

FINAL REPORT



Aquatic Animal Health Subprogram: training course on exotic diseases of aquatic animals

Kenneth A. McColl and Mark St. J. Crane

June 2004

FRDC Project No. 2002/666



Australian Government
Department of Agriculture,
Fisheries and Forestry



Australian Government
Fisheries Research and
Development Corporation



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Non-technical Summary

2002/666	Aquatic Animal Health Subprogram: training course on exotic diseases of aquatic animals
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Private Bag 24
Geelong VIC 3220

OBJECTIVES:

1. Prepare material to be used in providing a training course on recognition and management of exotic disease outbreaks.
2. Organise and provide a training course in recognition and management of exotic disease outbreaks, based at AAHL.

NON-TECHNICAL SUMMARY:

OUTCOMES ACHIEVED

The major outcomes of this project are: (1) as a result of the Training Course, each State/Territory now has one or two specialists who have recently been updated on the exotic diseases of the aquaculture industries in Australia (i.e., diseases on the *National List of Reportable Diseases of Aquatic Animals*). Their improved knowledge and awareness, and their capacity to improve the knowledge and awareness of many of their colleagues, will encourage greater confidence in the ability of regional aquaculture health specialists to recognize, and manage, incursions of exotic diseases. This, in turn, will assist Australian aquaculture industries to maintain their enviable status with respect to freedom from the major aquatic animal diseases of the world; and, (2) there is now a well-organized resource available for future training of aquaculture health specialists in those diseases that are of prime importance to the aquaculture industries of Australia, i.e., the diseases on the “*National List of Reportable Diseases of Aquatic Animals*”.

In recent years demand for high quality seafood world-wide has increased significantly. In the past 5 years the value of Australian aquaculture has doubled to approximately \$700 million (ABARE 2001) and is expected to increase to \$2.5 billion by 2010 (ACIL Consulting 1999). As the industry expands and intensifies the risk of infectious disease outbreaks also increases and there is a need for an increased level of expertise nation-wide on aquatic animal diseases.

Training courses for diagnosticians and fish health specialists will be required to maintain Australia's proficiency to detect and diagnose aquatic animal diseases, and maintain the confidence of our trading partners. Due to increased world trade and

travel, the threat of exotic disease is increasing. This project aimed at organising and conducting a Training Course that would provide information and training to aquatic animal health specialists to assist in recognition of exotic disease and management of disease emergencies.

Material for use in the Training Course on the recognition and management of exotic disease outbreaks in aquaculture species was gathered from many sources. It was also catalogued and presented such that it was ready for use by the participants. The most difficult resource to assemble was the collection of histological slides that encompasses most of the diseases on the "*National List of Reportable Diseases of Aquatic Animals*". There are still deficiencies in the collection of mollusc diseases but attempts will be made to rectify this deficiency in the future. In addition to the slides, three specialist presenters at the course (covering finfish, crustacean and mollusc diseases) provided a set of Powerpoint presentations that included images of clinical signs, and gross and histological lesions for many of the diseases under consideration. The latter is a resource that can be readily updated for use at any subsequent training courses.

The major outcome of these outputs is that there is now a well-organized resource available for current, and future, training of aquaculture health specialists in those diseases that are of prime importance to the aquaculture industries of Australia, ie, the diseases on the "*National List of Reportable Diseases of Aquatic Animals*".

Having gathered the necessary resources, a Training Course on the recognition and management of exotic disease outbreaks in aquaculture species was organised and undertaken in March/April 2004. Feedback from participants, guest lecturers, AFDL staff and other AAHL staff involved in the training course indicated that the course more than fulfilled its promise. As part of the course, a CD was produced that included a series of lecture notes and other resource material such as photographs of diseased aquatic animals, gross lesions, histological lesions, information on diagnostic techniques and procedures, as well as information on emergency disease management. Apart from directly increasing the skills base of the aquatic animal health participants (and indirectly influencing their colleagues through the use of the CD), the course also assisted in developing professional relationships and rapport among this group of national and international specialists.

Thus, the major outcomes of the course are: (1) each State/Territory now has one or two specialists who have recently been updated on the exotic diseases of the aquaculture industries in Australia (ie, diseases on the *National List of Reportable Diseases of Aquatic Animals*). Their improved knowledge and awareness, and their capacity to improve the knowledge and awareness of many of their colleagues, will encourage greater confidence in the ability of regional aquaculture health specialists to recognize, and manage, incursions of exotic diseases; (2) this, in turn, will assist Australian aquaculture industries to maintain their enviable status with respect to freedom from the major exotic diseases of the world; (3) the course has assisted in increasing the network of the participating aquatic animal health specialists, at both national and international levels.

In terms of further work, the CD, and the course material on which it is based, provides an important resource for Australia. The lecture notes, MS Powerpoint presentations and histological sections will reside permanently at AAHL, and it is anticipated that this resource will be maintained, and updated, by AFDL staff. As new exotic diseases are described, representative descriptions and histological sections

will be obtained from overseas laboratories, building on the current resource. In addition, if further training courses are held in the future, an attempt will be made to address many of the comments and recommendations made by the participants at the end of the current course. This would be likely to improve the course.

KEYWORDS: aquatic animal exotic diseases, training course, histopathology

Acknowledgements

Many of the resources, and much of the information, that have been used to develop the training course were supplied by people from laboratories around the world: Dr F Berthe, IFREMER, La Tremblade, France; Dr V Blazer, USDA/ARS National Center for Cool and Cold Water Aquaculture, Leetown, USA; Dr A Bolland, Intervet, The Netherlands; Dr D Bruno, FRS Marine Laboratory, Aberdeen, Scotland; Drs O Dale, K Falk and T Mo, National Veterinary Institute, Oslo, Norway; Drs D Elliott and J Winton, Western Fisheries Research Center, Seattle, USA; Drs S Feist and D Alderman, CEFAS, Weymouth Laboratory, UK; Dr A Goodwin, University of Arkansas, USA; Dr J Grizzle, Auburn University, USA; Dr D Groman, Atlantic Veterinary College, Canada; Dr L Hanson, Mississippi State University, USA; Dr J Hawke, Louisiana State University, USA; Drs R Hedrick and D Baxa, University of California, Davis, USA; Dr S Kanchanakhan, Kasetsart University, Thailand; Drs J Kurita and M Sano, National Research Institute of Aquaculture, Japan; Dr M Lancaster, Primary Industries Research Victoria – Attwood, Australia; Dr S La Patra, Clear Springs Inc., Idaho, USA; Dr D Lightner, University of Arizona, Tucson, USA; Drs N Moody and I Anderson, Oonoonba Veterinary Laboratory, Queensland, Australia; Drs N-J Olesen, E Ariel and BD Schyth, Danish Veterinary Laboratory, Aarhus, Denmark; Dr S Pyecroft, DPIWE, Tasmania, Australia; Dr R Reuter, IDEXX VPS, South Australia; Dr J Schuh, Applied Veterinary Pathobiology, Bainbridge Island, USA; Dr F Stephens, Western Australia Marine Research Laboratories, Australia; Dr M Stephenson, Department of Fisheries and Oceans, Moncton, Canada; Dr T Wahli, University of Bern, Switzerland; and, Dr M Yoshimizu, Hokkaido University, Japan.

A number of people at AAHL, although not directly involved in this project, also made valuable contributions. Kelly Steeper, Gemma Carlile, Dr Serge Corbeil, Lynette Williams and Tamasine Chamberlain gave valuable advice and assistance with aspects of the training course.

Background

AAHL Fish Diseases Laboratory has received several expressions of interest from the States and overseas (New Zealand) in a training course on exotic diseases of aquatic animals to be held at AAHL. In the past we have incorporated a segment on aquatic animal diseases in the biannual terrestrial animal exotic diseases training course for veterinary scientists which is run at AAHL. The number of participants in these courses who are interested in aquatic animal diseases has steadily increased and we have been approached to run a more comprehensive course on aquatic animal diseases. Stakeholders from State Governments and aquaculture industries have indicated that such a course is overdue.

Thus, as part of the Federal Government's *Building a National Approach to Animal and Plant Health* projects, AAHL was encouraged to submit a project as part of the program *Emergency Management Training and Incident Simulation (Training)* which encompassed training on exotic diseases of aquatic animals. The project was discussed with staff from DPIWE, Tasmania who expressed an interest in participating as course presenters.

In addition to running the training course, a separate project (FRDC Project Number 2002/654) was funded to assist with development of resources for the training course. Following commencement of these two projects, further planning and development occurred, as described in this report, and resulted in establishment of a comprehensive training course in exotic diseases of aquatic animals. With the inclusion of international experts as the main presenters, a comprehensive range of materials has been collected and can be used, with a small level of up-dating, as the basis for future training courses.

Need

In recent years demand for high quality seafood world-wide has increased significantly and continues to increase. This demand cannot be met by wild capture fisheries and has led to expansion of the world's aquaculture industries. In Australia, aquaculture is also growing. In the past 5 years the value of Australian aquaculture has doubled to approximately \$700 million (ABARE 2001) and is expected to increase to \$2.5 billion by 2010 (ACIL Consulting 1999). As the industry expands and intensifies the risk of infectious disease outbreaks also increases and there is a need for an increased level of expertise nation-wide on aquatic animal diseases.

As the range of aquaculture species expands so, too, will the range of diseases. Disease diagnosis and control will become an even higher priority than in the past. There will be a requirement to maintain and improve disease diagnostic capability. Increased diagnostic services will be required in these specialised areas, and training of personnel in aquatic animal pathology, bacteriology, virology, parasitology and mycology will be essential.

Currently, research on, and diagnosis of, aquatic animal diseases is undertaken with some limitations by State laboratories, private veterinary laboratories, universities, research institutes, and CSIRO divisions including AAHL Fish Diseases Laboratory (AFDL) at CSIRO Livestock Industries. It is essential to build on these resources to become better prepared for the anticipated growth in the aquaculture industry.

Training courses for diagnosticians and fish health specialists will be required to maintain Australia's proficiency to detect and diagnose aquatic animal diseases, and maintain the confidence of our trading partners. Due to increased world trade and travel, the threat of exotic disease is increasing. This project is aimed at providing information and training to aquatic animal health specialists to assist in recognition of exotic disease, and management of disease emergencies.

Objectives

1. Prepare material to be used in providing a training course in recognition and management of exotic disease outbreaks.
2. Organise and provide a training course in recognition and management of exotic disease outbreaks, based at AAHL.

Methods

Development of training course material

As a core activity, the AFDL has collected resource material (kodachromes and histological sections demonstrating exotic diseases of aquatic animals) from overseas laboratories. This can be utilised during the training course. Other material has also been obtained during routine in-house project work conducted at AFDL. This material was organised and developed further to facilitate its use in the training course. In addition, this material was supplemented with other resources from overseas laboratories, during the study tour undertaken by Dr Ken McColl as part of FRDC Project No. 2002/654.

Development of course structure

The course was run over a period of one week (Monday -Friday) and included lectures and practical sessions on exotic viral, fungal, bacterial and parasitic diseases of finfish, crustaceans and molluscs. Diseases covered were selected from those exotic diseases (see Appendix 3, Table 1) that are currently listed on the *National List of Reportable Diseases of Aquatic Animals*. Clearly, some diseases are more important to Australia than others. The course structure was similar to the AAHL terrestrial animal disease course, which, based on participant feed-back and its popularity, has been very successful.

Course presenters

During the development of the course (FRDC Project No. 2002/654), it became clear that there was an opportunity to involve overseas experts – researchers and managers who had direct involvement with outbreaks of diseases which are exotic to Australia. Three international experts were contacted: Drs Franck Berthe (France), David Groman (Canada) and Carlos Pantoja (USA), experts on molluscan diseases, finfish diseases and crustacean diseases, respectively. They each committed to provide lecture notes, histological sections and other useful material in their areas of expertise. In this way, participants at the training course would have the benefit of discussing aquatic animal disease matters with international experts who had been directly involved in the detection, identification and management of outbreaks of diseases exotic to Australia.

Unfortunately, one month prior to the exotic disease course taking place, Dr Carlos Pantoja (USA) had to withdraw from participating in the course. At very short notice Dr Barbara Nowak, University of Tasmania, Launceston, stepped in and presented lectures and practical sessions on crustacean diseases.

Course participants

All States and Territories were contacted and invited to send two participants to the training course on exotic diseases of aquatic animals. Response to the invitation to participate in the exotic disease training course was very positive. All States and Territories responded. Due to the low level of aquaculture in ACT and the low numbers of staff, the ACT CVO, although interested, could not justify attendance at the course.

Course assessment

All participants were invited to provide their frank assessment of the Training Course in order to determine if the course was of value to them and to the aquaculture industry that each of them served or represented. Assessment was by completion of an Assessment sheet.

Training course CD

It was planned that each participant would receive a CD that contained much of the information presented at the course. This would then allow further in-house training of clients and colleagues when the participants returned home. Further copies of the CD would also be available to other interested parties.

Results and Discussion

Training course dates

The Training Course at AAHL was run from Monday, 29 March 2004 to Friday 2 April 2004. This was slightly later than had been anticipated in the original proposal, but it was the first available time that was convenient for our overseas presenters, and for AAHL staff involved in the course.

Development of training course material

AFDL's reference collection of histological materials (H&E stained sections, unstained sections, paraffin blocks) and kodachromes (external signs, internal signs, histopathology, immunohistochemistry, agent isolation, immunocytochemistry etc.) pertaining to exotic diseases of aquatic animals was reviewed, organised, reproduced as needed, and catalogued (Appendix 4, Table 1 in FRDC Report 2002-654). During this process it became clear that this collection was relatively limited and required supplementation with a broader range of materials for each exotic disease.

A study tour was undertaken to supplement AFDL's reference collection, and largely as a result of this tour, AFDL has been able to establish two fully-catalogued collections of histological slides, one collection with a single copy of each slide (67 slides), and another collection where there are two copies of each slide (87 slides). Together, these sets of slides constitute a comprehensive collection of histological material covering almost all of the diseases on the National List of Reportable Diseases of fish and crustaceans. There are still deficiencies with respect to slides of the diseases of molluscs (but AFDL will continue to address this deficiency in the future). In addition, the study tour allowed personal contact with some of the world's leaders in aquatic animal diseases, and, as a result, three were persuaded to participate as presenters at the training course.

Development of course structure

In general, the course was very intensive, consisting of a series of lectures that were given on each morning during the course. There were three 1-hour lectures per morning (with a coffee break to allow informal discussion). These lectures were followed by lunch and then the afternoons were spent either examining histological sections or in the secure area laboratories undertaking practical classes on various aspects of aquatic animal pathology. Following dinner on one day, there was an evening session that covered topics of special interest that had not been included in the main course structure. In Appendix 3, Table 2 there is an outline of the course that was presented. Over the course of the week, the following activities took place:

1. Lectures

Lectures included information on each of the diseases concerning their diagnosis using clinical signs, gross pathology, histopathology and detection and identification of the aetiological agent.

In addition, other presentation included:

Aquatic animal health policy - Dr Linda Walker (AFFA)

Health management at the farm level - Dr Kevin Ellard (DPIWE, Tasmania)

Packaging of samples for transportation – Peter LeBlanc-Smith (AAHL)
A media awareness workshop – Judith Maunders (AAHL)

2. Practical sessions

In addition to histopathology sessions, participants were given the opportunity to practise dissection of aquatic animals for the preparation of samples for virology, bacteriology, mycology and parasitology, including preparation of fresh samples, fixed samples for histology and electron microscopy and samples for PCR analysis. They also processed and prepared samples for PCR analysis, and they prepared and stained smears of oysters under the guidance of Dr Franck Berthe.

Laboratory demonstrations included:

PCR technologies (Gemma Clark & Kelly Steeper)
Digital Imaging Network (Alex Hyatt)

An evening session was also conducted, and this focussed on disease control in aquaculture. It included discussion on drugs (chemicals) in aquaculture (presented by Dr Stephen Pyecroft), vaccines in aquaculture (Dr Rachel Bowater) and new technologies, in particular RNAi (Dr Serge Corbeil). The short presentations were followed by vigorous discussion involving most of the participants.

Course Presenters

The following people accepted our invitation to take a leading role in the course:

Dr Franck Berthe (mollusc expert)
IFREMER
Dept des Ressources Aquacoles
Laboratoire de Genetique et Pathologie
BP 133, 17390 La Tremblade, FRANCE
Accepted 09-Sept-2003

Dr David Groman (finfish expert)
Aquatic Diagnostic Services
Atlantic Veterinary College
University of Prince Edward Island
550 University Avenue
Charlottetown, PEI, CANADA
C1A 4P3
Accepted 15-Oct-2003

Dr Carlos Pantoja (crustacean expert)
University of Arizona
1117 E Lowell St
Bldg 90, Rm 114
Tucson AZ 85721
USA
Accepted 21-Nov-2003

Unfortunately, about one month prior to the exotic disease course taking place, Dr Carlos Pantoja (USA) had to withdraw from the course. At very short notice, Dr

Barbara Nowak, University of Tasmania, Launceston stepped in and presented lectures and practical sessions on crustacean diseases.

The guest lecturers provided lecture notes, some histological sections and other materials for use during the course and for use in compiling a training course CD.

Course Participation

All States and Territories were contacted and invited to send two participants to the training course on exotic diseases of aquatic animals. All States and Territories responded, and responses were very positive. Due to the low level of aquaculture in ACT and the low numbers of staff, the ACT CVO, although interested, could not justify attendance at the course. All other States and Territories sent at least one representative from each jurisdiction (Appendix 3, Table 3). The Australian Government Department of Agriculture, Fisheries and Forestry (Aquatic Animal Health Unit) was also invited and one DAFF representative participated in the course.

Course Assessment

We asked all participants to provide their frank assessment of the Training Course in order to determine if the course was of value to them and to the aquaculture industry that each of them served or represented. Assessment was by completion of an Assessment sheet. A score (1 through 10, where 1 was the lowest rating and 10 was the highest) was assigned to each activity in the Course, and mean values were then determined for each activity. The questionnaire covered all aspects of the training course including content, structure, accommodation, quality of lectures, practical sessions and laboratory demonstrations.

Eleven of the 13 participants (85%) responded, and the results of the course assessment are shown in Appendix 3, Table 4. The most important finding from the assessment is that all aspects of the course were rated highly by the participants as judged by an overall score of 8.4. In particular, our guest lecturers appeared to perform admirably, both as lecturers and as demonstrators in the histopathology sessions (all of which rated very highly). A small number of participants remarked how beneficial the course was in terms of developing professional networks, both national and international (with our guest lecturers).

There were a number of areas that could be improved or modified if further Courses are conducted in the future. In particular:

1. many respondents felt that the laboratory classes needed a better introduction so that participants had a better understanding of what they were doing, and why. More hands-on work was also favoured by a number of participants.
2. a number of participants felt that the histopathology sessions could be improved with access to better microscopes, a better setting, a multi-headed microscope (or digital system that allowed a number of people to look at one slide simultaneously), and even more time devoted to this exercise. Access to the required number of good quality microscopes is a difficult issue. They are expensive pieces of equipment, and, because diagnostic pathology is not a major imperative at AAHL, they are in relatively short supply at this laboratory. We were able to gather four very good machines, another two that were of passable quality, and a further one was kindly supplied by one of the participants (Dr Malcolm Lancaster). We currently have one digital imaging system in operation at AAHL, and, now that we know the importance of this to

participants, we can probably incorporate its use in any future course. The setting for the histopathology session was the Boardroom at AAHL. This was chosen for its comfort, the fact that it facilitated group discussion during the slide-reading sessions, and because it offered access to a Powerpoint facility if required. These all proved to be worthwhile reasons. However, what was not anticipated was that the long boardroom table was not quite solid enough for seven microscopes, and there was a small amount of annoying vibration when participants were examining slides. This is something that can be overcome in the future. While there were a small number of participants whose background precluded them from getting much out of the histopathology sessions, the majority actually requested even more time be devoted to this activity (even to the point of suggesting that lunch breaks could be reduced in length to provide the extra time!). In future exercises, it might be useful if we could devise a way of offering an option for more than the basic amount of time devoted to histopathology.

3. There was some interest in extending the content of the course such that it also included information on practical epidemiology, hypothetical case investigations, survey design and more information on emergency responses. How this would be incorporated without lengthening the course is not clear at present.
4. One participant requested more information on diseases of warm-water fishes.
5. One participant suggested that, because it is difficult to cater for the widely divergent knowledge and interests of participants (eg, some are experienced histopathologists, but others have never looked at a slide; some are only interested in crustaceans, and others in fish; some are experienced in aquaculture, others are novices; etc), future courses might be run as concurrent sessions. One stream could cater for the interests of one group, and another stream for another group. The groups could then intermingle at meal times and at other joint exercises, allowing cross-fertilization and networking. This is an interesting concept, and worthy of consideration.

The course organisers will use all of this information to modify the course should subsequent training courses be held in the future.

Training Course CD

A Training Course CD that contains a wealth of information for the use of Course participants (and others in their respective State/Territories) has been prepared. Information on the CD includes:

- Powerpoint presentations from each and every disease lecture given during the week of the Course. This includes lectures on diseases of finfish, crustaceans and molluscs.
- Selected photomicrographs of histological lesions from many of the diseases on the National List of Reportable Diseases.
- Powerpoint presentations from each of the remaining presentations that occurred during the week of the course, for example, "Collection and dispatch of specimens", "Exotic disease management and legislation", "Disease control" forum, and the "Media awareness" presentation.

This CD will be distributed to all course participants and their jurisdictions. In this way it is anticipated that the CD would be suitable for in-house training sessions to maximise the impact of the training course.

Conclusions

Based on the level to which each of the Objectives has been satisfied, the project would appear to have been very successful.

Objective 1

Material for use in the Training Course on the recognition and management of exotic disease outbreaks in aquaculture species was gathered from many sources. It was also catalogued and presented such that it was ready for use by the participants. The primary material was accessed from AFDL itself, and from numerous overseas laboratories. In some cases the material was derived from experimental cases of particular diseases, but, in many cases, the source was natural field cases of the disease. The most difficult resource to assemble was the collection of histological slides that encompasses most of the diseases on the "*National List of Reportable Diseases of Aquatic Animals*". There are still deficiencies in the collection of mollusc diseases but attempts will be made to rectify this deficiency in the future. In addition to the slides, the three specialist presenters at the course (covering finfish, crustacean and mollusc diseases) provided a set of Powerpoint presentations that included images of clinical signs and gross lesions for many of the diseases under consideration. The latter is a resource that can be readily updated for use at any subsequent training courses. In addition, the Powerpoint presentations and photomicrographs of lesions from many of the diseases of interest will provide an invaluable teaching resource for participants in future training courses.

The major outcome of these outputs is that there is now a well-organized resource available for current, and future, training of aquaculture health specialists in those diseases that are of prime importance to the aquaculture industries of Australia, ie, the diseases on the "*National List of Reportable Diseases of Aquatic Animals*".

Objective 2

A Training Course on the recognition and management of exotic disease outbreaks in aquaculture species was organised and undertaken in March/April 2004. Informal, and formal, feedback from participants, guest lecturers, AFDL staff and other AAHL staff involved in the training course indicated that the course more than fulfilled its promise. Apart from increasing the skills base of the aquatic animal health participants, the course also assisted in developing professional relationships and rapport among this group of specialists. The course also increased the reputation of Australian aquatic animal health as perceived by the international guest lecturers. They were impressed by the professionalism and rapport demonstrated by the participants, and they were keen to maintain linkages with the group.

Thus, the major outcomes of the course are: (1) each State/Territory now has one or two specialists who have recently been updated on the exotic diseases of the aquaculture industries in Australia (ie, diseases on the *National List of Reportable Diseases of Aquatic Animals*). Their improved knowledge and awareness, and their capacity to improve the knowledge and awareness of many of their colleagues, will encourage greater confidence in the ability of regional aquaculture health specialists to recognize, and manage, incursions of exotic diseases; (2) this, in turn, will assist Australian aquaculture industries to maintain their enviable status with respect to freedom from the major exotic diseases of the world; (3) the course has assisted in

increasing the network of the participating aquatic animal health specialists, at both national and international levels.

Benefits

Undoubtedly, the most important benefit to be derived from the Training Course will be the presence of aquaculture health specialists in each State/Territory who have a heightened awareness of the exotic diseases that are important to the industries in their region. In addition, participants in the training course gained diagnostic skills for a range of exotic diseases of finfish, crustaceans and molluscs. It is to be hoped that they are able to share their newfound, or updated, knowledge and skills with many of their local colleagues, thereby dramatically improving the regional capacity for the recognition of exotic disease incursions.

Australian aquaculture industries enjoy enormous benefits as a result of our freedom from many of the important diseases that exist overseas. Maintaining this status relies primarily upon rapid recognition of any incursions, and the subsequent management of any such incursion, were it to occur. If recognition and management were undertaken rapidly and professionally, this would provide the best opportunity of regaining the nation's status of being free of that particular disease. With this in mind, it is clear that the major beneficiaries of this project are the various finfish, crustacean and mollusc aquaculture industries around Australia. The ability to respond quickly and decisively to any incursion (and thereby resume our former disease-free status) could potentially save enormous amounts of money to the industries involved in the outbreak.

Further Development

The production of the training course CD, while it cannot replace attendance at a training course, does provide a reference not only for the course participants but also for other staff members at their host institution. It is anticipated that the CD could form the basis for in-house training, should the need arise.

In addition, the CD, and the course material on which it is based, provides an important resource for Australia. The lecture notes, MS PowerPoint presentations and histological sections will reside permanently at AAHL. It is anticipated that this resource will be maintained, and updated, by AFDL staff. As new exotic diseases are described, representative descriptions and histological sections will be obtained from overseas laboratories, building on the current resource.

The reference collection obtained during the course of this project and FRDC Project No. 2002/654 will form the basis for any future training courses on exotic diseases of aquatic animals. Very little effort will be required to maintain and update the collection so that future training courses will retain their relevance.

Planned outcomes

This project provided high quality resource material, on a range of exotic diseases of aquatic animals, and these resources were developed and organised into a training course format. The course then provided formal and informal training to aquatic animal health specialists from throughout Australia. Participants in this first course included aquatic animal pathologists and health specialists from all States and Territories with significant aquaculture industries. On completion of the course, participants had gained increased knowledge on exotic diseases of finfish, crustacea and molluscs through exposure to recognised experts from within Australia and from overseas.

Training course participants should now (a) be better prepared to recognise exotic disease outbreaks, (b) understand the issues involved in emergency disease management at both theoretical and practical levels, and thus (c) be better prepared to implement procedures aimed at protecting industry, wild-life and other natural resources from potentially devastating effects of an exotic disease incursion and its consequences.

“Graduates” from the course will be provided with a copy of the training CD which, in theory, could be used for some limited in-house training of other resident aquatic animal health specialists. Other aspects of the course, due to the exotic nature of some of the material, could only be carried out at AAHL. Thus it is expected that a full course, with updated material including hands-on experience with exotic disease agents, would be run at AAHL on an as-needs basis i.e. when interest from sufficient numbers of potential participants has been expressed.

References

ABARE 2001. Australian Fisheries Statistics 2000, Canberra, ACT.

ACIL Consulting 1999. Aquaculture beyond 2000. Facilitator's Report, prepared by Denis Hussey, Senior Associate, ACIL Consulting on a workshop, Changing Direction, held 23-24 August 1999, Canberra.

Appendix 1 - Intellectual Property

All information arising from this project has been used for the development and/or holding a training course on exotic diseases of aquatic animals. No intellectual property has been identified.

Appendix 2 – Staff

Name	Position	Section
Dr Ken McColl	Senior Research Vet	AAHL Fish Diseases Laboratory
Kelly Steeper	Experimental Scientist	
Gemma Carlile	PhD student	
Dr Mark Crane	Project Leader, AFDL	
Tamasine Chamberlain	Senior Technical Assistant	
Lynette Williams	Senior Technical Officer	

Appendix 3 – Tables

Table 1. Australian *National List of Reportable Diseases of Aquatic Animals* (version Sept 2003)

DISEASE	OIE Listed	OIE/NACA Listed	Exotic to Australia
FINFISH			
1. Epizootic haematopoietic necrosis – EHN virus	yes	yes	no
2. Epizootic haematopoietic necrosis – European catfish virus	yes	yes	yes
3. Epizootic haematopoietic necrosis – European sheatfish virus	yes	yes	yes
4. Infectious haematopoietic necrosis	yes	yes	yes
5. <i>Oncorhynchus masou</i> virus disease	yes	yes	yes
6. Spring viraemia of carp	yes	yes	yes
7. Viral haemorrhagic septicaemia	yes	yes	yes
8. Channel catfish virus disease	yes	yes	yes
9. Viral encephalopathy and retinopathy	yes	yes	no
10. Infectious pancreatic necrosis	yes	yes	yes
11. Infectious salmon anaemia	yes	yes	yes
12. Epizootic ulcerative syndrome (<i>Aphanomyces invaderis</i>)	yes	yes	no
13. Bacterial kidney disease (<i>Renibacterium salmoninarum</i>)	yes	yes	yes
14. Enteric septicaemia of catfish (<i>Edwardsiella ictaluri</i>)	yes	yes	yes
15. Piscirickettsiosis (<i>Piscirickettsia salmonis</i>)	yes	yes	yes
16. Gyrodactylosis (<i>Gyrodactylus salaris</i>)	yes	yes	yes
17. Red sea bream iridoviral disease	yes	yes	yes
18. White sturgeon iridoviral disease	yes	yes	yes
19. Furunculosis (<i>Aeromonas salmonicida</i> subsp. <i>salmonicida</i>)	no	no	yes
20. <i>Aeromonas salmonicida</i> - atypical strains	no	no	no
21. Whirling disease (<i>Myxobolus cerebralis</i>)	no	no	yes
22. Enteric redmouth disease (<i>Yersinia ruckeri</i> – Hagerman strain)	no	no	yes
23. Koi mass mortality	no	yes	yes
MOLLUSCS			
1. Infection with <i>Bonamia ostreae</i>	yes	yes	yes
2. Infection with <i>Bonamia</i> species	no	no	no
3. Infection with <i>Bonamia exitiosus</i>	yes	yes	?
4. Infection with <i>Mikrocytos roughleyi</i>	yes	yes	no
5. Infection with <i>Mikrocytos mackini</i>	yes	yes	yes
6. Infection with <i>Marteilia refringens</i>	yes	yes	yes
7. Infection with <i>Marteilia sydneyi</i>	yes	yes	no
8. Infection with <i>Perkinsus marinus</i>	yes	yes	yes
9. Infection with <i>Perkinsus olseni/atlanticus</i>	yes	yes	no
10. Infection with <i>Haplosporidium nelsoni</i>	yes	yes	yes
11. Infection with <i>Haplosporidium costale</i>	yes	yes	yes
12. Infection with <i>Candidatus Xenohalictis californiensis</i>	yes	yes	yes
13. Akoya oyster disease	no	yes	yes
14. Iridoviroses	no	no	yes
CRUSTACEANS			
1. Taura syndrome	yes	yes	yes
2. White spot disease	yes	yes	yes
3. Yellowhead disease	yes	yes	yes
4. Gill-associated virus	yes	yes	no
5. Tetrahedral baculovirus (Baculovirus penaei)	yes	yes	yes
6. Spherical baculovirus (<i>Penaeus monodon</i> -type baculovirus)	yes	yes	no
7. Infectious hypodermal and haematopoietic necrosis	yes	yes	yes
8. Crayfish plague (<i>Aphanomyces astaci</i>)	yes	yes	yes
9. Spawner-isolated mortality virus disease	yes	yes	no
10. Necrotising hepatopancreatitis	no	yes	yes
11. Baculoviral midgut gland necrosis	no	yes	yes

Table 2. Aquatic Animal Health Subprogram: training course on exotic diseases of aquatic animals - Schedule

Time	Mon 29 March		Tues 30 March		Wed 31 March		Thurs 1 April		Fri 2 April	
9.00 am	Welcome Introduction		Finfish lecture #2		Crustacean lecture #1		Finfish lecture #5		Specimen collection and dispatch	
10.00 am	Morning tea (non-secure)									
10.30 am	Finfish lecture #1		Mollusc lecture #2		Finfish lecture #4		Crustacean lecture #3		Exotic disease management/Legislation	
11.30 am	Mollusc lecture #1		Finfish lecture #3		Crustacean lecture #2		Finfish lecture #6			
12.30 pm	Lunch (non-secure)									
1.30 pm	Gp 1 Induction & Crustacean Lab (secure)	Gp 2 Histo	Gp 1 Histo	Gp 2 Induction & Crustacean Lab (secure)	Gp 1 Mollusc Lab (secure)	Gp 2 Histo	Gp 1 Histo	Gp 2 Mollusc Lab (secure)	Media/extension Photo Critique Finish ~ 2.30 pm	
6.00 pm	Dinners at AAHL						Course dinner (restaurant)			
7.00 pm			Discussion session: “Disease control in aquaculture”							

Table 3. Aquatic Animal Health Subprogram: training course in exotic diseases of aquatic animals - List of Participants

Name	Group
Participants	
John Creeper , WA	1
Rachel Bowater , QLD	1
Matthew Landos , NSW	1
Kevin Ellard , TAS	1
Colin Johnston , SA	1
Mehdi Doroudi , VIC	1
Linda Walker , AFFA	1
Malcolm Lancaster , VIC	2
Cathy Shilton , NT	2
Roger Chong , QLD	2
Jane Francis , NSW	2
Stephen Pyecroft , TAS	2
Stephen Yeomans , SA	2
Lecturers	
Dave Groman , CANADA	Finfish diseases
Franck Berthe , FRANCE	Mollusc diseases
Barbara Nowak , TASMANIA	Crustacean diseases
AFDL Staff	
Ken McColl	Course Organiser
Serge Corbeil	Presenter
Kelly Steeper	Demonstrator
Gemma Clark	Demonstrator
Mark Crane	Assistant

Table 4. Assessment sheet for Training Course in Exotic Diseases of Aquatic Animals

We would be pleased to receive your comments on the AFDL Training Course on “Exotic Diseases of Aquatic Animals”. Your frank assessment will help us to determine if the course was of value to you and to the aquaculture industry that you service/represent. This, in turn, will help us to determine if the course should be repeated regularly. Please assign a score (1 through 10, where 1 is the lowest rating and 10 is the highest) in each of the following open boxes.

	General	Finfish	Crustacean	Mollusc
Lectures				
Content		8.5	7.7	8.1
Presentation		8.2	7.7	8.1
Teaching value		8.5	7.8	8.2
Lab classes				
Content			6.1	6.8
Presentation			6.5	6.7
Teaching value			6.5	7.3
Histopathology sessions				
Content		8.6	8.5	8.6
Presentation		7.6	7.4	7.5
Teaching value		8.5	8.3	8.3
Discussion forum (Tues evening- Disease control)	7.6			
Specimen collection/dispatch				
Content	7.9			
Presentation	8.2			
Teaching value	7.2			
Exotic disease management/Legislation				
Content	7.4			
Presentation	7.4			
Teaching value	7.4			
Catering				
At AAHL	7.5			
At Course dinner	9.3			
Overall value of course	8.4			