FRDC
FISHERIES RESEARCH & DEVELOPMENT CORPORATION

aquatic animal health subprogram

# Health Highlights

Aquatic Animal Health Subprogram Newsletter
Volume 15, Issue 2, November 2015

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## From the Subprogram Leader

### *2015 FRDC Australasian Scientific Conference on Aquatic Animal Health*

The 2015 FRDC Australasian Scientific Conference on Aquatic Animal Health was held in Cairns at The Pullman Reef Hotel, on 6-10 July 2015. While the number of participants was down compared to 2013, the conference remains the main event for the aquatic animal health community in Australia and New Zealand.

The Proceedings for the 2015 FRDC Australasian Scientific Conference on Aquatic Animal Health have been distributed to all delegates via dropbox. If you have not received your copy please contact Joanne Slater, AAHS coordinator (joanne.slater@csiro.au).

Here are a few statistics from the conference. There were 75 registrations with, as expected, the vast majority from Australia:

| Country | No. delegates |
|---|---|
| Australia | 64 |
| New Zealand | 7 |
| Canada | 1 |
| USA | 1 |
| Japan | 2 |
| **Total** | **75** |

We received 26 returns of the conference feedback form. Thank you to all those who responded. These will help us with the planning for the 2017 Conference. A summary of the responses are shown in the following table. Not all questions were answered.

**Student awards: Cairns July 2015**

| ITEM | Excellent | Good | OK | Poor |
|---|---|---|---|---|
| **Location (Cairns)** | 16 | 9 | 1 | |
| **Venue (Reef Hotel)** | 19 | 5 | 2 | |
| **Dates (July)** | 14 | 10 | 2 | |
| **Frequency (biennial)** | 15 | 8 | 2 | |
| **Format** | 17 | 6 | 3 | |
| **Room layout** | 10 | 14 | | |
| **Program session topics** | 11 | 10 | | |
| **Length (4 days)** | 15 | 8 | 2 | |
| **Keynote speaker** | 13 | 3 | | |
| **Abstract format** | 15 | 9 | | |
| **Abstract book** | 15 | 8 | 1 | |
| **Food (breaks/lunches)** | 15 | 8 | 1 | |
| **Happy hours** | 12 | 12 | 3 | |
| **Conference dinner** | 15 | 7 | 1 | |
| **Registration fee value** | 12 | 12 | 1 | |

Most of the feedback was positive; there was some support for changing the location, having posters, and having the conference outside of school holidays.

Finally, congratulations again to the winners of the student awards:

**First prize:** Alejandro Trujillo-Gonzalez, James Cook University (supervisor: Kate Hutson)
**Second prize:** Georgia Jane Mercer, Flinders University (supervisors: Marty Deveney, James Harris)
**Third prize:** Kelly-Anne Masterman, University of Queensland (supervisor: Andy Barnes)

# STC/SAC Meetings

The Aquatic Animal Health Subprogram met on October 7 2015 to consider Expressions of Interest for the 2016 FRDC open funding round - feedback to be provided to Principal Investigators by FRDC.

# Health Subprogram Website

Our website is located on the FRDC site and can be accessed directly under:

http://www.frdc.com.au/research/aquatic_animal_health/Pages/default.aspx

There you can view this issue and all previous issues of *Health Highlights* - in addition to finding other information about the FRDC Aquatic Animal Health Subprogram. For Final Reports see http://www.frdc.com.au/research/final-reports/Pages/default.aspx.

Please contact FRDC if you have problems with this website.

# Announcements

### *Changes to the Steering Committee*

Ingo Ernst has resigned from the Subprogram Steering Committee due to an increased workload at the Department of Agriculture and Water Resources. Members of the Steering and Scientific Advisory Committees are extremely grateful to Ingo for his conscientious commitment and valuable input to the Subprogram and we wish him all the best as he takes on more responsibilities.

Ingo is also to be congratulated on being elected as President, OIE Aquatic Animal Health Standards Commission. This is deserved recognition for the work he undertakes at the international level and which promotes Australia's profile in aquatic animal health globally.

### *New Steering Committee Member*

It is a pleasure to welcome Brett Herbert, Department of Agriculture and Water Resources, as a new industry member to the Subprogram Steering Committee. Brett steps into the vacancy created by the resignation of Ingo Ernst.

### *Newsletter submissions*

The Aquatic Animal Health Subprogram welcomes contributions to *Health Highlights* on all aquatic animal health R&D news and events – both within and outside the FRDC. We aim to assist the widespread exchange of information by including any of the following in each annual edition: project updates, milestone reports, final reports, research papers, project communication and extension outputs, info sheets, and letters to the editor. Announcements of conferences, workshops, meetings, etc are also welcome.

### *Mailing list*

*Health Highlights* is distributed annually to stakeholders via hard copy and email as well as being posted on the FRDC website at: http://www.frdc.com.au/research/aquatic_animal_health/Pages/default.aspx. To change contact details or to ensure inclusion on the *Health Highlights* mailing list, contact Joanne:

Joanne Slater
FRDC AAH Subprogram Coordinator
CSIRO Australian Animal Health Laboratory
PO Box 24 Geelong VIC 3220
Email: joanne.slater@csiro.au

*Health Highlights* is funded by the Fisheries Research and Development Corporation. 

# Aquatic Animal Health Technical Forum

The 5th Aquatic Animal Health Technical Workshop was held on 17-19 June 2015 and hosted by James Cook University, Townsville. Twenty-nine registered participants attended for the duration of the workshop. There was also a number of James Cook University staff and students attending some sessions. The participants were from various laboratories and businesses involved in aquatic animal industries.

The workshop program consisted of presentations from participants covering a number of disciplines including molecular biology, histology, microbiology and virology.

Congratulations to Nette Williams and the organizing committee for another successful workshop, and thanks to James Cook University staff for their enthusiastic assistance and cooperation.

# *Completed AAHS Project Summaries*

**Project No. 2012/052:** Aquatic Animal Health Subprogram: Development of a laboratory model for infectious challenge of Pacific oysters (*Crassostrea gigas*) with ostreid herpesvirus type-1 (PI: Peter Kirkland)

## Executive Summary

### What the report is about

Between 2010 and 2013 there were devastating outbreaks of Ostreid herpesvirus 1 (OsHV-1) that caused the almost entire loss of commercially farmed and wild populations of Pacific oysters in the Georges River estuary in NSW and later in the Hawkesbury River. Scientists at the NSW Department of Primary Industries, Elizabeth Macarthur Agriculture Institute (EMAI) at Menangle have now developed a well characterised laboratory infection model to rapidly measure the level of resistance that new generations of Pacific oysters might have against this virus. This will allow oyster geneticists and breeders to select families of oysters from which future generations can be derived and reduce the impact of this devastating disease. In collaboration with scientists at the NSW DPI Fisheries Institute at Port Stephens, CSIRO Marine and Atmospheric Research, Tasmania and Australian Seafood Industries, the research team has successfully applied the model infection system to screen several generations of Pacific oysters to assess the level of inherited resistance to herpesvirus infection. This model will now be used as a key component in future breeding programs as one of the tools to reduce the impact of this disease.

### Background

In November 2010, a herpesvirus was identified as the cause of a disease outbreak which resulted in almost 100% mortality of farmed and wild Pacific oysters in the Georges River. Three years later the virus was detected in the Hawkesbury River in NSW. Commercial Pacific Oyster production is no longer viable in these estuaries. Since 2008 this variant herpesvirus (Ostreid herpesvirus type I µVar – OsHV-1) has devastated farmed Pacific Oysters (*Crassostrea gigas*) in many countries, particularly France and New Zealand. Early observations by scientists from the NSW Department of Primary Industries indicated that there may be some evidence of genetic resistance to this virus infection. However, to identify and breed from oyster lines that have resistance to OsHV-1 infection, selection requires exposure to infection under highly controlled conditions to ensure reliable data are obtained. While oysters could be exposed to natural infection under field conditions, there are many confounding variables. These include the presence and dose of virus, variations in virus strain, effects of temperature fluctuation and the influence of a number of other environmental factors. Because this virus will devastate Pacific oyster populations within weeks of exposure, biosecurity and containment is also an important consideration to ensure that the virus is not spread to other regions in NSW or elsewhere in Australia.

### Aims/objectives

The aim of this project was to develop a laboratory based system that simulates the conditions of natural infection as much as possible but overcomes the limitations of exposing oysters to herpesvirus infection in the field. Factors that had to be taken into account included the source of the virus, availability of the same virus over a long period of time, a method to ensure that the virus remained stable and the infectivity did not decline during storage in the laboratory, methods to infect oysters of different ages and sizes and a way to monitor virus infection in the oysters and confirm that any disease or death was due to the virus infection. These studies also had to be undertaken under conditions that would ensure that the virus is fully contained and could not be inadvertently released into the wild. The ultimate objectives were to produce a stable virus preparation that could be used in a biosecure system designed to screen large numbers of experimentally infected oysters of different genetic profiles.

### Methodology

To achieve these objectives, research was undertaken in the NSW Department of Primary Industries, Elizabeth Macarthur Agriculture Institute at Menangle NSW. High level containment, controlled temperature facilities are available to undertake these studies and the research team led by Dr Peter Kirkland in the Virology Laboratory has extensive experience in research with herpesviruses as well as undertaking experimental infections of animals. Initially virus was amplified by injecting healthy Pacific oysters from Port Stephens with an extract of tissue collected from oysters affected in the Georges River, immediately after the first outbreak of disease. Subsequently, large amounts of virus were produced, semi-purified and stored frozen in a cryo-preservative solution at approximately -80°C.

With a stabilised cryo-preserved virus preparation available, a series of experiments involving the immersion of oysters in a range of different virus concentrations were undertaken. Oysters were initially placed in a very small volume of water that contained virus and, after overnight exposure, the volume of artificial sea water was increased to a volume consistent with standard husbandry in the laboratory. Oysters were then held for up to 7 days, with food and complete changes of water every second day and were examined for signs of disease daily. Water samples were collected daily to test for the presence of virus. A real time PCR assay was used to determine the quantity of virus in oyster tissues and also in the water in which oysters were held. To provide a more reliable measure of

resistance to herpesvirus infection, oysters from a wide range of different genotypes were exposed to virus at several different ages.

**Results/key findings**

Stability studies have shown that this virus preparation has remained infectious for more than 18 months with little recognisable decline in infectivity when frozen at ultra-low temperatures (-80$^{o}$C or lower). Although the virus remains infectious for moderate periods at 4$^{o}$C, there is a gradual decline in infectivity to an extent that this is not suitable for use in comparative studies.

In nature, newly introduced Pacific oysters quickly become infected when placed in waters where OsHV-1 virus is endemic. During experimental studies conducted by French scientists it had only been possible to infect oysters when they were immersed in water that had held other oysters that had been recently infected by injection. Such an approach has significant limitations because it depends on infection of large oysters by injection and the need for a ready source of virus from naturally infected oysters. The resulting quantity of virus released from the injected oysters cannot be readily determined and varies from one experiment to another. These limitations have now been overcome and the research team has successfully and repeatedly infected oysters by immersion in water containing a known quantity of OsHV-1. The availability of a stabilised cryo-preserved virus preparation has also allowed oysters to be exposed to the same batch and dose of virus in a series of experiments. Consequently a reliable and reproducible infection model has been developed that essentially simulates natural exposure. Infection and disease have been induced in small spat as well as juvenile and sub-adult Pacific oysters.

The infection model developed now allows experimental virus challenges to be undertaken to assess the genetic basis for any variability in the susceptibility or resistance to OsHV-1 infection. The determination of virus load in holding water at 4-5 days after challenge has proven to be a simple non-invasive method to confirm virus replication in susceptible Pacific oysters. Scientists from the Cawthron Institute, New Zealand have also been trained in the establishment and use of this infection model and have successfully applied it to oyster herpesvirus research in New Zealand.

As well as applying this infection model to assess the genetic basis of resistance in Pacific oyster family lines, this system was later used to assess the susceptibility of Australian flat oysters (*Ostrea angasi*). Flat oysters were tested at ages ranging from a few months through to about 18 months of age. No disease was observed and no evidence of virus infection was detected, even after testing of tissues by a highly sensitive real time PCR assay.

**Implications for relevant stakeholders**

The infection model that has been developed now provides a key tool that will allow geneticists and oyster breeders to select genotypes that are resistant to infection with OsHV-1. When genetically resistant oysters become available to farmers this should form a firm foundation on which to develop strategies to minimise the impact of this highly contagious disease. This may allow farmers in affected areas of Australia to eventually resume Pacific oyster production and reduce the risk of major outbreaks in areas that are currently free of infection. The confirmation of resistance of flat oysters provides an alternative product that can be farmed in OsHV-1 endemic waters.

**Recommendations**

While an infection model has been developed and provides reproducible results, one of the long term limitations to its use is the need for a highly susceptible oyster line or cell culture to use as a standard substrate to monitor the stability and dose of the challenge virus. As resistant oysters are developed, if they are used as a control to determine virus levels, it is likely that they will give results that would suggest less virus has been used or that the stored virus has deteriorated. If the challenge virus is then adjusted on the basis of these results, it is probable that an artificially high level would be used and may not accurately reflect the level of genetic gain that has been achieved. Consequently there is a need to continue to breed small populations of highly susceptible Pacific oysters to use as a standard against which genetic gain can be measured and virus levels accurately determined.

**Keywords**

genetic resistance, genotype, infection, ostreid herpesvirus, Pacific oyster, real time polymerase chain reaction assay, susceptibility.

**Project No. 2013/414:** Aquatic Animal Health Subprogram: A review of vocational education and training aquatic animal health programs within Australia (PI: Mark Oliver)

**Background**

The FRDC Aquatic Animal Health Subprogram (AAHS) has identified the development of a national aquatic animal health curriculum in tertiary institutions as a high priority for the Australian aquatic animal sector. While the AAHS has a reasonable understanding of what aquatic animal health courses are available at Australian universities and veterinary schools, it is recognised that there is a lack of awareness of such courses available through vocational training institutes such as TAFEs. As a result the PI was engaged to undertake a strategic review of the vocational training environment within the context of Aquatic Animal Health (AAH) training, assessment and curriculum.

**Objectives**

1. Develop a comprehensive catalogue of vocational institutes providing courses in aquatic animal health;
2. Outline past and present vocational training courses that address aquatic animal health;
3. Define training package aquatic animal health content, elements, performance criteria, critical knowledge areas, critical skills areas, range statements, critical aspects of evidence and assessment for all vocational levels;
4. Outline specific topics/species covered in the learning materials of vocational training institutions; and
5. Define articulation procedures for vocational training areas of aquatic animal health into tertiary systems.

**Key findings**

The vocational training and education sector have an existing curriculum known as the Seafood Industry Training Package (SFITP)

Aquatic animal health is trained in all of the 5 level of qualifications offered in the SFITP

Training methodologies are designed from the SFITP

Practical application in training is a vital part of the vocational training framework

Although most areas of AAH are well serviced, the areas of biosecurity and aquatic animal welfare need to be enhanced within the SFITP and subsequent training delivery

Learning materials for the vocational sector need to be upgraded to meet current industry trends.

Vocational institutions are ready to work with other areas the tertiary sector to enhance AAH training and education.

**Project No. 2011/048:** Aquatic Animal Health Subprogram: Determining the susceptibility of Australian species of prawns to infectious myonecrosis (PI: Nick Gudkovs)

## Executive Summary

**What the report is about**

Scientists at the CSIRO Australian Animal Health Laboratory (AAHL) in Geelong Victoria, with assistance from Indonesian scientists at the Centre for Brackishwater Aquaculture Development (CBAD), Jepara, Indonesia have demonstrated that two prawn species of commercial importance to Australia are susceptible to the exotic virus, infectious myonecrosis virus (IMNV). IMNV causes infectious myonecrosis, a disease of penaeid prawns which has been reported to occur in north-eastern Brazil, in the East Java Island, west Java, Sumatra, Bangka, west Borneo, south Sulawesi, Bali, Lombok and Sumbawa in South-East Asia and possibly in other South-East Asian countries (OIE, 2014).

IMNV is known to cause significant disease outbreaks, associated with mortalities, in farmed Pacific white shrimp (*Litopenaeus vannamei*) i.e. by natural infection. In addition, the Pacific blue shrimp (*Penaeus stylirostris*) and the black tiger shrimp (*P. monodon*) are susceptible to experimental infection with IMNV (OIE, 2014). Apart from these data there is no information on susceptibility of other prawn species.

In 2011-12, Australian commercial prawn production was valued at $265 million (ABARES, 2013) and, together, commercial and non-commercial prawns are a significant resource of which the farmed banana prawn (*Fenneropenaeus merguiensis*) and the wild brown tiger prawn (*Penaeus esculentus*) are important species. It is important to know whether prawn species such as these are susceptible to infection by IMNV to assist in determining the risk this exotic virus may pose should there be an incursion.

Thus, in collaboration with MCBAD Indonesia, infectivity trials were undertaken (1) at AAHL to determine the susceptibility of IMNV to the banana prawn and the brown tiger prawn, and (2) at MCBAD, using the natural host the Pacific white shrimp as positive control.

**Background**

The prawn fishery, including prawn aquaculture, is an important natural resource for Australia that is also the basis for a valuable export industry. Fortunately, the Australian prawn industry is free from many of the diseases that have devastated prawn aquaculture overseas at one time or another, e.g., the estimated impact of white spot disease (WSD), caused by white spot syndrome virus (WSV) in Asia alone after its emergence in 1992 until 2001, was US$4-6 billion (Lightner, 2003). In the Americas, the emergence of WSD in 1999 resulted in immediate losses estimated at US$1 billion to 2001.

Infectious myonecrosis (IMN) is a viral disease that has caused significant disease outbreaks and mortalities in farmed *Litopenaeus vannamei* (Pacific white shrimp) overseas (OIE, 2014). The economic loss in Brazil alone was estimated to be US$20 million in 2003 (Tang et al., 2005). While *L. vannamei* is considered the principal (natural) host, experimental infection of *Penaeus stylirostris* (Pacific blue shrimp) and *P. monodon* (black tiger shrimp) has been reported (Tang et al., 2005). The susceptibility of other shrimp/prawn species is unknown. Information on the susceptibility of prawn species important to Australia is lacking. Using the bio-secure containment facility provided by the CSIRO Australian Animal Health Laboratory, this study provides significant new information on the susceptibility of two commercially important species of Australian prawns, *F. merguiensis* (banana prawn) and *P. esculentus* (brown tiger prawn), following exposure to exotic IMNV. Such information is important to policy-makers, regulators and primary

producers with respect to relevant biosecurity issues at all levels of government.

**Aims/objectives**

1. Import infectious myonecrosis virus (IMNV) of known pathogenicity
2. Determine the susceptibility of banana prawns to IMNV
3. Determine the susceptibility of brown tiger prawns to IMNV

**Methodology**

An infectious inoculum of IMNV was prepared at MCBAD, Jepara, Indonesia and transferred to CSIRO AAHL, Geelong. At Geelong, the inoculum was inoculated (i.m.) into banana prawns and brown tiger prawns which were subsequently monitored for signs of infection and disease. The prawns were sampled on a daily basis post-inoculation and tissues were processed for determining the presence of IMNV infection and disease using OIE methods. Following this first trial a second series of experiments were conducted to simulate natural modes of viral transmission and confirm susceptibility according to criteria developed by the OIE.

**Results/key findings**

This investigation has demonstrated that the two commercial species of prawns of Australian origin, *Fenneropenaeus merguiensis* and *Penaeus esculentus*, are susceptible to infection with the exotic virus IMNV. Such information is important to policy-makers, regulators and primary producers with respect to relevant biosecurity issues at all levels of government.

**Implications for relevant stakeholders**

While this project was limited to investigating the susceptibility of two important prawn species, the results suggest that the host range for IMNV is broader than previous data had indicated.

**Recommendations**

It is recommended that industry, regulators at all levels of government and the prawn health community in general note the results of this project and their implications with respect to biosecurity.

**Keywords**

Infectious myonecrosis (IMN); infectious myonecrosis virus (IMNV); banana prawn (*Fenneropenaeus merguiensis*); brown tiger prawn (*Penaeus esculentus*); *in vivo* infectivity trials; susceptibility; prawn virus

# *Progress Summaries for Active AAHS Projects*

**Project No. 2012/050:** Aquatic Animal Health Subprogram: A survey of *Edwardsiella ictaluri* in wild catfish populations in Australia (PI: Alan Lymbery)

Final Report in preparation.

**Project No. 2012/032:** Aquatic Animal Health Subprogram: Pacific oyster mortality syndrome (POMS) – risk mitigation, epidemiology and OsHV-1 biology (PI: Richard Whittington)

Final Report in preparation.

**Project No. 2013/001:** Aquatic Animal Health Subprogram: Determination of susceptibility of various abalone species and populations to the various known AbHV genotypes (PI: Serge Corbeil)

Preliminary analysis indicates that the abalone species tested to date from Victoria, South Australia and Tasmania are susceptible to all viral isolates.

**Project No. 2013/036:** Tactical Research Fund: Aquatic Animal Health Subprogram: Viral presence, prevalence and disease management in wild populations of the Australian Black Tiger prawn (*Penaeus monodon*) (PI: Jeff Cowley)

Final Report in review.

**Project No. 2011/004:** Development of Improved Molecular Diagnostic Tests for *Perkinsus olseni* in Australian molluscs (PI: Nick Gudkovs)

Draft Final Report in preparation.

**Project No. 2014/001:** Aquatic Animal Health Subprogram: Strategic approaches to identifying pathogens of quarantine concern associated with the importation of ornamental fish (PI: Joy Becker)

The project is continuing to meet the milestones set out in the application. Dr Kate Hutson is on sabbatical from June to December 2015. The QAP laboratories were audited as part of the AQIS annual inspection requirements. Both laboratories passed with no non-conformities. The QAP laboratories have been renewed until 30 June 2016.

A PhD candidate, Mr. Alejandro Trujillo González has been recruited to the project. Mr González has been awarded a Postgraduate Research Scholarship from James Cook University (JCU) and began his program in July 2015 at JCU under the supervision of Dr Kate Hutson. Mr. Josh Allas, a graduate diploma student from JCU completed a small research activity in parasitology that will value add to the project.

Miss Sophia Johnson, an honours student from USyd will be completing a small research activity in virology that will value add to the project. A PhD opportunity at USyd has been advertised and circulated to relative interest groups for one year. To

date, no candidates with an Australian Postgraduate Award have been identified. The position remains available and has not impacted the achieving the milestone.

The second sampling event (S2) was undertaken from 25 May to 6 June 2015. Dr Kate Hutson, Dr Terry Miller, Mr. Alejandro Trujillo González and Mr. Josh Allas travelled to Camden to participate in the sampling.

Ornamental fish exporters from whom we had ordered fish previously were contacted by email. As well, numerous new exporters were contacted. Meeting the minimum order size continues as an issue, especially for marine species. The next sampling event (S3) is scheduled for 19 to 31 October 2015. It is expected to be the final sampling event given that we will have collected more than three populations for each fish species. For viral pathogens, freshwater species will be tested to detect a minimum of 2% (n=150) and marine species at 10% (n=30). For a species ordered in excess of the required sample size, a simple random selection was used to choose the individual fish for testing. The remainder of the fish are held under quarantine at -80°C for use in Objective 4 as possible. The minimum sample size the bacteriology was set at 30 to detect 10% prevalence.

Five consignments of ornamental fish were imported with two from Singapore, and one from each Indonesia, Sri Lanka and Thailand.

**Project No. 2014/002:** Aquatic Animal Health Subprogram: Development of stable positive control material and development of internal controls for molecular tests for detection of important endemic and exotic pathogens (PI: Nick Moody)

Positive controls have been designed for 27 real-time and conventional PCR assays, detecting 14 viral pathogens of finfish, crustaceans and molluscs (white spot virus, oyster herpesvirus, *Megalocytivirus*, abalone herpesvirus, nervous necrosis virus, *Isavirus*, viral haemorrhagic septicaemia virus, spring viraemia of carp virus, Taura syndrome virus, pilchard orthomyxovirus, yellow head virus genotype 1, epizootic haematopoietic necrosis virus, Tasmanian Aquabirnavirus and Tasmanian salmon aquareovirus. Additional assays have been included due to changing/new priorities. These reagents are currently being evaluated.

**Project No. 2015/001:** Aquatic Animal Health Subprogram: Bonamiasis in farmed native oysters (*Ostrea angasi*) (PI: Tracey Bradley)

Contracts have been exchanged and project has commenced.

**Project No. 2015/003:** Aquatic Animal Health Subprogram: Development of standard methods for the production of marine molluscan cell cultures (PI: Andrew Reid)

Contracts have been exchanged and project has commenced.

**Project No. 2015/005:** Aquatic Animal Health Subprogram: Determining the susceptibility of Australian *Penaeus monodon* and *P. merguiensis* to newly identified enzootic (YHV7) and exotic (YHV8 and YHV10) Yellow head virus (YHV) genotypes (PI: Nick Moody)

Contracts have been exchanged and project has commenced.

## *Summary of Active Projects*

| Project No. | Project Title | Principal Investigator |
|---|---|---|
| 2009/315 | PD Program: Scholarship program for enhancing the skills of aquatic animal health professionals in Australia (*Associated species*: multi-species) | Jo-Anne Ruscoe<br>FRDC<br>Phone: 02 6285 0423<br>Email: jo-anne.ruscoe@frdc.com.au |
| 2011/004 | AAHS: Development of Improved Molecular Diagnostic Tests for *Perkinsus olseni* in Australian molluscs (*Associated species*: multi-species) | Mr Nick Gudkovs<br>CSIRO AAHL Fish Diseases Laboratory<br>Phone: 03 5227 5456<br>Email: nicholas.gudkovs@csiro.au |
| 2012/001 | AAHS: Strategic planning, project management and adoption (*Associated species*: multi-species) | Dr Mark Crane<br>CSIRO AAHL Fish Diseases Laboratory<br>Phone: 03 5227 5118<br>Email: mark.crane@csiro.au |
| 2012/002 | AAHS: Aquatic Animal Health Technical Forum (*Associated species*: multi-species) | Nette Williams<br>CSIRO AAHL Fish Diseases Laboratory<br>Phone: 03 5227 5442<br>Email: lynette.williams@csiro.au |
| 2012/032 | AAHS: Pacific oyster mortality syndrome (POMS) - risk mitigation, epidemiology and OsHV-1 biology (*Associated species*: Pacific oyster) | Prof Richard Whittington<br>University of Sydney<br>Phone: 02 9351 1619<br>Email: richardw@camden.usyd.edu.au |
| 2012/050 | AAHS: *Edwardsiella ictaluri* survey in wild catfish populations (*Associated species*: catfish spp.) | Prof. Alan Lymbery<br>Murdoch University<br>Phone: 08 9360 2729<br>Email: a.lymbery@murdoch.edu.au |
| 2013/001 | AAHS: Determination of susceptibility of various abalone species and populations to the various known AbHV genotypes (*Associated species*: *Haliotis* spp.) | Dr Serge Corbeil<br>CSIRO AAHL Fish Diseases Laboratory<br>Phone: 03 5227 5254<br>Email: serge.corbeil@csiro.au |
| 2013/036 | Tactical Research Fund: AAHS: Viral presence, prevalence and disease management in wild populations of the Australian Black Tiger prawn (*Penaeus monodon*) (*Associated species*: *Penaeus monodon*) | Dr Jeff Cowley<br>CSIRO Agriculture<br>Phone: 07 3214 2527<br>Email: jeff.cowley@csiro.au |
| 2014/001 | AAHS: Strategic approaches to identifying pathogens of quarantine concern associated with the importation of ornamental fish (*Associated species*: multi-species) | Dr Joy Becker<br>University of Sydney<br>Phone: 02 9036 7731<br>Email: joy.becker@sydney.edu.au |
| 2014/002 | AAHS: Development of stable positive control material and development of internal controls for molecular tests for detection of important endemic and exotic pathogens (*Associated species*: multi-species) | Dr Nick Moody<br>CSIRO AAHL Fish Diseases Laboratory<br>Phone: 03 5227 5749<br>Email: nick.moody@csiro.au |
| 2015/001 | AAHS: Bonamiasis in farmed native oysters (*Ostrea angasi*) (*Associated species: Ostrea angasi*) | Dr Tracey Bradley<br>Dept Economic Development, Jobs, Transport and Resources - Victoria<br>Phone: 03 9217 4171<br>Email: tracey.bradley@ecodev.vic.gov.au |
| 2015/003 | AAHS: Development of standard methods for the production of marine molluscan cell cultures (*Associated species*: multi-species) | Dr Andrew Reid<br>Elizabeth Macarthur Agriculture Institute<br>Phone: 02 4640 6332<br>Email: andrew.j.reid@dpi.nsw.gov.au |
| 2015/005 | AAHS: Determining the susceptibility of Australian *Penaeus monodon* and *P. merguiensis* to newly identified enzootic (YHV7) and exotic (YHV8 and YHV10) Yellow head virus (YHV) genotypes | Dr Nick Moody<br>CSIRO AAHL Fish Diseases Laboratory<br>Phone: 03 5227 5749<br>Email: nick.moody@csiro.au |

| | | |
|---|---|---|
| | (*Associated species*: *Penaeus monodon, P. merguiensis*) | |

## *Subprogram Contact Details*

| Name | Telephone | Fax | Email |
|---|---|---|---|
| Mark Crane, *Aquatic Animal Health Subprogram Leader* | 03 5227 5118 | 03 5227 5555 | mark.crane@csiro.au |
| Joanne Slater, *Aquatic Animal Health Subprogram Coordinator* | 03 5227 5427 | 03 5227 5555 | joanne.slater@csiro.au |
| **Steering Committee (STC)** | | | |
| Brett Herbert, *Australian Government Department of Agriculture and Water Resources, Canberra, ACT* | 02 6272 5402 | 02 6272 3856 | brett.herbert@agriculture.gov.au |
| Pheroze Jungalwalla, *National Aquaculture Council, Hobart, Tasmania* | 0419 898 852 | | pherozej@gmail.com |
| David Mills, *Paspaley Pearling Company, Darwin, NT* | 0411 059 769 | | dmills@paspaley.com.au |
| Tracey Bradley, *Department of Economic Development, Jobs, Transport and Resources - Victoria* (SCAAH Rep) | 03 9217 4171 | 03 9214 4322 | tracey.bradley@ecodev.vic.gov.au |
| Jo-Anne Ruscoe, *Fisheries Research & Development Corporation, Canberra, ACT* | 02 6285 0416 | 02 6285 4421 | jo-anne.ruscoe@frdc.com.au |
| **Scientific Advisory Committee (SAC)** | | | |
| Richard Whittington, *University of Sydney, Camden, NSW* | 02 9351 1619 | 02 9351 1618 | richardw@camden.usyd.edu.au |
| Nick Moody, *AAHL Fish Diseases Laboratory, CSIRO Australian Animal Health Laboratory, Geelong, Victoria* | 02 5227 5749 | 02 5227 5555 | nick.moody@csiro.au |
| Stephen Pyecroft, *University of Adelaide, Roseworthy Campus, South Australia* | 08 8313 7823 | | stephen.pyecroft@adelaide.edu.au |