Environmental Management System Framework

Tasmanian Oyster Industry

FRDC Project 2004/096

PhycoTec Environmental Management

TORC Tasmanian Oyster Research Council Limited

Australian Government Fisheries Research and Development Corporation

Tasmania

Environmental Management System Framework

Instruction for Template Use

PhycoTec

TORC

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Australian Government
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Instruction for TemplateUse

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Contents

The Environmental Management System Framework: Compliance Guide and Risk Assessment of Ecologically Sustainable Development for the Tasmanian Oyster 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 Oyster Research Council (TORC), the Tasmanian Fishing Industry Council (TFIC), the 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 Tasmanian Pacific oyster industry. It is envisioned that by adopting the EMS in facilities or regional areas, cost savings will occur through the efficient use of resources, streamlined processes and the access to information and data useful for improving future farm management practices.

The aim of the EMS Templates is to assist the Tasmanian oyster 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 oyster 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 OYS 100: Workplace Environmental Policy
- Form OYS 200: Environmental Hazard Identification Checklist
- Form OYS 300: Environmental Risk Assessment
- Form OYS 400: Environmental Objectives and Targets
- Form OYS 500: System Improvement Report
- Form OYS 600: Environmental Management Review

Part 2: Register Templates - to maintain your system.

- Form OYS 700: Environmental Monitoring
- Form OYS 800: Chemical Register
- Form OYS 900: Legal and Other Register
- Form OYS 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 (eg. 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 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 in which 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 OYS100

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 OYS200 & OYS300

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 OYS400

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 OYS500 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 OYS600

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 necessary 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's responsibility towards the EMS,
- Ensure the 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 any 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 tits 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 OYS100_Policy is available on the accompanying CD-ROM in a word format for you to adapt to your specific requirements.

Replace with the name of your business or regional group

"Your Oyster Company"

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

(your logo)

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

WORKPLACE ENVIRONMENTAL POLICY

Summary statement

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

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 an… program of continual improvement through adaptive management.

Commitment to continual improvement

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

Objectives

- 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.

Scope (or limits)

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

(Mana… 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.

Step 2: Process Planning.

Plan

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.

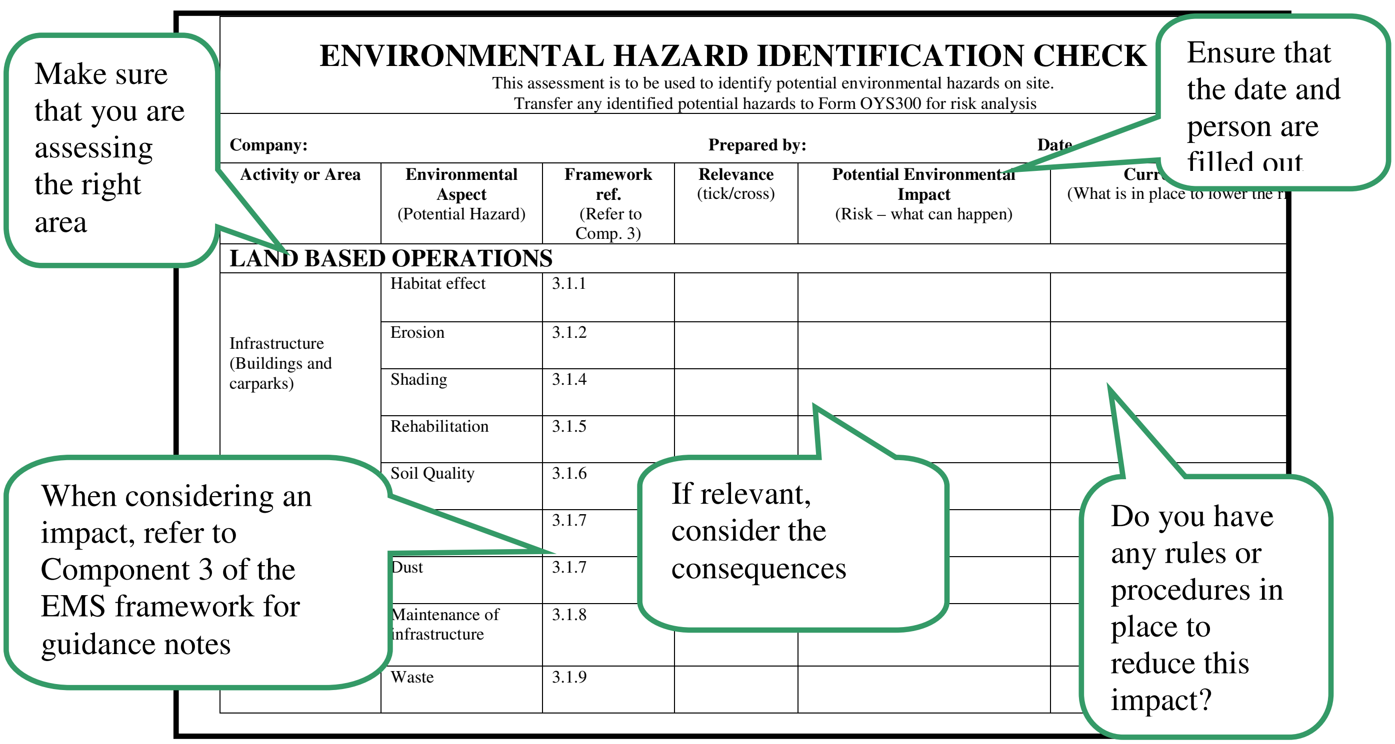
Template OYS200 is a checklist of any potential environmental impacts that may occur around your land based facility or on the marine lease. To complete the checklist you will need to refer to Component 3 of the ESD compliance document that deals with environmental impacts at a facility level.

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 OYS200, 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 OYS300 for the risk assessment.



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

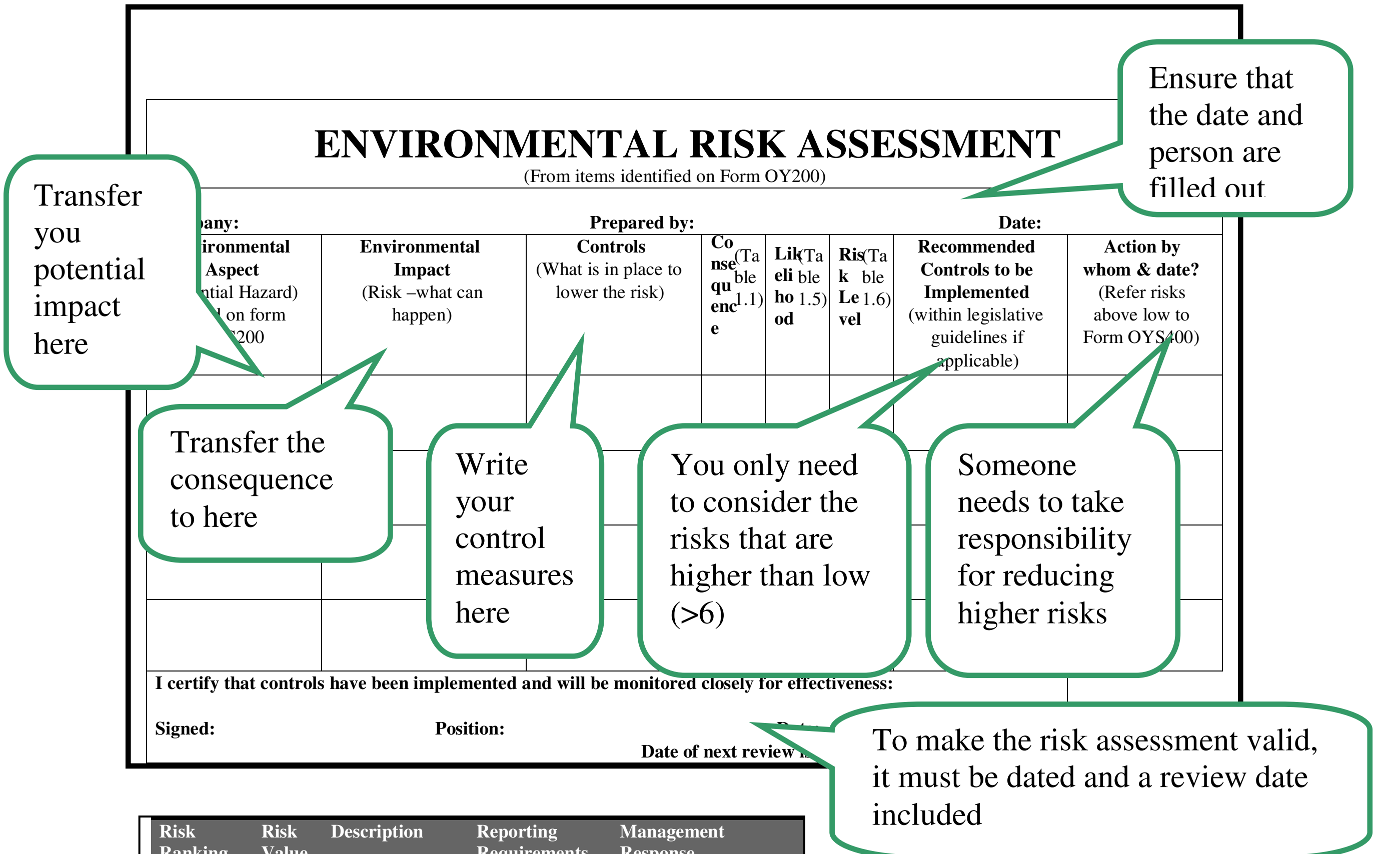
The likelihood multiplied by the consequence gives the risk value. A risk less than 6 is considered as low and requires no further action.

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	Probe current management 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 OYS200 and OYS300 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 (eg waste per 1000 dozen oysters 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

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

Use the information from the risk assessment (Form OYS200) 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 OYS300 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 OYS100) 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 OYS400 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 stormwater pipes.

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

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

SYSTEM IMPROVEMENT REPORT

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

Submitted by: ....

Issue

☐ Environmental ☐ OH&S ☐ Quality

☐ Public Complaint ☐ Customer Complaint ☐ Other

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

Description

....

....

....

....

Potential impact

....

....

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

Suggested Solution

....

....

....

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

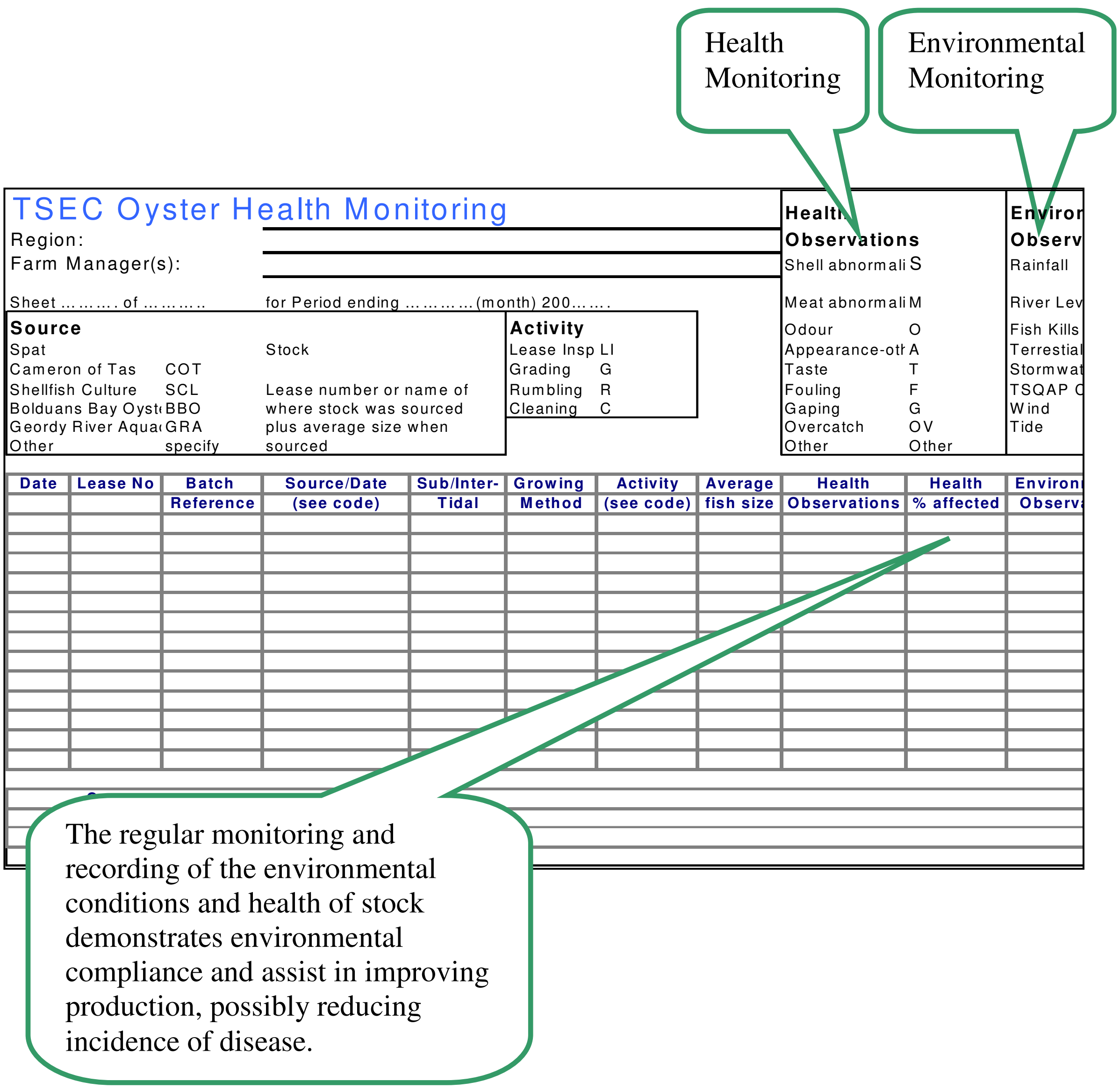
Addressed by the following action:	**Not addressed because:**
....	....
....	....
....	....
....	....
....	....
To be completed by	....
....(person) ☐Informed	....
....(date of completion)	....

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 TSEC Oyster Health Monitoring Form

Form OYS 700 for environmental monitoring has been especially developed by the Oyster Health Working Group to assist the Tasmanian Shellfish Executive Council determine the health status of Tasmanian oyster stocks and the whole of Industry is strongly encouraged to adopt the use of this form.

The form aims to gain information about the health of oyster stock, their source and movement on a State wide basis. Information from this form will assist you in monitoring of your stock , as well as a mechanism to determine Statewide trends in declining oyster health. For further information contact the Tasmanian Shellfish Executive Council.



TSEC Oyster Health Monitoring

Region:

Farm Manager(s):

Sheet ……… of ……… for Period ending ……… (month) 200…….

Source			Activity		Health Observations		Environ Observ
Spat		Stock	Lease Insp	LI	Shell abnormali	S	Rainfall
Cameron of Tas	COT		Grading	G	Meat abnormali	M	River Lev
Shellfish Culture	SCL	Lease number or name of	Rumbling	R	Odour	O	Fish Kills
Bolduans Bay Oyst	BBO	where stock was sourced	Cleaning	C	Appearance-oth	A	Terrestial
Geordy River Aqua	GRA	plus average size when			Taste	T	Stormwat
Other	specify	sourced			Fouling	F	TSQAP C
					Gaping	G	Wind
					Overcatch	OV	Tide
					Other	Other	

Date	Lease No	Batch Reference	Source/Date (see code)	Sub/Inter-Tidal	Growing Method	Activity (see code)	Average fish size	Health Observations	Health % affected	Environ Observ

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.

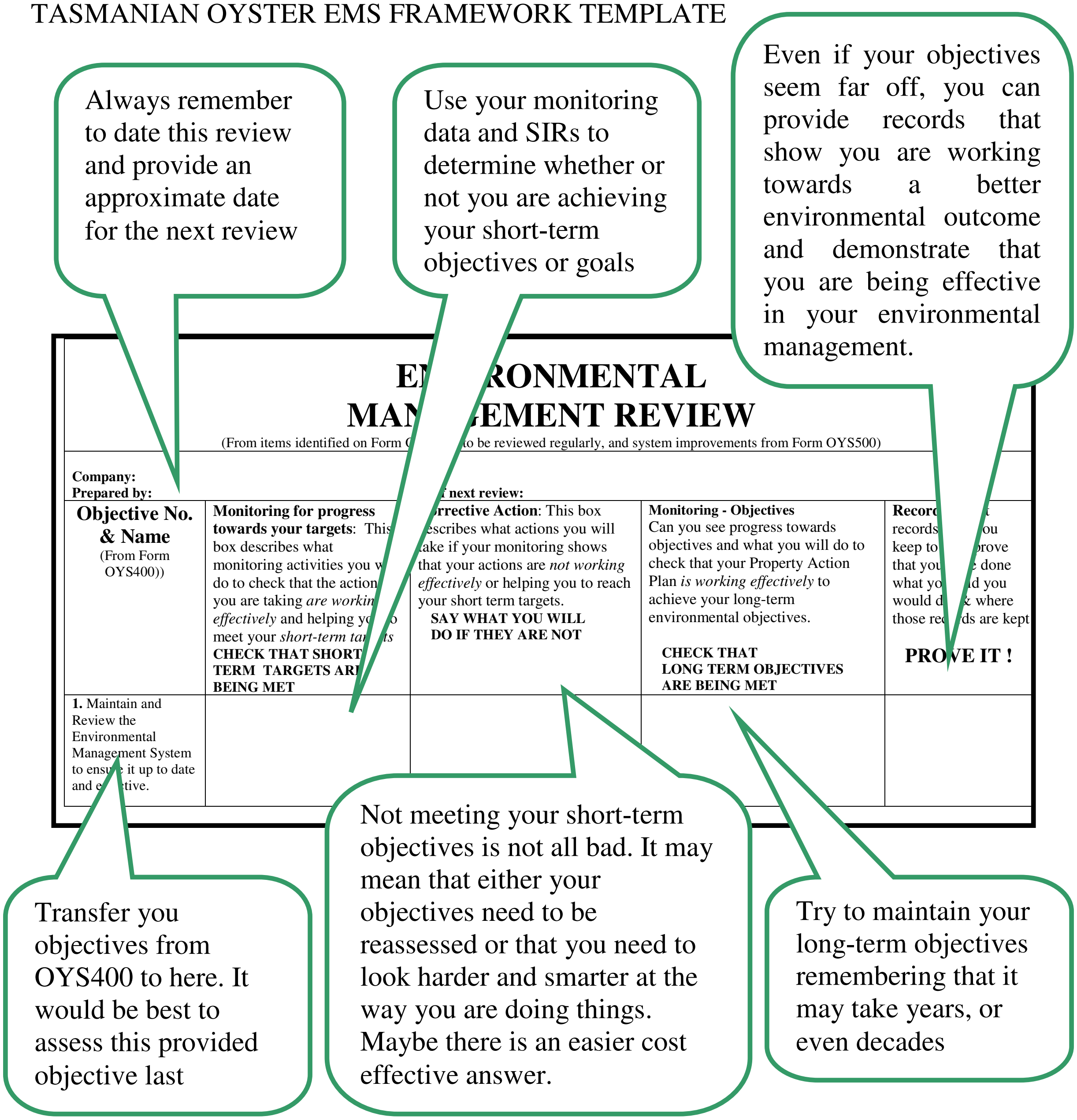
Where to start
Gather all the information that is relevant to the EMS, especially the System Improvement Reports (SIRs) and Registers.

Examine the current objectives set out on Form OYS400: Environmental Objectives and Targets.

Transfer the Objectives to the Environmental Management Review Form: OYS600. (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 OYS600 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 has been achieved.



The results of your review should be reflected in a new set of objectives and targets. You can use Form OYS400 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 OYS600 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 OYS 700: Environmental Monitoring
- Form OYS 800: Chemical Register
- Form OYS 900: Legal and Other register
- Form OYS 1000: Training Register
- Systems Manual
- Procedures Manual

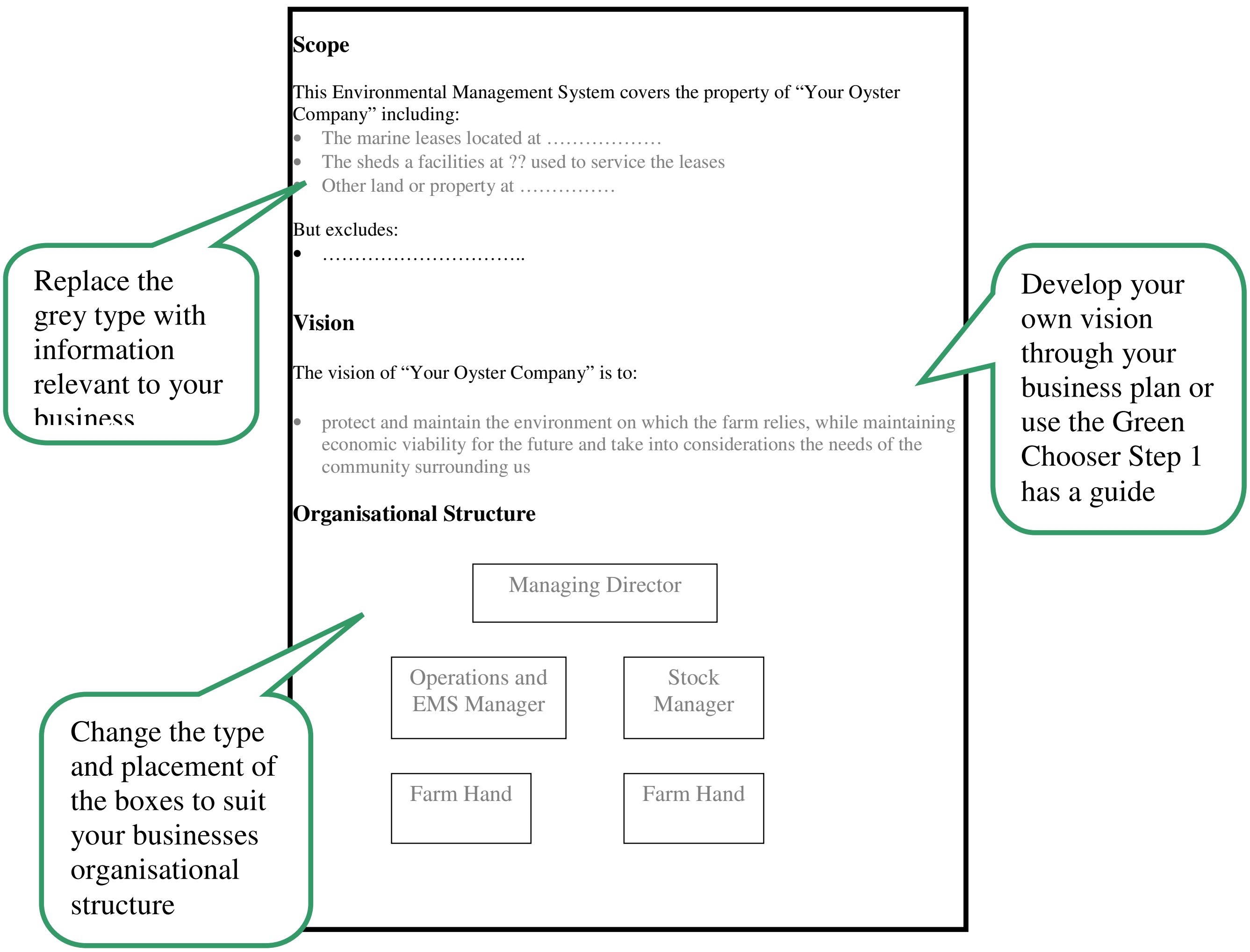
Obtain a recognised 3rd party certification
There is a substantial commitment required to produce an EMS that is ready for certification to an international standard such as ISO:14001. However, many business in many industries have found that this type of certification provides not only more efficiencies 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. Each business needs to adapt the manual to their requirements by relacing the grey type cues with information relevant their business.


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 refuelling 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 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 oyster stock and equipment between catchments	July 2006	Appendix 2.2.7. Sorting bench
	Protocol for oyster 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 TSEC, or engaging an Environmental Consultant.

Environmental Management System Framework

Part 1

EMS Working Form Templates

OYS100 Workplace Environmental Policy
OYS200 Environmental Hazard Identification Checklist
OYS300 Environmental Risk Assessment
OYS400 Environmental Objectives and Targets
OYS500 System Improvement Report
OYS600 Environmental Management Review

PhycoTec

TORC

Tasmania

Australian Government
Fisheries Research and Development Corporation

FRDC Project 2004/096

"Your Oyster 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 OYS300 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	3.1.4			
	Rehabilitation	3.1.5			
	Soil Quality	3.1.6			
	Noise	3.1.7			
	Dust	3.1.7			
	Maintenance of infrastructure	3.1.8			

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LAND BASED OPERATIONS					
Infrastructure (Buildings and carparks)	Waste	3.1.9			
	Water Flow	3.1.10			
	Alienation of public	3.1.12			
	Proximity to Sensitive Fauna/Regions	3.1.13			
	Visual impact	3.2.2.2			
	Water table	3.1.14			
	Sewerage	3.2.3.4			
	General rubbish	3.2.3.5			

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LAND BASED OPERATIONS					
Infrastructure (Buildings and carparks)	Storm water runoff	3.2.3.7			
	Fuel Storage		√	Fuel / oil spill	
	Chemical Storage	3.2.2.7		Chemical spill	

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LAND BASED OPERATIONS					
Operational Activities	Health of oysters	3.2.1.1			
	Stocking density	3.2.1.2			
	Predator/pest control	3.2.1.3			
	Fresh Water Usage	3.2.2.1			
	Energy efficiency	3.2.2.4			
	Noise	3.2.2.5			
	Light	3.2.2.5			

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LAND BASED OPERATIONS					
	Impact on sensitive habitats	3.2.2.6			
	Chemical usage	3.2.2.7			
Operational Activities	Fish and Shell disposal	3.2.3.3			
Basket Cleaning	Water Quality	3.2.3.1 3.2.3.6			
Ponds	Seepage	3.1.3			

ENVIRONMENTAL HAZARD IDENTIFICATION CHECK LIST

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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)
HATCHERY AND NURSARY LAND OPERATIONS					
Operational Activities	Health of oysters	3.2.1.1			
	Biosecurity	3.2.1.1			
	Disposal of unused culture equipment (bags)	3.2.3.5			
	Disposal of unused feeds	3.2.3.1			
	Waste treatment	3.2.3			
	Cleaning chemical usage	3.2.2.7			

ENVIRONMENTAL HAZARD IDENTIFICATION CHECK LIST

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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					
Racking	Shading	3.1.4			
	Rehabilitation	3.1.5			
	Maintenance of infrastructure	3.1.8			
	Water Flow	3.1.10			
	Navigation	3.1.11			
	Visual impact	3.2.2.2			
Rack Cleaning	Water Quality	3.2.3.1			
	Biofouling	3.2.3.6			

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MARINE BASED OPERATIONS					
Operational activities on boats	Noise	3.1.7 3.2.2.5			
	Light	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			
	Hydrocarbon usage and refueling	3.2.2.7			

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 OYS300 for risk analysis

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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					
	Impact on sensitive habitats	3.2.2.6			

ENVIRONMENTAL RISK ASSESSMENT

(From items identified on Form OY200)

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

Environmental Aspect (Potential Hazard) Listed on form OYS200	**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 OYS400)
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:

PhycoTec Environmental Management

ENVIRONMENTAL RISK ASSESSMENT

(From items identified on Form OY200)

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

Environmental Aspect (Potential Hazard) Listed on form OYS200	**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 OYS400)

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 OYS300 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 OYS100) 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

……………………………………………………………………………………

……………………………………………………………………………………

……………………………………………………………………………………

<table>
<tr><td colspan="2">Considered by……………………………. Date …………Addressed ☐Yes ☐No</td></tr>
<tr><td>Addressed by the following action:
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To be completed by
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PhycoTec
Environmental Management

ENVIRONMENTAL MANAGEMENT REVIEW

(From items identified on Form OYS400, to be reviewed regularly, and system improvements from Form OYS500)

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

Objective No. & Name (From Form OYS400))	**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

OYS700 TSEC Oyster Health Monitoring Report
OYS800 Chemical Register
OYS900 Legal and Other Requirements Register
OYS1000 Training Register

PhycoTec

TORC

TFIC

Tasmania

Australian Government
Fisheries Research and Development Corporation

FRDC Project 2004/096

TSEC Oyster Health Monitoring

Region: ____________________

Farm Manager(s): ____________________

Sheet ………. of ……….. for Period ending …………(month) 200…….

Source		
Spat		Stock
Cameron of Tas	COT	
Shellfish Culture	SCL	Lease number or name of
Bolduans Bay Oyst	BBO	where stock was sourced
Geordy River Aqua	GRA	plus average size when
Other	specify	sourced

Activity	
Lease Insp	LI
Grading	G
Rumbling	R
Cleaning	C

Health Observations		**Environmental Observations**	
Shell abnormali	S	Rainfall	R (?mm)
Meat abnormali	M	River Level	RL (H, M, L)
Odour	O	Fish Kills	FK
Appearance-otl	A	Terrestial kills	TK
Taste	T	Stormwater	SW
Fouling	F	TSQAP Closures	TQ (Y or N)
Gaping	G	Wind	W (knots)
Overcatch	OV	Tide	T (King, H or L)
Other	Other		

Date	Lease No	Batch Reference	Source/Date (see code)	Sub/Inter-Tidal	Growing Method	Activity (see code)	Average fish size	Health Observations	Health % affected	Environmental Observations	Mortalities % affected

Comments:

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 OYS200)

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

Legislative requirement	Relationship to Activity	Reference to ESD Compliance Document
Commonwealth Reference: http://www.comlaw.gov.au		
Quarantine Act 1908	Transfer of disease through import & export of oysters and spat.	Appendix 8.2.3.1 1.2.2: Transfer of disease overseas and interstate: Import and Export
Export Control Act 1982	Export of oysters for consumption	Appendix 8.2.3.1 1.2.2.1: Export
Export Control Act (Proscribed Goods) 2005	Export of live Tasmanian oyster spat overseas	1.2.2.2: Transfer of Disease, Export
Export Control Act (Animal Orders) 2004	Export of live Tasmanian oyster spat overseas	1.2.2.2: Export
Ramsar Convention of Wetlands 1971	Protection of Ramsar lister wetlands adjacent to industry activities	2.2.5: Protected Habitats
Environmental Protection and Biodiversity Conservation Act 1999	Export of flat oysters for consumption. Protection of migratory birds. Protected habitats	Appendix 8.2.3.1 1.1.1: Collection of Wild Stock 1.2.2.1: Export. 2.2.3: Listed Migratory Birds. Appendix 2.2.5: Protected Habitats.
Tasmanian Reference: http://www.thelaw.tas.gov.au		
Resource Management and Planning System	Promote the principles of sustainable development. Siting of marine farming zones	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
State Policy on Water Quality Management 1997		Appendix 8.2.3.1
State Coastal Policy Validation	Sustainable development of marine farming	Appendix 8.2.3.1

Act 2003	consistent with the State Coastal Policy.	
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
Marine Farm Environmental License Conditions and Requirements	Monitoring of environmental impact within and outside the lease boundaries, including stocking density, benthos and height of baskets from sea floor.	Appendix 8.2.3.1 Appendix 8.3.2.2 1.3.2 Food Chain Impacts 1.3.5: Sensitive habitats 2.1.2: Sedimentation. 2.4.1: Regional Carrying Capacity
Public Health Act 1997	Harvesting of oysters. Under section 29 to comply with the 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	2.1.3.1: Hydrocarbons
Threatened Species Protection Act 1995	Protection of threatened, endangered or protected species	Appendix 8.2.3.1 2.2.4: Threatened, Endangered & Protected Species. Appendix 2.2.4
Nature Conservation Act 2002	conservation and protection of the fauna, flora and geological diversity of the State	.2.4: Threatened, Endangered & Protected Species. 2.3.1: Terrestrial Habitat Removal 1.3.5: Sensitive habitats
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.	Appendix 2.3.4: Navigation
Environmental Management and Pollution Control Act 1995	Noise, water and air emission controls	Appendix 8.2.3.1 2.3.6: Noise
Agricultural and Veterinary Chemicals (Control of Use) Act 1995, and the Poisons Act 1971.	Supply and use of veterinary chemicals	2.1.3.2 Veterinary Chemicals http://www.apmva.gov.au

Crown Lands Act 1976	Protection of habitat on Crown Lands leased by the licence holder	Appendix 8.2.3.1 2.3.1: Terrestrial Habitat Removal 1.3.5: Sensitive habitats
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
Land Use Planning and Approvals Act 1993	Land based facilities taking into account natural, indegenous and historical heritage.. Disposal of waste	Appendix 8.2.3.1 Component 6 2.3.2: Heritage Area Affects 2.4.2: Disposal of Unmarketable Waste
Dangerous Goods Act 1998	Storage of chemicals and fuel	2.1.3: Other wastes/pollutants
Workplace Health & Safety Act 1995	Protection of the worker to ensure a safe working environment	5.1.2.3: Work related injuries
Other requirements		
Local or State Government regulations	Waste Disposal	Appendix 8.2.3.1 2.4.2: Disposal of unmarketable waste
Tasmanian Shellfish Quality Assurance Program (TSQAP)	Assurance that product is fit for human consumption	1.2.4: Quality Assurance (Public Health)
Pacific Oyster Health Program (POHP)	Maintaining the disease free status of farmed stock	1.1.2.2: Disease (Wild Stock) 1.3.1: Disease (Escaped stock)
Tasmanian protocol for the translocation of oyster stock and equipment between catchment areas	To reduce the risk of translocation of Invasive Marine Species between catchments	2.2.7: Translocation between Catchments
Code of Conduct for Australian Aquaculture		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

Australian Standard 1940 – The Storage and Handling of Flammable and Combustible Liquids	Legal requirements for fuel storage	3.2.2.7: Chemicals and theraputants
Liability cover		
Insurances etc.		

TRAINING REGISTER

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

Employee	EMS Induction	OH&S Induction	Boat Handling	Coxswains (Restricted)	Manual handling	TSQAP Procedures									

Environmental Management System Framework

Part 3

EMS Manual Templates

Systems Manual
Procedures Manual

TORC

Tasmania

Australian Government
Fisheries Research and Development Corporation

FRDC Project 2004/096

Environmental Management System

Systems Management Manual

for

"Your Oyster Company"

(Your Logo)

Version Number……………….

Revision Date…………………..

Contents

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:

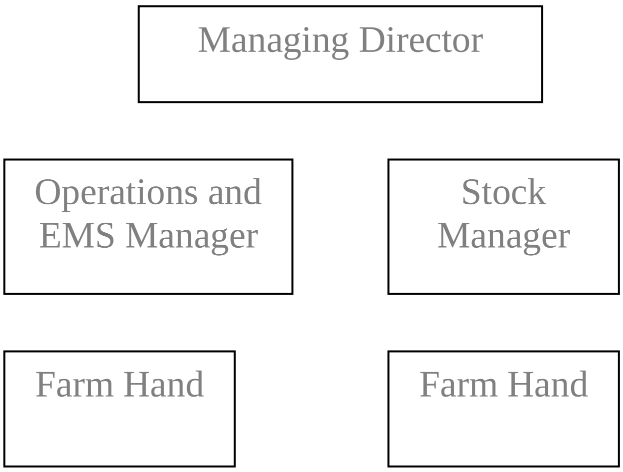
- …………………………..

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



Workplace Environmental Policy

"Your Oyster 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:
- Overseeing the production for the EMS
- Providing the resources and training to implement and maintain the EMS where appropriate
- Other?

The Operations/EMS Manager is responsible for:
- regular review and maintenance of the EMS
- regular auditing of the EMS
- holding regular meetings with staff about EMS issues (or tool box meetings)
- 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 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.

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

<u>Weekly/Fortnightly</u>
- Disposal of Rubbish and recycling
-

<u>Monthly</u>
- TSQAP sampling
-

<u>Biannual</u>
- Servicing of vehicles and outboards
-

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 oyster industry
- Annual Report
- TORC Newsletter or TSEC
- 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.

Environmental Management System

Procedures Manual

for

"Your Oyster 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 oyster stock and equipment between catchments	July 2006	Appendix 2.2.7. Sorting bench
P0016	Protocol for oyster 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

TORC

Tasmania

Australian Government
Fisheries Research and Development Corporation

FRDC Project 2004/096

Environmental Management System Framework

Tasmanian Oyster Industry

Compliance Guide and Risk Assessment for Ecologically Sustainable Development

Version 1.0
August 2006

FRDC Project 2004/096

ENVIRONMENTAL MANAGEMENT SYSTEM FRAMEWORK

Compliance Guide and Risk Assessment of Ecologically Sustainable Development for the Tasmanian Oyster 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 Oyster Research Council (TORC), 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 (2006). Environmental Management System Framework: Compliance Guide and Risk Assessment of Ecologically Sustainable Development for the Tasmanian Oyster Industry. Compliance Guide and Risk Assessment. Version 1.0 FRDC, Canberra, Australia. 153pp.

Document Control

The Environmental Management System Framework: Compliance Guide and Risk Assessment of Ecologically Sustainable Development for the Tasmanian Oyster Industry 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 it's 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.

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

Document	Version	Date of revision	Signature
ESD Oyster Compliance and Risk Assessment	1.0	June 2006	
		June 2009	

Signed ……………………………………………… Date …../……/……
(Chair Tasmanian Shellfish Executive Council)

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

Copy Number ………………………………………..

Issued to ……………………………………………

Date of Issue ……………………………………………

Document Control

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

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Document	Version	Date of revision	Signature
ESD Oyster Compliance and Risk Assessment	1.0	June 2006	
		June 2009	

Signed .... (Chair Tasmanian Shellfish Executive Council) Date 4./10/06

Signed .... (General Manager – Primary Industries) Date 3./10/6

Copy Number ....

Issued to ....

Date of Issue ....

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Executive Summary

The Environmental Management System (EMS) Framework for the Tasmanian oyster Industry was developed after consideration of the environmental, social and economic impacts of the industry. 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 achieve long term sustainability.

The Tasmanian EMS Framework is an Industry initiative embraced by the Tasmanian Oyster Research Council (TORC), the Tasmanian Shellfish Executive Council (TSEC), the Tasmanian Marine Farmers Association (TMFA) 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 Salmonid Growers Association (TSGA).

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 oyster 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.

The results found that the majority of the Industry's operational aspects were of low risk to the environment outside the lease area. Translocation of invasive marine species between regions was found to be high risk. Protocols are being developed by Industry and State Government to mitigate this environmental risk. Some impact to sensitive habitats such as saltmarsh may occur at a regional level.

The risk of the Industry causing large scale negative social impacts to the state, local and indigenous communities was assessed as low. The economic risk of Industry's sustainability was considered as moderate, which requires strategic business planning, the continued use of sustainable farming practices and risk management to decrease the economic risk.

Governance from Commonwealth, State and Local governments, Industry self-governance and impact from Non-Governmental Organisations (NGOs) were all considered to produce moderate risks to the long-term sustainability of the Industry. Recommendations to reduce the risk included effective, ongoing Government/Industry consultation, participation in the political process to ensure that Industry interests are taken into account in policy decision resulting in effective coordinated Industry representation and investment in development of human capital.

The majority of external environmental impacts on Industry from climate change, human activity and biological changes were assessed as presenting a moderate to extreme risk to the sustainability of Industry. Sea level rise, human induced changes to water quality, land use changes, environmental flows and exotic species introductions all ranked as an extreme risk. The lack of an appropriate disease field diagnosis service for Industry produces an extreme biological risk. Mitigation strategies to reduce these risks were identified as monitoring, directed research and development, and the Industry's ability to adapt to these changes. The Industry also identified that representation at legislative and policy review levels of Government is essential to mitigate human induced changes impacting on the Industry.

Other external drivers that impact upon the Industry's sustainability include sovereign risk and State government regulations.

The risk assessment process produced a number of key recommendations to address the identified risk to the Tasmanian oyster 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 include:

- Training of Industry staff on Invasive Marine Species (IMS) protocols and regular review of the management protocols by Industry for translocation of IMS
- Effective Industry based strategic business planning
- Ongoing sustainable farming practices with continued risk management and adaptive husbandry management
- Ongoing and effective engagement of State Government and participation in the political process to ensure that Industry interests are taken into account in policy decision making.
- Coordinated Industry representation to ensure effective, ongoing Government/Industry consultation
- Adherence to Industry Codes of Practice
- Investment in development of human capital
- Good governance practices of Industry representative groups
- Integrated and coordinated collection of baseline-farming information on which the effects of climate change can be measured to ensure targeted research of climate change impacts on the Industry
- Awareness raising of community on potential impacts and the need for change
- Effective engagement in Natural Resource Management (NRM) regional plans
- Development of appropriate field diagnostic services.

In summary, by 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 it's 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 oyster industry.

It is envisaged that in the future, the Tasmanian EMS Framework will be linked into the National Resource Management (NRM) objectives. The work done within this document are in keeping with the targets of the NRM.

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: Impact of Industry on the Environment							
Component 1.1: Wildstock of Cultured Species							
EO 1.1.1.1	1.1.1 Collection of Pacific Oysters		0	1	0	NEG	
EO 1.1.1.2	1.1.1 Collection of Flat Oysters		3	1	3	LOW	
EO 1.1.1.3		1.1.1 Collection of Pacific Broodstock	0	1	0	NEG	
EO 1.1.1.4		1.1.1 Collection of Flats broodstock	1	1	1	LOW	
	1.1.2 Escape of cultured species						
EO 1.1.2.1		1.1.2.1 Genetics Pacific oyster	0	1	0	NEG	
EO 1.1.2.2		1.1.2.1 Genetics Flat oyster	1	3	3	LOW	
EO 1.1.2.3		1.1.2.2 Disease Pacific oyster	4	1	4	LOW	
EO 1.1.2.4		1.1.2.2 Disease Flat oyster	4	1	4	LOW	
EO 1.1.2.5		1.1.2.3 Competition Pacific oyster	1	1	1	LOW	
EO 1.1.2.6		1.1.2.3 Competition Flat oyster	4	1	4	LOW	
Component 1.2 Cultured Stocks / Business							
EO 1.2.1	1.2.1 Genetics		3	2	6	LOW	
	1.2.2 Transfer of Disease						
EO 1.2.2.1		1.2.2.1 Import of disease	4	1	4	LOW	
EO 1.2.2.2		1.2.2.2 Export of disease in adults	4	1	4	LOW	
EO 1.2.2.3		1.2.2.3 Export of disease in spat	4	1	4	LOW	
	1.2.3 Translocation (Invasive Marine Species)						
EO 1.2.3.1		1.2.3.1 Export Overseas	3	1	3	LOW	
EO 1.2.3.2		1.2.3.2 Export of spat	4	1	4	LOW	
EO 1.2.4	1.2.4 Water Quality		3	1	3	LOW	
Component 1.3 Other Species/Community Processes							
EO 1.3.1	1.3.1 Disease		4	1	4	LOW	
	1.3.2 Food chain impacts						
EO 1.3.2.1		1.3.2.1 Marine lease	3	1	3	LOW	
EO 1.3.2.2		1.3.2.2 Hatchery	1	1	1	LOW	
	1.3.3 Chemicals						
EO 1.3.3.1		1.3.3.1 Treated Timber	1	1	1	LOW	
EO 1.3.3.2		1.3.3.2 Chlorination - dechlorination	2	1	2	LOW	
EO 1.3.4	1.3.4 Threatened & endangered species		4	1	4	LOW	
	1.3.5 Sensitive habitats						
EO 1.3.5.1		1.3.5.1 Seagrass beds	3	1	3	LOW	
EO 1.3.5.2		1.3.5.2 Supratidal saltmarsh	2*	3	6	LOW	

Objective	Activity	Aspect	Consequence	Likelihood	Numerical Risk	Descriptive Risk	Target Risk
Component 2: Regional Impacts of Industry on the Environment							
Component 2.1 Water Use Quality/Quantity							
	2.1.1 Nutrients						
EO 2.1.1.1		2.1.1.1 Marine Leases	1	2	2	LOW	
EO 2.1.1.2		2.1.1.2 Land Based	2	1	2	LOW	
EO 2.1.2	2.1.2 Sedimentation		2	2	4	LOW	
	2.1.3 Other wastes						
EO 2.1.3.1		2.1.3.1 Hydrocarbons	1	1	1	LOW	
EO 2.1.3.2		2.1.3.2 Veterinary Chemicals	1	1	1	LOW	
EO 2.1.4	2.1.4 Flow		2	1	2	LOW	
Component 2.2 Ecological Community Structure and Biodiversity							
EO 2.2.1	2.2.1 Plankton (eg blooms)		2	1	2	LOW	
EO 2.2.2	2.2.2 Benthic Communities		3	1	3	LOW	
EO 2.2.3	2.2.3 Listed Migratory Birds		3	1	3	LOW	
EO 2.2.4	2.2.4 Threatened/Endangered/Protected sp.		3	1	3	LOW	
EO 2.2.5	2.2.5 Protected Habitats		3	2	6	LOW	
EO 2.2.6	2.2.6 Behavioural Changes		2	1	2	LOW	
EO 2.2.7	2.2.7 Translocation between Catchments		4	4	16	**HIGH**	**LOW**
Component 2.3 Physical Structures and Construction & Tenure							
EO 2.3.1	2.3.1 Terrestrial habitat removal		0	2	0	NEG	
EO 2.3.2	2.3.2 Heritage Values		0	1	0	NEG	
EO 2.3.3	2.3.3 Soil Quality	2.3.3.1 Acid Sulphate Soils	2	1	2	LOW	
EO 2.3.4	2.3.4 Navigation		3	1	3	LOW	
EO 2.3.5	2.3.5 Infrastructure		2	2	4	LOW	
	2.3.6 Noise						
EO 2.3.6.1		2.3.6.1 Marine lease	1	4	4	LOW	
EO 2.3.6.2		2.3.6.2 Land based	1	4	4	LOW	
EO 2.3.7	2.3.7 Vehicular access		2	3	6	LOW	
Component 2.4 Production							
	2.4.1 Regional Carrying Capacity						
EO 2.4.1.1		2.4.1.1 Marine leases	3	1	3	LOW	
EO 2.4.1.2		2.4.1.2 Land based	0	1	0	NEG	
	2.4.2 Waste disposal						
EO 2.4.2.1		2.4.2.1 Marine leases	1	1	1	LOW	
EO 2.4.2.2		2.4.2.2 Land based	0	1	0	NEG	

Objective	Activity	Aspect	Consequence	Likelihood	Numerical Risk	Descriptive Risk	Target Risk
Component 4: National Social and Economic Wellbeing							
Component 4.1: Economic							
SEO 4.1.1	4.1.1: State Economy		4	3	12	**MOD**	**LOW**
SEO 4.1.2	4.1.2: National Economy		4	3	12	**MOD**	**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	1	4	LOW	
Component 5.2: Dependant Communities							
SEO 5.2	5.2 Economic & Social support		3	1	3	LOW	
Component 6: Indigenous Community Wellbeing							
Component 6.1 Income							
SO 6.1	6.1 Income		2	1	2	LOW	
Component 6.2 Employment							
SO 6.2	6.2 Employment		2	1	2	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	3	1	3	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		7.1.1.1: Management Agency	3	3	9	**MOD**	**LOW**
SEO 7.1.2		7.1.2.1: Local Government	3	3	9	**MOD**	**LOW**
SEO 7.1.3		7.1.2.2: Commonwealth Government	3	3	9	**MOD**	**LOW**
Component 7.2: Industry							
SEO 7.2		7.2: Industry representation	3	3	9	**MOD**	**LOW**
Component 7.3: Others (NGOs)							
SEO 7.3		7.3: Community representation	2	4	8	**MOD**	**LOW**

Objective	Activity	Aspect	Consequence	Likelihood	Numerical Risk	Descriptive Risk	Target Risk
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	2	6	12	**MOD**	
EO 8.1.1.2		8.1.1.2: Rainfall	3	6	18	**HIGH**	
EO 8.1.1.5		8.1.1.3:Sea-level Rise	4	12	24	**EXT**	
EO 8.1.1.3		8.1.1.4: Storms	2	4	8	**MOD**	
EO 8.1.1.4		8.1.1.5: Ocean Acidification	3	5	15	**HIGH**	
	8.1.2: Human Induced Changes						
EO 8.1.2.1		8.1.2.1: Water Quality	4	5	20	**EXT**	
EO 8.1.2.2		8.1.2.2: Land Use Changes	4	6	24	**EXT**	
EO 8.1.2.3		8.1.2.3: Environmental Flows	4	5	20	**EXT**	
EO 8.1.2.4		8.1.2.4: Air Quality (spray drift)	3	4	12	**MOD**	
EO 8.1.2.5		8.1.2.5: Exotic species and weeds	4	5	20	**EXT**	
	8.1.3: Biological Changes						
EO 8.1.3.1.1		8.1.3.1.1: Disease Surveillance	4	2	8	**MOD**	
EO 8.1.3.1.2		8.1.3.1.2: Disease in Spat	4	2	8	**MOD**	
EO 8.1.3.1.3		8.1.3.1.3: Emergency response	4	2	8	**MOD**	
EO 8.1.3.1.4		8.1.3.1.4: Disease Field diagnostics	4	5	20	**EXT**	**MOD**
EO 8.1.3.2		8.1.3.2: Predators	1	4	4	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	4	12	**MOD**	
SEO 8.2.1.2		8.2.1.2: Competing Uses	3	2	6	LOW	
	8.2.2: Economics						
SEO 8.2.2.1		8.2.2.1: Incentives etc.	2	2	4	LOW	
SEO 8.2.2.5		8.2.2.2: Markets	2	3	6	LOW	
SEO 8.2.3	8.2.3: Regulations	8.2.3: Regulations	3	5	15	**HIGH**	**LOW**

Acknowledgments

The Author wishes to thank the Environmental Management System Steering Committee and those who have been part of the Oyster Working Groups. These people have freely given up their time for numerous meetings and workshops to keep the project on track. I wish to give special thanks to Richard Pugh who put in an extraordinary amount of effort in reviewing and commenting on the document in the development phase. I also thank my Principal Investigator Neil Stump who took over the helm mid voyage and provided support while the Tasmanian Fishing Industry Council (TFIC) was restructured.

This project was funded through the TFIC by the Fisheries Research and Development Corporation (FRDC) with cash contributions from the Tasmanian Oyster Research Council (TORC), Tasmanian Abalone Growers Association (TAGA) and the Tasmanian Salmonid Growers Association (TSGA), 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 FRDC and Seafood Services Australia (SSA).

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Note to the Reader

The EMS framework for the Tasmanian Oyster 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.

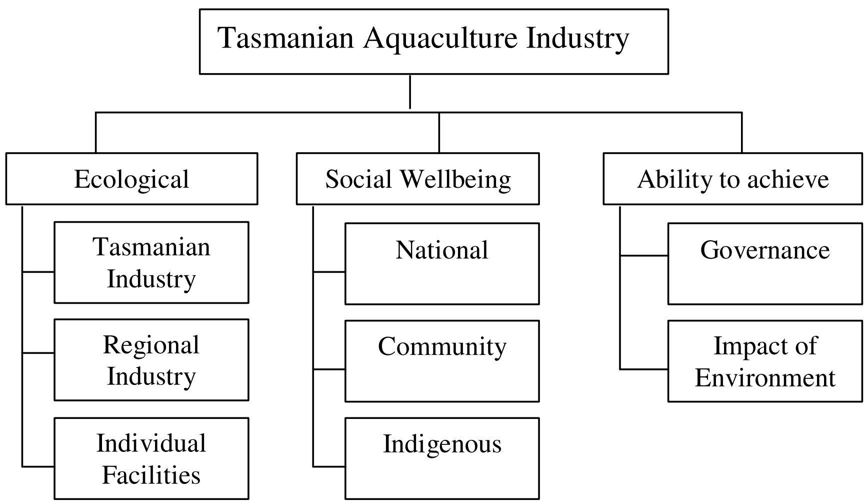

Figure i. Generic component tree from the national ESD framework (adapted from Fletcher et al 2004)

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**.

The components may be comprised of two parts; Part A, which deals with those aspects relevant to Marine Farming Leases and Facilities, and Part B, which deals with those aspects relevant to Hatchery and Nursery Facilities. The separation is due to the different governing authorities that regulate industry activities. Some aspects are dealt with in both Part A and Part B.

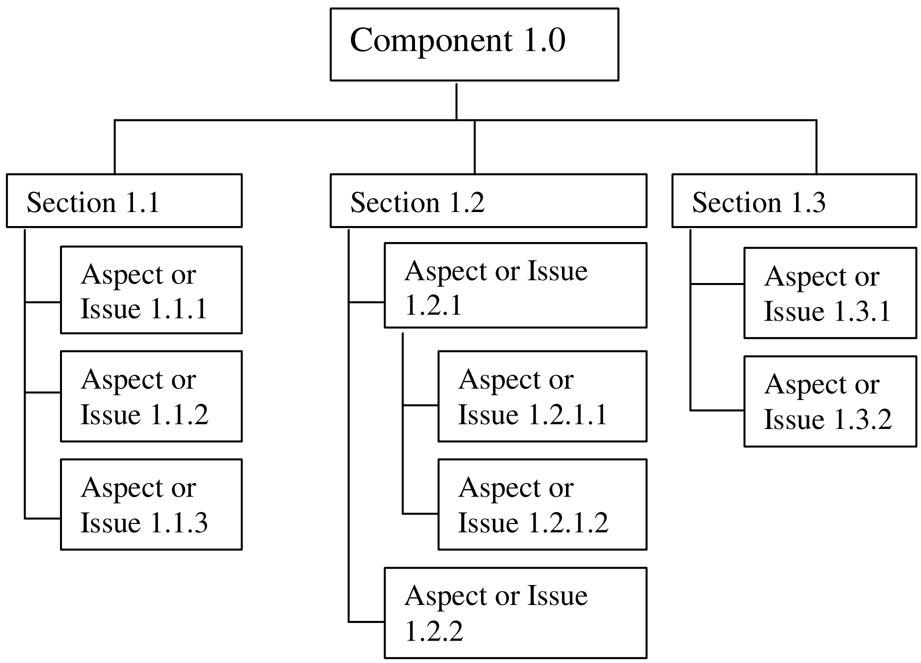

Figure ii. The construction of the component trees

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 oyster marine farming industry will be referred to as the **Industry**.

Introduction: Environmental Management System Framework and ESD Objectives

Background

The gross value of production (GVP) from Tasmanian marine farming was approximately $185 million in 2005 and is one of Tasmania's most significant industries. The Tasmanian marine farming industry has strong growth projections for the future and 90% of all marine farmers are engaged in oyster farming.

The Tasmanian Oyster Industry has long recognised and embraced 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 oyster 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) and the community to develop appropriate mandatory management controls under Marine Farming Development Plans, and mandatory licence conditions under the LMRMA, in compliance with the sustainable development objectives of RMPS. The Environmental Management System (EMS) Framework for the Industry has been developed to demonstrate the Industry's sustainability under current conditions, and to identify the external threats (those which are beyond the Industry's control) to the Industry's longer term sustainability.

The EMS Framework is a Seafood Industry initiative developed by the Fisheries Research and Development Corporation (FRDC) and Seafood Services Australia (SSA) through its publication of "The Seafood EMS Chooser". Its assimilation into Tasmania started with the Little Swanport Estuary EMS being adopted as one of six Australian Government Pilot Projects for the roll-out of EMS's in the seafood industry, as part of twenty such projects in the primary production sector in general. On the suggestion of the Little Swanport Estuary EMS Committee, the Tasmanian Aquaculture Council (TAC) recognised the value of incorporating the newly developed National ESD Reporting Framework into the structure of emerging EMS's. TAC, through the Tasmanian Fishing Industry Council (TFIC), successfully applied to FRDC for project funding for the development of ESD/EMS templates for the oyster, abalone and salmonid aquaculture sectors at a State and regional level.

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 objective of this document is to demonstrate that the Industry is operating within the objectives and principles of ESD, and through the EMS is meeting community expectations of good stewardship and environmental performance through adaptive management. The Industry has identified the relevant environmental, social/economic and governance issues, determined the appropriate level of management response using risk assessment techniques and provided a reporting structure to document the outcomes.

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 system.

Tasmanian legislation incorporates the objectives from Schedule 1 of the Resource Management and Planning System of Tasmania, including 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."

Further information on ESD and SD can be found in Appendix 1.1: Principles and objectives of ESD and SD.

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, page xi).

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 third level (Component 3).

The social wellbeing branch is also structured into 3 social strata;

- 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 the outcomes are being obtained through the development of EMS's, Codes of Practice 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
- Potential for increased profits
- Reduced resource use and waste generation
- Improved environmental performance

- A better understanding of operations and the environment on which they rely
- Demonstrated good environmental stewardship
- Improved environmental assets
- Attitudinal and behavioural change.

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 covers oyster farming in Tasmanian waters inclusive of intertidal and subtidal marine farming leases (Part A) and land based marine hatchery and nursery facilities (Part B). 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, who may affect the environmental quality and productivity of the region 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 –Aug 05 – June 06
Ralph Mitchell (TFIC) – Project Manager – July 04-Aug 05
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)
Bob Lister (TFIC)
Andrew Febey (TFIC)
Richard Pugh (TSEC)
Barry Ryan (TORC)
Colin Shepherd (DPIW)
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.

Review Process

The EMS framework document is scheduled for initial review 3 years after release by persons designated by Industry and/or the EMS Steering Committee. After this time, periodic review will occur at the discretion of Industry.

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

- changing legislation/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.

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 integtrity of the ecosystem in which the Industry operates.

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

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. The risk assessments were conducted by suitably qualified persons as listed in Table 1. 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 Oyster Working Group for risk assessments incorporating relevant personnel from industry, research and government.

Person	Relevant experience	Component 1	Component 2	Component 4	Component 5	Component 6	Component 7	Component 8
Dr Judith-Anne Marshall PhD. Dip. Ed. BSc. MEIANZ	Tasmanian EMS Project Officer; Principal Consultant, Phycotec Environmental Management; ISO 14001 Environmental Auditor	X	X	X	X	X	X	X
Neil Stump B App Sci, (Fisheries), BSc (Hons)	Principal Investigator, Tasmanian EMS Framework project;. President and Director, TFIC.	X	X	X	X	X	X	
Colin Dyke	Chair, Tasmanian EMS Steering Committee; Chair, TAC	X	X			X		X
Dr Barry Ryan BVSc (Hons)	Chair, TORC; Oyster Industry representative on the Tasmanian EMS Steering Committee	X	X			X		X
Richard Pugh Ass Dip App Sc (Aquaculture) GAICD	General Manager, Shellfish Culture Ltd.; Secretary/Treasurer, TSEC 2002-2005; Director, TORC 2002 - 2005; Chairman, Pipeclay Lagoon Oyster Growers Association 2002; Industry representative on the Tasmanian EMS Steering Committee.	X	X	X	X	X	X	X
Ed Smith B App Sci (Hons) (Aquaculture)	Project officer, TFIC; Tasmanian EMS Steering Committee member	X	X			X		X
Robert Gott	Branch Manager, DPIW Marine Farming.			X	X		X	
Dr Christine Crawford Ph D.	Program Leader-Natural Resource Management, TAFI; EMS Steering Committee member							X
Colin Shepherd B Sc. (Hons)	Principal Marine Environmental Officer, DPIW Marine Farming Branch; EMS Steering Committee member							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 and practices to determine the *managed* or *residual risk*. Where the risk assessment identifies issues that need the risk reduced and is the Industry's power to reduce the risk, a *target risk* would be incorporated. The target risk is 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 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 six 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 1), unless otherwise specified.

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.

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 2. Information from the consequence and likelihood tables are combined in a risk matrix table (Table 3) 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 4). Any risk ranked greater than low (6) in the EMS Framework requires a full performance report and management plan (Figure 1).

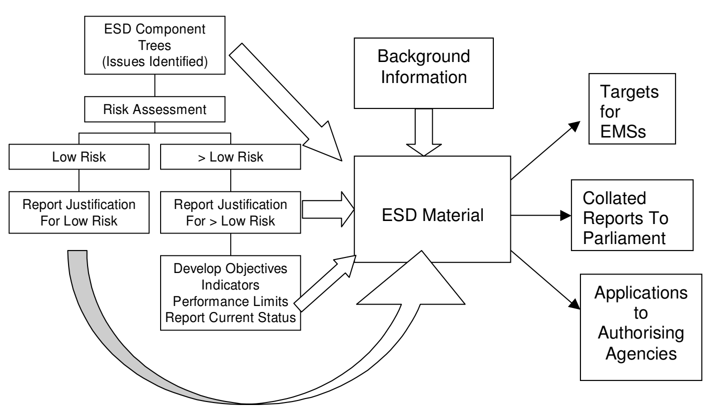

Figure 1. Summary of the National ESD Reporting Framework process for aquaculture (Adopted from Fletcher et al 2004).

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 adaptation to current 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

Introduction

The culture of molluscan shellfish worldwide has been considered a 'green' industry due to the shellfish grower's requirement for and commitment to good water quality. Shellfish are farmed successfully throughout the world and shellfish culture represents one use of the marine environment for sustainable food production. Oysters can act as environmentally sensitive monitors and water purifiers and the culture of oysters can promote sound resource stewardship.

Shellfish are at the base of the food chain as first order consumers. They act as a highly efficient filter of the water column, consuming phytoplankton and reducing turbidity and nutrient levels. Reduced turbidity leads to increased light penetration in the water column, improving the condition of critical habitat for important species such as seagrasses and other aquatic vegetation. Thus, the oyster is acting as an essential link between the bottom-dwelling aquatic community and phytoplankton production in the water column (Shumway et al 2003). However, under poor management practices, unregulated oyster farming has the potential to impact upon the environment by the depletion of food for other filter feeders.

Native flat oyster wild harvesting and farming.

Shells found in numerous aboriginal middens around the Tasmanian coast indicate that humans had harvested the native flat oyster (*Ostrea angasi*) for many thousands of years. The early settlers extensively and indiscriminately fished the native oyster beds around the state for local consumption and export to the mainland during the 1800s. Destructive and continuous dredging of native flat oyster beds led to the decline of the fishery in the 1870s. By the early 1880s the fishery had collapsed (Crawford 2003). An 1883 Royal Commission Report on the Fisheries of Tasmania stated that 44,700 bags of oysters, or 22.5 million individuals, were dredged annually in the southern and south-eastern waters of the state during the decade 1860-1870 (Mitchell 2000). The Commission concluded that the deterioration of the beds was due to overfishing and destruction of the bottom surface, mussel encroachment, disease and inclement weather (ie flooding and silt deposition) (Sumner 1972).

Government and private reserves were established in the mid 1880's for broodstock and reseeding of natural beds, leading to the establishment of 33 native oyster farms by 1887. However, the silting up of the government oyster beds at Oyster Cove lead to the abandonment of the project in 1889 (Crawford 2003).

Since the 1970s, various attempts have been made to culture the native oyster. In the early 1990s, wild oysters were harvested and grown out on farms at Georges Bay under the Flat Oyster Culture Program. This program was terminated when the protozoan parasite *Bonamia* spp. was discovered in the wild harvested oysters in 1992 (Crawford 2003). Presently there is a sustainable dive fishery harvesting the native flat oyster from

Georges Bay for the specialty market. Flat oysters are intermittently farmed in Tasmanian regional areas.

Introduction of the Pacific oyster to Tasmania

The Pacific oyster (*Crassostrea gigas* Thunburg 1793) was introduced into Tasmania from Japan in 1948-1953 by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) (Thompson 1952, 1959). The original oyster spat was introduced in Pitt Water and survived to reproductive size. The spawning of these oysters resulted in poor spat settlement. Oysters were translocated from Pitt Water to Port Sorell in the north of the state and survived to spawn successfully. However, in 1959 Thompson reported that the Pacific oyster had successfully spawned and settled at Pitt Water and could be considered to be naturalised. The popularity of the oyster has inadvertently lead to the fish being spread by people to a number of estuaries during the 1960s.

Oysters were intentionally introduced to the Tamar River in 1951, Port Davey in 1956, Robbins Passage in 1957, Georges Bay in 1959, North-West Bay and Porpoise Head in the D'Entrecastreaux Channel in 1963, North-East River and West Arm Inlet on Flinders Island in 1966 (Mitchell et al. 2000). The translocated oysters failed to establish in Port Davey and on Flinders Island.

By 1964 the Pacific oyster dominated the rocky shore of the Tamar River. The Pacific oysters were subsequently moved from these initial sites and introduced to other locations around the state. The population of Pacific oysters in the Tamar River had multiplied to such an extent by 1967 that large reefs of oysters were approaching nuisance proportions on the foreshores. Spatfalls were erratic in subsequent years and market size oysters were found to contain excessive levels of heavy metals, especially zinc, rendering them unfit for human consumption (Ayres 2003).

Commercial Culture of the Pacific Oyster

Three licenses were granted to farm Pacific oysters by the Department of Sea Fisheries (Dix 1987) in 1967. Farming was originally based upon the collection of natural spat on sticks and transporting them to intertidal farms around the state for ongrowing. The Tamar River was the major source of wild spat, but fluctuating environmental conditions produced an unpredictable spat supply. The commissioning of a pilot hatchery at the Marine Research Laboratories at Taroona during 1977-78 led to the eventual end to reliance on wild caught spat during the 1980's. The greater control over spat production allowed the industry to expand rapidly and penetrate into mainland markets (Crawford 2003).

In 1979, the Tasmanian Government and prospective oyster farmers established a pilot-scale commercial oyster hatchery at Bicheno on the East Coast. The success of this and later private hatcheries form the basis of the Industry today. The fishery is now totally reliant on hatchery produced spat.

Culture Methods

Hatchery

Selected broodstock are conditioned and spawned to produce swimming larvae that are fed a specifically tailored diet of mixed algal species. In a carefully controlled environment, the larvae are cultured in tanks for three weeks, where they grow from 70 micron up to 350 micron (0.35mm). Regular water changes and a strict grading regime encourage the larvae to grow vigorously. As the larvae approach the end of their planktonic life, they develop an eye spot, a foot and gills. The pediveligers commence a settlement phase and metamorphose into single seed oysters. On successful completion of the settlement phase they are called spat. The spat are raised in the hatchery up to a size of 1mm.

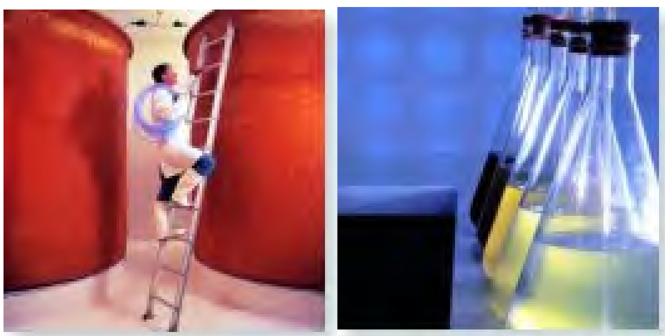

Figure 2. Hatchery Production of oyster spat. a. larvae tank; b. algal cultures

Land Nursery

A critical component of shellfish seed production is the nursery phase. Young seed (or spat) are carefully nurtured in upwellers until they are large and robust enough to be placed on conventional marine farms at a size of 4-6 mm.

Sea Nursery

The sea based nursery facilities, located in productive estuaries, are used for further growth and hardening of shellfish. Oyster seed are grown in fine mesh trays prior to sale to marine farms.

Figure 3. Nursery production of oysters. .a. Nursery seed; b. Oyster seed in upwellers; c. Oyster spat in trays when outgrown in sea nurseries.

Marine farms

Single seed spat allowed the development of new farming methods to be adopted, for example using plastic mesh baskets suspended on wooden racks to house oysters (Fig 4a). The height of the rack could be varied between regions, farms or conditioning requirements of the oyster. Generally the oysters are exposed to the air in the intertidal zone for 30-40% of the time. The advantage of intertidal rack culture include: easy access from the shore by tractor or small barge; a reduction in the marine fouling of the oysters due to periodic exposure to air; and regular air exposure to harden the shell and strengthen the adductor muscle of the oyster, leading to a longer shelf life (Crawford 2003).

Subtidal or deepwater oyster culture developed in the mid 1980s, as suitable intertidal areas became scarce. Oysters grown subtidally generally have a faster growth rate because they are continually submersed and can feed for longer periods. Deepwater farms consist of vertical layers of plastic trays attached to longlines of ropes and buoys (Fig 4b) which are serviced using boats assisted with on-board hydraulic lifts. The oysters are commonly relocated to intertidal culture for several months prior to harvest to harden the shell and strengthen the adductor muscle. Further information on intertidal and subtidal oyster culture is detailed in Ryan (1997).

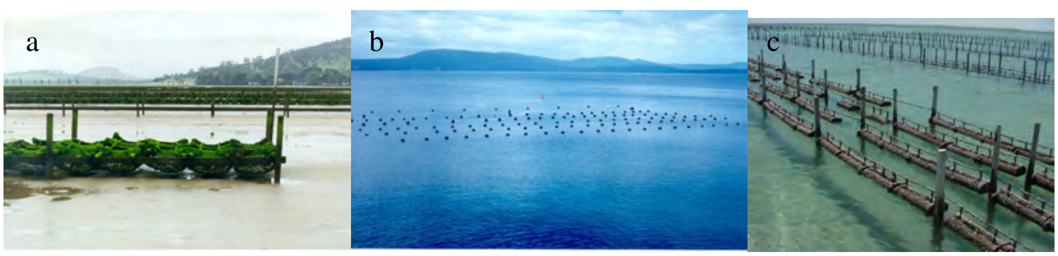

Figure 4. Production of oysters on marine leases. a. intertidal mesh baskets on racks; b. subtidal longline buoys supporting trays; c. the adjustable longline system for intertidal oyster culture.

A new culture method known as the 'adjustable longline system' allows oyster culture in relatively exposed sites and is currently being trialed in Tasmania. This method consists of plastic mesh containers that are hung from suspended system between posts in the intertidal zone (Fig 4c). The advantage of this method is that it allows culture of oysters in rough water and may improve efficiency, growth rates and meat condition. The wire can be easily lowered or raised to control growth rates.

The management protocols vary between each individual farmer, often adapted to accommodate regional and environmental variation between lease sites. Increasing mechanisation, including mechanical handling and grading of oysters has lead to efficiencies within the Industry.

Regional growing areas

There are 14 regional areas for marine farms identified by DPIW through the Marine Farm Development Plans. Eight of these areas are currently being used for oyster culture (Fig. 5 a and b). Two other areas, King Island and Tamar have minor or not-active marine leases. Areas covered by this document are described in Table 5.

Productivity values vary between these regions due to differences in primary productivity of the water and the type of oyster culture that a region may specialise in. Some regions are used for ongrowing of spat, whereas other regions are used to condition oysters for market.

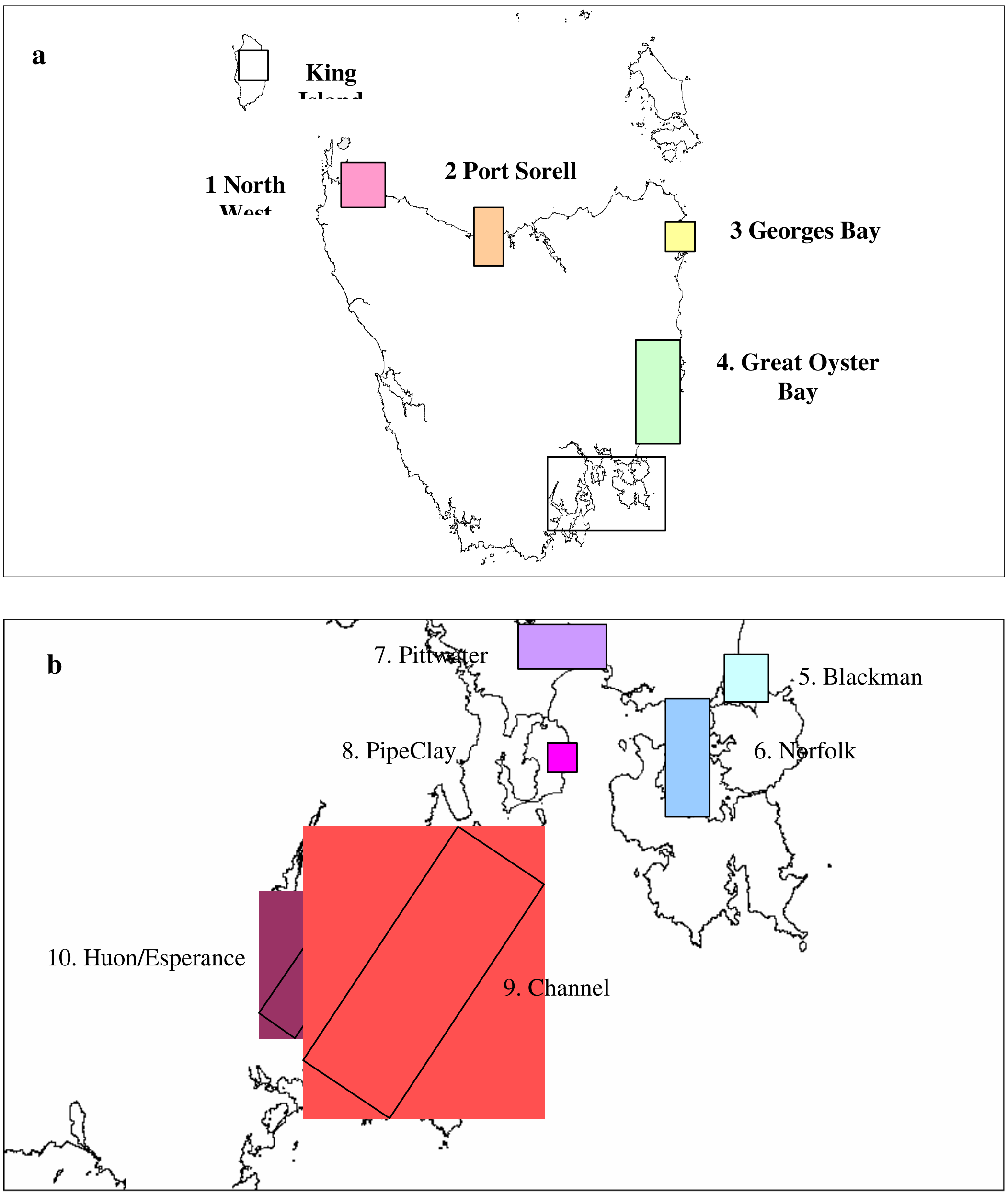

Figure 5. Regional marine farming areas as determined by the DPIW Marine Farming Development Plans. All further reference to growing areas is based on these areas.

Table 6 Geographical location of oyster leases and lease area details as provided by the relevant DPIW Marine Farm Management Plans (- indicates no data available)

Area	Number of zones	Maximum leasable area (ha)	Existing shellfish lease area (ha)	Number of Pacific oyster leases	Annual production (doz per ha)
1. North West	10	327	229	16	-
2. Port Sorell	5	24.5	49*	2	-
3. Georges Bay	6	102	95	10	6,234
4. Great Oyster Bay	19	2,677	2,035	14	-
5. Blackman	22	215	208	9	-
6. Norfolk	24	467	378	13	-
7. Pitt Water	5	133	108	7	5,125
8. Pipe Clay	3	47	49	9	18,152
9. Channel	34	870	391	27	-
10. Huon/Esperance	15	380	120	6	-

* The Port Sorell estuary MFDP provided for the removal of unusable water (in consultation with leaseholder) from the lease, when the leaseholder undertakes a lease variation. This will allow for the lease to occupy maximum water and be within the zones.

Component 1: Impact of the Industry on the Environment

Introduction

Shellfish farms can occupy areas of coastline and the potential disturbance to natural ecosystems is correspondingly large (de Grave et al 1998). However, shellfish farming is generally considered to have less environmental impact than finfish farming because there are no external sources of food or prophylactic treatments (Kaiser et al 1998). 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 three areas covered by the component tree include the potential impact that the Industry may have on:
(i) wildstock
(ii) the husbandry of cultured species
(iii) 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:
- Water Quality (Section 1.2.4) relating to public health. This aspect ensures that the shellfish harvested for human consumption is free of both toxic substances (algal toxins, heavy metals, herbicides and pesticides) and microbial pathogens. This important aspect is more relevant to Cultured Stocks/Business (Husbandry) than Section 1.3 Other Species/Communities Processes.
- Transfer of Diseases (Section 1.2.3) covers the importation and exportation of live oysters both overseas and interstate.
- Translocation of Invasive Marine Species (Section 1.2.4). The issue of translocation of invasive marine species (IMS) is critical to the Industry on a state, national and international level.

Combinations of topics include:
- Behavioural Changes and Impacts (migratory species) (under Section 1.3) has been integrated in to Component 2: Behavioural Changes on Species (Section 2.2.6).
- Food Composition and Food Chain Impacts (under Section 1.3) are closely aligned and have been combined under Section 1.3.2: Food Chain Impacts.

Excluded topics include:
- Stocking, Restocking and Stock Enhancement (Section 1.1.3). There is no planned release of either the Pacific oyster (*Crassostrea gigas*) or the native

oyster (*Ostrea angasi*) into the wild environment as part of a stocking or restocking program. All farmed oyster stock is contained and is covered in Section 1.2: Cultured Stocks.

- Animal Welfare (Section 1.2) as there are no proscribed conditions under the *Animal Welfare Act 1993* for shellfish.
- Disease (under Section1.2) was considered an external impact and has been transferred to Section 8.1.3.1: Disease.
- Formation of Wild Populations (under Section 1.3.2) is considered to be an adjunct of Section 1.1.2: escape of cultured species.

Part A of Component 1 assesses the impact of the marine farming leases and facilities on the environment. Part B assesses the impacts of land based hatchery and nursery facilities on the environment, which are governed by different legislation. The issues covered by Part B are shaded in Figure 1.0. The risk assessment for all topics or aspects have used the General Consequence Table (Appendix 1.0; Table 1.1)

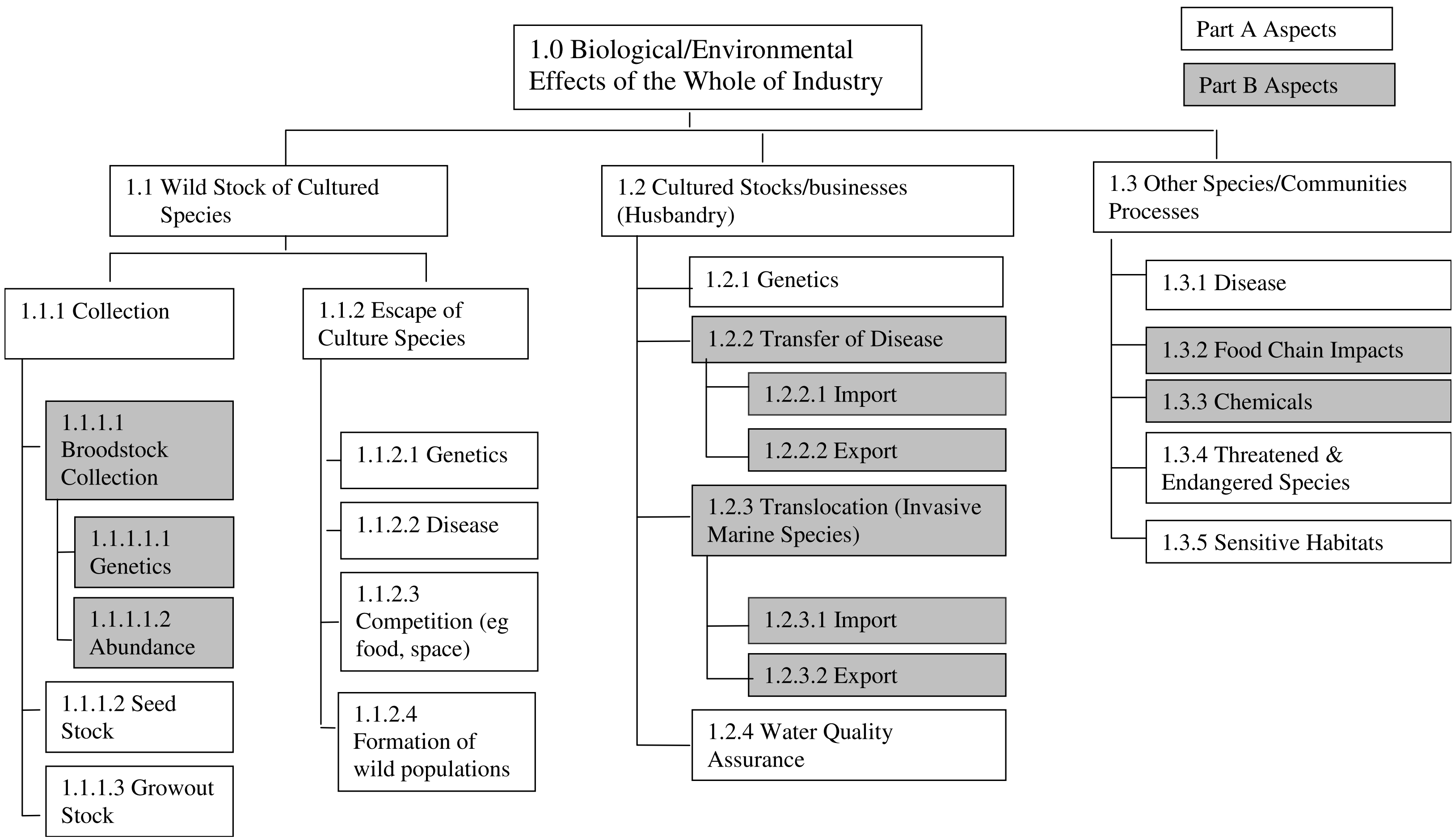

Fig 1.0. Component Tree1: Impact of the Tasmanian Industry on the Environment

PART A: MARINE LEASES AND FACILITIES

1.1: WILD STOCK OF CULTURED SPECIES

This Section describes the impact on the environment of removing wildstock of oyster species through oyster farming activities. Most oyster culture is based on the introduced Pacific oyster. The wild stocks of this species are considered a feral species even though they may play an important role in the ecosystem by removing nutrients from the water. Only low levels of native flat oyster culture occurs.

1.1.1: Collection of Wild Stock

Scope

To assess the impact on wildstock from Industry harvesting oysters from the wild.

Current Management Controls

Wildstock of flat and Pacific oysters are collected for direct sale to the public, or occasionally as broodstock for genetic enhancement in oyster hatcheries. Collection of oysters is undertaken through a species dependent permit issued under Section 14 of the *Living Marine Resources Management Act* 1995 (LMRMA).

Pacific oysters must be harvested by hand. There is no size or bag limit on the number of wild Pacific oysters that can be harvested for sale. Monthly harvest audits must be forwarded to the Marine Farming Branch of DPIW. There has been a trend of increased harvesting of wild Pacific oysters over the last decade.

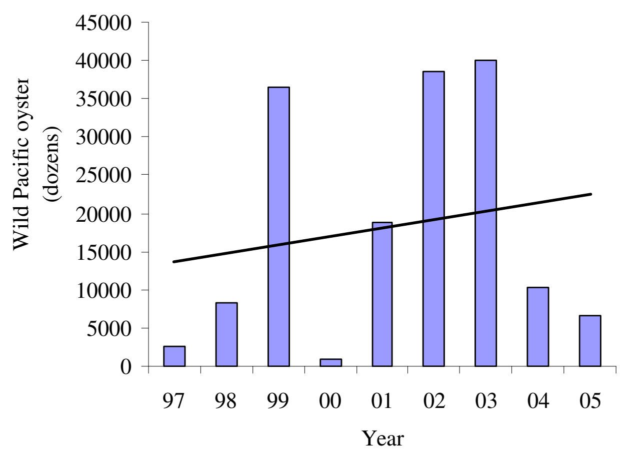

Figure 1.1.1. Pacific oysters harvested from the wild over the last 8 years (dozens per year).

The permit conditions for commercial taking of wild stock of native flat oysters stipulate the number and size of oysters, the method and area of collection, sale conditions and audit controls. At present, native flat oysters can only be harvested by permit from Georges Bay, St Helens. A Department of Environment and Heritage (DEH) certificate, which encompasses the principles of the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBCA), is required for harvesting for export.

1.1.1.1: Broodstock collection

Collection of broodstock is covered in Section 1.1.1.1. Part B.

1.1.1.2: Seed Stock

Only one marine farming lease exists in Tasmania for the collection of seed stock of Pacific oysters. Collection of seed stocks on sticks was once the predominant way of collecting spat until the advent of hatcheries in the 1970s (see Chapter 2 for details).

1.1.1.3: Grow out stock

Grow out of wild stock on marine farms does not occur in Tasmania. The conditions for wild harvest of Pacific oysters requires that fish must be held on a marine farming lease for a period of not less than 60 days to depurate under the TSQAP program (see Quality Assurance; Section 1.2.3). Generally, oysters are not kept on marine farms for the purpose of ongrowing.

<table>
<tr><td colspan="4">Environmental Objective 1.1.1.1: To ensure that collection of Pacific oysters by Industry does not impact upon the wild populations of Pacific oysters.</td></tr>
<tr><td>Consequence
C=0</td><td>Likelihood
L=1</td><td>Risk Rating
C x L =0
Negligible</td><td>Target Risk
Rating
N/A</td></tr>
<tr><td colspan="4">Environmental Objective 1.1.1.2: To ensure that collection of native flat oysters by Industry does not impact upon the native populations of flat oysters.</td></tr>
<tr><td>Consequence
C=3</td><td>Likelihood
L=1</td><td>Risk Rating
C x L =3
Low</td><td>Target Risk
Rating
NA</td></tr>
<tr><td colspan="4">Risk Management Options
• Continuing management of the flat oyster and Pacific oyster wild populations by DPIW</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Monitoring wild oyster population changes as determined by DPIW surveys.
• Monitoring continued compliance with permit conditions with regard to size, number, location and method of collection</td></tr>
</table>

1.1.2: Escape of Cultured Species

Scope

To assess the impact of the accidental escape of cultured Pacific adults, juveniles or progeny on the natural stocks of the native flat oysters.

Current Management Controls

The Industry takes precautions to prevent the accidental escape of cultured Pacific oyster from marine farm leases. Occasionally, oysters may accidentally be dislodged from baskets or equipment during adverse weather conditions. It is unlikely that oysters are released beyond the boundary of the lease. A license condition stipulates that marine farmers are expected to quickly salvage any stock spillage arising from adverse weather or from accidental damage to gear.

Native fish such as bream, skate, leatherjacket and crabs predate upon any displaced Pacific oysters (Col Dyke personal comment). However, predation is not relied upon by the Industry as a mechanism for cleaning up spilt stock. Protocols on the collection of spilt stock are dealt with on an individual facility basis. Management controls on leases require stock to be kept clear of the seabed and equipment to be kept in tidy and serviceable condition.

Oyster farmers endeavour to sell their stock from the water prior to spawning events. However, uncontrolled release of Pacific oyster spawn into the water is unavoidable. Further information is provided in Section 1.3.2: Feral Populations.

1.1.2.1: Genetics

The Pacific oyster (*Crassostrea gigas*), the native flat oyster (*Ostrea angasi*) and the Sydney rock oyster (*Saccostrea glomerata)* are related in the Family Ostreidae, although they belong to different species groups (Fig 1.1). It is recognised by biologists that some anatomical, physiological and behavioural characteristics may appear similar between these three species. However, the criterion for classification of species is that there is no potential gene flow between apparently similar populations (Keeton 1976). On this basis, the escape of the cultured Pacific oyster cannot have any genetic impact upon the Tasmanian native flat oyster populations.

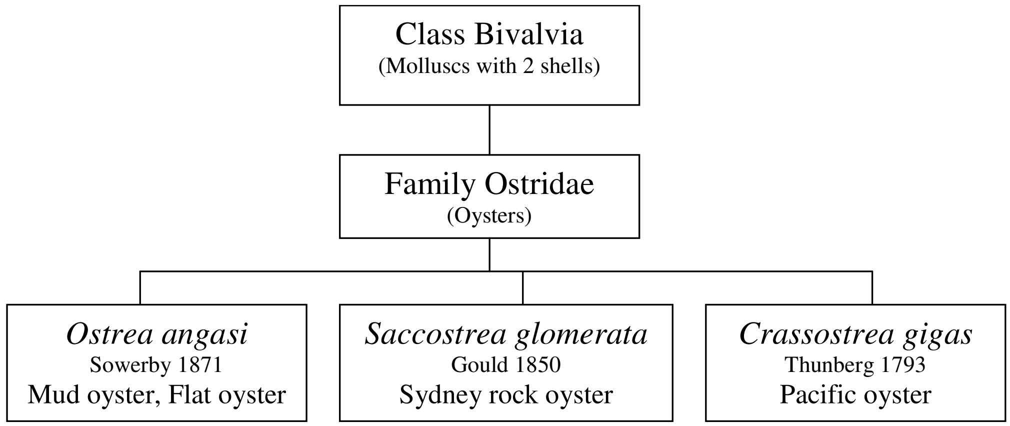

Figure 1.1.2.1. Genetic tree of the oyster species present in southeast Australia.

1.1.2.2: Disease

Wilson et al. (1993) has established the general health status of Pacific oysters and the native flat oyster through a study. Oyster health is monitored by the Pacific Oyster Health Program (POHP), which confirms the absence or presence of diseases currently listed under state legislation and the OIE, and of other significant agents. Wilson et al. (1993) found that the Pacific oyster was free of any prescribed or potential pathogens. The native flat oyster was found to be infected with *Bonamia* sp. and a viral inclusion of unknown significance. Transfer of disease between the Pacific oyster and the native flat oyster is not known to occur. Low levels of the following pest/disease agents have been identified through the POHP: *Boccardia knoxi* (mudworm), *Bonamia sp*., and a herpes-like virus. These pathogens are relatively benign and are described in Appendix 1.1.2.2. Disease hazards of import of oyster stock from South Australia are listed in Appendix 1.2.2.1.

1.1.2.3: Competition (eg food, space)

The ecological impact of wild Pacific oysters on the marine habitat was found to be substrate specific (Munday and Johnston personal communication). On sandbanks, the oyster reefs provided habitat for mussels, barnacles, gastropods and crabs, but regional diversity was decreased. Oyster reefs on rock platforms showed the overall effect is of increased diversity associated with increased oyster cover, most likely due to the provision of 3D habitat and associated microclimates. On cobble there was no detectable effect. The Pacific oyster shell provides a microhabitat that is colonised by native species, which may also lead to an increase in native fauna abundance (Coleman 1986). Competition for food is discussed in Section 1.3.2: Food Chain Impacts.

The Pacific oyster had naturalised in Tasmanian coastal waters (Thompson 1959) prior to the establishment of oyster farming. Wild populations of Pacific oysters are established at locations favourable for oyster settlement as shown in Figure 1.1.2.3.

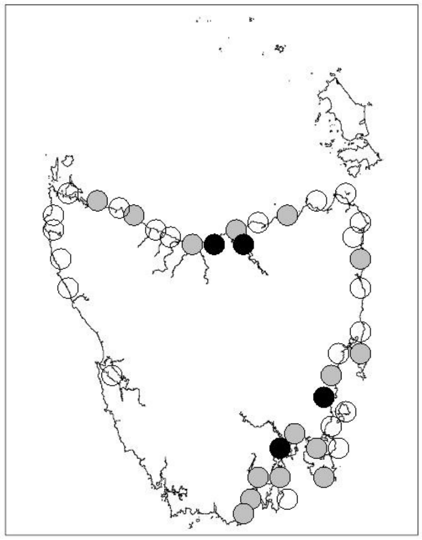

Figure 1.1.2.3. Current distribution of wild populations of Pacific oysters in Tasmania.
Black circle = high density of oysters (> $50m^2$), Grey circle = low density (1-50 oysters m^2), Clear circle = absent. Data adapted from Mitchell et al 2000.

The native flat oyster is predominately subtidal and less competitive in the intertidal environment where air exposure during tidal cycles occurs. It occupies a different niche in the marine environment than the Pacific oyster, but is occasionally found in mixed populations (Mitchell 2004). As there are two species usually occupying different ecological niches, it is unlikely that the escaped Pacific oyster would have an impact upon wild native flat oyster populations.

1.1.2.4: Formation of Wild Pacific Oyster Populations

Larvae released from farmed Pacific oysters may settle where a suitable substrate is present, causing problems in some regions. Historical records show that successful spawning and settlement of Pacific oysters is intermittent (Ayres 2003) and dependant upon a number of predisposing factors (Mitchell et al 2000).

Pacific oysters, which were initially introduced into Pitt Water and Port Sorell, are now widespread and abundant in Tasmania. The state-wide spread of this species can firstly be attributed to the artificial relocations, which took place in the 1950's and 60's, and secondary to the natural dispersive abilities of the species (Mitchell et al 2000). However, the introduction of oyster larvae settlement has not been successful in all areas. The current distribution of wild Pacific oysters is discussed in Section 1.1.2.3 (Competition). The successful settlement of Pacific oysters is generally confined to the intertidal regions of shorelines. This settlement has been associated with a number of predisposing factors that include; appropriate substrate, sheltered conditions, freshwater influences, water temperatures, reduced likelihood of predation and dispersal. Wave exposure and fetch has the greatest influence on the success of settlement of feral Pacific oysters (Mitchell et al 2000).

There is no clear correlation between the settlement of Pacific oyster spat and the location of marine farming oyster leases (Mitchell et al 2000). Mitchell reports that "on occasions sites close to farms contained no oysters, even though the sites appeared suitable for settlement (eg pebbles, boulders, rock platforms) and were sheltered". Therefore, it may be argued that oyster culture may not be the primary source of wild Pacific oysters. There is no evidence that spawn from cultured Pacific oysters have any impact upon the wild population of Pacific oysters.

Environmental Objective 1.1.2.1: To ensure that the genetics from escape of cultured flat oysters does not impact upon the flat oyster population.			
Consequence C=0	**Likelihood L=1**	**Risk Rating C x L =0 Negligible**	**Target Risk Rating NA**
Environmental Objective 1.1.2.2: To ensure that the genetics from escape of cultured Pacific oysters does not impact upon the wild Pacific oyster population.			
Consequence C=1	**Likelihood L=3**	**Risk Rating C x L =3 Low**	**Target Risk Rating NA**
Environmental Objective 1.1.2.3: To ensure that disease from escape of cultured Pacific oysters does not impact upon the flat oyster population.			
Consequence C=4	**Likelihood L=1**	**Risk Rating C x L =4 Low**	**Target Risk Rating NA**
Environmental Objective 1.1.2.4: To ensure that disease from escape of cultured Pacific oysters does not impact upon the wild Pacific oyster population.			
Consequence C=4	**Likelihood L=1**	**Risk Rating C x L =3 Low**	**Target Risk Rating NA**
Environmental Objective 1.1.2.5: To ensure that competition from escaped cultured Pacific oysters does not impact upon the wild Pacific oyster population.			
Consequence C=1	**Likelihood L=1**	**Risk Rating C x L =1 Low**	**Target Risk Rating NA**
Environmental Objective 1.1.2.6: To ensure that competition from escaped cultured Pacific oysters does not impact upon the native flat oyster population.			
Consequence C=4	**Likelihood L=1**	**Risk Rating C x L =4 Low**	**Target Risk Rating NA**
Risk Management Options • Wild oyster population changes as determined by regular DPIW surveys			
Suggested Performance Measures • Reporting of diseases from the Pacific Oyster Health Program			

1.2: CULTURED STOCKS / BUSINESSES (HUSBANDRY)

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

1.2.1: Genetics

Scope

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

Current Management Controls

A genetic improvement selective breeding program is operated by Australian Seafood Industries P/L (ASI) for Pacific oysters. The Tasmanian Oyster Research Council (TORC), the South Australian Oyster Research Council (SAORC) and the South Australian Oyster Growers Association (SAOGA) are all shareholders of ASI.

The program is based on an initial pool of selectively bred oyster lines. A quantitative geneticist is consulted to assist with the breeding plan, reduce the likelihood of inbreeding and maintain genetic diversity. Broodstock of family lines are available to the four Tasmanian hatcheries after consultation with ASI, growers and hatchery managers. Hatcheries may select stock for growth, shape, uniformity, tendency to not 'frill' on shell, and colour. More information on the ASI Genetic Improvement Program is available in Appendix 1.1.1.1.1.

In addition to the ASI program, individual hatcheries have their own selective breeding programs that have been operating for a number of years. The Industry does not invest in genetically modified organisms (GMOs). The conditions of triploidy or double haploidy, a condition where individual fish possess a greater number of chromosomes than normal, are not considered as GMOs under the *Gene Technology Bill 2000* or the *Tasmanian Gene Technology Act 2001*.

<table>
<tr><td colspan="4">Environmental Objective 1.2.1: To minimise the risk of introducing undesirable characteristics through cultured stock breeding programs by maintaining an appropriate level of genetic diversity of oysters.</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 of genetic programs</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Testing of genetic diversity in Tasmanian oyster stocks
• Seek industry feedback on performance of stock</td></tr>
</table>

1.2.2: Transfer of Disease Overseas and Interstate

Scope

To assess the risk of aquatic disease transfer through export and import of cultured Pacific and native flat oysters.

Current Management Controls

1.2.2.1: Import

Import into Australia of live oysters is controlled by Biosecurity Australia (DAFF) and would require a permit under the *Quarantine Act 1908* (QA) and the *EPBCA*. At present import of live shellfish into the country for marine farming purposes is not allowed. A policy, including an import risk assessment complying with the OIE International Aquatic Health Code 2004, would need to be developed at a national level before imports could occur.

The Standing Committee on Fisheries and Aquaculture has endorsed a National Translocation Policy for Live Aquatic Organisms. This policy paper does not oblige State Governments to impose any regulatory controls on the translocation of live aquatic organisms. Nonetheless, State Governments are bound by the *Mutual Recognition Act* 1992, which provides for recognition of regulatory standards between the states. Schedule 2 of the Act permits trade restrictions on the grounds of quarantine. All exemptions must meet the following criteria:

1. A law of the imparting State, or direction administered under that law, prohibits the importation of specified goods;
2. The State is substantially free of the disease;
3. It is reasonably likely that the goods would introduce the disease; and
4. It is reasonably likely that the introduction would have a long-term and substantially detrimental effect on the State.

Import of live oysters into Tasmania from South Australia is currently being addressed through a draft discussion paper. The risk assessment for import of oysters into Tasmania is based upon the Biosecurity Australia Guidelines for Import Risk Analysis Draft September 2001. Risk ratings above *Very Low* do not meet Tasmania's acceptable level of protection and risk management is required. Import of oysters from other states would require a similar risk assessment before approval. Further information on Risk Hazards associated with the import of Pacific oysters can be found in Appendix 1.2.3.

1.2.2.2: Export

The export of live Tasmanian oysters for consumption overseas is regulated by the *Export Control Act 1982* (ECA) under the *Proscribed Goods Act 2005*. These acts require all fish for export to be grown on licensed leases and harvested only when leases have an 'open' status as determined by the TSQAP program (DHHS: Section 1.2.3). Shellfish for export must be processed and packed in registered export premises, which operate under a quality based system audited by AQIS. Export to certain countries may also require a Health Certificate issued by AQIS under the

ECA. The European Union will only accept fish for direct human consumption and will not allow any imported fish to be released into any waters. The United States of America has previously applied stringent requirements dictated by the USFDA, but there is no protocol established at present.

The export of live oysters to be reinstated into the marine environment is covered by the ECA 1982 under the *Animal Orders Act* 2004, which requires the animals to be certified disease free (Section 1.2.2), and to comply with the health program and translocation policies of importing countries.

The translocation interstate of live Tasmanian oysters for ongrowing or as broodstock is governed by harvesting requirements stipulated by the *Public Health Act* 1997 under Section 29 (Section 1.2.4). Further conditions may be present from the relevant interstate Agencies. Primary Industries and Resources South Australia (PIRSA) has found Tasmanian produced oyster spat a low risk through an import risk assessment for the importation of live shellfish reared spat, covered in Section 1.2.4.1, Part B.

<table>
<tr><td colspan="4">Environmental Objective 1.2.2.1: To ensure that exotic mollusc diseases do not enter the state.</td></tr>
<tr><td>Consequence
C= 4</td><td>Likelihood
L= 1</td><td>Risk Rating
C x L = 4
Low</td><td>Target Risk
Rating
NA</td></tr>
<tr><td colspan="4">Environmental Objective 1.2.2.2: To ensure that diseases are not translocated from the state through export of oysters.</td></tr>
<tr><td>Consequence
C= 4</td><td>Likelihood
L= 1</td><td>Risk Rating
C x L = 4
Low</td><td>Target Risk
Rating
NA</td></tr>
<tr><td colspan="4">Risk Management Options
• Following 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 and relevant State Agencies
• Industry compliance with license conditions</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Annual reports of disease outbreaks from the Chief Veterinary Officer
• Written report provided to TORC Annual General meeting by the DPIW Fish Health Unit on the Pacific Oyster Health Program</td></tr>
</table>

1.2.3: Translocation of Invasive Marine Species Overseas & Interstate

This aspect is covered in 1.2.3: Translocation of Invasive Marine Species Part B.

1.2.4: Water Quality Assurance (Public Health)

Scope

To assess the risk of cultured Pacific and native flat oysters being unfit for human consumption.

Current Management Controls

The Tasmanian Shellfish Quality Assurance Program (TSQAP) is a water quality based surveillance program that assesses and classifies shellfish harvest areas. The classification is based on water quality criteria such as pollution, microbial loading and toxic substances (algal toxins, heavy metals, herbicides and pesticides). When water quality is unsuitable for the safe harvest of shellfish for human consumption, the shellfish farms are prohibited from harvesting under the program. When the water quality improves to a satisfactory level, harvesting may recommence. Since the program has been in operation, there has been no case of human sickness from the consumption of freshly harvested Tasmanian shellfish recorded by the DHHS Tasmanian (Ray Brown personal comment).

Further information on the TSQAP can be found in Appendix 1.2.4.

Environmental Objective 1.2.4: To ensure that oysters cultured in the Industry are safe for human consumption.			
Consequence C= 3	**Likelihood L= 1**	**Risk Rating C x L = 3 Low**	**Target Risk Rating NA**
Risk Management Options • Maintenance of the TSQAP Program			
Suggested Performance Measures • Annual third party audit of TSQAP against the ASQAP manual by AQIS			

1.3: OTHER SPECIES / COMMUNITY / PROCESS

The impact of oyster culture on marine ecosystem processes is potentially serious in uncontrolled conditions. The following topics cover the impacts of the Pacific oyster farming on ecological community processes and species within the marine community. The demise of the native flat oyster (*Ostrea angasi)* population, addressed in Chapter 2, is considered to be due to a combination of overfishing (Crawford 2003) and siltation from land clearing (Edgar in prep).

1.3.1 Disease

Scope

To assess the risk of disease from the cultured Pacific oysters or native flat oysters being passed to other fauna in the region.

Current Management Controls

The present day population of Pacific oysters in Tasmania does not harbour disease that is likely to be of significant impact to other marine fauna. Indigenous pathogens occur at low levels (Wilson et al 1993). The native flat oyster (*Ostrea angasi*) is infected with the serious pathogen *Bonamia* sp. (1.1.2.2 Disease). Evidence from Aboriginal middens show that the parasite is most likely endemic and other native marine species do not appear susceptible (Wilson et al 1993).

Regular surveillance of cultured and wild stocks of Pacific oyster and native flat oyster occurs under the POHP (Section 1.2.2) to maintain the disease free status. Transfer policies (Section 1.2.2.3 interstate and overseas, and Section 2.2.7 regionally) assist in preventing the likelihood of any diseases or pests being transferred into or around the state. The risk of potential disease introductions through the translocation of live oysters from South Australia has been identified by DPIW using risk assessment techniques (Table 1.1.2.2, Appendix 1.1.2.2). Risk management strategies are being developed for these diseases to prevent introduction and maintain the Tasmanian state *Perkinsus olseni/atlanticus* free status.

<table>
<tr><td colspan="4">Environmental Objective 1.3.1: To ensure that disease from farmed oysters is not passed to other marine fauna.</td></tr>
<tr><td>Consequence
C= 4</td><td>Likelihood
L= 1</td><td>Risk Rating
C x L = 4
Low</td><td>Target Risk
Rating
NA</td></tr>
<tr><td colspan="4">Risk Management Options
• Surveillance of native fauna at lease sites</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Monitoring changes in marine fauna population or disease status</td></tr>
</table>

1.3.2: Food Chain Impacts

Scope

To assess the potential risk of farmed oysters causing significant shifts in the food chain through consumption of natural phytoplankton.

Current Management Controls

Farmed oysters are totally reliant on the food available in the water column for growth (Section 1.3.3: Feed Composition). High densities of cultured shellfish may impact upon other filter feeders through the depletion of food. Competition between filter feeders for depleted food resources may alter the trophic structure of the culture area (Crawford 2003). Research measuring growth rates and densities of native filter-feeding shellfish has shown that there is no significant effect of Pacific oyster culture on competing filter-feeding shellfish within marine farms providing stocking rates are controlled (Hone 1996).

High densities of shellfish farming may cause disturbance to the natural populations of zooplankton in enclosed areas, due to increased competition for food. Management controls have been developed in consultation with Industry for the DPIW Marine Farming Development Plans. These controls limit the density of shellfish held on farms by limiting the amount of stocked racking, post and wire and longlines per hectare (Section 2.4.1 Regional Carrying Capacity). The stocking density of shellfish is controlled under Section 24 of MFPA.

As described in 1.3.3 Feed Composition, the industry regularly monitors the growth of its stocks to ensure maximal growth. Reduction in growth through overstocking has been recognised by the Industry as undesirable and has led to the voluntary reduction of stocking levels and lease area in some water bodies to ensure sustainability.

In hatchery and some nursery production, cultured phytoplankton is used to feed oyster larvae and spat. Further information on sustainable food sources for hatcheries is covered in Part B.

<table>
<tr><td colspan="4">Environmental Objective 1.3.2.1: To ensure that natural food sources are maintained for filter feeders.</td></tr>
<tr><td>Consequence
C= 3</td><td>Likelihood
L= 1</td><td>Risk Rating
C x L = 3
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</td></tr>
</table>

1.3.3: Chemicals

Scope

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

Current Management Controls

Generally, no chemicals are used or administered in oyster husbandry on marine leases. Any veterinary chemical use in the Industry is regulated by the *Veterinary Surgeons Act* 1987, the *Agricultural and Veterinary Chemicals (Control of Use) Act* 1995, and the *Poisons Act* 1971.

The supply and use of veterinary chemicals in Australia is controlled by the *Australian Pesticides and Veterinary* following 4 criteria:

- human and animal health and safety;
- efficacy – that the product works;
- environmental safety and
- that it will not affect international trade.

1.3.3.1: Preservative Treated Timbers

The industry uses timber that has been through a preservation treatment to construct the racking. The timber industry is required to produce approved and performance tested preservative treated timbers for use in the marine environment, following specifications from AS1604.1 2000. The use of approved CCA (chromium, copper, and arsenic) timbers sourced from renewable plantations is encouraged by the Industry. Some Industry members are in the process of looking at a suitable product made from recycled plastics as a viable alternative to treated timbers. Research has shown that there is insufficient evidence that treated timbers pose a threat to the marine environment (Scown and Cookson 1999).

Due to oysters being encapsulated in a shell, it is unlikely that they would ever come in direct contact with treated timber structures as found with univalves such as barnacles. Further information on preservative treated timbers can be found in Appendix 1.3.3.1.

Environmental Objective 1.3.3.1: To ensure that any preservative chemicals used in treated timber on marine farming infrastructure does not have significant impact upon the marine environment.			
Consequence **C= 1**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 1** **Low**	**Target Risk Rating** **NA**
Risk Management Options • Purchasing of only CCA-treated timber from approved merchants. • Sourcing cost effective alternative products to treated timbers.			
Suggested Performance Measures •			

1.3.4: Threatened & Endangered Species

Scope

To assess the impact of the Industry on threatened and endangered species.

Current Management Controls

The Industry is located in estuarine and coastal waters. Some of Industry may be located in areas adjacent to sensitive intertidal and wetland areas, and environments that may be shared with threatened and endangered species.

The location of intertidal and subtidal oyster leases is controlled by MFPA, which makes provision for zones where marine farming operations may occur. An environmental impact assessment, 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 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. More information on threatened and endangered species is covered at a regional level in Section 2.2.4 Threatened, Endangered and Protected species. Specific issues on interactions with protected or threatened species will be developed by industry on a regional basis (Section 2.2.4: Threatened/Endangered/Protected sp).

Environmental Objective 1.3.4: To ensure that the Industry does not impact on any threatened or endangered species.			
Consequence C= 4	**Likelihood L= 1**	**Risk Rating C x L = 4 Low**	**Target Risk Rating NA**
Risk Management Options • 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			

Aspect 1.3.5: Sensitive Habitats

Scope

To assess the impact of the Industry on sensitive habitats.

Current Management Controls

Although state planning processes are in place to ensure that the Industry is not located in areas where threatened species occur, oyster leases are often located in areas adjacent to seagrass beds and saltmarshes (some of which may be classified as sensitive).

1.3.5.1: Seagrass beds

Most studies have shown that the effect of shellfish biodeposits on seagrass is localised and short term. In Mexico, the benthic community structure under Pacific oyster culture has been shown to be typical of organically enriched areas, with the beds of the seagrass *Zostera marina* generally disappearing within two months of commencement of farming. *Z. marina* recolonised again about four months after the removal of oysters, with the invertebrates taking approximately six months to re-establish (Villarreal 1995). Similarly, Everett et al. (1995) observed in Oregon, USA, that the abundance of *Z. marina* declined in areas of Pacific oyster stake and rack culture to less than 25% compared to reference areas after one year of culture. In South Australia no significant differences in sea grass (*Posidonia sp.*) cover were detected between oyster growing sites (gaps between racks) and adjacent sites, but there was some localised loss under the seed trays due to shading (Hone 1996). Newell et al (2002) suggests that bivalves reduce turbidity and increase light penetration to the benthic substrate, which increases benthic primary production and allows increased seagrass growth.

The racking for oyster marine farming occupies only a small percentage of the total area of seagrass beds and hence has only a minor impact on the total seagrass. Adequate spacing between racks ensures that no large-scale loss of seagrass in any one area occurs. Licence Conditions for shellfish farms require:

> *There should be no unacceptable biological impact on the benthos outside the boundaries of the lease area. Unacceptable impacts would include, but not be limited to loss of seagrass other than in defined access channels.*

The Industry is aware of the importance of seagrass for the productivity of the marine environment and is pro-active in managing seagrass areas for minimal loss.

Environmental Objective 1.3.5.1: To ensure that oyster farming does not cause a long-term impact on seagrass beds outside the lease area.			
Consequence **C= 3**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 3** **Low**	**Target Risk Rating** **NA**
Risk Management Options • Boat traffic operate through defined navigation channels • Minimising physical contact with seagrass, including avoiding substrate compression			
Suggested Performance Measures • Marine farming inspectors reports • Continued TAFI mapping of seagrass beds around marine leases and ongoing assessment against the original baseline studies			

1.3.5.2: Supratidal saltmarsh

Scope

- To assess the impact of activities associated with Industry on saltmarsh habitat and its fauna.

Current Management Controls

Saltmarsh areas in Tasmania are generally poorly protected through regulation. Loss of saltmarsh from Industry activities is marginal. Marine farming leases that occupy areas adjacent to saltmarsh zones are careful to maintain the integrity of the environment by minimising operational activities in these areas.

The vascular plants of saltmarshes are referred to as halophytes (salt-loving plants). Saltmarshes around Tasmania occupy the upper intertidal zone that is not subjected to daily flooding by tides and are commonly dominated by the plant *Sarcocornia quinqueflora*. Saltmarsh is highly productive and has been reported to play a major role in cycling organic nitrogenous substances from coastal sediments (Boon and Cain 1988).

Threatened animals that live in the saltmarsh environment include the chevron looper moth (*Amelora acontistica*) and the saltmarsh looper moth (*Dasybela achroa*). Many coastal birds utilise the saltmarsh habitat for feeding and secure high tide roosts in areas adjacent to oyster leases (Section 2.3.3).

The impact on saltmarsh is generally regulated by Crown Lands licenses. Further information on saltmarsh communities is provided in Appendix 1.3.5.2.

Environmental Objective 1.3.5.2: To ensure that oyster farming does not cause a long-term impact on saltmarsh.			
Consequence **C= 2***	**Likelihood** **L= 3**	**Risk Rating** **C x L = 6** **Low**	**Target Risk Rating**

*Consequences may be greater at a regional level

Risk Management Options
- Education program for employees.
- Maintain clearly marked access points through saltmarsh areas.
- Direct any freshwater run off from land based facilities to clearly defined channels.
- Removal of invasive weeds (eg Rice grass, *Spartinia anglica*).
- Where practicable, locate new marine farming activities away from saltmarsh.

Suggested Performance Measures
- Monitoring of loss of saltmarsh vegetation at a regional level.

PART B: LAND BASED HATCHERY AND NURSERY FACILITIES

1.1: WILD STOCK OF CULTURED SPECIES

1.1.1: Collection of Wild Stock

Scope

To assess the impact of broodstock collection on wildstock.

Current management Controls

1.1.1.1: Broodstock collection

Conditions for the collection of Pacific and flat oysters for broodstock are covered by an authorisation under the LMRMA. A permit issued under Section 14 of the Act defines the number, size, area, method and conditions that fish are to be collected. Shellfish hatcheries are required to obtain wild broodstock from commercial harvesters operating under these conditions. No broodstock have been collected from the wild since the initiation of the ASI genetic improvement selective breeding program in 2000 (Section 1.2.1, Appendix 1.1.1.1.1).

1.1.1.1.1: Genetic Improvement

A genetic improvement program for the Industry is run by Australian Seafood Industries P/L (ASI). The role of ASI is to develop and maintain a selective breeding program. Background information on ASI is available in Appendix 1.1.1.1.1.

Each shellfish hatchery uses its own selection criteria for genetic traits to produce oysters for specific markets. Each batch of oysters is usually spawned from a large number of individuals and is tracked so a history can be provided. Individual hatcheries also have their own selective breeding programs with selected broodstock which have been developed over a number of years.

1.1.1.1.2: Abundance

Pacific oysters were originally introduced prior to marine farming and have now naturalised (Thompson 1959). There are no restrictions in relation to their collection as broodstock.

The abundance of the native flat oyster in Georges Bay, St Helens is surveyed on a regular basis by DPIW, prior to permits for collection being issued. The shellfish hatcheries are required to purchase any wild broodstock from licensed oyster harvesters.

Environmental Objective 1.1.1.3: To ensure that broodstock collection of Pacific oysters by Industry does not impact upon the wild populations of oysters.			
Consequence **C= 0**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 0** **Negligible**	**Target Risk Rating** **NA**
Environmental Objective 1.1.1.4: To ensure that broodstock collection of native flat oysters by Industry does not impact upon the native populations of oysters.			
Consequence **C= 1**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 1** **Low**	**Target Risk Rating** **NA**
Risk Management Options • Continued management of genetic strains of Pacific broodstock by hatcheries and ASI • Continued management of the wild flat oyster populations by DPIW			
Suggested Performance Measures • Wild oyster population changes as determined by DPIW surveys • Continued compliance with permit conditions			

1.2: CULTURED STOCKS / BUSINESSES (HUSBANDRY)

1.2.2: Transfer of Disease Overseas and Interstate

Scope

To assess the risk of aquatic disease transfer through movement of cultured Pacific and native flat oysters overseas and interstate.

Current Management Controls

1.2.2.1: Import

Import of live oyster spat into Australia and Tasmania covered in Section 8.1.3.2: Disease.

1.2.2.2: Export

The export of live Tasmanian oyster spat overseas for ongrowing is regulated by the ECA 1982 *Animal Orders* (2004). Export of oyster spat to overseas countries require:

- A health certificate issued by DPIW Animal Health Laboratories certifying a disease free status as required by DAFF.
- Permit to export animals or animal reproductive material issued by AQIS under the ECA 1982 *Animal Orders* 2004
- Pre-shipment treatment (such as temporary fresh water immersion to remove external biota followed by a period of depuration in sterile seawater) according to the requirements of the importing countries.

The translocation of live Tasmanian oysters interstate for ongrowing is governed by harvesting requirements stipulated by the *Public Health Act* 1997 under Section 29 (Section 1.2.4) and the export requirements of the destination. Further conditions may be present from the relevant interstate Agencies. Conditions for the export of spat to South Australia is provided in Appendix 1.2.2.2.

<table>
<tr><td colspan="4">Environmental Objective 1.2.2.3: To ensure that the export of oyster spat overseas and interstate does not result in the transfer of aquatic disease that may impact upon marine environment.</td></tr>
<tr><td>Consequence
C= 4</td><td>Likelihood
L= 1</td><td>Risk Rating
C x L = 4
Low</td><td>Target Risk
Rating
NA</td></tr>
<tr><td colspan="4">Risk Management Options
• Following export guidelines as set out by the OIE, AQIS and relevant State Agencies
• Maintain and build on existing protocol developed with the regulators</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Annual reports of disease outbreaks from the Chief Veterinary Officer
• Written report provided to Industry by the DPIW Fish Health Unit on the Pacific Oyster Health Program via the TORC</td></tr>
</table>

1.2.3: Translocation of Invasive Marine Species Overseas & Interstate

Scope

To assess the risk of invasive marine species being translocated overseas and interstate through Industry activities.

Current Management Controls

1.2.3.1: Import

Import into Australia of live oysters from overseas, controlled by Biosecurity Australia (DAFF), does not occur as described in Section 1.2.3.1:Part A.

Import of live oysters into Tasmania from South Australia or other Australian states is currently being addressed through the draft discussion paper discussed in Section 1.2.3: Part A. Transfer of potential invasive marine species (IMS) from the import of Pacific oysters has not been addressed through this process. The National Introduced Marine Pest Co-ordination Group (NIMPCG) is addressing the translocation of introduced marine pests between states through a risk assessment. Marine farming is only one of the vectors for translocation of IMS identified by NIMPCG. The other vectors include shipping, recreational and commercial vessels, and natural dispersal. At present, import of live adult Pacific oysters into Tasmania does not occur.

1.2.3.2: Export

The export of live Tasmanian oysters overseas is regulated through the ECA by AQIS, which requires live fish to be practically free from mud, weed, parasites or injury. Using the depuration process, described in Section 1.2.2 2 (Translocation of Diseases), assists in the elimination of IMS.

The export of live Tasmanian oysters interstate for ongrowing or as broodstock is also governed by harvesting requirements stipulated by the *Public Health Act* 1997 under Section 29 (Section 1.2.4). Oysters must also meet the import requirements of the destination. Fish are not allowed to be harvested from any waters where a bloom of the toxic dinoflagellate *Gymnodinium catenatum* is present in densities greater than 2000 cells per litre. PIRSA identified other invasive species including the Northern Pacific seastar (*Asterias amurensis*) and the Japanese seaweed *(Undaria pinnatifida*), using an import risk assessment.

Oyster spat is exported to New South Wales and South Australia. Translocation to other states requires protocols agreed to by local State bodies. The PIRSA (2001) Import Risk Assessment for the import of live shellfish spat recommended the following treatments:

- Northern Pacific seastar (*Asterias amurensis*): Exposure of immature seastars to salinities below 8.75 ppt is rapidly fatal. The adult seastars tolerance to low salinities is less clear but they are unlikely to survive low salinities for extended periods. Therefore oyster spat are required to be treated with freshwater for a period of 12 hours prior to translocation.
- Japanese seaweed (*Undaria pinnatifida*): There is potential for algal spores to remain viable within the saline environment of a live oyster during freshwater treatment. Oysters generally open their shell during seawater depuration and therefore would be expected to eliminate any viable *U. pinnatifida* spores. A depuration of 12 hours in filtered seawater is expected to provide a reasonable degree of risk reduction. Therefore oyster spat are required to be treated with freshwater for a period of 12 hours plus depuration in sterilised seawater for a period of 12 hours prior to translocation.

Further information on invasive marine species is provided in Appendix 1.2.3. No used oyster farming equipment is translocated either interstate or overseas.

Environmental Objective 1.2.3.1: To ensure that invasive marine species do not exit the state through export translocation of oysters.			
Consequence **C= 3**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 3** **Low**	**Target Risk Rating** **NA**
Environmental Objective 1.2.3.2: To ensure that invasive marine species that may impact on the marine environment, are not translocated from the state through export of oyster spat.			
Consequence **C= 4**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 4** **Low**	**Target Risk Rating** **NA**
Risk Management Options • Following translocation guidelines currently being developed through NIMPCG • Following export guidelines as set out by AQIS and relevant State Agencies • Inspect product prior to dispatch • Following export guidelines as set out by the OIE, AQIS and relevant State Agencies			
Suggested Performance Measures • Surveys through research and DPIW surveys on introduced marine pest range and abundance • Customer satisfaction surveys through research and DPIW surveys on introduced marine pest range and abundance • Annual reports of disease outbreaks from the Chief Veterinary Officer • Written report provided to Industry meeting by the DPIW Fish Health Unit on the Pacific Oyster Health Program for TORC			

1.3: OTHER SPECIES / COMMUNITY / PROCESS

1.3.2.2: Food Chain Impacts

Scope

To assess the impact to the food chain from hatchery reared oysters.

Current Management Controls

Shellfish spat are reliant on sustainable natural phytoplankton production occurring in growing areas supplemented with land based micro-algae production in bags, tanks or ponds. Larval cultures are reared solely on micro-algae produced within hatcheries. Biomass of stock in land based oyster facilities are negligible compared to the biomass of filter feeders in the surrounding marine community and would have no impact on phytoplankton levels. An unpublished study by Schultz and Blackburn found that no micro-algal species cultured in an East Coast hatchery had become established in the surrounding waters, and that the tropical species *Isochrysis* sp. (*T. Iso*) being fed to scallop spat was not viable in local waters.

Environmental Objective 1.3.2.2: To ensure that culture of oyster spat does not cause significant shifts in the food chain.			
Consequence **C= 1**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 1** **Low**	**Target Risk Rating** **NA**
Risk Management Options • Industry adoption of Australian micro-algal cultures after assessment and as they become available			
Suggested Performance Measures • Monitoring percentage usage of Australian strains compared to imported strains			

1.3.3 Chemicals

Scope

To assess the risk on the marine environment of using chemicals in Industry land based facilities.

Current Management Controls

Generally, only small amounts of chlorine disinfectant products are used for hygiene maintenance.

1.3.3.2: Chlorination/Dechlorination

Chlorination/dechlorination is a widely used, cheap, effective and acceptable method of disinfecting surfaces and equipment in the marine farming industry. Sodium hyporchorite ($NaOCl$), used as a common drinking water and pool water treatment, is available as commercial bleach. Great care is taken to neutralise the chlorine and prevent the discharge of residual chlorine into the environment by adding a sulfite salt such as Sodium Thiosulphate ($Na_2S_2O_3$). The advantage of this technique is that it protects aquatic life from the toxic effects of residual chlorine (EPA 2000). Only very small quantities of these chemicals, similar to domestic use, are used in the Industry.

Environmental Objective 1.3.3.2: To ensure that any chemicals used within Industry land based facilities do not impact upon the environment.			
Consequence **C= 2**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 2** **Low**	**Target Risk Rating** **NA**
Risk Management Options • Following manufacturers instructions • Maintaining a register of chemical usage • Reference to a Material Safety Data Sheet (MSDS)			
Suggested Performance Measures • Monitoring increase or decrease in chemical usage.			

Component 2: Regional Impact of Industry on the Environment

Introduction

The combination of a number of marine farming 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 lease and licence conditions 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.

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
- Vehicular Access (2.3.7).

Combinations:
- Behavioural Changes and Impacts from Component 1.3 and Scavengers from Component 2.2 have been incorporated into Section 2.2.6: Behavioural Changes and Impacts on Other Species (Migratory & Scavengers).
- World Heritage Areas, Marine Protected Areas and Ramsar sites have all been combined in Section 2.2.5 Protected Habitats.

Exclusions:
- Water Extraction (ground or freshwater: under Section 2.1 Water Quality/Quantity). Oyster farming does not extract freshwater from groundwater sources. Freshwater usage in the Industry is only at domestic levels.
- Seepage (under Section 2.1 Water Quality/Quantity). Land based ponds are not used by the Industry on marine farming 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.

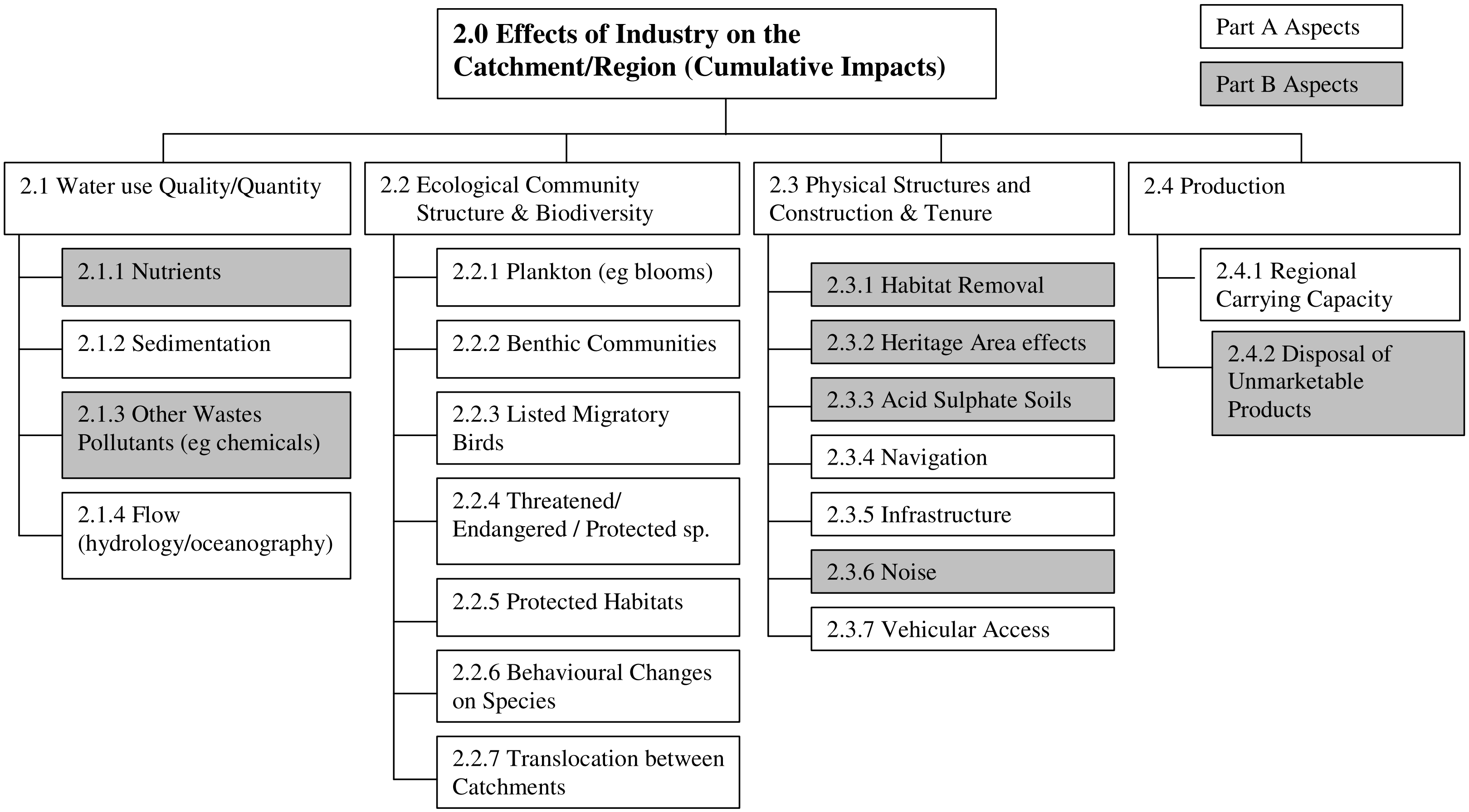

Figure 2.0. Component Tree2: Regional impact of the oyster industry on the environment

- Sensitive Habitats (under Section 2.2: Ecological Community Structure and Biodiversity) has previously been covered under Section 1.3.5: Sensitive Habitats.
- Water Table (under Section 2.3: Physical Structure and Construction & Tenure) is considered to be a local aspect and therefore delivered as guidance notes in Component 3.
- Aspect 2.4.2: Disease is covered on a whole of Industry basis in Component 1 (see Sections 1.1.2.2, 1.2.2, and 1.3.1 on Disease). Tasmania is considered a single region under OIE guidelines, therefore the risk assessment is the same as for 1.2.2 Disease of Cultured Stocks.
- Processing of oysters does not occur on marine farms; therefore processing wastes are not covered under Component 2.4 Production.

Part A assesses the impact of the marine farming leases and facilities on the environment. Part B assesses the impact of land based hatchery and nursery facilities on the environment, not covered by marine farming lease and facilities, due to different governing authorities. The issues (or aspects) covered by Part B are shaded in Figure 2.0. The risk assessment for all issues (or aspects) have used the General Consequence Table (Appendix 1.0; Table 1.1)

PART A: MARINE LEASES AND FACILITIES

2.1: WATER USE QUALITY/QUANTITY

Good water quality is a crucial factor in successful oyster farming. This component assesses the potential water quality issues within a catchment or region from the cumulative impact of oyster culture.

2.1.1: Nutrients

This issue assesses the impact on water quality from nutrients associated with oyster 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 affecting the marine environment

Current Management Controls

2.1.1.1: Industry Inputs

Shellfish are filter feeders that consume phytoplankton and detritus from waters they are growing in. No exogenous food sources are used in oyster culture on marine farms. The material digested by the oysters is converted to shell and meat and harvested by the marine farmers. Faeces and pseudofaeces are by-products from oysters and deposited into the environment to be utilised by micro-organisms and benthic fauna present in the area. Utilisation of this material will vary according to current flow, the amount deposited, number and types of micro-organisms and benthic fauna present (Mitchell 1999). The concentration of a large number of shellfish in a region may lead to the build up of excretions in the sediments under the racks or baskets. The degree of deposition will depend on stocking density and current flow in a particular region. Bacteria in the sediments also play an important role in removing nitrogen from oyster wastes in the marine system (Newell et al 2003).

Environmental problems may potentially occur if deposits are excessive and the utilisation rate is low, leading to a depletion of oxygen in the benthos. Such conditions are detrimental to the growth of shellfish but have not been a problem in Tasmania. This is most probably due to relatively low stocking densities, high current flows and farm management (Mitchell 1999). Management controls on stocking densities ensure minimal nutrient input to associated water bodies and are described in Section 2.4.1: Regional Carrying Capacity.

2.1.1.2: Nutrient Removal (filter feeders)

Oysters play a vital role in nutrient recycling in the marine-based ecosystem. Oyster reefs, as a whole, act as a biofilter to remove phytoplankton and are also important for nutrient cycling (Dame et al 1984). Oysters take up organic carbon and chlorophyll *a* from the water column and release ammonium. This process prevents carbon being available to the bacterial community that may lead to increased biological oxygen demand (BOD) and anoxia in the sediments (Newell 1988). An ecosystem model based on nitrogen cycling and oxygen developed for a Mediterranean lagoon showed that Pacific oysters are responsible for regenerating primary productivity through releasing nitrogen during the dry periods of summer (Chapelle et al 2000).

Filter feeding molluscs such as oysters remove nitrogenous particles from the water, and incorporate a large proportion in their tissues. A commercial harvest of oysters can compensate for a high level of anthropogenic (human) inputs by removing large amounts of nitrogen from the water. The Japanese are currently using oyster farming techniques as an "economically sustainable method of cleaning water affected by eutrophication" (Anon 2004).

Stocking density of farmed shellfish is controlled through enforceable marine farming license conditions to ensure that the concentration of plankton is not reduced such that it impacts upon other marine organisms (under Section 24 of MFPA 199; covered further in Section 1.3.5).

<table>
<tr><td colspan="4">Environmental Objective 2.1.1.1: To minimise any negative impact of oyster farming activities on nutrient cycling in the marine ecosystem.</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
• Adherence to the DPIW Marine Farming licence management controls on carrying capacity</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Oyster growth and health
• Future sediment analysis on marine farms</td></tr>
</table>

2.1.2: Sedimentation

Scope

To assess the impact within a region of sedimentation or erosion.

Current Management Controls

Most structures such as intertidal racks, trestles or longlines used for shellfish culture alter the hydrodynamics of an area to some degree (Kaiser et al 1998). Oyster farms are located in areas of adequate current flow to prevent scouring or accumulation of sediment around the farm structures.

Results of sedimentation studies undertaken on intertidal oyster farms in South Australia did not detect any increase or decrease in the sediment associated with oyster leases, largely due to the coarse sediments and naturally low levels of sediment in the water (Hone 1996). The impact of sedimentation often occurs in the area immediately underneath the racks. At low stocking densities, the effects of oyster cultivation are relatively benign and highly localised (Kaiser 2001). Preliminary work in Tasmania indicates the biodeposition rate in the lease area depends on the characteristics of the water body, including natural changes in an estuarine system (Iona Mitchell DPIW personal communication).

DPIW require subtidal and intertidal shellfish leases to complete a baseline survey as described in Schedule 4 (Appendix 8.2.3.2). This survey depends upon the culture method used and whether the marine farming lease occupies new water or has been previously farmed, and includes current flow information and a bathymetric profile, and identification of seabed characteristics. The purpose of establishing baselines is to enable surveys to be conducted on subtidal and intertidal leases from time to time if necessary to look for any temporal changes.

Environmental Objective 2.1.2: To minimise any changes to sedimentation from oyster farming activities.			
Consequence **C= 2**	**Likelihood** **L= 2**	**Risk Rating** **C x L = 4** **Low**	**Target Risk Rating** **NA**
Risk Management Options • Maintain current stocking densities			
Suggested Performance Measures • Water depth observation • If necessary, comparison of bathymetric profile with baseline survey			

2.1.3: Other wastes/pollutants

Scope

To assess the impact of pollutants (eg. Hydrocarbons, chemicals) at the regional scale.

Current Management Controls

No chemicals are directly used on marine leases in the husbandry of oysters. However, equipment such as boats and tractors use hydrocarbon fuels.

2.1.3.1: Hydrocarbons

Boats and tractors used in marine farming utilise hydrocarbon fuels which have a potential cumulative impact on the marine environment. The vessels are typically used for a short duration and the likelihood of impact is considered minimal.

Industry has been encouraged to use synthetic oils, fuel-injected outboard motors (Appendix 2.1.3) 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.

Environmental Objective 2.1.3.1: To ensure that hydrocarbon pollution does not occur from oyster farming activities.			
Consequence C= 1	**Likelihood L= 1**	**Risk Rating C x L = 1 Low**	**Target Risk Rating NA**
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.			
Suggested Performance Measures • Regionally reported hydrocarbon spills.			

2.1.4 Flow: (hydrology / oceanography)

Scope

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

Current Management Controls

The density of racking and longlines per hectare are determined through management controls contained in the MFDP to minimise the impact on hydrological flows. Where possible, oyster farms are located in areas of high current flow and exchange rate to maximise productivity. The predictive model of carrying capacity for oyster growing regions was developed after assessment of the flow, velocity and flushing rate of areas at different tidal heights (see Section 2.4.1: Carrying Capacity for further information). DPIW require subtidal and intertidal shellfish leases to complete an initial monitoring survey as described in Schedule 4IH (Appendix 8.2.3.2) including current flow direction

Environmental Objective 2.1.4: To ensure that oyster farming leases do not impact upon the natural hydrology of the catchment regions.			
Consequence C= 2	**Likelihood L= 1**	**Risk Rating C x L = 2 Low**	**Target Risk Rating NA**
Risk Management Options • Compliance with management control			
Suggested Performance Measures • Observation of significant changes in hydrology around marine leases			

2.2: ECOLOGICAL COMMUNITY STRUCTURE AND BIODIVERSITY

This component addresses the potential direct and indirect impacts on the catchment or 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 oyster farms in changing the frequency, intensity or composition of plankton blooms (algal, zooplankton or both, including toxic species) in a region.

Current Management Controls

Marine farming of oysters has minimal nutrient input to a region (Section 2.1.1.1: Industry Inputs) and is therefore unlikely to be associated with any increase in plankton bloom frequency, intensity or changed composition. Pacific oysters fill an important ecological niche left by the reduction in native flat oyster populations by selectively grazing phytoplankton species.

Primary production in Australian waters is generally low compared with temperate waters overseas, largely because of the limited availability of essential nutrients (Crawford 2001). As a result of this, densities of phytoplankton available for consumption by shellfish is likely to be low in Tasmania compared to many shellfish growing areas overseas. Predictive models for carrying capacity of oysters for growing areas in Tasmania have been developed (Crawford et al 1996, Crawford & Mitchell 1999) to assist in determining the stocking density of shellfish.

In regions where excessive algal blooms occur, oyster marine farming can have a positive effect in reducing phytoplankton blooms. Toxic phytoplankton blooms are monitored through TSQAP to ensure oysters are fit for human consumption (Section 1.2.4: Water Quality, Appendix 1.2.4). There is no documented link between the presence of toxic algal blooms and oyster production.

Environmental Objective 2.2.1: To ensure that oyster farms in a region do not significantly alter plankton bloom frequency, intensity or composition.			
Consequence **C= 2**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 2** **Low**	**Target Risk Rating** **NA**
Risk Management Options • Monitoring of phytoplankton and zooplankton species			
Suggested Performance Measures • Ongoing assessment of productivity of oysters • Ongoing assessment of productivity of local waters			

2.2.2: Benthic Communities

Scope

To assess the impact of oyster farming activities in regions to the benthic community.

Current Management Controls

Shellfish produce solid wastes - faeces and pseudofaeces - that consist of particulate organic and inorganic matter bound together by mucus into larger particles. These particles have a fast settling rate and are generally deposited in higher concentrations near marine farms. The stocking density and environmental conditions such as temperature, salinity, phytoplankton concentrations and turbidity, will affect the rate of production faeces and pseudofaeces by shellfish (Crawford 2001). The rate of accumulation or dispersion of the biodeposits also depends upon the velocity and direction of water currents around the farm, especially water movements close to the seabed.

Most studies on organic enrichment of the seabed from shellfish farming have concluded that the effect is small, and much less than that caused by finfish farming, (Buschmann et al 1996). Environmental conditions and the benthic community structure show greater variation between farming sites than between culture and reference areas, suggesting that shellfish farming appears to be having little effect on the environment (Thorne 1998). Mitchell (2001) investigated the biodeposition rate on an oyster farm at Pipe Clay Lagoon and concluded that the organic matter content of the sediments was low (1.9-2.5%) and that biodeposits were most likely being transported from the lease area and deposited or utilised elsewhere.

Other criteria demonstrating benthic health, such as fluxes in oxygen consumption and ammonia production in the sediments, have been shown to differ less between sites with Pacific oyster farms and control sites than that of seasonal variability (Mazouni et al 1996).

Dredging of oyster beds is common practice in many parts of the world and has been widely reported in the literature to cause major habitat and community changes (Crawford 2001). This practice is not used by the Industry.

Site selection is important to reduce impacts on the seabed under shellfish farms. Farms located in areas of poor current flow (less than or equal to ~5 $cm.s^{-1}$), are much more likely to result in accumulation of organic wastes and develop anoxic sediments (Crawford 2001). Current farm management practises involve the selection of sites and stocking densities appropriate to the environmental conditions of the farm to minimise the impact on the benthic environment.

DPIW requires subtidal and intertidal shellfish leases complete baseline surveys as described in Schedule 4IH, 4B and 5B (Appendix 8.2.3.2). This initial survey includes sediment analysis, visual assessment and redox and biological analysis of infauna for subtidal leases. Further to this, DPIW undertake an annual monitoring survey by underwater video to assess impacts.

Environmental Objective 2.2.2: To ensure that the Industry does not result in region wide changes to the benthic community.			
Consequence **C= 3**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 3** **Low**	**Target Risk Rating** **NA**
Risk Management Options • Adherence to current stocking density controls			
Suggested Performance Measures • Changes in the benthic ecology of the catchment outside the boundaries of the marine lease area as shown by research			

2.2.3: Listed Migratory Birds

Scope

To assess the impact of oyster farming activities on migratory birds protected under international agreements and the EPBCA.

Current Management Controls

Migratory coastal and shorebirds are often found throughout the year adjacent to oyster growing regions, due to many marine farming lease areas being located in intertidal shoreline habitats. The location of marine farming leases is carefully considered through the MFPA to ensure that oyster farming activities have minimal impact upon migratory bird species (Section 1.3.5:Threatened & Endangered Species; Section 2.2.6: Behavioural Changes and Impacts; Section 2.2.4: Threatened/Endangered/Protected sp; Section 8.2.3.1: Regulations).

Research in the USA on wintering shorebirds showed that the distribution of plovers, godwit, and sandpipers was not significantly affected by the presence of oyster workers or aquaculture equipment on oyster leases (Kelly et al 1996). Their study showed that species richness did not differ between aquaculture and control sites. Oyster farming structures such as racks have not been found to affect the feeding behaviour of shorebirds, including oystercatchers and curlews (Hilgerloh et al. 2001). Local experience is that birds have been observed to forage on top of and between oyster racks.

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

Environmental Objective 2.2.3: To ensure that the oyster farming activities do not impact upon listed migratory bird species in a detectable or significant manner.			
Consequence C= 3	**Likelihood L= 1**	**Risk Rating C x L = 3 Low**	**Target Risk Rating NA**
Risk Management Options • MFPA controls over the location of farms			
Management Options • Development of an oyster farming protocol for protection of migratory bird species in association with Birds Tasmania, documented in Appendix 2.2.3.1			
Suggested Performance Measures • Use of a migratory bird species diary by Industry to record sightings in the area surrounding the lease, developed in association with Birds Tasmania			

2.2.4: Threatened, Endangered & Protected Species

Scope

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

Current Management Controls

The location of intertidal and subtidal oyster leases is subject to an environmental impact assessment (EIA) process prior to approval being given through the State Planning Process. The EIA process ensures that farms are placed away from threatened species populations and do not encroach upon sensitive habitat.

Many oyster farming leases are located in areas rich in native species diversity and include species that are closely associated with the marine environment. A number of these species are protected under the LMRMA and have also been listed as rare, endangered, threatened or vulnerable under the *Threatened Species Protection Act* 1995 (TSPA) and the EPBCA. These species are listed in Appendix 2.2.4: Table 2.2.4.

The Industry recognises the importance of species diversity in the ecosystem and has an awareness regarding the need for appropriate management of threatened species. Coastal or shore birds are regarded as the species most 'at threat' from marine farming activities by their use of the coastal zone. Limited research in the US has found that there is no difference in species richness between marine farming and non-marine farming sites. Seasonal patterns demonstrated that some bird species avoided oyster marine farming sites at certain times of the year, with other bird species being attracted to oyster marine farming sites (Kelly et al 1996). Evidence collected from the American study also suggested that:

- Foraging shorebirds generally concentrate along the edge of the falling or rising tide; whereas
- Oyster growers concentrate their operations on the intertidal strata with particular tidal exposure regimes.

Therefore shore bird and oyster farming activities are unlikely to conflict and would likely result in very small losses in the extent or quality of available feeding habitat. More information on shorebirds can be found in Section 2.2.6: Behavioural Changes and Impacts, and in Section 2.2.3 Listed Migratory Birds.

The threatened or endangered terrestrial animals with specific habitats have been identified through the Marine Farming Planning Process. The largest impact on threatened insects comes from the use of chemicals and pesticides (not used in the Industry), or the loss of native vegetation. The presence of threatened marine mammals is unusual in oyster farming regions but is increasing with the rise in marine mammal populations. No marine farming zones are located in areas where the live-bearing sea star *Pattiriella vivpara* is found or on its preferred substrate. Protection of a stable habitat is required for the sustainability of the Industry, enhancing the protection of threatened marine species.

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

<table>
<tr><td colspan="4">Environmental Objective 2.2.4: To ensure that the Industry maintains minimal interaction with any threatened, endangered or protected species.</td></tr>
<tr><td>Consequence
C= 3</td><td>Likelihood
L= 1</td><td>Risk Rating
C x L = 3
Low</td><td>Target Risk Rating
NA</td></tr>
<tr><td colspan="4">Risk Management Options
• MFPA controls over the location of farms
• Development of a protocol for emergency response to marine mammal entanglement</td></tr>
<tr><td colspan="4">Management Options
• Development of an oyster farming protocol for protection of endangered and threatened bird species in association with Birds Tasmania, documented in Appendix 2.2.3.1</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Use of a rare and endangered species diary to record sightings in the area surrounding the lease, developed in association with Birds Tasmania
• DPIW surveys for threatened and endangered species</td></tr>
</table>

2.2.5: Protected Habitats

This aspect also considers whether the development is a referable action under the *EPBCA* 1999. Detail on specific sensitive habitat such as seagrass beds and saltmarsh is provided in Section 1.3.5: 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-listed wetlands, Marine Protected Area, or a sensitive habitat.

Current Management Controls

Some oyster growing regions are located adjacent to areas listed under the Ramsar Convention on Wetlands (1971). The broad aim of the Convention on Wetlands is to halt the worldwide loss of wetlands and to conserve those that remain through wise use and management.

Impacts to Ramsar wetlands are controlled under the EPBCA's assessment and approval provisions. Under this Act, a person must not take an action that has, will have, or is likely to have, a significant impact on the ecological character of a Ramsar wetland, without approval from the Australian Environment Minister. To obtain approval, the action must undergo a rigorous environmental assessment and approval process. Management plans for Ramsar wetlands must be consistent with Australia's obligations under the Ramsar Convention and with the Australian Ramsar Management Principles.

For the Pitt Water/Orielton Lagoon Ramsar site, it is considered that the marine farming operations proposed within the Pitt Water Marine Farming Development Plan, June 2001, fall within the principles of "wise use" as described by the Ramsar Convention and that generally impacts from marine farming leases on bird species will be minimal (DPIW 2001). Oyster farming marine leases do not adjoin any World Heritage sites, or Marine Protected Areas. Further information is provided in Appendix 2.2.5: Protected Habitats.

Environmental Objective 2.2.5: To ensure that the Industry does not impact upon any protected area.			
Consequence **C= 3**	**Likelihood** **L= 2**	**Risk Rating** **C x L = 6** **Low**	**Target Risk Rating** **NA**
Risk Management Options • Marine farm inspections by DPIW			

2.2.6: Behavioural Changes and Impacts on Other Species (Migratory & Scavengers)

Scope

To determine the impact of Industry causing "large-scale" changes to the behaviour of other species.

Current Management Controls

The presence of large volumes of shellfish and the associated faeces and pseudofaeces may attract marine animals and shore birds to the area. Similarly, the presence of people, vessels and marine structures may alter some behaviour of wild populations. Anecdotal evidence from farmers suggests an increase in marine predator grazing under the oyster farm racks does occur.

The activity and location of marine farm leases are controlled under the MFPA through the EPBCA, whose objectives are to protect native species (and in particular prevent the extinction, and promote the recovery, of threatened species) and to ensure the conservation of migratory species. Marine farm leases are also controlled under the *Resource Management Planning System* (RMPS). The RMPS comprises of a number of Acts that ensure the Industry is not located in sensitive areas, and has the appropriate management controls to ensure that the impact upon sensitive species is minimal (Section 8.2.3 Regulations). To date there is no evidence that oyster farming activities have positive or negative impacts on the behaviour of any animal species.

Table 2.2.6. Migratory species listed in the EPBCA, excluding birds (Covered in Section 2.2.3). E = endangered, V = vulnerable.

Common name	Scientific name	Region										
		Status	1. North West	2. Port Sorrel	3. Georges Bay	4. Great Oyster	5. Blackman	6.Norfolk	7. Pitt Water	8. Pipe Clay	9. Channel	10.Huon/Esprenc
Marine Animals												
White shark (P)	*Charcharodon charcharias*	V	-	-	-	-	-	+	-	-	+	+
Marine Mammals												
Blue whale	*Balaenoptera musculus*	E	-	-	-	+	-	+	-	-	+	+
Humpback whale	*Megaptera novaengliae*	E	-	-	-	+	-	+	-	-	+	+
Southern right whale	*Eubalaeba australis*	E	-	-	-	+	-	+	-	-	+	+
Reptiles												
Leatherback turtle	*Dermochelys coriacea*	V	+	-	+	-	-	+	-	+	+	-

Migratory species covered by the EPBCA are listed in Table 2.2.6, excluding birds, dolphins, porpoises and turtles (from the *Cheloniidae* family). Issues regarding the impact of oyster farming on listed migratory birds under the EPBCA are comprehensively covered in Section 2.2.3: Listed Migratory Birds. Oyster farms are generally located in shallow embayments that do not accommodate large marine mammal or reptile migrations, and are therefore unlikely to affect these species.

<table>
<tr><td colspan="4">Environmental Objective 2.2.6: To prevent any large-scale impact of oyster farming activities on the behaviour of marine and terrestrial species.</td></tr>
<tr><td>Consequence
C= 2</td><td>Likelihood
L= 1</td><td>Risk Rating
C x L = 2
Low</td><td>Target Risk Rating
NA</td></tr>
<tr><td colspan="4">Risk Management Options
• Regular surveys of migratory species by stakeholder groups
• Observation of animal behaviour by farm workers</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Long term changes in the numbers of migratory species
• Noted changes in animal behaviour by farm workers or local wildlife authorities
• Assisting Birds Tasmania in surveys of birds for comparison with historical data</td></tr>
</table>

2.2.7: Translocation Between Regions

National and State requirements are described in Section 1.2.3: Translocation of Invasive Marine Species (Export & Import).

Scope

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

Current Management Controls

There is potential for translocation of invasive marine species (IMS) through the movement of oyster stock around the state. Marine leases around Tasmania vary in the primary productivity making it necessary to transfer stock from one region to another. This is done to enhance production and fatten stock for market. The movement of oysters does not usually involve the movement of marine farming equipment, reducing the vectors by which pests may be translocated.

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. The known distribution of invasive marine species can be found in Appendix 2.2.7. Table 2.2.7. Only a small percentage of the introduced species are considered to be invasive species. These Industry has recognised the need for a Industry-wide Translocation Policy, currently being developed through Industry representative and Government consultation.

The transfer of hatchery spat interstate is also controlled through a protocol, as described in Section 1.3.1 Disease; Part B. National protocols are covered in Section 1.2.3 Translocation IMS.

Environmental Objective 2.2.7: To ensure that the Industry does not contribute to the spread between catchments of invasive marine species through oyster farming activities.			
Consequence **C= 4**	**Likelihood** **L= 4**	**Risk Rating** **C x L = 16** **High**	**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. • Development of methods for decreasing risk of translocation of IMS			
Suggested Performance Measures • Records of stock examination for IMS prior to translocation to be recorded by Industry • 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. The impacts assessments are based on the racks and lines within the marine farming leases and the sheds associated with the marine farming leases. The impact of land-based hatchery and nursery facilities are covered in Part B of this document.

2.3.1: Terrestrial Habitat Removal

The construction of oyster farming land based facilities, incorporating the removal of terrestrial habitat is the jurisdiction of local councils and Crown Land Services, and is covered in Part B of this document.

2.3.2: Heritage values

The heritage value of old buildings and historical sites is covered in Part B of this document.

2.3.3: Soil Quality

The presence of marine farming leases is unlikely to impact on soil quality. Any impact of the land-based facilities associated with marine leases is covered in Part B of this document.

2.3.4: Navigation

The level of impact will depend upon the siting of the equipment.

Scope

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

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 are permitted 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 Section22: Approved lights and daymarks for shellfish 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.

Environmental Objective 2.3.4: To ensure that the marine farming structures do not pose a navigation hazard regionally.			
Consequence **C= 3**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 3** **Low**	**Target Risk Rating** **NA**
Risk Management Options • Adherence to MAST controls and regulations			
Suggested Performance Measures • Licence non-conformances			

2.3.5: Infrastructure

Scope

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

Current Management Controls

The local council is the jurisdiction that controls infrastructure development under the local planning scheme. Local council is consulted with regard to the development of marine farming plans under the MFPA. Local councils 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.

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** **NA**
Risk Management Options • Compliance with planning schemes			
Suggested Performance Measures • Local Government assessments			

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 outboard motors 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.

Guidelines and regulations from the EMPCA control noise emissions in Tasmania. Management controls in the MFDP require compliance with the DPIW noise policy. Local government may stipulate noise level controls for land based facilities under EMPCA. For further information see Part B of this document.

Environmental Objective 2.3.6: To ensure that noise levels from the Industry does not impact upon the local environment.			
Consequence **C= 1**	**Likelihood** **L= 4**	**Risk Rating** **C x L = 4** **Low**	**Target Risk Rating** **NA**
Risk Management Options • Adherence to controls stipulated by EMPCA, DPIW and local council • Production of an Industry Code of Conduct for noise control			
Suggested Performance Measures • Non-conformance notices and complaints			

2.3.7: Vehicular access

Scope

To assess the impact of vehicular access to the water by the Industry on the environment.

Current Management Controls

Because of variations in the geology, tidal height and roughness of water, the Industry uses a variety of vehicles such as tractors, cars or vehicular based boats to launch and retrieve vessels and/or service the marine farming leases. These vehicles are usually launched from boat ramps but occasionally from beaches. The access controls to the foreshore depends upon the conditions stipulated in each Crown Land license. It is the responsibility of the license holder to comply with these licence conditions.

Vehicles driven from sheds to the lease sites via the beach may cause physical disturbance as a result of compaction and dispersal of the sediment. Heavy vehicular traffic may cause differences in species composition and abundance of epibenthos and infauna between access lanes and underneath oyster trestles (de Graves et al. 1998).

A recent Tasmanian study by MacLeod et al (in press) to assess the impact of the vehicles on the benthos, using Pipe Clay Lagoon as a case study, found that infaunal changes that occurred as a result of vehicular traffic were relatively minor. Species composition was generally not affected and species abundance was only reduced in the highest impact areas in the littoral zone (between high and low tide mark) were vehicles were driven on the same course. The impact was least in the intertidal zones where multiple tracks were used.

This study will assist in defining management controls for the use of vehicles with regard to benthic health. Operational practices will also need to consider the effects on the roosting, feeding and nesting activities of shorebirds in the area (Sections 2.2.3: Listed Migratory Birds and 2.2.4: Threatened/Endangered/Protected Species).

When considering the industry as a whole, the environmental impact of vehicular access is low risk. However, because of regional variation, this aspect needs to be considered further at an individual facility or group level. (Section 3.2.2.8)

Environmental Objective 2.3.7: To ensure that vehicular access to marine leases by the Industry minimises impact upon the local environment.			
Consequence C=2	**Likelihood* L=3**	**Risk Rating C x L =6**	**Target Risk Rating Low**
Risk Management Options • Protocol for use of vehicles on intertidal areas • Determine impact of vehicle use on seabird activities • Audit of controls by Crown land license			
Suggested Performance Measures • Biannual comparison by TAFI/DPIW of sediment status to baseline data.			

* may vary regionally

2.4: PRODUCTION

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

2.4.1: Regional Carrying Capacity

The impact of oysters on the food chain is also covered in Section 1.3.2: Food Chain Impacts.

Scope

To assess the impact of stocking density on other marine fauna or flora within the region.

Current Management Controls

The Industry has played an active role in ensuring that the maximum carrying capacity of a region is determined on the basis of sustainable development, and are aware that overstocking of a water body is detrimental to oyster productivity in a region.

The important factors to be considered in estimating carrying capacities of growing areas are the amount of phytoplankton available, the rate of replenishment and quality of the phytoplankton consumed by the oysters. Crawford et al undertook a detailed study on five oyster growing areas (1996: Pitt Water, Pipe Clay Lagoon, Little Swanport Lagoon, Georges Bay and Simpson's Bay). This study determined the environmental parameters that affect the growth of oysters, the transport of food and the regeneration rate of phytoplankton, such as temperature and nutrient concentrations. A one-dimensional carrying capacity model was developed for oyster farming in the Pitt Water area. The data from this predictive model were used in the preparation of the Marine Farming Development Plans (MFDP) in other regions, taking into consideration local conditions. Annual production in relation to the area used by shellfish leases is shown in the Description of Industry.

Licensees are required, through management controls contained in the MFDP to abide by the following conditions:

- 1.1 km of stocked racking per hectare of lease area; or
- 4.4 km of stocked post and wire farming equipment (commonly known as the BST system) per hectare of lease area; or
- 1.1 km of stocked effective backbone longline per hectare of lease area;
- Containers of oysters in intertidal lease areas must be clear of the seabed and there shall be no layering of containers on the racking;
- All longlines and associated equipment other than moorings for shellfish must be maintained at least 1 metre clear of the seabed.

The introduction of the MFPA in 1995 has resulted in the reduction of marine farming and leasable area in some regions that were previously over allocated.

Environmental Objective 2.4.1.1: To ensure that carrying capacity of a region is sustainable with no adverse impacts on other marine fauna or flora.			
Consequence C= 3	**Likelihood L= 1**	**Risk Rating C x L = 3 Low**	**Target Risk Rating NA**
Risk Management Options • Adherence to controls stipulated by DPIW			
Suggested Performance Measures • Non-conformance notices • Decreased oyster productivity of a region			

2.4.2: Disposal of unmarketable waste

Scope

To assess the impact of significant quantities of unmarketable waste.

Current Management Controls

Oyster shell and dead oysters are disposed of according to the Local or State Government regulations. Most oyster waste is shell from dead oysters that may be buried in land fill, or crushed for use as road base. Some oyster shell is also crushed and utilised as garden mulch. Disposal of generated waste is regulated by LUPA (for less than 100 tonne per annum).

Biodeposition may occur when the oyster racks are cleared of algae and ascidians. Most of this material is consumed by scavengers or settles in areas away from the lease sites (Mitchell 2000).

<table>
<tr><td colspan="4">Environmental Objective 2.4.2.1: To ensure that disposal of unmarketable waste does not impact upon the region.</td></tr>
<tr><td>Consequence
C= 1</td><td>Likelihood
L= 1</td><td>Risk Rating
C x L = 1
Low</td><td>Target Risk
Rating
NA</td></tr>
<tr><td colspan="4">Risk Management Options
• Disposal as under licence conditions, local council regulations
• Research alternative markets for recycling</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Non-conformance notices</td></tr>
</table>

PART B: LAND BASED HATCHERY AND NURSERY FACILITIES

2.1.1: Nutrients

Only nutrient input is considered relevant for land-based facilities.

Scope

To assess the impact of nutrients from land-based facilities on water quality.

Current Management Controls

Shellfish feed on phytoplankton and detritus obtained from the waters that they grow in. Shellfish hatcheries grow phytoplankton cultures to supplement background levels available in the seawater (Chapter 2). These cultures require additional input of nutrients to promote growth of the high density cultures. The nutrient media is used at very low concentrations and most nutrients are absorbed by the phytoplankton. The nutrient output is believed to be comparable to the natural nutrient levels of seawater.

Environmental Objective 2.1.1.2: To ensure that the Industry land-based hatchery and nursery facilities are not significant contributors to nutrient input into designated water bodies.			
Consequence **C= 2**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 2** **Low**	**Target Risk Rating** **NA**
Risk Management Options • Maintain current hatchery practices • Adherence to environmental monitoring program			
Suggested Performance Measures • Measurement of outfall nutrient levels • Changes in biodiversity in area surrounding outfall			

2.1.3: Other wastes/pollutants

Most cleaning in hatcheries utilises non-chemical methods such as pressure spray, small quantities of hot water or sun drying. The use of disinfectants is covered in Section 1.3.4: Part B. Some veterinary chemicals are used in the husbandry of oyster spat in land based facilities.

Scope

To assess the impact of chemical use from land based facilities on the region.

Current Management Controls

2.1.3.2 Veterinary Chemicals

Veterinary chemical use in the Industry is regulated by the *Veterinary Surgeons Act* 1987, the *Agricultural and Veterinary Chemicals (Control of Use) Act* 1995, and the *Poisons Act* 1971.

The supply and use of veterinary chemicals in Australia is controlled by the *Australian Pesticides and Veterinary Medicines Authority* (APVMA) who register products for use only if they meet the following four criteria:

- human and animal health and safety;
- efficacy – that the product works;
- environmental safety and
- that it will not affect international trade.

In Tasmanian oyster hatcheries, only hormones are occasionally used in minute amounts by the Industry. These veterinary chemicals may be used on broodstock and larvae. Further information can be found at http://www.apvma.gov.au.

<table>
<tr><td colspan="4">Environmental Objective 2.1.3.2: To ensure that the use of veterinary chemicals in hatcheries do not impact upon the marine environment.</td></tr>
<tr><td>Consequence
C= 1</td><td>Likelihood
L= 1</td><td>Risk Rating
C x L = 1
Low</td><td>Target Risk
Rating
NA</td></tr>
<tr><td colspan="4">Risk Management Options
▪ Use veterinary chemicals only as directed.
▪ Compliance with MSDS.
▪ Register of veterinary chemicals on site.</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Comparison of veterinary chemical usage over time.</td></tr>
</table>

2.3.1: Terrestrial Habitat Removal

Scope

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

Current Management Controls

Local Government, Crown Land Services and DPIW regulates the removal of terrestrial habitat associated with a land based oyster facility. Approval from these bodies should be sought prior to the construction of any marine farming facility under the local planning scheme. 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 3.1.1.

Environmental Objective 2.3.1: To ensure that land based facilities do not causes significant impact to terrestrial habitat.			
Consequence **C= 0**	**Likelihood** **L= 2**	**Risk Rating** **C x L = 0** **Negligible**	**Target Risk Rating** **NA**
Risk Management Options • Adherence to local planning scheme			
Suggested Performance Measures • Non compliance records			

2.3.2: Heritage Area Affects

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

Scope

To assesses the impact of Industry land-based facilities 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 Objective 2.3.2: To ensure that land based facilities do not cause significant impact to heritage areas or buildings.			
Consequence **C= 0**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 0** **Negligible**	**Target Risk Rating** **NA**
Risk Management Options • Adherence to planning scheme guidelines			
Suggested Performance Measures • Number of non compliance records issued			

2.3.3: Soil Quality

Scope

This aspect assesses the impact of Industry land-based facilities on the quality of the soils in an area, particularly acid sulfate soils.

Current Management Controls

2.3.3.1: Acid Sulphate Soils

Soils in Tasmania are protected by regional planning schemes to ensure that development does not occur on prime agricultural land, or impact on problem soils such as potential acid sulfate soils (PASS). Acid sulfate soils are associated with Holocene sediments in regional areas of Tasmania. PASS may occur in low lying coastal land associated with estuaries, lagoons, embayments, salt-water back swamps, filled in lagoons and bogs.

Locations of PASS in oyster growing regions occur around Robins Passage in the States north-west, in low lying coastal flats around St Helens and in the Swan River near Moulting Bay (Gurung 2001). No Industry land-based facilities presently occur in areas with PASS. The management of these soils is regulated by DPIW. Further information on oysters and acid sulfate soil pollution is provided in Appendix 2.3.3.

Environmental Objective 2.3.3.1: To ensure that the presence of Industry in a region does not significantly impact upon soil quality, particularly acid sulfate soils.			
Consequence C= 2	**Likelihood L= 1**	**Risk Rating C x L = 2 Low**	**Target Risk Rating NA**
Risk Management Options • Adherence to DPIW controls.			

2.3.6: Noise

Scope

To assess the impact of noise pollution from the Industry land-based facilities on the environment.

Current Management Controls

The main source of noise from land based facilities is from pumps, compressors, forklifts and other equipment. Guidelines and regulations from the EMPCA control noise emissions in Tasmania. Local government may stipulate noise level controls for land based facilities under EMPCA. All marine farmers are aware of the responsibility of noise control particularly when working outside normal daytime hours.

Environmental Objective 2.3.6.2: To ensure that noise levels from the Industry land-based facilities does not impact upon the local environment.			
Consequence **C= 1**	**Likelihood** **L= 4**	**Risk Rating** **C x L = 4** **Low**	**Target Risk Rating** **NA**
Risk Management Options • Adherence to controls stipulated by EMPCA, DPIW and local council • Production of an Industry Code of Conduct for noise control.			
Suggested Performance Measures • Non-conformance notices and complaints			

2.4: PRODUCTION

Optimal production of the cultured species in relation to the regional characteristics is an important part of environmental management. Management on a regional basis reduces the potential collective impacts of the individual operations. This Section assesses effects of production at a regional scale.

2.4.1.2: Land Based Carrying Capacity

The impact of oysters on the food chain is also covered in Section 1.3.5: Food Chain Impacts.

Scope

To assess the impact of stocking densities used in land based hatcheries and nurseries.

Current Management Controls

The Tasmanian oyster industry has played an active role in ensuring that the maximum carrying capacity of a region is determined on the basis of sustainable development. Overstocking of a water body would be detrimental to the productivity of an area.

Factors considered in estimating carrying capacities for land based hatcheries and nurseries are different from marine farms in that many hatcheries/nurseries propagate phytoplankton cultures for increased production per unit volume. Nurseries that do not propagate phytoplankton cultures, but rely on natural phytoplankton levels must consider the same capacity factors as that of marine farms, as described in Section 2.4.1: Regional Carrying Capacity Part A: Marine leases and Facilities. The cultured biomass in land based system is very small.

Environmental Objective 2.4.1.2: To ensure that land based hatchery/nurseries do not exceed the maximum carrying capacity of a region, nor impact upon the marine community.			
Consequence C=0	**Likelihood L=1**	**Risk Rating C x L =0 Negligible**	**Target Risk Rating NA**
Risk Management Options • Adherence to controls stipulated by DPIW			
Suggested Performance Measures • Monitoring any decrease in regional productivity • Monitoring stock growth, survival and health			

2.4.2: Disposal of unmarketable waste

Scope

To assess the impact of disposal of significant quantities of unmarketable waste from Industry land-based hatcheries or nurseries.

Current Management Controls

The land based Industry produces a minute quantity of oyster shell. Oyster shell and dead oysters are disposed of according to the Local or State Government regulations. Most oyster waste is shell from dead oysters that may be buried in land fill, or crushed for use as road base. Some oyster shell is also crushed and utilised as garden mulch. Disposal of generated waste less than 100 tonne per year is regulated by local government under LUPAA.

Environmental Objective 2.4.2.2: To ensure that disposal of oyster shell waste does not impact upon the region.			
Consequence C=0	**Likelihood L=1**	**Risk Rating C x L =0 Negligible**	**Target Risk Rating NA**
Risk Management Options • Disposal as per licence conditions • Alternative markets for recycling			
Suggested Performance Measures • Monitoring of non-conformance notices			

Environmental Management System Framework

Component 3 : Impact of Individual Facilities on the Environment

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 oysters.

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 review and identify 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:

- Entanglement Interactions. Most oyster baskets are a sealed container of fine mesh that is unlikely to result in an entanglement;
- 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;
- Animal Welfare (under Section 3.2.1) as there is no proscribed conditions for shellfish under the *Animal Welfare Act* 1993;
- Escapement (under Section 3.2.2) This is adequately covered at a whole of industry level under Sections 1.1.2: Escape of Cultured Species and 1.3.2: Formation of Feral Populations;
- Waste Feeds and Faeces (under Section 3.2.3) is covered adequately on an industry wide basis both for land based and marine facilities in Section 2.1.1: Nutrients;
- Processing (under Section 3.2.3) does not occur on site at oyster facilities.

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.

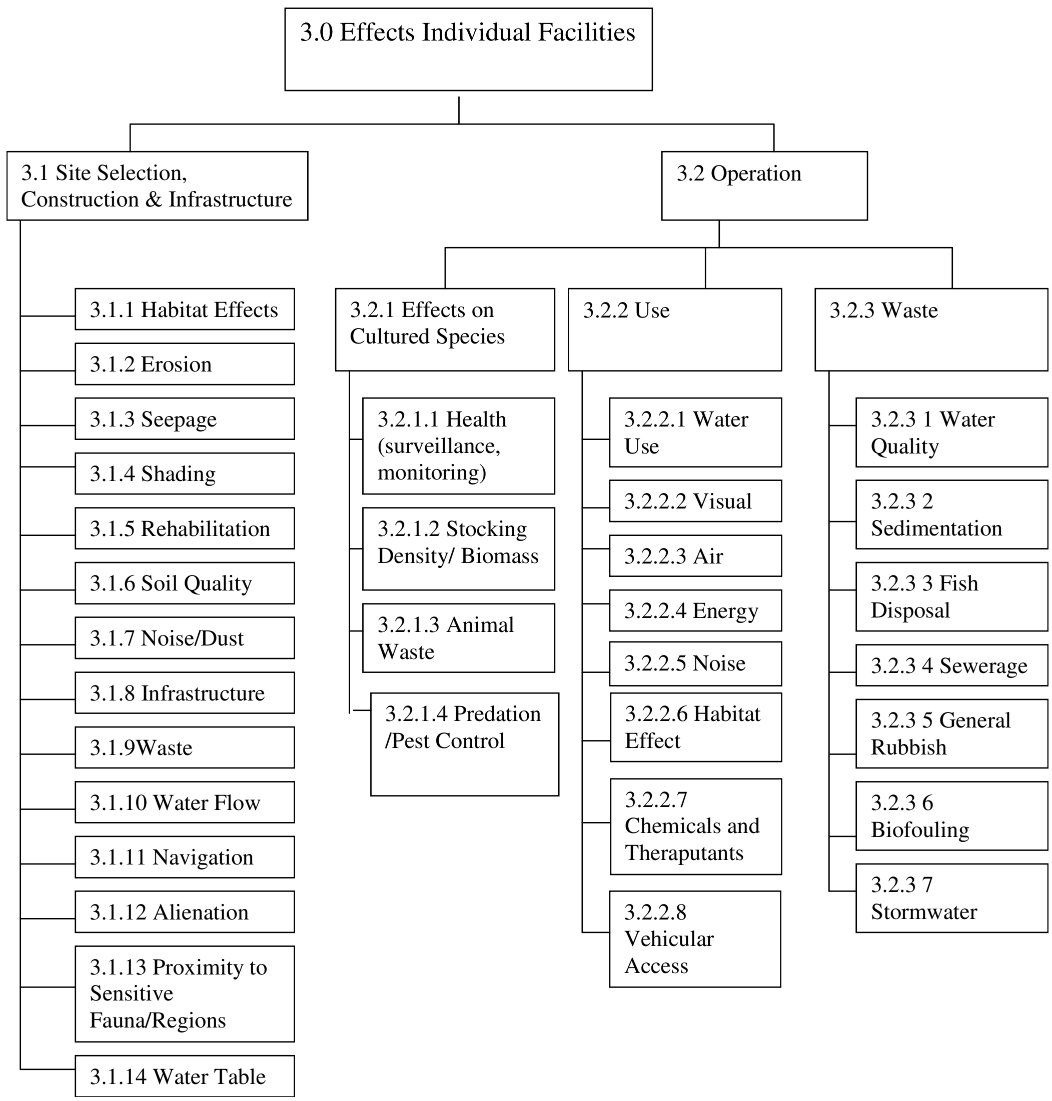

Figure 3.0. Component tree 3: Impact of individual facilities on the environment

3.1: SITE SELECTION, CONSTRUCTION AND INFRASTRUCTURE

This component covers the issues of the initial building, construction and development of a marine farming facility. It can also be used as a check-list 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 a marine farming 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, 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 catchment / regional scale • Replanting disturbed areas with native plants • Minimisation of run-off from roads and work areas into waterways
Related Aspects: • 1.3.5: Sensitive Habitats • 2.2.4 Threatened/Endangered/Protected species • 2.2.5: Protected Areas • 2.3.1: 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 a marine farming 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: • 1.3.5: Sensitive Habitats • 2.3.3: Acid Sulfate Soils

3.1.3: Seepage

Scope

To assess the potential impact of seepage from the marine farming facility.

Environmental Objective 3.1.3: To prevent seepage from Industry facilities.
Potential Impact: Contamination of the water table.
Suggested Control Measures • Local Government approval for construction of ponds • Monitoring and measurement of any seepage from ponds • Regular monitoring and maintenance of water/waste storage tanks, drains, gutters, downpipes etc. for leakage
Related Aspects: • 1.3.5: Sensitive Habitats • 2.3.4: Acid Sulfate Soils • 2.3.5: Water table

3.1.4: Shading

Scope

To assess the impact of shading on sensitive vegetation such as bush and seagrass beds from shading.

Environmental Objective 3.1.4: To reduce the long-term and short-term impact of shading on the environment.
Potential Impact: Degradation of the surrounding environment. Reduced growth of seagrass beds.
Suggested Control Measures • Adhere to DPIW controls on rack spacing • Regular rotation of rack use • Benthic monitoring if required
Related Aspects: • 1.3.5: Sensitive Habitats • 2.2.2: Benthic Communities

3.1.5: Rehabilitation

Scope

To assess the requirement for environmental rehabilitation after construction of a marine farming facility.

Environmental Objective 3.1.5: 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

3.1.6: Soil Quality

Scope

To assess the impact a marine farming facility on soil quality.

Environmental Objective 3.1.6: To ensure that problems with soils are managed to reduce impact on the environment.
Potential Impact: Activation of acid sulfate soils. Contamination of the waterways.
Suggested Control Measures • Identify any potential acid sulfate soils (PASS) • Environmental Management Plans to ensure that PASS does not get activated when construction occurs • Reduce potential erosion
Related Aspects: • 8.1.2.6 Land Use Changes & Habitat Modification • 2.3.4 Acid Sulphate Soils

3.1.7: Noise /Dust

Scope

To assess the impact of noise and dust on the environment.

Environmental Objective 3.1.7: To maintain minimal dust and noise impact where practicable.
Potential Impact: Displacement of local wildlife, decreased public amenity.
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: • 2.2.3 Listed Migratory Birds • 2.2.5 Protected habitats • 2.3.6 Noise • 5.2.7 Public Amenity

3.1.8: Infrastructure

Scope

To assess the impacts of the infrastructure on the environment.

Environmental Objective 3.1.8: To reduce the impact of facility infrastructure on the environment.
Potential Impact: Decreased public amenity.
Suggested Control Measures • 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

3.1.9: Waste

Scope

To assess the environmental impact of waste from the construction of a marine farming facility.

Environmental Objective 3.1.9: 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.
Suggested Control Measures • No dredging or dumping of any waste • Recycle material generated through the construction of the facility eg. plastic wraps, package casing, and land-fill • Environmental Management Plans for construction waste
Related Aspects: • 2.4.2: Disposal of Unmarketable Waste

3.1.10: Water Flow

Scope

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

Environmental Objective 3.1.10: 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 rack 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: • 2.1.4 Flow (hydrology/oceanography) • 2.3.3 Acid Sulphate Soils

3.1.11: Navigation

Scope

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

Environmental Objective 3.1.11: To ensure the facility complies with navigational legislation.
Potential Impact: Obstruction of water ways 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

3.1.12: Alienation

Scope

To assess the impact of alienation of other users in the area.

Environmental Objective 3.1.12: To ensure that other users of an area are not alienated by the facility.
Potential Impact: Alienation of local community**.**
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

3.1.13: 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 3.1.13: To ensure that sensitive fauna/regions are not impacted upon by the construction and use of the facility.
Potential Impact: Impact on wildlife breeding 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

3.1.14: Water Table

Scope

To assess the impact on the water table from the facility.

Environmental Objective 3.1.14: 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: • 3.1.3: Seepage

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 impacts 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 • Pacific Oyster Health Program • AQUAVETPLAN • *Quarantine Act* 1908 • TSQAP Program • Protocols, schedules and staff training for fish health related issues • Staff training in algal identification
Related Aspects: • 1.1.2.2. Disease (Wild populations) • 1.2.2 Disease (Cultured stock) • 1.3.1 Disease (Other species/communities/processes) • 1.2.4 Quality Assurance (water)

3.2.1.2: Stocking Density / Biomass

Scope

To assess the impact of inappropriate stocking density.

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 and management plan • Monitoring growth and health of stock • Monitoring phytoplankton levels of region
Related Aspects: • 2.4.1 Regional Carrying Capacity • 1.3.5 Food Chain Impacts

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 and/or stock losses.
Suggested Control Measures • Identification of problematic predators/pests such as shorebirds, crabs or skates a on the lease • Identification and management plan for potential predators, which are also, protected species • Protocol for management and disposal of Invasive Marine Species that may be pests • Staff training
Related Aspects: • 2.2.4 Threatened, Endangered and Protected Species • 2.2.6 Behavioural Changes on Species (Scavengers) • 2.2.7 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 water usage from the facility.

Environmental Objective 3.2.2.1: To maintain water usage in the facility at an environmentally responsible and sustainable level.
Potential Impact: Low water availability.
Suggested Control Measures • Identify risks to the availability of water (seawater, fresh water, river water, ground water), eg seasonal variation • Produce a water budget • Reduce, reuse, and recycle where practicable
Related Aspects: • 2.1.4 Flow (hydrology/oceanography)

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.
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 • Remove old unused racking • Use low profile posts and racks at even height • Evenly space racks in rows according to DPIW Controls
Related Aspects: • 2.4.1 Regional Carrying Capacity • 2.3.4: Navigation • 8.2.3: Regulations • 5.2.7 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 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: • 2.1.3. 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 2.1.3

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 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 2.1.3) • 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 • 2.2.3. Listed Migratory Birds • 2.2.4 Threatened/Endangered/Protected sp. • 5.2.7 Public Amenity • Appendix 2.1.3. Cleaner outboard motors

3.2.2.6: Habitat Effect

Scope

To assess the impact of the facility on the surrounding 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 salt marsh • 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 sp. • 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 chemicals and theraputants in the facility.

Environmental Objective 3.2.2.7: To ensure that the facility has appropriate controls on chemicals and theraputants.
Potential Impact: Contamination of the water and decreased water quality.
Suggested Control Measures • Appropriate bunded chemical storage systems • Appropriate disposal protocols of chemicals and theraputants • 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: • 2.1.3: Other wastes, pollutants eg chemicals • 1.3.3.: Chemicals

3.2.2.8: Vehicular access

Scope

To assess the impact from vehicular access to marine farming leases on the surrounding habitat, including marine and terrestrial.

Environmental Objective 3.2.2.8: To ensure that vehicular access to marine leases by the facility minimises impact upon the local environment
Potential Impact: Degradation of the benthic and terrestrial environment.
Suggested Control Measures • Establishing a clearly planned access track from the facility to the water edge • Driving with care when passing known bird roosting areas • Protocols or codes of conduct to reduce habitat impacts • Controlled driving on beaches • Using multiple tracks when on the benthic environment to spread the impact, or as advised by DPIW • Staff training
Related Aspects: • 2.3.7. Vehicular Access • 2.2.3. Listed Migratory Birds • 2.2.4 Threatened/Endangered/Protected sp. • 5.2.7 Public Amenity

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 leading to 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: • 1.2.4 Quality Assurance (water) • 2.1.1 Nutrients (water quality) • 2.1.3 Other wastes / Pollutants (chemicals)

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: • 2.1.2 Sedimentation • 2.4.1 Regional Carrying Capacity

3.2.3.3: Fish Disposal

Scope

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

Environmental Objective 3.2.3.3: To ensure fish waste disposal 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: • 2.4.2 Disposal of Unstable Products • 2.1.3 Other wastes/Pollutants (chemicals)

3.2.3.4: Sewerage

Scope

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

Environmental Objective 3.2.3.4: 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: • 2.4.2 Disposal of Unstable Products • 2.1.3 Other wastes / Pollutants (chemicals)

3.2.3.5: General Rubbish

Scope

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

Environmental Objective 3.2.3.5: 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 culture 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: • 2.4.2 Disposal of Unstable Products • 2.1.3 Other wastes / Pollutants (chemicals)

3.2.3.6: Biofouling

Scope

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

Environmental Objective 3.2.3.5: To ensure that biofouling removal from facility structures does not impact upon the environment.
Potential Impact: Decreased water quality.
Suggested Control Measures • Clean racks and trestles on an outgoing tide • Monitor waste levels after cleaning
Related Aspects: • 2.1.1: Nutrients • 3.2.3.1: Water Quality

3.2.3.7: Storm water Run-off

Scope

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

Environmental Objective 3.2.3.7: 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: • 2.1.4: Flow (hydrology/oceanography) • 1.3.5: Sensitive habitats • 5.2.7: Public amenity

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) to 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)

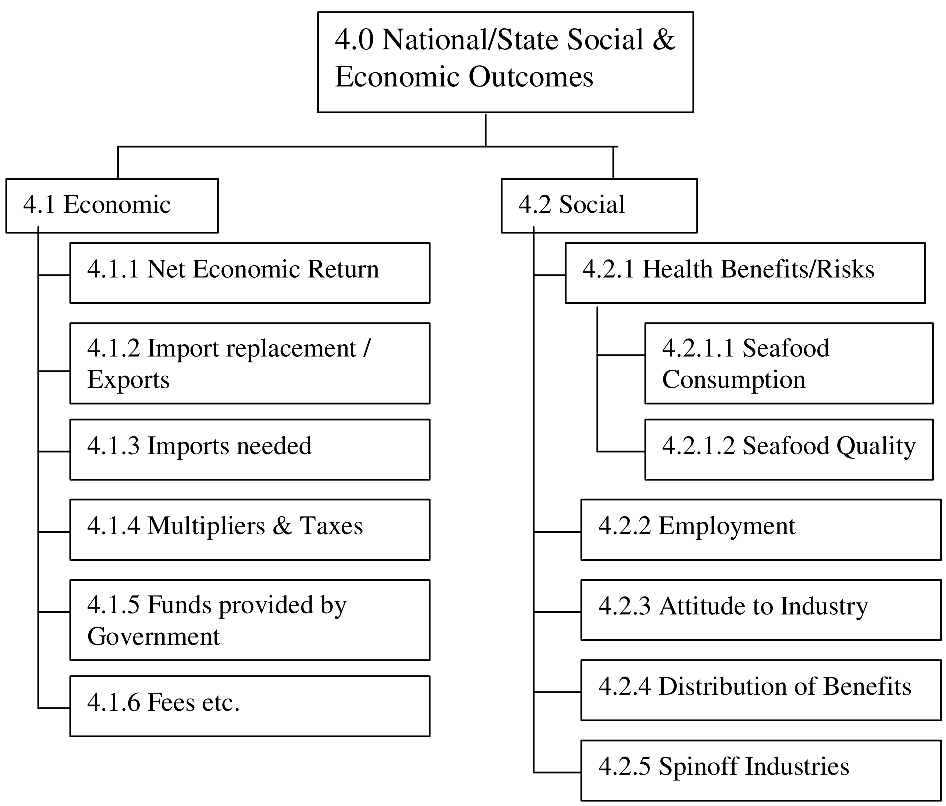

Figure 4.0. Component Tree4: Impacts of the Industry on national/state economic outcomes

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 oyster industry produced nearly 19.6% of the total Australian production of edible oyster in 2003-2004. Production in Tasmania has increased at an average rate of 7.5 percent per annum from 2001 to 2004 (Fig 4.1.1). The economic return of oyster farming is relative to the productivity and function of the growing region. Some regions are used for spat growth and show low relative economic returns whereas others used for pre-sale harvest demonstrate higher economic returns.

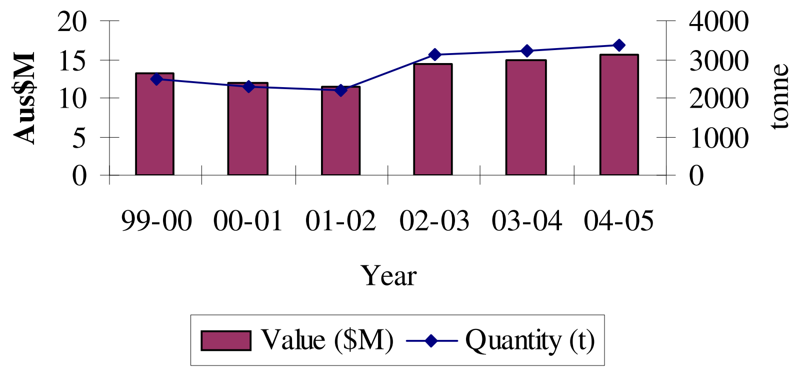

Figure 4.1.1. Value and quantity of Pacific oysters grown in Tasmania over 5 years.

4.1.2: Import replacement/exports

Tasmanian oysters are primarily marketed in the east Australian states, particularly in the cities of Sydney and Melbourne (Crawford 2001). Demand for product in the Asian markets is increasing, with current production not sufficient to meet overseas demand. Most exported Pacific oysters are sent to Japan, with the Tasmanian share of the export market rising to nearly 60% of the Australian market (Fig 4.1.2).
The focus of the Tasmanian market has been on national consumption, but with a reviewed emphasis on developing export markets.

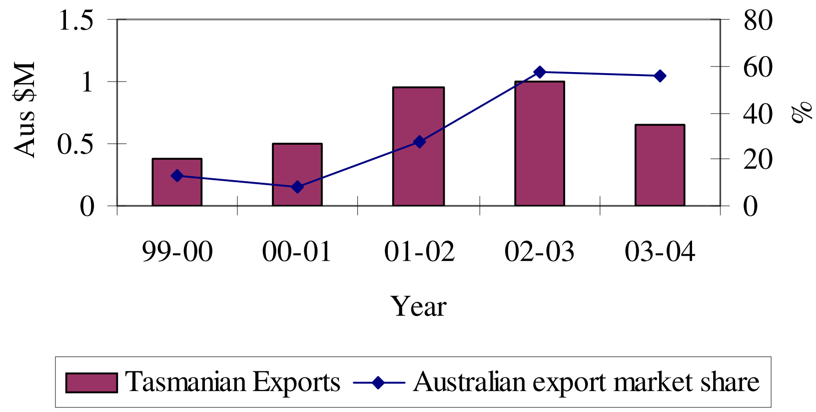

Figure 4.1.2. Tasmanian exports of Pacific oysters in value and as percentage of the Australian market share

Import of live oysters into Australia is restricted (Section 1.2.2.3.1). Canned and prepared oyster meats to the value of approximately $7M per annum are imported into Australia. The Tasmanian industry concentrates on producing high quality oysters for the fresh or live markets rather than for the processed market.

4.1.3: Imports needed

The industry does not have to specifically source imports to operate over and above general consumables.

4.1.4: Multipliers and taxes

Marine farming generally has a high "economic multiplier" effect. The oyster industry in the US has demonstrated that every dollar of revenue generates $7.5 dollars of additional economic activity locally in the form of spending on such items as new equipment, packaging and boat maintenance (TerrAqua 2003).

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 that match the 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 aquaculture industry has exceeded the 0.25% of AGV contribution in current years and provided $31,000 in 2004-2005 (ABARE 2005: Section 4.1.5).

In 2003-2004 the Commonwealth Government contributed $30,618 to Tasmanian Pacific oyster research, matching State contributions of $31,000 provided by

Industry and DPIW. This funding was used for new and ongoing FRDC approved projects including the ASI genetic enhancement program (Appendix 1.1.1.1).

Assistance is also provided to some industry participants through Seafood Services Australia under the National Seafood Environmental Management System Pilot Project. Three oyster farming companies located in the Little Swanport Estuary are one of six seafood pilot projects to assess the value of environmental management systems to food producers and natural resource management. The Little Swanport Estuary EMS Committee are identifying the hazards and risks affecting the sustainability of the estuary and oyster farms through an integrated catchment management approach and integrating decision-making and management processes.

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). Funding is also collected as part of the marine farming licensing process by DPIW and allocated to the Tasmanian Shellfish Quality Assurance Program (TSQAP) (approximately $204,000 in 2004/2005; Table 4.1.6.2).

The State Government provides services to the Industry in the form of governmental regulation and developmental support through a number of agencies including the DPIW Marine Farming Branch, Biosecurity and the Environment Branch at a cost of approximately M$1.45 in 2004/2005. Part of this funding is to help support the Pacific Oyster Health Program (POHP).

4.1.6: Fees etc

Fees paid to the Australian and State Governments are 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 and Industry bodies by the Tasmanian oyster industry for 2005.

Licence	Fees oysters
Tasmanian Fishing Industry Council (TFIC) Compulsory Levy	$350.00
Tasmanian Shellfish Quality Assurance Program (TSQAP) Compulsory Levy	$1,293.00
Bivalve Species farmed – first species	$902.50
Bivalve Species farmed – additional species	$111.00
Total fees for one species	$2,545.50

Licence fees are paid to the State Government by leaseholders. There are 116 licence holders for Pacific oyster farming in Tasmania who provided fees in 2005, as shown in Table 4.1.6.2. Other State Government fees include a marine farming lease rental fees, which comprise a base fee ($100), plus a fee per hectare (currently $50). The State Government collected M$1.09 from the marine farming industry in the financial year 2004-2005. Bivalve shellfish hatchery license fees are also being implemented in 2005. 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.

4.1.7: National Product Supply

Tasmanian hatcheries play a pivotal part in Australian Pacific oyster production as they supply approximately 80% of the national oyster seed production (Richard Pugh personal communication).

Economic Objective 4.1.1: To ensure that the Industry continues to contribute to the national economy.			
Consequence (Table 1.5) C= 4	**Likelihood L= 3**	**Risk Rating C x L = 12 Moderate**	**Target Risk Rating Low**
Economic Objective 4.1.2: To ensure that the Industry continues to contribute to the state economy.			
Consequence C= 4	**Likelihood L= 3**	**Risk Rating C x L = 12 Moderate**	**Target Risk Rating Low**
Risk Management Options • Strategic business planning • Sustainable farming practices • Risk Management			
Suggested Performance Measures • Evaluation of 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 –fatty acids occurs in seafood, including shellfish.

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 foods. It also provides an excellent source of selenium and fluoride. Other minerals which are provided in moderate amounts are iron, zinc and magnesium. The iron content is about a third to a half that in red meat.

Shellfish were once classified as foods high in cholesterol, but it is now known that most of the sterols in these foods are compounds other than cholesterol. Moreover, the cholesterol in the shellfish species is high-density lipoproteins (HDL) which help remove the more dangerous low-density lipoproteins (LDL). Shellfish have low to moderate amounts of cholesterol and contain very little saturated fats.

Health hazards associated with the consumption of seafood contaminated with heavy metals, (notably mercury), has received worldwide publicity. In Australia there have been no reported cases of mercury poisoning as a result of seafood consumption. The Australian Food Standards Code currently prescribes a maximum level for mercury in food of 0.5 mg kg^{-1} for molluscs.

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).

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 people consume seafood, with the majority of these people relying on the commercial sector, including marine farming, 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 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). The development of codes of practice within the industry, along with the unmarked reputation of the TSQAP program help to reassure consumers about the quality and safety of Tasmanian oysters (Section 1.2.4; Appendix 1.2.4).

4.2.2: Employment

The Tasmanian marine farming Industry directly employs 846 people representing 472 permanent and 204 part-time employees. A further 176 full time and 419 people are employed in the processing sector (incorporating wild fisheries and aquaculture; FRDC 2004). The 54 Tasmanian oyster producers employ 193 permanent and 75 casual staff directly (DPIW personal communication).

4.2.3: Attitudes to Industry

The Australian public recognises the socio-economic benefits of marine farming, especially its contribution to local economies in rural and remote regions. The public rate the environmental impacts as the most important issue facing marine farming, followed by the Industry's economic contribution and its impacts on other users of coastal and marine resources. Although no data were provided specifically for the Tasmanian oyster industry, the results found that the public had a higher trust in the oyster industry (72%) than any other marine farming industry on perceived environmental risks. The public believed that information about marine farming should be accessible and credible and the community values the chance to participate in marine farming planning management decisions (Mazur et al 2005).

4.2.4: Distribution of Benefits

Tasmanian grown oysters are consumed with relish both locally and interstate. Over 18% of seafood sold in Sydney supermarkets consists of oysters for at-home consumption (excluding finfish; Ruello et al 2002) indicating that the public enjoy oysters and are aware of the health benefits of consuming oysters.

4.2.5: Spinoff Industries

The industry supports a number of spin-off industries including seafood processing, local restaurants, preserved timber products, polyethylene products, boat building, engine supply, fuel, hardware and transport.

<table>
<tr><td colspan="4">Social Objective 4.2: To ensure that the Industry contributes to national social wellbeing.</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
• Strategic business planning
• Sustainable farming practices
• Risk Management</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Evaluation of industry profitability and sustainability</td></tr>
</table>

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.

The following information will be periodically revised by Industry bodies such as the Tasmanian Aquaculture Council (TAC) and the National Aquaculture Council (NAC) to 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)

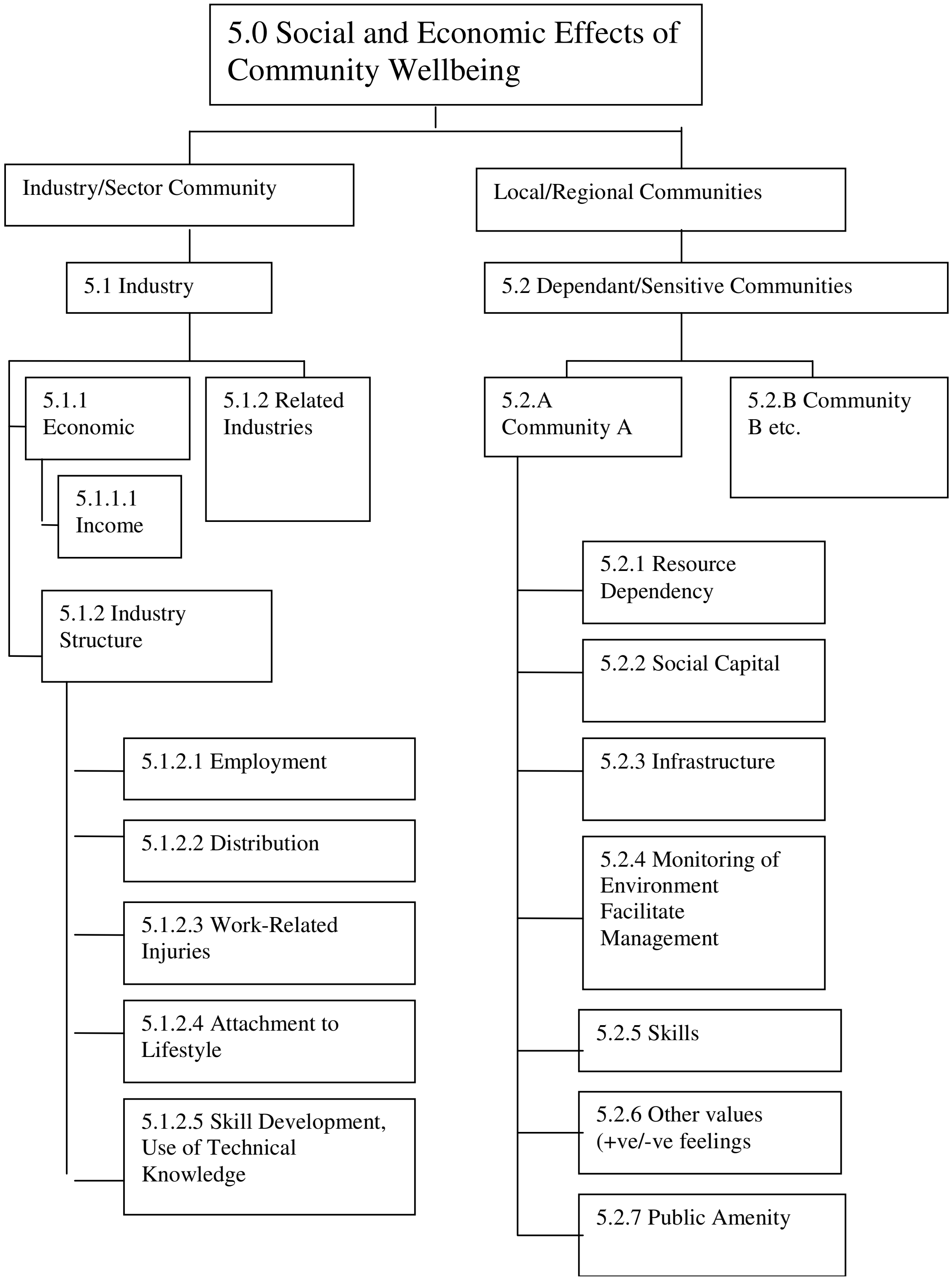

Figure 5.0. Component tree 5: Contribution of Industry to social and economicseffects of community wellbeing.

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.

5.1.1: Economic

Scope

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

5.1.1.1: Income

The oyster industry is the second most valuable aquaculture industry in Tasmania. The average gross value (AGV) of oysters at market ranges between $8,000 and $31,000 per hectare per annum (HRC 2003). Much of this value is returned to the community in the form of employment, and support of local businesses. There is also a multiplier affect of every dollar of revenue produced by Industry generating a potential $7.5 dollars of additional economic activity locally (Section 4.1.4: Multipliers and Taxes). The number of hectares utilised by Tasmanian oyster farms is shown in Table 5.1.2.2.

5.1.2: Industry Structure

Approximately 91% of marine farming businesses (70) have shellfish enterprises on their marine leases, of which the majority are Pacific oyster farms. These businesses are often family owned and employ an average of 3 to 4 people per business. Most oyster farms are managed by first or second generation farmers.

5.1.2.1: Employment

The Industry is a significant regional employer, with around 270 employees in 1999/2000 in which 95% have full-time positions. The location of oyster farms in regional remote locations means that the employment is often vital for the local community. Historical employment figures for the sector are provided in Table 5.1.2.1.

Table 5.1.2.1. Level of full-time and part-time/casual work and wages provided by the Tasmanian shellfish industry for the year 1999/2000. (adapted from Shoobridge 2000)

	Full time employees	Part-time/Casual employees	Wages $M
Farming	211	113	$6.7
Farming %	94%	97%	92%
Processing/Other	14	3	$0.6
Processing/Other %	6%	3%	8%
Full time equivalents		62	

5.1.2.2: Distribution

The distribution of Pacific oyster 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 Pacific oyster marine leases in Tasmania. Sourced from DPIW 2004.

Region	Number of Pacific oyster leases	Lease area for shellfish * (ha)	Regional production of Pacific oyster ('000 doz / 2001)
North West	16	229	180
Port Sorell	2	49	1
Georges Bay	10	95	752
Great Oyster Bay	14	2035	235
Blackman Bay	9	208	118
Norfolk Bay	13	378	156
Pitt Water	7	108	562
Pipe Clay Lagoon	9	49	987
Channel	27	391	150
Huon/Esperance	6	120	33

* not all Pacific oyster production.

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 marine farming) has average workplace accident rates when compared to all other industries. Of all workers compensation claims 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

Marine farming, 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. Many oyster farming businesses are family businesses and are passed onto the next generation. Sustainability is recognised as a major factor in being able 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, marine farming 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. Machines to efficiently grade the oysters are manufactured in Tasmania.

5.1.3: Related Industries

Related industries that support oyster farming include equipment supplies, treated timber suppliers, transport companies, engineering companies, wholesale and retail seafood outlets, restaurants, chandleries and fuel depots.
The Industry is reliant on these industries to maintain production and will often support businesses in the local/regional area.

<table>
<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</td><td>Likelihood
L= 1</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
• 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
• Evaluation of industry profitability and sustainability
• Staff turnover and ability to attract suitably qualified personnel
• Communication between the Tasmanian oyster industry and community</td></tr>
</table>

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 from the Industry is between $8,000 and $35,000 per hectare per annum (HRC 2003). Some smaller regional communities are believed to be highly dependent upon the Industry for employment, income and trade (as in Component 5.1). However, data are not available for all communities. The Little Swanport oyster growers have assessed their marine resource of having a value of $31,000 per hectare per annum (Col Dyke personal communication).

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. Many Industry businesses are run by families, indicating a high level of social capital in the Industry. Most businesses are members of the Industry body TSEC. No further data about social capital in Tasmania regarding the marine farming industry were sourced.

5.2.3 Infrastructure

The infrastructure installed by the Industry of benefit to local communities includes navigational aids, data loggers, boat ramps and jetties in some locations.

5.2.4 Monitoring of the Environment

Oysters are considered the ‘canaries of the marine environment’ due to their sensitivity to environmental change. A decline in the health of oysters 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 areas through TSQAP and ongoing farm based monitoring.

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.

5.2.6 Other values (feelings)

The Industry provides an identity in regional communities, with some communities regarding oyster farming as iconic (eg. Barilla Bay). Some sections of the community have negative perceptions of the Industry. Research undertaken in regions of South Australia indicates that the public surveyed regard the oyster industry as having a higher level of awareness on perceived environmental risks than any other marine farming industry (Mazur et al 2005; Section 6.2.3).

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 in accordance with the MFPA. Marine Farming Development Plan (MFDP) which takes into consideration other users and values in the region. The MFDP identifies zones in which marine farming may take place, including other marine farming 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 oyster 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.

Social and Economic Objective 5.2: To ensure that Industry provides economic and social support to the dependant community.			
Consequence **C= 3**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 3** **Low**	**Target Risk Rating** **N/A**
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			
Suggested Performance Measures • Evaluation of industry profitability and sustainability • Communication between the Tasmanian oyster industry and community.			

Component 6: Indigenous Community Wellbeing

Introduction

The Indigenous Community Wellbeing component assesses the positive or negative impacts of Industry on the Tasmanian Aboriginal communities. Coastal locations in Tasmania are rich in cultural sites, including archaeological sites, such as shell middens and stone quarries, as well as natural sites, such as headlands, river mouths, reefs and islands. The physical location of oyster leases in sheltered coastal interface results in Industry occurring in areas where the Aboriginal community or their artefacts exist. Indigenous history relating to oyster growing regions is documented in Appendix 6.0

The Indigenous Community Wellbeing component tree (Figure 6) demonstrates the issues involving Industry's influence 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 all care has been taken to understand 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.

The risk assessment for the Indigenous Community Wellbeing component utilises the Social/Political Consequence table as provided in Appendix 1.0 (Table 5). The minimisation of social impacts cannot be assumed to be made at the expense of ecological considerations.

All oyster farm 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 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 signs of the activities of any such original inhabitants or their descendants.

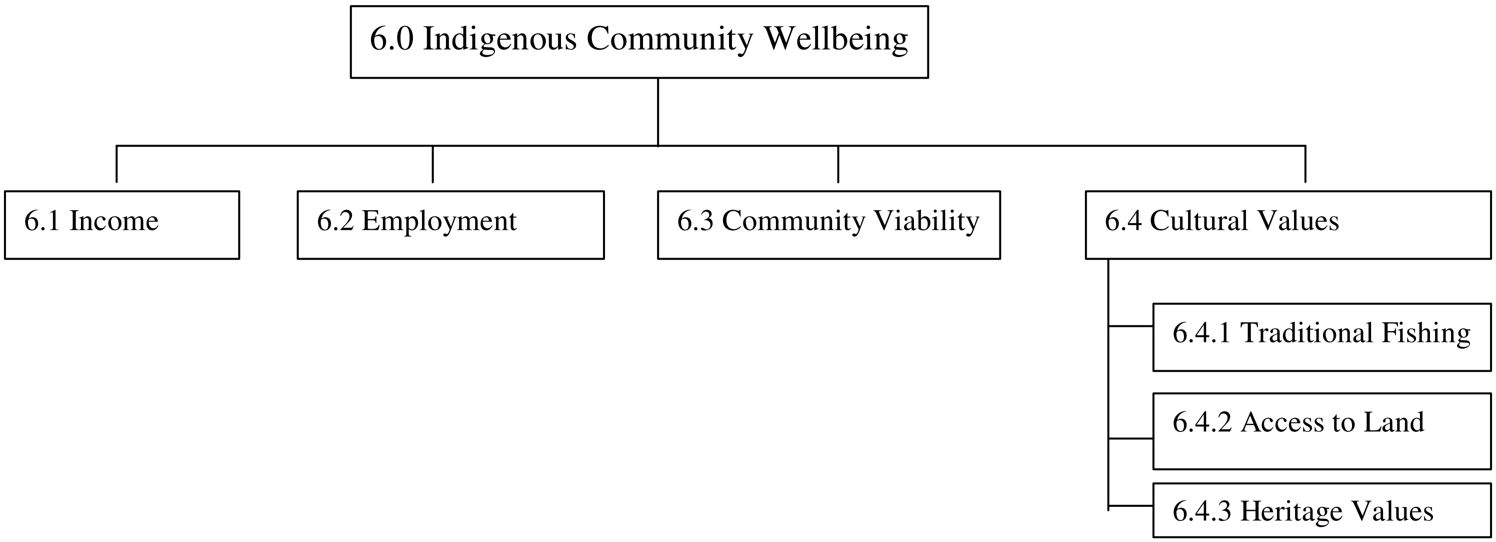

Figure 6.0. Component Tree 6: Indigenous community wellbeing in relation to the Industry.

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 impact of Industry on the Tasmanian Aboriginal community by providing impartial access to income.

Current Management Controls

The Tasmanian oyster industry operates successfully within the competition of a free market and provides stable investment return 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.

Social Objective 6.1: To ensure that the Tasmanian Aboriginal community has access to ongoing stable investment return from the Industry, as part of the wider community.			
Consequence **C= 2**	**Likelihood** **L= 1**	**Risk Rating** **C x L = 2** **Low**	**Target Risk Rating** **NA**
Risk Management Options • Maintenance of sustainable practices, strategic and financial management by companies			
Suggested Performance Measures • Evaluate return on investment			

6.2: EMPLOYMENT

The Tasmanian Aboriginal community has a large investment in the Industry that may provide an avenue for Aboriginal people to source employment in this area. The Tasmanian Investment Corporation comprising of seven Aboriginal community groups is exploring ways to increase marine farming ventures at places such as Little Swanport on the east coast (National Oceans Office 2002).

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 Oyster 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 willingness to work and competence rather than other attributes, which may be considered discriminatory.

<table>
<tr><td colspan="4">Social Objective 6.2: To ensure that the Aboriginal community has equal opportunity and continuity of employment in Tasmanian oyster marine farming Industry.</td></tr>
<tr><td>Consequence
C=2</td><td>Likelihood
L=1</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 the Anti-discrimination Act 1998
• Industry award or enterprise agreement clauses for discrimination and grievances</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Monitor complaints to the Tasmanian Anti-discrimination Commission
• Monitor employment statistics</td></tr>
</table>

6.3: COMMUNITY VIABILITY

Scope

To assess the contribution of Industry to Tasmanian Aboriginal community viability.

Current Management Controls

At present there is a high level of investment in oyster marine farming by the Aboriginal community (Section 4.1: Income), that contributes to the viability of the community by creating wealth. 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.

Social Objective 6.3: To ensure that the Aboriginal community has local opportunities for participating in the Industry.			
Consequence C=1	**Likelihood L=1**	**Risk Rating C x L =1 Low**	**Target Risk Rating NA**

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.

Sections 3, 10, 60 and 215 of the *Fisheries Rules* in the LMRMA 1995 cover traditional fishing rights of the Tasmanian Aboriginal community. These rules state that an Aborigine who is engaged in an Aboriginal cultural activity that is not likely to have detrimental effect on the living marine resource may fish without a licence or limitation.

Section 3 defines an "Aboriginal cultural activity" as the activity of fishing or gathering undertaken by an Aborigine for his or her personal use or sharing based on Aboriginal custom of Tasmania as passed down to the Aborigine concerned. The definition of an "Aborigine" is restricted to those of Aboriginal decent or who have always been known as an Aborigine. Traditional fishing for sale or barter is excluded from this exemption.

Aboriginal people are able to practice their cultural fishing without limitation or licence when fishing for the native flat oyster, as long as they do not have "detrimental effect" on the resource (*Fisheries Rules* 1999, Section 40A). There are no traditional fishing rights for the introduced Pacific oyster, however a licence is not required for personal use. Aboriginals have access to most marine and estuarine waters, except for areas occupied by the marine farming lease or marine protected areas.

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=3**	**Likelihood** **L=1**	**Risk Rating** **C x L =3** **Low**	**Target Risk Rating** **NA**

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

The Marine Farming Planning process ensures that access to culturally sensitive sites are not impeded through consultation with the Tasmanian Aboriginal community and private land stakeholders on the siting and activities of a marine farming lease under the MFPA. This process does not identify middens or artefacts significant to the Aboriginal community to ensure the integrity of the sites is maintained. Land based facilities undergo a similar process through local Council, or Crown Land Services in each respective area.

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 =3** **Low**	**Target Risk Rating** **NA**

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.

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 NA**

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 agencies, be they 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 oyster 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.

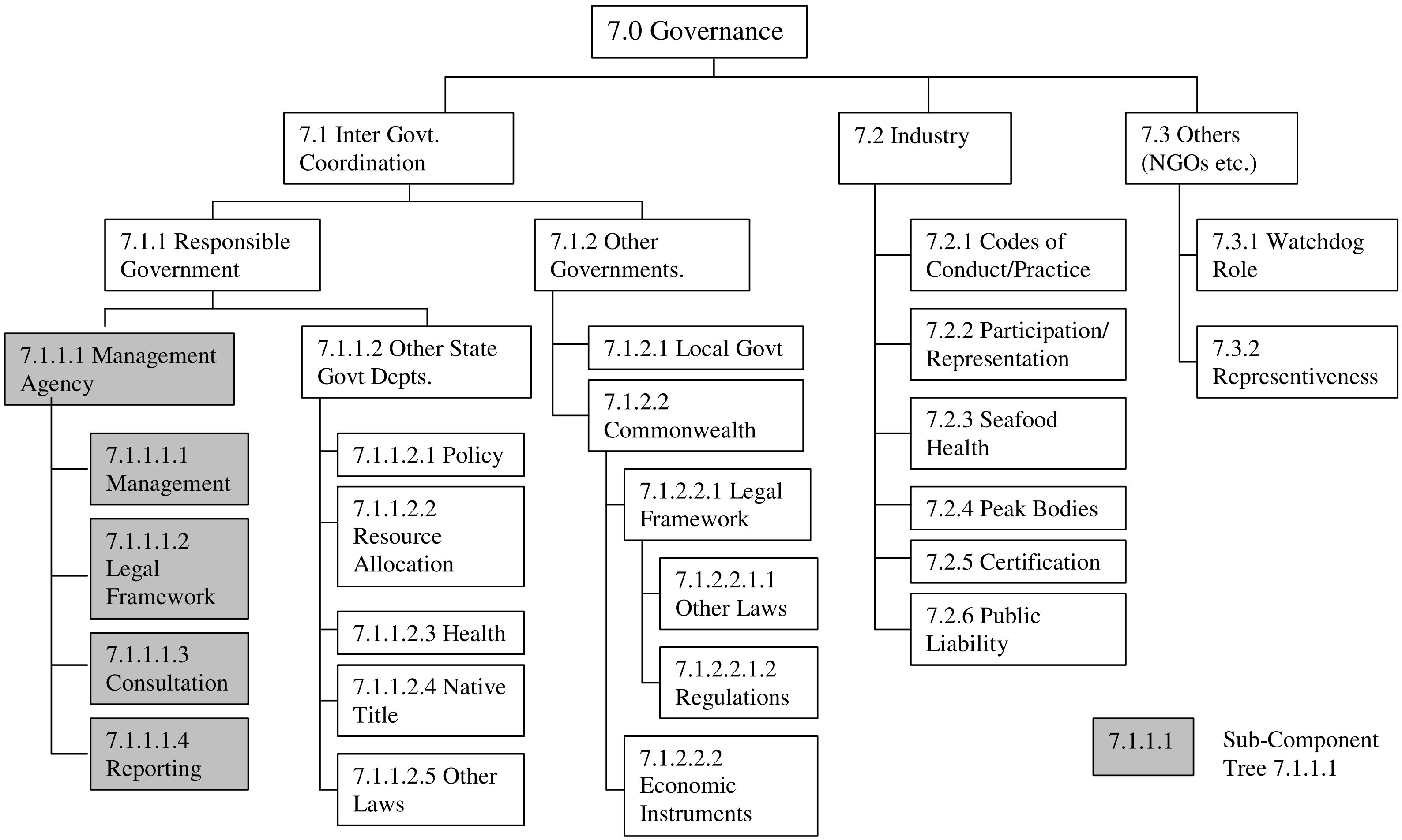

Figure 7.0. Component Tree 7: Governance (inclusive of Sub-Component Tree 7.1.1.1)

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.

<u>7.1.1.1: Management Agency</u>

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.

<u>7.1.1.1.1: Management</u>

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 over $M100 (employing 850 people) in 1999/2000 (Anon 2000).

7.1.1.1.1.2: Marine Farming Development Plans

The marine farming development planning 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 with no formal planning undertaken. A person could apply for a lease anywhere in State waters. 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.

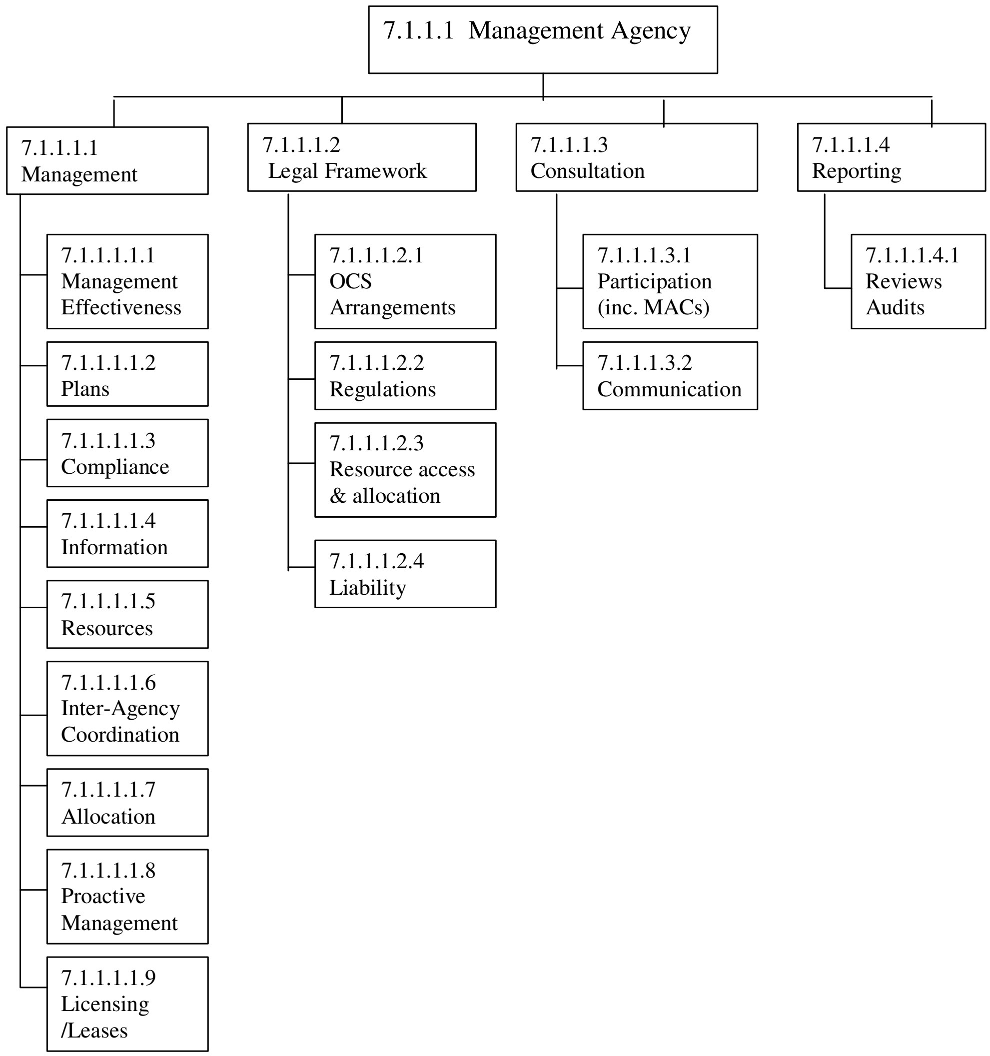

Figure 7.1.1.1. Sub-Component 7.1.1.1: Governance of the management agency

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 assessed 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 scrutinised an 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.

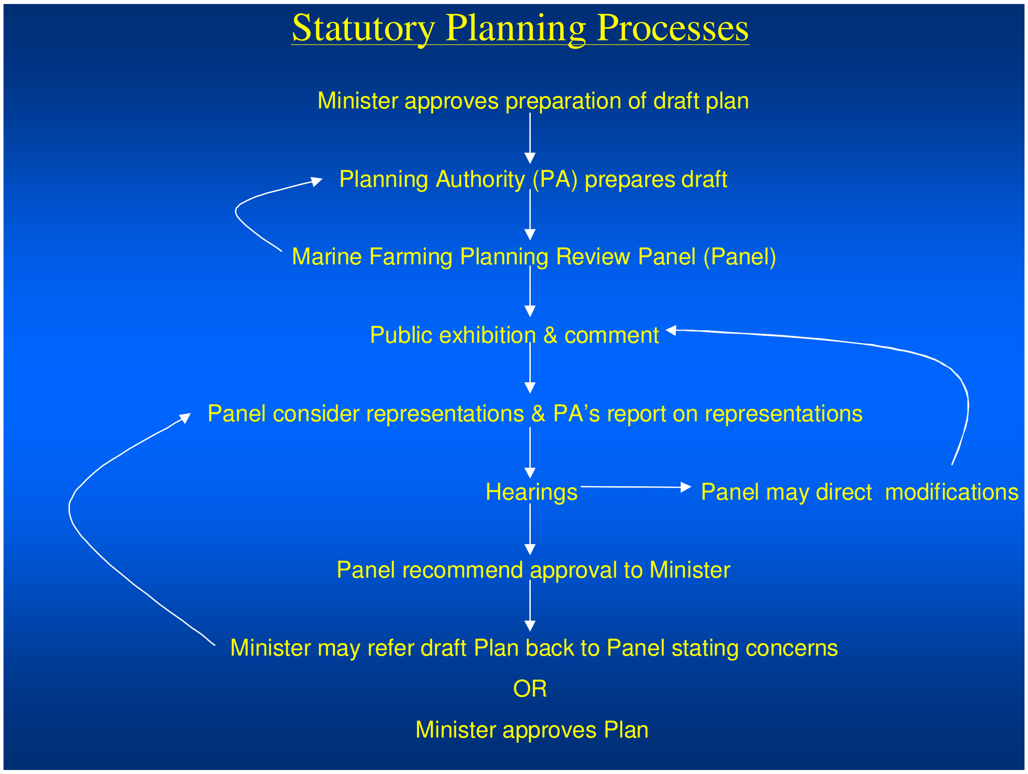

Fig 7.1.1.1.1.2. The statutory planning process for the Tasmanian DPIW Marine Farming Development Plans (adopted from T Thomas).

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 MFDP's is described in Appendix 8.2.3.2 and has been reported for the period 1997-2002 (Woods et al. 2004). Shellfish 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 was undertaken for existing lease areas at the commencement of the environmental monitoring program. The DPIW is working towards completion of initial environmental monitoring of shellfish lease areas.

7.1.1.1.1.4: Information

Routine dissemination of information on compliance from the management agency to leaseholders is through regular inspection reports (a letter with an accompanying map). A benthic report summary is produced every 2 years 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 MFDPs including: Environment Division of DTAE, Marine and Safety Tasmania (MAST); Resource Management and Conservation Division; Information and Land Services; Strategic Policy and Planning; and Tourism Parks and Heritage.

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 lease holder is responsible for complying with the provisions of the MFPA and LMRMA, marine farming development plan management controls, lease conditions and marine farming licence conditions.
The Minister may grant an application to renew a lease if satisfied that:

- the leaseholder has complied with the conditions 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 body for the Industry which is the Tasmanian Aquaculture Council (TAC) on matters of policy. This body is represented on the Marine Farming Environmental Advisory Committee, which includes, as a subset, the Tasmanian Shellfish 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 granted 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.

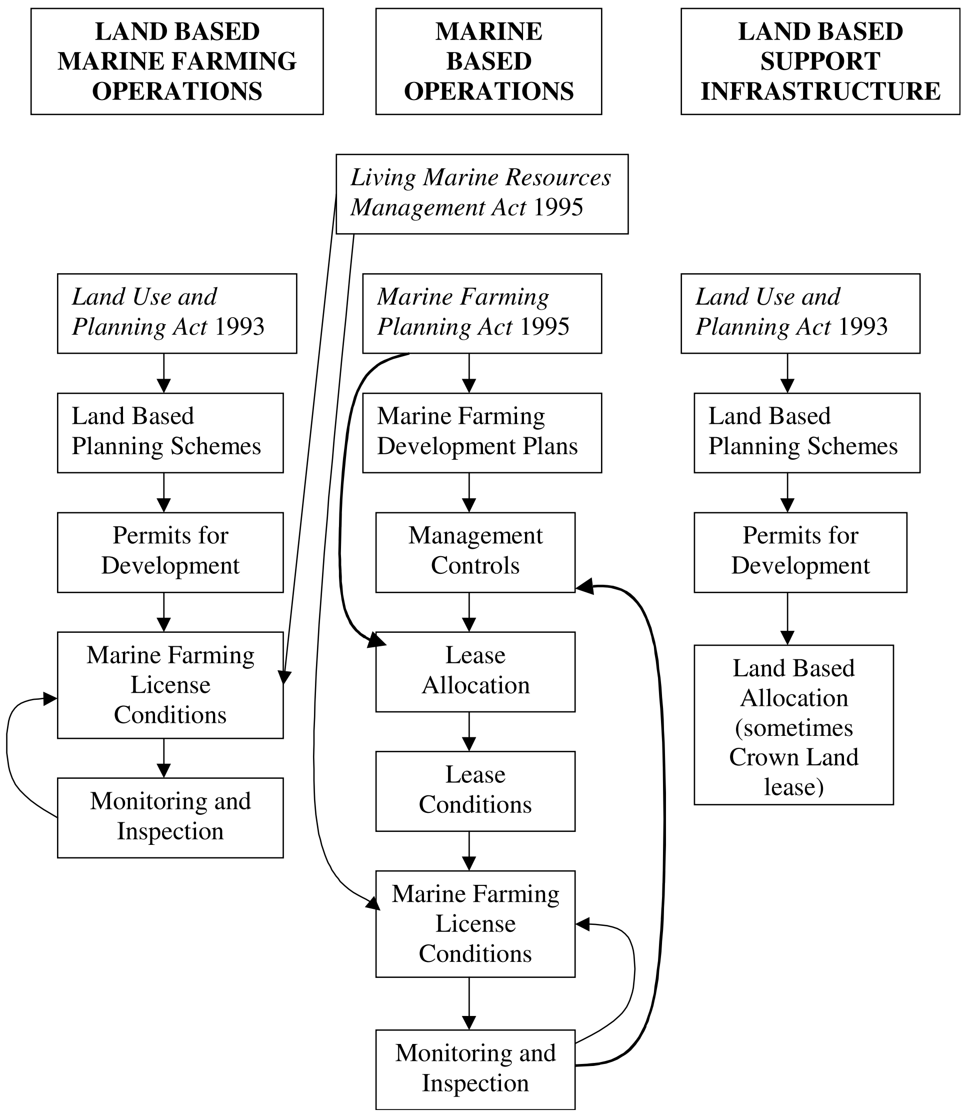

Figure 7.1.1.1.2.1. Regulatory requirements governing the establishment of marine farming operators.

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, subject to agreement of the licence holders.

<table>
<tr><td colspan="4">Social and Economic Objective 7.1.1.1: To ensure that State Government policies and processes do not impact on the sustainability of Industry.</td></tr>
<tr><td>Consequence
(Table 1.5)
C= 3</td><td>Likelihood
L= 3</td><td>Risk Rating
C x L = 9
Moderate</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
• Evaluation of continued Industry profitability and sustainability</td></tr>
</table>

7.1.1.2: Other State Government Departments

In the preparation of a 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 Commonwaelth Government's management on the sustainability of Industry.

7.1.2.1: Local Government

The MFPA requires a coordinated approach with Local Government, that 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. Applications for land based facilities are dealt with by Local Government through local planning schemes and pursuant to the provisions of the LUPAA as shown in Fig 7.1.1.1.2.1.

7.1.2.2: Australian 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 developments against the provisions of the Commonwealth 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 Commonwealth Minister for responsible for the environment. Commonwealth regulations such as the *Quarantine Act 1908* may impact upon the Industry's ability to compete on the international market.

<table>
<tr><td colspan="4">Social and Economic Objective 7.1.2.1: To ensure that Local Government policy and processes do not impact on the sustainability of Industry.</td></tr>
<tr><td>Consequence
C= 3</td><td>Likelihood
L= 3</td><td>Risk Rating
C x L = 9
Moderate</td><td>Target Risk
Rating
Low</td></tr>
<tr><td colspan="4">Social and Economic Objective 7.1.2.2: To ensure that Commonwealth Government's policy and processes do not impact on the sustainability of Industry.</td></tr>
<tr><td>Consequence
C= 3</td><td>Likelihood
L= 3</td><td>Risk Rating
C x L = 9
Moderate</td><td>Target Risk
Rating
Low</td></tr>
<tr><td colspan="4">Risk Management Options
• Ensure effective, ongoing Government/Industry consultation
• Effectively engaging Local/Commonwealth 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
• Evaluation of continued Industry profitability and sustainability</td></tr>
</table>

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 codes of practice (COP) such as one for Invasive Marine Species (Appendix 2.2.7). Although a number of COPs have been developed over the years, 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 TAC and TFIC in liaising with Government at both a National and State level. The Industry also has representatives on Natural Resource Management committees.

7.2.3: Seafood Safety

The Industry has joined with National and State regulatory bodies to develop mandatory protocols in pre- and post-harvest management. The pre-harvest management incorporates the TSQAP (Section 1.2.5: Quality Assurance). Through the TSQAP over 100 million Tasmanian oysters have been served and consumed without one recorded outbreak of illness.

The post-harvest regime includes a food safety program based on time/temperature protocols under Section 16 of the Primary Producers Processing Standard (PPPs 2006) as follows:

"16 Food safety management systems for bivalve molluscs

(1) A seafood business that engages in the primary production or processing of, or manufacturing activities concerning, bivalve molluscs must implement a documented food safety management system that effectively controls the hazards.

(2) A seafood business is taken to comply with subclause (1) if it implements –

- (a) a food safety program set out in Standard 3.2.1; or
- (b) a food safety management system set out in the Australian Export Control (Processed Food) Orders; or
- (c) the Codex Alimentarius Hazard Analysis and Critical Control Point System (HACCP) for food safety management set out in Annex C to CAC/RCP 1-1969, revision 4 (2003); or

(d) any other Hazard Analysis and Critical Control Point (HACCP) based food safety management system recognised by the Authority.

(3) For the purposes of subclause (1), a seafood business must comply with –

(a) the conditions of the ASQAP Manual specified in the Schedule to this Standard; or
(b) conditions recognised by the Authority”.

7.2.4: Peak Bodies

The peak representative bodies for the Industry are Tasmanian Aquaculture Council (TAC) and Tasmanian Fishing Industry Council (TFIC). A number of other bodies play vital roles in the management of the industry and have direct links to TFIC and TAC, as shown in Figure 7.2.4. These bodies include the Tasmanian Oyster Research Council (TORC), which defines strategic research directives for the Industry; and the Tasmanian Shellfish Executive Council (TSEC).

TSEC’s role is to:

- Establish a direct dialogue with Government upon issues relevant to the Industry;
- Promote the benefits and environmental sustainability of the shellfish industry to the community;
- Establish best practice guidelines and training for industry participants;
- Ensure economic and environmental sustainability of the industry;
- Collect and share information between industry members within Tasmania and interstate and overseas;
- Continue to unite the shellfish industry by supporting regional groups and providing an avenue for their concerns or triumphs to be heard;
- Establish a newsletter with reports from each of the regions on a regular basis.

TSEC has representation of two seats on TAC (of which one has voting rights) and one seat on the Shellfish Industry Council of Australia (SICOA). TFIC has representation on the Australian Seafood Industry Council (ASIC) and both TAC and SICOA have representatives on the National Aquaculture Council (NAC). The Industry currently has one representative on the TFIC board.

In addition there are a number of marine farming bodies associated with the Industry, both in Tasmania and interstate. See glossary for the acronyms.

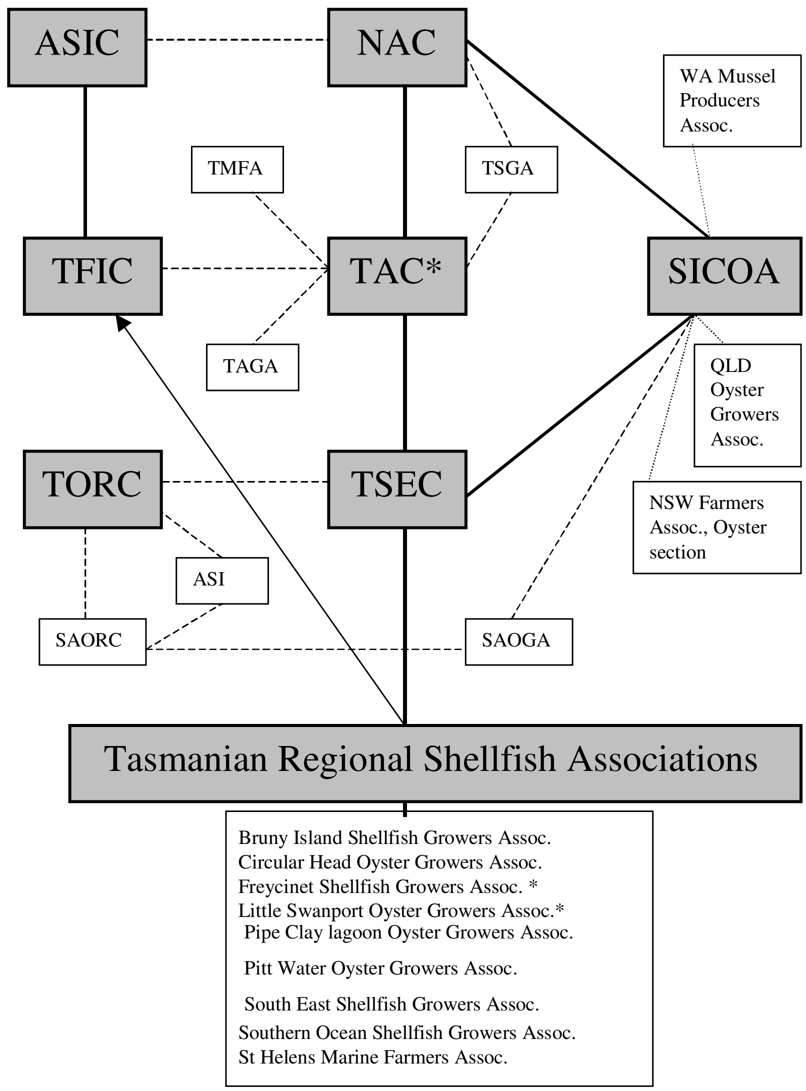

Figure 7.2.4. Tasmanian Shellfish Industry Structure and Links. See Glossary for acronyms. Solid lines represent structured methods of communication. * associations not yet incorporated.

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.

Social and Economic Objective 7.2: To ensure that Industry representation does not impact on the sustainability of Industry.			
Consequence **C= 3**	**Likelihood** **L= 3**	**Risk Rating** **C x L = 9** **Moderate**	**Target Risk Rating** **Low**
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			
Suggested Performance Measures • Evaluate continued Industry profitability and sustainability			

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. This representative is a member of the Tasmanian Conservation Trust representing the community and conservation groups.

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** **Moderate**	**Target Risk Rating** **Low**
Risk Management Options • Participation in statutory 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 • Monitoring the time required to complete 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 it, 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.
- Ocean Acidification 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

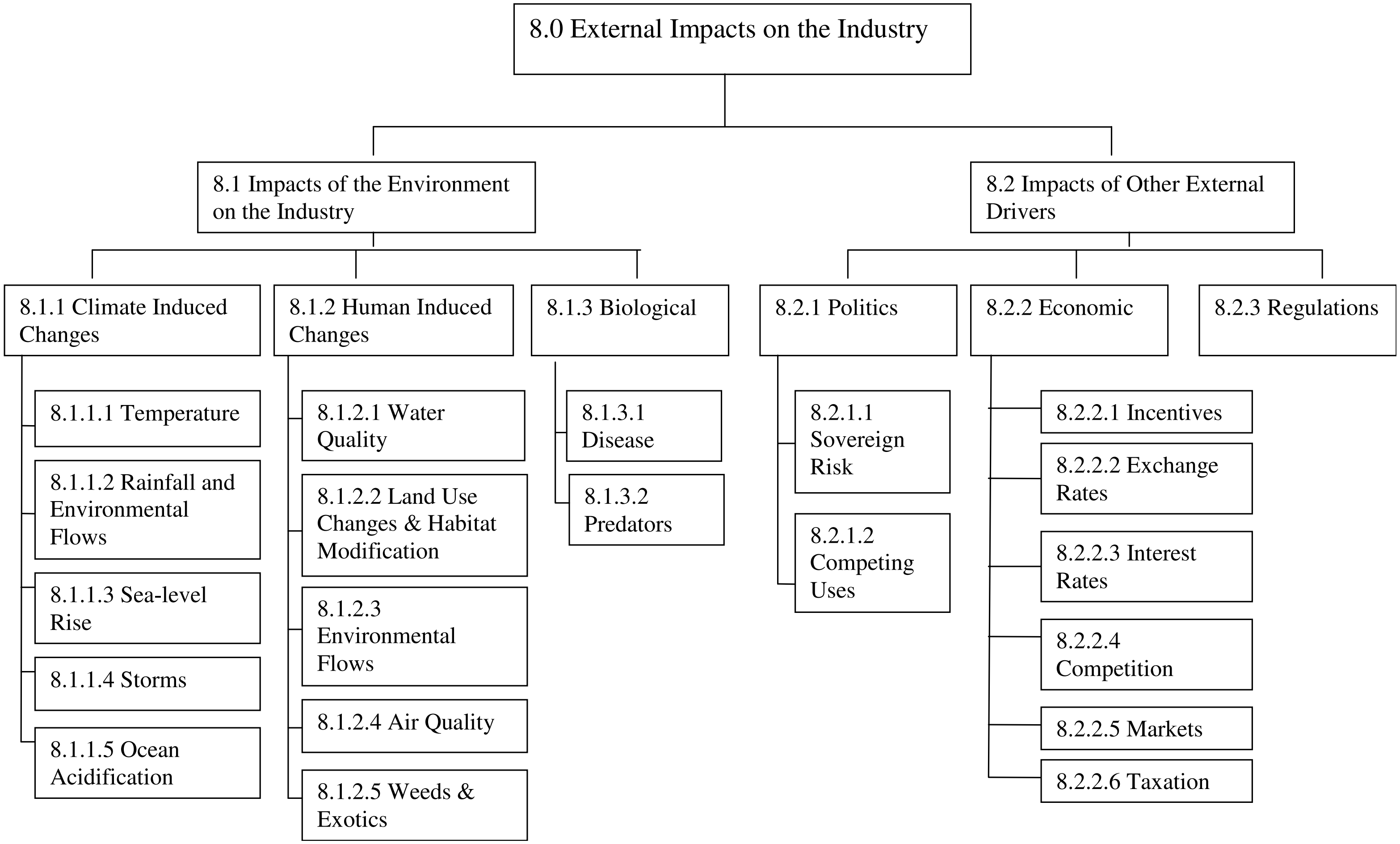

Fig 8.0. Component Tree 8: External Impacts of the Environment on the Industry

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 to reduce their impact through research and sound management practices.

8.1.1: Climate Induced Changes

Climate change is comprised of primary effects such as higher air temperatures and CO2 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.

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. Pacific oysters have an upper thermal limit of 30°C (Coleman 1986). The upper thermal limit of native flat oysters is unknown. Sea temperature of Tasmanian coastal waters has been reported to have increased 0.6 to 3 °C per 100 years (Crawford et al 2004) and is expected to continue to increase at a similar or greater rate. The impact of temperature rise on spawning and condition of the oysters has not been determined, therefore the long term impact on the survivability of Pacific and flat oysters is unknown. An increase in temperature may lead to an earlier spawning season and therefore a change in the seasonality and corresponding suitability for market (Richard Pugh personal comment)

A rise in sea temperature may also result in increased primary productivity, photosynthesis, decomposition and nutrient recycling. These impacts may enhance the growth of cultured oysters (The Royal Society 2005). There is some evidence of southward extension in the ranges of some native and introduced marine pests, possibly related to climatic warming. The range extension for the European shore crab, *Carcinus maenus,* from Victoria to Tasmania in the early 1990s has been linked to a series of unusually warm years and a stronger than usual East Australian Current (EAC) (Thresher et al 2003) and may impact upon the Industry (Section 8.1.3.2).

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, personal comment). 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 (DPIW 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 to 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 oyster culture in estuaries and bays by altering the nutrient input and increasing turbidity and salinity, affecting primary productivity and water quality. Unpredictable timing, duration and intensity of estuarine flows may increase the incidence of intermittent oyster mortalities and lead to structural damage on marine farms.

8.1.1.3: Sea-Level Rise

Sea-level is presently increasing at about 1.8mm per year. 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).

Severe change or loss of habitat may occur, leading to the need for Industry to relocate. Most oyster culture equipment may be adapted to compensate for gradual changes in sea-level rise. 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, enhanced erosion would probably be a significant problem for the Industry. Storm surges will most likely result in increased flooding of low-lying coastal areas and modification of saltmarsh and other low-lying estuarine and muddy shores (Sharples 2004). The Industry may need to adapt their culture techniques to accommodate increased storm frequency.

8.1.1.5: Ocean Acidification

The oceans are absorbing carbon dioxide (CO_2) from the atmosphere, causing chemical changes and making the oceans more acidic (The Royal Society 2005). This is likely to cause a reduction in the availability of the chemical compounds needed for calcified shells and plates. It also has repercussions for physiological affects such as hypercapnia (acidification of the blood) and acid-base balance in anoxia when shellfish seal themselves at low tide. Calcifying marine organisms important to the sustainability of the Industry such as phytoplankton and those species associated with the benthos in shallow embayments will also be impacted.

Environmental Objective 8.1.1.1: To ensure that the Industry has mechanisms to adapt to sea temperature rise.		
Consequence **C= 2**	**Likelihood** **L= 6**	**Risk Rating** **C x L = 12** **Moderate**
Environmental Objective 8.1.1.2: To ensure that the Industry has mechanisms to adapt to changes in rainfall patterns.		
Consequence **C= 3***	**Likelihood** **L= 6**	**Risk Rating** **C x L = 18** **High**
Environmental Objective 8.1.1.3: To ensure that the Industry has mechanisms to adapt to sea-level rise.		
Consequence **C= 4**	**Likelihood** **L= 6**	**Risk Rating** **C x L = 24** **Extreme**
Environmental Objective 8.1.1.4: To ensure that the Industry has mechanisms to deal with storm events.		
Consequence **C= 2**	**Likelihood** **L= 4**	**Risk Rating** **C x L = 8** **Moderate**
Environmental Objective 8.1.1.5: To ensure that the Industry has mechanisms to adapt to ocean acidification.		
Consequence **C= 3**	**Likelihood** **L= 5**	**Risk Rating** **C x L = 15** **High**

* Consequence may vary regionally

Risk Management Options

- Monitoring for environmental change
- Variable systems for oyster culture
- Adaptive husbandry management
- Enclosed basket systems for high energy areas
- Monitoring of phytoplankton community change
- Farming of triploid oysters
- Selective breeding of oysters
- Industry representation at legislative and policy review levels of Government
- Targeted research of climate change impacts on the Industry
- Collect baseline-farming information on which the effects of climate change can be measured.

Suggested Performance Measures

- Monitor information to determine impacts of climate change on productivity

8.1.2: Human Induced Change

A critical gap in planning and management processes of land and water is the failure to address the requirements of oyster marine farming.

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

The principal threats to oyster production may include human faecal contamination of oyster growing areas, turbidity, marine biotoxins, agricultural and industrial pollutants, and prolonged freshwater flooding (White 2001). Increased concentrations of seston (water borne organic material) can impact on oysters by decreasing clearance rates, clogging gill apparatus, lowering growth rates which may lead to death in oysters. In addition, increased sedimentation may kill oysters by smothering them. In heavily turbid waters (>100 mgL^{-1} of silt) the clearance rate of oysters may be reduced by 50%. Typically, threshold concentrations of sediment occur between 0.03 to 2 mgL^{-1} total particulate matter while critical concentrations occur between about 10 and 50 mgL^{-1} (White 2001). The health status of selected estuarine systems in which the Industry operates (Table 8.1.2.1) demonstrated that the threshold for particulate matter (TSS) is exceeded in 4 out of 5 estuaries examined. Water quality of the Duck Bay Estuary has critical TSS levels and relatively poor condition due to the elevated turbidity, nitrogen and phosphorus concentrations (Murphy et al 2003). The source of nitrogen and phosphoros most likely originates from anthropogenic sources upstream from the oyster leases.

Table 8.1.2.1. Health of estuarine systems associated with oyster marine farming. Letters in parenthesis indicate level of impact: L=low, M=medium, H=high, VH=very high. Chl *a* = Chlorophyll *a*; NOx = total nitrogen; PO_4 = phosphate; TSS = total suspended solids (total particulate matter). (adapted from Murphy et al 2003).

Region	Estuary	Yearly median values for parameters and indicator levels				
		Turbidity	Chl. *a* mgL^{-1}	NOx mgL^{-1}	PO_4 mgL^{-1}	TSS mgL^{-1}
1. North West	Duck Bay	8.3 (M)	1.5 (L)	127 (VH)	28 (H)	12.3
2.Port Sorell	Port Sorell	5.4 (M)	0.8 (L)	4 (L)	8 (M)	1.9
4. Great Oyster Bay	Great Swanport	1.4 (L)	0.5 (L)	1 (L)	3 (L)	5.0
	Little Swanport	1.8 (L)	1.1 (L)	0 (L)	4 (L)	8.6
9. Channel	Cloudy Bay Lagoon	1.0 (L)	0.7 (L)	1 (L)	6 (M)	7.2

Poor water quality can have a major impact on Industry due to farm closures by TSQAP when bacterial counts or harmful algae exceed approved levels (Section 1.2.3: Quality Assurance). Declining estuarine health and coastal water quality is of great concern to the Industry's sustainability.

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.

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). Urban development has been associated with higher water run-off leading to lower salinities and higher seston loads which was associated with greater oyster food availability and increased oyster growth in Sydney rock oysters, but decreased oyster health, survivorship and marketability (Paterson et al 2003).

No integrated catchment management legislation exists in Tasmania. There is very limited monitoring of the downstream impacts of land use changes. Water Management Plans developed by DPIW are principally involved in water allocation, with no management controls or license conditions able to be applied to the secondary or tertiary use of the water. Diffuse pollution sources from land based primary production systems have been identified as the most significant issue affecting water quality in the State of the Environment Report (RPDC 2003) at a state and national level, the State of the Marine Environment Report (Rees 1996), and the National Resource Management Framework (NRM 2005). Unless similar regulatory compliance placed on the marine farming industry is applied to land use, it will be one of the most significant risks to the sustainability of the Industry.

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.

The construction of dams, which reduce water flow, has been reported to disturb the lower estuarine and coastal sea ecosystems by retaining the dissolved-silica loading, and consequently reducing downstream diatom blooms (Rocha et al 2002). There are no management controls that consider the effect of habitat modification of upstream catchment users on estuarine oyster farms or the effect of developments near oyster farms.

Currently there is a regulatory desire to increase agricultural production through the allocation of irrigation water. The State of Growth strategic plan (DPIW 2003) has allocated an additional 20,000 ML per annum of irrigation water to agricultural farmers in Tasmania and could potentially allow the extra allocation of 50,000 ML per annum in the future. There is little information available to determine the requirements of freshwater quantity to maintain estuarine integrity, or the impact of flow reduction on Tasmanian coastal ecosystems. The human induced reduction in environmental flows may have serious consequences for the sustainability of the Industry by decreasing primary productivity of the bays and estuaries.

8.1.2.4: Air Quality (spray drift)

There is significant forestry activity around a number of oyster growing regions. Concerns are held by the Industry about the use of aerial spraying in forestry coups and chemical spraying in general, especially over catchments that drain into the marine farming zones. Due to environmental concerns on pesticides, the agro-forestry industries often seek alternative effective compounds. However, these compounds often have unknown potential to impact on aquatic life should sufficient amounts reach marine farming areas in run-off or flooding events. Currently chemicals used in agro-forestry include spinosad ('Success Naturalyte Insect Control') which is toxic to oysters and marine diatoms, Alpha-cypermethrin ('Dominex') which is considered highly toxic to fish and aquatic arthropods, but there is no reference to molluscs (eg. oysters) in the Material Safety Data Sheet. The herbicide, pendimethalin ('Stomp 330E') is also reported as dangerous to fish and other aquatic life on the Material Safety Data Sheet. Percival (2004) has recommended that any further investigation of the oyster health issue should include an audit of chemicals used during forestry activities within the George River catchment, their chemical characteristics and their pattern of use. This work is currently being conducted by DPIW.

8.1.2.3: 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. (NIMPCG). Further information can be found in Section 2.2.7 and Appendix 2.2.7.

The introduced rice grass (*Spartinia angelica*) has been shown to impact upon the Industry through invading estuarine and intertidal habitat. Control and preventative treatments at Little Swanport by the Industry and the DPIW Rice Grass team have almost eliminated this weed in the area. Rice grass occurs in seven regions of the state, including four where oysters are farmed.

Environmental Objective 8.1.2.1: To ensure that declining water quality does not impact upon the Industry.			
Consequence **C= 4**	**Likelihood** **L= 5**	**Risk Rating** **C x L = 20** **Extreme**	**Target Risk Rating** **Moderate**
Environmental Objective 8.1.2.2: To ensure that land use change does not impact upon the Industry.			
Consequence **C= 4**	**Likelihood** **L= 6**	**Risk Rating** **C x L = 24** **Extreme**	**Target Risk Rating** **Moderate**
Environmental Objective 8.1.2.3: To ensure that human induced changes to environmental flows do not impact upon the Industry.			
Consequence **C= 4**	**Likelihood** **L= 5**	**Risk Rating** **C x L = 20** **Extreme**	**Target Risk Rating** **Moderate**
Environmental Objective 8.1.2.4: To ensure that chemical spray drift does not impact upon the Industry.			
Consequence **C= 3**	**Likelihood** **L= 4**	**Risk Rating** **C x L = 12** **Moderate**	**Target Risk Rating** **Low**
Environmental Objective 8.1.2.5: To ensure that exotic species do not impact upon the Industry.			
Consequence **C= 4**	**Likelihood** **L= 5**	**Risk Rating** **C x L = 20** **Extreme**	**Target Risk Rating** **Moderate**
Risk Management Options • Monitoring of environmental and chemical parameters in the water • Monitoring land use change • Monitoring for exotic species • Rice grass reduction strategy • Targeted research • Awareness raising of community on potential impacts and the need for change • Industry representation at legislative and policy review levels of Government • Input into Natural Resource Management (NRM) regional plans			
Suggested Performance Measures • Monitoring for the presence of exotic species • Monitoring oyster health			

8.1.3: Biological

8.1.3.1: Disease

Scope

To assess the risk of disease in cultured Pacific and native flat oysters.

Current Management Controls

8.1.3.1.1: Identification of Disease in Adults

Pacific Oyster Health Program (POHP) assists with the identification of potential diseases through two main components:

- *Diagnosis of Unusual Events*: This component is designed to ensure early detection of disease incursions and new diseases, to provide growers with a diagnostic surveillance service and to assist them with their responsibility, both under the program, and under the law (*Animal Health Act* 1995), to report disease events and submit samples for investigation from mortality or other unusual events.
- *Surveillance program*: Designed to detect low levels of oyster disease, which might be overlooked until the disease has spread widely, and to provide proof of absence of disease for trade and international reporting purposes. Surveillance sampling looks at sites of particular risk, using wild oysters as sentinels in these sites. Production areas are assessed as well as hatcheries.

In addition, Industry is investigating the possibility of a field diagnostic service to address health problems such as mortality, disease and low productivity. Such a service would supplement the laboratory based POHP.

Fish Health Emergencies are triggered by any event that indicates serious existing or potential aquatic animal illness or mortality and may be due to infectious causes (disease outbreak) or an environmental hazard. Under the Tasmanian *Animal Health Act* (1995), a grower who suspects that an undiagnosed disease is causing unusual mortality or illness in his/her oyster stocks is obliged to:

- engage a veterinary surgeon to investigate the disease and its cause: or
- notify a Departmental inspector of the presence or possible presence of an unknown disease; and if possible
- isolate that group of animals.

8.1.3.1.2: Identification of Disease in Spat

Under the current POHP, all oyster hatchery facilities are required to:

- Submit broodstock for disease certification by DPIW Fish Health Unit once a year.
- Submit spat for disease certification twice a year for histology and parasitology by DPIW Fish Health Unit.

In addition, Tasmanian oyster hatcheries are required to certify that oyster spat supplied to states such as South Australia are free from several specified oyster diseases and to include a current general health certificate with all spat shipments. The notifiable diseases and disease agents associated with molluscs for importation into South Australia are listed in Table 8.1.3.1.2.

Table 8.1.3.1.2. Disease and disease agents associated with molluscs notifiable under the South Australian Acts of Parliament (Adopted from PIRSA 2003).

Fisheries Act 1982	Livestock Act 1997
Mytilicola spp.	Bonamiosis
Urosalpinx spp.	Haplosporidiosis
Dermocystidium spp.	Marteiliosis
Minchinia spp.	Mikrocytosis
Perkinsus spp.	Perkinosis
Labyrinthomyxa spp.	*Bonamia ostreae*
	Mikrocytos mackini
	Oyster velar disease
	Perkinsus atlanticus
	Perkinsis marinus
	Boccardia knoxi

<u>8.1.3.1.3: Response</u>

Emergency response to aquatic marine disease is difficult to make, due to the difficulty in containment of water on marine leases. 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 and emergency management organisations. The basis for this planning is contained in the AQUAVETPLAN being developed by the Aquatic Animal Health unit of 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 response manual for AQUAVETPLAN and is available from http://tod.DPIW.tas.gov.au/tod.nsf/WebPages/CPAS-5VL3YA?open.

The Tasmanian Fish Health Advisory Group (TFHAG) has been established to be a central group in the development and implementation of fish health emergency plans. The TFHAG consist of representation from Government departments and Industry groups. The terms of reference for the TFHAG 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.

The DPIW Fish Health Unit is an integral part of the AQUVETPLAN, the TOM Manual and the POHP, and provides veterinary pathology and fish microbiology diagnostic services for marine farming and wild fish, including shellfish. To contact the Fish Health Unit at Mt Pleasant Laboratories phone: 03 6336 5216 E-mail: specimenreception@DPIW.tas.gov.au.

The Industry's response to National and Statewide emergency incursions of disease is well planed and documented. However, non-emergency disease events have no developed responses and limited service. Lack of field diagnosis services lead to an extreme-risk situation. To ensure that the Industry has non-emergency disease response capabilities, the industry needs to have available:

- added field diagnosis
- sampling protocols
- Industries access to a specialised diagnostician.

Environmental Objective 8.1.3.1.1: To ensure that an appropriate disease surveillance program is in place to reduce the disease risk in the Industry.			
Consequence C= 4	**Likelihood L= 2**	**Risk Rating C x L = 8 Moderate**	**Target Risk Rating N/A**
Environmental Objective 8.1.3.1.2: To ensure that disease does not impact upon the Industry through hatchery and nursery activities.			
Consequence C= 4	**Likelihood L= 2**	**Risk Rating C x L = 8 Moderate**	**Target Risk Rating N/A**
Environmental Objective 8.1.3.1.3: To ensure that appropriate emergency response mechanisms are effective in reducing the impact of disease outbreaks in the Industry.			
Consequence C= 4	**Likelihood L= 2**	**Risk Rating C x L = 8 Moderate**	**Target Risk Rating N/A**
Environmental Objective 8.1.3.1.4: To ensure that field diagnostic services are in place to reduce the impact of disease outbreaks in the Industry.			
Consequence C= 4	**Likelihood L= 5**	**Risk Rating C x L = 20 Extreme**	**Target Risk Rating Moderate**
Risk Management Options • Maintenance of the Pacific Oyster Health Program in compliance with the OIE • Provision of staff by DPIW with the appropriate level of expertise to ensure the POHP is compliant • Added field diagnosis, sampling protocols			
Suggested Performance Measures • Provision of annual reports of disease outbreaks from the Chief Veterinary Officer • Written report provided to TORC Annual General meeting by the DPIW Fish Health Unit on the Pacific Oyster Health Program			

8.1.3.2: Predators

Scope

To assess the risk of predators impacting on the Industry

Current Management Controls

Marine farmers have identified the introduced green crab (*Carcinus maenas*) as a predator on farmed oysters, although the impact of the green crab on the Industry has not been quantified. In its native range (Europe), this crab has been reported as a significant predator of cultured Pacific oysters grown on the seabed, and has no difficulty in eating Pacific oysters up to 5 g in size (Walne and Dean 1977). The presence of a mesh cover over the baskets greatly enhances survival of Pacific oysters from green crap predation (Walne and Dean 1977). The Industry is also developing a protocol to reduce the spread of the green crab (Appendix 2.2.7).

Other predators include fish, skate and ray which will forage for oyster stock that may have accidentally escaped from the baskets (Section 2.2.6: Behavioural changes of species).

Environmental Objective 8.1.3.2: To ensure that the Industry can remain sustainable in the presence of predators.			
Consequence **C= 1**	**Likelihood** **L= 4**	**Risk Rating** **C x L = 4** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • Adherence to a translocation protocol • Staff education • Exclusion of predators through appropriate equipment			
Suggested Performance Measures • Increase in significant predation events reported to DPIW as per quarterly returns			

8.2: IMPACTS OF OTHER EXTERNAL DRIVERS

Political, economic and regulatory drivers may influence an industries capacity to compete in the market place. This 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 EPBC Act provides the overarching legal requirements for environmental impact assessment of development proposals in Australia. The Nathan Dam case (McGrath 2003) widened the scope of relevant impacts that must be considered for assessment under the EPBCA. The outcome decision dramatically strengthened the ability of the Act to protect the environment. The decision confirmed that the Commonwealth Minister must take a broad approach when setting the terms of reference for environmental impact assessments under the EPBC Act, and must consider indirect impacts and effects which are the consequences of the proposed action, even if they are undertaken by a third party. State and Territory governments performing environmental impact assessment under bilateral agreements on behalf of the Federal Government under the EPBC Act will also be required to comply with the same principles.

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.

<table>
<tr><td colspan="4">Socio-Economic Objective 8.2.1.1: To ensure that the Industry can remain sustainable with the current sovereign risk.</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">Socio-Economic Objective 8.2.1.2: To ensure that the Industry can remain sustainable with the current competing uses.</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
• Industry representation at legislative and policy review levels of Government
• Awareness raising of community</td></tr>
<tr><td colspan="4">Suggested Performance Measures
• Monitoring proposed changes to present legislation</td></tr>
</table>

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. There are limited incentives that have been developed for the Industry at this stage; those that have been developed include Envirofund, FarmBis, Landcare and Seafood Services Australia. However, accessibility to incentives, level of detail and number of supporting documentation required from the stakeholder often make these applications prohibitive.

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

As the Industry is relatively new, access to competitive interest rates has been historically difficult. However, as the Industry develops it is expected that confidence will provide lower interest rates.

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

Problems for the Industry occur in remaining competitive on the open markets. Industry cannot compete on the processed meats market due to its inability to be cost competitive with countries having cheaper labour or greater production. The Tasmanian Shellfish Quality Assurance program (TSQAP) allows access of the Tasmanian Industry to overseas markets (Section 1.2.5: Quality Assurance). Further information on exports can be found in Section 4.2.1: Import replacements/exports.

The Tasmanian Industry currently has around 20% of the Australian oyster production (Figure 8.2.2.5: ABARE 2005). However, the Tasmanian focus is more on high quality product rather than high production.

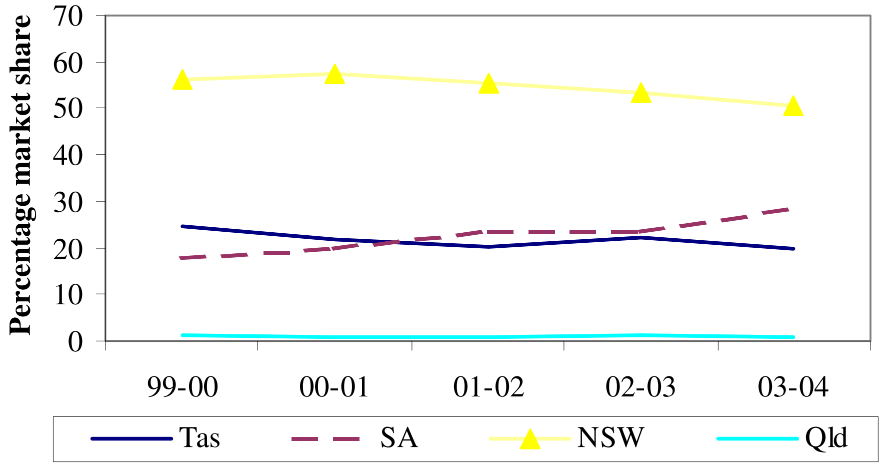

Figure 8.2.2.5. Oyster production by state demonstrating the South Australian increased growth competitiveness on the market compared to decreased production in Tasmania. Most production in NSW represents the Sydney rock oyster.

Further information on export markets is provided on Section 4.1.2: Import replacement/exports

8.2.2.6: Taxation

The Industry receives tax incentives similar to other primary industries.

Economic Objective 8.2.2.1: To ensure that the Industry can remain sustainable with the current economic incentives, exchange rates, interest rates, competition policy and taxation.			
Consequence **C= 2**	**Likelihood** **L= 2**	**Risk Rating** **C x L = 4** **Low**	**Target Risk Rating** **N/A**
Economic Objective 8.2.2.2: To ensure that the Industry can remain sustainable with the current market share.			
Consequence **C= 2**	**Likelihood** **L= 3**	**Risk Rating** **C x L = 6** **Low**	**Target Risk Rating** **N/A**
Risk Management Options • Diversity of product • Industry marketing strategy • Industry training • Quality assurance • Supply chain assurance			
Suggested Performance Measures • Monitoring Industry profitability			

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 outside the boundary of the marine farming lease area. Relevant environmental parameters must be monitored in accordance with the requirements specified in the relevant marine farming licence*."

Socio-Economic Objective 8.2.3: To ensure that the Industry can remain sustainable within the current regulatory framework.			
Consequence C= 3	**Likelihood L= 5**	**Risk Rating C x L = 15 High**	**Target Risk Rating Low**
Risk Management Options • Industry representation at legislative and policy review levels of Government			
Suggested Performance Measures • Monitoring proposed changes to present legislation			

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Glossary of Acronyms and Terms

Acronyms

AQIS	Australian Quarantine Inspection Service
ASI	Australian Seafood Industries Pty. Ltd.
ASQAP	Australian Shellfish Quality Assurance Program
AUSVETPLAN	Australian Veterinary Emergency Plan
AWA	*Animal Welfare Act 1993*
CAMBA	China-Australia Migratory Bird Agreement
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CVO	Chief Veterinary Officer
DAFF	Department of Agriculture, Fisheries and Forestry, Australia
DHHS	Department of Health and Human Services, Tasmania
DPIF	Department of Primary Industry and Fisheries
DPIWE	Department of Primary Industry Water and Environment, Tasmania
DPIW	Department of Primary Industry and Water, Tasmania
DSF	Department of Sea Fisheries, Tasmania
ECA	*Export Control Act* 1982
EIS	Environmental Impact Statement
EPBCA	*Environmental Protection and Biodiversity Conservation Act 1999*
FHU	Fish Health Unit
FRDC	Fisheries Research and Development Corporation
FSANZ	Food Standards Australia and New Zealand
JAMBA	Japan-Australia Migratory Bird Agreement
LMRMA	*Living Marine Resources Management Act 1995*
LUPAA	*Land Use Planning and Approvals Act 1993*
MAST	Marine and Safety Tasmania
MFPA	*Marine Farming Planning Act 1995*
MFDP	Marine Farming Development Plans
NIMPCG	National Introduced Marine Pests Co-ordination Group
NPRMA	*National Parks and Reserves Management Act 2002*
OIE	Office International des Epizooties
PEV	Protected Environmental Values
Ramsar	Convention on Wetlands (Ramsar, Iran, 1971)
RMPS	Resource Management Planning System
SAOGA	South Australian Oyster Growers Association
SAORC	South Australian Oyster Research Council
SPWQM	State Policy on Water Quality Management 1997
TAFI	Tasmanian Aquaculture and Fisheries Institute
TFHAG	Tasmanian Fish Health Advisory Group
TMFA	Tasmanian Marine Farmers Association
TORC	Tasmanian Oyster Research Council
TPAA	Timber Preservation Association Australia
TSEC	Tasmanian Shellfish Executive Council
TSPA	*Threatened Species Protection Act 1995*
TSQAP	Tasmanian Shellfish Quality Assurance Program
USFDA	United States Food and Drug Administration

Terms

Accidental escape
The unintentional release of cultured oyster stock, irrespective of size or maturity, through processes beyond the control of the marine farmer. Those processes may include but are not necessarily limited to unusual climatic conditions, adverse weather or uncontrollable biological functions of the organism.

Aspect
Elements of an organisation's activities or products or services that can interact with the environment. (ISO 14001:2004).

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 oysters.

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 oyster marine farming industry, inclusive of marine leases, hatchery and nursery facilities.

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.

Spat
Juvenile oysters post-settlement.

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

TORC

Tasmania

Australian Government
Fisheries Research and Development Corporation

FRDC Project 2004/096

Environmental Management System Framework

Tasmanian Oyster Industry

Appendices Accompanying Guide and Risk Assessment

for

Ecologically Sustainable Development

Version 1.0

August 2006

PhycoTec Environmental Management

TORC Tasmanian Oyster Research Council Limited

TFIC

Tasmania

Australian Government
Fisheries Research and Development Corporation

FRDC Project 2004/096

ENVIRONMENTAL MANAGEMENT SYSTEM FRAMEWORK

Compliance Guide and Risk Assessment of Ecologically Sustainable Development for the Tasmanian Oyster 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 Oyster Research Council (TORC), 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 Ecologically Sustainable Development for the Tasmanian Oyster Industry: Accompanying Appendices is a living document subject to periodic review to capture regulatory changes and Industry's adaptive management.

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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 server-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 1.1.2.2: DESCRIPTION OF POTENTIAL PATHOGENS AS IDENTIFIED BY THE PACIFIC OYSTER HEALTH PROGRAM (POHP).

Boccardia knoxi (mudworm)

The mudworm *B. knoxi* is a marine polychaete worm with a planktonic larval stage that infests shellfish widely distributed in may areas of the world. Infected shellfish are detected by observing the presence of shell blistering. These blisters are common to many “mudworm” species, but *B. knoxi* is characterised by “chimneys” (extensions of the mudworm tunnel secreted by the worm) which make diagnosis easier. This mudworm demonstrates little host specificity and can infest a number of species of oysters, abalone and scallops (see Section 1.3.1). The prevalence of *B. knoxi* in Tasmania is considered so low as to be more of a regulatory problem than an economic one (DPIW veterinarian pers.comm.). Handley (1995) found that the lowest mortalities occurred in intertidally reared shellfish, probably due to the pest’s inability to survive periods of desiccation. Farm management practices of rotating stock ensure periods of air exposure, usually on intertidal racks. Wild Pacific oyster stocks almost always occur in the intertidal zone and therefore would have little impact from *B. knoxi*.

Evidence of mudworm in the native flat oyster has been found in aboriginal middens dating back thousands of years (Wilson et al 1993). The larvae are known to affect native clams, abalone and other molluscs. It is unlikely that escaped populations of cultured flat oyster would impact upon the natural disease levels within the native population.

Bonamia sp.

Bonamiosis is a serious lethal infection of flat oysters (genus *Ostrea*), caused by protozoan parasites *Bonamia* sp. and *Bonamia ostreae*. This organism has been previously associated with high mortalities and severe pathology in other parts of the world. The initial isolation of *Bonamia* sp. in Tasmania in 1992 from the native flat oyster was associated with low mortalities (3-35%) compared to Victoria (80%) and New Zealand (51%) (Wilson et al. 1993). The pathology of *Bonamia* sp. in *O. angasi* in Tasmania indicates that it has been present in Tasmanian for a number of years and its relatively recent discovery does not represent a newly acquired infection. At present *Bonamia* sp. has only been isolated from oysters in Georges Bay, St Helens and Birches Bay. Before commercial harvesting of *O. angasi* was permitted, mortality and growth trials were conducted by the Division of Sea Fisheries (Hobart) on a sample of 300 oysters translocated from Georges Bay to Birches Bay. *Bonamia* spp. have not been isolated from Pacific oysters and they are not regarded as susceptible species or a potential carrier.

Potential risk of disease introductions through the translocation of live oysters from South Australia shown in Table 1.1.2.2 have been identified by DPIW using hazard assessment techniques as shown. Risk management strategies are being developed for these diseases to prevent introduction and maintain the Tasmanian state *Perkinsus olseni/atlanticus* free status

Table 1.1.2.2 Hazard list for Tasmanian disease introductions (Adopted from the Discussion Paper, Introduction of Pacific Oysters from South Australia and Lleonart 2001)

Disease Disease Agent	Susceptible species	Adverse Impact in Tasmania	Occurrence	Potential hazard
Perkinsosis ***Perkinsus olseni/atlanticus***	Abalone (*Haliotis* spp.) Manila clam (*Ruditapes philippinarum*) Possible some 50 other mollusc species	Yes	Australia*: P. olseni* in SA, WA and NSW. *P. olseni atlanticus*-like species in QLD. Not detected in TAS	Yes
Herpes-like virus	Any mollusc	Yes	**Unknown**	Yes
Unidentified microcell **(may be *Bonamia, Microcytos, Haplosporidia, Larteilia, Perkinsus, Apicomplexa,* Marteiloides)**	Any mollusc	Unknown	**Unknown**	Unknown
Boccardi knoxi **(mudworm)**	Abalone (*Haliotis* spp.)	Yes	**Statewide**	Yes

References

DPIWE (in prep) Discussion Paper: Importation of Pacific oysters (*Crassostrea gigas*) from South Australia. DPIWE, Tasmania.

Lleonart M (2001) Australian Abalone Mudworms: Avoidance and detection. A FarmManual. Report for the Fisheries Research and Development Corporation, December 2001.

APPENDIX 1.2.1: SELECTIVE BREEDING OF PACIFIC OYSTERS

The Australian Seafood Industries P/L (ASI) was established in 2000 by the Oyster Industry to unify the delivery of commercially-oriented research to the industry and to provide leadership in commercialising the results of the research. The company was formed by key Tasmanian and South Australian industry groups, specifically to commercialise research conducted in the Fisheries Research and Development Corporation (FRDC) project 2000/206 - “Sustainable Genetic Improvement of Pacific Oysters in Tasmania and South Australia”. This project commenced in October 2000 as a joint venture between FRDC, CSIRO (Hobart), the University of Tasmania (TAFI) and the Pacific Oyster Industry, at an estimated cost of $1.6 million. The project built on selective breeding research, which had been in progress since 1996. ASI participated in the several committees directing the research project and two Board members of ASI were nominated as Co-Investigators.

Except for a relatively small but important segment to establish heritability estimates for various commercially significant oyster traits, the project concluded in November 2003, having established a basic breeding program with an initial pool of selectively bred oyster families. The project demonstrated the potential for selective breeding to improve the profitability of oyster farming, particularly by improving the uniformity of growth in batches of oysters.

The ASI Board has representatives from the Tasmanian Oyster Research Council, the Tasmanian Shellfish Executive Council, the South Australian Oyster Research Council and the South Australian Oysters Growers Association, providing direct access to industry. ASI is continuing the selective breeding research which was initiated by FRDC 2000/206, and aims to progressively commercialise the research outcomes. The breeding program is seen by many in the oyster industry to be of crucial importance in continuing to improve Pacific oyster stock and meeting specific requirements from a maturing industry.

During 2002/03, ASI utilised a Comet grant from AusIndustry to develop a commercialisation strategy. This has become a living document, now referred to as the Operations Manual. ASI has been identified by FRDC as the driving force for research into Pacific oysters in Australia, with representation on all FRDC-funded Pacific oyster research projects. FRDC regards ASI as an innovative leader in the commercialisation of oyster research. The Company is providing some assistance to several other industry groups (abalone, barramundi) with the development and commercialisation of selective breeding programs. The success of the ASI commercialisation model will depend on external funding (industry contributions, grants) until sales of improved oyster seed can set the company on a firm commercial base.

ASI’s main strategic objectives are to:
1. Continue the development of a sustainable selective breeding plan.
2. Produce selectively bred family lines and mass selection lines.
3. Assess performance of the selectively bred lines and analyse results to identify commercially viable family lines.

4. Disseminate scientific information to industry groups, including both growers and hatchery operators, to enable commercially viable lines to be introduced into the market.
5. Develop a comprehensive data-base to store and manipulate data from selectively bred lines.
6. Demonstrate to industry the saving associated with use of commercially desirable traits.
7. Continue the close links between ASI and research organisations throughout Australia.
8. Provide an industry-based research organisation to assist in postgraduate studies for higher education institutions.

The oyster industry, through ASI has over 150 families lines over 6 generations (called "Thoroughbred" oysters) on characters such as increased meat yield, improved shell shape, increased growth rate, disease resistance, colour and uniformity of offspring. The broodstock of selected breeding lines are maintained at two broodstock repository sites in Tasmania and one repository site in South Australia. By holding broodstock at more than one location, the risk of losing any one line of broodstock is reduced.

APPENDIX 1.2.2.1: DISEASE HAZARDS IDENTIFIED FROM THE IMPORT OF PACIFIC OYSTERS (*Crassostrea gigas*) FROM SOUTH AUSTRALIA TO TASMANIA

The hazards identified from the importation of Pacific oysters (*Crassostrea gigas*) from South Australia are as follows:

- *Perkinsus olseni/atlanticus:* this organism is pathogenic in Pacific oysters and an important disease of abalone in South Australia. The organism is believed to be widespread along the Australian coastline but was not found in over 2000 oysters surveyed in South Australian Pacific oysters. This disease has not been detected by surveillance in Tasmania, and thought not to be able to survive in water temperatures below 20°C, the unrestricted risk is rated as *Low*
- A herpes-like virus: Oysters with lesions in poor condition with marked digestive tubule atrophy have been linked to a possible infection by a herpes-like virus in the 2003 South Australian survey. This virus may affect any molluscs. The cause may have been due to adverse environmental conditions, but this possible agent has been retained as a risk until more is known about the condition. The unrestricted risk is rated as *Moderate*
- A yet-identified microcell: The presence of this class of organisms is potentially pathogenic and recognised as capable of carriage without pathogenicity in the Pacific oyster and thereby posing a significant risk to some other oyster species (OIE 2003). The unrestricted risk is rated as *Moderate*

Under the OIE requirements, Tasmania can be declared as a *Perkinsus olseni/atlanticus* free zone, which will require any consignment of live oysters being brought into the country to be from a zone that is officially declared *Perkinsus olseni/atlanticus* free, or an marine farming establishment officially declared *Perkinsus olseni/atlanticus* free under the OIE guidelines.

References

DPIWE (in prep) Discussion Paper: Importation of Pacific oysters (*Crassostrea gigas*) from South Australia. DPIWE, Tasmania.

APPENDIX 1.2.2.2: RECOMMENDED PROTOCOL FOR THE EXPORT OF HATCHERY REARED SPAT FROM TASMANIA TO SOUTH AUSTRALIA

Primary Industries and Resources South Australia (PIRSA) has conducted an import risk assessment for the importation of live shellfish spat and have recommended protocols for importation of hatchery reared spat from Tasmania (adapted from PIRSA 2003) which include:

- Spat must be stored in single-spawning size classes to minimise size variation between animals.
- Oyster broodstock must be sourced from intertidal areas or from upweller systems that provide an equivalent regime of desiccation (which achieves shell drying for at least a total of 4 hours per day for a minimum of 60 days) and subjected to a freshwater bath treatment of at least 72 hours.
- Spat and broodstock must be tested to OIE standards for diseases notifiable in SA (Table 3.2).
- Spat are required to be depurated in sterilised water (5μm filtered UV treated seawater) for a period of 12 hours prior to translocation.
- Spat suppliers are required to sign a declaration that they have adhered to the required protocol.
- The spat supplier must be part of a system that enables auditing by a Competent Authority of Tasmania.
- Spat suppliers must participate in any relevant surveillance programs.

Table 3.2. Disease and disease agents associated with molluscs notifiable under the South Australian Acts of Parliament (Adopted from PIRSA 2003).

Fisheries Act 1982	Livestock Act 1997
***Mytilicola* spp.**	Bonamiosis
***Urosalpinx* spp.**	Haplosporidiosis
***Dermocystidium* spp.**	Marteiliosis
***Minchinia* spp.**	Mikrocytosis
***Perkinsus* spp.**	Perkinosis
***Labyrinthomyxa* spp.**	Bonamia ostreae
	Mikrocytos mackini
	Oyster velar disease
	Perkinsus atlanticus
	Perkinsus marinus
	Boccardia knoxi

Reference

PIRSA (2003) Translocation of live hatchery reared spat of *Crassostrea gigas, Pecten fumatus, Mytilus edulis* and *Ostrea angasi* from Tasmania: Import Risk Analysis. Report from the Department of Primary Industries and Resources, South Australia. May 2003.

APPENDIX 1.2.3: INVASIVE MARINE SPECIES IMPORT RISK ANALYSIS FOR SOUTH AUSTRALIA

Primary Industries and Resources South Australia (PIRSA) import risk assessment for the importation of live shellfish reared spat identified the following risks from introduced marine pests:

- Northern Pacific seastar (*Asterius amurensis*)

  The Northern Pacific seastar can be recognised by its characteristic purple and yellow appearance (more detail in Section 2.2.7). It is present in Tasmanian oyster growing areas, (not in South Australia) and may survive under the moist cool conditions under which oysters (particularly spat) are transported. Although the likelihood of the Northern Pacific seastar being released with untreated exported Tasmanian oysters in South Australia is low, the consequence of its release is very high (PIRSA 2003). Therefore the unrestricted risk is not acceptable. Management strategies for the Northern Pacific seastar include exposing the oysters to water salinities below 8.75 ppt for an extended period (12 hours) to kill any immature seastars.
- Japanese seaweed (*Undaria pinnatifida*)

  The Japanese seaweed, also known as wakame, is a brown alga that reaches 1-3m in length (more detail in Section 2.2.7). It is present in Tasmanian waters, (not in South Australia), and may survive under the moist cool transportation conditions under which oysters are transported. The spores may survive in the liquid within the oyster shell. PIRSA (2003) has determined that the likelihood of the Japanese seaweed being released with untreated exported Tasmanian oysters in South Australia is high and the consequence of its release is also high. Therefore the unrestricted risk is not acceptable. Management strategies for the Japanese seaweed include a 12-hour freshwater treatment to kill external infections and a 12-hour depuration in sterile seawater to eliminate algal spores.

Reference

PIRSA (2003) Translocation of live hatchery reared spat of *Crassostrea gigas, Pecten fumatus*, *Mytilus edulis* and *Ostrea angasi* from Tasmania: Import Risk Analysis. Report from the Department of Primary Industries and resources, South Australia. May 2003.

APPENDIX 1.2.4: BACKGROUND TO THE TASMANIAN SHELLFISH QUALITY ASSURANCE PROGRAM (TSQAP)

Tasmania was the first Australian state to provide an appropriate level of public health protection for shellfish consumers by requiring the completion of comprehensive sanitary surveys and risk assessments for all commercial shellfish areas before harvesting for human consumption could occur.

This occurred in 1983 when the then Tasmanian Fisheries Development Authority initiated the setting up of the TSQAP, an environmental monitoring and risk assessment /management program. The TSQAP adopted from the outset the operating procedures of the renowned United States National Shellfish Sanitation Program (NSSP) as administered by the United States Food & Drug Administration (USFDA). The successful adoption of the NSSP by TSQAP was recognised by the USFDA and for many years Tasmania was the only Australian state with USFDA approval to export bivalve shellfish to the USA.

All other Australian states have subsequently followed Tasmania's lead to the extent that all states now follow the requirements of an Australian derivative of the NSSP called the Australian Shellfish Quality Assurance Program (ASQAP). The operating procedures and risk assessment criteria are contained in the *ASQAP Operations Manual* which can be found on the web at www.pir.sa.gov.au/ASQAP_MANUAL/

The implementation and maintenance of the ASQAP is overseen and managed under a co-operative arrangement by the Australian Shellfish Quality Assurance Advisory Committee (ASQAAC). The membership of this committee consists of one representative of the shellfish industry from each state together with one representative from each state's government agency having controlling authority for shellfish harvesting plus representatives from key federal government agencies (Australian Quarantine Inspection Service, Food Standards Australia New Zealand)
The basic and fundamental objective of the ASQAP is that shellfish destined for direct human consumption should only be harvested from waters that are free of toxic substances (algal toxins, heavy metals, toxic chemicals) and microbial pathogens of human health concern. Therefore each harvest area is required to be assessed and classified according to clearly defined criteria contained in the ASQAP Operations Manual. Each harvest area is subjected to an intensive shoreline survey in which all actual and potential pollution sources are identified and evaluated. Only when the shoreline survey data is coupled with the results of an intensive and ongoing microbiological sampling program and other appropriate environmental data can a proper risk assessment and "classification" of the growing area be assigned. The classifications derived following the completion of the sanitary survey are used to control harvesting through the development of appropriate management plans.

Areas classified as APPROVED have excellent water quality under the range of environmental conditions normally encountered by the area. Harvesting for direct consumption can occur all year round.

Some areas also have excellent water quality equivalent to APPROVED areas at all times except under well defined and easily recognised environmental conditions or events. These events typically include heavy rainfall. These areas can be classified as

APPROVED CONDITIONAL and will be subjected to periods of closure when the adverse conditions are present. Management plans are developed for such areas detailing the conditions and procedures for closure and re-opening.

Other areas may have pollution levels that may be chronic or intermittent and unpredictable yet are at a low enough level that the shellfish grown in such areas can be rendered safe by transferring them to an APPROVED area for an appropriate period prior to harvesting for market. Such areas are classified as RESTRICTED and are also subject to Management plans as described above.

Prohibited areas are all those areas not complying with the criteria of the above three classifications or which have not been classified at all. No harvesting of shellfish shall occur from prohibited areas.

The TSQAP has been very successful in achieving the goals and objectives of the ASQAP. Administered by the Department of Health & Human Services since 1991 the TSQAP has had no confirmed food poisoning outbreaks linked to the consumption of freshly harvested shellfish from Tasmanian waters since it commenced operation in 1983.

Any enquiries regarding shellfish and public health matters in Tasmania should be addressed to the manager, TSQAP, Public & Environmental Health Service, Department of Health & Human Service Tasmania was the first Australian state to provide an appropriate level of public health protection for shellfish consumers by requiring the completion of comprehensive sanitary surveys and risk assessments for all commercial shellfish areas before harvesting for human consumption could occur.

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Any enquires regarding shellfish and public health matters in Tasmania should be addressed to the manager, TSQAP, Public & Environmental Health Service, Department of Health & Human Services GPO Box 125B Hobart 7001. Tel (03) 62227718.

APPENDIX 1.3.3.1: PRESERVATIVE TREATED TIMBERS

Background

Preservative treated timbers are used extensively in the industry as a construction material for racks, frames and trays (See Chapter 2: Description of the Industry). Wood used in the marine environment is prone to attack by a variety of marine borers. Preservative treatment allows the wood to have a useful serviceable life and decreases the renewable time significantly. The preservatives commonly used to treat the timber for exposure to the marine environment are CCA (chromium, copper, arsenic) and creosote / PEC (pigment emulsified creosote) treatments.

The effect of CCA and creosote treated timbers on marine barnacles has been extensively researched. Barnacles growing on CCA plus creosote-treated eucalyptus timbers did not have significantly different chromium and copper levels from background levels in shell and tissue material. Copper and chromium levels continue to decline over time as shown from comparison with CCA levels in barnacles collected from timbers after 2 and 4 years in the marine environment. Barnacles growing 20-120 mm away from CCA-treated timbers did not have increased levels of copper or chromium compared to controls. There is no evidence that treated timbers pose a threat to the marine environment (Scown and Cookson 1999).

The timber industry is required to follow specifications from AS1604.1 2000 to produce approved and performance tested preservative treated timbers for use in the marine environment. The Tasmanian oyster industry will be encouraged to use approved CCA and creosote –treated eucalyptus timbers sourced from renewable plantations where possible. Some industry members are in the process of looking at a suitable product made from recycled plastics as a viable alternative to treated timbers.

Due to oysters being encapsulated in a shell, it is unlikely that they would ever come in direct contact with treated timber structures as found with univalves such as barnacles.

APPENDIX 1.3.5.2: SALTMARSH HABITAT

So you live near a Saltmarsh!

W. Andrews

The mouth of the Clarence Plains Rivulet at Rokeby Beach is a Saltmarsh.

This Saltmarsh, like many others, is under increasing threat from urban development and poor land management.

The saltmarsh provides a unique habitat that supports both freshwater and marine plants and animals and plays an important role in cleansing our waterways.

Tranmere - Clarence Plains Land & Coastcare Inc.

COASTCARE

How you can help

You can help this saltmarsh and other wetlands by keeping our waterways clean.

Remember if it goes into the stormwater it will end up in the saltmarsh and at our beaches.

Make sure your litter goes in a bin.

Do not let solid material, oils, poisons or paints go down the drain.

Wash paint brushes in buckets and pour water through paper to remove paint residue.

Wash your car on the lawn not in the street.

Get involved with Coastcare and help remove weeds and rubbish.

Dispose of garden waste in accordance with council regulations.

Do not take your horse, dog or bike into wetland areas.

Enjoy the saltmarsh for its beauty and value the role it plays in cleansing your environment.

For more information contact

Tranmere - Clarence Plains	
Land & Coastcare Inc.	6247 6925
Coastcare	6233 6427
The Parks and Wildlife Service:	
Seven Mile Beach Office	6248 4053
Clarence City Council	6245 8619
Birds Tasmania	
GPO Box 68 Hobart 7001	

COASTCARE

Published with the assistance of Coastcare - a cooperative Commonwealth / State / Local Government program supporting communities caring for our coast.

Saltmarshes are special

A saltmarsh is a special type of wetland. They form part of the intertidal zone of the coastline. At high tide they are flooded with seawater and at low tide they are a bed of mud and grasses.

Saltmarshes support a distinctive community of land plants and grasses with highly specialised salt tolerance. They also provide a unique habitat that supports both freshwater and marine animals.

Tidal creeks and freshwater streams cut through the saltmarsh and the plants and grasses act as a filtration system for water and other sediments from the surrounding catchment area.

Did you know?

Saltmarshes are important breeding grounds for both freshwater and marine fish!

The jollytail, a freshwater fish that can be found in saltmarsh areas.
Picture courtesy of The Fauna Handbook, Uni. of Tasmania

Importance of bacteria

Most of the food eaten by the invertebrates and young fish in a saltmarsh is in the form of broken down plant matter known as detritus.
The detritus is created by large numbers of good bacteria that live in the muddy bottom of the saltmarsh. Some of these bacteria enrich the water with nitrogen which can in turn be used by the plants.

Under threat

A healthy saltmarsh requires a buffer zone of native vegetation that prevents erosion and protects water quality. Native vegetation also provides homes for native wildlife.

The Clarence Plains Rivulet saltmarsh is under threat from a loss of native vegetation and water pollution.

Weeds like boneseed and African boxthorn can be introduced to saltmarsh areas by livestock grazing and the dumping of garden waste. Both of these plants are voracious competitors and replace native species very quickly.

The saltmarsh filters runoff from farms in the catchment area and roads in the surrounding surburban areas. Any litter or contaminants that make it into the stormwater will end up here.

Pollution can result in the death of the plants, which affects the entire saltmarsh community. An unhealthy saltmarsh means that polluted water flushes out into the Derwent Estuary as well.

Threatened species

The narrow-leaved New Holland daisy *Vittadinia muelleri*, which is listed as rare under the Tas. Threatened Species Protection Act 1995, can be found amongst the vegetation surrounding the marsh.

Photo courtesy of Hans and Annie Wapstra

Saving our saltmarshes!

The Tranmere - Clarence Plains Land & Coastcare Group recognises the importance of this area and in partnership with Clarence City Council and The Parks and Wildlife Service is working hard to preserve it.

Together with local land owners they have fenced the saltmarsh to prevent livestock, including horses, from grazing. They have implemented weed removal programs to tackle the boneseed and boxthorn infestation.

They have put together this information brochure and an onsite sign to educate you about the value of this area and what you can do to help preserve it.

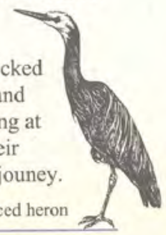
Watch out for the birds

This area is a great place to observe both native and migratory birds.

Saltmarshes provide homes and food for many species of birds, in particular wading birds like herons and egrets.

Look out for the white faced heron and shorebirds, such as kelp gulls and pied oystercatchers, who use the marsh area for food and shelter.

Migratory birds like the red necked stint, which breeds in Siberia and Alaska, may also be seen resting at the saltmarsh as they refuel their energy reserves for their long jouney.



White faced heron

APPENDIX 2.1.3: 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 meet 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

NSW EPA (2005) Measures to encourage the supply and uptake of cleaner marine outboard motors and personal watercraft. Prepared for the Department of Environment and Conservation, NSW, Australia January 2005.

APPENDIX 2.2.3: THREATENED, MARINE OR MIGRATORY BIRDS ASSOCIATED WITH OYSTER GROWING REGIONS.

Many migratory birds that spend some time of the year in Tasmania breed in the high Arctic tundra, Alaska and China during the northern summer and migrate to the Southern Hemisphere as winter approaches. One species of migratory shorebird breeds in New Zealand and winters in Tasmania. Shorebirds can be found feeding on exposed sand flats during low tide and roosting on available high ground near their feeding sites during the high tide. Migratory shorebirds are listed in Table 2.2.3.

Research from the USA on wintering shorebirds on oyster leases has shown that the distribution of plovers, godwit, and sandpipers were not significantly different when related to the presence of oyster workers or aquaculture equipment on leases (Kelly et al 1996). Species richness did not differ between aquaculture and control sites.

Birds have been observed foraging on top of and between oyster racks. A protocol for reducing the impact of oyster farming activities on migratory bird species has been developed in association with Birds Tasmania, documented in Appendix 2.2.3.1

References

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DPIWE (various) Marine Farming Development Plans, Department of Primary Industries, Water and Environment, Tasmania.

Kelly JP, Evens JG, Stallcup RW, Wimpfheimer D (1996) Effects of aquaculture on habitat use by wintering shorebirds in Tamales Bay, California. California Fish and Game 82(4): 160-174.

Table 2.2.4. 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 regions where oyster 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	Listed Marine Species	Listed Migratory Bird	Listed Threatened Species		Region									
				EPBCA/	TSPA	1. North West	2. Port Sorell	3. Georges Bay	4. Great Oyster Bay	5. Blackman	6.Norfolk	7. Pittwater	8. Pipe Clay	9. Channel	10. Huon/Esperence
Arctic jaeger	*Stercorarius parasiticus*	X	X			X					X			X	X
Arctic tern	*Sterna paradisaea*	X	X								X				
Bar-tailed godwit	*Limosa lapponica*	X	X			X	X	X		X	X	X	X	X	
Caspian tern	*Sterna caspia*	X	X			X	X	X			X	X	X	X	X
Common greenshank	*Tringa nebularia*		X			X		X	X	X	X	X		X	
Crested tern	*Sterna bergii*	X	X			X	X	X	X	X	X	X		X	X
Curlew sandpiper	*Calidris ferruginea*	X	X			X	X	X	X	X		X	X	X	
Double-banded plover	*Charadrius bicinctus*	X	X			X	X	X	X	X	X				
Eastern Curlew	*Numenius madagascariensis*	X	X			X	X	X	X	X	X	X		X	
Fairy tern	*Sterna nereis*				R	X	X	X	X	X		X	X	X	
Forty spotted pardalote	*Pardalotus quadragintus*			E	E									X	X
Great crested grebe	*Podiceps cristatus*				R			X	X	X		X			
Great knot	*Calidris tenuirostris*	X	X			X				X		X			
Grey Goshawk	*Accipiter novaehollandiae*		X		R	X	X	X	X		X			X	X
Grey plover	*Pluvialis squatarola*	X	X			X	X	X				X			
Grey-tailed tattler	*Heteroscelus brevipes*	X	X			X	X					X		X	
Hooded plover	*Thinornis rubricollis*	X		V		X	X	X	X	X	X			X	

Common name	Scientific name	Listed Marine Species	Listed Migratory Bird	Listed Threatened Species		Region									
				EPBCA/	TSPA	1. North West	2. Port Sorrel	3. Georges Bay	4. Great Oyster Bay	5. Blackman	6.Norfolk	7. Pittwater	8. Pipe Clay	9. Channel	10. Huon/Esperence
Latham's snipe	*Gallinago hardwickii*	X	X			X					X				
Lesser sand plover	*Charadrius mongolus*	X	X			X					X	X			
Little penguin	*Eudyptula minor*	X				N	N	N	N	N	N	N	N	N	N
Little tern	*Sterna albifrons sinensis*	X		E	E	X	X	X	X	X	X	X		X	
Orange-bellied parrot	*Neophema chrysogaster*	X				X									
Pacific golden plover	*Pluvialis fulva*	X	X			X	X				X	X	X		
Pectoral sandpiper	*Calidris melanotos*	X	X									X	X		
Red knot	*Calidris canutus*	X	X			X	X			X		X	X		
Red-capped plover	*Charadrius reficapillus*	X				X	X	X	X	X	X	X	X	X	
Red-necked stint	*Calidris ruficollis*	X	X			X	X	X			X	X	X		
Ruddy turnstone	*Arenaria interpres*	X	X			X					X	X		X	X
Sharp-tailed sandpiper	*Calidris acuminata*	X	X			X	X	X			X	X	X		
Short-tailed shearwater	*Puffinus tenuirostris*	X	X		N	N	N	N	N		N	N	N	N	N
Shy albatross	*Thalassarche cauta*	X		V	V	V									V
Swift parrot	*Lathamus discolor*	X		E	V	X	X	X	X	X	X	X	X	X	X
Whimbrel	*Numenius phaeopus*	X	X			X	X			X		X			
White/Great egret	*Ardea alba*	X	X			X	X	X	X	X	X	X	X	X	
Wedge tailed eagle	*Aquila audax fleayi*			E	V	X	X	X	X	X	X	X	X	X	X
White-bellied sea-eagle	*Haliaeetus leucogaster*	X			V	X	X	X	X	X	X	X	X	X	X
White fronted tern	*Sterna striata*	X			R	X						X			

APPENDIX 2.2.3.1: PROTOCOL FOR OYSTER FARMING ACTIVITIES IN THE PRESENCE OF LISTED THREATENED, MARINE OR MIGRATORY BIRDS.

To be developed

APPENDIX 2.2.4: NOTES ON THREATENED, ENDANGERED AND PROTECTED SPECIES:

Many oyster farming leases are located in areas rich in native 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/or the Commonwealth *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.

Kelly et al (1996) has demonstrated seasonal patterns of shore birds in the USA, with some species such as wintering sandpipers avoiding oyster aquaculture sites at certain times of the year and with other bird species being attracted to oyster marine farming sites. Oyster farming activities that co-occur with shorebirds may result in very small losses in the extent or quality of available feeding habitat for foraging shore birds. More information on shorebirds can be found in Section 1.3.6 Behavioural Changes and Impacts, and Section 2.3.3 Listed Migratory Birds

The threatened or endangered terrestrial animals that occur in oyster growing regions have specific habitats and would have been identified through the marine farm planning process (see Section 1.3.7). The key threat to many vulnerable insects is the use of chemicals, which is not used in the industry and pesticides and the loss of native vegetation. The industry maintains as part of its environmental management to:

- Maintain native vegetation where possible on site in areas 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 and coastal wetlands.
- 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.
- Minimise the use of chemicals.
- Control the presence of cats and dogs to reduce predation.

The presence of threatened marine mammals is unlikely to occur with oyster farming activities due to the shallow inshore subtidal and intertidal nature of Tasmanian oyster culture. Awareness and protection of a stable habitat is required for the oyster industry to be sustainable, which enhances the protection of threatened marine species. The areas zoned for marine farming are not located within the areas where the live-bearing seastar *Pattiriella vivpara* is found or on its preferred substrate.

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 from the shoreline, or damming preventing movement of water upstream
- Awareness of water quality to maintain habitat

- Awareness of invasive marine pests that may compete with and displace native threatened marine species (Refer to Appendix 2.2.7)
- Not disturbing or removing any threatened or endangered marine species.

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

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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 oyster 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									
		1. North West	2. Port Sorrel	3. Georges Bay	4. Great Oyster Bay	5. Blackman	6.Norfolk	7. Pittwater	8. Pipe Clay	9. Channel	10. Huon/Esperence
Birds											
Fairy tern	*Sterna nereis*	R	R	R	R	R	R	R	R	R	
Forty spotted pardalote	*Pardalotus quadragintus*				E	E	E	E	E	E	
Great crested grebe	*Podiceps cristatus*				R			R			
Grey Goshawk	*Accipiter novaehollandiae*		R				R			R	
Hooded plover	*Thinornis rubricollis*	V	V	V	V	V	V	V	V	V	V
Little penguin	*Eudyptula minor*	N	N	N	N	N	N	N	N	N	N
Little tern	*Sterna albifrons sinensis*	E		E	E	E	E	E		E	
Orange-bellied parrot	*Neophema chrysogaster*	E									
Short-tailed shearwater	*Puffinus tenuirostris*	N	N	N	N		N	N	N	N	N
Shy albatross	*Diomedea bulleri*										V
Swift parrot	*Lathamus discolor*			V	V	V	V	V	V	V	
Wedge tailed eagle	*Aquila audax fleayi*	V	V	V	V	V	V	V		V	V
White-bellied sea-eagle	*Haliaeetus leucogaster*	N	N	N	N	N	N	N	N		N
White fronted tern	*Sterna striata*							R			
Terrestrial Invertebrates											
Burgundy snail	*Helicarion rubicundus*						R				
Broad-striped ghost moth	*Fraus latistria*	i								R	
Broadtoothed stag beetle	*Lissotes latidens*					E	E		E		
Chaostola skipper	*Antipodia chaostola*				E					E	
Mt Mangana stag beetle	*Lissotes menalcas*									V	
Northwest velvet worm	*Ooperipatellus cryptus*	R									
Saltmarsh moth	*Amelora acontistica*								V		
Giant velvet worm	*Tasmaipatus barretti*			R							
Marine animals											
Australian grayling	*Prototroctes maraena*	V	V	V	V	V	V	V		V	V
Live bearing seastar	*Patririella vivipara*					E	E	E	E	E	
Seastar	*Smilasterias tasmaniae*									R	
Gunn's screw shell	*Gazamedia gunii*						V				
Spotted handfish (P)	*Brachionichthys hirsutus*						E	E	E	E	
White shark (P)	*Charcharodon charcharias*						V			V	V

Common name	Scientific name	Region									
		1. North West	2. Port Sorrel	3. Georges Bay	4. Great Oyster Bay	5. Blackman	6.Norfolk	7. Pittwater	8. Pipe Clay	9. Channel	10. Huon/Esperence
Marine Mammals											
Blue whale	*Balaenoptera musculus*				E		E			E	E
Humpback whale	*Megaptera novaengliae*				E		E			E	E
New Zealand fur seal	*Arctocephalus australis*	R					R			R	R
Southern elephant seal	*Mirounga leonina*						V				
Southern right whale	*Eubalaena australis*				E		E			E	E
Subantarctic fur seal	*Arctocephalus tropicalis*						E				
Terrestrial mammals											
Eastern barred bandicoot	*Perameles gunnii gunnii*	V	V	V	V	V	V	V	V	V	
New Holland mouse	*Pseudomys novaehollandiae*		R	R	R						
Spotted-tail quoll	*Dasyurus maculatus*			V	V	V	V	V	V	V	
Reptiles											
Leatherback turtle	*Dermochelys coriacea*	V		V			V		V	V	
Green and gold frog	**Litoria raniformis**		V	V	V		V	V	V		
Marine algae											
Brown alga	**Cystoseira trinodis**					R					

APPENDIX 2.2.5: PROTECTED AREAS: WORLD HERITAGE, RAMSAR, MARINE PARKS AND SENSITIVE HABITATS.

Some oyster marine farms are located adjacent to areas recognised as a matter of national environmental significance by the Ramsar Convention, National Estate and State authorities such as DPIW. These areas are listed in Table 2.2.5. Further information is provided on those sites which have management plans in place, such as the Pitt Water/Orielton Lagoon Ramsar site, Pitt Water estuary Shark Nursery Area and the Long Spit & Porpoise Hole Private Reserve.

Table 2.2.5. Protected habitats under the *EPBCA* 1999 adjacent to marine farming areas

Region (MFDP) Zone (MFZ)	Conservation area	Status	Significance
NorthWest			
5, 6, 7, 9	Boullanger Bay-Robbins Island shorebird habitat	National Estate property	Shorebird habitat
3,4	Shipwreck Point	Marine birds	Shorebird habitat
Port Sorell			
	Narawntapu National Park	NPW	Nature reserve
All	Port Sorell Estuary	DPIW	Shark nursery
Georges Bay			
2, 4, 5, 6a, 6b	Humbug Point Nature Recreation Area	NPW	Bush walking and bird watching
6a, 6b	St Helens Point Recreation Area	NPW	Sand dunes
All	Georges Bay	DPIW	Shark nursery
Great Oyster Bay			
11	Moulting Lagoon Game Reserve	Ramsar wetland	Waterfowl habitat
12b	Freycinet National Park	NPW	Nature reserve
6a, 6b	Seaford Point		Coastal birds
12a, 12b	Great Oyster Bay	DPIW	Shark nursery

2.2.5.1 Pitt Water/Orielton Lagoon Ramsar site

The Pitt Water/Orielton Ramsar site was listed in 1983, under the Ramsar Convention, as a Wetland of International Importance. The boundaries of the Ramsar site were modified in 1994, resulting in an area of 3289 hectares.

The significant values for the listing of the Pitt Water/Orielton Lagoon Ramsar site include the following:

- The area is one of the major summer feeding grounds in Tasmania for migratory shorebirds from as far as the Arctic tundra and Alaska, and is consequently the most southern major feeding area in Australia;

- Six plant species of particular significance (because of their threatened status or rarity) occur in the area;
- Around the rocky foreshores of Pitt Water and along both Sorell causeways is the largest concentration of the small endemic seastar *Patririella vivipara* (one of the few viviparous seastars) known. The seastar has also been listed as an endangered species under the Tasmanian *Threatened Species Protection Act* 1995;
- Orielton Lagoon is one of the few Tasmanian localities where Great Crested grebe *Podiceps cristatus* are seen.

Region (MFDP) Zone (MFZ)	Conservation area	Status	Significance
Blackman			
1, 2, 3, 4, 5, 6, 7, 8, 9, 19, 20, 21	Long Spit & Porpoise Hole	Private nature reserve	Coastal & migratory birds
All	Blackman Bay	DPIW	Shark Nursery
Norfolk			
All	Norfolk Bay	DPIW	Shark Nursery
Pitt Water			
1, 2, 3, 5	Pitt Water / Orielton Lagoon	Ramsar/JAMBA/ CAMBA	Migratory birds
1, 2, 3, 5	Pitt Water Nature Reserve incl. Orielton Lagoon, Woody Island, Barren Island, Barilla Bay and Northern Upper Pittwater	NPWA	Nature reserve
1, 2, 3, 4, 5	Pitt Water Estuary	DPIW	Shark nursery
4, 5	Seven Mile Beach Protected Area	Crown	Multiple use
Pipe Clay			
	Clifton Beach	Reserve	Coastal
Channel			
11a	Bruny Island Neck game reserve		ducks, shearwaters and penguin colonies
21b	Ida Bay State Reserve	SCA	Flora & Fauna
19	South Bruny National Park	NP	Flora & Fauna
Huon			
22a,22b	Southport Lagoon wildlife sanctuary	SCA	Water birds
9a, 9b	Port Cygnet conservation area	SCA	Water birds
13e	Hope Island nature recreation area	SCA	Historic

A *Draft Pitt Water/Orielton Lagoon Ramsar Site Management Plan 1*999 proposes a number of recommendations regarding marine farming activities to mitigate potential impacts. These recommendations include:

- No marine farming access should occur via, or in close proximity to, Sorell Rivulet.
- Access to marine farms should be such that disturbance to wildlife is minimised. The number of access points to leases should be limited, and multiple lessees should be limited, so that disturbance to wildlife is concentrated and not spread over a large area.
- Preferably, Iron Creek should not be used as access to leases. If this is unavoidable, consult with Marine and Safety Tasmania (MAST) to have restrictions placed on boat speed and distance from the sandspit so that disturbance to feeding and roosting birds is minimised.
- Ensure the assessment of all proposed access points for natural and cultural heritage values.

In consultation with the Birds Tasmania, a range of mitigation measures were identified that will to reduce the potential impacts from existing and future marine farming operations on bird species. It is considered that the marine farming operations proposed within the Pitt Water Marine Farming Development Plan: Pitt Water , June 2001, fall within the principles of "wise use" as described by the Ramsar Convention and that generally impacts from marine farming leases to bird speices will be minimal (DPIWE 2001).

2.2.5.2 Pitt Water Shark Nursery Areas

Pitt Water Estuary is one of a number of sheltered bays designated as a shark nursery area in the early 1960s, where the taking of either school shark (*Galeorhinus glaeus*) or gummy shark (*Mustelus antarcticus*) has been prohibited. Research on this site was used as an example to demonstrate that oyster farming activities in other sites does not affect important shark nursery areas. Female school sharks move into the Pitt Water Estuary to pup during November and December, with the juvenile sharks moving into deeper waters from March onwards (Olsen 1954). Studies by Olsen (1954) and Stevens and West (1997) show that school shark are captured in the deeper channels of the estuary. However, it is considered that the juveniles feed on the shallow sand flats during periods of high tides, retreating to the deeper channels on low tides (Olsen pers comm.).

It is important that marine farming structures do not restrict access of females to pupping areas of the juvenile sharks to feeding areas. Although no studies have been undertaken on the impacts of marine farming on juvenile sharks, anecdotal evidence suggests that marine farms may attract some species, as the infrastructure provides shelter and protection from predators.

Oyster farming activities do not adjoin any World Heritage sites, or Marine Protected Areas.

References

http://www.deh.gov.au/water/wetlands/ramsar/ramaust.html

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APPENDIX 2.2.5.1: PROTECTED AREAS: WORLD HERITAGE, RAMSAR, MARINE PARKS AND SENSITIVE HABITATS.

Tasmania

SHOREBIRD CONSERVATION

ROBBINS PASSAGE/BOULLANGER BAY WETLANDS AREA

Values Mapping Project

Where

Robbins Passage and Boulanger Bay are located on the far north west coast of Tasmania. This location contains the largest area of tidal mud and sandbanks in the state as well as a series of islands and tidal channels, beaches and estuaries. This variety of habitats makes the area especially important for many shorebird species. Although the region is generally sparsely populated, a number of activities such as dairy farming and commercial fishing have been practiced for over a century.

The birds

The Robbins Passage Wetlands are claimed to support higher numbers of shorebirds than all other shorebird sites in Tasmania combined. The area is especially important for migratory species such as eastern curlew, ruddy turnstone and curlew sandpiper. Resident species that occur in high numbers include the sooty and pied oystercatchers and the hooded plover which is nationally listed as a threatened species.

Who

The main players in the Values Mapping Project included the Robbins Passage Wetlands Coast and Landcare Group, Birds Tasmania, Community Solutions and WWF Australia. The catalyst for the Values Mapping Project and the involvement of so many stakeholders was a nomination to have the wetlands of this area listed under the Ramsar convention identifying it as a wetland of international importance. Considerable opposition was voiced by locals who were concerned that such a listing would impose restrictions upon use of the area. These events led to the formation of the Robbins Passage Wetlands Coast and Landcare Group which aims to promote community awareness of the conservation values of the wetland and to ensure that the area is appropriately managed.

Problems and Challenges

The important habitat value of the Robbins Passage Wetlands for shorebirds in Tasmania has only been fully appreciated in recent times. However, the area has been utilised for commercial and recreational purposes for well over a century. In the beginning, the general community's awareness of the importance of this area to shorebird conservation was low and no formally organised group existed to manage this extensive coastal wetland.

There was a perception from the locals that the public consultation process associated with the nomination for Ramsar listing was inadequate. This situation had the potential to create major division in the community and to result in a negative outcome for all parties involved. It was felt that the historical, social and recreational values of the area to the local population were not duly recognised.

Other problems facing the site include human disturbance- especially by the inappropriate use of four wheel drive vehicles, overfishing, impacts on water quality from surrounding dairy farms and the spread of weeds such as rice grass which have the potential to make shorebird roosting and feeding sites unusable.

Red-necked stint.

Solutions

Following local opposition, the nomination of the area for Ramsar listing was not endorsed by State Government. Instead, a local plan for managing the area was adopted which involved the formation of the local Robbins Passage Wetlands Coast and Landcare Group. The group recognised the need to build partnerships and raise awareness of the environmental values and issues of the area. This included a close working relationship with Birds Tasmania who had prepared the original Ramsar nomination. Both organisations were able to put the past behind them and work together to wisely manage the wetland.

This special area of coastline is valued by many different people for a range of reasons. The Values Mapping Project was proposed to bring together the range of stakeholder groups – user, management and interest – to identify and discuss important areas within the wetlands and any issues concerning their use, especially in relation to shorebirds. The Values Mapping Project took place over three days in Smithton and included small group discussions, a field trip followed by a series of presentations on the wetlands and a workshop on the final day. The project was coordinated by Community Solutions - independent consultants with experience in resolving conflict – in partnership with Birds Tasmania and WWF Australia (as part of the Shorebird Conservation Project).

This process identified values of the coastline held by different stakeholder groups, including recreational, social and economic values as well as the conservation values. Key areas where conflicting uses were likely to occur were identified and a conflict resolution process was undertaken. In nearly all instances favourable outcomes were achieved for all parties involved either by finding alternative sites were activities could be carried out where they had a lesser impact on other values, or by modifying the timing and the way in which activities were carried out. The project generated much trust and goodwill amongst participants and cleared the path for a collaborative approach to future management and planning to proceed.

The approach taken in this instance is one of total community inclusion. Eighteen stakeholder groups have been regularly involved in consultation and management of the wetland. These include organisations which can provide scientific advice and expertise such as the Nature Conservation Branch within the Department of Primary Industries, Water and the Environment (DPIWE) and Birds Tasmania, as well as user groups including the local oyster-grower's association and community groups such as local schools, indigenous groups and local council.

This close relationship with a wide range of stakeholders has helped the group to obtain nearly $100 000 of funding for a range of projects. At the same time the local community has retained a sense of ownership of their wetland.

Bird Pt (Robbins Isl) - an important roost site for shorebirds in NW Tas.

Outcomes for the environment

- Community awareness of the wetland and its values has been enhanced.
- Establishment of a close working relationship between the group, locals and other stakeholders.
- Interpretive signage has been installed at key access areas to the wetland and inappropriate four wheel drive vehicle access and use has been curtailed.
- Regular monitoring of shorebird numbers during summer and winter by experienced observers has been implemented.
- An innovative program to control the weed Rice Grass has commenced.
- A comprehensive water quality monitoring program is in use which utilises latest technology and will provide a high quality monitoring system.

Outcomes for the participants

- The public profile of the group has been raised substantially.
- Participants have gained knowledge and expertise from scientists, professionals and other stakeholders.
- Valuable experience in successfully applying for grants has been gained.

Measures of success

This project has successfully achieved a number of positive social outcomes, including the following:

- Conflicts over the use of the wetland have been successfully resolved.
- The profile of the wetland and its ecology among the local community has increased and a sense of ownership of the wetland has been developed.
- A community group with a desire to look after the environment has been established.

With time, the results of the current bird counts and water monitoring programs will provide valuable insights into the effects of certain activities. It is only then that it will be possible to see how successful the Values Mapping Project has been in protecting shorebirds from disturbance and habitat degradation.

Robbins Passage Wetland Group


Shipwreck Pt (Perkins Is) - an important roost site for shorebirds.


Sign at bird breeding site, Tasmania.

© Mike Weston/Aquila Images

Future strategies and directions

- The continuity of the public's support and enthusiasm will need to be maintained.
- Further survey work of shorebird numbers and distribution is required as it is likely that new roosting sites will be discovered.
- Monitoring of impacts of existing and proposed wind farms will be required.
- The appointment of a wetland coordinator to develop and initiate projects agreed as important during the values mapping project. These projects will focus on education, investigating shorebird use of the wetlands and weed control.

Key groups and contacts

Birds Australia
Tel (03) 9882 2622
Email: mail@birdsaustralia.com
Website: www.birdsaustralia.com.au

WWF Australia (Shorebird Conservation Project and Threatened Species Network)
Freecall 1800 032 551
Website: www.wwf.org.au

Community Solutions:
Website: www.communitysolutions.com.au

Robbins Passage Wetlands Coast and Landcare Group

Australasian Wader Studies Group
Website: www.tasweb.com.au/awsg/

Summary

The Robbins Passage Wetlands Coast and Landcare Group and values mapping project has made an important contribution to shorebird conservation because;

All stakeholders were included and worked together cooperatively

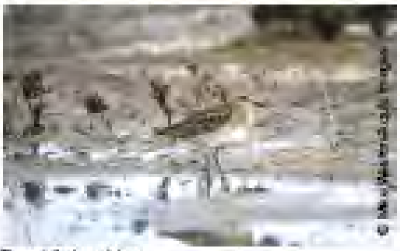
The local community was empowered to manage their wetland appropriately.

The group and project have utilised the media well to let the community know what they were doing and why the wetland was so important.

Important objectives for the group and the project in future will include;

Continuing to engage and cooperate with all existing stakeholders and include new stakeholders in the project as the need arises.

Continue to develop quantitative monitoring programs and gather data on project outcomes on a regular basis.



Sharp-tailed sandpiper.

Common Greenshank.

The shorebird case studies were developed by Birds Australia as part of the Shorebirds Conservation Project which is funded by the Natural Heritage Trust and managed by WWF Australia

APPENDIX 2.2.7.1: TASMANIAN PROTOCOL FOR THE TRANSLOCATION OF OYSTER STOCK AND EQUIPMENT BETWEEN CATCHMENT AREAS

Currently under development

APPENDIX 2.2.7.1: 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 oyster 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. North West	2. Port Sorrel	3. Georges Bay	4. Great Oyster Bay	5. Blackman	6.Norfolk	7. Pittwater	8. Pipe Clay	9. Channel	10. Huon/Esperence
		P	P			P	P		P		
Bivalves											
Asian theora clam	*Theora fragilis*									X	
Bag mussel*	*Musculista senhousia*			X							
Bivalve	*Theora ubrica*			X							X
European clam*	*Varicorbula gibba*			X			X			X	X
New Zealand bivalve	*Venerupis largillierti*									X	
Echinoderms											
New Zealand seastar	*Patiriella regularis*							X		X	
Northern Pacific seastar*	*Asterias amurensis*				X	X	X	X	X	X	X
Rough seastar	*Astrostole scabra*									X	
Gastropods (Univalves)											
New Zealand screwshell	*Maoricolpus roseus*			X	X					X	X
Crustaceans											
European shore crab*	*Carcinus maenas*	X	X	X	X	X	X	X	X	X	X
New Zealand cancer crab	*Cancer novaezealandiae*							X		X	
New Zealand half-crab	*Petrolisthes elongatus*			X	X			X		X	
Ascidians and Seasquirts											
Colonial ascidian	*Botryllus schlosseri*				X					X	
European seasquirt	*Ascidiella aspersa*				X					X	
Fish											
Atlantic salmon	*Salmo salar*									X	X
Brown trout	***Salmo trutta***		X							X	X
Rainbow trout	*Onchorhynchus mykiss*		X							X	X
Macroalgae											
Broccoli weed	*Codium fragile tomentosoides*									X	
Japanese seaweed*	*Undaria pinnatifida*			X	X	X	X	X	X	X	
Phytoplanton											
Toxic dinoflagellate*	*Alexandrium catenella*				X		X			X	X
Toxic dinoflagellate*	*Alexandrium tamarense*									X	X
Toxic dinoflagellate*	*Gymnodinium catenatum*			X	X	X	X	X	X	X	X

DESCRIPTION OF SELECTED TARGET INVASIVE MARINE SPECIES IN TASMANIAN OYSTER GROWING AREAS

Northern Pacific seastar

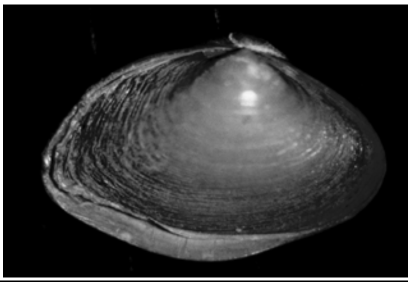
The northern Pacific seastar (*Asterias amurensis*) can grow up to 50 cm in diameter. It has 5 arms with pointed tips and is common around southeast Tasmania, particularly in the Derwent River. The seastar feeds on native species and may compete with native predators. It is also implicated in the decline 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).

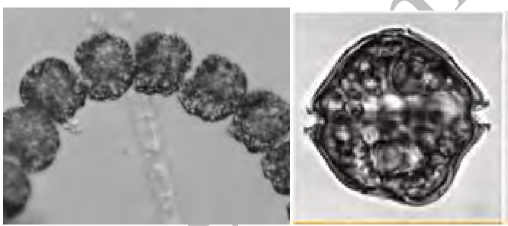
European green crab

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 2.3.3: ACID SULPHATE SOILS

MAR 2003

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Oysters and Acid Sulfate Soil Pollution

INTRODUCTION

Production of the Sydney rock oyster *(Saccostrea glomerata)* occurs in areas of some estuaries that are at times impacted by pollution originating from acid sulfate soils (ASS). Fish kills and fish disease are some obvious impacts of acid sulfate soil pollution. However, the effects of acid sulfate soil pollution on oysters are not as noticeable but can easily be identified.

WHAT IS AN ACID SULFATE SOIL?

Acid sulfate soils are soils containing iron sulfides. These soils may be found in low-lying areas such as floodplains surrounding estuaries, coastal lagoons and embayments. There are approximately 600,000 ha of ASS along the estuaries and coastline of New South Wales. Under most natural conditions, where the soil remains waterlogged, ASS do not cause environmental impacts. However, if the iron sulfides are exposed to air either by excavation or lowering of the water table, they react with oxygen in the air or water and can produce large quantities of sulfuric acid. The sulfuric acid also assists in releasing metals contained in the soil, including iron, aluminium and manganese.

WHAT IS ACID SULFATE SOIL POLLUTION?

Levels of acid are generally measured using a pH scale from 0-7. The pH of normal tap water is 7 and is considered "neutral" as it contains no acid. As the pH level decreases by 1 in the scale, the acidity of the measured solution increases 10 fold. Acid sulfate soil pollution is acidic and generally records pH levels of 2-6 in the field. For instance, in a normal healthy estuary unaffected by acid sulfate the pH of the water is about 8, however, in extreme acid sulfate affected estuaries the pH can fall as low as 4 which means there is 10,000 times (10 x 10 x 10 x 10) the amount of acid in the water.

Man made drainage of estuarine floodplains has accelerated oxidation of iron sulfides by unnaturally drying the ASS beneath affected floodplain areas. The drains provide an efficient pathway for ASS pollution to enter the estuary. Following high rainfall, extensive areas of the estuary can be acidified, particularly after long dry-spells. Acidification severely degrades estuarine ecosystems and can cause fish and oyster kills, fish disease, and can reduce oyster growth rates.

VISUAL INDICATORS OF ACID SULFATE SOIL POLLUTION

Acid sulfate soil pollution can cause a dramatic change in the appearance of estuarine water. An early indicator of ASS pollution is a sudden change in water colour from turbid brown to either crystal clear or azure blue/green following a flood. Water impacted by ASS pollution on a longer-term basis can also appear milky or yellow to red depending on the chemistry of the water. A graphic indicator of acid impacted drains is rusty coloured water as a result of iron oxides.

Figure 1: Acid sulfate soil pollution can appear very clear and is caused by low pH (3-4) and high levels of dissolved aluminium which clarifies the water.

Contact

Address: Aquaculture Division
Port Stephens Fisheries Centre
Private Bag 1
Nelson Bay NSW 2315

Phone: 02 4982 1232

Fax: 02 4981 9074

Figure 2: Acid sulfate soil pollution can also appear blue/green at pHs below 5 or milky white at pHs just above 5 and is caused by the presence of aluminium flocs (particles) suspended in the water column.

Figure 3: Shows examples of acid sulfate soil pollution appearing yellow to red due to the presence of iron. High levels of iron at low pHs (<4) appear yellow or at higher pHs the water appears red due to the iron flocs suspended in the water column, common in floodplain drains in ASS.

THE EFFECTS OF ACID SULFATE SOIL POLLUTION ON OYSTERS

Research has shown that acid sulfate soil pollution is harmful to the Sydney rock oyster (Dove et al., 2003). Overseas studies have found that a number of bivalve species are unable to tolerate pH levels below 7 (Bamber, 1987; 1990). Dove et al. (2003) found that oyster survival rates are reduced and death has been attributed to shell degradation, high levels of metals contained in ASS pollution and the injurious effect of acidity on the soft tissue of the oyster. This research has also found that poor growth rates occur in oysters that are exposed to extended periods of acid pollution with reduction in feeding behaviour of oysters the most likely factor.

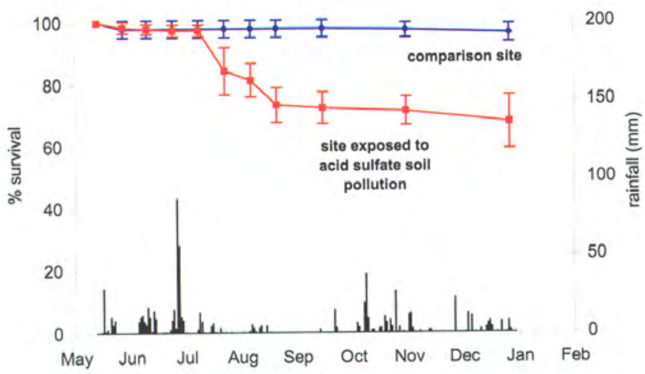
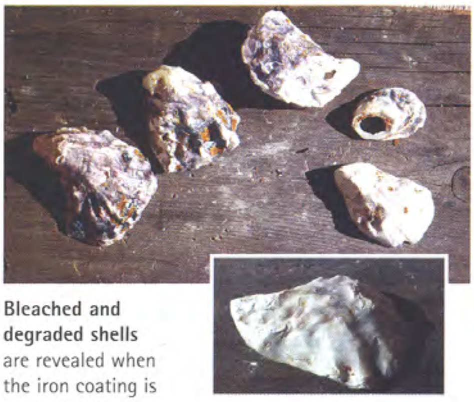


Figure 4: Percentage survival of oysters (±95% confidence intervals) exposed to ASS pollution on the Manning River and rainfall during the experimental period.

THE FOLLOWING PICTURES SHOW EXAMPLES OF THE EFFECTS OF ACID SULFATE SOIL POLLUTION ON OYSTERS.

How to identify the effects of acid sulfate soil pollution on oysters:

Iron coating on oyster trays, racks or the stream bank. Iron is a very good indicator of the presence of acidity



Bleached and degraded shells are revealed when the iron coating is removed. Severe shell bleaching occurs during extended exposure to acid sulfate soil pollution. Episodic acute events may not result in shell bleaching.

Red discolouration of the soft tissue (particularly the gills) which is caused by high levels of iron.

What are the recognisable impacts of acid sulfate soil runoff on oysters?

Red shells caused by the iron settling on the oysters.

Perforation occurs in the back section of oyster shells. Shell perforation occurs after approximately 25 days of chronic exposure to acid sulfate soil pollution.

Photographs: Michael Dove

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HOW TO MINIMISE THE EFFECTS OF ACID SULFATE SOIL POLLUTION ON OYSTER PRODUCTION

To minimise the impacts of ASS on oyster production:

- Avoid areas that become acidified after high rainfall to reduce potential problems associated with ASS pollution.
- If oysters are located in areas prone to acidification it is advisable to relocate oysters in the event of high rainfall.
- Spat to bottle size oysters are impacted by ASS pollution to a much greater extent than larger bistro or plate size oysters. Farming smaller oysters in areas affected by ASS pollution is not recommended.

The solution to the problem of ASS pollution will be achieved by better management of acidification at its source, which aims to reduce the magnitude and frequency of discharges and prevent further disturbance of iron sulfides. A cooperative approach by all stakeholders (government, floodplain landowners, industry and researchers) is continuing to address the problems caused by acid sulfate soil pollution via the NSW Acid Sulfate Soil Advisory Committee (ASS MAC), the NSW ASS Hot Spot Program, the NSW Fisheries North Coast Floodgate Project and initiatives by local government in the Tweed, Richmond, Clarence, Hastings and Macleay floodplain management programs.

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Faculty of the Built Environment
The University of New South Wales

Damian Ogburn
Principal Manager Aquaculture, NSW Fisheries

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Bamber, R.N. (1990). The effects of acidic seawater on three species of lamellibranch mollusc. *Journal of Experimental Marine Biology and Ecology,* **143**, 181-191.

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FURTHER INFORMATION

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FISHERIES RESEARCH & DEVELOPMENT CORPORATION

The information presented here is from Fisheries Research and Development Corporation Project 1996/285.

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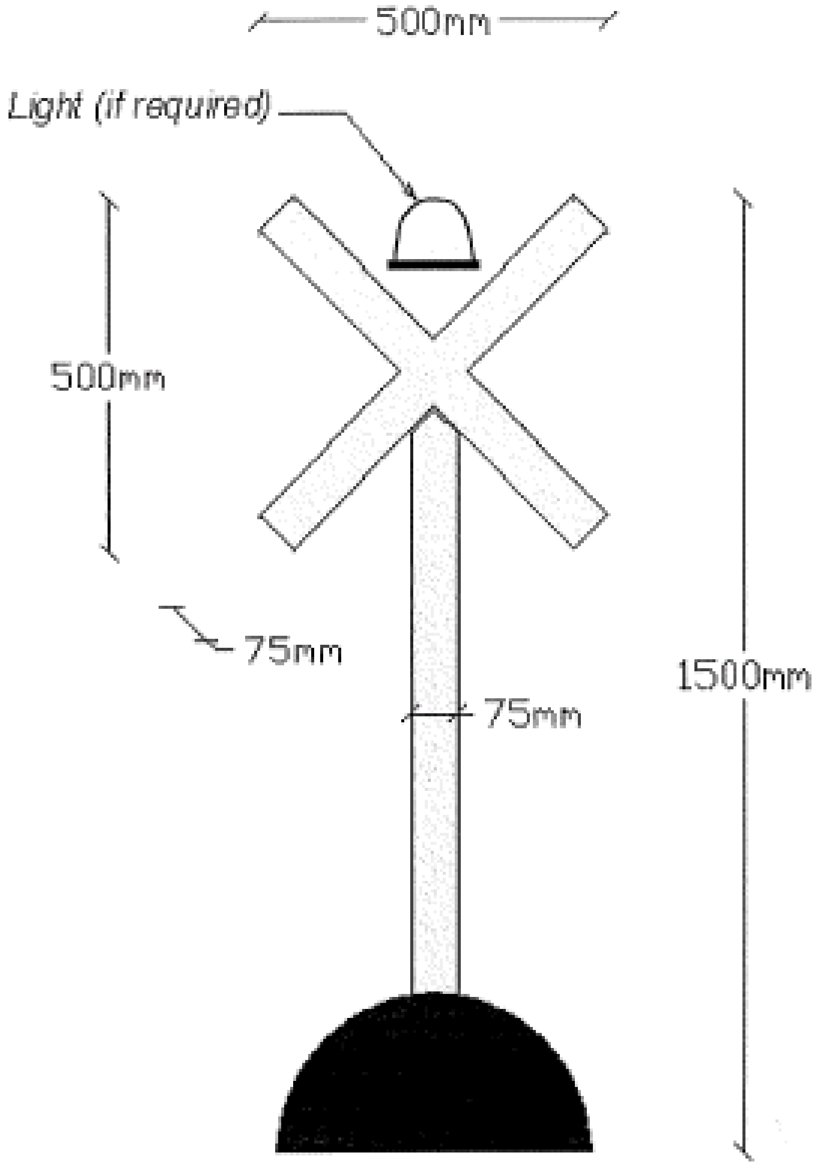
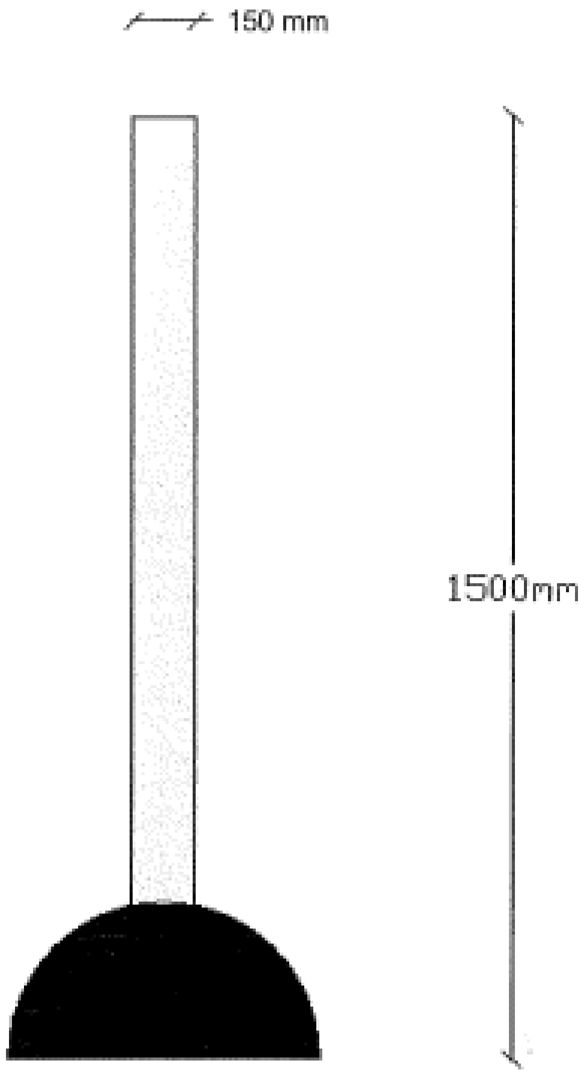
APPENDIX 2.3.4: MINIMUM SPECIFICATIONS FOR MARKERS FOR FISH FARMS AS DETAILED BY MARINE AND SAFETY TASMANIA



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 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 on 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. Seepage	3.1.4. Shading	3.1.5. Rehabilitation	3.1.6 Soil Quality	3.1.7. Noise / Dust	3.1.8. Infrastructure	3.1.9. Waste	3.1.10. Water Flow	3.1.11. Navigation	3.1.12. Alienation	3.1.13 Proximity to sensitive fauna/regions	3.1.14 Proximity to users	3.1.15. Water table
Aboriginal and Torres Strait Islander Heritage protection Act 1984															
Australian Maritime Safety Authority Act 1990								X			X				
Environment and Heritage Amendment Act 2000	X														
Environment Protection and Biodiversity Conservation Act 1999	X														
Fisheries legislation (Consequential Provisions) Act 1991															
Fisheries administration Act 1991															
Navigation Act 1912											X	X			
Protection of Movable Cultural Heritage Act 1986													X	X	
Resource Assessment Commission Act 1989	X												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. Erosion	3.1.3. Seepage	3.1.4. Shading	3.1.5. Rehabilitation	3.1.6 Soil Quality	3.1.7. Noise / Dust	3.1.8. Infrastructure	3.1.9. Waste	3.1.10. Water Flow	3.1.11. Navigation	3.1.12. Alienation	3.1.13 Proximity to sensitive fauna/regions	3.1.14 Proximity to users	3.1.15. 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	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	X
Farm Water Development Act 1993										X					
Fire Services Act 1979	X														X
Forest Practices Act 1985	X														
Groundwater Act 1985			X							X					X
Health Act 1997															
Hobart Regional Water (Arrangements) Act 1996								X							
Historic Cultural Heritage Act 1995	X												X		

Tasmanian Legislation Matrix	3.1.1. Habitat Effects	3.1.2. Erosion	3.1.3. Seepage	3.1.4. Shading	3.1.5. Rehabilitation	3.1.6 Soil Quality	3.1.7. Noise / Dust	3.1.8. Infrastructure	3.1.9. Waste	3.1.10. Water Flow	3.1.11. Navigation	3.1.12. Alienation	3.1.13 Proximity to sensitive fauna/regions	3.1.14 Proximity to users	3.1.15. Water table
Hobart Regional Water (Arrangements) Act 1996								X							
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	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			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														
Resource Planning and Development Commissions Act 1997															
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	

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. 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	3.2.3.1 Water Quality	3.2.3.2. Sedimentation	3.2.3.3. Fish Disposal	3.2.3.4.Sewerage	3.2.3.5. General Rubbish	3.2.3.6 Biofouling
Environment Protection and Biodiversity Conservation Act 1999			X						X			X				
Export Control Act 1982	X															
Export Control Act (Proscribed Goods) 2005	X															
Export Control Act (Animal Orders) 2004	X															
Ramsar Convention of Wetlands 1971									X							
Quarantine Act 1908	X															

Table 3.1.2. Tasmanian legislation pertaining to the operational aspects of a marine farming facility.

Tasmanian Legislation Matrix	3.2.1.1. Health surveillance	3.2.1.2. Stocking Density	3.2.1.3. 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	3.2.3.1 Water Quality	3.2.3.2. Sedimentation	3.2.3.3. Fish Disposal	3.2.3.4.Sewerage	3.2.3.5. General Rubbish	3.2.3.6 Biofouling
Agricultural and Veterinary Chemicals(control of use) Act 1995	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	
Health Act 1997											X		X	X	X	
Living Marine Resources Management Act 1995			X		X							X				X
Local Government Act 1993 – (Planning schemes)				X		X		X			X	X	X	X	X	
Marine Farming Planning Act 1995		X			X											
Marine and Safety Authority Act 1997					X											
National Parks and Reserves Management Act 2002									X							
Poisons Act 1971	X									X						
Pollution of Waters by Oil and Noxious Substances Act 1987				X					X							
Sewer and Drains Act 1954														X		
Threatened Species Protection Act 1995									X							
Veterinary Surgeons Act 1987	X															
Water Management Act 1895				X												
Workplace Health and Safety Act 1995										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

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. Cultural activities and festivals are still participated in by the Tasmanian Aboriginal community. 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.

North West

The NorthWest marine farming area encompasses the area, which was the home of the Parperloihener people, part of the NorthWest Tribe. Visits to the Robbins Island area were made from the Northern Tribes to collect food and shells and trade ochre with the NorthWest Tribes (Ryan 1996). However, Robinson's diary state that a source of ochre was identified form the mouth of the Welcome River in the area.

Port Sorell

The Punnilerpanner band from the Northern Tribe occupied the banks of the Port Sorell River. In early spring people of the Northern Tribe congregated there at the mouth of the Port Sorell and other northern coastal rivers to collect eggs of swans, ducks and other water birds as well as shellfish (Ryan 1996).

The Narawntapu National Park, which lies 4 km from the Port Sorell marine farming zones, has been identified as having significant cultural value to the Aboriginal community. The 4349 km park includes adjacent islands in Port Sorell, but does not include marine of estuarine waters. The management plan for the Narawntapu National Park has objectives that include:

Conservation of sites of areas of cultural significance

- To encourage cooperative management programs with Aboriginal people in areas of significance to them in a manner consistent with the purpose of reservation and the other management objectives.

Georges Bay
The NorthEast Tribes consisted of 7 bands in which the Panekanner lived closest to Georges Bay. However, all 7 band visited the coastal lagoons and estuaries, which provided abundant seasonal food resources such as muttonbird, swans, ducks and seals (Ryan 1996).

Great Oyster Bay
The coastline surrounding the Great Oyster Bay marine development plan was used extensively by Aboriginal Tasmanians prior to European occupation, with evidence easy to find in many coastal landforms. Many of these sites are marked with extensive middens, tools and other artefacts, as the East Coast was particularly important for the Aboriginal populations who moved to the area during winter.

A number of bands were members of the Oyster Bay Tribe, including the Linetemairrener tribe from North Moulting Lagoon, the Loontitetermairremener band at North Oyster Bay, and the Poredareme band in Little Swanport. Great Oyster Bay was also a winter site for the Ben Lomond Tribe. A large midden of oyster shells at Little Swanport is a legacy of the quality and quantity of the local flat oysters *(Ostrea angasi*) consumed by the local aboriginal population. The Great Oyster Bay area, particularly Moulting Lagoon, was considered to be a rich food source by the Aboriginal Tasmanians.

Blackman Bay
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). The Portmairremener band from Prosser River also gathered food from Blackman Bay. These bands harvested shellfish, hunted native animals, gathered plant foods and utilised the Blackman Bay region for every day living.

The remnants of these activities can be seen in Aboriginal middens and artefact scatter around the coastline of Blackman Bay. These sites and artefacts are extremely significant to today's Aboriginal community.

Norfolk
The Pydairrerme people from the Tasman Peninsula were of the Great Oyster Bay Tribe and would have lived and gathered food from the Norfolk Bay area.

Pitt Water and Pipe Clay Lagoon
The area around Pipe Clay Lagoon was part of the land of the Moomairemener band whose homeland ran from South Arm to the Jordan River and from the Eastern Shore of the Derwent River to Pitt Water and Coal River. This group was part of the larger Oyster Bay clan – a group of people with shared language and culture that lived on the East Coast of St Patrick's Head near St Marys (Felton 1989).

The land and water of the Moomairemener were rich in food. The best hunting grounds were around the shores of Pitt Water, near Kangaroo Point, Herdsmans Cove and at Clarence Plains and Risdon (Felton 1989). At this time, Pipe Clay Lagoon had many oysters, fish and birds. Shellfish formed a large part of the diet of Aboriginal people who lived on the coast and a number of middens are located around Pipe Clay Lagoon (Department of Environment and Land Management, 1996).

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 the 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.

Traditional Aboriginal economic systems differ from the capitalist, free market systems that dominate Wester economies (NOO 2002). To sustain the Aboriginal culture, it is important that there is as little negative impact as possible by the Tasmanian oyster industry.

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Ryan L (1996) The Aboriginal Tasmanians (2nd Edition) Allen & Unwin Pty Ltd., St Leonards, Australia. 380pp.

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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 DPIW Wild Fisheries)
- Recreational fishing (includes discussions with DPIW Recreation Fishing staff)
- General recreation
- Bureau of Meteorology
- Bureau Statistics
- Local councils re
  - -Effluent disposal (this includes discussions DPIW 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

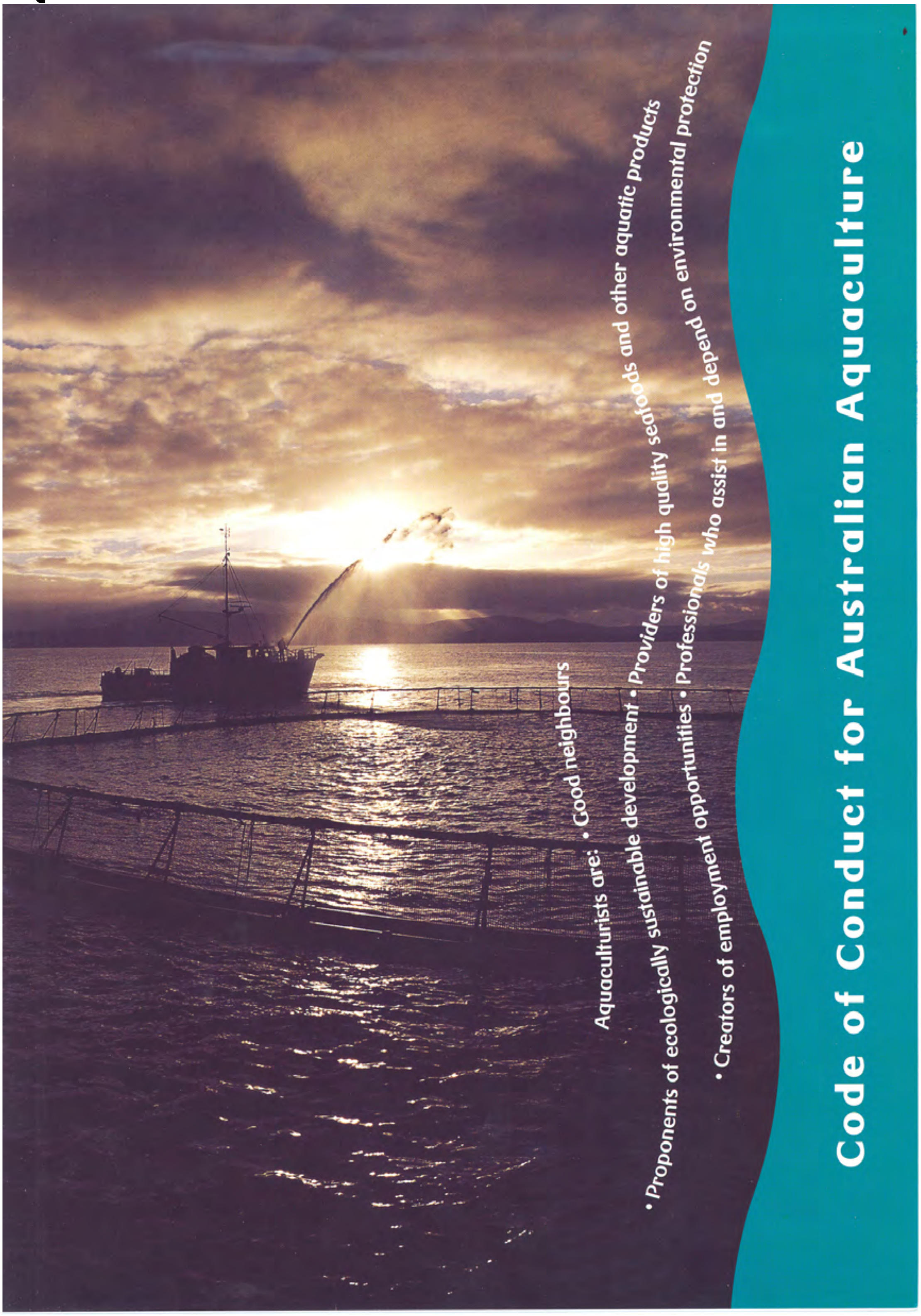
- Implementation of Marine Farming Development Plan.

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

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.

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FISHERIES RESEARCH & DEVELOPMENT CORPORATION

Environment Australia
Department of the Environment

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

AUSTRALIAN AQUACULTURE FORUM MEMBERS

Tasmanian Aquaculture Council
PO Box 878, Sandy Bay TAS 7006.

S.A. Oyster Growers Association
PMB 49, Port Lincoln, S.A. 5606.

NSW Farmers Association – Oyster Section
GPO Box 1068, Sydney, NSW 2001.

Victorian Aquaculture Council
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Aquaculture Council of W.A.
P.O. Box 55, Mt Hawthorn, W.A. 6016.

Oyster Farmers Assoc. Of N.S.W.
PO Box 254, Turramurra, NSW 2074.

Australian Tuna Boat Owners Association
PO Box 416, Eastwood, SA 5063.

Pet Industry Joint Advisory Council
Suite 2, 39 Darcy Rd, Wentworthville, NSW 2145.

Aquaculture Council of Queensland
PO Box 2064, Bribie Island, QLD 4507.

APPENDIX 8.2.3.1: REGULATORY IMPACTS ON THE TASMANIAN OYSTER INDUSTRY.

Contents

8.2.3.1: Background

Marine leases have been granted under various fisheries authorities since 1853. From 1853 to 1959, the Governor of Tasmania granted leases upon the recommendation of various fisheries authorities, including Commissioners of Fisheries, The Fisheries Board and the Minister of Fisheries. The 1853 "Act for the Improvement and Regulation of the Oyster Fisheries in Van Dieman's Land" referred only to the native oyster (*Ostrea angasi*) on marine farms as follows:

- That written permission be obtained from the Lieutenant-Governor to form or plant an artificial oyster bed
- That these approved oyster beds constitute private property over which the owner afforded exclusive control
- That a penalty of not less than 20 pounds or more than 50 pounds be levied against any person found guilty of interfering with artificial oyster beds
- Those oysters from natural oyster beds may be taken during part of the closed season when they are taken for the purpose of supplying artificial oyster beds.

In 1861, an Act was passed to grant Municipal Councils management control of all oyster beds and fisheries that lay adjacent to the shores of that Rural Municipality.

Regulations prescribing the requirements for making an application for an oyster lease were first specified in 1957, which required that a written application with a sketch plan be forwarded to the Minister for approval. A tender process was also introduced which required notification published in the Gazette and in a newspaper. In 1959 the *Fisheries Act 1952* was amended to provide that the Minister for Lands issue leases upon the recommendation of the Minister for Fisheries and with the consent of the Governor

A new regulation was introduced in 1962 requiring notice boards defining boundaries be erected. In 1967 further conditions were approved for oyster lease indentures

(Tamar River) which coincided with the emergence of Pacific oyster (*Crassostrea gigas*) culture in the region (see Section 2.1.2). These regulations required that:

- All leases be accurately surveyed and defined
- All oyster beds to be set out in regular and orderly pattern and to be maintained in a neat and tidy condition
- Access lanes are to be maintained to permit small boats access from the river to the shoreline adjoining any lease
- The whole Tamar oyster cultivation project is reviewed after the first five-year experimental period.
- Once a lease has expired all timber, stakes and debris are to be removed
- $40 to be lodged by the lessee at the Marine Board as an indemnity, per acre

In 1968 a Management Policy and Research and Extension Policy for the oyster industry in the Tamar River was introduced by the Minister for Agriculture and farmers were encouraged to assist and support oyster research and adopt modern oyster farming practices.

By 1969 a set of 23 conditions relating to the issue of temporary licences for oyster farms were finalised after a conference which took place between officers of the Hobart Marine Board, Lands and Surveys Department and Fisheries Division. From 1970 to through 1982 as series of further regulations were introduced, through recommendations of the Marine Board of Hobart, Department of Agriculture and Fisheries, the Tasmanian Fisheries Development Authority and the Lands Department. The Shellfish Sanitation Program was also introduced in 1983 to comply with the United States Shellfish Sanitation Program and the National Health and Medical Branch Council of Australia requirements for sale and export.

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 the Government's capacity to approve new applications. 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 Oyster industry by implementing well planned sustainable processes under the Marine Farm Planning Act 1995 (MFPA). 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 audit process 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 as listed below. The following section has been adapted from the DPIW Marine Farm Development Plans.

8.2.3.2: Resource Management and Planning System
A suite of laws, policies and procedures integrated under the Resource Management and Planning System (RMPS) guides the use and development of natural resource in Tasmania. The RMPS is based on the objectives 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 worth 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 following acts are relevant to the use, development and management of marine farming activities.

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 that 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 1975
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 form the Minister for national 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 provide 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; and
- the Commonwealth marine environment.

The Act requires the person proposing to take an action that 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.

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 to ensure that they do not prevent the achievement of recognised water quality objectives outside the marine farming leases.

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 that 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: 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 are 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

<u>Subtidal Shellfish</u>

Schedule 4	Conditions Relating To Environmental Management Of A Subtidal Shellfish Marine Farm.
Schedule 4B	Subtidal Shellfish Baseline Environmental Survey: Requirements For A New Lease Area, Relocation Or Expansion Greater Than 10% Of Lease Area.
Schedule 4IH	Subtidal Shellfish (High Production) Initial Monitoring Survey: Requirements For Subtidal Shellfish Lease Areas.
Schedule 4IL	Subtidal Shellfish (Low Production) Initial Monitoring Survey: Requirements For Subtidal Shellfish Lease Areas.

<u>Intertidal Shellfish</u>

Schedule 5	Conditions Relating To Environmental Management Of An Intertidal Shellfish Marine Farm.
Schedule 5B	Intertidal Shellfish Baseline Environmental Survey: Requirements For A New Lease Area, Relocation Or Expansion Greater Than 10% Of Lease Area.
Schedule 5I	Intertidal Shellfish Initial Monitoring Survey: Requirements For Intertidal Shellfish Lease Areas.

<u>Combined Subtidal/Intertidal</u>

Schedule 6	Marine Farming Licence Conditions Relating To Environmental Management Of A Subtidal/Intertidal Shellfish Farm

SCHEDULE 4 TO MARINE FARMING LICENCE:

MARINE FARMING LICENCE CONDITIONS RELATING TO ENVIRONMENTAL MANAGEMENT OF A SUBTIDAL SHELLFISH FARM

Conditions relating to the environmental management of subtidal shellfish farms are in four parts.

1. Compliance with environmental standards
2. Requirements for Environmental Monitoring Survey
3. Environmental records to be kept by licence holder
4 Environmental reports to be provided to the Department

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1. Compliance with Environmental Standards

The licence holder shall comply with the following environmental standards as they apply to effects attributable to the marine farming operations conducted on the marine farming lease area:

1. There should be no unacceptable visual, chemical or biological impact on the benthos outside the boundaries of the lease area. Unacceptable impacts would include but not be limited to:

    - Loss of seagrass other than in defined access channels
    - Accumulation of shell waste and fouling organisms
    - Change in sediment characteristics
    - Mats of *Beggiatoa sp*

2. No biologically significant levels of chemical residues (or antibiotics) shall be present in sediments within or immediately outside the lease area.

3. Surface waters surrounding the lease area shall contain no detectable levels of petroleum derived hydrocarbons, other than by normal vessel exhaust.

4. Wastes from harvesting or processing of produce from marine lease areas and from the removal of fouling organisms from marine farming structures and equipment, such as racking or longline droppers, must be disposed of in a manner that does not affect the ecology of the marine environment or nearby shoreline.

Under certain circumstances the Department may require the licence holder to make measurements to ensure compliance with these standards in both the water column and sediment within, and outside, the marine farming lease area.

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2. Requirements for Environmental Monitoring Survey

An Initial Monitoring Survey of the marine farming lease area is to be conducted in accordance with the attached schedule:

All survey and reporting requirements are detailed in this schedule.

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3. Environmental records to be kept by the Licence holder

The following records shall be kept by the licence holder and provided to the Department on request.

1. A list specifying the quantities, and date of use, of all chemicals which have been used on the lease area that are directly or indirectly released into the water. This includes, but is not confined to, therapeutants, anaesthetics, antibiotics, hormones, pigments, antifoulants, disinfectants and cleansers.

2. Details of the location of stocked longlines and the stocking density (length of longlines per hectare).

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4. Environmental reports to be provided to the Department

1. A record of any significant event (e.g. unusual algal bloom) and of any incidents of disease and/or shellfish kills. Disease outbreaks are to be notified to the Department of Primary Industries, Water and Environment in accordance with the *Animal Health Act 1995*.

2. The licence holder must notify the Department of Primary Industries, Water and Environment of the presence of any introduced marine pests within the lease area. These species include, but are not limited to the: Northern Pacific Seastar (*Asterias amurensis*), European shore crab (*Carcinus maenas*) and the Japanese seaweed (*Undaria pinnatifida*).

3. A report of the Initial Monitoring Survey must be submitted to the Department in accordance with specifications detailed in the attached schedule;

SCHEDULE 4B TO MARINE FARMING LEASE: XXX

SUBTIDAL SHELLFISH BASELINE ENVIRONMENTAL SURVEY:

REQUIREMENTS FOR A NEW LEASE AREA, RELOCATION OR EXPANSION GREATER THAN 10% OF LEASE AREA

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1. Outline of Requirements

The Baseline Environmental Survey is to be conducted in accordance with specifications determined by the General Manger Primary Industries Division, Department of Primary Industries and Water (DPIW) (Section 2 below) and undertaken by person(s) or organisations approved and authorised by the General Manger Primary Industries Division DPIW to undertake the work at the sites specified. An environmental baseline survey report must be submitted to the DPIW by the applicant within 4 months of conducting the survey.

The environmental baseline survey report must be submitted to the Marine Environment Section, DPIW by the applicant in accordance with section 2.6 of this schedule.

The sampling is to be conducted at each of the sites shown on the enclosed map. All positional requirements (prescribed control and sample site 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 photography is to be conducted on the same day, (or within one week if not practicable).

The applicant must notify the Marine Environment Section, DPIW [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 intertidal shellfish must include the following components, as detailed in section 2 of this Schedule:

- 2.1 Bathymetric profile- qualitative data
- 2.2 Seabed characteristics /habitat type profile - qualitative data
- 2.3 Underwater video survey
- 2.4 Sediment description
- 2.5 Biological analysis- benthic faunal survey - qualitative data
- 2.6 Reporting of results to DPIW

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2 Environmental Baseline Survey Specifications

2.1 Bathymetric profile

A bathymetric profile is required to provide a reasonable indication of the depth contours in and adjacent to, the marine farming lease area. Depth measurements should be made to the nearest metre from boats equipped with an echosounder and should be obtained along the following tracks:

(i) A single track parallel to and approximately 50m outside the lease boundary.
(ii) Soundings every 100m within the area covered in (i) above.

Any distinct depth features, such as trenches, channels, holes should be identified on the map. The approximate positions of the depth contours are to be drawn on the map provided.

2.2 Seabed Characteristics and habitat profile

Location of habitat type(s) must be sketched on the lease map provided. The map should provide an approximate position of the different habitat types within the lease area. 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

2.3 Underwater Video Survey

An underwater survey of the sea bottom is to be recorded by video cameras along the transect line indicated on the attached map.
This line will run from a point in the middle of the lease (or from a point approximately 200 metres from the boundary towards the middle of the lease, whichever is the lesser distance) in a straight line in a downstream direction to a point 100 metres beyond the boundary. Coordinates for relevant sites are specified on the attached baseline map.

Filming Procedure:
Digital video filming is to be conducted by diver, remotely operated vehicle (ROV) or a towed camera, with the transect cable or scale bar in view. Each transect must be identified on the film with the appropriate transect number e.g. T1, T2 etc. Filming needs to be conducted slowly along the transect to ensure clear well-lit images are recorded. Stationary video footage of the bottom must be provided at each of the duplicate sample sites. The stationary footage must be taken vertically, with the transect cable in view . A marker indicating the position of each of the duplicate sample sites must be clearly

visible on the transect cable. The diver/ROV should gently disturb the sediment by hand/mechanical arm at the start and end of the transect while filming to reveal the sediment colour beneath the surface. With a towed camera, the sled frame will provide disturbance as a matter of course.
Date and time must be visible at all times on the video tape.

Equipment:

- All video is to be in Digital format for computerised image analysis to be conducted by DPIW. Clear, well lit images on high quality tapes are required. The video is required to give both a general overview and quantitative data.
- Colour Digital camera 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.
- Digital Tapes: highest quality.

Diver/operator 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

Where water visibility is too poor to enable compliance with the above filming procedures, refer to section 2.5.1.

2.4 Sediment Analysis

Undisturbed sediment cores (duplicate) are to be taken using a Craib corer with perspex inner core 50 mm diameter, at the sites indicated on the attached map.

Visual assessment:
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, size and position in the sediment,
- sediment smell including presence/absence of hydrogen sulphide,

2.5 Biological analysis

Benthic faunal analysis:
Duplicate Van Veen grabs or diver collected wide-diameter core samples (150mm diameter x depth 100mm) are to be taken at sites 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. 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.

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.

2.5.1 Biological analysis required where video footage can not be obtained:

The following will take precedence over section 2.5 if underwater video footage can not be obtained due to poor visibility resulting in a lack of compliance with 2.3 Video Procedure:

Benthic faunal analysis & Preservation/Retention of Samples
Triplicate 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.

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.

Methods for the preservation/retention of samples should comply with those outlined in 2.5 above.

2.6 Reporting of Results to DPIW

Interim Report:
An initial brief report must be submitted within one month of conducting the baseline survey if farming is to commence prior to submission of the complete baseline 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
- the original unedited digital video tape

This document is to be approved by and submitted by the applicant.
The General Manager, Primary Industries Division, DPIW must approve the assessment and interpretation of the interim baseline information prior to issuing any written authorisation to the applicant to allow marine farming to commence.

Final Baseline Report:
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 must be submitted within 4 months of conducting the survey and 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 Division, DPIW 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 marine farming lease area will be provided to the lessee and, if requested, to person(s) undertaking the survey.

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 disc, CD or via email) which is compatible with the database system and software currently used by the Marine Environment Section DPIW. 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;
- habitat map of the lease area;
- description and interpretation of core profiles;
- description and interpretation of sample site photographs/ video footage;
- where relevant, an interpretation of results (written and graphical) from the benthic organisms from grab/core samples

Baseline Environmental Survey Map: MF , sample sites.

MF : Baseline Environmental Survey Sample Site Coordinates (AGD66, AMG Zone 55).

Lease No.	Year	Transect	Site Number	Bearing	Distance	Distance_Rel_Boundary	Type of sample	Easting	Northing

SCHEDULE 4IH TO MARINE FARMING LICENCE 015/00

SUBTIDAL SHELLFISH (HIGH PRODUCTION) INITIAL MONITORING SURVEY:

REQUIREMENTS FOR SUBTIDAL SHELLFISH LEASE AREAS.

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1. Outline of Requirements

The Initial Monitoring Survey is to be conducted in accordance with specifications determined by the General Manger Primary Industries Division, Department of Primary Industries, Water and Environment (DPIW) (Section 2 below) and undertaken by person(s) or organisations approved and authorised by the General Manger Primary Industries Division, DPIW to undertake the work at the sites specified. An initial monitoring survey report must be submitted to the DPIW by the applicant within 4 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 initial monitoring survey for marine farming subtidal shellfish (high production) includes the following components:

1. Current flow information
2. Bathymetric profile- qualitative data
3. Seabed characteristics /habitat type profile - qualitative data
4. Underwater video survey
5. Sediment chemistry - particle size analysis, organic carbon-quantitative data
6. Biological analysis- benthic faunal survey - qualitative data
7. Reporting of results to DPIW

Initial Monitoring Survey Specifications

2.1 Current flow information

An indication of the general current flow within the lease area. This should be drawn onto the bathymetric profile map (blank map attached).

2.2 Bathymetric profile

A bathymetric profile is required to provide a reasonable indication of the depth contours in and adjacent to, the marine farming lease area. Depth measurements should be made to the nearest metre from boats equipped with an echosounder and should be obtained along the following tracks:

(i) A single track parallel to and approximately 50m outside the lease boundary.
(ii) Soundings every 100m within the area covered in (i) above.

Any distinct depth features, such as trenches, channels, holes should be identified on the map. The approximate positions of the depth contours are to be drawn on the map provided.

2.3 Seabed Characteristics and habitat profile

Location of habitat type(s) must be sketched on the lease map provided. The map should provide an approximate position of the different habitat types within the lease area. 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

2.4 Underwater Video Survey

An underwater survey of the sea bottom is to be recorded by video cameras along the transect line indicated on the attached map.
This line will run from a point (x) in the middle of the lease (or from a point approximately 200 metres from the boundary towards the middle of the lease, whichever is the lesser distance) in a straight line in a downstream direction to a point (z) 100 metres beyond the boundary. The start of the transect can be located by either GPS or by using the bearings and distances shown on the attached map.

Filming Procedure:

Hi-8 video filming is to be conducted by diver, remotely operated vehicle (ROV) or a towed camera, with the transect cable or scale bar in view. Each transect must be identified on the film with the appropriate transect number e.g. T1, T2 etc. Filming needs to be conducted slowly along the transect to ensure clear well-lit images are recorded. Stationary video footage of the bottom must be provided for the following sites along the transect: -200m, -100m, 0m, 35m, 50m and 100m. The stationary footage must be taken vertically, with the transect cable in view (all sites where a core is to be removed must be identified clearly on the video prior to coring). A marker indicating the position of each of the 6 sites must be clearly visible on the transect cable. The diver/ROV should gently disturb the sediment by hand/mechanical arm at the start and end of the transect while filming to reveal the sediment colour beneath the surface. With a towed camera, the sled frame will provide disturbance as a matter of course.
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 DPIW. 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/operator 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

2.5 Sediment Analysis

Undisturbed sediment cores (duplicate) are to be taken using a Craib corer with perspex inner core 50 mm diameter, at the sites indicated on the attached map. From the cores obtained, the costs associated with 2.4.1 and 2.4.2 (below) will be covered by the DPIW.

2.5.1 Visual assessment and redox
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, 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 Analysis

The top 3 cm of each core is to be oven dried at 60ºC prior to analysis of total organic carbon (loss on ignition at 450ºC in a muffle furnace for 4 hours).

2.5.3 Particle size Analysis

A subsample of sediment from the top section of each core should be placed in a 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:
Duplicate Van Veen grabs or diver collected wide-diameter core samples (150mm diameter x depth 100mm) are to be taken at sites along the video transect (identified on the map). Each benthic sample should be sieved through a 4 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 DPIW

2.7.1 Interim Report

An initial brief report must be submitted within one month of conducting the initial monitoring survey 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.

2.7.2 The Initial Monitoring Survey Report

A complete Initial monitoring survey report must be submitted within 4 months of conducting the survey. All requirements for reporting of the 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 General Manger Primary Industries DPIW. 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 DPIW. 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
- 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 marine farming lease area is attached.

Initial Monitoring Survey Map: MF015 , sample sites including controls.

MF 015: Baseline Environmental Survey Sample Site Coordinates (AGD66, AMG Zone 55).

Lease No.	Year	Site Number	Type of sample	Easting	Northing

* The position of the control site may be varied if depth and habitat do not reflect that of the lease area.

SCHEDULE 4IL TO MARINE FARMING LICENCE: 089/05

SUBTIDAL SHELLFISH (LOW PRODUCTION) INITIAL MONITORING SURVEY:

REQUIREMENTS FOR SUBTIDAL SHELLFISH LEASE AREAS.

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1. Outline of Requirements

The Initial Monitoring Survey is to be conducted in accordance with specifications determined by the General Manger Primary Industries Division, Department of Primary Industries and Water (DPIW) (Section 2 below) and undertaken by person(s) or organisations approved and authorised by the General Manger Primary Industries Division, DPIW to undertake the work at the sites specified. An initial monitoring survey report must be submitted to the DPIW by the applicant within 1 month 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 initial monitoring survey for marine farming subtidal shellfish (low production) includes the following components:

1. Current flow information
2. Bathymetric profile- qualitative data
3. Seabed characteristics /habitat type profile - qualitative data
4. Reporting of results to DPIW

Initial Monitoring Survey Specifications

2.1 Current flow information

An indication of the general current flow within the lease area. This should be drawn onto the bathymetric profile map (blank map attached).

2.2 Bathymetric profile

A bathymetric profile is required to provide a reasonable indication of the depth contours in and adjacent to, the marine farming lease area. Depth measurements should be made to the nearest metre from boats equipped with an echosounder and should be obtained along the following tracks:

(i) A single track parallel to and approximately 50m outside the lease boundary.
(ii) Soundings every 100m within the area covered in (i) above.

Any distinct depth features, such as trenches, channels, holes should be identified on the map. The approximate positions of the depth contours are to be drawn on the map provided.

2.3 Seabed Characteristics and habitat profile

Location of habitat type(s) must be sketched on the lease map provided. The map should provide an approximate position of the different habitat types within the lease area. 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

2.7 Reporting of Results to DPIW

2.7.1 Report

A final report must be submitted within 1 month of conducting the initial monitoring survey including the following:

- Date, time, weather conditions of the sampling day,
- Current flow information
- Bathymetric profile- qualitative data
- Seabed characteristics /habitat type profile - qualitative data

This document is to be approved by and submitted by the applicant.

3. Map

A map relating to this marine farming lease area is attached.

MF 089 Initial Monitoring Survey Map: Bathymetric Profile

MF 089 Initial Monitoring Survey Map: Habitat Profile & Seabed Characteristics

SCHEDULE 5 TO MARINE FARMING LICENCE: 052/05

MARINE FARMING LICENCE CONDITIONS RELATING TO ENVIRONMENTAL MANAGEMENT OF A INTERTIDAL SHELLFISH FARM

Conditions relating to the environmental management of intertidal shellfish farms are in three parts.

1. Compliance with environmental standards
2. Environmental records to be kept by licence holder
3. Environmental reports to be provided to the Department

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1. Compliance with Environmental Standards

The licence holder shall comply with the following environmental standards as they apply to effects attributable to the marine farming operations conducted on the marine farming lease area:

1. There should be no unacceptable visual, chemical or biological impact on the benthos outside the boundaries of the lease area. Unacceptable impacts would include but not be limited to:

    - Loss of seagrass other than in defined access channels
    - Accumulation of shell waste and fouling organisms
    - Change in sediment characteristics
    - Mats of *Beggiatoa sp*

2. No biologically significant levels of chemical residues (or antibiotics) shall be present in sediments within or immediately outside the lease area.

3. Surface waters surrounding the lease area shall contain no detectable levels of petroleum derived hydrocarbons, other than by normal vessel exhaust.

4. Wastes from harvesting or processing of produce from marine lease areas and from the removal of fouling organisms from marine farming structures and equipment, such as racking or longline droppers, must be disposed of in a manner that does not affect the ecology of the marine environment or nearby shoreline.

Under certain circumstances the Department may require the licence holder to make measurements to ensure compliance with these standards in both the water column and sediment within, and outside, the marine farming lease area.

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2. Environmental records to be kept by the Licence holder

The following records shall be kept by the licence holder and provided to the Department on request.

1. A list specifying the quantities, and date of use, of all chemicals which have been used on the lease area that are directly or indirectly released into the water. This includes, but is not confined to, therapeutants, anaesthetics, antibiotics, hormones, pigments, antifoulants, disinfectants and cleansers.

2. Location and length of stocked racking in the marine farming lease area.

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3. Environmental reports to be provided to the Department

1. A record of any significant event (e.g. unusual algal bloom) and of any incidents of disease and/or shellfish kills. Disease outbreaks are to be notified to the Department of Primary Industries, Water and Environment in accordance with the *Animal Health Act 1995*.

2. The licence holder must notify the Department of Primary Industries, Water and Environment of the presence of any introduced marine pests within the lease area. These species include, but are not limited to the: Northern Pacific Seastar (*Asterias amurensis*), European shore crab (*Carcinus maenas*) and the Japanese seaweed (*Undaria pinnatifida*).

SCHEDULE 5B TO MARINE FARMING LEASE: **XXX**

INTERTIDAL SHELLFISH BASELINE ENVIRONMENTAL SURVEY:

REQUIREMENTS FOR A NEW LEASE AREA, RELOCATION OR EXPANSION GREATER THAN 10% OF LEASE AREA

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1. Outline of Requirements

The Baseline Environmental Survey is to be conducted in accordance with specifications determined by the General Manger Primary Industries Division, Department of Primary Industries, Water and Environment (Section 2 below) and undertaken by person(s) or organisations approved and authorised by the General Manger Primary Industries Division DPIW to undertake the work at the sites specified. An environmental baseline survey report must be submitted to the DPIW by the applicant within 4 months of conducting the survey.

The environmental baseline survey report must be submitted to the Marine Environment Section, DPIW by the applicant in accordance with section 2.5 of this schedule.

The sampling is to be conducted at each of the sites shown on the enclosed map. All positional requirements (prescribed control and sample site 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 photography is to be conducted on the same day, (or within one week if not practicable).

The applicant must notify the Marine Environment Section, DPIW [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 intertidal shellfish must include the following components, as detailed in section 2 of this Schedule:

2.1 Seabed characteristics/habitat type profile of seabed within the lease area
2.2 Photographs of each sample site
2.3 Sediment description
2.4 Biological analysis – analysis and interpretation of benthic infauna
2.5 Reporting of results to DPIW

2.1 Seabed Characteristics and habitat profile

A visual assessment of the seabed within the lease area must be undertaken and habitat types detailed on a scale map of the lease area. Habitat types noted include, but may not be limited to:

- hard bottom - rock, limestone reef, boulders, rubble
- soft bottom - sand, mud/silt
- seagrass/algae - species composition of dominant species present

2.2 Sample Site Photographs (standard 35mm or digital photos):

Daytime photos of the substrate at each of the prescribed sample sites must be taken. Each photo must include in the field of view a slate detailing the marine farming lease number, sample site number and a scale bar (10mm increments). Each photograph must be taken no more than 800mm above the sediment surface if the substrate is fully exposed on the low tide. Appropriate underwater housing will be required for photos at sample sites that are underwater at the time of sampling.

2.3 Sediment Profile

Visual assessment:
Duplicate undisturbed sediment cores, approximately 100mm length are to be taken using a corer with perspex inner core 50 mm diameter, at the prescribed sample sites. 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, size and position in the sediment,
- sediment smell including presence/absence of hydrogen sulphide,

2.4 Biological analysis

Benthic faunal analysis:
Duplicate wide-diameter core samples (150mm diameter x depth 100mm) are to be taken at each of the prescribed sample sites. Each benthic sample should be sieved through a 1 mm sieve and all fauna identified to family 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.

2.5 Reporting of Results to DPIW

Interim Report:
An initial brief report must be submitted within one month of conducting the baseline survey if farming is to commence prior to submission of the complete baseline report including the following:

- date, time, weather conditions of the sampling day,
- habitat map,
- photographs of all sample sites, and
- sediment profiles

This document is to be approved by and submitted by the applicant.
The General Manager, Primary Industries Division, DPIW must approve the assessment and interpretation of the interim baseline information prior to issuing any written authorisation to the applicant to allow marine farming to commence.

Final Baseline Report:
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 must be submitted within 4 months of conducting the survey and 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 Division, DPIW 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 marine farming lease area will be provided to the lessee and, if requested, to person(s) undertaking the survey.

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 disc, CD or via email) which is compatible with the database system and software currently used by the Marine Environment Section DPIW. 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;
- habitat map of the lease area;
- description and interpretation of core profiles;
- description and interpretation of sample site photographs;
- where relevant, an interpretation of results (written and graphical) from the benthic organisms from grab/core samples

MF XXX: Baseline Environmental Survey Sample Site Coordinates (AGD66, AMG Zone 55).

Lease No.	Year	Site Number	Type of sample	Easting	Northing

* The position of the control site may be varied if depth and habitat do not reflect that of the lease area.

SCHEDULE 5I TO MARINE FARMING LICENCE XXX/99:

INTERTIDAL SHELLFISH INITIAL MONITORING SURVEY:

REQUIREMENTS FOR EXISTING INTERTIDAL SHELLFISH LEASE AREAS

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1. Outline of Requirements

The Initial Monitoring Survey is to be conducted in accordance with specifications determined by the General Manager, Primary Industries Division, Department of Primary Industries, and Water (DPIW) (Section 2 below) and undertaken by person(s) or organisations approved and authorised by the General Manager, Primary Industries Division, DPIW to undertake the work at the sites specified. An initial monitoring survey report must be submitted to the DPIW by the applicant within 1 month 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 Initial Monitoring Survey for marine farming intertidal shellfish includes the following components:

1. Bathymetric profile-qualitative data
2. Photographs: A recent aerial photo of the lease area (optional) and 35mm photos from the boundaries of the lease area (signed by the lease holder and noting the date and relevant lease number).
3. Reporting of results to DPIW

Initial Monitoring Survey Specifications

2.1 Bathymetric profile

Approximate 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 an appropriate method at high tide for example using a measuring stick or lead-line or utilising aerial photo stereo pairs (available from the Lands Dept), the records of depth should be made approximately every 100m within the marine farming lease area and for an area extending 50m beyond the boundaries of the marine farming lease area.

The approximate position of depth contours are to be drawn on the map provided.

2.2 Photographs

Aerial photograph(optional):

A recent vertical aerial photograph of the lease is required (available from the Lands Dept).

Standard 35mm camera photographs:

Daytime photos at a low-low tide are required from the lease boundaries pointing across the marine farm, together with photos of the adjacent shoreline and photos showing access channels and any significant habitat areas. Each photo location must be clearly identified on the back of the photo and on the attached map. In addition, the lease holder must sign the back of each photo, noting the date, time and lease number.

2.3 Reporting of Results to DPIW

2.3.1 Report

A final report must be submitted within one month of conducting the initial monitoring survey.

This document is to be approved by and submitted by the applicant. 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:

Results:

- date, time, weather conditions of the sampling day,
- Bathymetric Profile of lease area (on attached map)
- 35mm camera photographs of the lease area (signature of lease holder, date and lease number noted on back of photographs)
- Aerial Photograph of lease area (Lands Department 1:25000)

3. Map

A map of this marine farming lease area is attached. MF XXX Initial Monitoring Survey Map: Bathymetric Profile

MF XXX Initial Monitoring Survey Map: Photograph location map

SCHEDULE 6 TO MARINE FARMING LICENCE **224/05**

]MARINE FARMING LICENCE CONDITIONS RELATING TO ENVIRONMENTAL MANAGEMENT OF A SUBTIDAL/INTERTIDAL SHELLFISH FARM

Conditions relating to the environmental management of combined subtidal and intertidal shellfish farms are in three parts.
1. Compliance with environmental standards
2. Environmental records to be kept by licence holder
3. Environmental reports to be provided to the Department

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1. Compliance with Environmental Standards

The licence holder shall comply with the following environmental standards as they apply to effects attributable to the marine farming operations conducted on the marine farming lease area:
1. There should be no unacceptable visual, chemical or biological impact on the benthos outside the boundaries of the lease area. Unacceptable impacts would include but not be limited to:

   - Loss of seagrass other than in defined access channels
   - Accumulation of shell waste and fouling organisms
   - Change in sediment characteristics
   - Mats of *Beggiatoa sp*

2. No biologically significant levels of chemical residues (or antibiotics) shall be present in sediments within or immediately outside the lease area.
3. Surface waters surrounding the lease area shall contain no detectable levels of petroleum derived hydrocarbons, other than by normal vessel exhaust.

4. Wastes from harvesting or processing of produce from marine lease areas and from the removal of fouling organisms from marine farming structures and equipment, such as racking or longline droppers, must be disposed of in a manner that does not affect the ecology of the marine environment or nearby shoreline.

Under certain circumstances the Department may require the licence holder to make measurements to ensure compliance with these standards in both the water column and sediment within, and outside, the marine farming lease area.

2. Environmental records to be kept by the Licence holder

The following records shall be kept by the licence holder and provided to the Department on request.
1. A list specifying the quantities, and date of use, of all chemicals which have been used on the lease area that are directly or indirectly released into the water. This includes, but is not confined to, therapeutants, anaesthetics, antibiotics, hormones, pigments, antifoulants, disinfectants and cleansers.

2. Details of the location of stocked longlines and the stocking density (length of longlines per hectare) in the marine farming lease area.

3. Location and length of stocked racking in the marine farming lease area.

3. Environmental reports to be provided to the Department

1. A record of any significant event (e.g. unusual algal bloom) and of any incidents of disease and/or shellfish kills. Disease outbreaks are to be notified to the Department of Primary Industries, Water and Environment in accordance with the *Animal Health Act 1995*.

2. The licence holder must notify the Department of Primary Industries, Water and Environment of the presence of any introduced marine pests within the lease area. These species include, but are not limited to the: Northern Pacific Seastar (*Asterias amurensis*), European shore crab (*Carcinus maenas*) and the Japanese seaweed (*Undaria pinnatifida*.

Environmental Management System Framework

Tasmanian Oyster Industry

Code of Practice

In Development

Tasmania

Australian Government
Fisheries Research and Development Corporation

FRDC Project 2004/096

Environmental Management System Framework

Tasmanian Oyster Industry

Tasmanian Oyster Industry

Code of Practice

In Development

FRDC Project 2004/096