish populations are being harvested during an active infection, other farms in the adjacent region should be notified.
- Recommended withdrawal periods for medications in fish must be exceeded prior to harvest so that there are no unacceptable residues in harvest fish.
- The harvesting and slaughter equipment must be clean and hygienic and should not cause abrasion, scale loss, or internal bruising.
- All harvesting and slaughter equipment must be operational before the harvest is started.
- Anaesthesia or immobilisation, slaughter and bleeding must be carried out using an appropriate humane method. All fish must be sedated and/or stunned prior to bleeding.

- Harvested fish should bleed out effectively to minimise the occurrence of blood spotting in products.

- Harvested fish must be must be kept in a minimal ice/water mix for transport to the processing factory. However, there should be sufficient ice to reduce the internal body temperature of fish to 4°C or less as soon as possible. Cooling regimes may vary slightly according to processing strategies, but should reflect that bacterial degradation of fish starts soon after the fish is killed.

- The ice used in harvest bins should be of good quality and be free of sharp edges and protrusions that cause skin abrasion or scale loss.

- Consideration should be given to site-specific harvest bins.

6.3 Bloodwater/Waste Management

For many infectious diseases, bloodwater is an important potential source of disease organisms. This is particularly the case in fish harvested during a disease outbreak, but possibly also in apparently healthy fish simply carrying the disease organism. Bloodwater also has a high biological oxygen demand and is nutrient rich.

- Transport, disposal and/or treatment of bloodwater must meet all the guidelines and regulations of local council regulations and any requirements stipulated by DPIWE.

- Harvest bloodwater must not be released back into the marine environment should be minimised at all times, but particularly at harvest.

- All bloodwater associated with the harvest of fish should be fully contained during the harvesting process for later treatment and/or appropriate disposal. Any bloodwater not contained (*eg.* accidental spillage, washdown water) must be treated with an appropriate disinfection method wherever possible.

- Harvest facilities must be capable of adequately controlling bloodwater in all weather conditions during which harvesting will occur, and during transport of harvested fish to shore facilities.

- Containment facilities must be capable of handling the largest harvest quantities that will be undertaken.

- Dry bleeding is a good method of bleeding fish as it minimises the volume of bloodwater that has to be controlled. However, dry bled fish must not be rinsed on site in such a way that results in the discharge of blood contaminated water into the environment.

- Bloodwater should not be released back into the aquatic environment unless it has been adequately treated with an effective disinfection process that is environmentally acceptable and has been approved by DPIWE.

- Bloodwater may be released into the sewerage system if appropriate under the direction of the local council, and subject to compliance with any other restrictions issued by the DPIWE.

- Preferably, bloodwater should be disposed of on land sites where there is no risk of leaching back into waterways and the disposal meets local council requirements. Ideally this should include burial to eliminate the potential for birds and vermin to gain access to the material. Further processing under secure conditions (eg. fertiliser) is also a favourable option.

- Bloodwater must not be transported to other farming regions for disposal/treatment unless the transport and disposal/treatment method is completely biosecure.

- Wastes from harvesting must be disposed of in a manner that has no unacceptable adverse impacts on the ecology of the marine environment or nearby shoreline.

6.4 Transport to Processing Factory

- Harvest bins should be secure during transport to ensure no leakage of solid or liquid wastes and to maintain fish and slurry temperatures.

- Bin of harvested fish should be transported to the processing factory as soon as is practicable.

- Bins of harvested fish should not be left in the sun or allowed to sit for extended periods such that the temperature in fish rises above 4°C before processing.

6.5 Record Keeping

Appropriate records should be kept to allow traceability of harvested fish, to validate that harvesting methods and procedure were undertaken as directed, to facilitate forward planning and to facilitate ongoing improvement in harvest performance.

7. PROCESSING

(To be developed)

8. OCCUPATIONAL HEALTH AND SAFETY

8.1 Introduction

Salmonid farming presents a wide variety of potential health and safety risks through the diversity of people, substances, equipment, work practices and varying environments. It is incumbent upon employers to take reasonable and practical measures ensuring all persons affected by the work/workplace are safe from injury or health risks.

Health and safety risks will almost certainly involve quality, productivity, environmental and financial risks, whether directly from the source, or indirectly through the behaviour of those at risk.

As such, business policy, planning, implementation, evaluation and continuous improvement strategies/practices should include health and safety as a primary consideration in every decision, at every level.

Fundamentally, the work should be adapted to the people, and not vice-versa.

8.2 General Principles

- Within their level of control, all persons should be familiar with the relevant health and safety legislative requirements for employers, employees and contractors/visitors. Additionally, there is a multitude of Standards and Codes of Practice available, relating specifically to equipment, work practices and environment. These are either called up in legislation or a guide toward common law expectations and best practice.

- Key components of good health and safety management include:

    - Clear policy on requirements, standards and responsibilities of every person
    - Systematic and reliable methods of:
        - Identification of hazards, risk assessment and control
        - Consultation and communication
        - Training and competency assessment
        - Documentation and performance reporting
        - Health surveillance (where appropriate)
    - Emergency preparedness
    - Incident reporting and investigation
    - Injury management
    - Management review

- Hazards will essentially result form one or more of the following energy types:

  - Muscular
  - Mechanical
  - Gravity
  - Speed
  - Electrical
  - Thermal
  - Compressed fluid or gas
  - Sound
  - Vibration
  - Chemical
  - Radiation
  - Psychological
  - Biological

- An assessment of risk for the above-mentioned energies should be undertaken:

  - Prior to introducing new work, equipment or substances
  - Whenever changes are planned
  - Whenever information becomes available that work, equipment or substances may impact on the health or safety of any person

- Controlling hazards should be undertaken through the progressive application of the following control methods in the following order:

  - Eliminating the hazard from the workplace
  - Substituting the hazard for a lesser hazard
  - Isolating the hazard from those at risk
  - Engineering methods
  - Administrative means, including work practices
  - Providing personal protective equipment

- Where elimination is not possible, a combination of controls often provides the best outcome.

- Management practices should be proactive in identifying and controlling reasonably foreseeable health, quality, environmental and financial risks. Risk management supports more informed decision-making and should become an integral part of company culture.

9. LEGISLATIVE REQUIREMENTS

It is the responsibility of each salmon farmer to ensure that they are aware of, and that their operations comply with all legislation and regulations relating to the development and operation of their business. Following is an outline of the legislation and regulations relevant to salmon farming in Tasmania:

- *Marine Farming Planning Act 1995*
    - Marine Farm Development Plans (Management Controls)
    - Issue of Leases (Lease Conditions)
- *Living Marine Resources Management Act 1995*
    - Issue of Licences (Licence Conditions)
    - Issue of Permits (Permit Conditions)
    - Regulation of activities causing detrimental effect
- Environmental Protection and Biodiversity Conservation Act 1999
    - Changes to lease areas may require consultation with Commonwealth
    - Interaction with Commonwealth listed endangered, threatened species with aquaculture
- Threatened Species Protection Act 1995
    - Interaction of State listed threatened species with aquaculture
- Nature Conservation Act 2002
    - Interaction of State listed threatened species with aquaculture
- Marine and Safety Authority Act 1997 and its By-Laws
    - Marking of marine farm leases
    - Operation of survey vessels
    - Certification of survey vessels
- Agricultural and Veterinary Chemicals (Control of Use) Act 1995
    - Regulation of chemical use
    - Code of Practice for the supple and use veterinary chemical products

- Environmental Management and Pollution Control Act 1994
    - Guidelines on permitted noise levels
    - Guidelines on Odour
- Animal Health Act 1995
    - Disease control
- National Parks and Reserves Management Act 2002
    - Guidelines on National Parks and Reserves
- Poisons Act
    - Scheduling of veterinary medicines
- Workplace Health and Safety Act 1995
- Workplace Health and Safety Regulations 1995
- Workers Rehabilitation and Compensation Act 1988
    - OHS regulations
- Land Use Planning Act 1993
    - Shore base planning
- Veterinary Surgeons Act
    - Prescription and labelling of medications.

Pages 54 and 55 missing