

Risk Assessment of Abalone Fishing and Farming Activities

Using Abalone Viral Ganglioneuritis as a Case Study

November 2007

**Department of Primary Industries and Water
Animal Health and Welfare Branch
Wild Fisheries Management Branch**



ACKNOWLEDGEMENTS

This risk assessment has been compiled by Kevin Ellard, Animal Health and Welfare Branch and Andrew Sharman, Wild Fisheries Management Branch. The Department would like to acknowledge the contribution of the Tasmanian Abalone Council, Tasmanian Abalone Growers Association and Tasmanian Fishing Industry Council for their participation and input into the *Tasmanian AVG working group*¹.

BACKGROUND

In December 2005, a disease causing high mortality of abalone was detected in a small number of aquaculture establishments in Victoria. The disease has subsequently been identified as a ganglioneuritis caused by a herpes-like virus. The condition, now referred to as 'abalone viral ganglioneuritis' (AVG), had not previously been detected in Australia but was similar to a condition recently reported in Taiwan.

Investigations into the disease event have suggested that the initial pattern of spread amongst farms was strongly linked to movements of broodstock as part of a selective breeding program. Although affected farms undertook voluntary destocking, clinical disease was later detected in wild populations of abalone on reefs in close proximity to farm outflows.

The disease has subsequently continued to spread along the Victorian coastline in easterly and westerly directions causing serious depletion of wild abalone stocks in some regions. The disease has also caused significant financial difficulty for affected farms.

Tasmania has Australia's most valuable wild abalone fishery and a growing aquaculture sector that would be seriously compromised if the disease were to become established in state waters.

The Department of Primary Industry and Water's (DPIW) biosecurity objective is "to protect and enhance Tasmania's biosecurity status for the benefit of Tasmania's industries, environment and public well-being, health, amenity, and safety." (DPIW Biosecurity Policy) This policy objective is realised through the effective adoption of the following seven elements.

1. Appropriate level of protection (ALOP)
2. Least restrictive sanitary and phytosanitary requirements
4. Risk-based resource allocation
5. Cost/benefit decision-making on control and eradication
6. Whole-of-government approach to biosecurity
7. Shared responsibilities

As part of risk-based resource allocation (point 4), outlined within this document is a qualitative risk assessment on potential mechanisms for the spread of AVG within Tasmania. The assessment was undertaken by the Animal Health and Welfare and Wild Fisheries Management and branches of DPIW, in consultation with both the wild fishery and aquaculture sectors of the Tasmanian abalone industry.

As part of this process, a draft risk assessment was developed by DPIW and presented at a meeting of the *Tasmanian AVG working group*¹. This group then discussed individual ratings and any agreed changes were incorporated into this final document.

The working group will use findings contained within this risk assessment as the basis for identifying key areas that need to be addressed as part of AVG biosecurity and emergency response plans within Tasmania. Although this document uses AVG as the disease model, findings could also be applied to other diseases of abalone.

GENERAL ASSUMPTIONS

During the development of this risk assessment a number of important assumptions were made regarding pathogen distribution, reporting time frames and disease epidemiology. A description of general assumptions is outlined within this section, but where specific activities require further explanation, details are supplied within the comments section of the activity tables in Part A (pages 7-17).

1. Distribution of pathogen

It was assumed that abalone stock within Tasmanian waters may become infected with AVG at some time but the exact location and timing of introduction is not known. Therefore, it is assumed that there is potential for infected abalone to be inadvertently moved around the state with normal fishing and farming practices before clinical disease is detected.

This risk assessment does not restrict itself to spread of disease within Tasmanian waters, but also takes into account potential for introduction from interstate, in particular Victoria. It is also assumed that the extent of infection within Victorian waters has not yet been confirmed and all interstate imports or movements could potentially come from infected sources.

As such, both Tasmanian and Victorian waters are considered potentially infected.

2. Assignment of likelihood ratings

Potential for an *infective dose*² of AVG to be established or distributed around Tasmanian waters is used as the basis for assigning a likelihood rating. This rating takes into account factors such as dilution of the pathogen in discharge waters, potential to survive off the host, potential for shedding and proximity to susceptible populations.

Likelihood also uses a specific type of activity undertaken by a group over time rather than a single event.

3. Assignment of consequence ratings

The period between infection of a population and detection of clinical disease through routine surveillance and reporting systems can directly affect the overall consequence of an event (ie. a longer period would allow greater dissemination of the pathogen throughout Tasmania). In order to address this issue an *infection to detection period*² of one month has been applied.

This assumes that infection could be present within Tasmanian waters for up to one month before disease was detected by normal surveillance activities and consequence is gauged against how far disease could spread during this period.

Although consequence uses geographic distribution over a one-month period as the primary basis for assigning ratings, natural environment and potential for establishment were also taken into account.

Map 1 identifies key regions used within the consequence table (table 2). These regions are closely aligned to current fishing zones, but also take into account geographic barriers, fishing patterns and landing ports.

The infection to detection period applies only to consequence ratings and has not been applied to likelihood ratings.

4. Potential mitigation activities

Mitigation activities include any measures that may be put in place to inactivate or limit exposure to the pathogen. The risk assessment rating within this document relates only to the specific activity being assessed and does not take into account potential mitigation activities that may be applied.

Where there is variation between particular facilities or activities due to their geographic location or infrastructure, a realistic worst case scenario is used for as part of the assessment process. Where specific geographic conditions present a realist natural barrier to limit spread of the disease, these were taken into account. Such geographic barriers could include a significant distance between abalone habitat (eg. Bass Strait) or isolated fishing regions (eg. King Island).

2: Refer to appendix 1

Mitigation activities are addressed in the part 2 of this document.

5. Individual ratings for interstate movements

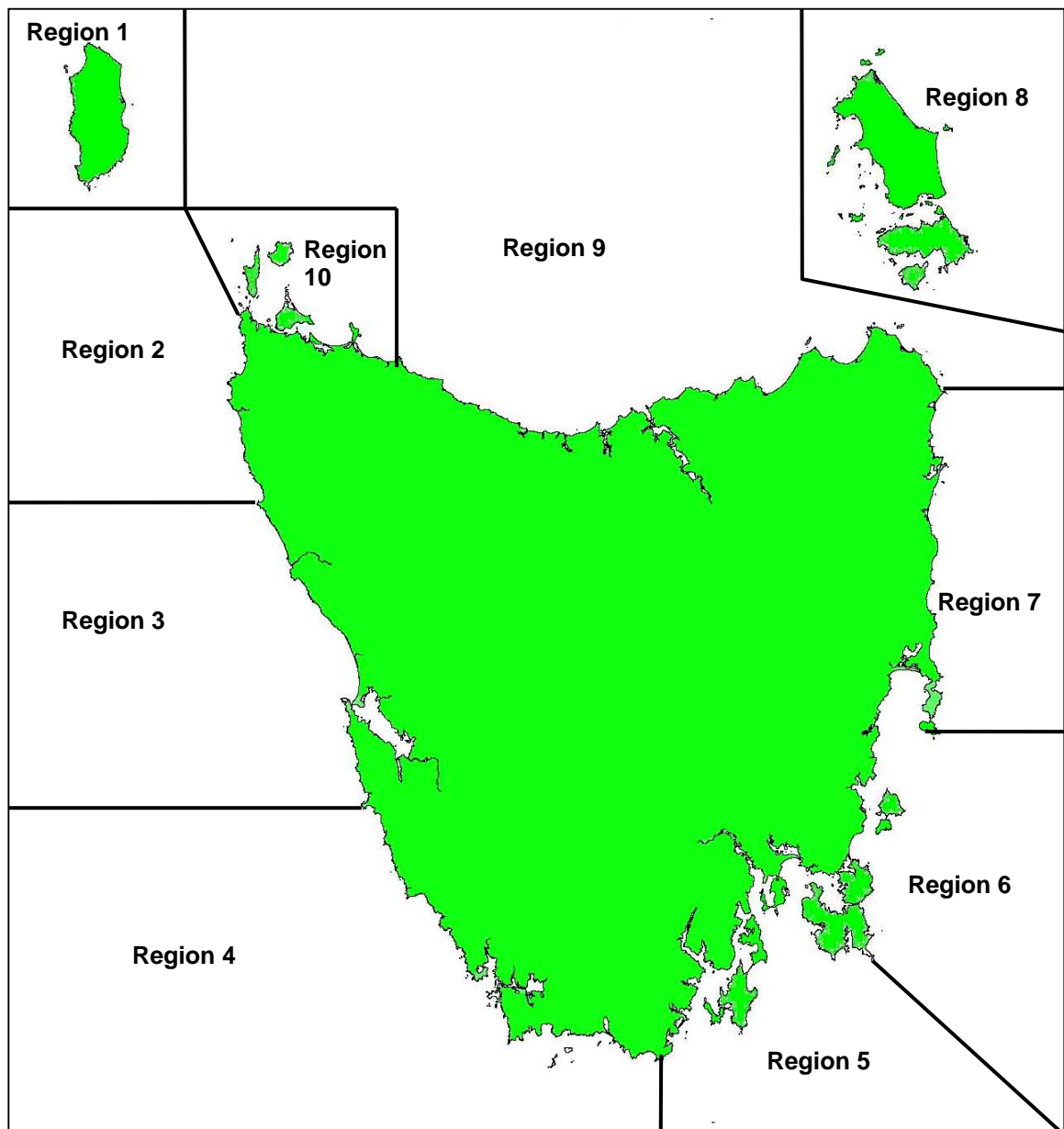
Similar activities that involve contact with interstate waters will vary in risk to those undertaken solely within Tasmanian waters.

For example, consequences associated with movement of disease into Tasmania from Victoria would be considered catastrophic, whereas movement of existing disease around Tasmania could range from very low for localised events to high if disease were to spread across regions. Similarly, due to the increased time taken for travel, the likelihood of disease being transferred from Victorian waters into Tasmania is often lower than a similar activity occurring within Tasmania.

In order to address this issue each of the two activity types has been assessed separately within the activity tables.

6. Identification of regions

Map 1 identifies regions used within the consequence table (table 2)



RATINGS TABLES

Table 1: Likelihood ratings

(ie. the likelihood of an AVG disease incursion event occurring from a specific activity)

Description	Definition
Negligible	Chances of event occurring so small as to be considered practically nil
Extremely low	Event occurring only under exceptional circumstances
Very low	Event possible but would be unlikely to occur
Low	Event that may occur at some time but will be infrequent
Moderate	Event likely to occur periodically
High	Event would be expected to occur frequently.

Table 2: Consequence rating

(ie. the extent of impact of AVG spread following an event within a specific timeframe)

Rating	Definition
Negligible impact	No perceivable consequences for either wild or farmed stocks
Very low impact	Minor impact, affecting only an individual tank or consignment of abalone
Low impact	Localised disease outbreak restricted to a single farm, single processor or a single well defined area of water
Moderate impact	Disease outbreak affecting multiple sites but restricted to a local area. Affecting several adjacent reefs, farms, holding facilities or processors within a small area.
High impact	Regional consequences, disease outbreak spread across a single region within the state.
Extreme impact	Statewide or interstate consequences, disease outbreak spread across the whole state or between states.

TASMANIA'S APPROPRIATE LEVEL OF PROTECTION

The varying levels of risk are illustrated below (table 3) in a risk estimation matrix based on the likelihood of an event occurring and the consequences if it occurs (Level of Risk = Likelihood x Consequence). This matrix forms the basis of the following biosecurity risk assessment to determine if the risk (either unmitigated or managed) would meet Tasmania's ALOP.

Zero risk is not possible and a managed approach to risk is practical and desirable. The Tasmanian Government's appropriate level of protection is aimed at reducing risk to very low levels, while not based on a zero risk approach.

In practical terms this means that for any activity assessed as having a risk rating above "very low risk" requires that management measures be implemented in order to reduce the risk estimate. Here this cannot be realistically achieved, the particular activity should cease.

Table 3: Risk assessment table

Likelihood of establishment and spread	High Likelihood	Negligible Risk	Very Low Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk
	Moderate Likelihood	Negligible Risk	Very Low Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk
	Low Likelihood	Negligible Risk	Negligible Risk	Very Low Risk	Low Risk	Moderate Risk	High Risk
	Very Low Likelihood	Negligible Risk	Negligible Risk	Negligible Risk	Very Low Risk	Low Risk	Moderate Risk
	Extremely Low Likelihood	Negligible Risk	Negligible Risk	Negligible Risk	Negligible Risk	Very Low Risk	Low Risk
	Negligible Likelihood	Negligible Risk	Negligible Risk	Negligible Risk	Negligible Risk	Negligible Risk	Very Low Risk
		Negligible Impact	Very Low Consequence	Low Consequence	Moderate Consequence	High Consequence	Extreme Impact
	Consequence of establishment and spread						

ASSESSMENT OF RISKS ASSOCIATED WITH VIRUS AMPLIFICATION

Whereas the risks associated with disease entering processing facilities and abalone farms can be considered using the assumptions previously outlined, the risks associated with the amplification of virus within stock held for periods of time within abalone farms or holding facilities has not been. The potential for amplification of AVG virus within facilities holding stock under intensive conditions has been identified as an important risk factor and therefore requires further discussion.

Amplification (increase in concentration) of virus within facilities holding abalone stock for extended periods of time has been demonstrated by the recent Victorian outbreak as a realistic risk of disease spread. It allows low levels of virus to build up within stock held in the facility (eg. abalone farms or holding facilities) and be excreted at much higher levels in discharge waters. This results in the increased likelihood of abalone populations in close proximity to the facility outflow being exposed to an infective dose of AVG. The level of discharge from a facility without decontamination infrastructure would increase as disease spread throughout stock held in the facility and would ultimately depend on the total biomass held and the percentage of stock affected.

The scenario described above contrasts with that expected within processing facilities, which receive a large number of abalone from a range of areas but are only held within the facility for short periods of time. Here the likelihood of infected animals entering the facility is much higher, however due the fact that abalone are only held for short periods of time, the ability for the virus to amplify is limited. Processing facilities may still have potential to discharge significant quantities of virus into the adjacent environment, however this is primarily dependent on whether they have imported significant quantities of infected abalone.

Abalone holding facilities are considered to have some potential for amplification but similar risk of introducing virus into the facility as processors.

Table 4 compares the relative risks of processors, holding facilities and farms. The table assumes that diseased stock will enter the facility at some time, there is not control of water outflow and the outflow discharges into viable abalone environment. Again an infection to detection period of 1 month has been applied.

Table 4: Comparison of abalone farm and processor discharge taking into account potential for viral amplification

	Likelihood of disease stock entering the facility	Duration of abalone within the facility/ ability for virus to amplify	Expected discharge of virus from facility if diseased stock are present	Likelihood of disease being established in surrounding environment	Consequences of disease spread
Processing facilities	High (Due to high frequency of stock movement from a wide range of areas)	Short/ low	Moderate (Generally low but high discharge levels may occur periodically if abalone collected from an infected area)	Moderate (Depends on the frequency of diseased abalone passing through the facility and the dilution of virus in discharge water)	High (Dependent on distance between fishing areas and processing facility)
Wild holding facilities	High (Due to high frequency of stock movement from a range of areas)	Medium/moderate	High	High	High (Dependent on distance between fishing areas and processing facility)
Aquaculture farms	Low (Due to low frequency of stock movement from limited areas)	Long/ high	High (Initially discharge would be low but would build up to very high levels over time)	High (Would be expected to occur if clinical disease occurs at the facility and is not detected rapidly)	High (Immediate spread would be to environment adjacent to the farm, but would depend on previous movements onto the farm from other areas)

Within the activity tables an overall risk of processing (tables 1A + 6C) and live holding (7A + 11C) facilities transferring disease within discharge waters has been calculated to be a high risk. Based on the criteria listed within table 4, the overall risk of farms transferring disease (tables 1D + 8D) in discharge water has also been calculated to be high. These scenarios, taking into account potential viral amplification, have been included in summary ranking of activities (table G).

Part 1: Assessment of risks associated with specific activities

ACTIVITY TABLE A (I): RISKS ASSOCIATED WITH COMMERCIAL ABALONE DIVING ACTIVITIES

Includes activities associated with commercial abalone fishing activities, including divers, well boats and movement of product to processors.

No.	Specific Risk	Likelihood	Consequence	Final Rating	Comments
1A	Movements of live animals from the wild into processing facilities within Tasmania	High	High	High risk	<ul style="list-style-type: none"> Refer to table 4 High frequency event Abalone collected from a range of areas across the state Abalone health may deteriorate in processor premises and begin shedding virus Consequence will vary depending on location of facility and proximity to abalone environment. Assume the time between wild to processor would be >24 hrs
2A	Movement of equipment and personnel by commercial divers from infected stocks/areas to uninfected stocks/areas	Moderate	High	High risk	<ul style="list-style-type: none"> Assumes virus will survive on equipment and personnel for a restricted period of time (ie <24 hrs). Distances between diving locations can vary greatly and may be across fishing zones and regions. Therefore a high rating has been applied to accommodate this more significant event
3A	Movement of potentially contaminated seawater between areas other than on ocean currents.	Low	High	Moderate risk	<ul style="list-style-type: none"> Examples include water discharged from live infected abalone aboard a boat Pathogen dilution associated with water flow rates and depth considered important factor in likelihood. Abalone are transported on larger mother boats in flow through holding tanks, smaller dinghies often pump water over abalone, this is discharged directly into the sea. Assumes that even with considerable dilution, viable virus has potential to infect other areas. Assumes that boats are not travelling between Vic and Tas

Part 1: Assessment of risks associated with specific activities

4A	Movement of equipment and personnel from Victoria or other state to Tasmanian waters	Low	Extreme	High risk	<ul style="list-style-type: none"> • Movement may occur via boats and equipment being transported to Tasmania via Bass Strait ferry service. • Likelihood is increased if boats travel directly to Tasmanian waters. • Event occurs infrequently.
5A	Unloading of abalone for processor pick up where abalone is repacked on wharf or boat ramp	Low	Moderate	Low risk	<ul style="list-style-type: none"> • Washing equipment on wharf and boat ramps may allow contaminated material to be discharged into marine environment, possibly contaminate environment or vessels nearby. • Consequence depends on habitat proximity, abalone are unlikely to be in close proximity to loading site.
6A	Movement of abalone from one reef to another	Moderate	Moderate	Moderate risk	<ul style="list-style-type: none"> • Practice of selective fishing, high-grading pose risk when fish are discarded despite regulations. • Although movement may occur, the distance travelled will be limited • Current regulations require all legal size abalone to be landed and not moved between sites. Additional rules allow over-catch and excess abalone to be landed and reconciled later.
7A	Movements of live animals from the wild into live holding facilities within Tasmania	High	High	High risk	<ul style="list-style-type: none"> • Refer to table 4 • High frequency event • Assumes that abalone are held within the facility for up to 10 days • Assumes facility discharges water into the marine environment

Part 1: Assessment of risks associated with specific activities

ACTIVITY TABLE B (I): RISKS ASSOCIATED WITH RECREATIONAL ABALONE DIVING

Includes common activities undertaken by recreational divers, including equipment and boats.

No.	Specific Risk	Likelihood	Consequence	Final Rating	Comments
1B	Movement of equipment and personnel by recreational diving and angling from infected stocks/area to an uninfected stocks/area within Tasmanian State waters	Moderate	Low	Low risk	<ul style="list-style-type: none"> Likelihood of transmission similar to commercial fishing activities for a single event but consequence lower because divers would be unlikely to move significant distances. Lower frequency of diving trips compared to commercial activities also affects likelihood.
2B	Indirect movement of equipment and personnel by recreational diving from infected stocks/area in Victoria to uninfected stocks/area in Tasmanian.	Very low	Extreme	Moderate risk	<ul style="list-style-type: none"> Relates to unregulated and unrestricted movements of recreational vessels from Victoria to Tasmania via Bass Strait ferry service Transit times would be expected to be >72 hours AQIS currently identifies organic material as QRM (Quarantine Risk Material) for vessels travelling to Tas on Bass Strait ferries.
3B	Direct movement of equipment and personnel by recreational diving from infected stocks/area in Victoria to uninfected stocks/area in Tasmania.	Low	Extreme	High risk	<ul style="list-style-type: none"> Relates to direct movement of amateur fishing boats across Bass strait Transit time for direct movement much shorter (<24 hrs) Most frequent movements between Apollo Bay and King Island. Entry to Tas not regulated through quarantine points such as ferry terminal or airport. Increased consequence/ risks due to known presence of virus in Victoria.

Part 1: Assessment of risks associated with specific activities

ACTIVITY TABLE C (I): RISKS ASSOCIATED WITH COMMERCIAL ABALONE PROCESSING

Includes all activities undertaken as part of procession wild catch or farmed abalone, includes equipment supplied to fishers/farmers and discharge water from procession facilities.

No.	Specific Risk	Likelihood	Consequence	Rating	Comments
1C	Movement of live animals to other processing facilities (ie between processors).	Low	High	Moderate risk	<ul style="list-style-type: none"> Significant movements between processors may result in contamination in several facilities, with subsequent increase in likelihood of disease transmissions into the environment adjacent to those facilities. Likelihood depends on prevalence of disease.
2C	Movement of other species that may harbour the virus to a processor within Tas	Extremely Low	High	Very low risk	<ul style="list-style-type: none"> Currently approval required by Chief Veterinary Officer (CVO) to import most species of concern and assessment is on a case by case basis. No specific information is yet available on any other species that can transmit this virus. Likelihood is therefore unknown.
3C	Sale of abalone viscera as bait to commercial and recreational fishers.	High	High	High risk	<ul style="list-style-type: none"> Assumes that bait is used in commercial fishing pots and traps. Longstanding prohibition on abalone as bait in recreational fishery. Bait taken directly to abalone habitat and plumes (spreads well). Sick fish more likely to be processed than sold live. Could include material from compulsorily destroyed animals.
4C	Inappropriate disposal of waste materials such as viscera, and shell into the marine environment.	Low	High	Moderate risk	<ul style="list-style-type: none"> Assumes that waste is disposed directly into the marine environment. Washing down of floors equipment into stormwater or similar.
5C	Inappropriate disposal of shells and waste materials such as viscera on land.	Extremely low	Moderate	Negligible risk	<ul style="list-style-type: none"> Processed shells containing meat etc left out where other animals such as rodents and birds may facilitate the spread. Open waste holding areas or bins accessible to rodents and birds.

Part 1: Assessment of risks associated with specific activities

6C	Discharge of water from processor facilities into the marine environment.	High	Moderate	Moderate risk	<ul style="list-style-type: none"> • Refer to table 4 • Risk differs with location of premises and proximity to abalone habitat. • Risk assumes that processor is adjacent to abalone habitat and is receiving abalone from all parts of the state. • Can cause area in proximity to processor to be contaminated with virus. • Abalone transported from all regions of the state into facilities.
7C	Discharge of water from processors into municipal sewage systems	Extremely low	High	Very low risk	<ul style="list-style-type: none"> • Although treatment systems vary, assumes full treatment system with some degree of chlorination
8C	Processing of whole interstate abalone	Moderate	Extreme	Extreme risk	<ul style="list-style-type: none"> • Activity not currently allowed. Likelihood rating has been made assuming regulations restricting movement are not in place
9C	Processing of partially processed interstate abalone for canning purposes	Very low	Extreme	Moderate risk	<ul style="list-style-type: none"> • Likelihood depends on where abalone are sourced • Likelihood depends on degree of processing undertaken prior to abalone entering Tasmania. Assume shucking, evisceration and rumbling
10C	Movements of contaminated equipment from processing facilities to divers.	Low	High	Moderate risk	<ul style="list-style-type: none"> • Examples include movement of bins and other equipment from processors back to divers • Assumes that sub-clinical infection in stock may be expressed following stress associated with handling and holding. • Combination of indirect contact with host, extended time, dilution and poor survival of pathogen results in low to very likelihood of transfer • Consequence is high because of the potential for wide ranging and rapid spread from a central processing point.

Part 1: Assessment of risks associated with specific activities

11C	Discharge of water from live holding facilities into the marine environment.	High	Moderate	Moderate risk	<ul style="list-style-type: none"> • Refer to table 4 • Risk differs with location of premises and proximity to abalone habitat. • Risk assumes that processor is adjacent to abalone habitat and is receiving abalone from all parts of the state. • Can cause area in proximity to processor to be contaminated with virus. • Abalone transported from all regions of the state into facilities.
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Part 1: Assessment of risks associated with specific activities

ACTIVITY TABLE D (I): RISKS ASSOCIATED WITH COMMERCIAL ABALONE FARMING

Includes all equipment, personnel and stock on farms as well as possible escapees and water discharged from farms

No.	Specific Risk	Likelihood	Consequence	Rating	Comments
1D	Movements of live animals from the wild into facilities as brood stock.	Low	High	Moderate risk	<ul style="list-style-type: none"> Refer to table 4 Import of brood stock abalone from outside Tas currently not permitted, assumed broodstock only taken from Tas waters Assumes broodstock are not quarantined upon entry to the farm. Assumes farm is receiving abalone from any part of Tasmania. Likelihood is low because, frequency of movements much lower than in processors, however present much greater risk to abalone farm stocks
2D	Movement of equipment and personnel to other land based aquaculture facilities.	Very low	High	Low risk	<ul style="list-style-type: none"> Assumes virus can survive on equipment and may allow disease to be introduced in across a farm, to another farm or processor. Movement will be around the farm or between farms.
3D	Movement of live animals to other land based aquaculture facilities.	Low	High	Moderate risk	<ul style="list-style-type: none"> Movements between farms may result in contaminations between facilities, with subsequent increase in likelihood of disease transmission into the environment. Assumes movements are within the state only.
4D	Movement of live animals to ocean based marine farms.	Mod	High	High risk	<ul style="list-style-type: none"> Marine based operations include ranching and reseeding operations, but not pump ashore Open water marine farms are entirely dependent on a supply of juvenile fish from a hatchery. Transfer of infection subsequently results in increased likelihood of disease transmission into the environment. Impact would depend on location of facility and proximity to abalone habitat Ocean based operations may prove difficult to monitor for disease and response to disease can be significantly delayed by weather etc.

Part 1: Assessment of risks associated with specific activities

5D	Movements of live animals from aquaculture facilities into processing facilities.	Low	High	Moderate risk	<ul style="list-style-type: none"> Moderate to low frequency event Aquaculture facilities may pack abalone on farm. Subsequently only held by processor briefly prior to export. Influenced by proximity of farm to processor and tanking arrangements of both.
6D	Movements of abalone for purposes of emergency harvest from aquaculture facilities into processing facilities.	Moderate	High	High risk	<ul style="list-style-type: none"> May include some compulsorily destroyed abalone in response to disease event on farm. Risks associated with disposal of waste material from additional processing of meats.
7D	Unintentional transfer of live animals from farm to the marine environment via feral or escaped stock	Low	Moderate	Low risk	<ul style="list-style-type: none"> Depends on incubation and severity of infection and latency or resistance in farm stock. Have assumed the farm discharge is adjacent to abalone environments. Movement of disease will only affect wild stocks adjacent to discharge point Sick abalone are likely to die rather than migrate significant distance. Amplification on farm may cause high viral loads affecting animals in pipes, drains settlement ponds and outflows.
8D	Discharge of water from farms into the marine environment	High	Moderate	High risk	<ul style="list-style-type: none"> Refer to table 4 Depends on virus concentration, dilution factors and survival time of virus outside host. Infection is likely to only affect habitat adjacent to discharge point. Assumes that virus is likely to amplify within the farm environment and result in high titres (concentration) if not detected. Influenced by, flow rates and duration within settlement ponds, location of farm and proximity to abalone habitat. Have assumed farm is adjacent to suitable habitat.

Part 1: Assessment of risks associated with specific activities

9D	Inappropriate disposal of mortalities, shells and waste material such as viscera on land.	Extremely low	Mod	Negligible risk	<ul style="list-style-type: none"> • Discard of shells or whole animals where other animals such as rodents and birds can access. • Via mortalities of escaped animals living in settlement ponds, outlets pipes etc that are transferred by 3rd party. • Likelihood is different to processors because live viable hosts are in much closer proximity
10D	Inappropriate disposal of shells and waste material into the marine environment	Low	Mod	Low risk	<ul style="list-style-type: none"> • Via leaching into adjacent environment • Via mortalities of escaped animal living in settlement ponds, outlets pipes etc. • Hogging/cleaning pipes and back flushing systems.
11D	Potential for imported feed to transmit disease to farmed abalone	Negligible	Extreme	Very low risk	<ul style="list-style-type: none"> • Assumes abalone product is not used in the feed • Meat meal component is heat treated • Assumes feed is manufactured away from infected regions
12D	Potential for domestic feed to transmit disease to farmed abalone	Extremely low	Extreme	Low risk	<ul style="list-style-type: none"> • Assumes actual content and processing is unknown • Assumes feed is manufactured close to infected regions • Assumes some input of local produce included

Part 1: Assessment of risks associated with specific activities

ACTIVITY TABLE E (I): RISKS ASSOCIATED WITH MISCELLANEOUS ACTIVITIES

Includes any activities not addressed above.

No.	Specific Risk	Likelihood	Consequence	Rating	Comments
1E	Movement of the virus from an infected area to an uninfected area/reefs by human activity not mentioned above	Low	High	Moderate risk	<ul style="list-style-type: none"> • Examples of such activities include reef-restocking research. • Tagging and release studies • Risk rating relates to movement of live abalone of unknown health status • Assumes movements are within regions/ moderate distances • Formal translocation activities only permitted with approval from CVO and Manager Wild Fisheries
2E	Movement of the virus from infected area to an uninfected area/reefs by other animals (carriers, vectors, predators, scavengers etc.)	Very low	Moderate	Very Low risk	<ul style="list-style-type: none"> • Dead abalone will be consumed by a variety of fish and invertebrates, but it is unknown if they can act as reservoirs • Physical movement by larger fish may facilitate spread on local scale • Heavily infected areas have experienced large numbers of dead abalone washed up, sea birds and rodents can carry whole abalone along shore to uninfected areas. Movement at local scale, 100's of Meters.
3E	Movement of equipment and personnel by commercial fishers (other than abalone) from infected stocks/areas within Tasmania to an uninfected stocks/areas.	Extremely low	High	Very low risk	<ul style="list-style-type: none"> • Assumes virus can survive on equipment and cause disease in abalone populations at another location. • Rock lobster pots, and scalefish graball nets used in infected areas may contain virus particles at very low levels. • Heavily infected areas would be rated as a higher likelihood and potentially include vessel movements and ballast water etc.
4E	Movement of equipment and personnel by commercial fishers (other than Abalone) from infected stocks/areas outside of Tasmania to an uninfected stock/area within Tasmania	Extremely low	Extreme risk	Low risk	<ul style="list-style-type: none"> • Dual jurisdictional fishing (Vic/Tas) increased likelihood • Rock lobster pots, and scalefish graball nets used in infected areas may contain virus particles at very low levels. • Heavily infected areas would be rated as a higher likelihood and potentially include vessel movements and ballast water etc.

Part 1: Assessment of risks associated with specific activities

5E	Movement of the virus through natural movement of abalone or via water currents	Very low	Moderate	Very low risk	<ul style="list-style-type: none"> No realistic management or controls are available to address risk.
6E	Illegal abalone fishing activities	Very low	Extreme	Moderate risk	<ul style="list-style-type: none"> Primarily concerned about movement of boats from Vic. Increased risk of shucking and dumping at sea.
7E	Movement of ballast water in maritime vessels	Negligible	Extreme	Very low risk	<ul style="list-style-type: none"> Assumes that abalone are not present within ships ballast and ballast water. Assumes that ballast loading will occur in areas away from abalone environment, ie. ports

Part 2: Potential mitigation procedures for specific activities

Part 2 lists all activities assessed as having a risk rating above 'very low' and assigns potential mitigation measures that may be used to reduce risk.

ACTIVITY TABLE A (II): RISKS ASSOCIATED WITH COMMERCIAL ABALONE DIVING

No.	Specific Risk	Final Rating	Potential Mitigation Measures
1A	Movement of live animals from Tasmanian waters into processing facilities within Tasmania	High risk	<ul style="list-style-type: none"> • Individual assessment of processor facilities based on proximity to environment and discharge infrastructure • Dispose of outflow water into a secure site eg council sewage system • Efficient removal of solid waste • Recirculate water within holding facilities with treatment of small quantities of outflow water • Allocate fishing regions to specific processors • Establishment of an industry code of practice • Ongoing passive surveillance program • Ongoing awareness program • Introduction of active surveillance program targeting outflow habitats
2A	Movement of equipment and personnel by commercial divers from infected stocks/areas to uninfected stocks/areas.	High risk	<ul style="list-style-type: none"> • Establishment of routine cleaning and disinfection procedures or Standard Operating Protocol • Establishment of an industry code of practice, possible inclusion of time constraints on movements across state and transporting abalone around the state. • Ongoing passive surveillance program • Ongoing awareness program
3A	Movement of potentially contaminated seawater between areas other than on ocean currents.	Moderate risk	<ul style="list-style-type: none"> • Establishment of routine cleaning and disinfection procedures • Establishment of an industry code of practice • Modify fishing movements, ie motherboats and dinghies carrying live abalone • Management of water flows when in close proximity to abalone habitat • Investigate viability of recirculation or outflow treatment

Part 2: Potential mitigation procedures for specific activities

4A	Movement of equipment and personnel from Victoria or other state to Tasmanian waters	High risk	<ul style="list-style-type: none"> • Regulation/prohibition of dual jurisdiction abalone fishing. • Establishment of routine cleaning and disinfection procedures • Establishment of an industry code of practice • Continue requirement for all abalone to be landed in Tasmania
5A	Unloading of abalone for processor pick-up, where abalone is repacked on wharf or boat ramp	Low risk	<ul style="list-style-type: none"> • Establishment of routine cleaning and disinfection procedures • Establishment of an industry code of practice for unloading catch • Allocation of landing areas and SOP's for vessels returning from extended trips
6A	Movement of abalone from one reef to another.	Moderate risk	<ul style="list-style-type: none"> • Development of translocation Standard Operating Protocol prior to permitting any movements • Active surveillance program • Small scale movements only
7A	Movements of live animals from the wild into live holding facilities within Tasmania	High risk	<ul style="list-style-type: none"> • Individual assessment of holding facilities based on proximity to environment and discharge infrastructure • Dispose of outflow water into a secure site eg council sewage system • Efficient removal of solid waste • Recirculate water within holding facilities with treatment of small quantities of outflow water • Allocate fishing regions to specific processors • Establishment of an industry code of practice • Ongoing passive surveillance program • Ongoing awareness program • Introduction of active surveillance program targeting outflow habitats

Part 2: Potential mitigation procedures for specific activities

ACTIVITY TABLE B(II): RISKS ASSOCIATED WITH RECREATIONAL ABALONE DIVING

No.	Specific Risk	Final Rating	Mitigation Measures
1B	Movement of equipment and personnel by recreational diving and angling from infected stocks/area to an uninfected stocks/area within Tasmanian State waters	Low risk	<ul style="list-style-type: none"> • Ongoing awareness program • Ongoing passive surveillance program • Regulation on disposal of recreational fish waste and education campaign
2B	Indirect movement of equipment and personnel by recreational diver from infected stocks/area in Victoria to uninfected stocks/area in Tasmania	Moderate risk	<ul style="list-style-type: none"> • Ongoing awareness program • Requirement for quarantine restrictions and inspections, including adequate education and enforcement powers for quarantine officers
3B	Direct movement of equipment and personnel by recreational diving from infected stocks/area in Victoria to uninfected stocks/area in Tasmania	High risk	<ul style="list-style-type: none"> • Ongoing awareness and education program • Restriction and regulation of vessel movements, ie. ensure that all abalone first landed in Tasmania. • No transit between Tasmanian/Victoria with abalone • Memorandum of Understanding with Victoria fisheries and police • Closure of recreation fishery in areas close to Victoria. • Mandatory cleaning and inspection protocols for al vessels intending to fish in Tasmanian waters

Part 2: Potential mitigation procedures for specific activities

ACTIVITY TABLE C(II): RISKS ASSOCIATED WITH COMMERCIAL ABALONE PROCESSING.

No.	Specific Risk	Rating	Mitigation Measures
1C	Movement of live animals to other processing facilities (ie between processors).	Moderate risk	<ul style="list-style-type: none"> • Insufficient information on extent of this activity • Movement SOP's for all abalone transported between facilities • Establishment of routine cleaning and disinfection procedures • Establishment of an industry code of practice
3C	Sale of abalone viscera as bait to commercial and recreational fishers.	High risk	<ul style="list-style-type: none"> • Establishment of an industry code of practice for storage and identification of waste and by-product, traceability for all products sold by processors. • Stringent standards for treatment and disposal of all solid waste. • Extension of regulations prohibiting use of abalone product as bait to include commercial fishers.
4C	Inappropriate disposal of waste materials such as viscera, and shell into the marine environment.	Moderate risk	<ul style="list-style-type: none"> • Establishment of an industry code of practice • Stringent standards for treatment and disposal of all solid waste in licensing conditions (AQIS) • Periodic inspection of premises
6C	Discharge of water from processors into the marine environment	High risk	<ul style="list-style-type: none"> • Individual assessment of processors/holding facilities based on proximity to environment and discharge infrastructure • Dispose of outflow water into a secure site eg council sewage system • Efficient removal of solid waste • Recirculate water within holding facilities with treatment of any small quantities of outflow water • Treatment of effluent, standards developed and independently assessed • Allocate fishing regions to specific processors • Establishment of an industry code of practice • Ongoing passive surveillance program • Ongoing awareness program • Introduction of active surveillance program targeting outflow habitats

Part 2: Potential mitigation procedures for specific activities

8C	Movement of whole interstate abalone	Extreme risk	<ul style="list-style-type: none"> • Zero effluent or extensive treatment and discharge infrastructure. • Dispose of outflow water into a secure site eg council sewage system (assessment of associated council systems prior to approval) • Stringent standards for treatment and disposal of all solid waste. • Introduction of active surveillance program targeting outflow habitats
9C	Movement of partially processed interstate abalone for canning purposes	Moderate risk	<ul style="list-style-type: none"> • Zero effluent or extensive treatment and discharge infrastructure • Dispose of outflow water into a secure site eg council sewage system (assessment of associated council systems prior to approval) • Stringent standards for treatment and disposal of all solid waste • Introduction of active surveillance program targeting outflow habitats
10C	Movements of contaminated equipment from processing facilities to divers.	Moderate risk	<ul style="list-style-type: none"> • Establishment of routine cleaning and disinfection procedures for all bins exchanged • Establishment of an industry code of practice • Allocation fishing of regions to specific processors
11C	Discharge of water from live holding facilities into the marine environment	High risk	<ul style="list-style-type: none"> • Individual assessment of holding facilities based on proximity to environment and discharge infrastructure • Dispose of outflow water into a secure site eg council sewage system • Efficient removal of solid waste • Recirculate water within holding facilities with treatment of any small quantities of outflow water • Treatment of effluent, standards developed and independently assessed • Allocate fishing regions to specific processors • Establishment of an industry code of practice • Ongoing passive surveillance program • Ongoing awareness program • Introduction of active surveillance program targeting outflow habitats

Part 2: Potential mitigation procedures for specific activities

ACTIVITY TABLE D(II): RISKS ASSOCIATED WITH COMMERCIAL ABALONE FARMING

No.	Specific Risk	Rating	Mitigation Measures
1D	Movements of live animals from the wild into facilities as brood stock.	Moderate risk	<ul style="list-style-type: none"> • Prohibition on non Tasmanian brood stock • Establishment of quarantine facilities • Individual assessment of aquaculture facilities based on proximity to environment and discharge infrastructure • Recirculation and/or disinfection of quarantine facility outflow water • Testing of broodstock prior to release into the general population (includes offspring) • Allocation of regions to farms for collection of broodstock • Establishment of an aquaculture active surveillance program • Establishment of comprehensive farm biosecurity measures • Establishment of an industry code of practice
2D	Movement of equipment and personnel to other land based aquaculture facilities.	Low risk	<ul style="list-style-type: none"> • Establishment of an aquaculture active surveillance program • Establishment of accreditation program for farms (ie zoning policy) • Mandatory requirement for pre-movement testing • Establishment of comprehensive farm biosecurity measures • Establishment of an industry code of practice • SOP's for all abalone movements between facilities • Individual assessment of aquaculture facilities based on proximity to environment and discharge infrastructure
3D	Movement of live animals to other land based aquaculture facilities.	Moderate risk	<ul style="list-style-type: none"> • Establishment of an aquaculture active surveillance program • Requirement for pre-movement testing • Establishment of comprehensive farm biosecurity measures • Establishment of a translocation protocol and mandatory SOP • Individually assess all receiving facilities based on proximity to environment and discharge infrastructure

Part 2: Potential mitigation procedures for specific activities

4D	Movement of live animals to ocean based marine farms	High risk	<ul style="list-style-type: none"> • Establishment of an aquaculture active surveillance program • Comprehensive risk assessment including tide and current data. • Requirement for pre-movement testing • Establishment of stringent farm biosecurity measures • Establishment of a translocation protocol and mandatory SOP • Comprehensive Individual assessment of in water lease based on proximity to abalone environment. • Zoning restrictions on seed stock for all in water aquaculture facilities
5D	Movements of live animals from aquaculture facilities into processing facilities	Moderate Risk	<ul style="list-style-type: none"> • Movement SOP's for farmed and wild abalone between facilities • Establishment of routine cleaning and disinfection procedures • Establishment of an industry code of practice • Allocation fishing regions to specific processors
6D	Movement of abalone for purposes of emergency harvest from aquaculture facilities into processing facilities	High risk	<ul style="list-style-type: none"> • Movement SOP's for farmed and part processed abalone between facilities • Dispose of outflow water into a secure site eg council sewage system • Establishment of an industry code of practice • Establishment of routine cleaning and disinfection procedures
7D	Unintentional transfer of live animals from farm to the marine environment via feral or escaped stock	Low risk	<ul style="list-style-type: none"> • Establishment of comprehensive farm biosecurity measures including removal and testing of escaped abalone within farm (ie drains, pipes and settlement ponds) • Individually assess aquaculture facilities based on proximity to environment and discharge infrastructure • Introduction of active surveillance program targeting outflow habitats

Part 2: Potential mitigation procedures for specific activities

8D	Discharge of water from farms into the marine environment	High risk	<ul style="list-style-type: none"> • Establishment of an industry code of practice • Individually assess aquaculture facilities based on proximity to environment and discharge infrastructure • Recirculate water within holding facilities with treatment of small quantities of outflow water • Treatment of effluent, standards developed and independently assessed • Establishment of comprehensive farm biosecurity measures • Establishment of an aquaculture active surveillance program • Introduction of active surveillance program targeting outflow habitats
10D	Inappropriate disposal of shells and waste into the marine environment	Low risk	<ul style="list-style-type: none"> • Introduction of industry code of practice • Individually assess aquaculture facilities and inspect disposal procedures
12D	Potential for imported feed to transmit disease to farmed abalone	Low risk	<ul style="list-style-type: none"> • Introduction of industry code of practice

Part 2: Potential mitigation procedures for specific activities

ACTIVITY TABLE E (II): RISKS ASSOCIATED WITH MISCELLANEOUS ACTIVITIES

No.	Specific Risk	Rating	Mitigation Measures
1E	Movement of the virus from an infected area to an uninfected area/reefs by human activity not mentioned above	Moderate risk	<ul style="list-style-type: none"> • Pre-movement testing of stock from source location • Restrictions of movement within regions, ie small scale only. • Standard Operating Protocols for scientific and research diving.
4E	Movement of equipment and personnel by commercial fishers (other than abalone) from infected stocks/areas outside of Tasmania to an uninfected stock/area within Tasmania	Low	<ul style="list-style-type: none"> •
6E	Illegal abalone fishing activities	Moderate risk	<ul style="list-style-type: none"> • Increased surveillance and policing of vulnerable areas. • Industry involvement in reporting suspicious and illegal activity, eg. Fishwatch hotline or dedicated Abwatch number.

Part 2: Identification of potential mitigation measures for specific activities

SUMMARY RANKING OF ACTIVITIES REQUIRING ATTENTION

Table F: Border containment priorities (ie. those activities that pose a threat of introduction of the disease into Tasmanian)

Extreme risk activities	
8C	Movement of whole interstate abalone
High risk activities	
4A	Movement of commercial abalone equipment and personnel from Victoria or other state to Tasmanian waters
3B	Direct movement of equipment and personnel by recreational diving from infected stocks/area in Victoria to uninfected stocks/area in Tasmania
Moderate risk activities	
2B	Indirect movement of equipment and personnel by recreational diver from infected stocks/area in Victoria to uninfected stocks/area in Tasmania
9C	Movement of partially processed interstate abalone for canning purposes
5E	Illegal abalone fishing activities
Low risk activities	
4E	Movement of equipment and personnel by commercial fishers (other than abalone) from infected stocks/areas outside of Tasmania to an uninfected stock/area within Tasmania

Table G: Spread restriction priorities (ie. those activities that pose a threat of spreading disease throughout state-waters)

High risk activities	
1A	Movement of live animals from Tasmanian waters into processing facilities within Tasmania
1D ³	Movements of live animals from the wild into facilities as brood stock.
7A	Movement of live animals from the wild into live holding facilities within Tasmania
2A	Movement of equipment and personnel by commercial divers from infected stocks/areas to uninfected stocks/areas
3C	Sale of abalone viscera as bait to commercial and recreational fishers.
6C	Discharge of water from processors into the marine environment
11C	Discharge of water from live holding facilities into the marine environment
4D	Movement of live animals to ocean based marine farms
6D	Movement of abalone for purposes of emergency harvest from aquaculture facilities into processing facilities
8D	Discharge of water from farms into the marine environment

Part 2: Identification of potential mitigation measures for specific activities

Table G continued

Moderate risk activities	
3A	Movement of potentially contaminated seawater between areas other than on ocean currents.
6A	Movement of abalone from one reef to another.
1C	Movement of live animals to other processing facilities (ie between processors).
4C	Inappropriate disposal of waste materials such as viscera, and shell into the marine environment.
10C	Movements of contaminated equipment from processing facilities to divers.
3D	Movement of live animals to other land based aquaculture facilities.
5D	Movements of live animals from aquaculture facilities into processing facilities
1E	Movement of the virus from an infected area to an uninfected area/reefs by human activity not mentioned above
Low risk activities	
5A	Unloading of abalone for processor pick-up, where abalone is repacked on wharf or boat ramp
1B	Movement of contaminated equipment and personnel by recreational diving and angling from infected stocks/area to an uninfected stocks/area within Tasmanian State waters
2D	Movement of equipment and personnel to other land based aquaculture facilities.
7D	Unintentional transfer of live animals from farm to the marine environment via feral or escaped stock
10D	Inappropriate disposal of shells and waste material into the marine environment
12D	Potential for imported feed to transmit disease to farmed abalone

Appendices

Appendix 1: Definitions

For the purposes of this risk assessment the following definitions apply:

Active Surveillance- Structured sampling and monitoring program that is used to detect a change or trend in the health of a population.

Amplification- The increase in concentration of a disease causing organism (ie AVG) within a population resulting in greater shedding of the organism into the environment and increase chance of uninfected populations being exposed to an infective dose.

Biosecurity- Processes or systems applied to protect from the introduction or establishment of an infective pathogen within wild or farmed abalone stocks. Examples of such measures may include, but not restricted to, movement restrictions, decontamination measures, inspections procedures and public awareness programs.

Code of Practice (COP)- Rules established by regulatory bodies or industry associations, which are intended as a guide to acceptable or behaviour best practice. As such they do not have the force of law behind them and are generally not mandatory.

Infective dose- The minimum dose of disease causing organism (in this case AVG virus) required to provide transfer of disease to a previously uninfected host.

Infection to detection period- The period of time that newly established disease within a previously naive population would be expected to be detected by existing surveillance networks currently operation within Tasmania. In this case, a period of four weeks has been applied for AVG.

Passive Surveillance- Reports of disease or diagnostic samples collected from unsolicited sources and are used to detect a change or trend in the health of a population.

Standard Operating Procedure (SOP)- A written document which details an operation, analysis, or action whose mechanisms are prescribed thoroughly and which is commonly accepted as the method for performing certain routine or repetitive tasks to meet an objective such as biosecurity or health control. Compliance can be mandated and monitored.

Appendix 2: Acronyms

DPIW- Tasmania Department of Primary Industries

CVO- Tasmanian Chief Veterinary Officer

AVG- Abalone viral ganglioneuritis

ALOP- Appropriate level of protection

Appendix 3: Members of the AVG risk assessment workshop

Alan Gray	Tas Abalone Council (diver / quota holder)
Dean Lisson	Tas Abalone Council (exec/ diver/quota holder)
Tony Johnson	Tas Abalone Council (Processor)
Nick Savva	Tasmanian Abalone Growers Association
Mike Wing	Tasmanian Abalone Growers Association
Neil Stump	Tasmanian Fishing Industry Council
Rod Andrewartha	DPIW Chief Veterinary Officer
Judith Handlinger	DPIW Veterinary Pathologist
Kevin Ellard	DPIW Senior Veterinary Officer (Aquatic Animal Health)
Andrew Sharman	DPIW Manager Abalone Wild Fisheries
Grant Pullen	DPIW Manager Wild Fisheries
Robert Gott	DPIW Manager Marine Farming
Matthew Bradshaw	DPIW Manager Scale Fish

Appendices

Catherine Campbell Minister's Office (Observer)