Australian Government
Fisheries Research and Development Corporation

Health Highlights

Aquatic Animal Health Subprogram Newsletter
Volume 13, Issue 2, May 2013

In this issue

From the Subprogram Leader……..…1

AAHS Committees membership……..1

STC/SAC Meetings ……2

Health Subprogram Website…..……..2

Special Article……..2

Completed AAHS Project Summaries….3

Summary of Active Projects……..7

Subprogram Contact Details……..…..8

Cairns Conference Programme…..……9

The Pullman Reef Hotel, Cairns – Venue for the 2013 Australasian Scientific Conference on Aquatic Animal Health, 8-12 July 2013

From the Subprogram Leader

2013 FRDC Australasian Scientific Conference on Aquatic Animal Health

The main purpose of this early edition of *Health Highlights* is to provide the programme for the 2013 FRDC Australasian Scientific Conference on Aquatic Animal Health. You should be aware by now that the conference is to be held in Cairns at The Pullman Reef Hotel, on 8-12 July 2013. The conference programme has been finalised and is attached – see page 9 of this newsletter. The submitted abstracts are the usual high quality and with over 100 registrants, to date, the conference should be informative and enjoyable.

Registration for the conference is available at the following website:

http://seek.hosting.exacttarget.com/EventManagement/EventPage.aspx?ispbk=clear&SUBID=-1&JOBID=17580398&MID=84905

Contributions by FRDC, the major sponsor of this conference, make it possible for us to invite international experts as conference keynote presenters and to subsidise conference attendance by students registered at Australian universities and other tertiary education institutes.

Notice to Cairns Conference Presenters

- If authors notice any errors in the title of their presentation or the author list, please contact Joanne Slater (Email: joanne.slater@csiro.au).
- Please provide Joanne Slater (Email: joanne.slater@csiro.au) with a short biography that can be used by session chairs to introduce you prior to your presentation.
- As with previous conferences, the conference proceedings will be produced on CD and distributed to all registrants and other interested parties, on request. Please let Joanne Slater know if you have concerns with this policy.
- You will note that the conference programme has a tight schedule. Please ensure that your presentation, including question time (allow 5 minutes), is no longer than 20 minutes. Session chairs will terminate your presentation promptly to maintain the programme on schedule.

Changes to AAH Subprogram Committees

I am pleased to announce that after a lot of interest in the vacant positions in the AAHS committees we have a full complement of members for both the Steering committee and the Scientific Advisory Committee. We welcome the following new members to the Steering Committee:

Representing the commercial fishery sector: David Ellis, Director, Australian Southern Bluefin Tuna Industry Association.

Representing the Federal Government Sub-committee on Aquatic Animal Health (SCAAH): Tracey Bradley, Principal Veterinary Officer – Aquatic Animal Health, CVO Unit, Dept Primary Industry, Victoria.

Stephen Pyecroft, Senior Lecturer, University of Adelaide, has joined the Scientific Advisory Committee.

Contact details for AAHS committee members can be found on page 5 of this newsletter.

As AAH Subprogram Leader, I wish to thank former committee members, Drs Brian Jones and Barbara

Nowak, for their support and valuable contribution to AAHS over the past few years.

STC/SAC Meetings

The FRDC AAHS met in March when priorities for the 2014-15 funding cycle were discussed and recommendations were forwarded to FRDC for review. Subsequently, earlier this month, you should have received an email from us concerning the 2014 Annual Competitive Round Call for Expressions of Interest (EoIs) addressing these priorities. Please note that EoIs need to be submitted to the relevant FRABs/Subprograms via FishNet (http://www.fishnet.gov.au/fishnet/) by 15 June 2013 for review by AAHS in July.

Health Subprogram Website

Our website is located on the FRDC website (http://frdc.com.au/Pages/home.aspx) and can be accessed directly at:

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.

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 bi-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. Contact Joanne Slater (Email: joanne.slater@csiro.au).

Mailing list

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

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Special Article

Please note the following article, contributed by the Australian Government Department of Agriculture, Fisheries and Forestry's Aquatic Animal Health Program, concerning Animal Health Committee (AHC) protocols for sending aquatic animal health samples overseas.

Sending aquatic animal samples overseas – What are the risks and procedures?

To demonstrate Australia's favourable animal health status to international trading partners, fisheries and aquaculture industries, state and territory governments and the Australian Government invest considerably in surveillance, disease investigation and official reporting activities. This investment is important for our industries to access international markets and for Australia to justify quarantine arrangements that aim to manage the risk of exotic diseases entering the country.

Suspicion of important exotic diseases in Australia is managed through arrangements that include: A legal requirement to report the suspicion of diseases listed on *Australia's National List of Reportable Diseases of Aquatic Animals* in each state and territory; initial diagnosis in state and territory government laboratories; referral to Australia's national laboratory, the CSIRO Australian Animal Health Laboratory for confirmatory testing; and consideration of diagnostic test results by the Aquatic Consultative Committee on Emergency Animal Diseases. These arrangements are supported by standards and quality systems that operate in Australian laboratories.

Based on past experiences, there is a real risk to Australia's aquatic animal trade and health status associated with the transfer of specimens overseas for infectious and parasitic disease testing. The risk can result in a loss of market access, leading to significant socio-economical impact on Australia's fisheries and aquaculture industries. Major issues of concern include:

1. The possibility of inappropriate overseas reporting of test results that suggests the presence of an infectious or parasitic agent not previously known to occur in Australia.

2. The difficulty in refuting any questionable test results when the standard of testing and the provenance of samples (and so the validity of test results) are beyond Australian control.

State and territory governments have agreed on a policy to manage the risks associated with the transfer of specimens overseas for infectious and parasitic disease testing. The policy applies to all testing laboratories, research institutions and persons sending biological specimens from Australian animals to overseas laboratories or other agencies for laboratory or consultative procedures that may lead to or suggest a diagnosis of infectious or parasitic disease.

The *Policy for the Transfer of Biological Specimens to Overseas Laboratories for Infectious and Parasitic Disease Testing* is available on the website of the AHC Subcommittee on Animal Health Laboratory Standards (SCAHLS) at: http://www.scahls.org.au/procedures/other_procedures

Anyone intending to send aquatic animal specimens overseas for disease testing should consult this policy. For further information, contact your state or territory aquatic animal health officer or DAFF's Aquatic Animal Health Program (aah@daff.gov.au).

Completed AAHS Project Summaries

Project No 2010/070: Tactical Research Fund: incidence and possible causes of saddleback syndrome in the fish species of south east Queensland (Matthew Campbell and Michelle Landers, Department of Agriculture, Fisheries and Forestry (QLD))

OBJECTIVES:

1. Quantify the extent of Saddleback Syndrome in Queensland using existing databases
2. Review National and International published and grey literature in order to document the occurrence of Saddleback Syndrome and its causes
3. Convene a workshop of stakeholders to present the results of the database searches and literature review

NON TECHNICAL SUMMARY

OUTCOMES ACHIEVED TO DATE

This project was a coordinated approach to evaluate Saddleback Syndrome; its' prevalence, occurrence worldwide and provide a forum to discuss the results of these reviews. The primary outcome of this project is that further research is required regarding Saddleback Syndrome in south east Queensland. The objectives of further research are as follows:

1) Sample recruitment areas to determine if SBS is more or less prevalent in juveniles;

2) Combine eggs and sperm in situ of bream with SBS and rear larvae at BIRC to determine if SBS is genetic; and

3) Monitor catches at areas known to have high incidences of SBS in order to supplement the monitoring undertaken by Assessment and Monitoring.

Yellowfin Bream, *Acanthopagrus australis*, is an important commercial and recreational fish species in Queensland, with a commercial harvest in 2009/10 of 165t and the recreational catch in the millions of individuals per year. *A. australis* is endemic to coastal and estuarine waters between Townsville and Victoria on the east coast of Australia, inhabiting shallow seagrass and mangrove areas in turbid estuaries within Moreton Bay. *A. australis* are demersal, feeding on benthic plants and animals such as sea grass, molluscs, crustaceans, worms, fish and ascidians. The spawning season occurs at lower water temperatures in the winter near surf bars during which females produce a large number of eggs.

A skeletal deformity, characterised by a crescent-shaped indentation of the dorsal surface, has occurred in natural populations of *A. australis* for decades, with recreational anglers in south east Queensland claiming that the deformity was a result of either commercial fishers carelessly removing undersize fish from gill nets or attacks by predators such as birds and sharks. This deformity has been identified (Diggles, in press) as Saddleback Syndrome (SBS) which, for the purposes of this study, is defined as:

An abnormality of the dorsal fin and profile, lacking one to all of the hard spines and rays, accompanied by shape, number and position abnormalities of the associated pterygiophores.

Pterygiophores are internal cartilage or bone that support median fin rays or spines and are located between the vertebral spines and the spines and rays of the dorsal fin.

Queensland's peak recreational fishing representative body, Sunfish Queensland, was concerned that the incidence of this deformity had increased in the years preceding 2009. This increasing incidence was corroborated by commercial tunnel net fishers from Moreton Bay. As such, in 2009, Fisheries Queensland was provided with three *A. australis* - two with the deformity and a control - for testing in order to determine the edibility of the deformed fish. Queensland Health reported that the levels of pesticides and heavy metals in the affected individuals were acceptable for human consumption. The samples provided to Queensland Health, mentioned by Pollock (2010), revealed that the SBS-affected individuals had 2.4 mg/kg and 3.0 mg/kg, respectively, of arsenic compared to 1.2 mg/kg for the control specimen. Mercury, lead and cadmium levels were similar for both affected and unaffected fish. Similarly,

pesticide and PCB levels were identical for both affected and unaffected individuals.

An analysis of data collected by Fisheries Queensland's Assessment and Monitoring (A & M) Unit indicated that SBS occurs in approximately 3.3% of *A. australis* caught in south east Queensland. The data indicated that SBS was most prevalent on the Sunshine Coast, specifically the Maroochy, Mooloolah and Noosa Rivers, and the beaches adjacent to these estuaries. The incidence of SBS did not differ significantly between 2009 and 2010. This sampling was undertaken as part of A & M's routine sampling which focuses on gathering age and length data for stock assessments and, as such, may not have been representative of catches where high incidence of SBS has been reported including the Gold Coast Broadwater and Jumpinpin.

A review of the international scientific literature revealed that SBS was identified in several species, including some similar to *A. australis*. For the most part, SBS has occurred in cultured populations or populations that are relatively isolated. From these studies, a range of factors have been identified that *may* cause SBS, although the authors of these studies fail to identify a single factor or combination of factors that cause SBS.

In wild populations, one study suggested that heavy metal contamination may have been the cause of SBS in the green sunfish *Lepomis cyanellus* in a freshwater lake situated adjacent to a coal-fired power station. Another study failed to identify a single factor causing SBS in three sparids – sea bream *Archosargus rhomboidalis* silver porgy *Diplodus argentus* and pinfish *Lagodon rhomboids* – from a semi-enclosed, subtropical estuary lagoon in Florida, USA. These authors suggested that the populations of these species had declined in this estuary to the extent that genetic variability had been substantially reduced.

Several authors have reported SBS in cultured populations of fish; however, few describe the causative factor, or combination of factors, responsible. During ontogeny (early larval stages), developmental deformities were linked with nutrition. Studies have found that SBS could be caused by feeding conditions, quantity and quality of larval food. One study noted a higher rate of deformity in cultured populations of ayu, *Plecoglossus altivelis*, compared to natural populations. This author suggests that the higher incidence in reared populations could be attributed to unfavourable environmental conditions, such as unfavourable temperature and hypoxial conditions, during ontogeny and also rearing condition, but failed to identify a single cause of the deformity. Another study suggested that SBS in a cultured population of the blue tilapia, *Sarotherodon aureus*, may have been caused by gene mutation. A Greek study found that stocking density and nutrition in cultured populations may have caused SBS in the sparid *Dentex dentex*. The authors of this study stated that the larvae used in these experiments were produced by common parents, excluding any genetic basis for the deformity. A Turkish study published the first account of SBS occurring in gilthead sea bream, *Sparus aurata*, cultured in sea cages. These authors reported that nutritional phosphorus and micronutrients such as Vitamin A, C and D deficiencies are factors that can cause skeletal deformities and, as such, may be a causative factor in SBS.

The project workshop participants, consisting of relevant stakeholders, were presented with information from the literature review and the analysis of the A & M data. The workshop participants concluded that further research was required regarding the causes of SBS in *A. australis* in south east Queensland. Specifically, the workshop participants formulated the following objectives for further research:

1) Sample recruitment areas to determine if SBS is more or less prevalent in juveniles;

2) Combine eggs and sperm *in situ* of bream with SBS and rear larvae at the Bribie Island Research Centre to determine if SBS is genetic; and

3) Monitor catches at areas known to have high incidences of SBS in order to supplement the monitoring undertaken by Assessment and Monitoring.

Project No 201/053: Project 2011/053: Aquatic Animal Health Subprogram: Pacific oyster mortality syndrome (POMS) - understanding biotic and abiotic environmental and husbandry effects to reduce economic losses (Richard Whittington, Ika Paul-Pont and Navneet Dhand, U. Sydney)

OBJECTIVES:

To correlate biotic and abiotic environmental factors with POMS occurrence in selected oyster populations.

NON TECHNICAL SUMMARY

OUTCOMES ACHIEVED TO DATE

This project will assist in ensuring the sustainability and profitability of the aquaculture industry and the health of natural resources by providing new data on the epidemiology of Pacific oyster mortality syndrome (POMS). Practical management measures based on increasing growing height to reduce adult oyster losses due to POMS are possible but require confirmation through a second season of study because the summer of 2011-2012 was unusually mild and wet, and it is possible that POMS disease expression will be different in a typical hot dry summer. There is a broader responsibility towards the Australian community to ensure the sustainability of Australian aquatic natural resources. This was achieved through the promotion of information about oyster health in general and POMS in particular. This project assisted industry to strengthen biosecurity practices: there were proposals from specific sectors of the oyster industry for voluntary

restrictions on oyster movements between estuaries, and objective laboratory testing of oysters for specific pathogens prior to movement to decrease the risk of disease spread. This will protect commercial aquaculture. The need for genetic selection to improve oyster health was addressed by flow of data from this project to the POMS genetic selection program, whereby optimal experimental design for field trials was confirmed to enable identification of a genetic component in resistance. Communication of the most recent findings of the project, namely confirmation that growing height could beneficially affect survival of adult oysters in the face of an outbreak, will be ongoing, including through a fully illustrated website that was established during the project and has proven to be very popular with industry (www.oysterhealthsydney.org).

There is a disturbing pattern of emerging diseases in commercial molluscs nationally that has required a succession of government/industry responses. Pacific oyster mortality syndrome (POMS), which appeared in NSW in 2010, is an internationally significant disease that has severely impacted Pacific oyster production in Europe and New Zealand. This project was based on the premise that the oyster industry will need to learn to live with POMS by managing husbandry.

We investigated the epidemiology of POMS during its second summer in Australia to identify factors which may be exploited to reduce the impact of this viral infection. We describe the outbreak of POMS in Woolooware Bay near Sydney NSW, which started in November 2011 and in which virus associated mortalities were observed until late April 2012. The distribution of disease was non uniform, clustered, highly variable in time and space, and clearly dependent on the age of oysters and their growing height or position in the water column. Implementation of different farming practices, in this case modification of the growing height, could play a role in disease management and help reduce mortality of adult oysters during an OsHV-1 outbreak. The pattern of infection and disease was different on different leases suggesting that underlying environmental factors influence disease expression. Differences in mortality among sites, ages and growing heights were evaluated in relation to the intensity and prevalence of viral infection and the environmental data recorded during the outbreak. The epidemiological observations are of considerable importance and inform future strategies to control OsHV-1, including the methodologies to be applied in the genetic selection program.

Crassostrea gigas were stocked into 3 different oyster leases in Woolooware Bay and allocated into groups to study growing height and age. Two heights were used: a standard growing height, and one 300mm higher than this. Oysters comprised adults (12 month old; 67-93 mm length) and spat (2-3 month old; 21-38 mm) and were placed in plastic trays with lids. Other oysters were kept in floating baskets at each site. The sites were managed by oyster growers with the assistance of researchers and all sampling was conducted by the researchers. Oysters were placed during the late spring in October 2011, before POMS had recrudesced. The level of OsHV-1 virus, *Vibrio* sp., mortality rates and environmental parameters such as temperature and salinity were studied in detail before, during and after the outbreak.

Spat were highly susceptible to the virus and all those kept in trays died regardless of growing height. In contrast, the high growing height reduced the deaths of adult oysters by 40%. The pattern of results was consistent at all three sites. In a second smaller experiment, spat survived in floating baskets but not in trays.

Environmental factors may affect POMS disease events. We found a slight decrease in salinity and variable changes in water temperature just before three mortality events in Woolooware Bay in the Georges River. Importantly, salinity and temperature readings in the Hawkesbury River system were similar to those in the Georges River and therefore may be suitable for POMS to establish.

Overall the observations suggest that OsHV-1 is a necessary but insufficient factor in the mortality event or that OsHV-1 is a sufficient cause but with a very strong dose effect. The virus was detected in oyster tissues up to 2 months before mortalities commenced therefore other factors may be required. These factors could include environmental conditions/triggers or other as yet undiscovered pathogens. *Vibrio spp.* bacteria, which have been suggested to be involved with OsHV-1 virus in POMS disease in France, did not appear to be involved in this outbreak in Woolooware Bay because their intensity did not increase until after the POMS outbreak had started, the species of *Vibrio* present did not change over time and a similar number of *Vibrio* spp. bacteria were present in tissues of healthy oysters in the Hawkesbury River.

Importantly, the virus did not appear to be transmitted free in water. There was considerable epidemiological evidence that its distribution was clustered in Woolooware Bay, and that it behaved as if it was moving together with still to be defined planktonic particles. These important results have already been used by other researchers to confirm the optimal design of field experiments to study the resistance of different *C. gigas* family lines, to support a genetic selection program.

During the outbreak up to 92% of the oysters tested positive for OsHV-1 but afterwards the infection prevalence decreased over time suggesting that surviving adults can clear the virus. Some appeared to be resistant as they survived three separate mortality events during the summer 2011-2012. This suggests possible immunological mechanisms

and underlying potential for genetic resistance to the infection.

It can be concluded from this study that husbandry factors may strongly influence the survival of adult *C. gigas* during an outbreak of POMS. It is possible that measures to reduce the level of exposure of oysters to OsHV-1 as distinct from preventing exposure may be sufficient to prevent mortalities.

Recommendations were made for further development. Further studies are indicated to confirm the effect of growing height on mortality rates, as the present research trial was conducted during an unusually wet and cool summer. If the same results are obtained when the trial is repeated in a more typical summer, oyster growers can confidently take steps to reduce the risk of losses of valuable adult oysters should POMS spread in Australia. Further studies are also required to investigate why some oysters appear to be resistant and how some clear the virus from their organs, to precisely identify the seasonal window of infection, to confirm the mode of transmission of the virus in the environment, to evaluate the risk of transmission with equipment and by handling oysters, to understand how environmental factors combine with the virus to cause mortality, whether a certain level of viral load in the environment is needed to initiate mortalities, and to identify potential wild mollusc hosts for the virus.

Note added in press: A new outbreak of POMS was detected in the Hawkesbury River on 21 January 2013

KEYWORDS: POMS, ostreid herpes virus, Pacific oyster, *Crassostrea gigas*, aquaculture, disease control

Summary of Active Projects

Project No.	Project Title	Principal Investigator
2008/041	AAHS: Tools for investigation of the nodavirus carrier state in marine, euryhaline and freshwater fish and control of NNV through integrated management (*Associated species:* multi-species)	Prof Richard Whittington University of Sydney, Camden, NSW Phone: 02 9351 1619 Email: richardw@camden.usyd.edu.au
2009/032	AAHS: Characterisation of abalone herpes-like virus infections in abalone (*Associated species: Haliotis* spp.)	Dr Mark Crane CSIRO AAHL Fish Diseases Laboratory Phone: 03 5227 5118 Email: mark.crane@csiro.au
2009/044	AAHS: Surveys of ornamental fish for pathogens of quarantine significance (*Associated species:* multi-species)	Prof Richard Whittington University of Sydney, Camden, NSW Phone: 02 9351 1619 Email: richardw@camden.usyd.edu.au
2009/315	PD Program: Scholarship program for enhancing the skills of aquatic animal health professionals in Australia (*Associated species:* multi-species)	Jo-Anne Ruscoe FRDC Phone: 02 6285 0423 Email: jo-anne.ruscoe@frdc.com.au
2010/034	AAHS: Investigation of an emerging bacterial disease in wild Queensland gropers, marine fish and stingrays with production of diagnostic tools to reduce the spread of disease to other states of Australia (*Associated species*: multi-species)	Dr Rachel Bowater DEEDI, Biosecurity Queensland Phone: 07 4760 1592 Email: rachel.bowater@deedi.qld.gov.au
2010/036	AAHS: Improved fish health management for integrated inland aquaculture through Better Management Practices (BMPs) (Associated species: *Maccullochella* spp)	Dr Tracey Bradley DPI Victoria Phone: 03 9217 4171 Email: tracey.bradley@dpi.vic.gov.au
2011/003	AAHS: Investigations into the genetic basis of resistance to infection of abalone by the abalone herpes-like virus (Associated species: *Haliotis* spp)	Dr Serge Corbeil CSIRO AAHL Fish Diseases Laboratory Phone: 03 5227 5254 Email: serge.corbeil@csiro.au
2011/004	AAHS: Development of Improved Molecular Diagnostic Tests for *Perkinsus olseni* in Australian molluscs (*Associated species*: multi-species)	Mr Nick Gudkovs CSIRO AAHL Fish Diseases Laboratory Phone: 03 5227 5456 Email: nicholas.gudkovs@csiro.au
2011/005	AAHS: Investigation of inclusions in Australian prawns (*Associated species*: multi-species)	Dr Melanie Crockford Dept Fisheries WA Phone: 08 9368 3205 Email: mcrockford@agric.wa.gov.au
2011/048	Tactical Research Fund - AAHS: Determining the susceptibility of Australian species of prawns to infectious myonecrosis (*Associated species*: multi-species)	Dr Mark Crane CSIRO AAHL Fish Diseases Laboratory Phone: 03 5227 5118 Email: mark.crane@csiro.au
2011/245	Research methods to manage pathogenic microbiological and biological organisms within a redclaw (*Cherax quadricarinatus*) egg incubator hatchery to improve survival and reliability (*Associated species*: *Cherax quadricarinatus*)	AquaVerde Redclaw Hatchery & Farm Phone: 07 4091 2020 Email: info@aquaverde.com.au
2012/001	AAHS: Strategic planning, project management and adoption (*Associated species*: multi-species)	Dr Mark Crane CSIRO AAHL Fish Diseases Laboratory Phone: 03 5227 5118 Email: mark.crane@csiro.au
2012/002	Aquatic Animal Health Technical Forum (*Associated species*: multi-species)	Nette Williams CSIRO AAHL Fish Diseases Laboratory Phone: 03 5227 5442 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 University of Sydney, Camden, NSW Phone: 02 9351 1619 Email: richardw@camden.usyd.edu.au
2012/052	Development of a laboratory model for infectious challenge of Pacific oysters (*Crassostrea gigas*) with ostreid herpesvirus type-1 (*Associated species*: Pacific oyster)	Dr Peter Kirkland EMAI Phone: 02 4640 6333 Email: peter.kirkland@dpi.nsw.gov.au
2013/004	The Neptune Project: A comprehensive database of Australian aquatic animal pathogens and diseases (*Associated species*: multi-species)	Dr Marissa McNamara Queensland Museum Phone: 07 3842 9173 Email: marissa.mcnamara@qm.qld.gov.au

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Second FRDC Australasian Scientific Conference on Aquatic Animal Health

The Pullman Reef Hotel, Cairns
8-12 July 2013

CONFERENCE PROGRAMME

DAY 1 Monday 8 July

18.00-20.00 Registration and Welcome Happy Hour

DAY 2 Tuesday 9 July

8.00 Registration

8:30 Welcome and Introduction. Mark Crane, FRDC AAH Subprogram Leader

8:35 Keynote Presentation I. Emergence of a new disease in southeast Asian shrimp farms: Pathology. Lightner DV, Redman RM, Pantoja CR, Noble BL, Nunan TM, Loc Tran.

9.35 Session 1: Crustacean Health I (Chairs: Jeff Cowley and Mark Crane)

9.40 Gill-associated virus epizootics in Queensland prawn farms in 2012. Anderson IG, Bowater RO, Condon K.

10.00 Detection of a new genotype of the yellow head complex of viruses in *Penaeus monodon*. Mohr PG, Moody NJG, Hoad J, Williams LM, Anderson IG, Crane MStJ.

10.20 Detection of a new rickettsia-like organism in wild-caught sand crabs (*Portunus pelagicus*) from Darwin and Bynoe Harbours. Diggles BK, MacBeth WG, Barnes L, Dyrting K.

10.40 Coffee Break

11.05 Session 2: Finfish Vaccines (Chairs: Richard Morrison and Matt Cook)

11.10 From research to development: Pioneering the use of aquaculture vaccines in Australia. Carson J, Morrison R, Cornish M.

11.30 Evaluation of an experimental and commercial state-of-the-art vaccine against enteric redmouth disease (ERM) in rainbow trout by waterborne challenge with *Y. ruckeri* O1 biotype 2. Strøm HK, Aalbæk B, Otani M, Villumsen KR, Raida MK.

11.50 Effect of inactivation method of *Yersinia ruckeri* on the efficacy of single dip vaccines. Nguyen DT, Bridle AR, Nowak BF.

12.10 Oral and anal vaccination against enteric red mouth disease protection against yersiniosis. Neumann L, Villumsen K, Strøm H, Raida M.

12.30 Use of a recombinant protein from the amoebae *Neoparamoeba perurans* as a vaccine candidate against AGD in Atlantic salmon. Valdenegro-Vega VA, Crosbie P, Cook M, Nowak BF.

12.50 Lunch Break

13.25 Session 3: Amoebic Gill Disease (Chairs: Barbara Nowak and Phil Crosbie)

13.30 The comparative susceptibility of four Tasmanian endemic fishes and Atlantic salmon to experimentally induced amoebic gill disease (AGD). Adams MB, Bridle AR, Nowak BF.

13.50 A cross-species approach to functional feed development for Amoebic Gill Disease. Maynard B, Appleyard S, Colgrave M, Taylor R, Cook M, Brock M, Glencross B, Brown M.

14.10 Immune gene expression in Atlantic salmon (*Salmo salar* L.) affected by AGD. Pennacchi Y, Bridle AR, Leef MJ, Nowak BF.

14.30 *In vitro* assessment of gill function in AGD affected Atlantic salmon *Salmo salar* gills. Leef M, Nowak BF.

14.50 Culture and trialling of cryopreservation techniques for *Neoparamoeba perurans*, the causative agent of amoebic gill disease in marine-farmed Atlantic salmon, *Salmo salar*. Crosbie PBB, Bridle AR, Nowak BF.

15.10 Towards the application of RNA interference (RNAi) against Amoebic Gill Disease (AGD) of farmed Atlantic salmon (*Salmo salar*). Lima PC, Botwright N, Harris JO, Cook M.

15.30 Tea Break

15.55 Session 4: Aquatic Animal Health Education and training (Chairs: Ingo Ernst and Mark Crane)

16.00 DAFF-FRDC Aquatic Animal Health Training Scheme. Humphrey K, Ruscoe J.

16.20 The Neptune Project - a comprehensive database of Australian aquatic animal pathogens and diseases. McNamara M, Ernst I, Adlard R.

16.40 Aquatic Animal Health Technical Forum (AAHTF) - Current Status. Williams LM, Jones Belinda K, Cornish MC.

17.00 A national curriculum for aquatic animal health. Whittington R, Pyecroft S.

17.20 Close Day 2

18.00-19.00 Happy Hour

DAY 3 Wednesday 10 July

8.00 Registration

8.30 Welcome. Crane MStJ.

8.35 Keynote Presentation II. Emerging Problems in Fish Pathology. Ferguson H.

9.35 Session 5: Finfish Disease and Pathology I (Chairs: Ken McColl and Tracey Bradley)

9.40 Dinoflagellate dilemma. Bannister J.

10.00 Gladstone: Clearing the mud from the waters - why the animals died. Landos MA, Diggles B, Dennis M.

10.20 Infection of wild Queenfish (*Scomberoides commersonnianus*) with sea lice (*Lepeophtheirus spinifer*) (Copepoda: Caligidae) in Australia, with observations of erythematous skin lesions in fish from Gladstone Harbour, Queensland. Diggles BK.

10.40 Effects of chronic heavy metals exposure on thyroid hormone pathway related genes of sand flathead (*Platycephalus bassensis*) from the Derwent River, a historically polluted estuary. Dingkun F, Bridle A, Nowak BF, Leef M.

11.00 Coffee Break

11.25 Session 6: Aquatic Animal Health Regulation (Chair: Tim Lucas and Jeffrey Go)

11.30 A risk analysis of Australia's marine ornamental value chain focusing on biosecurity (diseases and pathogens) concerns. Erickson KP, Campbell ML, Hewitt CL, Flint N.

11.50 Risk analysis of the aquarium trade as a pathway for release of dwarf gourami iridovirus (DGIV) in Australia and the risks of exposure of wild native fish. Rimmer AE, Becker JA, Toribio JA, Whittington RJ.

12.10 Incursions of cyprinid herpes virus 2 in goldfish populations in Australia despite quarantine practices. Becker JA, Tweedie A, Rimmer A, Landos M, Lintermans M, Whittington RJ.

12:30 US FDA regulatory approach to veterinary drugs used in aquaculture. Montwill B.

12:50 Welfare and Aquaculture: Where we are? Where we go? Caraguel CGB.

13.10 Lunch Break

13.45 Session 7: Pacific oyster mortality syndrome I (Chairs: Peter Kirkland and Tim Green)

13.50 Pacific oyster mortality syndrome in NSW (2010-2013). Doolan DA, O'Connor WA, Dove MC, Walker ML, Lyall I, Kirkland PD, Hick P, Gabor M, Spiers ZB.

14.10 OsHV-1 in Pacific oysters in NSW – molecular detection and partial characterisation. Moody NJG, Mohr P, Boyle D, Hick P, Kirkland PD, Crane MStJ.

14.30 Ostreid herpesvirus-1 (OsHV-1) in commercially farmed Pacific oysters (*Crassostrea gigas*) in the Hawkesbury River in 2013: Outbreak investigation. Paul-Pont I, Evans O, Dhand N, Rubio A, Coad P, Whittington RJ.

14.50 Investigating the transmission factors of Ostreid herpesvirus-1 (OsHV-1) within the environment: Wild mollusc species as a possible source of infection? Evans O, Paul-Pont I, Whittington RJ.

15.10 Effects of husbandry practices to reduce OsHV-1 associated mortality of Pacific oysters *Crassostrea gigas*, and first steps towards integrated management within an infected estuary. Paul-Pont I, Evans O, Dhand N, Rubio A, Whittington RJ.

15.30 Tea Break

15.55 Session 8: Pacific oyster mortality syndrome II (Chairs: Richard Whittington and Mark Crane)

16.00 Experimental infection of Pacific oyster *Crassostrea gigas* using the Australian OsHV-1 strain: mortality, dose-response relationship and inoculum storage conditions. Paul-Pont I, Evans O, Whittington RJ.

16.20 Design of a detection survey for Ostreid Herpesvirus using hydrodynamic dispersion models to determine epidemiological units. Pande A, Brangenberg N, Acosta H, Keeling S.

16.40 Poly I:C induces a protective antiviral immune response in the Pacific oyster (*Crassostrea gigas*) against subsequent challenge with Ostreid herpesvirus (OsHV-1 µvar). Green TJ, Montagnani C.

17.00 Susceptibility of the black-lip pearl oyster, *Pinctada margaritifera*, to Ostreid herpesvirus (OsHV-1). Dang C, Tan T, Paul-Pont I, Evans O, Barnes AC, Whittington RJ, Fougerouse A, Bichet H.

17.20 Close Day 3

18.00-19.00 Happy Hour

DAY 4 Thursday 11 July

8.00 Registration

8:30 Introduction. Mark Crane.

8.35 Keynote Presentation III. Emergence of a new disease in southeast Asian shrimp farms: Agent isolation and completion of Koch's postulates. Lightner DV, Redman RM, Pantoja CR, Noble BL, Nunan TM, Loc Tran.

9.35 Session 9: Crustacean Health II (Chairs: Ian Anderson and Nick Moody).

9.40 Teaching driving research: A case study using a novel microsporidium found in western king prawns off the Townsville coast. Elliman J, Owens L.

10.00 The effect of a combined temperature and salinity drop on immune parameters and gene expression in *Penaeus monodon*, fed feeds containing fucoidan. Pountney DC, Nowak BF, Adams LR.

10.20 Endogenous virus-like elements in redclaw crayfish *Cherax quadricarinatus*. Rusaini, La Fauce KA, Elliman J, Bowater RO, Owens L.

10.40 Coffee Break

11.05 Session 10: Finfish Disease and Pathology II (Chairs: Stephen Pyecroft and Rachel Bowater)

11.10 South Australian marine mortalities, summer 2013: An overview. Roberts SD, Bastianello SB, Pyecroft S, Wilkinson C, Van Ruth P, Neverauskas V.

11.30 Common problems with fish blood samples, haematology, biochemistry and feed analysis. Stephens F.

11.50 Yellowtail kingfish (*Seriolae lalandi*) taurine deficiency - A diagnostic case study. Huynh C, Landos M.

12.10 An unusual keratitis and uveitis in farmed barramundi; history, histopathology and cause. Anderson IG.

12.30 Lunch Break

13.15 Session 11: Diagnostic test development and validation (Chairs: Charles Caraguel and Serge Corbeil)

13.20 Design and reporting of validation studies for diagnostic assays used for detection of aquatic animal pathogens: Are improvements necessary? Gardner IA, Burnley T, Caraguel CGB.

13.40 Development and validation of a specific immunohistochemistry method for the detection and localization of *Streptococcus agalactiae* infections in fish tissues. Delamare-Debouteville J, Bowater R, Stanford J, Barnes AC.

14.00 SYBR, TaqMan, or both: Highly sensitive, non-invasive detection of *Cardicola* blood fluke species in Southern Bluefin Tuna (*Thunnus maccoyii*). Bridle A, Polinski M, Belworthy Hamilton D, Nowak BF.

14.20 Use of real-time PCR assay for detection of *Yersinia ruckeri* and asymptomatic carriers in Atlantic salmon. Pradenas J, Bridle A, Nowak BF.

14.40 Use of next-generation sequencing during the biosecurity response to the detection of *Flavobacterium psychrophilum* in New Zealand. Draper J, Brosnahan C, Haydon T, Spence R, Williams RE, Jones B, McDonald, WL.

15.00 MALDI-TOF for bacterial identification and application to strain typing of *Vibrio harveyi*. Buller NB, Tong J, Hair S.

15.20 Tea Break

15.45 Session 12: Finfish viruses (Chairs: Agus Sunarto and Mark Crane)

15.50 Koi herpes virus: Dreaded pathogen or white knight? McColl KA, Sunarto A, Clarke B, Prabandono A, Slater J, Hoad J, Williams LM, Ward A, Doran TJ, Crane MStJ.

16.10 Genotype analysis of koi herpesviruses detected in quarantine in Singapore from 2005 to 2011. Jing C, Chee D, Yahui W, Yee LG, Min CS, Taoqi H, Nuo LY.

16.30 Preliminary characterization of Tasmanian *Aquareovirus* (TSRV) isolates. Zainathan S, Carson J, Crane MStJ, Moody NJG, Williams LM, Hoad J, Gudkovs N, Hyatt AD, Crameri S, Nowak BF.

16.50 Experimental transmission of megalocytivirus between freshwater and marine fish populations through the use of a model euryhaline species Australian bass, *Macquaria novemaculeata*. Go J, Whittington RJ.

17.10 Sero-prevalence of Nervous Necrosis Virus across barramundi and Australian bass adult populations. Jaramillo D, Hick P, Dyrting K, Anderson IG, Whittington RJ.

17.30 Close Day 4

18.00- Happy Hour
19.00

DAY 5 Friday 12 July

8.00 Registration

8.30 Introduction. Crane MStJ.

8.35 Keynote Presentation IV. Gill diseases of fish. H. Ferguson.

9.35 Session 13: Finfish Parasites I (Chairs: Ingo Ernst and Shane Roberts)

9.40 Integrated parasite and disease management strategies for finfish aquaculture in tropical north Queensland: a JCU and QLD Department of Agriculture, Forests and Fisheries initiative. Miller TL, Knuckey R, Reynolds A, Hutson KS.Miller TL, Knuckey R, Reynolds A, Hutson KS.

10.00 Development of an Australian strain of *Ichthyophthirius multifiliis* infecting rainbow trout under different temperatures. Forwood JM, Harris JO, Deveney MR, Landos M.

10.20 Gill lesions in Murray cod (*Maccullochella peelii*) raised in farm dams. McCowan C, Cohen S, Bradley T, Ingram B, Mansell P.

10.40 Review of the fish-parasitic cymothoid crustacean 'tongue biter' genus *Ceratothoa* (Fabricius, 1775) in Australian waters. Martin MB, Bruce NL, Nowak BF.

11.00 Tea Break

11.15 Session 14: Bacteriology (Chairs: Nicky Buller and Jeremy Carson)

11.20 Research findings from the investigation of *Streptococcus agalactiae* in Queensland grouper *Epinephelus lanceolatus*, and wild fish and crustaceans of north Queensland. Bowater RO, Delamare-Debouteville J, Barnes A, Fisk A, Condon K, Dyer K.

11.40 Novel Chlamydia-like epitheliocystis agents in Australian farmed yellowtail kingfish *Seriola lalandi*, striped trumpeter *Latris lineata* and barramundi *Lates calcarifer*. Stride MC, Polkinghorne A, Miller TL, Groff JM, LaPatra SE, Powell M, Nowak BF.

12.00 First report of *Flavobacterium psychrophilum*, the bacterial agent associated with peduncle disease, from Chinook salmon (*Oncorhynchus tshawytscha*) in New Zealand. Williams RE, Jones B, Draper J, Brunton J, Fischer, J, Brosnahan C, McDonald WL.

12.20 *In vitro* use of synthetic antimicrobial peptides against aquaculturally relevant pathogens. Blumhardt M, Bridle A, Nowak BF.

12.40 Lunch Break

13.15 Session 15: Mollusc Diseases (Chairs: Rob Adlard and Tim Green)

13.20 Detection of bacteriophage-related chimeric marine virus in cultured abalone in Taiwan. Chang PH, Chen MS, Chen YW, Kuo ST.

13.40 CSIRO AAHL-IFREMER: Collaborative studies on mollusc pathogens. Corbeil S, Arzul I, Renault T, Faury N, Crane MStJ.

14.00 A longitudinal study of winter mortality disease in *Saccostrea glomerata* (Sydney rock oysters). Jenkins C, Spiers ZB, Gabor M, Fell SA, Carnegie RB, Dove M, O'Connor W, Frances J, Go J, Marsh IB.

14.20 Session 16: Quality Assurance (Chairs: Nette Williams and Peter Mohr)

14.20 New Zealand's salmon export testing scheme. Lane H, Brosnahan C, Orr D, Spence R, McDonald WL.

14.40 A regional aquatic animal health laboratory proficiency testing program in Asia. Herbert BW, Leaño E, Crane MStJ, Gudkovs N, Hoad J, Moody NJG, Warner S.

15.00 International proficiency testing for viral pathogens of finfish. Hoad J, Moody NJG, Williams LM, Crane MStJ

15.20 Tea Break

15.45 Session 17: Finfish Parasites II (Chairs: Kate Hutson and Dave Ellis)

15.50 Infestation of Isopod parasite *Catoessa boscii* (Cymothoidae) on Malabar trevally *Carangoides malabaricus* (Carangidae), Southwest Coast of India. Ravichandran S, Rameshkumr G, Trilles J-P.

16.10 Parasites of introduced freshwater fish species in Murrumbidgee Basin and their impact on aquaculture development in the region. Turner A, van Keulen M, Eulink G, Wassens S, Shamsi S.

16.30 Survival strategies of an insidious fish ectoparasite, *Neobenedenia* sp.. Hutson KS, Truong DH.

16.50 Effects of temperature and salinity on the life cycle of *Neobenedenia* sp. (Monogenea: Capsalidae) infecting farmed barramundi (*Lates calcarifer*). Brazenor AK, Hutson KS.

17.10 Differences in epithelial pathology of fish microhabitats infected with the ectoparasitic monogenean *Neobenedenia* sp.. Trujillo AG, Constantinoiu CC, Johnson LK, Hutson KS.

17.30 Efficacy of garlic (*Allium sativum*) extract in managing the fish ectoparasite *Neobenedenia* sp. (Capsalidae: Monogenea). Militz TM, Hutson KS.

17.50 Close Day 5

19.00-22.00 Conference Dinner