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Exercise Sea Fox: Testing aquatic animal disease emergency response capabilities within aquaculture

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Executive Summary

The South Australian State government (Primary Industries and Regions South Australia, PIRSA), together with the South Australian Oyster Growers Association (SAOGA), lead a national aquatic disease response exercise: "Exercise Sea Fox". The exercise scenario was based on a fictitious outbreak of Pacific Oyster Mortality Syndrome (POMS) and was conducted in 3 parts; a field trip, a workshop and a discussion exercise during October and November 2012 in South Australia. A key outcome was the development of an emergency disease response plan specific to POMS. Being an emergent disease of national priority in Australia, POMS represents a significant threat to the seafood industry. Exercise Sea Fox was successful in enhancing prevention, preparedness and response capabilities for the oyster growing sector, providing greater food security and protection for regional communities.

POMS is a disease caused by a microvariant of the Ostreid Herpesvirus (OsHV-1 microvariant), and was responsible for significant oyster mortalities (80 – 100 %) and economic impact in Europe, including France, during 2008 and in New Zealand and Australia (NSW) since 2010. Given the significant threat POMS poses to the oyster growing sector of Australia's seafood industry, building emergency response capacity in the aquaculture sector is a high priority at a State and National level.

The aim of Exercise Sea Fox was to enhance government and industry's preparedness for responding to an emergency aquatic animal disease and identify gaps in current emergency response capabilities.

Exercise Sea Fox followed on from FRDC 2011-043 (Understanding and planning for the potential impacts of OsHV-1 microvariant) and was conducted in 3 parts. Firstly, a field trip provided State government emergency response staff experience and knowledge of the aquaculture industry. Secondly, a workshop provided government and industry participants technical aspects for responding to aquatic diseases. Thirdly, a discussion exercise provided the opportunity to practice current emergency response arrangements (State and National), procedures and systems for responding to a fictitious disease outbreak. The exercise scenario was based on a simulated outbreak of POMS in South Australia. The disease outbreak was chosen to draw out some of the challenges when responding to this disease, identify gaps in current preparedness arrangements and key risks. Participants included personnel from government, industry and universities, representing DAFF (Canberra), South Australia, New South Wales, Tasmania, Western Australia and New Zealand.

A key output from the exercise included a summary of issues (and gaps) in current response capabilities. Importantly, it was highlighted that no POMS-specific disease response plans (State or National) existed in Australia (at the time), which would impede effective emergency response. However, generic AQUAVETPLAN manuals (e.g. enterprise manual) can be used to respond to unknown diseases, although they lack detail for responding to specific disease risks. Thus, key components of a disease response plan for POMS were discussed, and include; a case definition, reporting requirements, response strategies, tracing, emergency harvest, destruction-disposal-decontamination, movement controls, legislative powers, surveillance and monitoring.

Exercise Sea Fox improved working relationships within government (State and National) and between government and industry. Outcomes from the exercise broadly cover prevention, preparedness and response capabilities for the oyster growing sector, providing greater food security and protection for regional communities. The economic benefit of prevention and preparedness for an exotic disease threat can be estimated at 1:100 (e.g. for every dollar spent, a return of approximately one hundred dollars can be expected). This compares to 1:25 for eradication and 1:5-10 for containment.

Recommendations from Exercise Sea Fox include:

1. Consider outcomes of this project for the development of disease response plans for POMS
2. Improve surveillance systems
3. Improve stock records
4. Cost sharing arrangement to be considered
5. Commitment to ongoing response training
6. Commitment to awareness campaigns

The outcomes and extension of this project have exceeded the initial objectives (see Chapter 6). All recommendations are currently being addressed. Importantly a State response plan specific to POMS has been developed (Appendix 6), while post Exercise Sea Fox workshops have included risk assessments and presentations to industry. National and industry response plans are now being developed.

Key words: Aquatic disease, Pacific Oyster Mortality Syndrome, POMS, OsHV-1 microvariant, Emergency Response

1 Introduction

1.1 Background

Pacific Oyster Mortality Syndrome (POMS) poses a significant threat to the Australian oyster growing industry. The disease, caused by a microvariant of the Ostreid Herpesvirus (OsHV-1 microvariant), was responsible for significant oyster mortalities (80 – 100 %) and economic impact in Europe and France during 2008 (Pernet et al. 2012), and in New Zealand and Australia since 2010 (AusVet 2011).

In Australia OsHV-1 microvariant is restricted to parts of New South Wales (NSW) including the Georges River and Botany Bay, Parramatta River and Port Jackson and the Hawkesbury River. Oysters, growers and processors are subject to control measures (for containment) in NSW, while South Australia and Tasmania have enacted controls to manage the risk of introduction and establishment of the virus.

To date, infection with OsHV-1 microvariant, and associated mortality, is only recorded in Pacific oysters (*Crassostrea gigas*), despite other species being farmed in close proximity. The disease affects all age groups, with higher mortalities apparent in younger life stages (<12 months old, >80%). Temperature is important in expression of disease, with temperatures at 17°C and above associated with mortalities (NSW DPI personal communications). Stress is likely to play a substantial role in susceptibility (Burge et al. 2007; AusVet 2011).

Being an emergent disease, limited biological and epidemiological information is available, and at the time Exercise Sea Fox was initiated, no POMS-specific disease response plans (State or National) existed in Australia. Although, generic AQUAVETPLAN manuals (e.g. enterprise manual) and State response manuals (e.g. PIRSA's Emergency Management Document for Aquatic Animal Health) can be used to respond to unknown diseases, these manuals lack detail for responding to specific disease risks.

The aim of Exercise Sea Fox was to enhance government and industry's preparedness for responding to an emergency aquatic animal disease and identify gaps in current emergency response capabilities.

In 2011, infection with OsHV-1 microvariant was listed on *Australia's National List of Reportable Diseases of Aquatic Animals* (http://www.daff.gov.au/animal-plant-health/aquatic/reporting/reportable-diseases). The listing provides the driver for government to respond to this disease due to its potential impact on the oyster growing sector of Australia's seafood industry. The significant threat this disease poses to the Australian seafood industry ensured it a high priority in government policy, research funding and at an industry level.

Emergency aquatic disease response plans and exercising such plans are at the core of disease prevention, disease management and effective response to disease outbreaks, particularly for the aquaculture sector (Doroudi et al. 2007). In particular, an aquatic disease outbreak exercise in the oyster growing sector was needed to test current emergency response arrangements and identify areas for improvement (Lewis et al. 2012, FRDC 2011-043).

Exercise Sea Fox was conducted in 3 parts; a field trip, a workshop and a discussion exercise during October and November 2012 in South Australia. The exercise formed part of the regular cycle of PIRSA emergency preparedness activities. National funding enabled this to become a national exercise, which was planned and conducted by PIRSA with assistance from the oyster industry. Financial support was provided by PIRSA, the Commonwealth Department of Agriculture, Fisheries and Forestry (DAFF) and the Fisheries Research and Development Corporation (FRDC). Participants included personnel from government, industry and universities, representing DAFF (Canberra), South

Australia, NSW, Tasmania, Western Australia and New Zealand.

The exercise scenario was based on a simulated outbreak of POMS in South Australia. The disease outbreak was chosen to draw out some of the challenges when responding to this disease, identify gaps in current preparedness arrangements and key risks. The outcomes would then be used to develop POMS-specific response plans at the state level and provide advice on a national response strategy.

1.2 Need

Emergency response arrangements and exercising these arrangements for an aquatic disease outbreak is at the core of disease prevention and management. POMS is a national high priority aquatic (notifiable) disease that poses a threat to the oyster growing aquaculture sector, particularly for SA, NSW and TAS.

Government and industry have state and national obligations for responding to biosecurity incursions, including notifiable diseases. The emergency response framework includes OIE manuals, AQUAVETPLAN manuals, State legislation and emergency management plans. Effective response requires on-going training (including exercises). The need for an aquatic disease exercise has been highlighted at both State and National levels.

Being an emergent disease, at the time of Exercise Sea Fox, there were no State or national response plans specific to POMS and emergency disease response training specific to the oyster growing sector was needed.

2 Objectives

1. Raise awareness within government and industry of national and state emergency management obligations
2. Provide government and industry personnel with an opportunity to develop and practice skills and procedures when responding to an emergency aquatic animal disease
3. Develop knowledge within government of the aquatic industry
4. Identify gaps in the government and industry's aquatic disease response capability

3 Methodology - Exercise planning and conduct

Exercise Sea Fox was planned over a 6-month period by a core group of seven people from PIRSA and Oysters Australia (OA) (authors of this report). SAOGA also provided support in the planning and conduct of this exercise, particularly Jill Coates (President) and Trudy McGowan (Executive Officer). The Executive Director of Fisheries & Aquaculture and Biosecurity SA had the overall responsibility for the exercise. The Exercise Director was Nancy Bombardieri. Two members of the planning team wrote the exercise scenario and facilitated the conduct of the exercise (N. Bombardieri and M. Deveney).

Documents that guided the preparation and conduct of the exercise are listed in Appendix 2.

Exercise Sea Fox was conducted in 3 parts; a field trip, a workshop and a discussion exercise during October and November 2012 in South Australia. Agendas for each part are provided in Appendix 3. Debriefing and evaluation forms were used to provide feedback to the planning team on the conduct of the exercise, including: whether objectives were achieved, processes and procedures were appropriate, benefits were achieved. Feedback was positive including strong indication that objectives were met, including greater understanding of emergency response arrangements, requirements and the operating environment.

3.1 Field Trip (Part 1)

A field trip, based in Port Lincoln South Australia (23 – 25 October 2012), was designed to provide hands on experience of the aquaculture sector, particularly the complexity of day-to-day oyster site operations, focusing on the practical difficulties in handling an on-site disease outbreak.

The field trip was aimed at State government emergency response staff (largely Biosecurity SA terrestrial Animal Health Officers) to provide experience and knowledge of the aquaculture industry. This part of the exercise up-skilled participants to ensure the discussion exercise (part 3) was effective and efficient.

The field trip aimed to:

- Gain knowledge on the level of Biosecurity (e.g. disease prevention, control, response) that can be applied to the different aquaculture farming systems
- Identify unique features that need to be considered when responding to an emergency disease outbreak in the aquatic environment, in comparison to terrestrial farming systems
- Ensure these unique features of aquaculture were understood by emergency response staff

3.2 Workshop (Part 2)

The workshop was based in Port Lincoln South Australia (25 – 26 October 2012), and included industry and government participants. The workshop covered technical aspects of aquatic diseases (in general and specific POMS), concepts of biosecurity (prevention, preparedness, response) and government's emergency response frameworks (State and National plans). The combination of industry and government personnel provided valuable discussion on response capabilities in the context of policy, compliance and on-ground operational logistics.

This part of the exercise increased the knowledge of participants regarding POMS to ensure the discussion exercise (part 3) was effective and efficient.

The workshop aimed to:

- Identify methods for reducing disease risks
- Raise awareness of existing plans
- Develop knowledge of the systems that are applied during a disease incident
- Identify potential Industry Liaison Officers for emergency response

3.3 Discussion Exercise (Part 3)

The discussion exercise was held on 27 – 29 November 2013 in Adelaide, South Australia, and provided the opportunity to practice current emergency response arrangements (State and National), procedures and systems for responding to a fictitious disease outbreak. The exercise aimed to allow participants to share their skills and knowledge of disease response, improve emergency response preparedness and identify gaps in current response capabilities and arrangements.

The scenario for this exercise was based on a simulated outbreak of POMS causing significant mortalities in oysters in South Australia's oyster growing areas. The outbreak represented the first hypothetical case of POMS in SA. The scenario is outlined below.

The following government departments, industries and universities were represented at the exercise:

- PIRSA Fisheries & Aquaculture
- PIRSA Biosecurity SA
- PIRSA SARDI Aquatic Sciences
- New South Wales (NSW), Department of Primary Industries
- Commonwealth Department of Agriculture, Fisheries and Forestry
- Western Australia Department of Fisheries, Biosecurity Policy
- Adelaide University, School of Animal & Veterinary Sciences
- New Zealand, Ministry for Primary Industries
- South Australian Oyster Growers Association
- Australian Southern Bluefin Tuna Industry Association
- Southseas Abalone
- Oysters Australia
- NSW Oyster Growers
- Tasmanian Oyster Growers

The discussion exercise recommendations would be used to develop a POMS-specific response plan.

The following objectives were identified as key priorities and outcomes for the discussion exercise:

- Raise awareness of State and National emergency disease management obligations
- Provide participants with an opportunity to develop and practice skills and procedures when responding to an emergency aquatic animal disease
- Explore and agree to the policies and strategies to apply during a POMS incident
- Identify gaps in the government and industry's aquatic response capability

A number of presentations were given to participants providing a background information source on the experiences, difficulties and successes that other jurisdictions and countries have had in responding to the outbreak of POMS in their regions.

Scenario

The discussion exercise consisted of the following scenario being presented to the participants:

Friday 26 October

- A producer contacts the Manager, Aquatic Animal Health in PIRSA to report that there has been a 30% mortality event within his oyster stock at Smoky Bay
- A sample of oysters is collected and transported to VETLAB. The mortality effects young/juvenile oysters approximately 45mm in size. The owner has not visited the site for about two months and biological information from the growing region is provided by SASQAP.

November 5

- Results received include PCR negative for OsHV-1 microvariant & nonspecific histopathology findings (oedema in connective tissues & signs of poor condition or nutritional stress).

November 6

- The producer contacts PIRSA again to say he has been out to his licence and can smell a problem. There are also similar reports from producers at Streaky Bay and Stansbury. The producers at Stansbury are reporting >90% mortality rate and at Streaky Bay a 25-40% mortality rate, but with poor data.
- Samples are submitted to VETLAB from each farm

November 7

- CVO contacts AAHL with a request to expedite diagnostics

November 9 –

- AAHL results. Smoky and Stansbury return positives for PCR to OsHV-1 microvariant
- All Streaky Bay results are negative
- Positive leases have been quarantined i.e. no stock in or out
- PIRSA has now declared restrictions on movements for all stock in Smoky Bay and Stansbury
- Trace back to Tasmanian hatchery occurs

Method

This was a desktop exercise, with tables having representatives from different organizations, including a mix of government, industry and interstate personnel. The scenario was provided to the groups in stages to simulate the kind and sequence of on-ground information inputs that would occur during a real scenario. As information was being presented to the groups, participants were asked to discuss the information that was being presented and then provide feedback to the whole exercise on the range of actions that were suitable to guide the response.

All group information and outputs were discussed and documented. Outputs, including issues identified, are provided below.

4 Results – Workshop outputs

Key issues and gaps in current aquatic emergency response capabilities were identified during the exercise (Table 4.1). From this table, key recommendations for improving response capability for the oyster growing sector are outlined in Section 8.

Recommendations include:

- Develop disease response plans for POMS
- Improve surveillance systems
- Improve stock records
- Consider cost-sharing arrangements
- Commitment to ongoing response training
- Commitment to awareness campaigns

It was agreed that continued effective collaboration between government and industry, and across jurisdictions (continue work on national committees and working groups) was important for prevention (i.e. improving surveillance systems and biosecurity practices) as well as response capabilities.

Table 4.1 Summary of key issues in current response capabilities that require consideration

Response area/ Issue	Recommended in State plan	Recommended in National plan	Comments
Case definition	**Yes**	**Yes**	**Required for decisions about when to investigate and what constitutes a positive detection for POMS. Incorporate the use of stress test to assist with ensuring accuracy of surveillance.**
Response options	**Yes**	**Yes**	**The initial response should be containment (e.g. stock standstill for minimum 72 hours, up to 1 week, or until laboratory results received) while ongoing response options are considered. SA industry indicated up to 1 week would result in minimal impact.** **Eradication, Containment and Control are three broad response options to be considered. Dependent on farming system, presence of natural hosts (i.e. escaped wild Pacific oysters), extent of outbreak, industry willingness, cost-benefit (short vs long term).** **Eradication is likely possible for semi-closed systems (i.e. hatchery), although unlikely, but possible, for semi-open systems (i.e. marine lease site). For semi-open systems, if considered feasible (including industry willingness), agreements / policies should be in place to minimize economic impact on industry (i.e. cost sharing, emergency lease).**
Quarantine	**Yes**	**Yes**	**Determine criteria for Infected Premises, Dangerous Contact Premises and Suspect Premises.** **State response plans to clearly prescribe the legislation to be used for specific quarantine measures.**

Response area/ Issue	Recommended in State plan	Recommended in National plan	Comments
Movement controls	**Yes**	**Yes**	**State response plans to clearly prescribe the legislation to be used for each type of activity.** **SA to document process for notification of bay closures during an outbreak i.e. through SASQAP network and/or industry bay representatives (industry liaison officers).** **Emergency harvest where possible (e.g. allowed to sell non-viable product to market) – to be captured in policy.** **Consult with marine user groups (stakeholders) and determine practical application of movement controls in areas where there are public/fishing/ recreational users e.g. Coffin Bay over school holidays.** **Farm gate sales of live oysters (direct to public) should be restricted or banned during a response.** **Determine how sales of equipment can be managed. Determine effectiveness of NSW and SA restrictions and protocols.**
Stock destruction of clinical cases versus stock outside infected area	**Yes**	**Yes**	**National plans to have policy on acceptable methods.** **State plans to describe preferred methods (include emergency harvest) and outline unacceptable methods.**
Disinfection / decontamination	**Yes**	**Yes**	**Response plans to list preferred agents based on availability, safety and environmental impacts.** **Develop relevant SOPs.**

Response area/ Issue	Recommended in State plan	Recommended in National plan	Comments
Disposal method	**Yes**	**Yes**	**List methods that are applicable / preferred. Consider Environment Protection Authority policies for this. May require development of an SOP.**
Surveillance and tracing	**Yes**	**Yes**	**Determine surveillance methods (sampling and timing), including preferred diagnostic tests. Consider methods for both infected (extent of disease / freedom surveillance) and non-infected areas (early detection surveillance).** **Stock movement records are a priority for effective tracing.** **This is a legislative requirement in most jurisdictions (including SA).** **PIRSA to assist industry to establish appropriate movement registers / databases. Include the following data – origin, destination, date, size, number. Give guidance on time for records to be retained (SA legislation requires five years).** **Government and industry (i.e. associations) should work together to encourage reporting of unusual mortality events, pivotal for early detection. Unusual mortality to be better defined for this industry.** **Consider providing farms with sampling kits to expedite investigations in unusual mortality events.** **Ensure government response plans have the mechanism for ensuring prompt sample analyses (priority) from State / National laboratories.**
Funding	**Yes**	**Yes**	**Cost-sharing arrangements between government and industry should be discussed prior to a response. Determine government funding limits, in-kind and financial costs. Financial assistance may include hire of industry equipment (or include as in-kind value towards a response),**

Response area/ Issue	Recommended in State plan	Recommended in National plan	Comments
			waiving license fees etc.
Develop Communications strategy and plan for response	**Yes**	**Yes**	**Consult with stakeholders who may be critical during a response. E.g. ensure recreational fishing sector is engaged.** **Determine and identify primary and secondary stakeholders in response plans** **Ensure management of confidentiality is documented and understood by all stakeholders** **Determine if social media will be used and how** **Ensure Minister is informed in a timely manner** **Plan for effective internal communications**
Proof of freedom	**Yes**	**Yes**	**Should be included in response plans as a component of surveillance methods**
Decision making process	**Yes**	**No**	**State government to discuss with industry the ongoing decision making process during an emergency response, especially around movement controls and any changes to response options.**
Training and education	**Yes**	**No**	**State government to continue to raise awareness of emergency response processes and plans with stakeholders (e.g. industry, aquatic research departments, regional staff) and continue to build an understanding of aquatic disease risks**

Response area/ Issue	Recommended in State plan	Recommended in National plan	Comments
			Ensure key personnel (industry and government) have appropriate emergency response training
Emergency Management frameworks in response plans should follow AIIMMS	**Yes**	**Yes**	**Ensure that government response plans outline emergency management structures (e.g. identifying the Incident Controller) to manage the response efficiently (including initial investigations).**
Risk Assessment	**Yes**	**Yes**	**Ensure all options in plans are underpinned by documented risk assessments where possible**
Relief and recovery strategy	**Yes**	**Yes**	**Ensure this is addressed in response plans.** **Include counseling for community and producers** **Spat supply is a vulnerability for SA. Strategies to minimise this risk should be planned for with industry and can include:** - **Increasing number of SA Oyster Hatchery/SARDI – nursery sites** - **Identify nursery sites – prioritise** - **Identify capacity and capability in local hatcheries** - **Consider what alternative species and resistant strains are available** - **Work with industry to prioritise available spat supply**
Imported frozen oysters	**Yes**	**Yes**	**SA to determine level of risk and control measures**
Feral oysters	**Yes**	**Yes**	**Include consideration for this population in the plan**
Movement of equipment from infected areas	**Yes**	**Yes**	**Determine risk and controls required for oyster farming equipment being sold by affected farms**

5 Discussion: Improving response capabilities for the oyster growing sector

5.1 POMS Response Plans

In 2011, infection with OsHV-1 microvariant was listed on *Australia's National List of Reportable Diseases of Aquatic Animals* (http://www.daff.gov.au/animal-plant-health/aquatic/reporting/reportable-diseases). Subsequently, jurisdictions listed OsHV-1 microvariant (i.e. South Australia in 2012), providing the requirement for industry to report this disease and the driver for government to respond to this disease due to its potential impact on the oyster growing sector of Australia's seafood industry.

Currently, an emergency disease response in the oyster growing sector would rely on the generic national response plans available (e.g. AQUAVETPLAN Enterprise Manual, Control Centre Manual etc), which simply provides technical information on type of aquaculture enterprises (e.g. semi-open systems) and suggested government response structures.

The development of POMS-specific response plans (State and National) were identified as a high priority during Exercise Sea Fox.

Key components of such response plans were identified and discussed during Exercise Sea Fox. These included the following:

5.1.1 Case definition

While licensed aquaculture farmers are required to report notifiable disease (suspected or confirmed) and unusually high mortalities, an agreed case definition for POMS would further assist appropriate disease response. Case definitions provide the trigger for when an aquatic animal disease incident is investigated and assists epidemiological analyses for appropriate response strategies during an emergency response.

Outbreaks of POMS generally occur at temperatures over 17°C (Segarra et al. 2010) with mortalities being 80 – 100 % (AusVet 2011). The oyster growing industry also experiences mortality events during winter (not caused by OsHV-1 microvariant), so refining 'suspected' case definitions with a temperature trigger may assist investigations. While it is important to note that mortality figures can be highly variable among individual oyster growers (AusVet 2012), an oyster farmer would know what an unusually high mortality is for their particular farm. Further, the SA oyster growing industry agreed that >10% mortality at a single grading event would be concerning for the majority of farmers (AusVet 2012). As such, the proposed case definitions for POMS are:

Suspected case definition –

- Unusually high and unexplained mortality or if unsure >10% at grading

(optional: Mortality associated with water temperature estimated at 17^{o}C or greater)

Confirmed case definition –

- Positive PCR result for OsHV-1 microvariant on at least one repeat oyster sample

For oysters (wild, farmed or sentinels) collected as part of active surveillance during winter (<17^{o} C), consider a stress test through increasing water temperature (in a biosecure holding facility) to >17^{o} C and testing for OsHV-1 microvariant using PCR.

5.1.2 Reporting requirements

In accordance with the World Animal Health Organization (OIE) and subsequently Australian Commonwealth requirements, all Australian State (and Territory) government legislation requires the reporting of notifiable disease and unusually high mortalities (to cover emergent or unknown diseases) in the aquaculture industry. However, government and industry should work together to encourage reporting and investigation of unusual mortality events, which is critical for early detection.

Reporting structures should follow the Australasian Inter-Service Incident Management System (AIIMS), which is the nationally recognized emergency management structure (e.g. identifying the Incident Controller to lead an investigation or response). This provides for an effective and efficient response to a report of a disease incident.

5.1.3 Response strategies

The initial step of the response should be immediate stock movement restrictions (e.g. no movement of oysters within the jurisdiction) for a minimum of 72 hours (up to 1 week) or until the extent of the outbreak has been determined from field investigations and laboratory results.

This aims to contain the potential outbreak. The response strategy for the outbreak can then be determined:

Options for response strategies to POMS may be:

- Eradication of the virus (if feasible)
- Containment of virus. Define the geographic areas these pertain to and restrict movement and access through zoning
- Control and mitigation of disease. Manage the frequency and severity of disease episodes in infected populations and keeping them within acceptable levels

The most appropriate response strategy is that which minimizes the socioeconomic impact on industry and community (i.e. consider economic benefits and costs of the response strategy to regional communities) in the short or long term.

Selecting the most appropriate response option will depend on:

1. Culture system. e.g. semi-closed (i.e. hatchery) vs semi-open (i.e. marine lease site)
2. Extent of outbreak (e.g. confined or widespread)
3. Presence, proximity and disease status of feral populations of Pacific oysters (e.g. naturalised escaped stock) or other susceptible hosts
4. Short-term costs of eradication vs control
5. Long-term costs to both government and industry, including disruption to production

Eradication is an option, but success depends on:

- Points 1-3 above (culture system, extent of outbreak, feral oysters)
- Industry willingness (support from industry, including use of personnel and equipment, is pivotal to effective response)
- Options being available to affected farmers to avoid economic hardship. This may include:
    - Agreed paid services of the farm (e.g. use of personnel and equipment) to assist with the response (i.e. a form of financial support)
    - Waiving licence fees
    - Provision of an emergency lease (to allow farming in an unaffected growing area)
    - Consider allowing farming in eradication zone with native, non-susceptible oysters (e.g. *Saccostrea commercialis*, *Ostrea angasi*)
    - Financial assistance (or compensation) from a pre-existing "Industry Emergency Response Fund". Such a fund does not currently exist for the oyster industry, but in South Australia (as an example) there are mechanisms in legislation (e.g. Primary Industry Funding Schemes Act 1998) for government to establish such a fund for industry. The money for the fund may be sourced from a levy system (either pre or post-response)

An example scenario for eradication as a potential option in a semi-open system (e.g. estuary or bay) would be a confirmed positive PCR detection of OsHV-1 microvariant in a batch of oysters (on a farm) during cooler temperature months (<17°C) and surveillance has confirmed that the infection is restricted (i.e. not present in adjacent farms or bays or feral oyster populations).

After the infection has been immediately contained and if 'eradication' is attempted as the response option, it should be attempted as early as possible while the virus is contained. If eradication is attempted, it should be reviewed periodically (e.g. weeks or months) to determine its effectiveness and whether the response strategy needs to be down-graded to containment or control.

5.1.4 Tracing

Easily accessible and comprehensive stock records are a priority for effective tracing during a response.

Stock records are a legislative requirement for aquaculture licence holders in most jurisdictions. To enhance tracing and surveillance the industry must have an accurate system for recording movements of stock that can be efficiently interrogated for critical information during a response.

Easily accessible and comprehensive stock movement records may include the following data – origin, destination, date, size, number.

New South Wales currently have an electronic, web based, database for licence holders to enter stock record information. The South Australian oyster growing industry are currently designing a similar web-based stock record database (with an option for smart phone application updates), which could be quickly accessed by government for tracing purposes. However, for 100% effectiveness, the system must be used by all farms. Since this is unlikely (cannot legislate a licence holder to use technology), a level of farm visits during a response would still be required to access stock records for tracing.

5.1.5 Emergency harvest

Emergency harvest should be an option where possible (particularly during 'eradication' or 'containment'). Product should be sold to the human consumption market as non-viable oyster product (i.e. frozen or half shell). Appropriate seafood processors should be considered (i.e. potential large amount of product), while controls should be put in place (e.g. licence conditions) for processors that deal with oysters from infected (or potentially infected) areas (e.g. product not to be sold as bait/berley). These processors should be identified and protocols agreed by industry and government prior to a response to ensure maximum commercial gain.

5.1.6 Destruction, disposal and decontamination

Protocols should follow EPA guidelines and AQUAVETPLAN manuals for destruction, disposal and decontamination. NSW DPI *'oyster equipment movement and field decontamination'* protocols provide good guidance to minimise risk of disease spread.

Ostreid herpesviruses (including OsHV-1 microvariant) (Family *Malacoherpesviridae*, Order *Herpesvirales*) are a group of viruses that are susceptible to decontamination agents, desiccation and radiation. These viruses posses a lipid envelope, are of intermediate-to-large size and generally have low survival outside of the host. These are the easiest viruses to inactivate because the lipid envelope is sensitive to many lipophilic compounds such as soaps and detergents. Chlorine-based disinfectants seem effective against these viruses.

Other issues that provided good discussion and required further consideration included:

- Leaving oysters in situ is not a disposal option both for environmental reason and disease risk factors
- Disposal appeared to be simple but volume of animal and shell from a farm may pose some difficulties. This will be necessary to identify suitable disposal sites, especially where burial is used.

5.1.7 Movement controls

At the suspicion (or confirmation) of POMS, implement an immediate stock standstill (minimum 72 hours). Industry has indicated that this could be done voluntarily (if appropriate) and that there will be minimal impacts to them for a seven day standstill.

Determine criteria for quarantine areas, including: infected, restricted and control areas.

Movement controls within declared areas should consider live oysters and other bivalves, bait/berley use, oyster farming equipment and personnel, other sectors that utilize the same marine environment (e.g. aquaculture, fishers, boating), oyster processors, shipping, scavengers and other fomites and vectors.

5.1.8 Legislative powers

State response plans should clearly prescribe the legislation to be used for specific quarantine or controls (e.g. stopping stock movement between quarantine areas or stopping commercial/recreational vessels from entering an area). This was highlighted as an important aspect to clarify with legal experts prior to a response to improve response times.

5.1.9 Surveillance and monitoring

Passive surveillance systems (e.g. requirement to report disease) should be adequate (see section 5.1.2. above) to provide early detection capability. This is pivotal to effective response.

Surveillance and monitoring during a response may be to 1) confirm presence of disease, 2) determine spatial extent of disease or 3) determine freedom of disease. Epidemiological principles and OIE guidelines should be considered. Consider the use of sentinels and stress tests (artificial increases water temperature), particularly during winter months to elicit disease.

5.2 Cost sharing arrangements

There are no national arrangements for industries and governments to share the costs and responsibilities for responding to emergency aquatic animal disease incidents. In the absence of such national arrangements, sharing of costs (including owner reimbursement for stock destroyed as part of an eradication program) is a matter for affected enterprises and the state or territory government where that enterprise is located. Previous disease emergencies indicate that under current arrangements, state or territory governments are unlikely to provide direct financial assistance to affected enterprises (e.g. owner reimbursement of lost stock) but may provide other forms of support (e.g. waiving license fees).

Aquatic animal industries and the Australian state, territory and Commonwealth governments have agreed on an approach to pursue the development of emergency aquatic animal disease response arrangements that are appropriate for aquatic animal industries.

Cost sharing for the oyster growing sector was discussed during exercise sea fox and it was agreed that during an aquatic emergency disease response, government would be heavily reliant on the resources that industry would be able to provide (e.g. personnel such as divers, infrastructure, vessels, and equipment). The in-kind contribution that industry would need to make during a response would be substantial to ensure an effective and efficient response. This was acknowledged, while government and industry agreed a collaborative joint response is the best option.

For South Australia, industry liaison officers (industry representatives that would provide technical and on-ground assistance to government in a response) were identified as “Bay representatives”. SAOGA have already identified industry representatives for each growing region (or ‘bay’).

5.3 Training

Emergency response training is critical to ensuring effective preparedness and rapid response to disease outbreaks. Training ensures skills are maintained and updated for new and existing staff. It also provides the mechanism to test response plans, procedures and capabilities. Ongoing training should be considered at the:

1. National level
2. State level
3. Industry level
4. Farm level

Future State based emergency response exercises should consider National and cross sector participation, which provides valuable expertise and experience. Training should include all staff and industry personnel that may be involved in an emergency response, particularly those that would be delegated a critical role in the response structure.

5.4 Communication during response

Critical to the success of any emergency response is the internal (e.g. government-industry) and public information/communications function. The response will be dependent on industry and government working collaboratively on communications. A communications strategy should be developed with industry that includes the following:

- Timely notification of area closures
- How and when will social media be used
- How will PIRSA (as lead agency during a response) communicate with growers and the public (e.g. frequency of reports)
- Ensure communications and decision-making with the Minister is timely
- PIRSA and industry to have internal processes for protecting confidentiality

6 Conclusions

Exercise Sea Fox was successful in enhancing emergency response training in aquaculture and identifying ways for improving Australia's preparedness and disease response capabilities in the oyster growing sector, particularly for POMS. Importantly, National, State and industry POMS-specific response plans have been developed, or are being drafted. State response plans should be in line with AQUAVETPLAN, while industry response plans should be in line with both.

Ongoing training exercises should be considered at National, State, industry and farm levels. A national simulation exercise (as opposed to a desktop exercise) for an aquatic animal disease should also be considered in the future. A previous national simulation exercise – Exercise Tethys – for an aquatic animal disease (FRDC Project 2003-669) was conducted in 2003 (East and Scott, 2004). The most recent national simulation was based on bluetongue virus in sheep (May 2012), conducted by Animal Health Australia, DAFF and PIRSA:
http://www.pir.sa.gov.au/pirsa/news_2012 (4 May 2012)

Efficient response capabilities provide for rapid detection and effective disease management (i.e. allowing eradication to be truly considered as an option, if feasible). The key benefit is to maintain Australia's health status and potential trade and market access, while reducing potential impacts at the enterprise level (farm production and economics).

Exercise Sea Fox fostered a working relationship within government (State and National), between government and industry as well as with New Zealand counterparts. These networks need to be maintained, particularly at the National level.

Finally, the recommendations outlined in this report should be considered by all oyster growing areas. Particularly, active surveillance programs for semi-open systems should be considered to provide an additional level of early detection. Risk assessments should be used to assist with prioritizing action plans.

7 Implications

Exercise Sea Fox served to foster a greatly improved working relationship within government (State and National), between government and industry (particularly with SAOGA and Oysters Australia) as well as with New Zealand counterparts.

Outcomes broadly cover increased prevention, preparedness and response capabilities for the oyster growing sector, providing greater food security and protection for regional communities. For example, South Australia is the largest oyster producing State in Australia, producing 7,200 tonnes (2011-12) with a value of $44 million (contributing a total value of $210M to the State) (Econsearch, 2013). Production is in the regions of the State, employing 274 people directly with some local communities heavily reliant on this sector (e.g. employment and tourism).

The economic benefit of prevention and preparedness for an exotic disease threat can be estimated at 1:100 (e.g. for every dollar spent, a return of approximately one hundred dollars can be expected) (see Figure I.1 in Appendix 6). This compares to 1:25 for eradication and 1:5-10 for containment.

8 Recommendations

Key broad recommendations for improving current aquatic emergency response capabilities include the following:

1. Consider outcomes of this project for the development of disease response plans for POMS (e.g. AQUAVETPLAN manual, State and industry plans)
2. Improve surveillance systems (passive and active) to facilitate early detection and rapid response
3. Improve stock records data at an industry level to facilitate emergency response (e.g. tracing)
4. Cost (or resource) sharing arrangements between government and industry to be considered
5. Commitment to ongoing aquatic disease response training
6. Commitment to awareness campaigns

9 Extension & Adoption

All objectives were achieved, while all recommendations are currently being addressed to different degrees. Outputs, extension and benefits of this project have exceeded expectations. Broadly these include:

1. Enhanced emergency disease response capabilities and preparedness for the oyster aquaculture sector

2. Development of a State (SA) response plan for POMS (see Appendix 6). National and industry plans are subsequently being developed.

3. Awareness campaigns

9.1 Enhanced Preparedness

Prior to Exercise Sea Fox, industry personnel generally had a limited understanding of the State and National emergency response frameworks, while government veterinarians and emergency response personnel (particularly those that work in the terrestrial realm) had limited experience or understanding of aquaculture practices prior to this exercise. It was clearly evident that Exercise Sea Fox greatly improved these shortfalls in awareness, skills and knowledge.

Exercise Sea Fox served to foster a greatly improved working relationship within government (State and National), between government and industry (particularly with SAOGA and Oysters Australia) as well as with New Zealand counterparts. National committees and working groups (e.g. SCAAH POMS working group) are critical to knowledge sharing, developing national policies and guidelines and disease status updates.

In South Australia post Exercise Sea Fox, PIRSA and SAOGA have worked collaboratively on:

1) Development of the State POMS response plan
2) Developing industry response plans
3) Ongoing industry awareness campaigns (e.g. articles in SAOGA newsletter)
4) Reviewing mortality reporting requirements and protocols to improve early detection
5) Developing stock record databases
6) Scoping active surveillance programs
7) Reviewing translocation policies
8) Reviewing license conditions and policies to provide for the culture of alternate species (e.g. *Ostrea angasi*)
9) Developing an “Emergency Lease Policy” and
10) Conducting POMS related risk assessments

9.2 Development of State and National POMS Response Plans

In line with recommendation 1 (Section 8 above) drafting of POMS-specific emergency response plans were of high State and National priority. Immediately following the discussion exercise (Exercise Sea Fox, part 3, November 2012) drafting of the South Australian POMS response plan commenced. This has since been finalized and is provided (minus personal contact list) in Appendix

6 (*PIRSA Disease Response Plan: Pacific Oyster Mortality Syndrome*).

The Response plan provides protocols and strategies for responding to POMS. These include a proposed case definition, emergency management information and reporting protocols, investigation and response strategies, tracing protocols, emergency harvest protocols, disposal and decontamination protocols, movement controls, legislative powers (for SA), surveillance and monitoring strategies.

Furthermore, DAFF is currently leading the development of an AQUAVETPLAN Disease Strategy Manual for OsHV-1 microvariant. AQUAVETPLAN is a series of technical response plans that describe the proposed Australian approach to aquatic animal disease incursions. The documents provide guidance based on sound analysis, linking policy, strategies, implementation, coordination and emergency-management plans. AQUAVETPLAN manuals can be found at: http://www.daff.gov.au/aquavetplan

Lastly, industry (Association and farm level) are moving to develop response plans for POMS with assistance from government.

9.3 Awareness campaigns

Public and industry awareness campaigns of Exercise Sea Fox and POMS have included:

1. DAFF Animal Health Surveillance, Volume 17 (2) 2012
    a. 'Aquatic animal health and surveillance in South Australia' Volume 17 (2) 2012

2. Regular articles in SAOGA newsletters, including:
    a. "SA prepares for aquatic disease emergency" January 2013

3. PIRSA Aquascope newsletter
    a. "SA prepares for aquatic disease emergency" December 2012

4. PIRSA public website updates – "aquatic disease response capabilities put to the test". 24 October2012: http://www.pir.sa.gov.au/pirsa/media_list/fisheries/aquatic_disease_response_capabilities_put_to_the_test

5. Media:
    a. Port Lincoln Times 30/10/2012 page 5, "Training for oyster disease".

    b. Eyre Peninsula Tribune 1/11/2012 page 2: "Testing aquatic disease response capabilities".

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Appendix 1 List of Participants

Field Trip: Attendance List (Part 1)

PARTICIPANT	ORGANISATION
Ben Tanti	PIRSA
Michelle Besley	PIRSA
Alex Chalupa	PIRSA
Wayne Mossop	PIRSA
Amelia Bartlett	PIRSA
Adrian Harvey	PIRSA
Jeremy Rogers	PIRSA
Emily Litzow	PIRSA
John Gilliland	PIRSA
Annabel Cox	PIRSA
Steve Wortley	DAFF
Brett Herbert	DAFF
Shane Roberts	PIRSA
Peter Lauer	PIRSA
Carlie Heaven	PIRSA
Nancy Bombardieri	PIRSA
Claire Webber	ASBTIA (Tuna industry)
Jo Tsoukalas	PIRSA

Workshop Attendance List (Part 2)

PARTICIPANT	ORGANISATION
Ben Tanti	PIRSA
Michelle Besley	PIRSA
Alex Chalupa	PIRSA
Shane Roberts	PIRSA
Peter Lauer	PIRSA
Carlie Heaven	PIRSA
Nancy Bombardieri	PIRSA
Margaret Rowley	PIRSA
Sebastian Lambert	PIRSA
Dave McDonald	PIRSA
Steve Wortley	DAFF
Brett Herbert	DAFF
James Sheppard	PIRSA
Kimberly Griffin	PIRSA
Kane Slater	PIRSA
Yolande Markey	PIRSA
Claire Webber	ASBTIA (Tuna industry)
Shane McLinden	Southseas Abalone
Trudy McGowan	SAOGA
Jill Coates	SAOGA (President)
Bruce Zippel	Oysters Australia (President)
Carl Jaeschke	SA Oyster grower
Jedd Routledge	SA Oyster grower
Max Lowe	SA Oyster grower
Adam Butterworth	SA Oyster grower

Discussion Exercise - Attendance list (Part 3)

PARTICIPANT	ORGANISATION
Zacharin, Will	PIRSA (Executive Director, Biosecurity SA)
Mehdi Doroudi	PIRSA (Executive Director, Fisheries & Aquaculture)
Sean Sloan	PIRSA (Director, Fisheries & Aquaculture)
Rahaley, Rob	PIRSA (Chief Veterinary Officer, Biosecurity SA)
Clinton Wilkinson	PIRSA
Dowsett, Paul	PIRSA
Shane Roberts	PIRSA
Peter Lauer	PIRSA
James Sheppard	PIRSA
Kimberly Griffin	DAFF
Sebastian Lambert	DAFF
Michelle Besley	PIRSA
Alex Chalupa	PIRSA
John Gilliland	PIRSA
Jack Van Wijk	PIRSA
Claire Webber	ASBTIA (Tuna industry)
Shane McLinden	Southseas Abalone
Jill Coates	SAOGA (President)
Trudy McGowan	SAOGA
Carl Jaeschke	SA Oyster grower
Jedd Routledge	SA Oyster grower
Steve Bowley	SA Oyster grower
Victoria Aitken	WA Fisheries
Kevin Ellard	Tas. DPIPWE
John Preston	Tas. DPIPWE
Tom Lewis	Tas. Oyster industry
Jane Frances	NSW DPI
Rob Moxham	NSW Oyster grower
Marty Deveney	PIRSA - SARDI
Nancy Bombardieri	PIRSA
Ben Tanti	PIRSA
Charles Caraguel	University of Adelaide
Margaret Rowley	PIRSA
Brett Herbert	DAFF
Melissa Walker	NSW DPI
Carlie Heaven	PIRSA
Fleur Matthews	NZ - Ministry for Primary Industries
Esther Richardson	NZ - Ministry for Primary Industries
Rissa Williams	NZ - Ministry for Primary Industries

Appendix 2 List of Documents for Exercise Sea Fox

The following documents guided the preparation and conduct of the exercise:

1. For the Exercise Planning Team:
    a. Exercise Plan
    b. Logistics Sub Plan
    c. Risk Management Sub Plan

2. For participants:
    a. Joining instructions, including pre-exercise reading and information

3. For the Exercise Control Team:
    a. scenario outline
    b. background information and profiles
    c. Master Schedule
    d. inputs and attachments
    e. facilitator checklists (identifying required actions and/or outputs)

4. For the Evaluator (internal PIRSA evaluation):
    a. Evaluation Sub Plan,

Documentation with sensitive or scenario-related information was clearly marked with the words **EXERCISE ONLY**, to ensure that it was not mistaken for real information.

5. Legislation
    a. Emergency Management Act 2004 (SA)
    b. Livestock Act 1997 (SA)
    c. Aquaculture Act 2001(SA)
    d. Fisheries Management Act 2007 (SA)
    e. Quarantine Act 1908 (Commonwealth)

6. Other
    a. Relevant AQUAVETPLAN manuals (including Control Centres Management manual, Enterprise manual, Destruction-Disposal-Decontamination manual)
    b. AQUAPLAN
    c. PIRSA Aquatic Animal Health Plan
    d. PIRSA Disease Response Plan: Abalone Viral Ganglioneuritis
    e. PIRSA Internal audit report on biosecurity emergency response framework June 2011

Appendix 3 Exercise Sea Fox – Part 1: Field Trip Agenda

Day 1 Tuesday 23 October 2012. Pt Lincoln, SA. Field trip

Session	Length	Time	Topic
	30 minutes	12:00	Lunch
1	15 mins	12:30	Welcome and Induction
2	120 mins	12:45	Presentations: Overview of aquaculture industry: • Differences between aquatic and terrestrial animal farming systems • Aquaculture systems • Aquatic diseases of significance • From spat to plate • Discussion and questions
3	30 mins	14:45	Describe regulatory framework for aquaculture and which Acts may apply for an EAAD
	15 mins	15:15	Break
4	90 mins	15:30	Visit Abalone Farm – Point Boston
		17:00	**CLOSE**

Day 2 Wednesday 24 October 2012. Pt Lincoln, SA. Field trip

Session	Length	Time	Topic
1	30 minutes	08:30	Briefing
2	90 mins	09:00	Visit Oyster Hatchery – Louth Bay
3	60 mins	11:00	Visit Processing facility – Port Lincoln
4	60 mins	12:00	Return to Port Lincoln for lunch
5	240 mins	13:00	Visit Oyster farm – Coffin Bay
		17:00	**CLOSE and travel back**

Day 3 Thursday 25 October 2012. Pt Lincoln, SA. Field trip

Session	Length	Time	Topic
1	180 mins	09:00	Debrief on unique features of aquaculture facilities What does the FRT Operations team need to develop to be prepared? Are there gaps in legislation? Are there gaps in plans? What do we need to know about DDD – unique factors to consider?
		12:00	**CLOSE and LUNCH**

Appendix 4 Exercise Sea Fox - Part 2: Workshop Agenda

Day 1 Thursday 25 October 2012. Pt Lincoln, SA. Workshop

Session	Length	Time	Topic
	60 minutes	12:00	LUNCH provided
1	30 mins	13:00	Introduction and induction Overview – aim and Objectives
2	60 mins	13:30	Disease Prevention • Explore current documented biosecurity plans • Examples will be provided and how they are applied to a production unit
3	60 mins	14:30	Emergency Aquatic Animal Diseases • What are the important diseases • How do they spread • What effects do they have on production
4	20 mins	15:30	Break
5	60 mins	15:50	How is industry involved in a response? • What plans do we have and how dothey work • Discuss legislative ability to undertake activities • Where is industry represented? What sorts of people are involved? What skills do you need?.
		16:50	Close and instructions for following morning

Day 2 Friday 26 October 2012. Pt Lincoln, SA. Workshop

Session	Length	Time	Topic
1	15 minutes	08:30	Morning briefing
2	60 mins	08:45	Planning, Reporting and Decision Making • What document do we use • How do we make decisions • Understand the need to work together • Where does industry contribute • What regulatory framework applies – orders and powers of legislation • Understand the environment
3	60 mins	09:45	Managing Information • Where does it come form • Why do we need to manage information • How to respond appropriately to different types of information
	15 mins	10:45	Break

Session	Length	Time	Topic
4	45 mins	11:00	Introduction to POMS • Describe signs, incubation period, lab tests and samples needed • Are there any plans that will help? • Review NSW and France response o What effect on industry o What actions can be taken to minimise spread o What are the basic tools for control/eradication o What are the risks to industry
5	45 mins	11:45	Exercise – based on a disease scenario participants will be asked to explore a series of questions and make decisions regarding a response. Examples: • Which plans and legislation will be relevant • What will be the strategy? • What movement restrictions? • What level of decontamination is required
	45 mins	12:00	Lunch
6	120 mins	13:00	Exercise continued
7	30 mins	15:00	Debrief and where to from here?
		15:30	**CLOSE**

Appendix 5 Exercise Sea Fox – Part 3: Discussion Exercise Agenda

Day 1 Tuesday 27 November, 2012.

Session	Length	Time	Topic
	60 minutes	**12:00**	**LUNCH**
1	15 mins	13:00	Welcome by PIRSA Chief Executive
2	20 mins	13:30	• Welcome and Introduction • House keeping
3	20 mins	13:50	Emergency Aquatic Animal Diseases Arrangements • State arrangements, systems and plans
4	15 mins	14:10	Emergency Aquatic Animal Diseases Arrangements • State legislation and plans
5	15 mins	14:25	Emergency Aquatic Animal Diseases Arrangements • National - AQUAVETPLAN
6	15 mins	14:40	Pacific Oyster Mortality syndrome (POMS) • Overview of the disease
7	15 – 30 mins	14:55	POMS in NSW • Overview of their approach to response • Lessons learnt
8	15 mins	15:10	French POMS • Overview of their response • Lessons learnt
	15 mins	15:25	**BREAK**
9	15 mins	15::40	Scenario presented
10	60 mins	15:50	**Exercise Sea Fox commences** Discussion exercise based on an incursion of POMS
		14:45	**CLOSE**

Day 2 Wednesday 28 October

Session	Length	Time	Topic
1	15 minutes	09:30	Morning briefing
2	75 mins	09:45	Exercise Sea Fox continues
	20 mins	10:30	**BREAK**
3	115 mins	10:50	Exercise Sea Fox continues
	45 mins	12:45	**LUNCH**
4	90 mins	13:30	Exercise Sea Fox continues
	20 mins	15:00	**BREAK**
5	40 mins	15:20	Exercise Sea Fox continues
6	30 mins	16:00	Hot Debrief
		16:30	**CLOSE**
		18:30	**Dinner at a venue TBA**

Day 3 Thursday 29 November

Session	Length	Time	Topic
1	15 minutes	09:00	Morning briefing
2	75 mins	09:15	Summarise recommendations for policy on POMS from previous days discussion to be considered in development of industry, State and National plans
	20 mins	10:30	**BREAK**
3	70 mins	10:50	Debrief groups and individuals
		12:00	**CLOSE and LUNCH**

Appendix 6 South Australian Government POMS Response Plan

FISHERIES
& AQUACULTURE
PIRSA

PIRSA Disease Response Plan:
Pacific Oyster Mortality Syndrome

growing
sustainable
regions

Government
of South Australia
Primary Industries
and Regions SA

FOREWORD

This plan provides the operational and technical framework for responding to Pacific Oyster Mortality Syndrome (POMS). POMS is a disease of Pacific Oysters (*Crassostrea gigas*) that has the potential to cause devastating losses to the Pacific Oyster aquaculture industry in South Australia. The disease is caused by a pathogenic strain of ostreid herpesvirus (OsHV-1 microvariant). At a national level, it has been decided to call this disease POMS. There is no risk to humans consuming a POMS infected pacific oyster.

POMS has devastated oyster growing industries throughout Europe (including France) and Asia since 2008, with rapid mortalities of 80-100%. In 2010 POMS was identified in New Zealand causing major impacts upon the industry and in late 2010 was detected in two estuaries in NSW, Australia. This disease was subsequently listed as a notifiable disease at both a national and State (SA) level. A second recorded outbreak in NSW occurred in January 2013, this was an extension of the known range which spread into the Hawkesbury river system.

POMS has been declared a notifiable disease in South Australia under the *Livestock Act 1997*. It is thus a mandatory requirement for suspected cases of POMS to be reported to an inspector by the quickest practicable means. At the date at which this Plan was finalised, POMS had not been identified within South Australian waters or any aquaculture farms.

This POMS Response Plan provides a framework for Primary Industries and Regions South Australia (PIRSA) staff and industry to prepare for, and respond to, a suspected or confirmed case of POMS in South Australia. The Plan forms part of the South Australian Government's disease management strategy for POMS, which is consistent with the national AQUAVETPLAN series of manuals prepared by the Department of Agriculture, Fisheries and Forestry. At the date at which this plan was finalised, the national AQUAVETPLAN disease strategy manual for Ostreid Herpes Virus-1 microvariant (POMS) was being drafted. This plan was also developed with consideration of previous outbreaks and aquatic animal health responses in both France, New Zealand and recently in New South Wales. Its preparation included three discussion exercises held in Port Lincoln and Adelaide (2012-2013) as part of a national emergency response exercise (named Seafox).

This Plan was prepared by PIRSA Fisheries & Aquaculture and Biosecurity SA and reviewed by members of the POMS Working Group (POMS-WG), PIRSA's Emergency Management Group, technical experts and the South Australian Oyster Growers Association.

Prof Mehdi Doroudi
EXECUTIVE DIRECTOR, FISHERIES AND AQUACULTURE

Will Zacharin
EXECUTIVE DIRECTOR, BIOSECURITY SA

CONTENTS

Introduction

Purpose

- This Response Plan provides specific operational guidelines for PIRSA staff and industry to respond in the event of a suspected or confirmed Pacific Oyster Mortality Syndrome (POMS) outbreak.
- This Plan will be activated by the report of a pacific oyster health incident suspected to be caused by POMS.
- This Plan can also be used as a response template for unknown (non-POMS), suspected infectious (e.g. high mortality) oyster diseases.

Case Definition

Information here originates from a 'South Australian oyster mortality' workshop (22 October 2012) and exercise Seafox (October/November 2012, DAFF/FRDC project 2012/044)

POMS:

The POMS response plan will trigger an investigation (lead by PIRSA Fisheries & Aquaculture) if the following conditions are reported in conjunction with each other:

Alert Phase

Suspected case (at the farm level):

- Unusually high and unexplained mortality
  or >10% at grading, and
- Mortality associated with water temperature estimated at 17^{o}C or greater

Background 'normal' mortality in the industry is up to 5% at grading and 20-30% over grow-out (~18months). However, this can be highly variable among growers.

Response Phase

A full response (lead by Biosecurity SA) will be initiated when a PCR test confirms a positive result for OsHV-1 microvariant.

SAMS:

PIRSA investigates all unusually high and unexplained mortalities in aquaculture.

The pacific oyster growing industry in South Australia has a known winter mortality issue, which has been unofficially called South Australian Mortality Syndrome (SAMS). This is a known low level mortality issue (approximately ~30% over a 6-month period) in juvenile Pacific Oysters in SA. To date, infectious and notifiable disease has been ruled out.

The SAMS case definition does not necessarily trigger this plan, although PIRSA assists and facilitates further investigations and research into this issue, including ruling out POMS when first suspected in an area.

Suspected case (at the farm level):

- Unusually high and unexplained mortality
  or >10% at grading
- Mortality occurs in the first winter for spat (~May – August)
- Mortality occurs in spat (20-60mm size or <12 months)

Version Control

Version date	Version number	Updated sections	Description of Changes
August 2013	V1 A1557970	Complete Plan	Final draft.
October 2013	V2 A1557970	Section I: Response Options	Options clarified with further detail.

Background

- An outbreak of POMS in South Australia has the potential to significantly impact the oyster growing aquaculture industry (8 growing regions) and the rural communities that rely on this sector.
- On suspicion or confirmation of POMS, immediate containment measures (State-wide stock movement) will be enacted for up to 1 week or until the extent of the outbreak (infection) has been determined from surveillance, tracing activities and laboratory results (which may take more than 1 week in an extensive outbreak scenario).

  Options for the disease response strategy are

  1) Eradication of the virus (if feasible; e.g. land-based hatchery) or
  2) Containment of the virus or
  3) Mitigation of disease
- This Plan was prepared in accordance with the Commonwealth AQUAVETPLAN and the PIRSA Aquatic Animal Health Plan.
- This Plan should be considered as a working document that can be refined and amended with further information regarding POMS.

Key relevant documents

Key documents and manuals can be found at the following websites / PIRSA intranet addresses:

- AQUAVETPLAN series of manuals:

  http://www.daff.gov.au/animal-plant-health/aquatic/aquavetplan
- *PIRSA Emergency Management Document for Aquatic Animal Health*

  http://intranet.pirsa.sa.gov.au/pages/business/foodandfibre/emergency/plans/aquatic_animal_health.pdf

Section A. Disease response phases, triggers, and actions

Purpose

The disease response is divided into four phases: 1) standby; 2) alert; 3) response; and 4) stand down. This section describes the triggers used to determine the response phase at any particular time, and provides actions (including strategies and protocols) for each phase (Table A.1).

Response phases

Table A.1. Triggers and actions for disease response phases. This table can be updated as progress is made and further information is acquired.

	Triggers	Actions	Progress	Responsibility
STANDBY PHASE	*No triggers – standby phase applies until the alert phase is triggered*	1. Review and update of response plans 2. Regular response training and awareness for PIRSA and industry groups 3. POMS Working Group (POMS-WG) to meet when required. - debrief, review plans and develop new strategies and protocols as required 4. Preparation, review and update of material in Communications strategy, (for standby phase)	1. Review and update Plan: including all policies and protocols. ongoing 2. Ongoing 3. Ongoing 4. Standby phase Implemented	1,2,3. Aquatic Animal Health Officer (PIRSA F &A) Emergency Management Officer (BSA) 4. PIRSA Communications Manager All above

	Triggers	Actions	Responsibility
ALERT PHASE	***Aquaculture Level 1 (POMS suspected)*** 1. Unusually high and unexplained mortality of pacific oysters or if unsure >10% mortality at grading, and 2. Water temperatures approximately 17 ^{o}C or greater	Investigate to determine if cause is POMS or other notifiable or infectious disease 1. Implement sampling protocol (Section D). Samples should be sent to the laboratory to rule out POMS as soon as possible. 2. Consider quarantine and movement controls. e.g. Verbal order to cease oyster movements until results available (Section J). Up to 1-week stock standstill of oysters State-wide. 3. Implement alert phase for Communications strategy (Section B). Including industry consultation (SAOGA / appropriate Bay representatives) 4. Implement alert phase for Information & Reporting protocol (Section C). Including POMS-WG notified (including ED and CVO) 5. Consider Destruction, Disposal & Decontamination protocols (Section F) where appropriate 6. Consider monitoring strategy, (Section E). Survey area surrounding incident site to assess extent of potential outbreak	Incident Controller (PIRSA Fisheries and Aquaculture)
	Aquaculture Level 2 (POMS likely) 1. Abnormally high, unexplained and rapid mortality of pacific oysters (estimated at >50% mortality) reported by more than 1 farm, and 2. Water temperatures approximately 17 ^{o}C or greater	Investigate to confirm POMS 7. Implement steps 1-6 above. 8. Notify the Minister, CVO, ED's & EMC of likely presence of POMS	State Controller (ED Biosecurity SA) Supported by EMC

	Triggers	Actions	Responsibility
RESPONSE PHASE	***Aquaculture (POMS confirmed)*** Alert phase Level 1 or 2 triggers above and: 1. One positive PCR result on at least one repeat oyster sample for OsHV-1 microvariant (POMS).	Implement response phases of all strategies and protocols, with consideration of adjacent marine waters. Specifically: 1. Notify the Minister, CVO, ED's & EMEOG of confirmed presence of POMS. An Incident Controller is appointed, who then appoints an Incident Management Team (IMT) for support. 2. Implement Quarantine and Movement Controls strategy (Section J: immediate stock standstill to contain the outbreak) if not already done. 3. Consider Response Options (Section I). Eradicate if feasible (e.g. land-based hatchery). Other options are Containment or Mitigation. 4. Implement Sampling, Monitoring and Tracing protocols (Sections D, E and G). Additional samples collected and tested to determine extent of infection (which production areas or farms). 5. Consider emergency harvest and associated controls, including processors (e.g. non-viable oyster sales only, ban farm gate sales, no new stock into infected area) to facilitate de-stocking farm or growing area (e.g. Bay) 6. Destruction, Disposal & Decontamination protocols (Section F). Consider vessel, vehicle and equipment decontamination. 7. Media updates as needed (if public / industry concern). Provision of Q/A and discussion points.	State Controller (ED Biosecurity SA)
STAND DOWN PHASE	1. POMS widespread through all growing regions, and considered established, or 2. No new infected areas in South Australian waters for twelve months, or 3. POMS eradicated from aquaculture lease and no new disease-affected areas in adjacent waters for twelve months. Proof of freedom sampling must have been conducted, or 4. Incident not caused by POMS or other suspected infectious disease.	1. If not POMS and a pacific oyster mortality issue still exists, ensure laboratory testing rules out other infectious disease (histopathology and other diagnostics). If suspected SAMS, facilitate further investigations and contribute to research where appropriate. **Post-POMS outbreak** 1. Debrief 2. Consider long term disease management (ongoing controls, zoning, surveillance) 3. Consider long term adjustment for aquaculture industry (e.g. alternate oyster species, alternate spat supply / new hatcheries, selective breeding programs) 4. Review legislation and policy (review & amend where necessary).	Aquatic Animal Health Officer (PIRSA F &A) and POMS-WG

Section B. Communications strategy

Purpose

The communications strategy is a key component of the Response Plan and aims to ensure that all relevant stakeholders and users of the pacific oyster resource are appropriately informed of the disease and its status.

Response phases

The communications strategy describes the trigger, key messages, target audience and methods of communication for each of the standby, alert, response and stand down phases of the response (Table B.1.). Responsibility is with the PIRSA Communications Manager. This is a joint effort with industry (SAOGA).

Table B.1. Communications strategy. Those methods of communication highlighted with an asterisk (*) are considered a priority for preparation.

	Trigger	Key messages	Target audience	Methods of communication
STANDBY PHASE	Prior to any detection of disease	1. Awareness of the disease 2. Awareness of protocol for reporting and suspected sighting 3. Minimise/avoid spread of disease into South Australian waters	1. Oyster aquaculture industry 2. PIRSA Fisheries staff a. Fisheries Officers b. Front counter c. Fishwatch call centre 3. PIRSA Fisheries and Aquaculture staff 4. Biosecurity SA Aquatic Pests' unit staff. 5. PIRSA EM staff – State Controller/CVO 6. Restaurants / food industry	1. Prepare draft talking points and draft holding statement* 2. PIRSA website 3. Establish 1800 Fishwatch reporting protocols for operators 4. Media release 5. Factsheet to oyster aquaculture 6. Aquaculture industry meetings
ALERT PHASE level 1	POMS suspected / likely (as outlined in Section A)	1. Awareness of PIRSA emergency response Plan 2. Samples are being tested for confirmation of disease (at least 5 working days)	**CONFIDENTIAL** 1. Briefing for Minister 2. Pacific Oyster Disease Working Group 3. State/National oyster health body 4. Relevant PIRSA staff e.g. State Controller/EMEOG/CVO	1.Confidential meeting with industry groups 2.Emails – in confidence 3.Personal communication – in confidence **PREPARE AND HOLD** 1. Holding statement for the media. (No proactive media) 2. Draft media release 3. Dedicated POMS response website information prepared 4. Letters to industry 5. Letters to local government 6. Letters to state controllers in other states 7. Heads up for

				National Communicators' Network. 8. Draft Public notices and targeted publications list. 9. Paid advertising 10.Signs (beaches and boat ramps) 11. POMS enews bulletin/Aquascope article 12. Obtain maps of affected area?

ALERT PHASE Level 2	Containment or movement control	1.Precautionary action being taken 2. Emergency Plan being activated 3. Compliance with control measures 4. Minimise spread through protocols	As above And AqCCEAD by CVO when appropriate	Communications methods on hold as outlined in Level 1 activated to the appropriate level and updated where necessary.
RESPONSE PHASE	POMS highly likely / confirmed (as outlined in Section A)	1. Compliance with PIRSA's Disease Response Plan 2. Containment protocol a. Access b. Fishing c. Treatment d. Sales procedures / protocols - distribute sales plans to each bay (reminders) 3. Minimise spread 4. Provide ongoing updates to target audience	*As above plus* 1. Other aquaculture industries 2. All other aquatic users 3. Media 4. Broader public	*As above plus* 1. Continues to be activated and reinforced where needed
STAND DOWN	As outlined in Section A	Any of the above, as required, including update on present status of situation. Post event quarantine.	All target audience notified up to this phase. Media	Continued media statement updates; website information and current status situation reports; amended maps if certain areas come out of quarantine or restricted zones.

Section C. Information and reporting protocol

Purpose

The following Information and reporting protocol describes the activities and outcomes to be achieved by PIRSA during the standby phase and throughout the disease management response following a report of suspect oyster, regardless of its source. This protocol has been modified from the PIRSA Emergency Management Document for Aquatic Animal Health, and is specific to POMS.

Response phases

This set of protocols applies at any time.

Protocol

1. The key phases, actions and personnel involved in this protocol are outlined in the PIRSA Emergency Management Document for Aquatic Animal Health.

Alert Phase

2. A report of suspect oysters is likely to come from one of the following sources:
    a An aquaculture licence holder; or
    b A fish processor; or
    c Other persons or bodies via Fishwatch (e.g. fishers, compliance officers etc.).
3. All reports of suspect oyster should be directed as soon as possible to the Aquatic Animal Health (AAH) Officer if the report concerns aquaculture stock.
4. If the report is received by Fishwatch, the Fishwatch Duty Officer will ask a set of questions (outlined in Section D – discovery and sampling) specific to POMS and provide this information immediately to the Aquatic Animal Health Officer.
5. Roles must be appointed. Suggested organisational structure for PIRSA Fisheries & Aquaculture :
    a Incident Controller (IC) (i.e. ED Fisheries & Aquaculture),
    b Planning Manager (i.e. Aquatic Animal Health Officer)
    c Operations/logistics Manager (i.e. Manager, Aquaculture Policy, Planning and Environment Program)
    d Media Manager (i.e. Communications Manager)
    e Local Controller - Operations (i.e. Aquaculture Program Leader).
    1. Roles are outlined in the PIRSA Emergency Management Document for Aquatic Animal Health.
    2. For smaller incidents (i.e. Alert phase level 1), these roles may be appointed differently (i.e. IC – AAH Officer) or more than one role appointed to a person.
6. In the absence of an aquatic animal health expert (i.e. AAH Officer), seek assistance from SARDI Program Leader - Biosecurity or see Section L (Contacts) for a list of alternative aquatic animal health experts to assist with investigations
7. If the report concerns aquaculture stock, the Aquatic Animal Health Officer (or Operations Manager) will either visit the site or request the assistance of the farm staff, regional PIRSA officers or private veterinarians to assist with on-ground investigation
8. Information sharing:
    a The IC will promptly alert the Chief Veterinary Officer (CVO) and the State Controller.
    b The IC will consider providing situation reports (i.e. via e-mail) to relevant and appropriate groups (i.e. response team involved in the investigation, industry reps).
9. Support to IC:
the IC will consider being supported by the core POMS Working Group (POMS-WG) and or the

Emergency Management Committee for technical and/or strategic support (ie provide resources for the planning function, provide strategic advice).

10. If there is no need to further investigate, all reports and actions taken to date will be reported to the Chief Veterinary Officer (CVO and any other technical/strategic groups or personnel involved including industry representatives.
11. If there is a need to further investigate, the lead investigator will arrange further sampling and laboratory analyses. The CVO and Biosecurity SA Diagnostics Services Officer should be alerted to samples submitted, who will then prioritise analyses with Vetlab (State veterinary laboratory).
12. The SASQAP Program Leader (Biosecurity SA) should be contacted to arrange water sample analyses.
13. The POMS-WG provides cross departmental technical and logistic support during Alert and Stand-down phases (lead by PIRSA Fisheries & Aquaculture) as required.
14. The IC to consider providing updates to the national Sub-Committee for Aquatic Animal Health (SCAAH) as required.
15. The EMC will provide strategic support as required during the Alert phase

Response Phase

16. If POMS is confirmed, the State Controller (currently ED Biosecurity SA) for the incident will inform the Minister, appoint an Incident Controller who in turn will appoint an Incident Management Team (IMT). In consultation with industry and the IMT, the State Controller will approve a response strategy that will be documented in an incident response plan.
17. The lead group during the Response phase is Biosecurity SA.
18. Options for a Response Strategy include: Eradicate (if feasible), Containment or Mitigation. See Section I.
19. The "*Aquatic Animal Health Plan – PIRSA Emergency Management Documents*" will be activated and provides the guidance for an aquatic disease response.
20. For the duration of the incident, the State Controller, in addition to coordinating the response according to this Plan, will ensure the following issues are analysed and appropriate plans developed to implement required actions:
    a. Notifying the national Aquatic Consultative Committee on Emergency Animal Diseases (AqCCEAD);
    b. AQUAVETPLAN arrangements;
    c. Surveillance and ongoing monitoring to determine the extent of the infected area and the rate of spread;
    d. Risk assessment of various activities that may influence the spread of the disease;
    e. Containment to prohibit activities identified in the risk assessment;
    f. Finalisation of diagnosis/identification;
    g. Initial eradication/control strategy development;
    h. Public awareness / media and communications management;
    i. Requirement for a State Control Centre (SCC);
    j. Briefing the Minister and AqCCEAD;
    k. Briefing relevant staff;
    l. Support required (eg mapping, payroll, financial etc); and
    m. OHS&W issues (including fatigue and stress).

Stand-down Phase

21. Post POMS investigation or response, PIRSA Fisheries & Aquaculture will continue to analyse associated issues, particularly regarding:

    - Long term adjustment for industry (e.g. alternate oyster species, alternate spat supply / new hatcheries, selective breeding programs).
    - Long term aquaculture management (e.g. containment, control, zoning).
    - Review of legislation (and amend, where necessary).

Supporting Committees & Working Groups

22. The proposed base membership of the EMC (strategic support to the Incident Controller during Alert and Stand-down Phases) is suggested as:

    a. Incident Controller (Chair)

       (suggested Executive Director, Fisheries and Aquaculture)

    b. Chief Veterinary Officer

    c. Chief Scientist, SARDI Aquatic Sciences

    d. Director, Fisheries and Aquaculture Policy

    e. Director, Operations (Compliance)

    f. Manager, Aquaculture Policy, Planning and Environment Program

    g. Aquatic Animal Health Officer

    h. PIRSA Communications Manager

    i. Biosecurity SA – Emergency Manager, Aquatic Pests

    j. Biosecurity SA – Emergency Management representative

    k. Representatives from other departments, aquaculture and fishing industries, recreational divers and other user groups may also be invited to attend EMC meetings as required. See Section L (Contacts)

23. The proposed base membership of the POMS-WG (technical and logistic support during Alert and Stand-down Phases) would comprise of 'core' members and additional members depending on the situation. The POMS-WG sits under the EMC. Suggested members as required:

    a. Director, Fisheries and Aquaculture Policy (Chair)

    b. Aquatic Animal Health Officer

    c. Manager, Aquaculture Policy, Planning and Environment Program

    d. Senior Fisheries Compliance Officer

    e. Biosecurity SA – Emergency Manager, Aquatic Pests

    f. Biosecurity SA – First Response Team (FRT) member for the planning function

    g. Subprogram Leader – Aquaculture, SARDI Aquatic Sciences

    h. Subprogram Leader – Biosecurity, SARDI Aquatic Sciences

    i. PIRSA Communications Manager

    j. Oyster industry representative

    k. Representatives from other departments, experts, aquaculture and fishing industries and other user groups may also be invited to attend EMC meetings as required. See Section L (Contacts).

During the Response phase, the IMT may consist of some of the above people. The IMT support the State Controller during Response Phase.

Section D. Discovery and Sampling for Industry

Purpose

This set of protocols describes the steps that should be taken at an oyster farm if POMS is suspected or confirmed (see triggers for reporting, Table A1).

The objective of this protocol is to 1) confirm presence of POMS and/or 2) assistance in 'early detection' surveillance (determine extent of infection). Early detection sampling aims for wide coverage, bias towards high risk areas and use of high sensitivity tests (i.e. PCR).

Response phases

This set of protocols applies at any time.

Protocol for sampling

1. Collect 30 live oysters (total) from at least 3 baskets within mortality site (i.e. affected line or lease site). Place the samples into a sealed plastic bag.
2. Label sample bag with identification (e.g. live from mortality site), batch number, lease number, farm location, number of oyster, date, name of collector.
3. Count the number of live/dead within at least 3 baskets from the mortality site. If high abundance (i.e. spat), separate approximately 100 animals from within a basket and count alive/dead.
4. In a separate (or decontaminated) vessel (to avoid contamination), collect 30 live oysters (total) from a separate area of your farm (as far away from the mortality site as possible) to determine extent of affected area.
5. Label bag with identification (e.g. live from control site), batch number, lease number, farm location, number of oyster, date, name of collector.
6. Count the number of live/dead within at least 3 baskets from a separate area of your farm (as far away from the mortality site as possible). If high abundance (i.e. spat), separate approximately 100 animals from within a basket and count live/dead.
7. All sample bags should be placed on ice and sealed in a foam container.
8. Notify and report the 'unusually high mortality' event to FISHWATCH on 1800 065 522. This step is required to ensure the report is officially logged and appropriate action is taken. Provide the following information:
    a The licence number, your name, your contact details;
    b The name of the oyster species affected;
    c The number or biomass (or an estimate of the percent mortality) of oyster that have died;
    d The time frame in which these mortalities occurred (number of days or weeks)
    e Whether or not this is unusually high compared to your previous 3 month average mortality
    f The approximate age of the oysters (ie. spat vs adults);
    g The approximate water temperature, and
    h Details of circumstances/factors that may have contributed towards the event.
9. Notify PIRSA Aquatic Animal Health Officer, on (08) 8226 3975 to provide the same information as above (this will speed up the response process) and discuss sample delivery.
10. Carry out a full biosecurity wash-down procedure following the Destruction, Disposal and Decontamination protocol as per the AQUAVETPLAN plan procedures (Section F)
11. Samples should be couriered to VetLab pathology (Glenside, Adelaide) within 24h (Appendix I) with request to rule out POMS (all samples tested using PCR) and unknown infectious disease (at least 10 samples for histology).
12. These sampling methods may be amended by the Incident Controller or State Controller at any time to assist surveillance / monitoring (see section E).

Section E. Monitoring

Purpose

This strategy (initiated by either Incident controller or state controller) describes the scale and scope of monitoring (surveillance) that would follow either a suspected or confirmed POMS outbreak as outlined in Section A (see Table A1).

Monitoring is to either confirm POMS (Alert phase) or to assess the spatial extent of disease by determining area's that are 'free of disease' (Response phase). Sampling methods are epidemiology based.

Response phases

This strategy applies to alert and response phases.

Protocol

Alert Phase (to determine presence / absence of disease)

1. This protocol is used when POMS has not been detected in South Australia (or within a declared disease free zone) and sampling is required to determine presence / absence of disease.
2. This protocol is 'early detection' sampling, which aims for wide coverage, bias towards high risk areas and use of high sensitivity tests . Sample size requirements are lower than for 'freedom of disease' sampling (below), considering active and passive surveillance to date has not detected POMS.
3. The geographic area of investigation must first be determined (e.g. farm, bay or growing region).
4. Sampling should commence within 24 h of initial report and include both observational data and sample collection for laboratory analyses. Sampling should be bias towards suspect oysters.
5. Sampling may be undertaken by: 1) farm staff, in the course of their normal daily activities, and/or by 2) PIRSA staff through routine sampling programs (SASQAP) or specific site visits. The Destruction, disposal and decontamination protocol (Section F) should be strictly followed if dead oysters are encountered
6. **The number of samples collected should be no less than 30 live oysters.**
   This assumes disease prevalence of <10% and accepted level of confidence of 95%. This is conservative considering POMS prevalence during an outbreak would be up to 80-100%,
7. The Ausvet website provides numerous tools to calculate sample size (www.ausvet.com.au).
8. Samples should be sent to VetLab pathology (Glenside, Adelaide) within 24h (Appendix I) with request to rule out POMS (PCR) and unknown infectious disease (at least 10 of the samples for histology).
9. If all 30 samples are negative for POMS, consider stand-down.
10. However, if mortality reports continue in the same geographic area defined above after a stand-down:
    Alert level 1- consider re-sampling if new report occurs after one month of last sample date.
    Alert level 2 - consider re-sampling if new report occurs after 2-weeks of last sample date

    Also, note that the case definition for SA mortality syndrome (SAMS) does not necessarily trigger this plan, although PIRSA assists and facilitates further investigations and research into this issue, including ruling out POMS when first suspected in an area.
11. If POMS is confirmed move to Response phase.

Response Phase (to determine presence / absence of disease)

12. This protocol is used when POMS has been detected in South Australia.
13. Sampling (to determine presence/absence) within officially declared disease free zones (e.g. a growing region) can follow the above protocols outlined in Alert phase.
14. Within an outbreak area (e.g. State or oyster growing region level), sampling may be for the purpose of
    a. Freedom of disease (i.e. for trade)
    b. Prevalence or case control study (i.e. for quarantine and control)
15. The Ausvet website provides numerous tools to calculate sample size (www.ausvet.com.au) depending on surveillance objectives.
16. An example of typical 'freedom of disease' sampling (internationally recognised for trade purposes) is:
    a. The geographic area of investigation must first be determined (e.g. farm, bay, growing region etc.)
    b. **The number of samples collected should be no less than 150 live oysters.** This assumes disease prevalence of <2% and accepted level of confidence of 95% (OIE standards). This is conservative considering POMS prevalence during an outbreak would be up to 90%.
17. Consider employing the assistance of an epidemiologist if required.

Sampling

18. Sampling of initial and ongoing disease outbreaks may be undertaken by: 1) aquaculture facility employees / farm managers, in the course of their normal activities as part of the response (as directed through the Incident Controller or SAOGA) or 2) SASQAP or other PIRSA staff. The Destruction, disposal and decontamination protocol (Section F) should be strictly followed when dead or moribund oysters are encountered.
19. Sampling should commence within 24 h of initial report and include both observational data and sample collection for laboratory analyses. Sampling should be bias towards suspect oysters.
20. Prepare samples as outlined in Appendix I.
21. **Sampling by farm managers and employees:** will be used to inform the broad scale distribution of any further outbreaks from the incident site. Briefing, feedback and retrospective observations by licence holders should be considered.

13. Information obtained by aquaculture facility employees, including the extent of any dead or moribund oysters in the selected lease areas, will be provided to the Aquatic Animal Health Officer and the Executive Officer (SAOGA).

Section F. Destruction, disposal and decontamination protocols

Purpose

These protocols provide guiding principles for: 1) destruction and disposal of oyster (shell, meat, gut), and 2) decontamination that would follow either a suspected or confirmed POMS outbreak.

These protocols pertain to oyster growers, processors and emergency response personnel and are: 1) prepared in accordance with the provisions outlined in the AQUAVETPLAN destruction, disposal and decontamination manuals and 2) New South Wales oyster equipment movement & field decontamination protocols (www.dpi.nsw.gov.au/factsheets).

Response phases

This set of protocols applies at any time.

Destruction

1. Live oyster may need to be destroyed through appropriate methods in a timely fashion to prevent the spread of POMS.
2. Destruction of oyster is only appropriate where eradication is feasible and where there are no other effective methods of control.
3. The easiest and safest method is to immediately remove oysters from the water and place oysters on land in a designated area (to be determined by IMT) away from the shoreline. Cover to avoid predation and virus spread.

Disposal

4. Disposal of oyster will depend on how they die:
    a. Live oysters that are likely to have been exposed to the virus may be harvested and processed for human consumption if appropriate (see emergency harvest/de-stock sub-section below).
    b. Affected oysters that are dead, dying or are destroyed may be; buried, composted or disposed of in licensed landfill (refer to EPA guidelines)
5. Oysters should only be shucked when the vessel has returned to land.
6. **Under no circumstances should shells or viscera be dumped at sea, or used as fishing bait or berley.**
7. Dead oyster, shells, viscera and rejected product may be buried, composted or for smaller quantities bagged in heavy duty plastic bags, the bags decontaminated with disinfectants prior to disposal.
8. Effluent water should not be allowed to run into any water ways or marine waters without proper chemical treatment. It is preferable that effluent water is disposed of to the sewer - applies to land based hatcheries etc.
9. Clean-up during and after a mass mortality event is the responsibility of the licence holder in the case of an aquaculture establishment and in accordance with EPA guidelines and the *Environment Protection Act 1993*.
10. Preferred methods for disposal of aquaculture waste material from a mass mortality includes (in order of preference, some may not be suitable for shell disposal):
    1. Composting
    2. Reusing/recycling
    3. Rendering
    4. Waste depot (landfill)
    5. On-site burial
    6. Cremation/burning

(Note: specific guidelines for each method of disposal are available by contacting EPA or visiting http://www.epa.sa.gov.au/xstd_files/Waste/Guideline/guide_mortalities.pdf, failure to follow these guidelines may result in a breach of the *Environment Protection Act 1993*).

Decontamination

11. Decontamination should include: vessels, vehicles, tanks, buildings, personnel, pipes, pumps, bilges and any other equipment and materials that have been present at a site of either a suspected or confirmed POMS outbreak.
12. Decontamination involves a combination of physical and chemical procedures that are used to remove soiling and inactivate the target disease organism (Figure F.1).
13. In general, decontamination involves:
    a. Cleaning: Mechanical brushing of surfaces with a detergent solution to remove soiling and organic matter. This is fundamental for achieving subsequent effective disinfection;
    b. Disinfection: is used to specifically inactivate the viral pathogen. Viruses are susceptible–moderately resistant to disinfectants, so the use of a suitable disinfectant is important.

    Although efficacy against POMS has yet to be tested, suitable disinfectants likely include:

    i. Iodine-based disinfectants; and
    ii. Chlorine-based disinfectants;

    c Equipment (including wetsuits, anchors, mooring lines, cages etc) should be soaked in disinfectant for a period of 30 minutes, rinsed and allowed to dry; and

    d Rinsing between and after these procedures is imperative for effective inactivation and removal of the viral pathogen. Freshwater should be used during the decontamination process.
14. The decontamination process, including types of detergents and disinfectants used, may need to be determined on an individual basis.
15. The decontamination process should take into account the following factors:
    1. The source and location of infection;
    2. The type of enterprise (e.g. farm or processing plant);
    3. The construction materials of vessels, buildings or other structures;
    4. The design of an aquaculture site and its proximity to other buildings or waterways;
    5. Current disinfection protocols;
    6. Workplace safety concerns
    7. Environmental impact of the disinfectant protocol;
    8. Legislative requirement (OH&S, environmental protection, chemical use); and
    9. Availability of approved, appropriate and effective disinfectants.
16. Decontamination procedures may vary for:
    a Vessels removed from water;
    b Vessels remaining in water;
    c Vessels exposed to POMS;
    d Wetsuits and other equipment;
    e Aquaculture facilities
    f Transport vehicles and boxes; and
    g Personnel

17. The following decontamination procedures have been used in the NSW response to minimise risk of spread of the disease to other areas, it is essential to use the following decontamination processes if sampling or in close contact with oysters suspected POMS infected oysters:

Personal – hands/skin

- Apply alcohol-based gel hand disinfectant
- Wash hands thoroughly in warm water with liberal use of soap

Clothes/equipment

- Remove from point of use in a large sealed plastic bag. Wash in hot water with generous use of detergent
- Can be soaked in chlorine-based disinfectant for 15 mins

Vehicles & vessels

- Commercial car wash

Larger equipment e.g. nets, grading equipment

- Decontaminate with chlorine-based disinfectant (or other disinfectant) as per above and layout in direct sunlight for at least 24 hours and allow to thoroughly dry before re-use

  OR

  Air dry for at least 30 days prior to relocation of equipment.

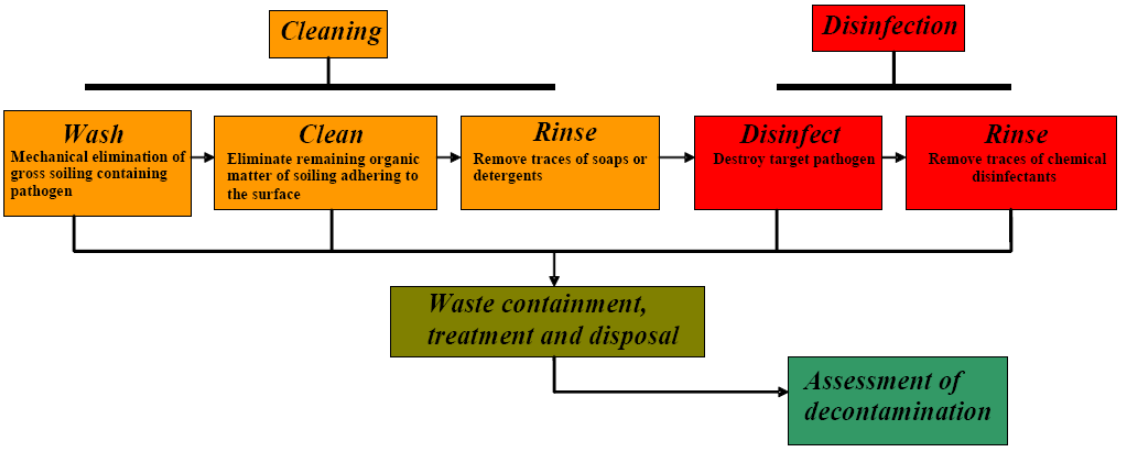


Figure F.1. Decontamination process. Figure from Aquavetplan Operational Procedures Manual – Decontamination (version1.0). (http://www.daff.gov.au/animal-plant-health/aquatic/aquavetplan)

Emergency Harvest / De-stock

18. An emergency harvest / de-stock is an option for eradication (as a response option).

19. The harvest of stock should occur within the shortest possible timeframe, and in the case of a semi-closed aquaculture farm (i.e. hatchery), outlet water should be immediately shut-off if instructed to do so by the Chief Veterinary Officer.

20. The full harvesting capacity (personnel, equipment) of the aquaculture facility should be devoted to such an emergency harvest.

21. Normal harvesting methods and protocols can be applied, although with special attention to the **Destruction, Disposal and Decontamination protocols** outlined above. Product being sold should not be sold live (i.e. frozen or half shell only) to avoid potential amplification and spread of infection.

22. PIRSA may impose restrictions for the processing of oyster in the case of a POMS outbreak. Restrictions for oyster processors may be as an amendment to licence conditions or requirement

to obtain a permit to process oysters from a 'POMS infected' area, and may include, but not limited to:

- sale of non-viable oysters only (i.e. frozen or half shell) if sourced from a POMS infected growing area;
- requirement to dispose of shells into specified landfill sites;
- requirement to dispose of processing water into a specified discharge area (e.g. sewer);
- preventing the return of oysters back to growers once received by a processor.

23. An independent government (PIRSA) representative should be present during an emergency harvest / de-stock to: a) assess the impact of the disease outbreak and b) ensure decontamination protocols are followed.

Section G. Tracing

Purpose

This strategy sets out guidelines for tracing a disease outbreak to determine the method and pattern of spread. Tracing investigations are crucial in determining all confirmed and potential locations of the disease, as well as defining restricted and control areas. The process of tracing is important for outbreaks in aquaculture facilities where high level of turnover occurs between leases.

Response phases

This strategy applies to alert (level 2: POMS likely) and response phases (POMS confirmed).

Protocol

1. Contact SAOGA in the first instance to interrogate the association database of stock movements and transfers.
2. For licence holders that do not provide data to the industry database, an industry representative (see contact list, Section L) and a PIRSA Officer to collect information and review stock registers from individual licence holders to determine the extent of stock movement (this should be undertaken within 24hrs of a suspected outbreak).
3. Tracing investigations should be made both retrospectively (trace back) and forward.
4. First priority is to trace back all contacts with infected oysters, premises and sites to establish the origin of the outbreak if possible.
5. Tracing forward involves the investigation of all contacts with infected oysters from origin of the outbreak to reported site of disease to determine the current location and potential spread of infection. An up to date stock register for each licence holder will significantly aid in determining movements quickly and accurately.
6. The following items should be traced:
    a Oysters;
    b Oyster products;
    c Aquaculture water – input and output (land based);
    d Vehicles and boats – oyster transport vessels and vehicles, feed vehicles (land based), other vehicles;
    e Materials and equipment – including aquaculture grading equipment, feed, transport equipment;
    f Personnel – farm workers, sales and feed representatives, tradespeople, veterinarians, scientists, technicians, and visitors;
    g Processing facilities;

Section H. Legal powers for control of activity and access

Purpose

In the event of a suspected or confirmed incident of POMS in aquaculture facilities and leases, a range of legal powers may be required to respond to the incident to minimise the risk of spreading the disease through human activity, depending on the nature and location of the incident.

These include:

1. The power to prohibit, or place conditions on, fishing activities or types of fishing activities in an area (recreational fishing around leases);
2. The power to prohibit, or place conditions on, non-fishing activities in an area;
3. The power to prohibit, or place conditions on, entry to an area; and
4. The power to change, or place conditions on, aquaculture activities on a farm or in the area.

Note: Since 24 September 2008 (updated 9 December 2010) the Executive Director of Fisheries & Aquaculture has delegated powers under sections 37 and 40 of the *Livestock Act 1997*, for the purpose of assisting in the implementation of closures.

Response phases

This strategy applies to alert (level 2: POMS likely) and response phases (POMS confirmed).

Reporting requirements

1. Pursuant to Section 4 of the *Livestock Act 1997*, POMS has been declared a notifiable disease in South Australia.
2. Notifiable diseases must be reported under Section 27 of the *Livestock Act 1997*:

   '**27—Requirement to report notifiable conditions**

   (1) If a person knows or has reason to suspect that livestock or livestock products owned by or under his or her control are affected with, or have died from, a notifiable condition, the person must—

   (a) report the existence or suspected existence of the notifiable condition to an inspector by the quickest practicable means; and

   (b) give the inspector further information reasonably required by the inspector; and

   (c) in the case of a notifiable disease—take all reasonable measures to control or eradicate the disease.'

Control of fishing activities

3. Under Section 79(1) of the *Fisheries Management Act 2007*, the Minister (or the Minister's delegate), may gazette a declaration prohibiting certain fishing activities. This gazettal would allow for certain limitations to be placed on a fishing activity by wording the prohibition appropriately.
4. Under Section 79(1) of the *Fisheries Management Act 2007*, the Minister (or the Minister's delegate) or a Fisheries Officer may, as an urgent action, direct a person (or persons) not to engage in fishing activity during a specified period.
5. Under Section 40 of the *Livestock Act 1997*, Inspectors may take any reasonable action for the control or eradication of disease or contamination. This may include limiting activities in a certain area. Fisheries Officers are authorised as Inspectors from 1 December 2007.

Control of non-fishing activities

6. Under Section 37 of the *Livestock Act 1997*, the Minister (or the Minister's delegate) may gazette imposition of any requirement reasonably required in the circumstances for a specified period.

7. Under Section 40 of the *Livestock Act 1997*, Inspectors may take any reasonable action for the control or eradication of disease or contamination. This may include limiting activities in a certain area. Fisheries Officers are authorised as Inspectors from 1 December 2007.

Control of entry to a specific area

8. Under Section 37 of the *Livestock Act 1997*, the Minister (or the Minister's delegate) may gazette imposition of any requirement reasonably required in the circumstances for a specified period.

9. Under Section 40 of the *Livestock Act 1997*, Inspectors may take any reasonable action for the control or eradication of disease or contamination. This may include limiting activities in a certain area. Fisheries Officers are authorised as Inspectors from 1 December 2007.

Control of aquaculture activities

10. Under Section 37 of the *Livestock Act 1997*, the Minister (or the Minister's delegate) may gazette imposition of any requirement reasonably required in the circumstances for a specified period.

11. Under Section 40 of the *Livestock Act 1997*, Inspectors may take any reasonable action for the control or eradication of disease or contamination. This may include limiting activities on a certain farm.

12. Under Section 52 of the *Aquaculture Act 2001*, the Minister (or the Minister's delegate) may vary the conditions of a licence at any time if the variation is considered necessary by the Minister in order to prevent or mitigate significant environmental harm or the risk of significant environmental harm.

13. Under Section 11 of the *Aquaculture Regulations 2005*, the licensee of an aquaculture facility must notify the Minister immediately if an unusually high number of aquatic organisms farmed under a licence die within a period of 24 hours and the cause is not immediately apparent.

14. Under Section 12 of the *Aquaculture Regulations 2005*, a licensee, who knows, or ought to reasonable know, that an aquatic animal being farmed is or may be affected with disease, the licensee may not move the animal from the farm.

Other legislation

15. In South Australia, POMS is listed as a notifiable disease under the *Livestock Act 1997*. This legislation includes provisions that:

    a Require any person to report the occurrence or suspected occurrence of a notifiable condition;

    b Makes acts causing or likely to cause livestock to become affected with notifiable condition illegal;

    c Makes it an offence to bring a notifiable disease into South Australia;

    d Makes it an offence to move or supply livestock or livestock products that are, or may be, affected with a notifiable condition; and

    e Makes it an offence to feed products that may cause livestock to become affected with a notifiable condition.

16. A range of powers exist under the *Harbors and Navigation Act 1993*, but their use may be limited by the objects of the act which relate to the safe use of South Australian waters. This Act should be considered only if it is the last remaining option to control activity and access.

Table. H. 1 Summary of specific response actions and corresponding legislation.

ACTION	LEGISLATION
• Inspect leases suspected of having a notifiable disease • Removal of wild oysters from reef areas • Controlling recreational fishing within or next to lease area	Section 130 *Fisheries Management Act 2007* Section 79(1) *Fisheries Management Act 2007* Section 79(1) *Fisheries Management Act 2007*
• Requirement to clear wild oysters from lease infrastructure • Requirement industry to maintain mortality records and movement of stock records • Health certification requirements for importing spat • Move stock outside of lease area	*Section 17 Aquaculture Regulations 2005* *Section 12 Aquaculture Regulations 2005* *Section 12 Aquaculture Regulations 2005* Section 12, *Aquaculture Regulations 2005*
• Report of notifiable disease • Closure of road to infected area • Destruction of infected stock	Section 27 *Livestock Act 1997* Section 37 and 40 *Livestock Act 1997* Section 37 and 40 *Livestock Act 1997*
• Disposal of dead stock • Exotic species (eg. pacific oysters) and aquaculture species cannot be deposited (bait/berley) into State waters	*Environmental Protection Act 1993- guidelines* Section 78, *Fisheries Management Act 2007*
• Installation of closed area signs • Closure of boat ramp in infected area • Boat access to specific area	*Road Traffic Act 1961* *Harbors and Navigation Act 1993* *Harbors and Navigation Act 1993*

Section I. Response Options

Purpose

These protocols provide options and guidance for the decision making process to determine an appropriate disease response strategy to POMS.

On suspicion or confirmation of POMS, immediate containment measures are implemented (e.g. State-wide stock standstill while the extent of the outbreak is determined). Subsequently, a response strategy can be determined.

Guiding principles are provided below to either 1) Eradicate the virus (if feasible), 2) Contain the virus to minimise the risk of spread to other areas or 3) ongoing Mitigation of disease to manage outbreaks as they occur. It identifies potential transmission sources for the disease, and factors that need to be considered for designing an effective response.

Response phases

This policy applies to the alert (level 2: POMS likely) and response phases (POMS confirmed).

Response options & considerations

The virus associated with POMS is unlikely to survive outside of the infected host oysters for extended periods in air or water. However, persistence of the virus is likely to increase in decayed material released from infected and/or dead oysters, thereby increasing the chances of disease transmission.

Possible broad scenarios for new OsHV-1 microvariant detections include:

- from Pacific oysters (e.g. hatchery or marine lease) as part of routine testing, with no clinical signs of disease (i.e. no mortality)
- from wild or farmed Pacific oysters displaying increasing morbidity and/or mortality
- from another species of wild or farmed mollusc.

Depending on location and extent of the outbreak, response strategies may include:

1. ***Eradication*** with the aim of returning a newly infected premise or area to freedom from OsHV-1 microvariant :
2. ***Containment*** with the aim of placing restrictions in areas in which OsHV-1 microvariant infection is endemic to prevent its further spread to uninfected areas; and
3. ***Mitigation*** with the aim of mitigating the impacts of disease if it is accepted that the virus will remain endemic in new outbreak areas.

The most appropriate response strategy is that which minimizes the socioeconomic impact on industry and community (i.e. consider economic benefits and costs of the response strategy to regional communities) in the short or long term.
All response strategies can utilise either legal closures (Section J) or voluntary closures.

Selecting the most appropriate (feasible) response option will depend on:

- Culture system. e.g. semi-closed (i.e. hatchery) vs semi-open (i.e. marine lease site)
- Extent of outbreak (e.g. confined or widespread)
- Presence, proximity and disease status of feral populations of Pacific oysters (e.g. naturalized escaped stock) or other susceptible hosts.
- Short-term costs of eradication vs control
- Long-term costs to both government and industry, including disruption to production

The following response strategies are in line with the draft AQUAVETPLAN Disease Strategy: Ostreid Herpes Virus-1 microvariant:

OPTION 1 – ***Eradication*** with the aim of returning a newly infected premise or area to freedom from OsHV-1 microvariant:

Eradication may have the highest short-term economic costs, although the greatest economic return on investment (as a guide, see Figure I.1 below).

Despite there being no records of successful eradication of OsHV-1 microvariant infection, attempting to eradicate OsHV-1 microvariant may be considered for the following scenarios:

Scenario:

- Possible to eradicate in a semi-closed or closed system (e.g. oyster hatchery or research facility)

- Eradication in the marine environment is unlikely, but possible. Industry has indicated that at the time this Plan was developed, they are unlikely to support eradication in the marine environment.

  Note that in the marine environment, eradication may be possible if detected in a confined marine area (e.g. single marine lease or oyster farm).

Requirement:

- Possible to eradicate if feral oysters / other host species in the proximity of the outbreak are absent, rare or can be eradicated. Consider:

  - If attempting eradication in an infected semi-closed system (e.g. oyster hatchery or research facility), monitor any feral oysters / other host species within 5NM of the facility's outflow.
  - If attempting eradication in the marine environment, any feral oysters or other host populations within 5NM of the declared infected area should be tested and be negative for OsHV-1 microvariant.

  Epidemiological separation can be considered as 5NM. This originates from a Western Australia Department of Fisheries policy paper ('marine farm distances and disease spread'), which is based on an acceptable level of risk of disease spread in the marine environment.

Factors to consider:

- For this response strategy to be successful, early detection and containment of the virus is critical. As an option, eradication should be attempted as soon as possible while the infection is contained. The response option implemented may change as more information becomes available (if infection is found to be widespread)
- Industry capacity and willingness (support from industry, including use of personnel and equipment, is pivotal to effective response).
- Options being available to affected farmers (in eradication area) to avoid economic hardship. These may include:
  - Emergency harvest (selling frozen or half shell product to market)
  - Agreed paid services of the farm (e.g. use of personnel and equipment) to assist with the response
  - Waiving licence fees
  - Farming systems resuming operating in eradication zones could be stocked with native, likely non-susceptible oysters (*Ostrea angasi*).
  - Provision of emergency leases (to allow farming in an unaffected growing area)
  - Financial assistance (or compensation) from a pre-existing "Industry Emergency Response Fund". Such a fund does not currently exist for the oyster industry, but in South Australia there are legislated mechanisms (e.g. Primary Industry Funding Schemes Act 1998) for such a fund to be established. The money for the fund may be sourced from a levy system (either pre or post response).

- Cost-benefit analyses of eradication compared to containment or mitigation (short and long term) are favourable. See Figure I.1 for a guide on return on approximated investment for eradication as a response strategy.
- If eradication attempted in a marine environment (semi-open system), consider ability to effectively establish an eradication zone. Consider relevant epidemiological factors. Rapid emergency harvest as outlined in the response plan is likely to be required to minimise viral load in the water and viral transmission.
- Extensive decontamination of equipment, fomites and infrastructure.
- Sources of OsHV-1 microvariant-free stock remain available

Implications:

- Short term economic hardship for affected farmers
- Short to mid-term costs (of response) for government and industry
- Risk that eradication may not work in the marine environment if rapid spread of infection occurs. Regular ongoing review of the effectiveness of the strategy, if implemented, would be required to determine if eradication is still feasible.
- If eradication is determined to be successful by the State Controller, proof of freedom of disease (ongoing surveillance for a time period) may be required to resume livestock movements from the infected area.

Eradication is unlikely to be successful or feasible if epidemiological investigations determine that infection is widespread, has no point source, or is unable to be contained due to:

- Lack of ability to understand subclinical infection, and particularly establishment of infection at levels that are difficult to detect.
- Lack of ability to control naturalised Pacific oyster populations.
- If OsHV-1 microvariant-free stock become unavailable because hatchery stock prove to be infected or due to movement restrictions.

Closed or semi-closed systems with strict biosecurity controls could resume production if:

- Water is filtered and decontaminated.
- Farms in such zones could source OsHV-1 microvariant-free stock.

Eradication measures include:

- establishment of specified zones — infected, *restricted*, *control*, *free*
- quarantine and movement controls/restrictions on Pacific oysters and other bivalves (and their products, i.e. restrict their use as bait/berley), water and any other potential vectors (including materials and equipment) in zones declared restricted or control to prevent the spread of infection
- destruction and disposal of all clinically diseased or suspected diseased Pacific oysters
- processing of exposed or potentially exposed, but clinically normal Pacific oysters within the infected zone to prevent the spread of infection
- disinfection and safe disposal of processing effluent and waste (oyster shells, shell liquor, processing water)
- disinfection, decontamination and safe disposal where necessary of facilities, products, equipment, vessels, vehicles etc to eliminate the virus from infected premises and to prevent spread
- control of scavenger access, particularly birds, to live and dead oysters
- tracing and surveillance to determine the source and extent of infection and to provide proof of freedom from the disease
- a public awareness campaign to encourage cooperation from industry and the community.

OPTION 2 – ***containment*** with the aim prevent spread of OsHV-1 microvariant from infected areas to uninfected areas through movement controls and zoning

There are no effective means available commercially of curing Pacific oysters that have become infected by OsHV-1 microvariant. If virus eradication is deemed to be unfeasible following an outbreak of OsHV-1 microvariant, zoning and associated disease control measures should be implemented to mitigate virus spread to uninfected zones.

Scenario (once eradication determined not to be feasible):

- Possible to contain in a semi-open system (e.g. growing region / bay):
  Outbreak confined geographically to a single, or epidemiologically isolated growing areas. Infective material (and water) cannot, or is unlikely to spread from the defined infected area

  Infected area should include a 5NM buffer zone where none to negligible feral oysters / other host species populations are present. As such, epidemiological separation can be considered as >5NM.

Factors to consider:

- Industry capacity and willingness (support from industry, including use of personnel and equipment, is pivotal to effective response).
- Industry ability to adjust business to control and zoning measures (i.e. restrictions on movement of stock, equipment etc. out of zoned areas to other farming areas), which will be in place indefinitely and which will reduce profitability
- Farmers within restricted zones provided with the option to continue to farm Pacific oysters (sourced from disease free hatcheries) or to farm other likely non-susceptible oysters (*Ostrea angasi*).
- (and their products, i.e. restrict their use as bait/berley)
- How long (i.e. years) containment should be for to ensure cost < benefit
- Long term adjustment for industry (e.g. alternate oyster species, alternate spat supply / new hatcheries, selective breeding programs)
- Cost-benefit analyses of containment (short and long term) are favourable. See Figure I.1 for a guide on return on approximated investment for containment as a response strategy.

Implications:

- Long-term economic impediments for affected farmers caused by control mechanisms
- Long-term costs (of response) for government and industry
- Containment may only be considered for a specific time period, after which costs outweigh benefits
- Proof of freedom of disease is required for non infected areas to maintain stock movement between bays and/or trade & market access (i.e. hatcheries selling to interstate buyers) and to continue to support control measures

Justification for attempting to contain and control OsHV-1 microvariant infection within a zone is based on knowledge that:

- Tissue from moribund and dead oysters and water containing OsHV-1 microvariant discharged during outbreaks (wild and farmed) will be a source of infection to other farms and naturalised oysters.
- Farms in such zones could source OsHV-1 microvariant-free stock.

Measures for containment, control and zoning are similar to those for eradication. Procedures might include:

- zoning/compartments to define infected and disease-free areas
- quarantine and movement controls/restrictions on Pacific oysters and other bivalves (and their products, i.e. restrict their use as bait/berley), water and any other potential vectors (including materials and equipment) within the infected zone and to free zones
- management of outbreaks in the free zone
- surveillance, with destruction and safe disposal of any oysters shown to be PCR positive in the infected zone, followed by clean-up and disinfection
- testing of broodstock and spat for OsHV-1 microvariant
- compartmentalisation of selected facilities (such as hatcheries for production of OsHV-1 microvariant-free stock) may be a part of a control and mitigation strategy
- emphasis on high standards of hygiene (including decontamination and use of sentinels before restocking) and biosecurity (screening of incoming spat for OsHV-1 microvariant)
- tracing and surveillance to determine the source and extent of infection
- a public awareness campaign to encourage cooperation from industry and the community.

OPTION 3 –***mitigation*** with the aim of mitigating and managing the impacts of disease outbreaks (caused by OsHV-1 microvariant) if it is accepted that the virus will remain endemic in new outbreak areas:

Scenario:

- OsHV-1 microvariant considered widespread either throughout the State or within broad zones.

  This would require industry management of disease at the farm level, while government provides legislative framework to prevent and control further disease spread and new infections. Similar to other endemic notifiable diseases within the State (e.g. Perkinsus, nodavirus, EUS).

Factors to consider:

- Farms or areas suspected or known not to be infected.
  - Zoning and compartmentalisation of selected facilities such as hatcheries to mitigate against disease introduction and assist with trade
- Best-practice management to minimise the effects of disease (e.g. industry Biosecurity plans)
- Long term adjustment for aquaculture industry (e.g. alternate oyster species, alternate spat supply / new hatcheries, selective breeding programs)
- Cost-benefit analyses of on-going management measures (minimum cost out of the response options) as opposed to attempting to eradicate or contain are favourable (short v long term). Dependent on alternative options for industry. See Figure I.1 for a guide on return on approximated investment for mitigation as a response strategy

Implications:

- Short to long-term economic impediments for non-affected farmers.
    - Mitigation measures to prevent disease introduction
    - Proof of freedom of disease may be required to maintain stock movement and trade (particularly for hatcheries)
- Short term costs (of initial response) for government and industry

In a mitigation program, the aim may simply be to reduce the frequency of existing disease to biologically and/or economically acceptable levels. Critically, there may be a level of disease in the population below which the cost of further expenditure on control would be greater than the benefit.

Justification for attempting to mitigate OsHV-1 microvariant infection within a zone is based on knowledge that:

- Tissue from moribund and dead oysters and water containing OsHV-1 microvariant discharged during outbreaks will be a source of infection to other farms and naturalised oysters.
- Farms in such zones could source OsHV-1 microvariant-free/resistant stock.
- Altered management strategies may exist that decrease losses and allow farms to operate albeit at reduced profitability.
- Outbreaks may be geographically self-limiting because of discontinuities in Pacific oyster growing regions and areas where Pacific oysters are naturalised.

All of the principles outlined for ‘containment’ as a response strategy apply to ‘mitigation’, except:

- the establishment of formal free and infected zones
- not taking an aggressive approach to management of clinical disease where it occurs

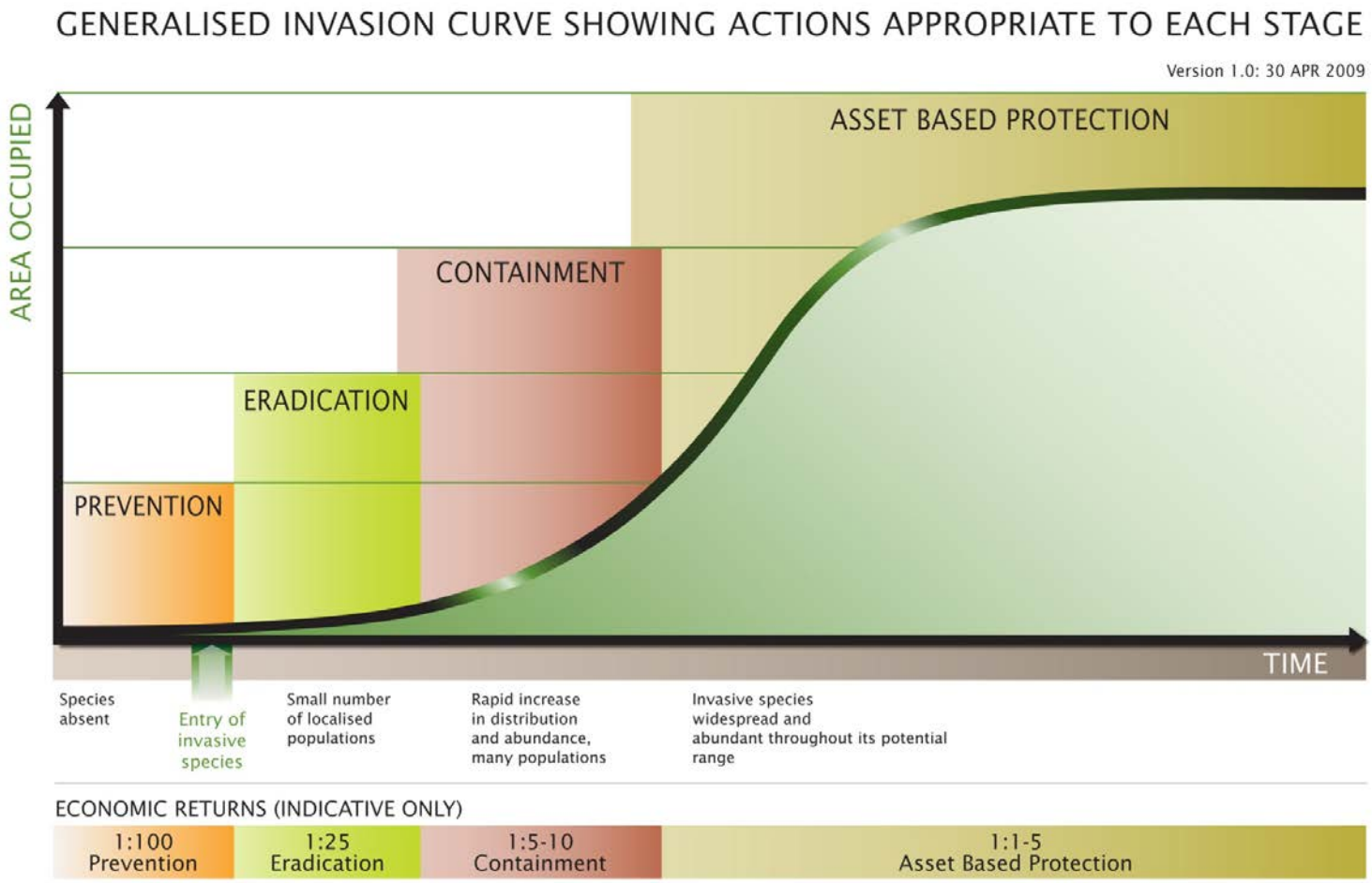
If infection is extensive, naturalised oysters are infected and widespread, or if OsHV-1 microvariant-free/resistant stocks are not available, it might not be appropriate to institute the controls described in this section, and an industry-based program to mitigate the effects of the disease might be appropriate.

In a mitigation strategy, it will be the responsibility mainly of individual producers to manage the disease in their facilities using recommended measures to reduce the likelihood and severity of outbreaks.

Measures for mitigation include:

- best-practice management (e.g. Biosecurity plans) to minimise the effects of disease
- farm surveillance, with destruction and safe disposal of all clinically diseased Pacific oysters
- use of OsHV-1 microvariant-free/resistant spat where possible
- emphasis on high standards of hygiene (including decontamination and use of sentinels before restocking) and biosecurity (screening of incoming spat for OsHV-1 microvariant)
- Compartmentalisation of selected facilities such as hatcheries.

Figure I.1. Approximated return on investment for prevention and different response strategies (based on invasive species management). Greatest return on investment is prevention, followed by eradication, containment then mitigation (asset based protection). Graph sourced from www.depi.vic.gov.au



Section J. Quarantine and movement controls

Purpose

This strategy sets out guidelines that could be implemented immediately upon suspicion of POMS in an aquaculture facility to prevent spread of the disease from an infected area to the surrounding area or farms.

Response phases

This policy applies to the alert (level 2: POMS likely) and response phases (POMS confirmed).

The following quarantine and movement restrictions should be implemented immediately upon suspicion of OsHV-1 microvariant.

Establishment of Quarantine areas

Establishment of specified areas (see AQUAVETPLAN Enterprise Manual Section A for more details), including:

- ***Declared area*** – includes restricted area and control area
- ***Restricted area*** – area around infected premises or area
- ***Control area*** – a buffer between the restricted area and free areas
- ***Free area*** – non-infected area (this area is not considered a 'declared area' and may include large areas of Australia in which the presence or absence of OsHV-1 microvariant remains unassessed).

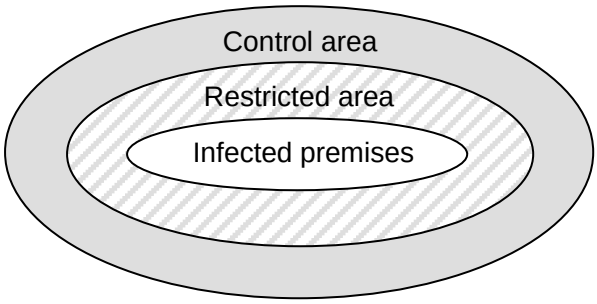


Figure J.1 Establishment of specified areas to control OsHV-1 microvariant

In the declaration of quarantine areas, the following factors need to be taken into account:

- Proximity of other Pacific oyster farms to the index farm
- Proximity of other farms growing other filter feeding bivalves
- Proximity of naturalised Pacific oyster populations
- Hydrology and oceanography of the receiving marine or estuarine system

The following practices must be considered when implementing response options:

- Local sales of Pacific oysters and disposal of Pacific oyster products
- Restricted use of Pacific oyster products as recreational fishing bait
- Other commercial aquaculture of potential hosts or species that can mechanically carry the virus
- Processing of Pacific oysters and other potential hosts and mechanical carriers, and discharge of untreated processing waste
- Disposal of shell and other normal by-products of farming and processing bivalves
- Other commercial fishing and aquaculture activities, particularly those that move infrastructure such as traps or pots
- Commercial and recreational shipping biofouling and carriage of ballast water
- Activities of scavengers and other potential fomites

Movement Controls

Movement controls include:

- bans on the movement of live Pacific oysters and other bivalves from infected areas
- bans on the movement of live bivalves into disease-free areas
- restrictions or bans on releasing bivalves and water into river systems or other aquatic environments
- restrictions or bans on the movement of bivalves between different estuary or marine systems, other aquatic environments or farms
- restrictions or bans on the use and movement of equipment within and between different estuary or marine systems and between farms
- restrictions or bans on the movement of live Pacific oysters and other live bivalves from processing factories/businesses dealing with seafood product from infected areas.

Implementation of bans and restrictions will be a dynamic process, determined by the location and extent of the disease outbreak and whether the aim is to eradicate the disease agent or to control its spread. Some restrictions may be impractical or unnecessary but others will be of critical importance to eradication or control.

The feasibility of restrictions and bans and extent to which these are able to be enforced will depend on the location of infection, the location and type of enterprises affected and the control response option chosen.

Zoning

If OsHV-1 microvariant were to become endemic in specific regions of Australia, a zoning policy specific for OsHV-1 microvariant may be necessary to protect noninfected areas and to prevent further spread of infection. Zones would be based on the distribution of OsHV-1 microvariant species and of any vector species present (if appropriate), the geographical and hydrological characteristics of water bodies and landform, and predictions of the most likely method of spread of infection. Zoning may rely on the identification of biogeographic barriers. A corresponding surveillance and monitoring program for OsHV-1 microvariant would be required to support the zoning policy. Principles of zoning for infected and noninfected zones in Australia are outlined in the AQUAPLAN Zoning Policy Guidelines[1] and in the OIE *Aquatic Animal Health Code* (OIE).

Such controls are in place to contain and manage the outbreaks of OsHV-1 microvariant in New South Wales.

[1] http://www.daff.gov.au/aquaticanimalhealth

Section K. Aquaculture management

Purpose

To describe aquaculture management responses to a POMS outbreak in South Australian.

Response phases

These aquaculture management responses apply to the investigation, response and stand down phases as indicated.

Management responses

Alert Phase

1. Consider a mandatory 72hr stop movement of oyster in South Australia on the suspicion of POMS.
2. Consider industry view that a stop movement order longer than 7 days may have a financial impact on lease holders.

Response phase

3. Assist with investigations and emergency response. This may include:
    a. Lease and licence holder information (i.e. for monitoring and tracing)
    b. Legal & legislation
    c. Quarantine and movement controls
    d. Translocation and chemical use approvals
    e. Liaise with fisheries policy for fisheries related issues (i.e. restrictions and controls on commercial and recreational fishers)
    f. Provide ongoing information to industry through communication networks (i.e. bay reps, SASQAP network etc)
    g. The grant of emergency leases

Stand down phase

4. Consider long term disease management (ongoing controls, zoning, surveillance)
5. Consider long term adjustment for aquaculture industry (e.g. alternate oyster species, alternate spat supply / new hatcheries, selective breeding programs).
6. Review legislation and policy (review & amend where necessary).Consideration should be given to relocating healthy oysters into the previously infected areas, once those areas are deemed to be free of POMS (subject to the most up to date scientific information available at the time).

Section L. Contacts

Purpose

To provide details of relevant key contacts for the communication of information concerning the threat or occurrence of the disease in South Australian waters (Table L.1).

Response phases

Contact details may be required during any time or phase of the disease response.

<Note: personal contact details have been removed for the FRDC report version of this plan>

Table L.1. Contact details for the communication of information concerning POMS.

Name/Organisation	Position	Telephone/Mobile	Email
South Australian Government Departments/SARDI Aquatic Sciences			
PIRSA Animal Health			
Jack Van Wijk (Deputy CVO)	Manager, Animal Health Operations		
Dr Roger Paskin CVO	Chief Veterinary Officer		
PIRSA Aquaculture			
Dr Shane Roberts	Aquatic Animal Health Officer		
Dr Peter Lauer	Manager, Aquaculture Policy, Planning and Environment Unit		
PIRSA Communications and Marketing			
Julie Gregory	General Manager , Communications		
Cathy Parker	Communications Manager		
PIRSA Emergency Management Unit			
Nancy Bombardieri	Manager, Emergency Management and Biosecurity		
Danielle Kowalski	Emergency Management Planning Officer		
PIRSA Fisheries Compliance			
Christopher Morrison	Fisheries Officer		
Peter Dietman	Director, Operations		
Andrew Carr	Regional Manager, Pt Lincoln		

Name/Organisation	Position	Telephone/Mobile	Email
PIRSA Fisheries & Aquaculture Executive / Media			
Prof. Mehdi Doroudi	Executive Director, Fisheries and Aquaculture		
Sean Sloan	Director, Fisheries and Aquaculture Policy		
Joanna Tsoukalas	Manager, Communications		
Biosecurity SA			
John Gilliland	Manager, Marine Biosecurity Response		
Dr John Virtue	Manager, NRM Biosecurity Unit		
Will Zacharin	Executive Director, Biosecurity SA		
SARDI Aquatic Sciences			
Steven Clarke	Program Leader – Aquaculture		
Prof. Gavin Begg	Chief Scientist		
Dr Marty Deveney	MISA Biosecurity Node Leader		
SARDI media			
Heather Riddell	Marketing and Communications		
Other State Government Departments/Research			
DPI NSW			
Ian Lyall	DPI NSW - Aquaculture		
Melissa Walker	DPI NSW – Aquatic Biosecurity		
DPIPWE Tas (Aquaculture)			
Dr Rod Andrewartha	Chief Veterinary Officer		
Dr Kevin Ellard	Animal Health and Welfare		
Sample Analysis			
State VetLab – Veterinary Pathology			
Sue Fitzsimons	PIRSA Diagnostic Services Manager		
Dr Stella Bastianello	Gribbles Pathologist – Glenside Vetlab		
Hamish Southwood	Gribbles Manager - Glenside Vetlab		
Water analyses			

Name/Organisation	Position	Telephone/Mobile	Email
Clinton Wilkinson	SASQAP Program Leader		
Technical expertise			
Dr Mary Carr	PIRSA Veterinarian epidemiologist		
Dr Charles Caraguel (Adelaide Uni.)	Veterinarian / Epidemiology		
Dr Stephen Pyecroft	Veterinarian/ pathologist		
Dr James Harris (Flinders Uni.)	mollusc disease, physiologist		
Dr James Munro (Adelaide Uni.)	Virologist. Aquatic disease (mollusc)		
Aquaculture Industry			
Trudy McGowan	Executive Officer (SAOGA)		
Jill Coates	President (SAOGA)		
Bruce Zippel	President Oysters Australia		
David Simms	Bay Rep - Coffin Bay		
Jedd Routledge	Bay Rep - Coffin Bay		
Carl Jaeschke	Bay Rep - Cowell		
Gordon Gardner	Bay Rep - Denial Bay		
Greg Window	Bay Rep - Haslam		
Ken Rowe	Bay Rep - Kangaroo Island		
Gary Zippel	Bay Rep - Smoky Bay		
Reg Brown	Bay Rep - Streaky Bay		
Steve Bowley	Bay Rep - Yorke Peninsula		
Fish Processors			
Mark Cody	Seafood Processors and Exporters Council		

Appendix I: Sample preparation

Preparation of Pacific Oyster samples

1. Preferred option: immediately send (via express courier) fresh samples (on ice, labelled) to VetLab pathology (Gribbles, Glenside, Adelaide).

   Adelaide address: Flemington Street, Glenside SA 5065 (Specimen Reception: (08) 8202 3333)

   VetLab Pathology (Gribbles,Glenside, Adelaide) will act as a central coordinating point for biological samples during an emergency response, and will forward samples to other laboratories for analyses (ie. AAHL) as appropriate.

   Regional animal health officers that may assist with transport:

   - Port Lincoln: PIRSA Animal Health Officer (currently Emily Litzow): 8688 3436
     Port Lincoln District Officer, 5 Adelaide Place, Port Lincoln.

     Request samples be sent to VetLab, Glenside (address above).

2. Contact PIRSAs Diagnostic Services Manager 8207 7949 to:
   - Obtain alternative courier arrangements if required
   - Inform of samples being sent and prioritise
   - Request VetLab (Gribbles) to rule out POMS (PCR) and unknown infectious disease (histology)

3. Oysters must be separated and identifiable by sample type (dead, moribund, or live) throughout this protocol, particularly dead/moribund samples from 'live' samples. All samples must be clearly labelled with contact name and mobile, date, location, sample type, individual id and fixative type if applicable.
4. If dissection is required (i.e. technical field staff during an emergency response), follow the instructions and diagrams below.

Dissection

5. Measure the shell length of the left valve from the outer tip of the hinge to the longest point of the bill using callipers and record the measurement (to the nearest mm).
6. Open "shuck" by inserting an oyster shucking knife either between the valves along the dorsal side adjacent to the adductor muscle or between the valves at the hinge ligament and use a twisting motion to partially severe the adductor muscle.
7. Insert a scalpel and cut the adductor muscle as close to the right valve attachment as possible and pry off the right valve using hand or leverage with shucking knife without applying pressure to soft tissues.
8. Evaluate "rate" the opened oyster for Health / Vitality (normal, weak or dead) and for Condition (fat, medium or watery), also note if there is any indication of mantle recession, and record all observations.
9. Remove the oyster by cutting the adductor muscle attachment site as close to the left valve as possible.

10. Pick up oyster by the posterior end of both mantle margins using curved forceps allowing mantle fluid to drain away.

11. Transfer oyster onto paper towel folded 4 layers thick on a plastic cutting board and perform macroscopic examination of external tissue surfaces (including the labial palps) for the presence of lesions and record observations.

12. Using a scalpel cut two parallel transverse tissue sections approx. 2-3 mm in thickness through the middle region of the visceral mass (See Appendix 1, Fig.1). Tissue representation should include digestive gland, gut, connective tissue, gonad, mantle and gills.

13. Place one of the transverse tissue sections in Davidson's solution for 16 to 72 hours maintaining a minimum 1:10 volumetric ratio of tissue to Davidson's solution (gentle agitation is recommended for facilitating rapid penetration of fixative). After preservation in Davidson's solution, transfer the sample to a jar(s) containing 70 % Isopropyl alcohol for histological processing

14. From the second transverse tissue section dissect out 2 "replicate" small cubes of tissue (approx. 5 to 10 mm3) from the region where the gills attach to the visceral mass (See Appendix 1, Fig.2). Tissue representation should include very small portions of digestive gland, connective tissue, gonad and gill. Preserve these tissue samples in 2 separate green microcentrifuge tubes containing 95% ethanol (ensure a minimum 1:10 ratio of tissue to fixative). Note: Replicate DNA samples are preserved so that one sample can be sent to AAHL (Geelong) for PCR assays while the replicate sample can be retained at VetLab in the event that any additional confirmatory tests are required.

15. Record all measurements and observations.

16. Dispose of all shells, excess tissue, soiled paper towels and chemicals etc appropriately.

17. Disinfect all work surfaces and dissecting tools appropriately.

18. All samples should be sent to VetLab for storage, forwarding onto AAHL (for PCR) and analyses.

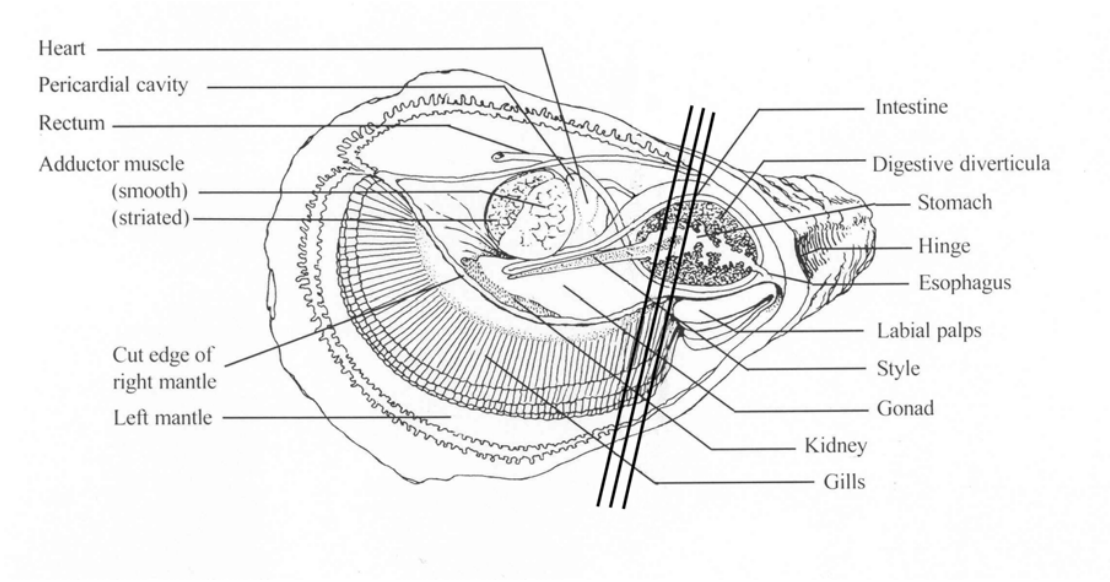


Figure 1. Anatomy of an oyster with bold lines indicating the location where parallel transverse tissue sections should be cut for histology and DNA sampling.
(Modified from illustrations by, A.J. Lippson, Bozman, M.D. in Howard et al. 2004)

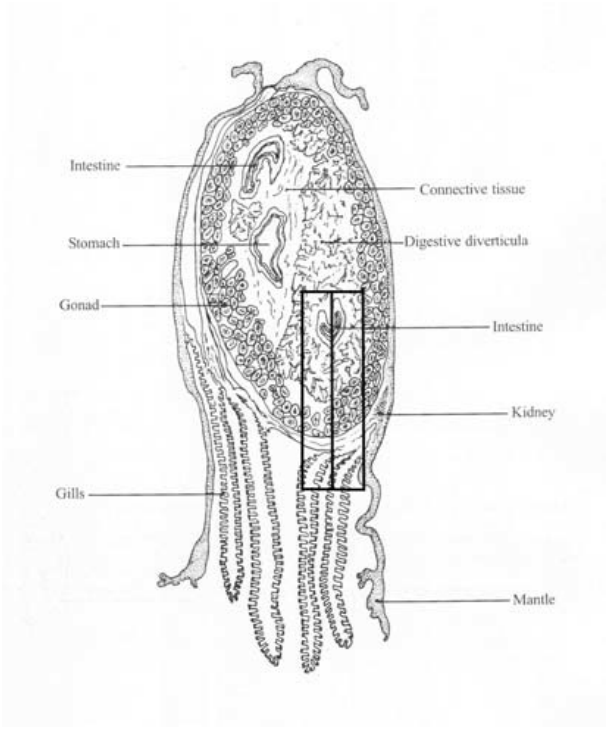


Figure 2. Transverse section through an oyster with rectangular boxes indicating the location where replicate DNA tissue samples should be excised.
(Modified from illustrations by, A.J. Lippson, Bozman, M.D. in Howard et al. 2004)

Water samples

19. Place water samples into a disposable esky with cold pack. Separate samples from the cold pack using padding such as newspaper.
20. Contact Clinton Wilkinson (Program Leader, SASQAP, Biosecurity SA), Pt Lincoln

    ((08) 8683 2533 or Clinton.Wilkinson@sa.gov.au)
21. Courier the water samples to SASQAP (Port Lincoln Marine Science Centre, PO Box 1511, Port Lincoln, SA, 5606).

Appendix II: Glossary

Agent	The biological agent that causes disease. In the case of POMS, the agent is a virus. See also *disease*.
AQUAVETPLAN Australian Aquatic Veterinary Emergency Plan.	A series of technical response manuals prescribed by the Department of Agriculture, Fisheries and Forestry (Australian Government) that describe the proposed Australian approach to an emergency aquatic animal disease incident.
Chief veterinary officer / Chief Inspector of Stock (CVO / CIS)	The senior veterinarian of the animal health authority in South Australia (PIRSA Animal Health) who has responsibility for animal disease control in this State.
Closure	Refers to either a legally binding notice made under an Act (Fisheries / Aquaculture / Livestock), or voluntary agreement, to cease fishing, farming operations and/or other activities within a defined area and for a defined time period.
Containment	The process of containing a disease outbreak to within defined areas (declared, restricted and control areas).
Control	Reduction in morbidity and mortality from disease by measures intended to interfere with the unrestrained occurrence of disease.
Control area	A buffer between the restricted area and areas free from disease. Restrictions on this area will reduce the likelihood of the disease spreading further. As the extent of the outbreak is confirmed, the control area may reduce/increase in size. In most cases, permits will be required to move animals and specified product out of the control area into the free area.
Declared area	A defined tract of land or water that is subjected to disease control restrictions under emergency animal disease legislation. Types of declared areas include restricted area, control area, infected premises, dangerous contact premises and suspect premises.
Decontamination	Includes all stages of cleaning and disinfection.
Disease	A general term for, in this case, POMS and/or ostreid herpesvirus (OsHV-1 microvariant). See also *agent*
Disinfectant	A chemical used to destroy disease agents outside a living animal.
Disinfection	The application, after thorough cleansing, of procedures intended to destroy disease agents; applies to premises, vessels, vehicles and other objects that may have been directly or indirectly contaminated.
Disposal	Sanitary removal of fish / oyster waste, effluent water and any other contaminated objects by burial, burning or some other process so as to prevent the spread of disease.
Electron microscopy	A diagnostic method used in pathology to detect and identify a disease agent. Electron microscopes can magnify specimens up to 2 million times. *See also histology and PCR*.
Emergency animal disease	A disease that is (a) exotic to Australia or (b) a variant of an endemic disease or (c) a serious infectious disease of unknown or uncertain cause or (d) a severe outbreak of a known endemic disease, and that is considered to be of national significance with serious social or trade implications.

Eradication	Refers to the elimination of an infectious agent from a specified area.
Fomite	Refers to any inanimate object or substance capable of carrying an infectious agent (ie. virus) and hence transferring them from one host to another. See also *vector.*
Free area	An area known to be free from the disease agent.
Histology	A diagnostic method used in pathology to detect the presence of disease and disease agents in samples. Histology is the study of the microscopic anatomy of cells and tissues, and is performed by examining thin slices of tissue under a light microscope (up to 2000 times magnification). See also *electron microscopy and PCR*
Infected premises or area	The premises or area in which the disease has been confirmed. Definition of an 'infected area' is more likely to apply to an open system, such as a sea-based aquaculture farm or wild fishery.
Monitoring	Routine collection of data for assessing the health status of a population. See also *surveillance*
Movement control	Restrictions placed on the movement of fish, oysters, people and other things to prevent the spread of disease.
Polymerase chain reaction (PCR)	A method of amplifying specific DNA sequences to detectable levels that can be used to detect the presence of DNA from a disease agent. See also *electron microscopy and histology*.
Premises or area	A production site or area of marine waters. A production site may range from an aquarium to an aquaculture lease in the open ocean.
Quarantine	Legal restrictions imposed on a place, oysters, vehicles, or other things, limiting movement.
Restricted area	The area around an infected premises (or area), likely to be subject to intense surveillance and movement controls. Movement of potential vectors of disease out of the area will, in general, be prohibited. Movement into the restricted area would be by permit only. Multiple restricted areas may exist within one control area.
Surveillance	A systematic series of investigations of a given population (oyster aquaculture lease) to detect the occurrence of disease for control purposes, and which may involve testing samples of a population.
Susceptible animal	Animal that can be infected with a particular disease agent.
Tracing	The process of locating animals, persons or other items that may be implicated in the spread of disease, so that appropriate action can be taken.
Vector	A living organism that transmits an infectious agent from one host to another. A biological vector is one in which the infectious agent must develop or multiply before becoming infective to a recipient host. A mechanical vector is one that transmits an infectious agent from one host to another but is not essential to the lifecycle of the agent. See also *fomite*
Zoning	The process of defining disease-free and infected areas.

Appendix III: Abbreviations

AAH	Aquatic animal health
AAHL	Australian Animal Health Laboratory
AqCCEAD	Aquatic Consultative Committee on Emergency Animal Diseases
AQUAVETPLAN	Australian Aquatic Veterinary Emergency Plan
POMS	Pacific Oyster Mortality Syndrome
CVO	Chief Veterinary Officer
DAFF	Department of Agriculture, Fisheries and Forestry (Australian Government)
DEWNR	Department for Environment, Water and Natural Resources
DNA	Deoxyribonucleic acid
EM	Electron microscopy
EMC	Emergency management Committee
EMEOG	Emergency management executive officers group
EPA	Environment Protection Authority
ETA	Estimated time of arrival
FRDC	Fisheries Research and Development Corporation
GPS	Global positioning system
IT	Information technology
ITQ	Individual transferable quota
OHS&W	Occupational health, safety and welfare
PBF	Phosphate buffered formalin
PCR	Polymerase chain reaction
PIRSA	Department of Primary Industries and Regions South Australia
POMS-WG	Pacific Oyster Mortality Syndrome Working Group
SARDI	South Australian Research and Development Institute
SAOGA	South Australian Oyster Growers Association
SASQAP	South Australia Shellfish Quality Assurance Program