FINAL REPORT

Aquatic Animal Health Subprogram: development of a national translocation policy using abalone and prawns as templates for other aquatic species

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October 2006

FRDC Project No. 2004/080

Australian Government
Department of Agriculture, Fisheries and Forestry

Department of Fisheries

Fish for the future

Australian Government
Fisheries Research and Development Corporation

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Title: Aquatic Animal Health Subprogram: development of a national translocation policy using abalone and prawns as templates for other aquatic species

The Fisheries Research and Development Corporation plans, invests in and manages fisheries research and development throughout Australia. It is a federal statutory authority jointly funded by the Australian Government and the fishing industry.

Printed by Department of Fisheries, PO Box 20, North Beach WA 6920. October 2006

Fisheries Research Contract Report No. 14.
ISBN 1 877098 95 7

GLOSSARY

Appropriate level of Protection (or Acceptable Level of Risk): *The level of protection deemed appropriate by the member [state] establishing a sanitary or phytosanitary measure to protect human, animal or plant life or health within its territory.* (SPS Agreement, Annex A, Definition 5, words in [] are ours).

Biodiversity: *Biological diversity or biodiversity refers to the variety of life forms: the different plants, animals and micr-oorganisms, the genes they contain, and the ecosystems they form. It is usually considered at three levels: genetic diversity, species diversity and ecosystem diversity* (Anon. 1993).

Environment: *Environment is made up of physical, biological, chemical and social components* (HB 203:2004).

Pathogenicity: *The quality or state of being pathogenic, the potential ability to produce disease* (Shapiro-Ilan et al. 2005).

Risk: *The chance of something happening that will have an impact on objectives. It is measured in terms of a combination of the consequences of an event and their likelihood* (AS/NZS 4360: 2004). Note that the "objectives" are those of the community, not the proponent.

Risk Analysis: *A systematic process to understand the nature of and to deduce the level of risk* (Australian Standard AS/NZS 4360: 2004).

Risk Assessment: *The overall process of risk identification, risk analysis and risk evaluation.* It is an iterative process, as set out in the Australian Standard AS/NZS 4360: 2004.

Risk Evaluation: *The process of comparing the level of risk against risk criteria* (Australian Standard AS/NZS 4360: 2004)

Risk Identification: *The process of determining what, where, when, why and how something could happen* (Australian Standard AS/NZS 4360: 2004)**.**

Risk Management: *The culture structures and processes that are directed towards realising potential opportunities whilst managing adverse effects* (Australian Standard AS/NZS 4360: 2004)**.**

Translocation: *The movement of live aquatic material (including all stages of the organisms life cycle and any derived viable genetic material): -beyond its accepted distribution; to areas which contain genetically distinct populations; or to areas with superior parasite or disease status* (Anon. 1999)**.**

Alternatively:

The movement of living organisms from one area with free release in another. (International Union for the Conservation of Nature and Natural Resources (IUCN 1987). The IUCN distinguish three different classes of translocation:

- *Introduction of an organism: is the intentional or accidental dispersal by human agency of a living organism outside its historically known native range.*

- *Reintroduction of an organism: is the intentional movement of an organism into part of its native range from which it has disappeared or become extirpated in historic times as a result of human activities or natural catastrophe.*

- *Restocking: is the movement of numbers of plants or animals of a species with the intention of building up the number of individuals of that species in that habitat* (ICUN 1995).

LIST OF ABBREVIATIONS

ALOP	Appropriate Level Of Protection
BMNV	Baculoviral Midgut Gland Necrosis Virus
CSIRO	Commonwealth Scientific And Industrial Research Organisation
DNA	Deoxyribose Nucleic Acid
FRDC	Fisheries Research And Development Corporation
GAV	Gill Associated Virus
HPV	Hepatopancreatic Parvo-Virus
IHHNV	Infectious Hypodermal And Haematopoetic Necrosis Virus
ISH	*In-Situ* Hybridization
LOV	Lymphoid Organ Virus (Same as GAV)
LPV	Lymphoid Parvovirus
MBV	Monodon Baculovirus
MoV	Mourilyan Virus
NSW	New South Wales
NT	Northern Territory
OIE	Office International des Épizooties (World Organisation for Animal Health)
PCR	Polymerase Chain Reaction (A method of copying DNA)
PL's	Post-Larvae (Of prawns and shrimps)
QLD	Queensland
RLO's	*Rickettsia*-Like Organisms
SA	South Australia
SMV	Spawner-isolated Mortality Virus
SPF	Specific Pathogen Free
TAS	Tasmania
VIC	Victoria
WA	Western Australia
WSSV	White Spot Syndrome Virus
YHV	Yellow Head Virus

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PROJECT INVESTIGATORS

Project title:	Aquatic Animal Health Subprogram: development of a national translocation policy using abalone and prawns as templates for other aquatic species
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2004/080 Aquatic Animal Health Subprogram: development of a national translocation policy using abalone and prawns as templates for other aquatic species

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OBJECTIVES

- *To develop a single consistent translocation policy document for live temperate abalone, involving Victoria, Tasmania, South Australia and Western Australia, which is based on scientific risk assessment principles; recognises that the disease status of wild abalone populations is still unclear; may recognise different zones of "risk" and is consistent with Australia's international obligations.*

- *To develop a single consistent translocation policy document for live prawns, involving Queensland, Northern Territory, New South Wales and Western Australia, which is based on scientific risk assessment principles; recognises that the disease status of wild prawn populations is still unclear; may recognise different zones of "risk" and is consistent with Australia's international obligations*

- *To indicate how these policies can be a template for other translocation issues*

NON-TECHNICAL SUMMARY

The use of scientifically based hazard identification, risk analysis and risk management is fundamental to managing unwanted effects. Hazards, such as quarantine incursions, will continue to occur despite the use of risk assessment methodologies but the frequency and severity of their occurrence will be reduced.

This was recognised by the Ministerial Council on Forestry, Fisheries and Aquaculture in 1999 when they published the "*National policy for the translocation of live aquatic organisms*".

This FRDC project provides a simple risk assessment methodology based on the Australian Standard for Risk Management (AS/NZS 4360: 2004) and one that is consistent with the Ministerial Council policies. It was trialled in a workshop situation involving stakeholders to derive scores for likelihood and consequences associated with identified hazards. From these scores a risk rating can be obtained that will indicate whether risk management measures need be applied. At the workshop a number of management measures were suggested for reducing risks associated with abalone and prawn translocations and these are documented. However, the application of management measures is an issue for individual jurisdictions who assess the risk in terms of their own acceptable level of risk and then adopt appropriate management measures. For example, the risks associated with translocation of trout in

Tasmania have far greater consequences to that state than the same risks would in Western Australia. .

Overall, and for both abalone and prawns, the known risks associated with translocation of selected lines of juvenile stock bred in high health hatcheries and of known disease status, to onshore grow out facilities should prove to be manageable in terms of risk. Examples of translocation management measures adopted in Western Australia and Queensland are provided as appendices. Translocation of animals of known disease status into open water or semi-open water culture situations is more problematic and is likely to be influenced by genetic issues as well as disease issues.

The risk assessment methodology used is readily adaptable to other species and to risks associated with the environment or genetic issues, though, with the exception of fouling organisms on abalone, these were not specifically addressed during the workshop.

Domestic trade is governed by the Commonwealth Government's *Mutual Recognition Act 1992* and complementary legislation. This ensures that consistency with World Trade Organisation and sanitary and phytosanitary principles extends to trade between States and Territories. It is probable that States and Territories will adopt differing entry requirements due to differing assessments of risk based on individual assessments of likelihood and consequence, and variations between acceptable levels of risk between jurisdictions. However, the measures adopted and the reasons for their adoption must be documented and they must be science based.

OUTCOMES ACHIEVED

I. The project has documented a simple risk assessment process "*The application of risk assessment to interstate aquatic animal movements*" that can be used to assess the likelihood and consequences of any translocation including ecological and genetic considerations.

II. The risk assessment process involved convening a workshop of key personnel to identify hazards and assign scores to likelihood and consequences of a specified event, though due to time and resource constraints, genetic issues were not explored during the workshop.

III. The workshop process proved successful in developing a consensus view of the level of perceived risk.

IV. The project has also documented the main disease hazards facing both Australian abalone and prawn translocation as at December 2004.

V. The project has raised the awareness of states and territories of the need for documenting their risk assessment processes that are required to underpin all management measures applied to translocations.

VI. The workshop process identified several key recommendations for future research to underpin (and streamline) translocation and management policies.

VII. A single translocation document has <u>not</u> been achieved. However, the principles developed during the workshop process have been incorporated in documents produced by several jurisdictions.

This document reflects the information available to the workshop participants in November 2004 and also that became available during development of the document, up to December 2005.

It is recognised that jurisdictions are now rapidly developing their own documents to underpin their translocation activities and also that the scientific information on diseases is still evolving.

In particular, the advent of abalone ganglioneurites in Victoria in 2006 has not been included, however, the principles contained in this document still apply

KEYWORDS

Abalone, aquaculture, prawns, shrimp, translocation, risk assessment.

ACKNOWLEDGEMENTS

Under this project, a workshop was conducted in Melbourne. Subsequently members assisted by providing detailed and helpful comments on various drafts of this final report.

The members of the Workshop were:

Brian Jones	Principal Investigator
Tina Thorne	Facilitator
Fran Stephens	Department of Fisheries, Western Australia
Tiina Hawkesford	Queensland Department of Primary Industries
Eva-Maria Bernoth	Australian Government Department of Agriculture Fisheries and Forestry
Ann Fleming	FRDC Abalone Aquaculture subprogram
Colin Johnston	Primary Industries and Resources, South Australia.
Mark Gervis	Southern Ocean Mariculture (abalone farmer)
Peter Beers	Biosecurity Australia
Sue Leelawardana	Biosecurity Australia
John Humphrey	Department of Primary Industry and Fisheries, Northern Territory
Matthew Landos	NSW Department of Primary Industries
Rod Andrewartha	Department of Primary Industries Water and Environment, Tasmania
Mehdi Doroudi	Department of Primary Industries, Victoria
John Talbot	Department of Agriculture Fisheries and Forestry
Judith Handlinger (part)	Department of Primary Industries Water and Environment, Tasmania
Martin Breen (by telephone)	Prawn Producers Association

BACKGROUND

One of the research strategies of the Fisheries Research and Development Corporation (FRDC) Abalone Aquaculture Subprogram is to both increase and apply knowledge of genetics to improve the performance of farmed stock. To that end, there are four funded FRDC projects on abalone genetics (2000/201; 2000/202; 2001/254; 2002/202). Since 2000, through FRDC funding of these projects, the abalone aquaculture industry has established a national selective breeding program for commercial temperate abalone species.

At the same time, there is an increasing desire by prawn farmers to source *Penaeus monodon* broodstock from Western Australia. There is also a national research program to close the life cycle of *P. monodon* that, if successful, will ensure that requests for trans-border movements of *P. monodon* expand dramatically.

To maximize gains from these breeding programs they will need to cross best performing stock. Where the stock is located in different states there is a need to move the animals across state borders, preferably as broodstock animals, but the ability to move gametes or larvae would be viewed as significant progress towards achieving the objectives of the program. The project leaders are also requesting that the business of selling genetically enhanced stock not be restricted to customers within state borders as this limit would make the program economically unviable.

The economic advantage from the breeding programs is predicted to be significant given the potential for improvements in production. However, there is no nationally agreed translocation process for any aquatic species, though the 1999 Ministerial Council policy document '*National Policy for the Translocation of Live Aquatic Organisms – Issues, Principles and Guidelines for Implementation*' (Anon. 1999) does provide some guidance.

On 25th April 2003, the FRDC approached each state, through the abalone aquaculture subprogram, seeking advice on the best way to progress the issue. In a letter seeking state assistance, FRDC noted industry's recognition of the risks of translocation and cited evidence, activities and circumstances to support a decision to allow abalone movement. It specifically sought state assistance in developing a national translocation protocol for the land-based abalone industry.

In addition to the FRDC approach, international obligations that underpin the quarantine provisions require that the measures used to control movements of aquatic animals within Australia should, in cases where the risk is similar, be consistent with the requirements that Australia imposes on importers. While the federal government is responsible for the movement of aquatic animals into and out of Australia, it is the state and territorial governments who share the responsibility to control interstate movements of aquatic animals. A consistent approach to assessing and managing risk with interstate movements within Australia is therefore needed to support import controls and to avoid adoption of state policies that might undermine national import controls.

NEED

With the increasing demand for movement of live aquatic animals between jurisdictions within Australia, there have been a number of state or territory specific policy documents issued that attempt to assess and manage the risk associated with translocations across borders. However, these have tended to concentrate on risk management measures and the risk assessments on which the management measures are based have not always been made available. Exceptions include a qualitative risk assessment of the effects of shellfish farming in Tasmania (Crawford 2003) and qualitative risk analyses undertaken for specific high-risk activities in Queensland, including exotic fish culture, aquaculture of bait and aquaculture of barramundi (DPIF 2004). South Australia has also recently produced a number of risk assessment based policy documents including one on the translocation of barramundi (Anon. 2005). Victoria is also actively developing translocation documents for mussels and, as of late 2005, abalone.

OBJECTIVES

This project was funded through the FRDC subprogram on aquatic animal health with the objectives:

- *To develop a single consistent translocation policy document for live temperate abalone, involving Victoria, Tasmania, South Australia and Western Australia, which is based on scientific risk assessment principles; recognises that the disease status of wild abalone populations is still unclear; may recognise different zones of "risk" and is consistent with Australia's international obligations.*

- *To develop a single consistent translocation policy document for live prawns, involving Queensland, Northern Territory, New South Wales and Western Australia, which is based on scientific risk assessment principles; recognises that the disease status of wild prawn populations is still unclear; may recognise different zones of "risk" and is consistent with Australia's international obligations.*

- *To indicate how these policies can be a template for other translocation issues.*

METHODS

A one day workshop was held in Melbourne with invited representatives from Tasmania, Western Australia, Northern Territory, Victoria, South Australia, New South Wales, Queensland, Department of Agriculture Fisheries and Forestry, the Prawn Producers Association and the FRDC Abalone Aquaculture Subprogram to examine current legislation and translocation policies for each jurisdiction, to review current information on abalone diseases, and to formulate a draft translocation policy.

The resulting document was refined through e-mail before being submitted for comment to the subprogram and National Aquatic Animal Technical Working Group. The final document will be referred to AAHC for endorsement and a recommendation that Standing Committee endorse it.

DISCUSSION

WHAT IS UNDERSTOOD BY "TRANSLOCATION" AND WHAT HAS ALREADY BEEN AGREED?

The 1999 '*National Policy for the Translocation of Live Aquatic Organisms – Issues, Principles and Guidelines for Implementation*' (Anon. 1999) defines translocation as:

"The movement of live aquatic material (including all stages of the organisms' life cycle and any derived viable genetic material):

-beyond its accepted distribution

-to areas which contain genetically distinct populations; or

-to areas with superior parasite or disease status"

The following principles were endorsed by Standing Committee on Fisheries and Aquaculture in 1997 and are taken from the national translocation policy:

1. *Translocation of an aquatic species or non-indigenous stocks of such species may have a clear potential economic, social or conservation benefit, but it is recognised that translocation of aquatic organisms can involve serious risks for the receiving ecosystem (and human health).*

2. *Translocations into catchments or maritime regions that are under more than one jurisdiction, for example the Murray Darling system, require the agreement of all relevant jurisdictions.*

3. *All translocation proposals should undergo an adequate and balanced risk assessment process particularly with regard to the pest potential, disease status, potential to introduce parasites and diseases and possibilities of affecting biodiversity, in accordance with consistent risk assessment protocols aimed at minimising adverse impacts.*

4. *A decision to permit translocation may include a protocol that may be used for similar translocations.*

5. *The risk assessment will include assessment of the likelihood and consequences of an introduction and the mechanism for risk management and minimisation. Where aquatic organisms are released into the wild, considerations of habitat preservation, threatened species status, and the genetic effects need to be evaluated.*

6. *Whenever disease and parasite considerations are adequately addressed, translocation of "threatened" species for the purpose of stock rehabilitation is supported with appropriate measures to ensure the genetic diversity and integrity of the species.*

7. *Monitoring programs will be used by implementing agencies to assess and improve the accuracy of predictions generated by risk assessments and the effectiveness of management strategies applied to translocations.*

However, the *National Translocation Policy* does not adequately explain how "*an adequate and balanced risk assessment process"* or "*assessing effects on biodiversity*" (principle 3, above) should be carried out in practice. In addition, where animals are released into the wild "*considerations of habitat preservation, threatened species status, and the genetic effects need to be evaluated"* (principle 5, above) and methods for doing this are not provided.

HOW CAN THIS DOCUMENT BE APPLIED TO OTHER TRANSLOCATION DOCUMENTS?

The principles set out in this project are based on standard risk assessment principles, as set out in the national translocation policy (Anon 1999) and following the Australian Standard (AS/NZS 4360: 2004). If the method is followed, it is possible to assess the risk in a manner that will satisfy the need for scientific transparency.

The method is ideally suited to a workshop format, with involvement of stakeholders, and can be applied to genetic and environmental issues as well as to disease hazard information. The main challenge with the workshop format is to ensure that participants capture their comments in support of the scores assigned to likelihood and consequences.

It is also important that, where risk values are higher than the acceptable level of risk, the management measures imposed do actually reduce the risk in a documented and defensible way. Failure to do this may lead to challenges to the risk assessment outcomes.

Where the origin and destination of the stock are of similar known disease risk it is unlikely that disease testing will be required. An exception is where the receiving jurisdiction has a formal surveillance program in place testing local stock for disease, in such cases translocated stock may need to be tested to the same level.

THE APPLICATION OF RISK ASSESSMENT TO INTERSTATE AQUATIC ANIMAL MOVEMENTS

INTRODUCTION

The principal agreements governing international movement of aquatic animals are the General Agreement on Tariffs and Trade and the Sanitary and Phytosanitary Agreement. These can be found on the World Trade Organisation website (http://www.wto.org/). These require that 'quarantine risk' for member countries is assessed and managed through a process of risk assessment. The process followed by Australia has been documented in the *Import Risk Analysis Handbook 2003* published by Biosecurity Australia, Department of Agriculture, Fisheries and Forestry Australia (http://www.affa.gov.au).

Australia has never had a "no risk" policy for imports or for translocations into Australia. (Senate Standing Committee 1979; Senate Rural and Regional Affairs and Transport Committee 1995). Such a policy would mean, for example, a ban on most imports, untenable restrictions on the movements of passengers, aircraft and ships and control over the movement of migratory species (Anon. 1988). Instead, Australia seeks '*to limit the level of quarantine risk to one that is acceptably low'* (Quarantine Proclamation 1998, clause 70).

Other consistent risk assessment approaches have also been documented. The joint Network of Aquaculture Centres in Asia / Food and Agriculture Organisation handbook "*Manual on risk analysis for the safe movement of aquatic organisms*" is available online at (http://enaca.org.).

The World Organisation for Animal Health (OIE) has also published two volumes on import risk assessment. They can be found at http://oie.int/eng/publicat/ouvrages/A_IRAvol1.htm.

The use of scientifically based hazard identification, risk analysis and risk management is fundamental to managing unwanted effects. Hazards, such as quarantine incursions, will continue to occur despite the use of risk assessment methodologies but the frequency and severity of their occurrence will be reduced.

THE PROCESS OF RISK ASSESSMENT

The risk assessment process is a tool that has been widely used in commercial and industrial fields as well as for quarantine and translocation applications. An Australian Standard, AS/NZS 4360: 2004, and an accompanying handbook, HB 436: 2004 are available and describe the generic risk assessment process.

A risk assessment requires several steps:

- Establish the 'scope' or context;
- Hazard identification or 'risk identification' (what can go wrong);
- Risk analysis and 'risk evaluation' (how likely is it to go wrong?);
- Risk management (what can we do about it?);
- Monitor and regularly review the effectiveness of all steps in the process.

Establish the Scope or Context. The limits to the risk assessment process and the situations to which the assessment is applicable must be defined. For example, the species involved and the extent of the movements to be considered by the assessment must be defined.

The risk assessment will be a snapshot in time and space (which should both be defined) since new data or situations may require that the assessment be revised or extended.

Hazard Identification involves identifying:

- What parasites and diseases are present? What is known of their distribution and host susceptibility?
- What genetic issues are associated with the translocation?
- What environmental impacts associated with the translocation, including feral population (escapement) issues associated with the translocation and the potential for translocation of associated species?
- The national translocation policy also requires that, for release into the wild, considerations of habitat preservation, threatened species status and genetic effects need to be considered (Anon. 1999, Article 5).

Risk analysis and evaluation examines, for each of the identified hazards:

- What is the 'likelihood' of:
    - The hazard being introduced (or released);
    - The hazard being spread (or establishing).
- What are the 'consequences' of occurrence?
    - Including biodiversity and habitat impacts;
    - Economic consequences
    - Biological (and social) impacts

Risk can be assessed in a quantitative manner, in which the likelihood and consequences are expressed in mathematical terms and the risk is expressed in terms such as "one event in 100

years". This approach presents particular challenges (Murray 2002) and usually involves Monte Carlo simulation modelling (Vose 2000). An alternative approach, particularly where information is scarce, is to use a qualitative or semi-quantitative method where likelihood and consequences are expressed in terms such as "high", "medium" or "low". This approach is the one that was used in this project.

Likelihood estimation. Likelihood is a general description of probability or frequency (AS/NZS 4360: 2004). For the purposes of this project, 'likelihood' has been described according to the likelihood table (Table 1). It should be noted that likelihood tables can have more than four levels and the descriptors can be altered. The interpretation of the descriptors should reflect the scope or context of the risk assessment.

Table 1 Likelihood Table

Level	Descriptor
Negligible (1)	Chance of event occurring is so small that it can be ignored in practical terms.
Low (2)	Event would be unlikely to occur.
Moderate (3)	There is less than an even chance of the event occurring.
High (4)	Event would be expected to occur.

Consequences assessment. These are the outcomes, or impact of a given event. The following 'general consequences table' was also used (Table 2). The factors that may be considered when evaluating 'consequences' for disease incursion are, by international agreement, constrained. They include only the potential damage in terms of loss of production or sales in the event of the entry, establishment or spread of a pest or disease, the costs of control or eradication and the relative cost effectiveness of alternative approaches to limiting risks (Sanitary and Phytosanitary Agreement, Article 5.3). The potential for environmental damage is also very important but is not considered by the Sanitary and Phytosanitary Agreement.

As with the other tables, the number of levels and the descriptors of the effects can be varied. The scales should be chosen to reflect the needs of the study. Those used in Table 2 were derived for the purpose of this project. Where different types of consequence are shown together in the descriptor it is assumed that they are equivalent.

Table 2 The General Consequence Table

Level	Descriptor
Negligible (0)	Establishment of the disease would have no significant biological consequences, may be transient and/or readily amenable to control or eradication and; Economic effects may be low at an enterprise level and insignificant at an industry level and; Effects on environment negligible.
Low (1)	Establishment of the disease has mild biological consequence and would be amenable to control or eradication and; May harm economic performance at an enterprise level but be of limited significance at an industry level and; Effect on environment would be minor or temporary.
Moderate (2)	Establishment of the disease has moderate biological consequences and disease may be amenable to control or eradication, at a significant cost and; May harm economic performance at an industry level and; May affect the environment, but not seriously and may be reversible.
High (3)	Establishment of the disease would have serious biological consequences (high mortality or morbidity etc) with effects that would be felt for a prolonged period and would difficult to control or eradicate and; Will significantly harm economic performance at an industry level or regional level and may cause serious harm to the environment.
Catastrophic (4)	Establishment of the disease would significantly harm economic performance at a national level and; May cause long-term or irreversible harm to the environment.

The overall level of risk is calculated as the mathematical product of the likelihood and consequence levels (Risk = Likelihood X Consequence) and is called the 'risk value'. In our example risk value has a possible value from 0 to 16. These values are usually displayed as a 'risk matrix table' (Table 3). From the 'risk value' each issue can be assigned a 'risk ranking' depending upon where a risk value falls within one of a number of predetermined categories or criteria (Table 4).

Though the method is based on an arithmetic scale for ease of calculation, the nature of 'consequences', in particular, is not linear. The risk values in table 3 have been separated into three risk ranking categories. Jurisdictions may consider more or fewer risk ranking categories to be appropriate, but three is a commonly used number (HB 436: 2004).

Table 3 Risk Matrix – numbers in cells indicate Risk Value, the colours/shades indicate Risk Rankings (see Table 4 for details)

		Consequences				
Likelihood		**Negligible**	**Low**	**Moderate**	**High**	**Catastrophic**
		0	**1**	**2**	**3**	**4**
Negligible	**1**	0	1	2	3	4
Low	**2**	0	2	4	6	8
Moderate	**3**	0	3	6	9	12
High	**4**	0	4	8	12	16

Table 4 Risk Rankings and Outcomes

Risk Rankings	Risk Values	Likely Management Response
Negligible Acceptable	0-4	Risks are acceptable and are managed through current procedures.
Moderate Management Required	5 – 8	Risks are acceptable provided Risk Reduction measures are implemented to reduce risk to acceptable level.
Extreme Unacceptable	9 – 16	Risk is unacceptable. Risk management measures will be required to achieve "acceptable risk", or it may not be possible to meet the "acceptable risk" at all.

Acceptable risk. The acceptability of risk in a particular circumstance is perceived differently by different individuals and organizations including governments. Governments accept taking risks because of the net community benefits (which may be environmental, social or financial) that are expected to accrue from their risk-taking behaviour. The amount of risk they will tolerate (i.e. the 'expected loss' if things go wrong) is known by a variety of terms including 'acceptable level of risk' (SPS Agreement), 'tolerable risk' (HB 436: 2004) or the 'appropriate level of protection (ALOP)' (Biosecurity Australia). There is an excellent explanation of the concept of "tolerable risk" in HB 436: 2004 (page 65-66).

The 'acceptable level of risk', once determined, should be applied consistently, without any arbitrary variation when applied to different situations whether for plants, mammals or fish.

Australia's ALOP and 'acceptable risk'. The Agreement on the Application of Sanitary and Phytosanitary Measures refers to the 'level of protection deemed appropriate by the member establishing a sanitary or phytosanitary measure to protect human, animal, or plant life or health within its territory (SPS Agreement, Annex A, para. 5). This is described by Australia as its 'appropriate level of protection', or ALOP. The ALOP is not defined but is a concept embodied in the totality of quarantine policies and practices developed by Australia over

time. Australia has, since the 1950's, managed quarantine risk by reducing it to 'very low levels', 'while not based on a zero-risk approach', i.e. Australia has a conservative ALOP (Anon. 1988; WT/DS18/AB/R para. 197).

States and territories that are undertaking translocation risk assessments will need to apply their own 'tolerable risk' or 'acceptable level of risk' based on their own assessment of likelihood and consequences and depending on the risk that they are individually prepared to accept[1]. That acceptable level of risk will vary between states and territories depending on such factors as environmental conditions and species present. Again, **jurisdictions should ensure that their 'acceptable level of risk' is applied consistently, without any arbitrary variation, when applied to different situations whether for plants, mammals or fish.**

Under the national treatment provisions of the SPS Agreement members may not set different levels of protection between imported commodities and those produced domestically, where there are hazards in common. It is therefore important that states and territories ensure that their 'acceptable level of risk' aligns with the national ALOP.

Once a risk has been assessed, risk management measures may be required.

RISK MANAGEMENT

Risk management involves the process of identifying, evaluating and monitoring measures that can be taken to ensure that the risk is reduced to a level consistent with the acceptable level of risk. This can be done either by reducing the probability of the event occurring (preventative measures), or by reducing the consequences should the event occur (mitigation measures). The measures that are implemented must be the minimum required to achieve the acceptable level of risk and are not to be used as a disguised restriction on trade**.** They must also be "transparent" i.e. readily available to interested parties and the scientific justification provided as required.

The assessment of acceptable risk in each state will be affected by local factors. This may lead to variations in acceptable level of risk and in risk management measures between jurisdictions within Australia. For example, the disease risks associated with the translocation of salmonids will be of much greater concern to Tasmania than to Queensland.

Where there are problems between the acceptable risk between jurisdictions, or within jurisdictions, the setting up of 'zones' to reflect hazards is an acceptable risk management measure. For an explanation of the generic principles of zoning based on pathogen distribution, the movement principles between zones, and international relevance of national zoning please see the 'AQUAPLAN zoning policy guidelines' available from the Department of Agriculture Fisheries and Forestry website (http://www.affa.gov.au). This concept of zoning is being actively pursued by the Northern Territory (John Humphrey, pers.com.).

The risk assessment process is iterative, that is to say, the process of assessing the risk should be repeated, assuming that the risk management strategy is in place, to show that each measure in the management strategy will have the desired effect of reducing risk.

[1] An explanation of how Victoria assesses "Acceptable Level of Risk" is to be found in DPI 2003.

This iterative step also serves to check that the strategy achieves the required level of protection in the least trade-restrictive manner. For example, a risk management strategy that achieves a reduction in the risk would be a total prohibition on movement but there may well be less trade-restrictive measures that could achieve an acceptable reduction in risk and these must be used instead.

UNCERTAINTY AND RISK

Risk is characterised by uncertainty (HB 436: 2004). It is important to clearly document uncertainty and its effect on the risk analysis so that the decision maker can evaluate both the level of risk and the degree of uncertainty in the estimate when making a decision. It is also important to remain objective during the risk analysis and evaluation phase. One of the criticisms raised by the New Zealand Government against the Australian "*Draft Import Risk Analysis on the Importation of Apples from New Zealand*" (MAF 2000) was that instances occurred where "a logical conclusion based on science has been reached but because of "uncertainty" (or perhaps consequences) further conservatism is introduced. The New Zealand document makes the point that consideration of the ALOP should only be introduced at the risk management stage and not during the risk assessment stage. The ALOP should not be allowed to influence the objective process of estimation of risk from scientific evidence (MAF 2000).

MONITOR AND REVIEW ASSESSMENT

This recognises that circumstances change, often quite quickly. New information on hazards will become available, industry practices will change and management measures may no longer be appropriate. The risk assessment process should be regularly reviewed, preferably in consultation with stakeholders. One way of achieving this is to include a 'review by' date on the document.

OUTLINE OF A DRAFT RISK ASSESSMENT FOR ABALONE AND PRAWNS

Using the above principles and framework some of the identified hazards were put through a risk assessment process at a workshop held at the Victorian Department of Primary Industries Attwood Conference Centre, Melbourne on 18th November 2004. These were further developed "out of session" during the early part of 2005 and give a practical example of how a risk assessment could be documented.

The process provided here can be applied to any situation where animals are to be translocated.

DRAFT ABALONE RISK ASSESSMENT

BACKGROUND

Abalone forms the basis of a valuable industry in New South Wales, Victoria, Tasmania, South Australia, and Western Australia. Total Australian production (wild and farmed) in 2003-04 was worth $238 million (ABARE 2005). There are two main commercial species of abalone in Australia and both are endemic. Greenlip abalone cluster in favourable habitat on inshore rocky reefs from 10 m to about 40 m and are distributed from Victoria to Western Australia including Tasmania and Bass Strait. Blacklip abalone live in crevices on reefs to about 10 m depth and have a nearly continuous distribution from New South Wales around the south coast of the continent to Western Australia including Bass Strait and Tasmania. Drift algae dominate the diet of both species (Shepherd 1973, Shepherd & Cannon 1988).

The commercial fishery is primarily a dive fishery. Abalone are removed from the shell and then cleaned and processed. Almost the entire catch is exported, primarily to Japan and Hong Kong. Abalone are grown onshore or in marine farms using a variety of culture techniques. In South Australia there is one abalone farm based in a ship.

SCOPE OF ABALONE RISK ASSESSSMENT

For the purposes of the workshop this risk assessment is confined to abalone:

- Sourced from the wild in Australia and intended for broodstock on farms;
- Sourced from farms for translocation to other farms within Australia;
- Other than live animals sold to the ornamental trade;
- Other than live product sold to the retail market for food.

This risk assessment only considered Australian endemic diseases. The responsibility for assessing animal and plant risks associated with movements into or out of Australia rests with Biosecurity Australia.

Live wild abalone are also transported between states for commercial processing purposes and this too poses a risk of pathogen transfer. However, this practice does not come within the definition of a "translocation" and thus falls outside the present project. Nevertheless, there also needs to be a risk assessment for that practice.

HAZARD IDENTIFICATION FOR ABALONE

The parasites and diseases associated with abalone in Australia are being identified through a national project (FRDC 2002/201) coordinated by Dr Judith Handlinger. Her project team has examined over 3000 abalone from Western Australia, South Australia, Victoria, New South Wales and Tasmania. Unfortunately, the final results of that study were not available at the time of finalising this document.

Hazards identified at the workshop are:

- *Perkinsus* sp.
- *Vibrio* spp.
- Flavobacteria
- Non-specific fungal infections
- Mudworm infections
- Gill ciliates
- Cestode metacercariae
- Parasitic flukes
- Shell fouling organisms
- Parasites/viruses/rickettsia-like organisms of unknown significance

Of these reported parasites and diseases, known at the time that the workshop was held, only one, *Perkinsus olseni*, is nationally reportable, and is associated with clinical disease only in South Australia and New South Wales.

RISK ASSESSMENT

The methodology used here involved obtaining a consensus by the workshop attendees as to the consequences and likelihood scores for each identified hazard. The approach taken at the workshop was to condense the likelihood of pathogen transfer and the likelihood of pathogen establishment into one likelihood, that of establishment, and this initially caused some confusion. The likelihood of a pathogen being transferred is quite different from the likelihood that the pathogen will establish or spread in the marine environment once the initial transfer has occurred (either from farm to farm or from farm to the environment). For example, there is a likelihood associated with the transfer of a *Bonamia* infected oyster to a new location, but successful establishment of *Bonamia ostreae* in a new host requires a challenge dose which is much greater than one infected particle and may require a simultaneous challenge with thousands of infectious particles to be successful (Hervio et al. 1995).

For the purposes of the workshop, and to simplify the methodology, the likelihood was defined as the likelihood of pathogen transfer and establishment in the new environment, not that of disease outbreak. The reason for this is that, while the likelihood of successful transfer and establishment can be deduced, the expression of clinical disease involves an interaction between the host (and its existing parasite fauna), the disease agent and the environment that is more complex to predict.

The consequences were based on the potential impact if a disease outbreak were to occur. Some pathogens will spread rapidly through the population causing high mortality, others will be slow to spread and have a limited impact at the population level and this information was incorporated into the scores provided by the workshop attendees.

The product of the consequences score and the likelihood score generated a risk ranking (from Table 3). The justification for the risk ranking was documented in order that the ranking can be defended against criticism. At the workshop, known state and territory differences for each hazard were also documented.

At the workshop, issues raised that were outside of the ability of the participants to resolve but which might have a bearing on the scores were noted as "Major Issues". These generally involved lack of research information and are included in this document after "Next Steps".

GENETIC ISSUES

These are more problematic and were not discussed at the workshop. However, concern was raised at the workshop about the open-ended nature of the translocation definition. Just how are "genetically distinct populations" to be defined? The genome of each individual is unique, and there is still disagreement over the amount of variation required to define a "genetically distinct population". This makes it difficult for managers to make informed translocation decisions.

There are several genetic issues associated with translocation including those associated with movement of genetic material between farms and from wild populations into farms; however, these are primarily farm stock management issues. The environmental questions faced by regulators are those associated with movement of genetic material from farms to wild stocks and the risk posed to the environment by such movements.

Potential genetic impacts due to translocation are summarized by Bulloch et al. (1996). Captive populations are inevitably exposed to selection pressures that are different from those in the wild, and animals bred in captivity may carry deleterious traits that may cause outbreeding depression in wild populations or breakdown of genetic barriers between populations. On the other hand, translocation may bring about an increase in genetic diversity and decrease inbreeding depression.

While there are many papers which document differences in genetic markers between populations within a species, and the differences between wild populations and cultivated populations (Smith & Conroy 1992; Mgaya et al. 1995; Evans et al. 2004), there are few which document the natural variation in the genetics of population cohorts in the wild over time (Smith 1987; Smith & Francis 1983; Fèral 2002), and even fewer which document the effects of translocations on the genetics of wild populations over time (Fèral 2002). Whether changes in genetic markers have any effect on the ecology of the animal concerned is seldom addressed at all (see discussion in Johnson 2000). Gutierrez-Gonzalez and Perez-Enriquez (2005) analysed the genetic diversity at two hatcheries inMexico which were involved in stock enhancement but found that the presence of released larvae in the wild was low, possibly due to mortality or larval dispersal.

Sekino et al. (2005) point out that over 65 marine and brackish water species in 27 countries have been extensively stocked, in places for over 30 years, yet information on the genetic effects of these activities at the population level is still unclear. This is particularly important in that abalone appear to be 'r' selected organisms with a high juvenile mortality rate resulting in limited spawning success in the wild (Barton & Tegner 2000; Gutierrez-Gonzalez & Perez-Enriquez 2005)

The risk associated with abalone genetic material escaping from translocated abalone in an on-shore farm and establishing to breed in the wild were evaluated by Hawkins & Jones (2002). They estimated that the source of broodstock for land-based farms is of little importance in terms of genetic impact on wild populations since the probability of a viable

population establishing from escapees was very low. Johnson (2000) also points out that selective changes to hatchery populations are likely to make the offspring less suited to natural conditions and are therefore less likely to survive and spawn.

A study of *Haliotis roei* populations in south western Australia (Hancock 2000) determined that there were relatively high rates of gene flow across the 3000 km range sampled between Kalbarri in Western Australia and West Island in South Australia. Brown (1991) documented a pattern of decreasing genetic similarity with distance over 2500 km of coast, with an estimated genetic neighbourhood of about 500 km (Johnson 2000) while Conod *et al.* (2002) found that *H. rubra* had restricted gene flow across Bass Strait suggesting that Tasmanian populations were isolated from the mainland but that populations within Tasmania were relatively homogeneous.

In summary, there are not expected to be any long-term genetic consequence from translocating abalone genetic material to a land-based aquaculture facility. The impacts of translocations to the marine environment (barrel culture or grow-out) are unknown and un-quantifiable based on current information.

ENVIRONMENTAL ISSUES

These include the release of abalone from aquaculture into areas where they do not naturally occur, release of abalone in such numbers that they change the population density in an area and the movement and release of incidental organisms living with or on live abalone. In this context, the issue of shell-fouling organisms on abalone was specifically discussed at the workshop to show that the proposed methodology would work. Indeed, the outcome placed shell-fouling organisms in the "Extreme" Risk ranking category (Table 4) that would require risk management measures be applied.

It should be noted that the abalone environmental risk assessment of Crawford (2003) assesses the level of risk of spread of pests and diseases during shellfish aquaculture as "high" without providing any justification for the rankings. All of the examples cited in Crawford (2003) as examples of translocated pests were those that have been spread by non-aquaculture activities. This underscores the need for objective evaluation and detailed documentation.

ABALONE RISK ASSESSMENT – DISEASE HAZARDS

These hazards were discussed in the workshop. The Facts/Issues column and the justification column captured comments raised by those present. The Consequences, Likelihood and Risk Rating were derived by consensus, based on the tables 1-4 (above).

Hazard/Pathogen 1: *Perkinsus* spp.

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
May be strain differences including pathogenic strains but none have yet been documented for *P. olseni*[2]. Agent may or may not cause clinical disease. *P. olseni* may be a normal symbiont of unstressed molluscs[3]. Found in clinically unaffected stock. The organism is found in SA, WA, NSW, Vic and Qld but not TAS[4]. Host range includes 50 species of molluscs[5]. Life stage of parasite that causes disease is unknown, but the parasite has a direct lifecycle.[6] Abalone down to 75mm have been found as positive for the agent in the wild. Stock below this size have not been surveyed but juvenile abalone have been experimentally infected[7]. Presence of disease may affect where broodstock is collected by industry. Seasonal in its expression (higher in	4	2 May be higher for wild stock to farm movements	8 (or higher)	Known to be associated with disease and lesions.[9] Associated with economic loss. Hasn't actually caused a problem to aquaculture farms except in a few instances of wild-caught abalone (despite testing many animals in some states). Mainly in wild stock. Some species of *Perkinsus* are OIE listed, but the justification for this has been questioned. No effective treatment (husbandry practices may affect mortality). More work required on testing methodology (can be negative on histology, but positive on Ray's test). No validated tests (including Rays test) under Australian conditions at this stage and there is no guarantee that PCR

[2] Murrell *et al.* (2002), Goggin and Lester (1995)
[3] Haywood (pers. comm.), Goggin and Lester (1987), Goggin *et al*. (1989) and Hine and Thorne (2000)
[4] Goggin and Lester (1987, 1995), Norton *et al.* (1993), Hine and Thorne (2000)
[5] Goggin *et al.* (1989), Goggin and Lester (1987, 1995), Hine and Thorne (2000)
[6] Villalba *et al.* (2004), Goggin *et al.* (1989)
[7] Lester and Hayward FRDC Project 2000/151

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
higher water temperatures)[8]. Results from Rays test suggest *Perkinsus* in SA is restricted to specific reefs.				will be better than present methods of detection. Cost of testing is expensive (PCR test for *P. marinus* was considerably more sensitive for detection compared with Rays test and histology). Specificity and sensitivity of Rays test for *P. olseni* is unknown. Agent can be maintained in a population at a very low prevalence. Would cause rejection of product if abscess present. Likelihood of stock being infected from an aquaculture facility is low; chance of disease passing out of system to infect wild stocks in unknown.

State Differences
Has been associated with catastrophic losses of wild stocks in NSW. Does not usually have the same effect in SA but some diebacks have occurred. Blacklip *H. rubra* is infected in SA and NSW. Greenlip, *H. laevigata*, is infected in SA but greenlip does not occur in NSW. Disease not seen in abalone in WA, but agent present.

[8] Lester and Haywood FRDC Project 2000/151, Goggin and Lester (1995)
[9] Lester et al. 1981, O'Donoghue et al. 1991.

Hazard/Pathogen 2: *Vibrio* bacteria (*V. harveyi, V. splendidus*)

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Distribution of pathogenic *Vibrio* spp. currently unknown. An issue for aquaculture farms only? Disease is related to temperature; farm management practices; density (stress); hygiene on farm; presence of silt in water supply; water flow rates and tank designs. Tends to affect all life stages.	1	4	4	Causes lesions and mortalities in abalone in farms in SA, TAS, WA, VIC. Agent can be found when no clinical disease present. Easy to detect, test not very expensive. New test kit under development[10]. Can be treated with antibiotics at a farm level prior to sale (subject to withholding period), efficacy related to method of application and antibiotic used. Treatment prior to translocation may not be effective.

State Differences
Poor understanding of distribution of *Vibrio* spp.

Hazard/Pathogen 3: Flavobacteria

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Causes superficial and deep erosions inside the shell[11]. Are not invasive but are secondary invaders in damaged or dead tissue[12].	1	4	4	Agent considered to be ubiquitous in environment.

State Differences
No information.

Hazard/Pathogen 4: Non-specific fungal infections

[10] Carson, J. FRDC Project 2001/628
[11] Handlinger FRDC Project 2002/201
[12] Handlinger FRDC Project 2002/201

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Causes erosions inside the shell, eroded epithelium and agent has been seen in foot.[13]. Thin walled, hard to stain.	1	4	4	

State Differences
No information.

Hazard/Pathogen 5: Mudworm infestations (*B. knoxi, P. hoplura*, etc.)

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Number of species and hosts involved. Related to farm site and management; drawing water from more muddy/silting areas; high populations of molluscs off shore. Shell with high growth rate = less mudworm[14]. Can be transmitted from wild broodstock, including to the wild from aquaculture[15]. Mudworm infestations occur in farms in most states, but are not a major issue in some states (site specific).	2	2	4	Causes mortalities and blisters[16]. Suppresses shell growth. Easy to identify, relatively inexpensive to test for. Causes shell abnormalities. Difficult to filter larvae out of water supply (need to filter below 200µm?). Some work done on treatments at a farm level (some success). If areas are free of mudworm, translocation of infected stock to that area becomes an environmental issue. Size of the animal will affect likelihood of translocation.

State Differences

[13] Handlinger FRDC Project 2002/201
[14] Simon *et al.* (2004)
[15] Kuris & Culver (1999); Radashevsky & Olivares (2005).
[16] Lleonart et al. (2003a,b)

Lack of knowledge of taxonomy and distribution of mudworms means that distribution across states is unknown.

Hazard/Pathogen 6: Gill ciliates

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Species identification and differences are not known.	0	2	0	Not known to be pathogenic and ciliates on gills of molluscs seem to be common.

State Differences
Lack of knowledge of taxonomy and distribution. Present in wild abalone in WA, TAS[17].

Hazard/Pathogen 7: Metacercariae

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Wild abalone can be intermediate hosts for some tapeworm species. Species infecting abalone in Australia have not been identified.	1	1	1	Unlikely to be a problem in on-land aquaculture systems. A suitable final host would need access to abalone for transmission to occur.

State Differences
No information.

[17] Handlinger FRDC Project 2002/201

Hazard/Pathogen 8: Parasitic flukes

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Abalone can be intermediate hosts for Digenea. Species infecting abalone in Australia have not been identified.	1	1	1	Unlikely to be a problem in on-land aquaculture systems. A suitable final host would need access to abalone for transmission to occur.

State Differences
No information on taxonomy or distribution of metacercariae. Wild abalone infected in WA and TAS.

Hazard/Pathogen 9: Shell fouling organisms

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Fouling organisms include: Boring sponges, boring algae, barnacles, seastars, seaweeds, spirorbids.	3	3	9	Ballast water and hull fouling are much greater risks than translocated shell at moving fouling organisms. Ecological risk potential exists - risk to other shellfish (other industries) from borers. Farms may suit some sabellid spp[18]. Sabellid and spionid polychaetes have been translocated and subsequently have escaped from farms with unfiltered effluent[19]. Borers can lead to secondary infections. Shell can be coated with 'Pearl safe' or antifouling paints. Fouling organisms less prevalent on 'onshore' farm bred stock. Some organisms can be dislodged prior to translocation. States would need to establish whether fouling organisms of concern were present in their waters, however, evidence for freedom can be based on historical freedom, not just from targeted surveillance. See the OIE website for the rules: http://www.oie.int/eng/normes/fmanual/A_00013.htm.

State Differences
Lack of information on taxonomy and distribution of fouling organisms.

[18] Simon et al. (2005).
[19] Kuris & Culver (1999); Radashevsky & Olivares (2005).

Hazard/Pathogen 10: Unknown parasites/diseases/viruses/RLOs

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Occasional infections with other parasites/ pathogens such as viruses in the digestive gland, Rickettsia-like organisms (RLOs) and Gregarine's were seen in abalone from most states.[20]	3	3	9	Parasites/pathogens that are endemic in the original species and site are often not identified as pathogens because they are do not cause disease outbreaks. After translocation, a naïve host or new host species may become infected resulting in significant disease.

State Differences
No information.

RISK MANAGEMENT FOR ABALONE TRANSLOCATION

It was an interesting outcome from the Workshop that *Perkinsus*, nationally and internationally reportable, had a risk ranking of at least eight. The ecological threat posed by shell fouling organisms was assessed to be higher, at nine, requiring specific risk management.

For those hazards that require management, there are a range of options available to Managers. **Some** of these, which **may** be used by managers, were identified by the workshop in the following risk management table.

There was some criticism by reviewers that the risk management table gives no indication of the impact of each measure on the "acceptable risk" or whether a combination of measures might be necessary. This was deliberate. It became clear during the course of the project that jurisdictions did not want to be bound by measures that they might or might not want to impose to meet their individual "acceptable risk". Instead a "toolbox" approach was adopted for this project and a number of potential management measures have been tabled.

[20] Handlinger FRDC Project 2002/201

TRANSLOCATION OF ABALONE – RISK MANAGEMENT – OR "CONTROLLING STRATEGIES" TABLE

Hazard/Pathogen	Risk rating	Controlling Strategies					Comments/Issues
		Quarantine Measures	**Facility requirements (design, effluent treatment, recirculation, etc.)**	**Treatment or management requirements.**	**Documentation (translocation app, licence, health certification etc.)**	**Other**	
Perkinsus spp.	8	For wild stock, separation from other stock on farm (before or after movement).	Choice of site location (whether near natural populations). In the marine environment, increasing distance between farm and wild susceptible animals reduces risk of infection through dilution.	Only use visually clean broodstock. Maintain optimal nutrition of stock. Reporting of significant mortalities on a routine basis, with follow-up laboratory analysis.	Statutory Declarations from farmers (surveillance and sampling of wild cohorts for broodstock). Collect stock, produce progeny and batch test, destroy adults (numbers tested depends on confidence level required). History of	Restrict age groups or life stages. Wild versus captive bred stock. Restrict movement to on shore facilities (no open water)[21]. Separation of adults and juveniles at fertilization.	

[21] Imported live fish, eggs and gametes of aquaculture origin should not be released into unenclosed waters. European Commission Decision 2003/858/EC.

				Keeping records of stock numbers, keeping mortalities for examination.	facility testing, taking into account seasonality. Documented health surveillance program.		
***Vibrio* bacteria**	4			Avoid transfer of stock during periods of high temperatures. Hygiene measures.			Doing nothing is an option from a regulatory perspective. Control at a farm level.
Flavobacteria	4						
Fungal infections	4						
Mudworm	4			Visual inspections of stock. Air-drying[22] [23].	Only move stock from farms with no history of mudworm. Only move stock from facilities where water is	Not moving adult shell from known affected areas to uninfected areas?	Successfully eradicated from coastal zone by handpicking affected shell[24].

[22] Lleonart et al. (2003b). May not be effective. See comments and lists of treatments at http://www.pac.dfo-mpo.gc.ca/sci/shelldis/pages/sabelab_e.htm
[23] Air drying recommended by Handlinger et al. FRDC project 98/307

					filtered. Health certification if going to an area free of mudworm.		
Gill ciliates	0						
Metacercariae	1						
Parasitic flukes	1						
Shell fouling organisms	**9**	Quarantine, spawn and then destroy broodstock adults.	Cleaning shell prior to movement. Treat with antifouling paints, etc. Only translocate farm-bred stock from land-based sites (preferably using filtered water).	Visual inspections of stock.	History of freedom from shell fouling on farm.	Smaller shell less likely to have fouling organisms.	
Unknown	**9**	Separation		Stress animals		Restrict	This was put in to

[24] Raloff (1999)

diseases		from other stock on farm (before or after movement) together with effluent water treatment).		to see if the disease occurs in stressed animals[25]. If not, then there may not be a problem.		movement to on shore facilities (no open water).	show that the process would work for a wide range of problems. Where there are scientifically based concerns over pathogens which are present but not causing disease, but which have the potential to cause disease (e.g. rickettsia, microcells in mollusc haemocytes) then some form of disease risk minimisation may be warranted.

[25] Malham et al. (2003) provide evidence for a link between stress and disease outbreaks in abalone.

MONITOR AND REVIEW

Information on emerging diseases or additional information on known diseases will become available when FRDC project 2002/201 (Abalone disease survey) becomes available. The risk assessments associated with abalone will need to be re-evaluated to incorporate new knowledge about hazards, and to ensure that management measures are still appropriate.

NEXT STEPS

It is up to each jurisdiction to complete the 'likelihood' and 'consequences' tables for their jurisdiction, to complete the documentation of the reasons for the scores assigned and then to adopt such management measures as will allow the translocation of abalone to meet their acceptable level of risk.

The use of a workshop of invited expertise to facilitate communication of available scientific information to environmental decision makers is a useful method for developing consensus on risk and has been previously used by the United States Environmental Protection Agency in preparing their 'Report on the shrimp virus peer review and risk assessment workshop (US EPA 1999).

The potential to translocate fouling and boring organisms was identified as the most serious risk. Both that risk, and the risk posed by the identified disease agents, is capable of being managed through a range of management measures, particularly the use of on-shore facilities.

In the case of hatchery reared genetic lines the disease and fouling risks might best be managed through the use of high health hatchery facilities to produce the genetically selected lines. These could then be sold as "specific pathogen free" stock.

There is a lack of information on the prevalence of many Australian disease agents. It was noted during the workshop that: "Absence of evidence is not evidence of absence". This lack of information has a critical bearing on translocation since proposed movements from an area of known infection to an area of unknown disease status will likely be disallowed, but may have been permitted if the disease status of the two areas was known to be similar.

The impact of selected abalone genetic lines on the marine environment is of theoretical concern in the absence of evidence of a real effect over time in sea stocked molluscs and the risks cannot be quantified on evidence currently available.

DRAFT PRAWN RISK ASSESSMENT

BACKGROUND

Principal commercial species in Australia are king prawns (*Melicertus latisulcatus)*, brown tiger (*Penaeus esculentus*) prawns, endeavour (*Metapenaeus endeavouri*) prawns and banana (*Fenneropenaeus merguiensis*) prawns. During the year June 2003 to June 2004 the Australian wild capture prawn fishery yielded over 23 400 t of mixed prawn species, worth $300 million and caught primarily from Queensland waters (54.1%) followed by Western Australia (15.6%), the Northern Territory (14.1%), New South Wales (8%) and South Australia (7.8%). From aquaculture, Queensland grew an additional 3200 t and New South Wales grew 360 t (ABARE 2005). There is substantial recent investment in prawn farming in the northern Territory and a number of licenses for prawn farming have been issued in Western Australia.

Black tiger prawns *Penaeus monodon* provide most of the prawn aquaculture in Australia. All spawning stock is obtained from the wild, either as berried females or pre-spawning adults. However, black tiger prawns are uncommon in Australian waters and occur only as by-catch. In aquaculture, once spawned and hatched, the larvae are kept in tanks and fed algae, zooplankton and formulated feeds. Post-larvae are stocked into ponds in which algal blooms are encouraged. Prawns are also fed a commercial pellet diet. Time to harvest is 4-9 months, depending on temperatures and salinity (http://www.dpi.qld.gov.au/fishweb/2688.html.)

SCOPE OF PRAWN ASSESSMENT

For the purposes of the workshop this risk assessment is confined to prawns:

- Sourced from wild in Australia and intended for broodstock on farms;
- Sourced from farms for translocation to other farms within Australia
- Other than live animals sold to the ornamental trade;
- Other than live product sold to the retail market for food.

Note that the process only looked at Australian endemic diseases, not exotic ones. The responsibility for assessing risks associated with exotic diseases and imports into or out of Australia rests with Biosecurity Australia.

HAZARD IDENTIFICATION

The parasites and diseases associated with prawns in Western Australia have been identified through an FRDC project "Determination of the disease status of Western Australian commercial prawn stocks" (Jones 2004). In addition, there have been a considerable number of papers published on Australian prawn diseases, particularly viruses, by authors from CSIRO, Queensland Department of Primary Industries and James Cook University. Prawn aquaculture worldwide has been severely affected by prawn virus epizootics most of which

have been spread through translocation activities. The known viruses of Australian prawns (as at December 2005) are listed in Appendix 1.

RISK ASSESSMENT

The methodology used here involved obtaining a consensus by the workshop attendees as to the consequences and likelihood scores for each identified hazard. The approach taken at the workshop was to condense the likelihood of pathogen transfer and the likelihood of pathogen establishment into one likelihood - that of establishment, and this initially caused some confusion. The likelihood of a parasite being transferred is quite different from the likelihood that the pathogen will establish or spread in the environment once the initial transfer has occurred (either from farm to farm or from farm to the environment). For example, there is a likelihood associated with the transfer of a *Bonamia* infected oyster to a new location, but successful establishment of *Bonamia ostreae* in a new host requires a challenge dose which is much greater than one infected particle and may require a simultaneous challenge with thousands of infectious particles to be successful (Hervio et al. 1995).

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The consequences were based on the potential impact if a disease outbreak were to occur. Some pathogens will spread rapidly through the population causing high mortality, others will be slow to spread and have a limited impact at the population level and this information was incorporated into the scores provided by the workshop attendees.

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At the workshop, issues raised that were outside of the ability of the participants to resolve but which might have a bearing on the scores were noted as “Major Issues”. These generally involved lack of research information and are included in this document after “Next Steps”.

GENETIC ISSUES

Genetic issues are more problematic and they were not discussed at the workshop. However, concern was raised at the workshop about the open-ended nature of the translocation definition. Just how are “genetically distinct populations” to be defined? The genome of each individual is unique, and there is still disagreement over the amount of variation required to define a “genetically distinct population”. This makes it difficult for managers to make informed translocation decisions.

There are several genetic issues associated with translocation including those associated with movement of genetic material between farms and from wild populations into farms; however, these are primarily farm stock management issues. The environmental questions faced by regulators are those associated with movement of genetic material from farms to wild stocks and the risk posed to the environment by such movements.

There has been some work done on prawn genetics within Australia and geographic differences do occur (Owens 1990; Benzie 2000; de Bruyn et al. 2004; Jones 2004). Prawns are 'r-selected' organisms displaying a high reproductive output and high mortality during early life-stages. It is likely that the high, environmentally driven annual mortality, will impose severe selection pressure on the F1 generation and that selection pressure will (in the wild) change from year to year. The impact of this variable pressure on the genetic structure and fitness of the survivors is unknown, but means that "one-off" surveys to describe the genetics of shrimp populations are probably of limited value (See Smith and Francis 1983, Smith 1979, 1984).

ENVIRONMENTAL ISSUES

These were not addressed by the workshop. Environmental issues include the release of prawns into areas where they do not naturally occur and the release of prawns into the wild in such numbers that they change the natural prawn population density in an area.

PRAWN RISK ASSESSMENT – DISEASE HAZARDS

These hazards were discussed in the workshop. The Facts/Issues column and the justification column captured comments raised by those present. The consequences, likelihood and risk rating were derived by consensus, based on the tables 1-4 (above).

Pathogen/Disease 1: GAV/Yellowhead disease

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Infects *P. monodon*[26], *P. esculentus, F. merguiensis, and M. japonicus*[27]. NT farmers believe GAV was imported from QLD[28]. Can lose 10-100% of crop in one individual pond. GAV is often found in prawns with mid crop mortality syndrome[29]. Vertically transmitted.	2	4	8	Associated with mortalities or decreased production in PL's. Believed to cause mortalities in stressed broodstock[30]. High proportion of wild *P monodon* carrying virus. Farmers in NT tend to pool broodstock in tanks during collection increasing infections. GAV SPF broodstock being developed in NT. Testing by PCR is very expensive. Internationally notifiable disease. Cannot be controlled or eradicated. Appears to be highly contagious. Can be managed at a farm level through reducing stocking densities, managing water quality. Has been translocated already.

State Differences
Endemic to Qld, NSW, parts of NT[31]. Zones in place for NT to restrict movements of PL's. Parts of WA are free from GAV, including the economically important wild capture prawn fisheries on the northwest shelf.

[26] Spann et al (1997)
[27] AGDAFF(2004)
[28] John Humphrey, NT (pers. comm.)
[29] Anderson and Owens (2001)
[30] Callinan & Jiang (2003); Pruder (2004); de la Vega et al. (2004)
[31] AGDAFF (2004), Callinan *et al.* (2003), J Humphrey (pers. comm.)

Pathogen/Disease 2: *Penaeus monodon*-type baculovirus, also known as spherical baculovirus (MBV)

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Infects *P. monodon*[32], *M. endeavouri, P. esculentus, F, merguiensis and M. latisulcatus*[33], *P. semisulcatus, P. kerathurus, M. plebejus*[34] No work has been done to identify strain differences within Australia.				Economically significant disease but excludable from farm[35].

State Differences
Endemic to Qld[36], WA[37], NSW [38]. Spread by vertical transmission.

[32] Lightner and Redman (1981)
[33] Jones (2004)
[34] AGDAFF (2004)
[35] Pruder (2004)
[36] Doubrovsky et al. (1988)
[37] Jones (2004)
[38] AGDAFF (2004)

Pathogen/Disease 3: Hepatopancreatic parvovirus (HPV)

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Infects *P. monodon*[39], *F. merguiensis*[40], *P. esculentus*[41], *and M. latisulcatus*[42]. Pathogenicity is uncertain because diseased prawns are usually also infected with other viruses.				Economically significant disease but excludable from farm[43]. Causes stunting[44].

State Differences
Endemic to WA[2], NT, Qld, NSW.

Pathogen/Disease 4: Mourilyan Virus (MoV)

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Infects *P. monodon, M. japonicus*[45] Virus identified through viral DNA research, in association with GAV infections[46]. Some pathology present, but no specific disease. Research being undertaken to determine extent of virus and any disease.	0	1	0	Virus detected, but no disease identified. Pathogenic significance unknown. Role in mid-crop mortality syndrome unknown. Not considered to be a significant primary pathogen at present.

State Differences
Endemic to Qld and NSW.

Pathogen/Disease 5: Spawner-isolated mortality virus (SMV)

[39] Owens (1997)
[40] Jones (2004)
[41] Jones (2004)
[42] Jones (2004)
[43] Pruder (2004)
[44] Flegel et al. (2004)
[45] http://www.iq2000kit.com
[46] Cowley *et al*. (2002)

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Virus identified through viral DNA research, in association with GAV infections. No pathology and no specific disease. Often found in prawns with mid crop mortality syndrome[47]. Research being undertaken to determine extent of virus and any disease. Infects *P. monodon.*	0		0	Virus detected, but no disease identified. Pathogenic significance unknown. Role in mid-crop mortality syndrome unknown. Not considered to be a significant primary pathogen at present.

State Differences
Endemic in Qld[48]

[47] Owens, L. and McElnea (2000), Anderson and Owens (2001)
[48] Owens and Glazebrook (1998), Owens *et al*. (2003)

Pathogen/Disease 6: Microsporidia

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Common name is white cotton disease. Unable to detect in cooked prawns. Taxonomy confusing. Does not appear to kill the prawn, affects muscle. Also affects rock lobster, crabs, freshwater crayfish (different species involved?). Lifecycle poorly understood, possibly requires a conditioning host.	0	1	0	No human health risk Prevalence in wild populations is usually very low. Rarely cause disease in penaeids in aquaculture, probably because of lack of 'intermediate hosts' or 'conditioning intermediate hosts'[49].

State Differences
Not seen in farm prawns in QLD, seen in wild prawns[50] Status in NT unknown, looked for incidentally. Not found in WA prawns in survey[51] but has been seen in wildstock in northern WA[52].

[49] Lightner (1996)
[50] Owens and Glazebrook (1988)
[51] Jones (2004)
[52] Owens and Glazebrook (1988)

Pathogen/Disease 7: Infectious hypodermal and haematopoietic necrosis-like virus (IHHNV)

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Infects *P. monodon, F. merguiensis*[53], *M. japonicus*[54], *P. semisulcatus and F. merguiensis*[55]. Virus identified through viral DNA research[4], in association with GAV infections. Some pathology present, but no specific disease Research being undertaken to determine extent of virus and any disease.	0		0	Virus detected, but no disease identified Pathogenic significance unknown[56] Not considered to be a significant primary pathogen at present. Infects juveniles only[57]. Effect of this virus on wild populations in Gulf of California is controversial.[58]

State Differences
Present in Qld[59] and NT [60]. Status in other states is unknown.

[53] Munday and Owens (1998)
[54] OIE website
[55] AGDAFF (2004)
[56] Flegel et al. (2004) detected IHHNV in clinically normal prawn pond populations in Thailand
[57] US EPA 1999
[58] US EPA 1999
[59] Krabsetsve et al. (2004)
[60] AGDAFF (204)

Pathogen/Disease 8: Haplosporidia

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
No work has been done on species identification.	1	1	1	Haplosporidia have caused ill thrift in prawns in Thailand, Indonesia, Philippines, and Caribbean countries. Almost nothing published on organism. Prevalence in Australian wild prawns is very low.

State Differences
Found in WA in *M. endeavouri and P. esculentus* in Exmouth Gulf[61] and in *P. monodon* in QLD[62].

Pathogen/Disease 9: Gregarines

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Infection occurs by ingestion of the intermediate host. There is no information on the number of species infecting prawns. Prawns are likely to rapidly lose their infections[63].	0	1	0	Occur naturally in gut of wild prawns and other crustaceans. Infection is unlikely to cause serious health problems in prawns.

State Differences
No information on taxonomy or distribution. Common in midgut of all species in WA[64].

[61] Jones (2004)
[62] Kahn(1998)
[63] Overstreet (1973)
[64] Jones (2004)

Pathogen/Disease 10: Metacercaria and other metazoa

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Prawns are intermediate hosts for many metazoan parasites.	1	2	2	Lesions are often associated with nerve chord and other organs of individual prawns. However, infections are unlikely to cause serious health problems in prawn populations.

State Differences
No information on taxonomy or distribution. In WA includes cestode plerocercoids, trematode metacercaria and larval nematodes infecting various prawn species[65].

Hazard/Pathogen 11: Baculoviral midgut gland necrosis-like virus

Facts/Issues	Consequences	Likelihood	Risk rating	Justification for risk rating
Infects *M. japonicus, P. monodon, P. semisulcatus, and M. plebejus*[66]. Disease seen only in hatchery-reared larvae.				Removed from OIE and Australian lists of significant and reportable disease because it is no longer a major cause of disease.

State Differences
Was only reported in Qld and is not known to be endemic in any state at present.

[65] Jones (2004)
[66] AGDAFF (2004)

RISK MANAGEMENT FOR PRAWN TRANSLOCATION

The highest score (8) was for GAV, which is known to occur across the north of Australia from NSW to Joseph Bonaparte Gulf in the east Kimberley.

Though MBV and HPV were not given a rating, due to time constraints, these diseases occur throughout the northern part of Australia and it would be difficult to justify interstate translocation controls for these diseases in the absence of any internal control measures.

For those hazards that require management, there are a range of options available to Managers. Some of these, which may be used by managers, were identified by the workshop.

TRANSLOCATION OF PRAWNS – CONTROLLING STRATEGIES

Hazard/Pathogen	Risk rating	Controlling Strategies					Comments/Issues
		Quarantine measures	**Facility requirements (design, effluent treatment, recirculation, etc)**	**Treatment or management requirements**	**Documentation (translocation application, licence, health certification etc)**	**Other**	
GAV/Yellowhead	8	Quarantine and testing of broodstock (i.e. GAV free) Same with PL's	Sterilise effluent in quarantine Treat incoming water (or use groundwater), filter and UV sterilise Physical containment, staff hygiene etc.	Management practices employed in QLD.	No certification required for import into QLD, protocols have been developed. See Appendix 2.	Totally ban importation (farmers need to be self sufficient for PL's).	Broodstock testing not 100% certain. Not a high level of confidence that farmers will abide by quarantine requirements (remote areas). Not possible to separate effects of GAV from other viruses. Lack of data available on GAV and other infectious agents.
MBV (*P. monodon*-type baculovirus)				Rinse fertilized eggs to remove virus.			
HPV (hepatopancreatic parvovirus)				No treatment has been used.			
Mourilyan virus	0			No treatment or management options have been studied.			Effect of virus and ability to cause disease is unknown.
Spawner-isolated mortality virus (SMV)	0			Avoid stressing prawns.			Effect of virus and ability to cause disease is unknown.

Microsporidia	0			No known management options.			Not a problem in aquaculture.
IHHN virus	0			No specific management options have been assessed in Australia.			Effect of virus and ability to cause disease in Australia is unknown.
Haplosporidia	1						Not a problem in aquaculture
Gregarines	0			Infections are likely to be self-limiting.			Not a problem in aquaculture.
Metacercariae	2			Infections are unlikely to occur in farmed prawns or are likely to be self-limiting.			Not a problem in aquaculture.
Baculoviral midgut gland necrosis-like virus				Improved hatchery management techniques appear to be correlated with the absence of epizootics of the disease.			

MONITOR AND REVIEW

Information on emerging diseases or additional information on known diseases will continue to become available. The risk assessments associated with prawns will need to be re-evaluated to incorporate new knowledge about hazards, and to ensure that management measures continue to be appropriate.

NEXT STEPS

It is up to each jurisdiction to complete the 'likelihood' and 'consequences' tables for their jurisdiction, to complete the documentation of the reasons for the scores assigned and then to adopt such management measures as will allow the translocation of prawns to meet their acceptable level of risk.

There is a lack of information on the prevalence of many Australian disease agents. It was noted during the workshop that: "Absence of evidence is not evidence of absence". This lack of information has a critical bearing on translocation since proposed movements from an area of known infection to an area of unknown disease status will likely be disallowed.

The Department of Primary Industries and Fisheries in Queensland has developed a "*Health Protocol For The Importation Of Selected Live penaeid Species From Outside Queensland's East Coast Waters*" (Aquaculture Protocol FAMPR001). This is attached as Appendix 2.

The Northern Territory Department of Business, Industry and Resource Development is also developing rules for the movement of penaeid species into and within the Northern Territory - based on principles of zoning for disease. The policy is entitled "Transboundary Movements of Living Aquatic Animals: A Zoning Strategy for Disease Control in the Northern Territory. Part 3. Prawn Disease Control Zones" (John Humphrey, pers com.).

The Department of Fisheries in Western Australia allows the importation of penaeid prawns into quarantine premises for scientific purposes but otherwise does not usually permit post-larvae or broodstock to be imported, in order to protect the valuable north west shelf prawn fisheries from GAV and SMV. Following the discovery of GAV in the Joseph Bonaparte Gulf, collection of broodstock prawns from the Gulf has also not been permitted. All batches of post-larvae spawned in Western Australia must be tested (sample size = 150) for disease by histology and by PCR for GAV prior to leaving the hatchery. The protocol for translocation of aquatic animals into Western Australia is attached as Appendix 3.

CONCLUSIONS

Translocation of aquatic organisms may occur for many reasons including restocking of waterways for environmental restoration, recreational fishing, aesthetic reasons, the release of unwanted animals, escape of animals from captivity and for aquaculture.

The release of aquatic animals, whether intentional or otherwise, carries risks, including the spread of diseases and parasites and potential environmental consequences (including potential impacts on population genetics). Thus, the potential consequences of translocations can extend far beyond any direct impact on the importer and are usually irreversible. For this reason, responsible governments have moved to control the importation and release of animals and plants, including aquatic organisms.

States and Territories have legislative power to control movements of live aquatic animals into and within their territories. The various Acts are administered by State Primary Industry and/or Fisheries Departments and environmental legislation (including federal legislation) may also be relevant. Domestic trade is governed by the Commonwealths Mutual Recognition Act 1992 and complementary legislation. This ensures that consistency with WTO and SPS principles extends to trade between States and Territories.

The Ministerial Council for Forestry Fisheries and Aquaculture in 1999 endorsed the National Policy for the Translocation of Live Aquatic Organisms (MCFFA 1999). This sets out the nationally agreed policy relating to movements of live aquatic organisms within Australia.

The risk assessment process, as set out in the Australian Standard (AS/NZS 4360: 2004) is a mechanism that can be used to document the likelihood, consequences and risks associated with movements of aquatic animals within Australia. The method provides a framework but diligence is required to carefully document the justification for risk ratings in order to make the process as objective and open as possible.

Abalone

The risk assessment process, as carried out at the workshop in late 2004, identified *Perkinsus olseni* and shell fouling organisms as the risks that required management during abalone translocation. It was recognised that the full results of the national survey of abalone parasites are not yet available and that those results may affect the assessment of risk in future. In addition, genetic and environmental risks associated with translocation into the sea were not adequately addressed. Both *Perkinsus* and the presence of shell fouling organisms are risks capable of being managed through a variety of measures, such that translocation of juveniles from high health hatchery production to onshore grow-out operations should be manageable.

Prawns

The risk assessment process for prawns was not completed, but identified GAV as a disease where management was required. In practice this has translated into testing of post-larvae and broodstock (WA, NT, QLD); movement controls (WA and NT); and use of quarantine premises (WA and QLD). The genetic and environmental risks associated with translocation of prawns into the sea were not addressed at the workshop. However, the translocation of selected lines of prawns, produced in high health hatcheries for translocation to other jurisdictions should be a manageable risk.

KEY RECOMMENDATIONS

1) The use of a workshop process to assess the likelihood, consequences and risk associated with translocation has been successfully applied by the US EPA (1999) in developing a qualitative ecological risk assessment for the establishment of prawn virus diseases in the Gulf of Mexico and south eastern Atlantic Ocean. The workshop process undertaken by this FRDC project also proved successful in deriving the background information and the scores assigned to the likelihood and consequences. The use of such stakeholder workshops in future to explore the issues associated with identified hazards is strongly recommended.

2) States and territories that are undertaking translocation risk assessments will need to apply their own 'tolerable risk' or 'acceptable level of risk' based on their own assessment of likelihood and consequences and depending on the risk that they are individually prepared to accept. That acceptable level of risk will vary between states and territories depending on such factors as environmental conditions and species present. Again, jurisdictions should ensure that their 'acceptable level of risk' is applied consistently, without any arbitrary variation, when applied to different situations whether for plants, mammals or fish.

3) During the risk assessment process for abalone it was identified that:

   a) There is a need for further research into the life-stages of abalone that may be carrying *Perkinsus* spp. and/or factors that may trigger disease in *Perkinsus* spp. infected stock.

   b) There is a need for a case definition for most abalone diseases.

   c) There is a need for prevalence information for many Australian disease agents "Absence of evidence is not evidence of absence".

   d) There is a need for additional diagnostic methods, including a PCR for *Perkinsus olseni,* which has been validated and standardised under Australian conditions. There are a growing number of PCR tests reported in the literature but few have been validated under Australian conditions.

   e) Studies of the long-term impact of selected genetic lines on the genetics of wild mollusc populations are needed. Indeed, mollusc culture and stock enhancement using hatchery-reared abalone has been practiced for over 30 years in many countries. The lack of published studies on the actual genetic impact over time of this hatchery activity on wild mollusc populations is remarkable.

4) During the risk assessment process for prawns it was identified that:
   a) Because all wild prawns appear to be infected with multiple virus species, it is not known whether some agents e.g. MoV, SMV or IHHNV, cause disease.
   b) There is a need for a good case definition for most prawn diseases
   c) There is a need for more information on control methods for alleviating the effects of prawn viruses. For example, egg-washing appears to be effective in reducing the prevalence of some viruses, but the protocols have not been validated or widely disseminated.
5) This risk assessment process can be applied to all aquatic animal movements in Australia.

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APPENDIX 1. Prawn viruses and other parasites reported to occur in Australian prawns

Updated from Jones (2004). Published records of prawn viruses reported to occur in Australian prawns as at December 2005. Abbreviations of viruses follow international practice and are included in the table of abbreviations.

Host species	Virus	Notes
Penaeus monodon	IHHNV	Does not react to DiagXotics IHHNV ISH (Anderson & Owens 2001)
	lymphoid parvovirus (LPV)	
	haemocytic rod-shaped virus	Similar to WSSV? (Owens 1997)
	MBV-like virus	Reacts +ve to DiagXotics MBV ISH kits (Anderson & Owens 2001; Spann & Lester 1996)
	GAV /LOV	Reacts to YHV probe (Tang *et al.* 2002). YHV and GAV/LOV are distinct viruses (Cowley *et al.* 1999)
	SMV	
	HPV	-ve on DiagXotics HPV ISH (Anderson & Owens 2001)
	BMNV-like	
	MoV	not yet published
P. monodon x P. esculentus	IHHNV	Reacted to IHHNV ELISA (Owens *et al.* 1992; Krabsetsve *et al.* 2004)
	LPV	
	Haemocytic rod-shaped virus	
Melicertus latisulcatus	MBV-like	
	BMNV-like	
P. esculentus	HPV-like	
	LPV	
	Haemocytic rod-shaped virus	
	MBV	
	GAV	Experimental infection
Metapenaeus bennettae	Benettae baculovirus	Similar to MBV but does not react to MBV probe (Spann & Lester 1996)
Marsupenaeus japonicus	Parvo-like virus	Smaller virus than HPV
	GAV	Experimental infection
	MoV	Not yet published
Fenneropenaeus merguiensis	HPV-like	Reacts +ve to DiagXotics HPV ISH after modification (Anderson & Owens 2001). Reacts to Asian gene probe for HPV (Lightner 1996)
	LPV	
	MBV-like	
	GAV	Experimental infection
	Haemocytic rod-shaped virus	

Other prawn parasites known from Australia, from Jones (2004)

Host species	**Parasite or disease**	**Notes**
Penaeus esculentus	Bacterial shell disease	Bacteria are commonly isolated from moribund prawns in aquaculture ponds.
	Haplosporidiosis	Very rare
P. monodon	Haplosporidiosis	Very rare
Fenneropenaeus merguiensis	Haplosporidiosis	Very rare
F. merguiensis	Microsporidiosis	Very rare
P. semisulcatus	Microsporidiosis	Very rare
Melicertus latisulcatus	Digenean metacercariae	
All species?	Gregarines	Probably many species of gregarines
All species?	Trypanorhynch metacestodes	Probably several species of cestodes
All species?	acanthocephalans	May be several species
All species?	Nematode larvae	May be several species

APPENDIX 2. Department of Primary Industries and Fisheries, Queensland. Prawn Translocation Health Protocol

DEPARTMENT OF PRIMARY INDUSTRIES AND FISHERIES

AQUACULTURE TRANSLOCATION PROTOCOL

HEALTH PROTOCOL FOR THE IMPORTATION OF SELECTED LIVE PENAEID SPECIES FROM OUTSIDE QUEENSLAND'S EAST COAST WATERS

(i.e. Gulf of Carpentaria, Torres Strait, Northern Territory and Western Australia)

Aquaculture Protocol FAMPR001[67]

Queensland
Department of Primary Industries and

Government
Fisheries

[67] Version 2 - May 2005

CONTENTS

1.0 INTRODUCTION

The development of a broodstock translocation protocol for the movement of prawns into Queensland from waters outside the established East Coast collection sites is a high priority for the prawn aquaculture industry in Queensland. The potential to source broodstock that are free of the diseases that are endemic in the normal East Coast populations would be beneficial for future development of the industry in Queensland.

Areas outside the East Coast waters that are still part of Queensland such as Torres Strait and the Gulf of Carpentaria are also potential sources of broodstock prawns. Whilst these areas are regarded as being part of Queensland waters there is still a potential risk that they will have diseases not encountered in the East Coast populations. As such, until the disease status of prawns from these areas has been established any translocation of prawns from these areas will also be subject to the conditions in this protocol.

At this time there is no absolute means of identifying potential unknown diseases or strains of known diseases, hence the need for close attention to quarantine measures. It is important to note that despite the strict conditions for quarantine and testing there still remains an element of risk of disease in movement of live aquatic animals.

It is important to note that under this protocol any activities requiring the provision of services by the Department of Primary Industries and Fisheries (DPI&F) will be charged to applicant at actual cost. Therefore the applicant will need to assess what these costs will be before proceeding with the application.

2.0 DISEASES OF CONCERN FOR PRAWNS

The condition for the importation or movement of prawns requires the sampling to exclude the presence of any diseases of concern for prawns in Queensland. Exotic diseases of concern are listed on the Queensland Declared Disease List.

Diseases and disease agents of concern on Queensland's Declared Disease List for prawns are:

- Baculoviral midgut gland necrosis virus
- Tetrahedral baculovirosis (*Baculovirus penaei*)
- Infectious hypodermal and hematopoietic necrosis virus - virulent strain
- Taura syndrome virus
- White spot syndrome virus
- Yellowhead disease virus
- Necrotising hepatopancreatitis (reportable nationally only)

These diseases are all exotic to Australia

Other diseases and disease agents of importance that are reportable nationally (and to the OIE) but not on Queensland's Declared Disease List are:

- Gill-associated virus
- Spherical baculovirosis (Penaeus monodon-type baculovirus)
- Spawner-isolated mortality virus disease

These diseases, of national and international importance, are not listed on the Queensland Declared Disease List because they are known to occur in Queensland. Listing of an endemic disease or agent has implications under the *Fisheries* Act 1994.

Other diseases and disease agents of importance are:

- Lymphoidal parvovirus
- Mourilyan virus
- Hepatopancreatic parvo-like virus

3.0 APPLICATION TO IMPORT

Permission to import live penaeids from outside Queensland's East Coast waters into Queensland hatcheries must be obtained in writing from DPI&F prior to arrival of the prawns into Queensland's East Coast mainland (Section 80 of the *Fisheries Regulations 1995* of the *Fisheries Act 1994).*

1. A prawn hatchery in Queensland can apply for permission to import broodstock from outside Queensland east coast waters. The premises would need to be inspected by a nominated DPI&F officer, usually the fish veterinary officer of the region, to meet the criteria in this protocol. A summary of the criteria is in Appendix one. It will be necessary for an annual inspection of the premises to ensure that the grower is adhering to the set conditions.

2. Permission can be obtained from the delegate at DPI&F. Advice on who the delegate is can be obtained from the Fisheries Aquatic Animal Health manager. A copy of the form "Application to allow the translocation of live aquatic animals into and within Queensland" is in Appendix two. The permit will not be issued until the delegate at DPI&F receives written advice from the nominated DPI&F officer that the hatchery and farm meets the quarantine requirements as described in this document.

3. A new permit must be issued for each consignment of imported prawns.

4. Each importer must have a valid permit to import and, 2 weeks prior to the arrival of each shipment of prawns, must notify the Aquatic Animal Health manager at DPI&F of the address of the approved premises where the prawns are to be detained in quarantine.

5. A pre-consignment health check of each consignment of prawns will be required. The Health Certificate or pathology report issued by the exporting State/Territory Authority, including the freedom from the infection specified, will be sent to the Aquatic Animal Health manager at DPI&F and the appropriate regional licensing officer.

6. In the event that the exporting state, territory or region is unable to issue pre-consignment certification of the broodstock then suitably qualified and experienced Queensland veterinary officers would need to inspect and sample (if indicated) the prawns on arrival at the biosecure facility.

7. Each consignment of live penaeids must be accompanied by documentation including:
    - a list of the individual box or carton identification numbers, and the scientific name and number of prawns corresponding to each container of the consignment,
    - the source location of the prawns,
    - the name and contact of the broodstock collector,
    - the importer's aquaculture licence number,
    - the name and address of the premises where the prawns will be held in quarantine on arrival in Queensland.
    - a Health Certificate or report (as above) issued by the exporting State or Territory Fisheries or veterinary authorities declaring the broodstock clinically healthy and free of gross lesions. The certificate or report should state that the prawns are free from any of the diseases listed on Queensland's Declared Disease List. If this documentation is unavailable due to the inability of the exporting state or territory to provide it then notification to DPI&F is required to arrange inspection, including sampling if indicated, on arrival.

4.0 HATCHERY QUARANTINE

A quarantine hatchery must separate any tank or area used for holding the imported broodstock or their sexual products or their progeny physically from areas/tanks used to hold East Coast broodstock or their sexual products or progeny OR separate rearing runs of imported and local prawns by time. The separation must ensure biosecurity of imported prawns.

1. The structures and capacity to be a quarantine hatchery would require inspection and approval by a nominated DPI&F officer before use. Further hatchery modifications may be required by DPI&F. That officer will provide written advice to the Aquatic Animal Health manager that the hatchery meets these quarantine requirements.

2. Physical separation would have to be by complete enclosure, floor (drain) to ceiling by double plastic sheets a metre apart or other impervious washable surface to prevent aerosol spread of infectious organisms. All prawns must be kept in tanks. Biofilters are permitted, provided they are cleaned and disinfected by immersion in 100 mg/L active chlorine (or 100mg/L active iodine from an iodophor) for 60 minutes before reuse. Floors and drains must be impervious and have a washable surface.

3. The hatchery will ensure that no imported prawns leave the premises under any circumstances without the approval of the nominated DPI&F officer. All dead imported prawns must be removed from tanks as soon as possible and placed in a plastic bag, ensuring the bag is clearly identified with the date, tank number and species of prawns. The dead prawns should preferably be stored in a freezer (domestic type at approximately -20°C), though storage in saturated brine solution or 80% ethanol is permitted.

4. Dead prawns, including the broodstock, are to be disposed of in an approved manner (refer to an authorised biological waste collection company or the AQUAVETPLAN Disposal Manual - http://www.daff.gov.au/content/publications.cfm?ObjectID=448A0116-62BC44D7-9418A60DED71 BCA5). Method of disposal to be stipulated in the application to translocate and accurate records kept of dates and numbers disposed for trace back purposes. No prawns, in particular the imported broodstock, are to be disposed of without the authorisation of the DPI&F officer in charge of the translocation.

5. Hand and footbaths using iodophors or chlorine or alcohol at virucidal concentrations (at least 500 mg/L active iodine or chlorine) and replaced daily must be placed and used at any boundary between quarantine and nonquarantine areas.

6. All equipment e.g. probes, measuring cylinders, beakers, screens, clothing and footwear etc., used in the quarantine areas must be permanently identified as `quarantine' and must not be used in non-quarantine areas unless cleaned in warm water with detergent, rinsed, disinfected by immersion in 100 mg/L active chlorine (or 100mg/L active iodine from an iodophor) for 60 minutes, rinsed and then sun-dried for 24 hours.

7. All water and waste (syphonings) from the hatchery must be held before discharge for disinfection with 200 mg/L active chlorine for 24 hours before aeration then discharge.

8. All hatchery work in quarantine areas is to be done by trained quarantine areaonly staff i.e., staff who do not work in any non-quarantine area or by staff after they have completed all the necessary work to service non-quarantine areas in any one day.

9. After use all tanks, water pipes, airlines, drains, floors and walls of quarantine areas must be scrubbed clean with hot detergent water, rinsed, then chlorinated with 200 mg/L active chlorine solutions that is sprayed on and left for at least 60 minutes (or other agreed to disinfection method) and then allowed to dry.
10. All cleaning water must be held before discharge for disinfection with 200 mg/L active chlorine for 24 hours before aeration then discharge.
11. On arrival, the prawn broodstock will be transferred to a quarantine tank and the imported water held and subject to disinfection (200 mg/L active chlorine) before discharged, and imported bags will be disinfected by immersion in 100 mg/L active chlorine (or 100mg/L active iodine from an iodophor) for 60 minutes prior to disposal.
12. Any unusual mortality of imported broodstock or their progeny must be reported immediately to DPI&F. If requested samples must be provided to Oonoonba Veterinary Laboratory (OVL) or Yeerongpilly Veterinary Laboratory (YVL) for examination. Measures will be taken by DPI&F to limit the spread of any disease. Detection of an exotic viral infection will result in destruction of the affected prawns under DPI&F supervision.
13. Batches of PLs from imported prawns and East Coast broodstock should not be mixed to make numbers for a pond stocking.
14. Tank numbered record sheets of broodstock and progeny are to be kept and are to be available for inspection by DPI&F nominated officers during hatchery rearing and for 12 months there after.
15. All broodstock must be retained on the premises until authorisation to dispose of them has been received in writing from the nominated DPI&F officer.
16. Before leaving the hatchery a random sample of 150 PLs (at PL 5-8) from each nursery tank in the quarantine area must be submitted to OVL or YVL for histological examination (material submitted to OVL or YVL may be forwarded to a third party for more detailed virus analyses where considered appropriate). The detection of any exotic viral or other inclusions or any abnormal lesions will result in that tank of PLs being destroyed under DPI&F direction. Following testing written approval must be obtained from the laboratory before the stock is released into the ponds.

5.0 FARM GROW-OUT

1. Ponds holding the progeny of imported prawns should be kept separate from
   - local east coast prawns
   - other batches of imported prawns

   It is recommended that the imported prawn ponds be clearly identified as to the origin of the stock.
2. Provision must be made to be able treat water from ponds containing progeny of imported prawns in the event of a disease outbreak - see aquaculture license/development approval condition:
   - The *holder must be able to demonstrate control over the release of water from all ponds, tanks and drainage systems within the approved Aquaculture Area.*
3. Specific precautions must also be taken to prevent escape of imported prawns from grow-out ponds - see aquaculture license/development approval conditions:
   - The *holder must implement all reasonable and practicable measures to ensure that all waters (ponds, tanks, aquaria etc.) and associated plumbing, pumps etc. on the approved Aquaculture Area are secured in such a way as to prevent the escape of any specimens (eggs, juveniles or adults) into Queensland waters*

- The *holder must secure the Aquaculture Area to prevent the overland escape of aquacultured product by maintaining a perimeter barrier that is impervious to all size classes of the aquacultured species.*

4. Measures to prevent predator access, such as netting or some form of screening, should be available or readily accessible for deployment in the event of a serious disease outbreak.
5. Equipment used in ponds with imported prawns should not be used in other ponds unless cleaned, disinfected (100 mg/L active chlorine for a least 60 minutes) then sun dried for 24 hours.
6. Any unusual mortality or stunting in imported prawns or the progeny of imported prawns must be reported immediately to the DPI&F and appropriate samples of prawns must be provided to OVL or YVL for examination. Any detection of an exotic or suspected exotic disease will result in destruction of the entire pond of prawns and a disinfection of pond water prior to any discharge.

One percent mortality per day in the ponds should be regarded as unusual in this situation. Another method of assessing unusual mortality is if there is any mortality in conjunction with ANY TWO of the following criteria:

- Prawns coming to the edge of the pond.
- Prawns demonstrating unusual swimming patterns
- Reduced feeding and failure to thrive.
- Unusual changes in the physical appearance of the prawn such as red or black colouration of prawn, erosion of tails, fouling of gills or any other physical abnormality.

6.0 Summary of the Special Conditions for Permitting the Importation of Penaeus Broodstock into Queensland

Because the Health Certificate or pathology report from the exporting jurisdiction would currently be based on limited monitoring and surveillance testing of the wild prawns in that jurisdiction, the importing aquaculture licence or permit holders will need to apply for a permit to import non-indigenous fisheries resources. The permit, if approved, would incorporate the special conditions outlined below.

1. To provide suitable quarantine hatchery facilities at the property that could hold the non-East Coast broodstock during spawning and the progeny should be reared in a quarantine area separate from any East Coast prawns in the hatchery. Fisheries officers would need to inspect the property to ensure that there is effective physical isolation. Discharge water would have to be held, disinfected and rendered inactive prior to release.
2. Testing of the post-larvae progeny of imported prawns by DPI&F Veterinary Laboratories to determine health status before transfer from hatchery to the grow-out ponds.
3. The juvenile prawns should be reared in strict isolation in the grow-out ponds on the farm and should not be mixed with prawns derived from East Coast broodstock. Additionally batches of imported progeny from different sites and cohorts should also be reared in isolation from others.
4. Fisheries officers would have the right to inspect the property at any time during normal business hours 7 days a week.
5. If at any time there were unusual mortalities (hatchery or farm), fisheries officers would need to inspect and quickly take steps to prevent any chance of spread of disease to wild crustaceans. Under section 96 of the Fisheries Act 1994 there is power to require immediate destruction and appropriate disposal (with disinfection) of the broodstock, larvae, post-larvae or juveniles affected.
6. This protocol is designed for the production of prawns for human consumption. If prawns are being cultured for the purpose of a future breeding program, it is highly recommended that the stock is held separately from the local progeny and there is an additional test of the health status before they go into the program.

These conditions will apply for each consignment of imported prawns. A new permit will be required for each consignment.

7.0 Appendices

APPENDIX ONE - INSPECTION CRITERIA

	Comments
Hatchery:	
Physical separation of tanks and hatchery building(s) from surrounding marine environment.	
Floors and drains.	
Biofilter components capable of effective disinfection.	
Storage capacity for all dead imported prawns.	
Hand and footbaths between quarantine and non-quarantine areas.	
Separate equipment for quarantine work	
Capacity for all water to be held before discharge for disinfection	
Written procedures which detail hatchery biosecurity and sanitation standard operating procedures.	
Trained quarantine area workers	
Farm:	
Physical separation of ponds.	
Control over discharge water.	
Prawn escape prevention.	
Access to equipment and materials etc., to prevent predator access to pond.	
Written procedures which detail farm/pond biosecurity and sanitation standard operating procedures.	

APPENDIX TWO - APPLICATION FORM

Queensland Government
Department of Primary Industries and Fisheries

APPLICATION TO ALLOW THE TRANSLOCATION OF LIVE AQUATIC ANIMALS INTO AND WITHIN QUEENSLAND

Full name of applicant:.....

Business name:.....
(if applicable)

Business/Residential address:..... .....

Postal Address:.....

Telephone: Work..... Home..... Fax.....
Mobile.....

Please note that failure to provide any of the information requested and/or insufficient detail may result in the applications refusal.

Application Details
(please answer all questions)

1. List the specific aquatic species that this application is for: (give common and scientific names - genus and species)

Mollusc ? Finfish ? Crustacean ? Other ?

_____
_____

2. Specify the intended use of translocated species

Stocking ? Farming ? Research ? Ornamental ?Broodstock ? Other ?
Please specify_____

3. Why translocation is required: Stock not available locally ? Other ?

4. Source of the stock to be translocated:

Hatchery ? Wild Collection ? Research ? Ornamental ? Other ? (name, address, telephone/fax contact details)
(if wild collection the location of waters from which the stock will be collected)

_____
_____

5. Number and age/maturity of each species:

_____

6. Date (s) of intended translocation:_____

7. Health certifying authority - attach certificate or pathology report:
Certificates/Reports must be from a recognised NATA Accredited Laboratory (provide laboratory name,

telephone/fax contact details) and must be dated no more than 1 week before the shipment date (unless otherwise indicated).

_____

_____

8. Mode of transport:_____

9. Biosecurity measures during transport including quarantine procedures:
(Attach details including any requirement for on-route water changes/disposal).

_____

10. Provide full details of final destination:
(name, address, telephone/fax contact details and aquaculture approval number if relevant)

_____

_____

11. Physical biosecurity measures at facility including procedures:
(Attach details. Prior inspection and approval by Departmental officer may be required dependent on the detail of the intended translocation)

_____

_____

_____

12. Supply details of quarantine procedures and protocols for the arrival of the animals:
(Attach details including timeframes)

_____

_____

13. Contingency arrangement in case of disease or death of aquatic animal:
(Attach details including intended method of disposal of both shipment and post-shipment mortality)

_____

_____

I certify that the information in this application is correct and accurate, applying to the batch of aquatic animals to be shipped. I certify that I understand the implications of transporting and communicating diseases and diseased fisheries resources in Queensland and am aware of the consequences of such actions whether inadvertent or deliberate.

Signature of applicant:..... Date:.....

OFFICE USE ONLY

APPROVED/NOT APPROVED..... Date:.....
(subject to conditions) (Director of Fisheries or Delegate)

8.0 References

Import Risk Analysis: Prawns and Prawn Products Draft Import Risk Analysis Paper

DISEASES ENDEMIC TO QUEENSLAND

Gill associated virus (GAV)

Cowley JA, Dimmock CM, Spann KM and Walker PJ (2000) Detection of Australian gill-associated virus (GAV) and lymphoid organ virus (LOV) of Penaeus *monodon* by RT-nested PCR. Disease *of* Aquatic Organisms **39**:159-167.

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9.0 Review of the protocol

This protocol will be periodically reviewed as required.

APPENDIX 3. HEALTH AND QUARANTINE MEASURES FOR THE IMPORTATION OF AQUATIC ANIMALS INTO WESTERN AUSTRALIA

Aquatic animals from the eastern states carry a small number of infectious diseases that could compromise the health status of aquatic animals in Western Australia. Fisheries WA therefore require that live aquatic animals be imported under a health-testing program.

General conditions

1. Health testing and certification to be carried out by government veterinary officers or other authorized officers in approved laboratories using approved methods.

2. Testing standards to meet the 95 % degree of confidence that the imported population is free of the nominated diseases.

3. Nominated diseases to include Notifiable Diseases and any other diseases nominated by the Fisheries Department for the particular populations to be imported.

4. All costs of importation, quarantine, and disease testing to be borne by the proponent.

5. The proponent to hold all Licence(s) and/or Import Permit(s) as required by Fisheries WA.

Options for importation protocols:

1. Preferred Option: Importation of broodstock into quarantine in WA

1.1. A small number of broodstock to be imported to an approved quarantine facility supplied and operated by the proponent in WA. The farmed or other population of origin to have certification of freedom from known outbreaks of nominated diseases of concern for the preceding two years, to the knowledge of a government veterinary officer or other approved officer.

1.2. The brood animals to be bred and-the juveniles separated from the brood animals as soon as possible.

1.3. The broodstock to be then supplied to Fisheries WA for disease testing. All imported animals to be accounted for and supplied, including any animals which die during quarantine; any such dead animals must be frozen or otherwise preserved as nominated by officers of Fisheries WA.

1.4 (a). The juveniles then to be released from quarantine if the broodstock tests are negative,

0R, if the broodstock tests are positive or suspicion exists for diseases of concern:

(b) The juveniles to be retained in quarantine and up to 150 or more tested for nominated diseases as above after 12 months of age or another period specified by the Fisheries Department, and only juveniles from the tested batch (and subsequent batches reared in the same way in quarantine) to be released from quarantine.

2. Option 2: Testing population of origin.

2.1. The farmed or other population of origin to have certification of freedom from known outbreaks of nominated diseases of concern for the preceding two years, to the knowledge of a government veterinary officer or other approved officer, plus:

2.2. Broodstock animals on the farm of origin or in the population of origin to be tested and certified with negative results for nominated diseases as above by an approved officer in the state of origin on two occasions not less than six months apart, at the expense of the proponent, and:

2.3. The imported animals of any age to be placed in a quarantine facility supplied and operated by the proponent in Western Australia and approved and supervised by Fisheries WA, and:

2.4. The quarantine period and a disease testing protocol to be prescribed by Fisheries WA, generally a sampling of up to 150 or more animals, and:

2.5 The animals, including all progeny, which may be produced during quarantine, to be released from quarantine only if all disease tests are negative.

Notes: Other protocols may be considered where circumstances differ from the above.

Prescribed Quarantine Procedures and Standards

1. An Import Licence issued by the Fisheries Department shall be held prior to the importation of any aquatic species.

2. The shipment to be accompanied by any required certificate(s) including those described in 1.1, 2.1 and 2.2 above to enable inspection at the point of entry to proceed.

3. The animals to be ordered into quarantine and transferred directly to the approved quarantine facility and to remain in quarantine until the prescribed or additional requirements have been met, and any imported packing materials and water to be disinfected or destroyed or disposed of as directed by officers of Fisheries WA.

4. Officers of Fisheries WA and Agriculture WA to have right of entry to the property and facility and inspection of the facility at all reasonable hours or other hours by arrangement with the owner or owner's representative, and the following specific rights prescribed by the Licence or Permit under the Fisheries Act, and the Stock Diseases Act, and penalties therein:

4.1. Right to enter property and facility and examine the aquatic animals and the facility.

4.2. Right to obtain information from the owner or his or her representative.

4.3. Right to inspect, sample, seize, remove from the facility, and forward to health testing or other laboratories or facilities any or all aquatic animals alive or dead or to order same without compensation.

4.4. Right to destroy or order to be destroyed any or all aquatic animals, or to order any or all aquatic animals to be forwarded to a nominated place for destruction, without compensation.

4.5. Right to disinfect or order to be disinfected in a nominated way any animal or other materials or components in the facility at the owner's expense.

5 The quarantine facility to be constructed and operated as follows:

5.1. To be constructed in a location approved by Municipal authorities where required and in any case not to be located in an area classified as a flood-prone area by any State or Municipal authority.

5.2. To be used only as a quarantine facility and not to contain any other fish or animals unless these are never to be removed from the facility, and not to form part of another facility for the keeping of aquatic animals or an access way to any other facility whatsoever unless approved.

5.3. All tanks, troughs or other holding devices to be permanently numbered and fitted with a recording chart to be kept up to date and indicating total number of animals, losses through death, and any signs of disease in same. Any unusually high mortalities or other signs of disease must be reported to the Fisheries Department within 24 hours.

5.4. The facility to contain or have in an adjacent approved place a freezer capable of holding all the quarantined stock at *minus* 8 ºC or less, into which all animals which die or are removed on the point of death from the holding device are to be placed in clean, new plastic bags including a label in pencil or other indelible ink giving the date of same and number of the tank.

5.5 The facility to be lockable so as to prevent unauthorised entry, and to have secure walls and sealed floors so as to prevent the unintentional escape of aquatic animals or other animals, or the total volume of water, or other materials.

5.6. The holding facilities to be so constructed that the aquatic animals can be readily accessed and inspected and so that there is sufficient light supplied or supplied as directed by an inspecting officer.

5.7. Waste water to be discharged *only* to a sewer or drain which discharges directly or via a sewage treatment plant to a marine outfall.

OR

Waste water to be transferred from the facility without spillage to a tank, or to a tank in the facility, which can be removed without spillage, for disinfection and disposal as follows. The tank to be of a non-metallic material such as plastic or fibreglass that will resist the corrosive action of disinfectants where chemical disinfectants are to be used. The disinfectant to be added in one of the following ways as directed by and subject to any variation required by Fisheries WA:

Chlorination: Chlorine to be added as a fresh batch of sodium hypochlorite (available from swimming pool or farm suppliers) or equivalent to yield an active chlorine level nominally exceeding 100 ppm (= mg/litre or grams/cubic metre of water) and let stand for at least one hour. (For example, adding 1 ml of a common commercial 120 gram/litre solution of "available chlorine" to each litre of wastewater will yield 120 ppm). The wastewater may then

be discharged to sewer or on to land subject to any Municipal or other licence condition to remove or neutralise the chlorine before discharge.

Iodination: Povidone Iodine (PVP-I, "Betadine", other brands) to be added at a rate of 200 ppm (= 200 mg/litre or 200 grams/cubic metre), and let stand for at least one hour before discharge to sewer or land subject to any Municipal or other licence requirement for treatment before discharge. (Note: iodine will only be approved for control of viral agents; chlorine will be approved for all agents)

OR

Heat: Heat treatment in a suitable metal tank by heating the wastewater to at least 85oC for at least thirty minutes before discharge.

Notes: Ultra-violet "filter" treatment is not acceptable for water to be *discharged* The above procedures for water disinfection are also applicable to disinfection of the container or other fittings only following cleaning their surfaces of organic matter.

5.8. The facility to contain a sink discharging to sewer as 5.7 above, or tubs or other devices to enable the washing and rinsing of hands or any other part of the body contacting the aquatic animals or water with a quaternary or other approved general disinfectant, and all persons entering the facility to carry out such disinfection before leaving the facility.

5.9 Entry to the facility to be restricted to the owner and employees thereof, and to of officers of Fisheries WA or Agriculture WA or other persons approved by these Agencies.

5.10. A facility no longer required as a quarantine facility, or a facility to be used for quarantine of further animals is to be disinfected and otherwise dealt with as directed by Fisheries WA.

Compliance

1. The release from quarantine of the aquatic animals and the holding of a Fish Farm Licence and/or Import Permit are subject to the satisfactory performance of the above procedures and can be denied or suspended or the owner of the animals be subject to the prescribed powers and penalties of the Fisheries Act and the Stock Diseases Act.

2. Completion of the above Health and Quarantine protocol does not in itself entitle or imply entitlement of the owner to farm, move to or stock into any water or otherwise deal with the aquatic animals, such being subject to regulatory requirements of Fisheries WA and/or other authorities, notwithstanding that the above protocol may form part of these requirements.

3. The intention of these requirements is to conduct the above procedures in a cooperative fashion to reduce the risk of importing diseases that may compromise aquatic health on farms or in the wild, in a convenient way for the benefit of the proponent and the public generally.