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FINAL REPORT

# **Aquatic Animal Health Subprogram: Development of a national aquatic animal health curriculum (NAAHC) for delivery by tertiary institutions**

**Report from consultative workshop, Adelaide 13-14  
February, 2014**



**Dr Stephen B Pyecroft**

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**Summary report: Development of a national aquatic animal health curriculum for delivery by tertiary institutions**

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In submitting this report, the researcher has agreed to FRDC publishing this material in its edited form.

# Contents

<b>Contents</b> .....	<b>iii</b>
<b>Tables</b> .....	<b>iv</b>
<b>Figures</b> .....	<b>v</b>
<b>Abbreviations</b> .....	<b>vi</b>
<b>Executive Summary</b> .....	<b>vii</b>
<b>Introduction</b> .....	<b>1</b>
<b>Objectives</b> .....	<b>2</b>
<b>Method</b> .....	<b>3</b>
<b>Results</b> .....	<b>7</b>
Activity 1: What is your definition of a National Curriculum for AAH, why do we need one and who is it designed to educate?.....	7
Activity 2: Gap identification in the existing national AAH education for each sector .....	11
Activity 3: Develop a core competencies list for each educational sector and as requirements for government, industry and others .....	18
<b>Discussion</b> .....	<b>26</b>
<b>Conclusion</b> .....	<b>30</b>
<b>Recommendations</b> .....	<b>31</b>
<b>Further development</b> .....	<b>32</b>
<b>References</b> .....	<b>33</b>
<b>Appendices</b> .....	<b>34</b>
Appendix A .....	34
Appendix B .....	36
<b>Addendum</b> .....	<b>38</b>
<b>FRDC FINAL REPORT CHECKLIST</b> .....	<b>47</b>

# Tables

Table 1 Invite and final Attendee list

Table 2. Core learning outcomes for an Aquatic Animal Health and Production course, their ranking (A = most important to C = least important), corresponding discipline and relevant teaching resource “module”.

Table 3 Practical learning outcomes for the Aquatic Animal health and Production course

Table 4. Core learning outcomes for non-veterinary graduates

Table 5. Core practical competencies for non-veterinary graduates

# Figures

Figure 1 Graduate numbers related to degree of specialisation.

Figure 2 Levels of industry requirements for aquatic animal health professionals

Figure 3 Knowing-Acting-Being models for educational sectors in AAH

Figure 4 Interactions of the providers and users of AAH education

# Abbreviations

AAH – Aquatic Animal Health

FRDC – Fisheries Research and Development Corporation

SFITP – Seafood Industry Training Package

TAFE – Technical and Further Education

SCAAH – Sub Committee on Aquatic Animal Health

ANZCVS - Australian and New Zealand College of Veterinary Scientists

AAHC - Aquatic Animal Health Chapter

NAAHC – national aquatic animal health curriculum

# Executive Summary

This report summarises the process and outcomes from an interactive workshop which was convened over 1.5 days in Adelaide in February 2014 to progress the possible development of a national aquatic animal health curriculum (NAAHC) for the education of undergraduate, postgraduate and vocational students, by representatives of the Australian aquaculture industry, state and federal governments, universities and vocational trainers.

It has been indicated by government and the aquaculture industry that trained professionals in aquatic animal health (AAH) are needed to support the continued development and sustainability of the aquaculture sector within Australia.

The Fisheries Research and Development Corporation identified the need for such training capacity within the Aquatic Animal Health Sub Program priorities and the review and potential subsequent curriculum development was identified as clear objective within AQUAPLAN 2014-2019, Australia's National Strategic Plan for Aquatic Animal Health.

Currently a diverse range of training opportunities and educators with appropriate corporate knowledge exist relatively un-connected across the country resulting in poor coverage of the core attributes required of health managers for industry and government.

A concise review of vocational education and training programs in AAH within Australia was undertaken by Mark Oliver of Australian Aquaculture Support Services Pty Ltd for the FRDC Aquatic Animal Health Sub-Program identifying the key deliveries for AAH training to this sector. The documents for this training are organised in the Seafood Industry Training Package (SFITP) and whilst the training is organised within a training package underpinning the Australian Qualifications Framework and managed by Agrifood Skills Australia, the content development and presentation is independent of a nationally relevant and agreed upon message.

Education of veterinary and non-veterinary scientists in the skills of AAH are currently ad hoc, sporadic and lack a central theme, reflecting more the expertise in the various institutions providing the education and training rather than a nationally recognised cohesive need for the relevant stakeholders.

Previous workshops and studies have indicated the need for a concise, coherent, well-resourced, stakeholder-directed curriculum to deliver a common aquatic animal health message. This project was the first step in the development of such a framework for teaching aquatic animal health.

This workshop aimed to:

- Review the need, scope and end user market for a national curriculum in aquatic animal health
- Develop a general understanding of the current content and provision of aquatic animal health education within the tertiary sector in Australia and how this is utilised by end users within the aquaculture sector and other end users of graduates.

In order to engage all recognised stakeholder groups the workshop was structured around a number of sessions including scene-setting and summary presentations as well as break-out groups and interactive discussion sessions (see Appendix 1 workshop agenda). The workshop

was facilitated by the Dr Stephen Pyecroft of the University of Adelaide and attendees were organised in a number of discussion groups from which ideas and conclusions were derived.

The key objective subjects were discussed specifically across the stakeholder sectors.

Having a consensus of understanding of what is meant by a national curriculum in the context of AAH education was a key to carrying forward any development of a curriculum. Delegates identified a number of key attributes of a curriculum.

It must be:

- Harmonised and Standardised
- Transportable
- Recognised
- Flexible being ‘fit-for-purpose’

The curriculum would deliver a common message that would have to be defined and be applicable across multiple sectors taking advantage of a multi-disciplinary approach. The road map linked all components in the system allowing specific content development at vocational and the various university levels.

It must also allow the development of skills, attributes, competencies of its graduates and have clearly defined learning outcomes and it should not be seen as is a silver bullet for solving all educational circumstances within AAH training. It was recognised that there is an existing diversity of approaches to AAH education and that developing a prescriptive curriculum fails to recognise not only the investment already made by many in the educational sector but also the scale of investment required to develop a ‘one-fits-all curriculum’ is in itself prohibitive of its development at all, in the current economic climate.

It was also recognised that there are a diversity of skills required by end users and so the development of different levels of expertise and specialisation of graduates made a prescriptive approach non-viable.

Specifics of the content of the curriculum should remain variable within the context of the learning outcomes and the general core learnings should form the skeleton on which all content is supported.

It was seen that a curriculum could be a resource deposit, library or more, catering for resource sharing for a tiered system of training recognising that complete harmonisation across a range of diverse educational targets with variable legal frameworks and dealing with many aquatic animal species will be difficult. There would also be an increased dissemination of knowledge by breaking down the silos perceived as being present now in the existing system. Students would have an understanding of the different disciplines within the AAH sector allowing them to better direct their interest and receive the appropriate training. Breaking the silos down may also allow greater facilities interaction and so a national approach would allow greater access to existing knowledge at all levels.

The key to the development of a national curriculum would be to produce educated personnel who are capable of fulfilling various roles in aquatic animal health required by the Australian aquaculture industry and other end-users such as governments.

Another key and most important aspect would that it would allow AAH professionals to map pathways to careers. The development of such a system would identify common outcomes and



improve visibility of the sector by identifying career paths, linking career options and allowing recognition of what's available.

The brief gap analysis of existing national AAH education provision undertaken at the workshop can be summarised simply as a lack of a proper facility for the production of appropriately educated AAH professions for industry and government and a lack of a coordinated approach, at a national level, to address this issue. Once this is addressed then a detailed curriculum content GAP analysis can be undertaken during the development of the specific core elements of the curriculum for, and by, each sector.

Delegates by sector, in the short time available at the workshop, identified key attributes of AAH graduates from each educational sector and for each employer sector. These attributes and requirements will form the core educational components of any national curriculum.

Stakeholders at the workshop agreed upon a number of specific recommendations (focusing and confirming previous consultation on this subject):

1. That the development of a national curriculum for aquatic animal health proceeds to delivery.
2. That a mechanism for curriculum review be developed so that timely regular reviews of the content and delivery of the NAAHC are undertaken to ensure relevance and optimal delivery of the curriculum for all sectors of industry and government.
3. Establish a model of funding that will allow initial development and ongoing review of the NAAHC.

The workshop proposal aimed to initiate the development of an NAAHC, which led to this workshop and identified the need for a series of workshops or working group sessions to allow the development of a national curriculum. This proposed process was confirmed at the workshop by stakeholders who expressed enthusiasm in carrying the process forward.

It was agreed that the development and delivery of an NAAHC will only be achieved by undertaking a number of vital tasks in a process toward delivery and are as follows:

- A. **EITHER** appoint a project manager to coordinate the curriculum development project **OR** establish a working group made up of representatives of key stakeholders (i.e. universities, vocational educators, government and aquaculture sectors) to oversee the project.
- B. Formation of working groups within the university sectors (i.e. veterinary and non-veterinary) to align existing teaching amongst institutes, identify gaps in teaching resource and develop needed modules for undergraduate and post graduate education that specifically fulfil the needs of the curriculum.
- C. Use the key competencies identified at this workshop as a foundation for a further survey of end users of AAH graduates, to develop a national key competency list around which the curriculum will be developed.

These elements could be initiated and progressed by an additional workshop aimed at developing a work plan for curriculum development and require a funding model to allow progression.

## **Keywords**

**Curriculum, Aquatic Animal Health, training, competencies, education, vocational, university, national, bench-marked**

# Introduction

It has been indicated by government and the aquaculture industry that trained professionals in aquatic animal health (AAH) are needed to support the continued development and sustainability of the aquaculture sector within Australia. The productivity and marketability of the aquaculture and fishing industries depend directly on the capacity to promote, monitor, manage, research, and regulate the health and welfare of a wide range of species in a wide range of aquatic environments.

Currently a diverse range of training opportunities and educators with appropriate corporate knowledge exist relatively un-connected across the country resulting in poor coverage of the core attributes required of health managers for industry and government.

It was necessary to review available training capacities enabling a gap analysis so that a standard national curriculum could be developed for the education of relevant veterinarians and other aquatic animal health professionals as well as industry members.

The Fisheries Research and Development Corporation identified the need for such training capacity within the Aquatic Animal Health Sub Program priorities and the review and potential subsequent curriculum development was identified as clear objectives within AQUAPLAN 2014-2019, Australia's National Strategic Plan for Aquatic Animal Health.

A concise review of vocational education and training programs in AAH within Australia was undertaken by Mark Oliver of Australian Aquaculture Support Services Pty Ltd for the FRDC Aquatic Animal Health Sub-Program identifying the key deliveries for AAH training to this sector. The documents for this training are organised in the Seafood Industry Training Package (SFITP) and whilst the training is organised within a training package underpinning the Australian Qualifications Framework and managed by Agrifood Skills Australia, the content development and presentation is independent of a nationally relevant and agreed upon message.

Education of veterinary and non-veterinary scientists in the skills of AAH is currently ad hoc, sporadic and lack a central theme, reflecting more the expertise in the various institutions providing the education and training rather than a nationally recognised cohesive need for the relevant stakeholders.

A concise, coherent, well-resourced, stakeholder directed curriculum to deliver a common aquatic animal health message is needed and this project was the first step in the development of such a framework for teaching aquatic animal health.

# Objectives

The objectives of the workshop were to:

- Review the need, scope and end user market for a national curriculum in aquatic animal health
- Develop a general understanding of the current content and provision of aquatic animal health education within the tertiary sector in Australia and how this is utilised by end users within the aquaculture sector and other end users of graduates.

## Method

An interactive workshop was convened over 1.5 days involving scene-setting and summary presentations as well as break-out groups and interactive discussion sessions (see Appendix 1 workshop agenda). The workshop was facilitated by the Dr Stephen Pyecroft and attendees were organised in a number of discussion groups from which ideas and conclusions were derived.

The initial session at the workshop was ‘scene-setting’ allowing delegates to be informed about what had preceded the workshop in the activities of establishing the importance of education and training in AAH as directed by key stakeholders and highlighting what programs and governances there were at least at the policy level in Australia. They set the scene for the workshop and helped to establish a common understanding of the basis for the projects objectives. The PowerPoint presentations are attached to this report as Annex 1 and a brief summary follows.

The first presentation posed the question “What is meant by a Curriculum?” As the PI scoped the interest of educationalists around the country for developing an AAH curriculum (in developing a funding application prior to the workshop) it became quickly evident that there was no consensus about what was meant by a national curriculum for AAH. Some believed it was an opportunity to access funding for course module development whilst others saw it as an opportunity to better predict the attributes of graduates from such a program. This situation paralleled what is reported in the educational literature by authors such as Hicks (2007) and they make the point that without a clear understanding of what is meant by curriculum in the context of how it will be applied by educators, then outcomes expected from the curriculum will be destined for failure.

Within this confusion of definition a framework for curriculum development is proposed in Hicks (2007) and highlights the key attributes of any education curriculum directed at higher education of vocational training.

A curriculum should embrace:

- What is to be learnt – content
- Why it is to be learnt – rationale and underlying philosophy
- How it is to be learnt – process and pedagogy
- When it is to be learnt – structure of the learning process
- How the learning will be demonstrated and achievement assessed – quality

An example of national curriculum development in the field of animal health was also presented as a possible template for any future AAH curriculum (Holyoake, 2005). The example was the development of a pig health and production course for veterinary schools in Australia where experts in the field of pig health and production met and worked together creating and sharing resources for a course that could be used in all veterinary schools that choose to participate. There was initially a significant amount of work involved, however this was offset by the fact that many of the participants had existing resources and they could share the workload for any

that were deemed important to develop in the context of the overall outcomes of the course. Furthermore, they embedded within the course an ability to review content every year for relevance and ease of presentation and if updating or new developments were required they shared the workload, to add them to the program. This appeared to be a logical approach on which the development of a relevant NAAHC could be modelled. A summary of the history of the relevance of a national strategy of AAH education was then presented, so that the workshop participants could see this workshop in the context of a possible next step in the activity continuum of maintaining and developing aquatic animal health professionals for Australia's growing aquaculture sector. Some positive outcomes have been made in this space however an overall strategy and outcome has not yet been achieved. It appears that there has been, and still is presently, a recognised need (as indicated by industry and government sectors) for AAH professionals; however the mechanisms to educate these people in a cohesive, defined, outcome-driven way has not been achieved.

Following this summary of direction and need, the educational sectors presented brief snapshots of some of the educational activity within the vocational, non-veterinary and veterinary university training that is currently available in the field of AAH.

The sectors produced evidence of undergraduate, post-graduate and vocational programs that have been well-resourced and planned and developed in the various environments of need and available expertise that exist in the AAH education area.

Vocational training provided under the format of the Seafood Industry Training Package is directed to the seafood industry needs and covers a wide range of units, many of which are not AAH-focused. It is a program that has been in existence for 14 years and is under constant review to keep it relevant to industry needs. The package is outcome based in its design and defines what is expected of someone who has undertaken specific modules of training. Ensuring the supply of appropriately resourced and competent trainers is seen as a significant gap for this sector.

The undergraduate and post-graduate education and training provided by the universities is multi-focused and reflects either the needs of the specific institutions or the concentration of expertise within the institution. There are some attempts to make the courses relevant to industry and the education is of high quality however there is lack of cohesion amongst providers producing duplication of resource development, underutilisation of expertise and making career paths for graduates confused and non-directional. Scientists looking to develop a career in AAH are faced with the difficult task of identifying core competencies within multilevel and multidimensional degrees to acquire the necessary education and on-the-job training to be qualified in the area of AAH. Ultimately these graduates and researchers must be 'job-ready' trained so that they can meet the needs of the industries that will employ them.

It was agreed by the brief discussion that followed these presentations that a national curriculum in AAH will need to utilise the expertise and resources already developed within country, will need to be directed at specific needs of the potential employers of graduates, will need to have the important national perspectives embedded within it and will need to have a standard for measuring the competencies of graduates educated under it. It was agreed that this could be achieved by cohesion of those already engaged in providing AAH education and training. With a clear focus of what is important within a potential curriculum, the development relies upon funding, a common design and engagement by the various sectors, to make it happen.

The second and most substantial part of the workshop was then undertaken by engaging the various group discussions in an attempt to establish common ground on what was defined as a national curriculum, and then how one would be established if the need for this method of AAH education was deemed important.

### Group discussions

The membership of the groups changed over the two days of the workshop dependent upon the questions being discussed. The PI assigned the membership of 3 discussion groups for Activity 1 so that there was a mixture of all sectors within each of the groups.

The membership of the 5 discussion groups for Activity 2 and 3 were from each of the key sectors invited to participate (i.e. universities with veterinary programs, universities without veterinary programs, vocational education sector, industry groups, and government sectors responsible for AAH) in order to produce a specific stakeholder group perspective on the question being discussed.

The topics for discussion were as follows:

*Activity 1: What is your definition of a National Curriculum for AAH, why do we need one and who is it designed to educate?*

*Activity 2: Gap identification in the existing national AAH education for each sector*

*Activity 3: Develop a core competencies list for each educational sector and as requirements for government, industry and other.*

Workshop attendees were invited from universities providing courses in aquatic animal health in veterinary and non-veterinary courses as well as vocational training institutions and key aquaculture industries (e.g. yellow tail kingfish, tuna, prawn, salmonids, barramundi) (Table 1). In addition members of the Sub-Committee of Aquatic Animal Health (SCAAH) were also invited to attend. The composition of the workshop was designed to capture the opinions and perceptions of providers and users of graduates with aquatic animal health training.

**Table 1 Invite and final Attendee list**

	Name	Organisation	Email address	Attendance Response
<b>Industry</b>				
1	Craig Foster	Clean Seas	craig.foster@cleanseas.com.au	N
2	Tony Charles	APFA	tony@australianprawnfarms.com.au	Y
3	Adam Main	TSGA	adam.main@tsga.com.au	N
4	Pheroze Jungalwalla	NAC/FRDC AAHS	pherozej@gmail.com	Y
5	Kirsten Rough	ASBTIA	kirstenrough@bigpond.com.au	Y
6	Marty Philips	Barramundi Industry	marlinka@bigpond.com	N
<b>Tertiary Institutes</b>				
7	Josephine Mair	TAFE SA Urrbrae Campus	Josephine.Mair@tafesa.edu.au	Y

8	Charles Caraguel	University of Adelaide	charles.caraguel@adelaide.edu.au	Y
9	Leigh Owens	James Cook University	leigh.owens@jcu.edu.au	Y
10	James Harris	Flinders University	james.harris@flinders.edu.au	Y
11	Paul Hick	University of Sydney	paul.hick@sydney.edu.au	Y
12	Richard Whittington	University of Sydney /FRDC AAHS	richard.whittington@sydney.edu.au	Y
13	Susan Kueh	Murdoch University	S.Kueh@murdoch.edu.au	Y
14	Jasmin Hufschmid	University of Melbourne	huj@unimelb.edu.au	Y
15	Stephen Pyecroft	University of Adelaide/FRDC AAHS	stephen.pyecroft@adelaide.edu.au	Y
16	Melanie Leef	University of Tasmania	bnowak@amc.edu.au	Y
17	Lisa Terry	NSW North Coast TAFE	Lisa.Terry@det.nsw.edu.au	Y
<b>Government</b>				
18	Shane Roberts	SARDI (SCAAH)	Shane.Roberts@sa.gov.au	Y
19	Tim Lucas	QDAFF (SCAAH)	Tim.Lucas@daff.qld.gov.au	Y
20	Kitman Dyrting	NT (SCAAH)	Kitman.Dyrting@nt.gov.au	Y
21	Kevin Ellard	Tas (SCAAH)	Kevin.Ellard@dipwe.tas.gov.au	N
22	Fran Stephens	WA (SCAAH)	fran.stephens@agric.wa.gov.au	Y
23	Claire Taylor	DAFF (SCAAH)	Claire.Taylor@daff.gov.au	Y
24	Ingo Ernst	DAFF (SCAAH/FRDC AAHS)	Ingo.ernst@daff.gov.au	Y
25	Marissa McNamara	Qld Museum	marissa.mcnamara@qm.qld.gov.au	Y
26	Tracey Bradley	Vic (SCAAH/FRDC AAHS)	Tracey.bradley@depi.vic.gov.au	Y
27	Juliet Corish	NSW (SCAAH)	juliet.corish@dpi.nsw.gov.au	Y
28	Yuko Hood	DAFF (SCAAH)	Yuko.Hood@daff.gov.au	N
29	Ramesh Perera	DAFF (SCAAH)	Ramesh.perera@daff.gov.au]	N
30	Marty Deveney	SARDI	Marty.Deveney@sa.gov.au	Y
<b>FRDC Subprogram</b>				
31	Nick Moody	FRDC AAHS	Nick.moody@csiro.au	Y
32	Mark Crane	CSIRO (SCAAH/FRDC AAHS)	Mark.crane@csiro.au	Y
33	Jo-Anne Ruscoe	FRDC	crispian@frdc.com.au	Y
<b>Others</b>				
34	Matt Landos	Future Fisheries (salmon)	Matty.landos@gmail.com	Y
35	Mark Oliver	Aqua. Support Services	aquaculturesupportservices@gmail.com	Y



# Results

## **Activity 1: What is your definition of a National Curriculum for AAH, why do we need one and who is it designed to educate?**

The outcomes from the discussion groups are presented individually for Activity 1 as the individual group summaries have key commonalities but also differences.

### **Red group**

This group agreed that a curriculum was necessary and whilst this group didn't actually define a curriculum specifically they identified a number of key attributes of a curriculum.

It must be:

- Harmonised and Standardised
- Transportable
- Recognised
- Flexible being 'fit-for-purpose'

It must also allow the development of skills, attributes, competencies of its graduates and have clearly defined learning outcomes.

One thing the national curriculum should not be seen as is a silver bullet for solving all educational circumstances within AAH training. It was recognised that there is an existing diversity of approaches to AAH education and that developing a prescriptive curriculum fails to recognise not only the investment already made by many in the educational sector but also the scale of investment required to develop a 'one-fits-all curriculum' is in itself prohibitive of its development at all, in the current economic climate.

It was also recognised that there are a diversity of skills required by end users and so the development of different levels of expertise and specialisation of graduates made a prescriptive approach non-viable.

Specifics of the content of the curriculum should remain variable within the context of the learning outcomes and the general core learnings should form the skeleton on which all content is supported.

They proposed that a curriculum could be a resource deposit, library or more catering for resource-sharing for a tiered system of training recognising that complete harmonisation across a range of diverse educational targets with variable legal frameworks and dealing with many aquatic animal species will be difficult.

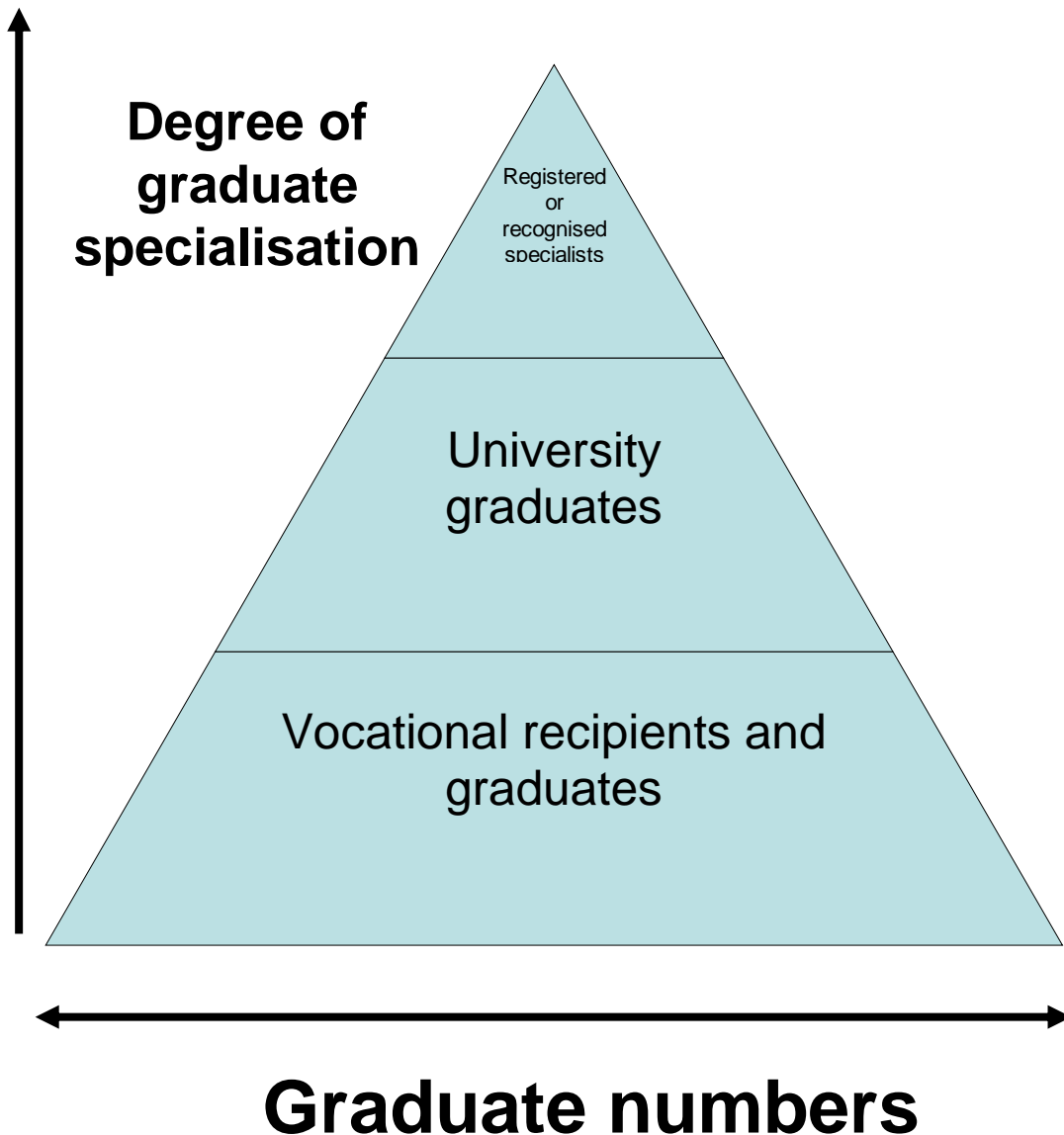
The key to the development of a national curriculum would be to produce educated personnel who are capable of fulfilling various roles in aquatic animal health required by the Australian aquaculture industry.

There were some limitations identified in the current system of education. These were:

- Learning resources – access, availability and wide usage.
- Poor communications between the sectors providing training in AAH
- Equivalency in levels of education and recognition of qualifications and the associated responsibilities.

Finally this group identified who would be the target for the curriculum and identified a need for an overarching standard and content of education that allowed the up-skilling of present personnel with in AAH service provision and recognised other specific needs of industry. The curriculum should be fit-for-purpose with clearly defined standards.

Figure 1 Graduate numbers related to degree of specialisation.



## Blue Group

Defined a curriculum as having these attributes:

- Acting as a framework for a range of learning outcomes possessing variable depths and breadths of expertise
- Coordinating existing and developing resources within a common structure
- Possessing the ability to sustain gap analysis for needs and resources
- Should be people-focused
- Able to direct resource to where it is most needed and best utilised

They also recognised that it can't cover everything and so there was a need to prioritise learning deliverables.

They asked the question: Is a standardised curriculum achievable? They promoted the idea that development should start with a benchmarking focused on outcomes rather than content (i.e. select content to deliver needs of graduates and employers rather than standardised practices of subject development).

The group also identified some key issues with the delivery of any standardised curriculum. These included the appropriate identification of issues and management of the requirements for aquatic animal ethics, a need to build the capability of the people delivering the education, resources need to be in a form that makes the teaching job easier and there must be a prioritisation of resource development versus capability development (i.e. investing in teachers). The curriculum must also include a research context enabling flexibility to include a lecturer's own research interests.

They also identified the possibilities of including existing international course expertise to cover units of study not already developed in country.

AAH professionals were seen to have an impact on the profitability and sustainability of aquaculture industries and so it was seen as important that a gap analysis be undertaken across all sectors of the aquaculture industry to identify deficiencies and then prioritise the actions required to address these deficiencies in the most timely, cost effective manner. If a resource is identified as available to facilitate educational development, then mechanisms should be created to allow its utilisation.

This group agreed that a curriculum should address student aspirations and should be a harmonisation of participant and end user as opposed to being standardised in its content and that it should also ensure that the priorities of stakeholders are met. In other words a curriculum needs to specify the breadth and depth of skills provided within it as well as be flexible, reflecting the real world's needs and not be static.

They identified a number of possible logistical challenges towards the development of a national curriculum in AAH. These would include the balance of willingness of participants to share resources and the protection of an individual's educational patch, the crowding of

existing curricula (i.e. veterinary example would be fish vs pigs), and limited buy-in by educators for a national curriculum.

Once established a national curriculum would allow the best use of resources with sharing and ability to continually develop and improve by shortening feedback loops making the curriculum more responsive to end user needs. There would also be an increased dissemination of knowledge by breaking down the silos perceived as being present in the existing system. Students would have an understanding of the different disciplines with the AAH sector allowing them to better direct their interest and receive the appropriate training. Breaking the silos down may also allow greater facilities interaction and so a national approach would allow greater access to existing knowledge at all levels. For instance it was seen that oyster farmers have a knowledge-base that would be invaluable to diagnosticians not familiar with this sector.

Another key and most important aspect would that it would allow AAH professionals to map pathways to careers.

## **Yellow Group**

This group did try to define what they saw as a curriculum for AAH:

“A roadmap for the strategic advancement of the AAH sector allowing educational delivery at a range of levels for different industry sectors, utilising common teaching resources”.

The curriculum would deliver a common message that would have to be defined and be applicable across multiple sectors taking advantage of a multi-disciplinary approach. The road map linked all components in the system allowing specific content development at vocational and the various university levels.

Key work areas for the development of such a curriculum were identified as:

- What are the key messages?
- Definition of linkages between providers of AAH education
- How the system could be categorised to suit needs of various levels and sectors but maintaining integration of these various areas.

The purpose of a coordinated curriculum would be to avoid a disconnection between what is taught in the different sectors and institutions; allowing an improvement in the portability between sectors and institutions; and improve efficiencies by removing duplication.

The development of such a system would identify common outcomes and improve visibility of the sector by identifying career paths, linking career options and allowing recognition of what's available.

This group attempted to define the ultimate targets for a national curriculum. Generally it was seen as the whole seafood producing sector but key levels of the industry were:

- Farm level – a general awareness was required

- Academics and registered training organisation trainers
- Policy makers
- The general community allowing a raising of industry visibility
- Individuals who wanted to develop specific skills which may not be awarded or may be undertaking in small intensive block teaching format.

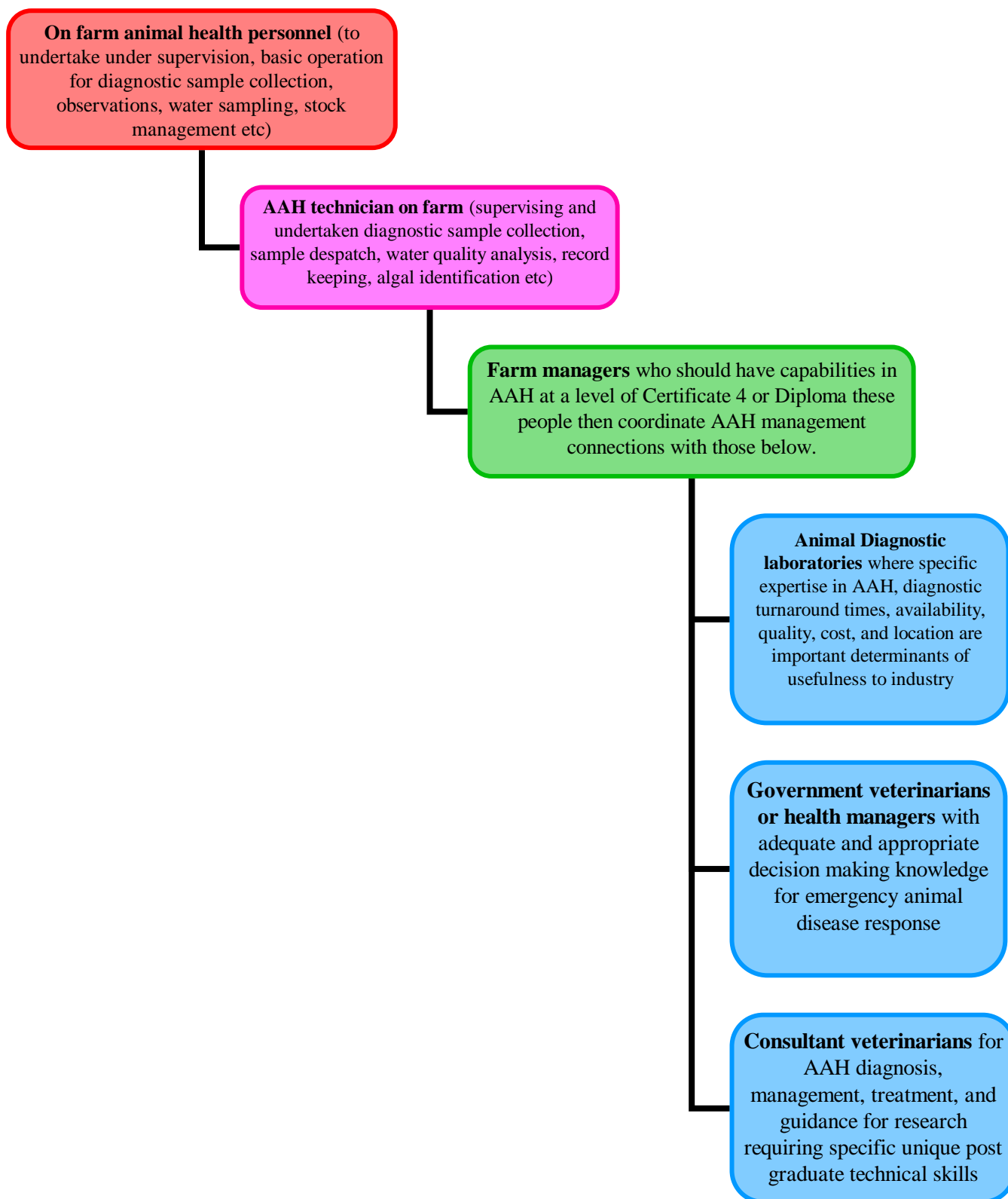
## **Activity 2: Gap identification in the existing national AAH education for each sector**

This activity was conducted with participants being divided into three education provider groups and two graduate end user groups. The summary of their discussion outputs are as follows.

### **Industry Group**

The discussions were centred on the question of whether AAH provision was adequate for industry and the scope was restricted by the small number of industries represented at the workshop however some gap analysis in AAH provision were identified for Southern Bluefin Tuna (SBT) and farmed prawn industries. The analysis was based upon two levels of service provision to the industries (i.e. vocational and professional). The key deliverable for industry was a need for access to problem spotters, managers and responders (i.e. contacts to resolve industry AAH issues).

Industry identified a hierarchical pathway of AAH delivery at the farm level and beyond as well as the capability requirements of each level for support of industry (see Figure 2).



**Figure 2 Levels of industry requirements for aquatic animal health professionals**

There was a consensus in the group that vocational training was adequate for the Southern Bluefin Tuna and prawn industries needs but required some industry specific adjustments and additions.

It was also recognised that there are significant present needs for technicians, managers and consultants with higher level AAH training which will continue for the next 5-10 years. For both the SBT and farmed prawn industries the system structure was working however university graduates were seen as the most appropriately trained personnel for higher level AAH management.

The SBT industry currently prioritised work health safety above AAH as priority focuses for investments.

### **Vocational Providers Group**

It was agreed generally by this group that at the core of vocational training was the Seafood Industry Training Package (SITP). This is a training package that was developed under the remit of AgriFood Skills Australia, one of 11 independent, not-for-profit Industry Skills Councils (ISCs) established by the Australian Government Department of Industry to ensure skills and workforce development within five main sectors: Rural and related industries (including agriculture, horticulture, conservation and land management, animal care and management), Food, beverage and pharmaceutical processing, Meat, Seafood and Racing (greyhound, thoroughbred and harness).

*“The Seafood Industry Training Package covers all levels of work, ranging from the inexperienced new entrants to the industry, through to skilled operators, supervisors and managers. In 2005, qualifications in environmental management for the seafood industry were added to SFI04 in response to the heightened importance of environmental management across all seafood industry sectors as well as the demand for specialist skills and knowledge to support its implementation.”* From

<http://www.agrifoodskills.net.au/?page=SeafoodBackground>.

The package has undergone a number of reviews and was seen by this group as a structured, informed package that is focused on skills and knowledge development allowing problem solving capabilities of graduates. There are clearly defined pathways between units of study producing clearly definable qualifications and exit points. The package is designed in a way that allows the ability for educators to customise units into skill sets whilst maintaining adherence to the clearly defined standards of the training package. It was seen as essential for industry competency standards and qualification packaging t could be reviewed for industry relevance and continuous improvement.

It was emphasised that the package must remain relevant for industry and the process of review must be structured and regular and embrace other stakeholders who can add value particularly in the AAH area.

### **Universities with Veterinary programs Group**

In discussing the potential educational gaps in AAH provision to veterinary students this group spent a significant amount of time trying to identify what AAH content there was in Australian veterinary schools curricula. This content has to compete with a wide range of other species related content within the curricula and so priority of inclusion was identified as a limiting factor in terms of content proportion.

The specific seafood industry needs for veterinary graduates with AAH expertise and stakeholder commitment to driving the educational priorities for veterinary graduates was identified as important by this group. It was identified that a thorough review of industry needs was required.

By briefly discussing the structure of veterinary education in terms of AAH content and identifying historical pathways of veterinarians who now undertake AAH work within Australia, a multi-tiered approach to producing veterinarians with AAH expertise was identified.

There were three key levels of education and expertise identified.

- Undergraduates – students within the various veterinary degrees
- Post graduates veterinarians with an interest in the area of AAH
- Post graduate veterinarians with expertise and specialist training in the area of AAH

Veterinary schools in Australia (n=7) offer veterinary degrees either as 5 year Bachelor of Veterinary Science or a 3yr Bachelor of Science or equivalent with emphasis on animal sciences relevant to Veterinary Science, followed by a 3yr graduate Doctor of Veterinary Medicine degree. For the purposes of the gap analysis discussion either of these scenarios was deemed undergraduate veterinary degrees. Veterinary schools within Australia seek accreditation for their institutions and curriculum so that their graduates meet the requirements of having a set of standard ‘first day skills’. In this context graduate veterinarians have a set of skills that are directly applicable to AAH but may not be specifically directed towards aquatic animals and their management. Some veterinary school or faculties had AAH curriculum content, however it was directly proportional to the interest and expertise of the academic staff and the specific aims of the institution. Some institutions were aiming to produce graduates with expertise in aquatic animal health management and so had content including clinical management of teleost fish cases (primarily ornamental fish), health management of intensively reared aquatic animals for aquaculture, aquatic parasitology, and many other sporadic aquatic animal health topics embedded within established subjects such as general pathology and anatomy.

The second tier made up of graduate veterinarians with an interest in aquatic animal medicine either as clinical practitioners or even researchers were seen as acquiring their education in AAH via learning on the job as cases were seen, combined with literature review or undertaking specific non award continuing professional development via short courses or conferences. Their expertise is as general clinical practitioners with an interest in applied medicine.

The third group and arguably the most useful group to the aquaculture industries were the post graduate trained veterinarians. This group undertakes specific training in AAH as researchers combine with specific course work either as honours, masters or PhD students or are vocationally trained under mentorship as they fulfil the requirements of Membership or Fellowship of the Australian and New Zealand College of Veterinary Scientists within the Aquatic Animal Health Chapter. They may also undertake similar peer assessment with the Royal College of Veterinary Surgeons in the UK. Their paths are varied and ill-defined towards attainment of accredited credentials and capabilities and aligned more to their personal needs and directions than to fulfilling any industry requirements for AAH professionals. They will



have specific highly applicable training in a wide variety of disciplines. Products of this education system would have an educated voice, have an availability when required by the production sector (i.e. as a result of a specialised career direction). Graduates should be employable as there is a willing market and they will provide a veterinary perspective to AAH.

The significant present gaps identified in the discussions by this group were:

- That the end product of an appropriately skilled aquatic animal health veterinarian required a multi-level education through paths that were presently ill defined.
- There is presently no coordination amongst providers of educational paths and content with no common format for learnings
- There is presently no clearly identified career path
- The delivery of education is distinctly different between the undergraduate and post graduate levels and so key deliverables for the levels are poorly defined.
- At a case management level for veterinary graduates AAH is necessarily multidisciplinary and a lack of structure in training prohibits veterinarians in this career path the ability to access and utilise the diverse expertise available in Australia for training.

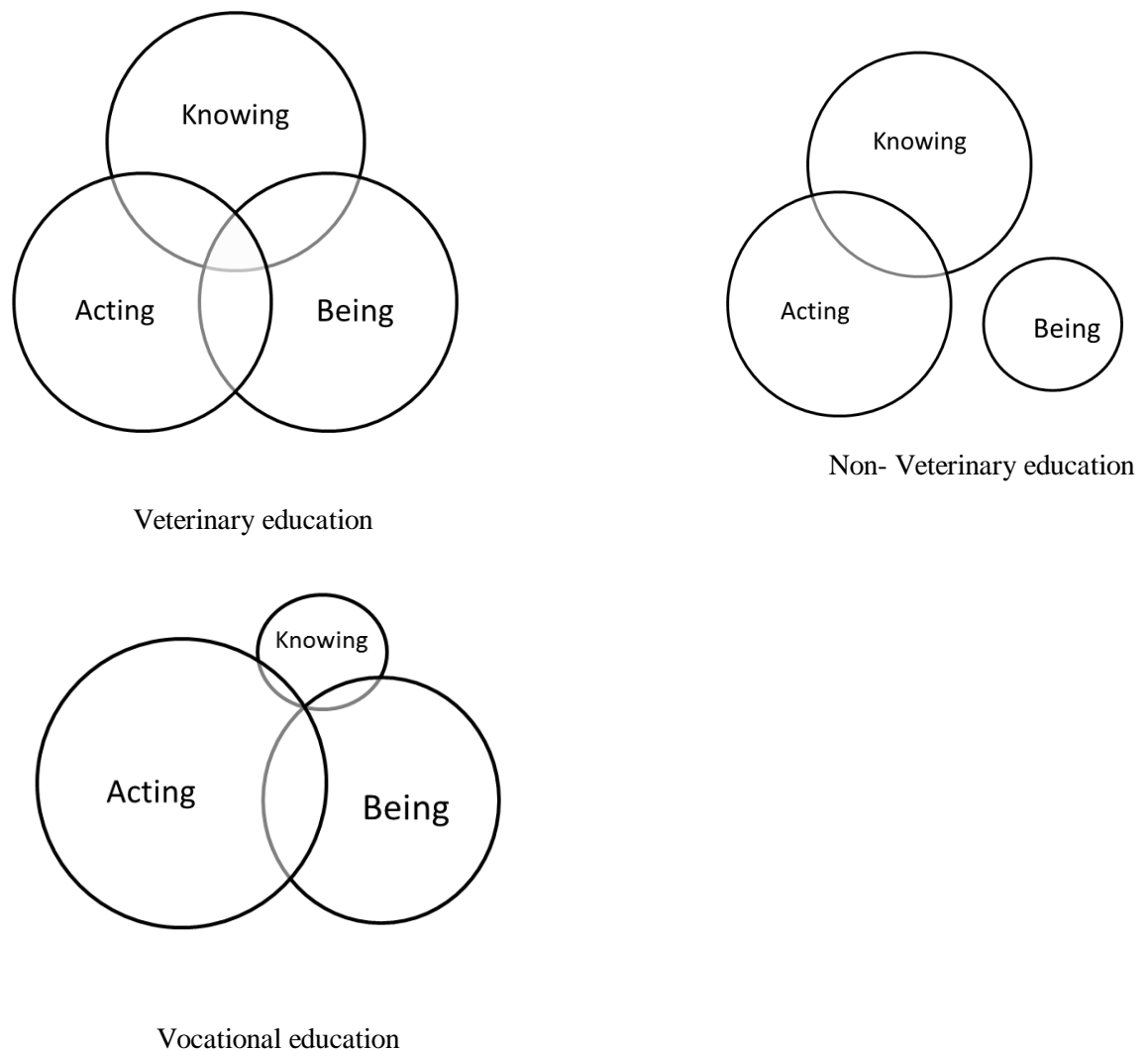
The approach taken by the University of Sydney outline in its Final Report to the Australian Pork Ltd (Project 1900.06: Development of a Pig Health and Production course for the Veterinary Schools of Australia) was discussed in detail by this group and it was agreed that the course framework could and should be used as a template for further development of a coordinated approach to educating veterinary students in AAH.

### **Universities without Veterinary programs Group**

The discussions of this group centred on the curriculum definitions and whether the current situation of AAH education reflected the principles of curriculum design set out by Barnett and Coate (2005), equally for all sectors. By analysing these aspects of curriculum design they then went on to identify any deficiencies within their own sector.

Barnett and Coate (2005) stated that “*A curriculum has to be understood as the imaginative design of spaces where creative things can happen as students become engaged.*” They proposed three key elements as important in the design matrix. These being Knowing (knowledge and a student’s awareness of that knowledge), Acting (applying specific skills in a directed way) and Being (a student’s self-awareness of the application of skills and knowledge as well as context). They argue that curriculum design should take in all these aspects and it should be remembered that not all have to be equal in their importance when a curriculum is designed.

This group then went on to analyse the applications of these three elements, within curriculum design, for each of the educational sectors and confirmed the consensus from their discussions that the following graphics represented how the elements should relate in each of the sectors (Figure 3).



**Figure 3 Knowing-Acting-Being models for educational sectors in AAH**

In summary this group considered that veterinary education should have equal emphasis on the three elements for AAH in the veterinary context. This was because veterinary education was used to train those that would usually act in a consultant (lead expert) type of role with all the legislative responsibilities that accompanied being a registered veterinary surgeon within Australia and so training should be directed towards producing AAH professionals who had all the attributes, equally.

Their view of vocationally educated AAH professionals was that they would have a more narrow specific AAH skill set but would need to be able to apply their knowledge well and also have a sound environmental knowledge of the industry in which they were engaged. Those who were educated within the non-veterinary universities were expected to have a specialised understanding of a more narrowed scope of activities than their veterinary counterparts and be able to apply these skills, however they may not be as well-equipped to understand the broader environment in which they would have to apply their skills. There was no disadvantage seen from these curriculum designs just the realisation that we may not be able to design a curriculum which would encompass the needs of all graduates in applied AAH.

Generally speaking this group believed for the non-veterinary university sector a curriculum should have 4 key characteristics:

- It should be learning outcome based
- It should possess a flexibility in delivery and content
- It should reflect local needs with a global context
- There should be a maintenance of identity for specific institutions (i.e. centres of excellence)

Generic national skills attributes could be incorporated within a national curriculum and expertise should be accessible more readily from institutions that are part of the national collective deliverable of AAH training.

They identified significant gaps in resources for course work development and a coordinated system to assess what is available already within the system that could be used across a network of educational providers. In times when financial resources are scarce there is a need to avoid duplication of educational resource development and combine expertise for cost-effective review of the present resources.

They could not identify any specific need for expertise development or provision as a result of there being no clear understanding of what is required by end users of AAH graduates.

### **Government (State and Federal) Group**

The discussions of this group were focused around the specific needs of this sector for AAH expertise. Experts require specific skill sets that are focused on the areas of responsibility that relate to emergency animal disease management including early detection, passive surveillance, response to incursions and policy issues related to trade and management of disease-free status at a state and national level.

It was identified that by including these modules of training within a general curriculum then AAH graduates would be more job-ready at graduation, allowing an increase in scope for employment within the government sector. It was seen that by including relevant modules within a holistic training framework training could possibly be undertaken at a reduced cost. The significant gap identified by this group was access to specifically trained and skilled AAH experts.

### **Activity 3: Develop a core competencies list for each educational sector and as requirements for government, industry and others**

#### **Universities with Veterinary programs Group**

The role of veterinarians in the provision of AAH services has change dramatically in the past 30 years. As a result there is a realisation that AAH must be included in the curricula of veterinary schools. The challenge with the adoption of this realisation is that undergraduate curricula are already at capacity for content. Education based upon bench marking against ‘day one skills or competencies’; a measure accredited by Australasian Veterinary Boards Council through the Veterinary Schools Accreditation Advisory Committee (VSAAC), Royal College of Veterinary Surgeons (RCVS) and the American Veterinary Medical Association (AVMS)), means that there are specific core competencies required of new graduates and so designing curricula with these in place makes any 5- or 6-year course content-heavy. Now that AAH is deemed important by developing and established aquaculture businesses, the core competencies associated must now also be included possibly at the detriment of other competencies.

Veterinarians with AAH skills usually acquire them after graduation through speciality training whilst consulting to industry. They use their skills acquired during undergraduate course in intensive animal medicine as a core on which to build. So it was recognised that veterinarians acquire AAH competences in two phases; as undergraduates and as post graduates. It was discussed that some aquatic animal skill could be readily dove-tailed into existing veterinary curricula simply by having modules which enhanced existing topics in the curriculum. For instance animal husbandry courses should include a section on aquatic animal handling and management. The design and content of such modules could be developed at a national level and made available for educators. They would therefore contain common national themes and could be edited as required and again made available. In addition there could be developed elective subjects or additional core subjects within the veterinary curricula that would allow focused AAH and production emphasis. This would rely upon students obtaining skills that could be expanded with the focus purely on AAH.

With this in mind the veterinary educators set about frame-working a set of core competencies that could be included into existing undergraduate veterinary education which would serve as a foundation for further specialist skill development.

Using the approach outlined within Holyoake (2005) they developed this example course containing what was thought to be core competencies for veterinary AAH professionals (see Table 2 and 3).

**Table 2. Core learning outcomes for an Aquatic Animal Health and Production course, their ranking (A = most important to C = least important), corresponding discipline and relevant teaching resource “module”.**

Learning Outcome	Rank (A-C)	Discipline	Teaching resource module*
Identify health-related reasons for excessively high aquaculture production costs (Cents/ kg carcass weight)	A	Economics	1
Problem-solve poor reproductive performance for hatchery broodstock (range of species)	A	Reproduction economics	2,3,4
Problem-solve poor growth performance (growth rate, mortality, feed efficiency) range of species	A	Economics	5
The role of vets in programs that include the utilisation of QA programs that result in the production of safe, wholesome food for aquaculture.	B	Public Health, Quality Assurance	1,12
An understanding of best practise on how ova and milt are used for <i>in vitro</i> fertilisation and fry and larvae production (range of species).	C	Reproduction	2
The ability to diagnose and effectively test for, control and prevent common finfish, crustacean and mollusc diseases in Australia and the Asia pacific.	A	Pathology/ Medicine	6-11,13,14
Have an understanding of key emergency and exotic diseases to Australia affecting farmed finfish, crustaceans and molluscs.	A	Pathology/Medicine/Biosecurity	6-11,15
Identify housing, husbandry and management practices on-farm including water quality monitoring that may influence/result in disease expression and transmission.	A	Epidemiology/ Chemistry	5,7-11, 17
The ability to use medications in a way that minimises the risks of pathogen resistance developing and tissue residues occurring.	A	Medicine	13
Recognise and resolve animal welfare issues.	A	Welfare	16

\*Module numbers are purely as an example

**Table 3 Practical learning outcomes for the Aquatic Animal health and Production course**

The ability to undertake husbandry practices related to a variety of commercial production systems for finfish, crustaceans and molluscs – i.e. capture, restraining, blood and haemolymph collection, injection techniques and condition scoring.
The ability to conduct a clinical examination and recognise sick animals.
An understanding of best practice principles for crowding, grading, vaccination, humane harvest and other common practices for aquatic animals.
An awareness of common breeds and breeding methods such as triploidy.
Assess housing, husbandry and management of stock on-farm
Evaluate performance using clinical, epidemiological, necropsy and farm performance.
Calculate the amount of medication required to provide an effective dose to fish (parenterally, in water and in-feed)
A knowledge of the legal requirements for prescribing and dispensing medications to aquatic animals.
Ability to communicate effectively with a variety of stakeholders in the seafood production industry

It was acknowledged that the resource material for such a course could be developed by the appropriate experts within the university sector and utilised by all veterinary schools associated with its development. The advantages of this approach would be that the resource is developed once by a collaboration of experts, reducing time and other input costs, and duplication of pedagogical resources by educators.

Common national and industry themes could be incorporated, aligning education with the needs of those who would be ultimately serviced by the veterinarians. All veterinary schools could provide a similar education in AAH for their students reducing institutional bias and bringing a degree of certainty to national capacity in veterinary AAH expertise.

The post-graduate education of veterinarians in the field of AAH, presently, is ad hoc and without structure. Veterinarians looking to develop specialist skills will generally look to Masters or PhD programs with the addition of peer assessment through the Australian and New Zealand College of Veterinary Scientists (ANZCVS) for membership or fellowship of the Aquatic Animal Health Chapter (AAHC).

The core competencies for the attainment of any of these post-graduate qualifications are clearly defined in the case of membership and fellowship of the ANZCVS AAHC (see ANZCVS Membership and Fellowship handbooks as well as the Subject Guidelines- <http://www.anzcv.org.au/info/membership/>) and will be determined by the individual projects and requirements of the Universities involved in the Masters and PhD programs.

The pathway to attainment of the qualifications, identification of relevant projects and the structuring of a post-graduate courses allowing the possible parallel attainment of, for example, a Masters and membership of the ANZCVS simultaneously was seen as a key area for further discussion and development by this group.

### **Universities without Veterinary programs Group**

This educational sector has a divergent focus on subjects and expertise that encompass AAH. Currently they encompass expertise as broad as aquatic animal parasitology, virology, microbiology, mycology, production nutrition, environmental monitoring and aquaculture engineering design. They provide key expertise in a range of very specific competencies and are a significant and important sector in AAH education.

During discussion this group also developed a list of learning outcomes and practical competencies from an AAH curriculum. These are as follows in Tables 4 & 5:

**Table 4. Core learning outcomes for non-veterinary graduates**

Familiarity with different environmental requirements for the species of highest economic/commercial importance
Clear understanding of the host/pathogen/environment interaction
Up-to-date knowledge of immunology of the 3 main classes of cultured animals i.e. fish, mollusc and crustacean
Underpinning of the above deliverable with appropriate level of understanding of anatomy and physiology
Knowledge of non-infectious and infectious diseases with some specific local examples of what and how.
Understand how to interpret records as indirect indicators of health for farmed stock
Good understanding of disease management in the areas of: prevention, treatment, vaccination, SPF/SPR stock
Understanding of policy and legislation related to AAH nationally

**Table 5. Core practical competencies for non-veterinary graduates**

Record-keeping and analysis of records for stock health and water quality
Recognising normal conditions and behaviour of commonly cultured stock

Aquatic animal handling
<ul style="list-style-type: none"> <li>- Anaesthesia/euthanasia</li> <li>- Stress reduction</li> </ul>
-Anatomy/sampling/dissection techniques with an emphasis of correct sample fixation and preparation.
Correct microbiological techniques
Smear preparation
Parenteral administration of treatments.

It was noted by some members of this group that the development for a national curriculum for AAH may take a lot of time and monetary investment by a large group of experts and so there may be a reluctance to engage working groups to undertake the task.

### **Vocational Providers Group**

A concise review of vocational education and training programs in AAH within Australia was undertaken by Mark Oliver of Australian Aquaculture Support Services Pty Ltd for the FRDC Aquatic Animal Health Sub-program identifying the key deliveries for AAH training within the vocational sector (Oliver, 2014). The documents for this training are organised in the Seafood Industry Training Package (SFTIP) and the training is organised within a training package underpinning the Australian Qualifications Framework and managed by Agrifood Skills Australia. The core competencies are clearly stated within each skill set and qualification however the content and educational resources are outside the endorsed components of the training package, and development of these remains the responsibility of training providers. As such, these important components are variable in their quality and pedagogical value.

This group of educators thought the key focus for improving delivery was also the development of standardised, informed, up-to-date, readily usable teaching resources that could be used to deliver training and assessment within the existing training framework.

A short list of priority units for development were as follows:

- Within the broad category of Biosecurity, standalone units in Surveillance and preparedness for, responding to and managing disease incursions and events
- Current-trending disease issues
- Chemicals in aquaculture



- Animal welfare in aquatic animals

### **Industry Group**

The aquaculture industry relies upon a range of expertise both internally and externally to advise on and manage all aspects of AAH for production and on the occasions where emerging disease and focal-point mortality events occur.

Discussion related to core competencies needed by aquaculture were initiated by dividing the needs of industry into 3 broad AAH supply sectors. These being:

- a. Farm-level AAH expertise provided by technical and managerial staff.
- b. Non-veterinary advisors
- c. Veterinary advisors

The specific competencies required by these groups are included in the following lists. It was recognised by the group that the lists were not exhaustive and that further consultation was required in the event of further development of a national curriculum so that a concise needs analysis could be catered for within the end curriculum. It was also deemed necessary to align present deliverable education with this needs analysis so that inefficiencies in curriculum design and delivery are avoided. If there are existing education modules already presented within the loose national framework that currently exists it would make sense to incorporate rather than redevelop teaching resources within a national curriculum.

#### **a. An on-farm manager needs:**

- In-depth knowledge of water quality chemistry, monitoring and management
- Disease recognition at the level of knowing normal stock appearance vs abnormal stock appearance
- Record keeping skills and ability to interpret changes in data collected
- Be able to collect appropriate samples for submission to a diagnostic laboratory
- Anatomical, physiological and immunological knowledge of cultured species under their care
- At least rudimentary skills of microscope operation and necropsy techniques at least to collect samples for further testing.
- Nutritional knowledge of the species being cultured at least at the managerial level and all staff with some knowledge of feed management
- Awareness of state and federal disease response plans at all levels and managerial staff need a contextual understanding of the application of such plans.
- Understanding of and having the ability to implement farm hygiene plans
- Understanding of biosecurity to a level of detail concerning such things as fomite and vector spread and risk management skills

- Developed planning skills at the managerial level.
- Understanding of the application of treatments including OH&S aspects.

It was agreed that many of these competencies could be provided by appropriate TAFE Cert III or Cert IV course within the SFITP. One detailed submission to the workshop from the Australian Prawn Farmers Association highlighted core competencies required of students at an undergraduate level that would be deemed useful for employment in the prawn farming industry (see Appendix B)

**b. Non-veterinary advisers need:**

- Understanding and experience in site selection and design planning for new and existing aquaculture enterprises.
- Environmental management experience including contaminants knowledge.

**c. Veterinary advisers need:**

In addition to normal veterinary skills the industry required experts to have a range of aquatic animal specific skills.

- Knowledge of environmental impacts from and to aquaculture production farms.
- Knowledge, understanding and experience in Regulatory responsibilities for treatments, toxicants and environmental issues
- Depth of experience in the various other 'ology's in science that are applicable to AAH (e.g. virology, microbiology, parasitology etc).
- Problem solving skills.
- Epidemiology skills.
- Disease identification and management skills (in the context of aquatic animals).

**Government (State and Federal) Group**

The government sectors are an important employer of AAH expertise and they require specific skills and competencies in order to maintain their ability to undertake the overseeing of state and national legal requirements as well as the additional oversight of regional industries, necessary for the economic management of the aquaculture industries.

The competency list developed was more reflective of a post-graduate requirement in education as many of the skills were advanced and required undergraduate science as a

prerequisite. For veterinary experts the core competencies would be delivered as they graduate from veterinary schools underpinned by the principles and bench-marking of 'first day competencies'. In addition the following skill sets were deemed important.

- Understanding of the various industries and have a demonstrable level of practical experience of them.
- Understanding of the important endemic, emerging, exotic and notifiable diseases within a range of species and be able to readily identify clinical signs, sample collection for diagnosis of the agent, be familiar with the appropriate diagnostic test required for these agents and gauge the significance of the disease incursion.
- Have competency in the principles of veterinary epidemiology.
- Understand disease prevention and control including early detection systems, contingency planning (e.g. Aquaplan), and emergency management.
- Understanding of veterinary medicines and product knowledge including regulatory framework, resistance development and use.
- Animal welfare as it applies to aquatic animals.
- Knowledge of relevant legislation, policy and regulatory responsibilities as they apply to the aquaculture industries.
- Understanding of the international trade framework including health certification.
- Have a high level of communication skills enabling appropriate interaction with a range of stakeholders.
- Abilities in risk analysis.
- A background and understanding in scientific research allowing the application and interpretation of scientific research in the context of aquatic animal production systems.

For non-veterinary graduates these competencies are still valuable and the list for these experts would have to necessarily omit the legislative and legal aspects that are the responsibility of veterinarians registrable within the states and territories of Australia.

# Discussion

Conceptually, an agreement across all delegates was that a curriculum should be a roadmap for the strategic advancement of the AAH sector allowing educational delivery at a range of levels for different industry sectors, utilising common teaching resources. Why this is such an applicable description of curricula applied to the aquatic animal health sector, is because it highlights the diversity of student outcomes, industry needs and institutional delivery which exists and requires coordination within a single framework.

The curriculum would deliver a common message that would have to be defined and be applicable across multiple sectors taking advantage of a multi-disciplinary approach. The road map will link all components in the system allowing specific content development at the vocational and the various university levels.

In terms of clearly defining what the specific components of the curriculum for AAH education within Australia would be, the following guideline from Hicks (2007) functions as a clear framework around which specific requirements there are for AAH education, as identified by the workshop.

*A curriculum should embrace:*

- *What is to be learnt – content*
- *Why it is to be learnt – rationale and underlying philosophy*
- *How it is to be learnt – process and pedagogy*
- *When it is to be learnt – structure of the learning process*
- *How the learning will be demonstrated and achievement assessed – quality*

It was not the intent of the workshop to design a curriculum in 1.5 days but to identify the key elements and directions of a future national curriculum. Expanding each of the five facets of a functional curriculum in the context of the provision of AAH education is very useful in getting a true sense of what was thought most important in a national curriculum by the workshop delegates.

*What is to be learnt – content.*

The development of a multidiscipline curriculum aimed at student levels ranging from purely vocational to post-graduate university levels and delivered from a range of institutions each with their own expertise and institutional directives, was deemed difficult at best and without a current funding model. The ‘top down’ approach where those with expertise within the educational sector design a curriculum comprised of what they believe are the key components for aquatic animal health expertise, attracts some passion from educators philosophically but is recognised as being logistically and economically unfeasible. More attractive is the ‘bottom up’ or end user determined content within a curriculum which allows the development of a curriculum that has core competencies and outcomes from those engaged in learning from it and a smaller more manageable curriculum that can have additional dimensions developed at individual institutions allowing a maintenance of institutional identity and academic freedom for the range of experts contributing to the curriculum.

From this core component offered from a range of institutions there is a national consensus about what is important content and it utilises a range of experts to develop the learning modules which gives the units peer review and internal quality control simply by the nature in which they were developed. If the pedagogy is also hard-wired in the modules, then there is an added level of quality control from the

students' perspective as they would expect to gain equal education for these core components wherever they are offered giving a predictability to the national outcomes in AAH education.

The purpose of a coordinated curriculum would be to avoid a disconnection between what is taught in the different sectors and institutions allowing an improvement in the portability between sectors and institutions and improve efficiencies by removing duplication.

The ancillary benefits to having a core curriculum is that it also allows identification of common outcomes and improve visibility of the sector by identifying career paths, linking career options and allowing recognition of what is available.

This core approach is what the template was in Holyoake (2005). The key difference in the curriculum for porcine health and production and an AAH curriculum is the sheer complexity of educational dimension within the aquatic animal space.

It was agreed that for further development of an AAH curriculum the key components of content would be determined by the end user and the end user would be defined as groups utilising the skills of graduates with AAH qualifications. This approach does not limit what can be taught within the area of AAH by vocational and university educators but allows a framework onto which can be attached additional teaching and training material.

Examples of core competencies that would form the basis for module development are included in the section of this report entitled "Develop a core competencies list for each educational sector and as requirements for government, industry and others". These are not exhaustive lists and it would be recommended that further development of these lists be undertaken in the future for the curriculum to develop.

#### *Why it is to be learnt – rationale and underlying philosophy*

Amongst vocational and university educators and the industries and governments that employ the graduates of such education, there is an overwhelming agreement that a coordinated approach to AAH education is a necessity if we are to have continued growth and sustainability in aquaculture production in Australia. For the last 15 years this is documented in the development of a SFITP for vocational training and in Aquaplan 2005-2010, Landos *et al* (2007), and now in the new Aquaplan 2014-2019 documents. A need has been identified over this time at least, that a coordinated approach to AAH education with a common message exists. The key driver for this is the ongoing requirement for appropriately trained experts in the field of AAH. The curriculum is a tool by which these people are made available to industry. Internationally it is also recognised that AAH professionals are essential to developing aquaculture enterprises. For instance the OIE recognises that there is a minimum standard for aquatic animal health services and maintenance of these services worldwide is dependent upon appropriately training veterinary graduates (OIE, 2013) and Hartman *et al* (2006) highlight needs and mechanisms for educating veterinary post-graduates in an American context.

It was re-iterated during discussion with stakeholders as this project was scoped, and echoed at the workshop, that there is a clear need identified. The challenge was now doing some tangible work in creating a unified educational approach.

The need for a national curriculum is dictated by the need for individuals with competency in AAH. The curriculum is the means by which these people are educated. These individuals can be employed at various levels within industry and government and it is the needs of these employers that will determine what competencies are required. So the curriculum facilitates training outcomes and serves as a mechanism for efficiently enhancing attributes of those working in AAH.

Aquatic animal health education is already undertaken in a range of vocational and university institutions. The curriculum is a way of coordinating messages, core competencies and providing an efficiency of teaching resources utilising a vast array of expertise. Additionally it may provide a construct for the capturing and utilisation of ‘legacy collections’ of materials and samples pivotal to all AAH training programs. Funding for resource development is currently the responsibility of individuals and institutions and a national approach would allow at least efficiencies for a better utilisation of existing resources but may also allow a mechanism for additional funds to be allocated for national benefit.

### *How it is to be learnt – process and pedagogy*

The general consensus of discussions by delegates of how a common, relevant and current national curriculum could be taught was that a curriculum which included modules of core competencies could be developed and made available for use by the individual educational sectors as they saw fit. The key was that core competencies were captured within a structured curriculum. Having a core “Meta-curricula” on which to add other components would allow for varying imperatives to be developed and delivered as need required.

The three education sectors that currently deliver AAH education in Australia are the vocational sector, and the university science sector and veterinary schools. It was seen by workshop delegates that a national curriculum would be less effectively dispersed if it were designed as a standalone course and so some flexibility of use of individual modules makes the curriculum components more likely to be utilised within the education sectors. It would be seen important that any institution or organisation providing AAH education would include the entire curriculum within courses provided so that a congruent national perspective was maintained with the messages presented to the AAH community.

Presently the vocational sector is well-organised with an established framework under the SFITP and so modules could be adopted into this existing training package. The course work resources would need to be developed, as for other sectors, and there would possibly need to be a train the trainer aspect to adoption within the package.

The university sector is less readily visualised in terms of AAH provision. The sector for the purposes of audit of course work currently provided in AAH, would be divided into those providing veterinary training and those that do not have veterinary training. This separation would allow a quick and less complicated assessment of what and where the training is being offered. This will also allow a specific gap analysis for deficiencies in the core competencies and identification of the specific materials already available for course work delivery. It is important to understand and appreciate that the veterinary schools and the science schools are distinctly different in their drivers, directions and graduate (undergraduate and post-graduate) characteristics and so separation also allows a clear identification of capacities, capabilities and uniqueness of these groups in the realm of AAH.

Some attempt was made at the workshop to specifically identify AAH deliverables for the universities around Australia, however time did not allow the production of a concise listing of all specifically relevant courses available to undergraduate and post-graduate students. This will be a key task in the development of a national curriculum, allowing a gap analysis of core competency units (i.e. are they available and where are they available from and to whom). This is part of the audit process on content which will precede any further curriculum development.

There was a great willingness by workshop delegates to share teaching resources and to use a collaborative approach to resource development for modules required within the curriculum. The wish amongst delegates to also embrace advanced pedagogical techniques allows a much easier ability to share resources once the material is developed. It was seen that once curriculum modules had been

identified that it would take a series of working groups to put the information together. This process will allow the aggregation of experts on specific topics and embed a peer review process for the contents and the materials. This method of modular development would give coherence to the curriculum delivery and help define the linkages between providers of AAH education in specialised fields.

The delegates remarked that there was great benefit from having the providers and recipient stakeholders of AAH education in the same room and discussing the issues around developing a national AAH curriculum and so the working groups and collaboration would greatly accelerate the development of the curriculum.

*How the learning will be demonstrated and achievement assessed – quality*

It is proposed that all components would be developed by those that have expertise in the various areas of AAH and so a natural peer review process will be in place as the curriculum is developed. Graduates educated with the curriculum will be assessed against the ‘First Day Attributes’ as outlined by OIE.

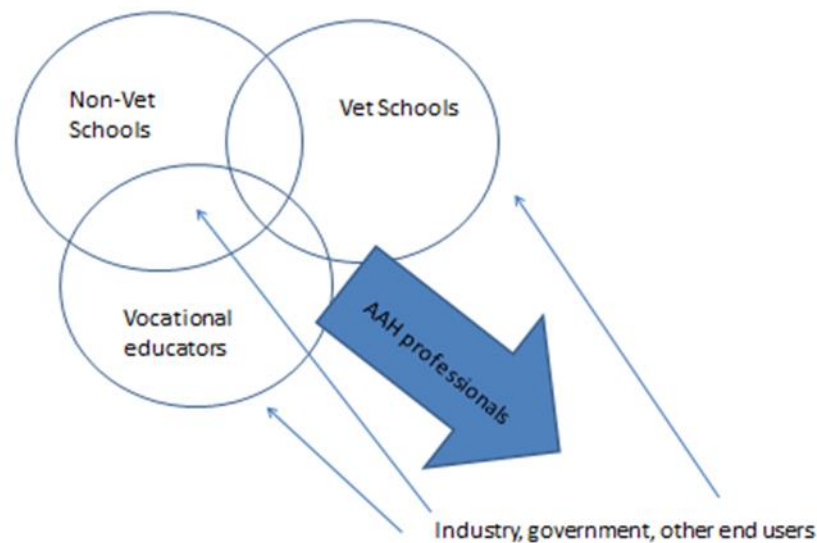
The vocational graduates will align with competencies assessed by requirements of the SFITP outcomes.

Audit and improvement of the curriculum will be a continuous process based upon a yearly structured peer review of content and to assess its application for industry and government stakeholder needs.

# Conclusion

A national curriculum should be developed and delivered for use by veterinary schools, universities and Registered Training Providers that are providing education and assessment (undergraduate and post-graduate) in the field of aquatic animal health. A standardised curriculum, with resources designed and created by the leading veterinarians and scientists working in the field of aquatic animal health, will be invaluable as a captured resource and will allow the education of consistently qualified veterinarians and scientists who will then be able to support the fishing and aquaculture industries in Australia.

Figure 4 Interactions of the providers and users of AAH education



An evidence-based national curriculum will ensure the validity of the information presented to trainees. The curriculum will be structured to allow for regular review and update with the best current scientific evidence. It will access a depth of national knowledge that is only attainable presently by those who have worked in the field for many years.

It will allow a system of mentorship and networking unsurpassed in the veterinary field and other applied sciences. This networking is not designed for individual gain but for capability development of the individuals who will be supporting the fishing and aquaculture industries. These industries will have access to more adequately informed scientific advisors. These advisors may be in the private sector, academic institutions (educational and research facilities) or government. Career paths for those providing aquatic animal health services could also be more clearly defined and exit points for education paths, identified.

One of the major benefits for the providers of education is that they will be able to readily access validated and harmonised teaching material allowing them to concentrate on the course delivery and student support and assessment.

The development of the curriculum will greatly enhance the aquatic animal health network within the country as providers work together on a common tangible goal with clear national benefit.



# Recommendations

1. That the development of a national curriculum for aquatic animal health proceeds to delivery. A development plan to be determined by engaged educators.
2. Establish a model of funding that will allow initial development and then the ongoing review of the NAAHC.
3. That a mechanism for curriculum review be developed so that timely regular reviews of the content and delivery of the NAAHC are undertaken to ensure relevance and optimal delivery of the curriculum to all sectors of industry and government.

## Further development

The workshop aimed to initiate the development of an NAAHC and led to identifying the need for a series of workshops or working group sessions to allow the development of a national curriculum. This proposed process was confirmed at the workshop by stakeholders who expressed enthusiasm in carrying the process forward.

It was agreed that the development and delivery of an NAAHC will only be achieved by undertaking a number of vital tasks in a process toward delivery and are as follows:

A. **EITHER** appoint a project manager to coordinate the curriculum development project **OR** establish a working party made up of representative of key stakeholder groups (i.e. universities vocational educators, government and aquaculture sectors) to oversee the project.

B. Formation of working groups within the university sectors (i.e. veterinary and non-veterinary) to align existing teaching amongst institutes, identify gaps in teaching resource and develop needed modules for undergraduate and post graduate education that specifically fulfil the needs of the curriculum.

C. Use the key competencies identified at this workshop as a foundation for a further survey of end users of AAH graduates, to develop a national key competency list around which the curriculum will be developed.

These elements could be initiated and progressed by an additional workshop aimed at developing a work plan for curriculum development and requires a funding model to allow progression.

Agreements and understandings for the sharing of curriculum content by institutions could be developed through the collaborative process which underpins the philosophy of this project. There was some concern among attendees at the workshop that there would be issues with content sharing. If issues arose as the curriculum developed then they would be addressed as required. The current vocational model of content sharing should be embraced across the entire curriculum.

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# Appendices

## Appendix A

### Workshop Agenda

#### FRDC AAHS Workshop on National Aquatic Animal Health Curriculum

13-14 February 2014, SARDI, West Beach, Adelaide, South Australia

#### Agenda

##### Day 1 Thursday 13 February 2014

Time	Item	Leader
9.00	Welcome; introduction; purpose of the workshop	SP
9.15	Setting the scene: What has gone before?	IE
9.30	AAH courses provided by Schools of Veterinary Medicine	PH/RW
10.00	AAH courses provided by University Schools of Biological Sciences	ML
10.30	AAH courses provided by other tertiary institutes (i.e. Vocational Trainers)	MO
11.00	Tea/Coffee	
11.30	<u>Instructions for workshop activity 1</u> : What is your definition of a National Curriculum for AAH, why do we need one and who is it designed to educate	SP
11.45	Activity 1 group discussions	groups
12.30	Lunch	
13.30	Reporting back and discussion	groups
15.00	Tea/Coffee	
15.30	<u>Instructions for workshop activity 2</u> : Gap identification in the existing national AAH education for each sector	groups
16.30	Reporting discussion outcomes	groups
17.30	Close Day 1	SP
19.00	Workshop dinner	

**Day 2 Friday 14 February 2014**

<b>Time</b>	<b>Item</b>	<b>Leader</b>
08.45	Summary of Day 1 outcomes particularly the question of Why do we need a National Aquatic Animal Health Curriculum	SP
09.00	Instructions for workshop activity 3: Develop a core competencies list for each educational sector and as requirements for government, industry and other.	SP
09.15	Activity 3 breakout discussions	groups
10.00	Reporting discussion outcomes	groups
10.45	Tea/Coffee	
11.00	Discussion of the integration of the AAH curriculum - Road Mapping	SP
12.15	Next steps – finalising a plan and seeking agreement by industry, government and educators	SP
12.30	Workshop close and lunch	

Leader code: SP – Stephen Pyecroft, EI – Ingo Ernst, PH – Paul Hick, RW – Richard Whittington, MO – Mark Oliver, ML – Melanie Leef,

## Appendix B

### **Core undergraduate competencies as outlined by the Australian Prawn Farmers Association for the workshop scoping the development of a national curriculum in aquatic animal health.**

- Basic Microbiology Theory and Practical Skills
  - Bacteria ID and biology
  - Agar plate (TCBS, MA) preparation, inoculation (streak and spread technique) and incubation and interpretation
  - Histology
  - Microscope use
  - Gill/pleopod/hepatopancreatic ID under microscope – identify ‘healthy’ vs ‘non-healthy’ and possible ID of cause.
- Disease Transmission and Prevention
  - Understanding vectors and their roles and ID’s in hatchery, brow-out and production systems
  - Hatchery and Farm biosecurity practices
- Virology
  - Basic biology of viruses
  - Control and prevention methods
  - ID and understanding different virus types/groups
  - Understand theory behind PCR techniques
  - Sampling protocols to preserve DNA for PCR
- Health and Immunity
  - Influence of good dietary and husbandry practices and immunity
  - Roles of immunostimulants etc in disease prevention
  - Study how crustaceans defence system works, roles of hepatopancreas and other organs
- Treatments
  - Antibiotics
  - Probiotics
  - Herbal supplements
  - Immunostimulants
  - Chemicals (provolone iodine, chlorine, formalin, Virkon/PUT etc)


- Know what to use and why and choose a method for particular purposes
- Harmful Algal blooms/ Toxic algae
  - Understand what are HAB's (using case studies)
  - Algae ID techniques – microscope
  - Bloom control and manipulation (e.g. how to encourage diatom bloom and how to rid pond of dinoflagelates/blue green algae etc)
- Optimal water quality parameters
  - Hatchery and grow out situations
  - Possible problems with incoming water including insecticides, herbicides, hormones and Trichodesmium etc and the effects they have on the health of the animals
- Fouling organisms
  - ID, causes and treatments
- National & Local Biosecurity
  - Preventing introductions of exotic diseases
  - Response procedures in the event of a disease outbreak.

# Addendum

Workshop presentations.


## Towards a National Aquatic Animal Health Curriculum

Dr Stephen Pyecroft  
Dr Charles Caraguel



## Background

- \* Trained professionals in aquatic animal health are needed to support the continued development and sustainability of the aquaculture sector within Australia.
- \* The productivity and marketability of the aquaculture and fishing industries depend directly on the capacity to promote, monitor, manage, research, and regulate the health and welfare of a wide range of species in a wide range of aquatic environments.
- \* Currently, training opportunities and resourceful corporate knowledge exist across the country covering only a subset of the core attributes required to meet industry, government and service needs.
- \* It is necessary to review available training capacities to develop a standard national curriculum to educate relevant veterinarians and other aquatic health professionals.




## What is a curriculum?

- \* We require a corporate understanding of what we all mean by the term curriculum before we can answer the question of:
  - \* Do we need a national one for aquatic animal health?


AND

- \* Who will we direct it too?




## Billett, S. Vocational Education , Springer Science, 2011

- \* *“There is a range of ways that the term curriculum is used within the educational literature and also in the public discourse about education”*
- \* *“Therefore, as a starting point, it seems both helpful and necessary to discuss what is meant here by curriculum”*




## Billett, S. Vocational Education , Springer Science, 2011

- \* *The discussion is required for three distinct reasons:*
- \* *1. The term curriculum is widely used and embedded within beliefs and ideologies.*
- \* *2. The usages of the term often comprise short-hand forms for the position or viewpoint of those that use them*
- \* *3. different usages exert different influences on such things as goals for, purposes, focus and conceptions of curriculum*



## Owen Hicks

- \* *“‘Curriculum’ is a term that has been given little currency, or at least little profile, in higher education in Australia.*
- \* *Either a limited ‘content’ focused use of the term is assumed, or the term is used as a vehicle for the discussion of critical issues in higher education e.g. inclusive curriculum, learner-centred curriculum....”*





## UK Higher Education Academy, Imaginative project 2007

### \* A curriculum should embrace:

- \* • what is to be learnt - content
- \* • why it is to be learnt - rationale and underlying philosophy
- \* • how it is to be learnt - process
- \* • when it is to be learnt - structure of the learning process
- \* • and includes consideration of how the learning will be demonstrated and achievement assessed.



## Pork industry model – Project 1900.06 Development of a pig health and production course for the veterinary schools in Australia – P.K. Holyoake

### \* 5 Veterinary schools across Australia

### \* Aims to:

- \* Produce resources that maximise relevance to the pig industry in Australia as opposed to using OS material
- \* Ensure optimal up to date course content
- \* Reduce individual work loads for course coordinators
- \* Reduce the costs of running courses through resource sharing



## Pork industry model – Project 1900.06 Development of a pig health and production course for the veterinary schools in Australia – P.K. Holyoake

- \* 3 x face to face meetings
- \* Primarily discussed three classes of learning outcomes identified
  - \* 'core' learning outcomes
  - \* Practical learning outcomes
  - \* General learning outcomes
- \* Ranked outcomes – must have done, most have observed, has knowledge of
- \* Competencies
- \* Modules – for use as required at each institution



## So what are we here to do?

Discussion will be directed to answer the key questions of:

- \* Is there an identified need for a national curriculum for AAH in Australia?
- \* What is the scope of such a curriculum if required?
- \* Who should it be directed to?
- \* What do we have now and where are the gaps in AAH education?
- \* What do we need to do to address the gaps?
- \* How might we best undertake this?
- \* How would we deliver it?
- \* How to we assess the competencies of the recipient of such education?



Good luck

Thank you

Australian Government  
Department of Agriculture, Fisheries and Forestry

### Aquatic animal health curriculum workshop:

#### Setting the scene

Adelaide  
13-14 February 2014



Ingo Ernst  
Aquatic Animal Health  
Animal Division  
13 February 2014

1. AQUAPLAN 2005-2010
2. Report on training needs
3. National AAH workshop
4. National AAH training scheme
5. New AQUAPLAN 2014-2019

### AQUAPLAN 2005-2010

- \* AQUAPLAN 2005-2010 was Australia's second National Strategic Plan for Aquatic Animal Health
- \* Strategy 4 – Education and training in the aquatic animal health sector
- \* Rationale "...aquaculture sector requires expert support in health management, .... includes access to well-trained and competent aquatic animal health professionals"

## 2. Report on education and training needs

### Report on current and future training needs (AQUAPLAN project 4.1)

- "Identification of current resource levels within the aquatic animal health service industry, with thought given to possible succession planning activities"
- Completed through FRDC project 2005/641
- Questionnaire methodology used; report is available on FRDC website.

### FINAL REPORT



**Aquatic Animal Health Subprogram:  
Current and future needs for aquatic  
animal health training and for systems for  
merit-based accreditation and competency  
assessments**

**Matt Landos, Navneet Dhand, Brian Jones and  
Richard Whittington**

March 2007

FRDC Project No. 2005/641



### Aquatic animal health education and training workshop (Cronulla, 3 April 2008)

- Held to consider outcomes of FRDC project 2005/641
- Aimed to identify the two highest priority (achievable) actions to address education and training gaps
- Priorities identified included:
  1. Provision of training to aquatic animal health professionals to enhance their skills across a range of aquatic animal health specialist disciplines. Is to focus on up-skilling for practicing professionals – not basic training.
  2. Provision of post-graduate training (including traineeships) to provide career progression and specialist training opportunities for graduates within, or with application to, the field of aquatic animal health.

## 3. National AAH education and training workshop

## 4. Aquatic animal health training scheme

### National AAH Training scheme

- The training scheme addressed priority 1 identified at the 2008 Cronulla workshop; i.e. to improve training opportunities for practising professionals
- Initially ran from 2010-2012; was jointly funded by DAFF and FRDC
- Department of Agriculture and FRDC agreed to continue the scheme following positive review findings
- 2014 round of applications now open.

## 5. AQUAPLAN 2014-2019

### New AQUAPLAN 2014-2019

- Awaiting endorsement by governments
- The proposed plan includes an objective on education and training
- 5.2 Assess requirements for a national aquatic animal health curriculum that can be adapted for end users ranging from vocational training to higher education
- 5.3 Develop national aquatic animal health curricula for vocational, veterinary and science training

ingq6m2  
Department of Agriculture

AAH curriculum workshop  
agenda

13 Feb 2014

25

## Aquatic Animal Health University of Tasmania



NCMCRS

Dr Melanie Leef / Prof Barbara Nowak



### NCMCRS degrees including AAH units

- Associate Degree in Aquaculture
- Bachelor of Applied Science (Marine Environment) - Aquaculture major
- Graduate Certificate – Aquatic Animal Health major, Aquaculture major
- Graduate Diploma – Aquatic Animal Health major, Aquaculture major
- Masters – Aquatic Animal Health major, Aquaculture major



UTAS

### Background

- Aquatic Animal Health (originally Disease Management in Aquaculture) taught for >25 years
- Developed by Dr Barry Munday
- Initially part of Graduate Diploma in Aquaculture and Diploma Aquaculture
- Targeted at applied science students
- Since mid 1990s coordinated and taught by Prof Barbara Nowak

### AAH units offered

- Fish Health Management (Associate Degree in Aquaculture or elective)
- Aquatic Animal Health – (BAppSc (ME) Aquaculture major or elective)
- Aquatic Animal Health (Grad Cert, Grad Dip or Masters AAH major or Aquaculture major)
- Fish Histopathology (Grad Cert, Grad Dip or Masters AAH major or Grad Cert Research)

### AAH units offered

- Aquatic Animal Health – (BAppSc (ME) Aquaculture major or elective)
- Recognised by Australian Society for Parasitology – ASP undergraduate prize for the best student



### Future developments

- E-learning – e-pathology and digitised slides
- Research projects for outstanding students
- Continuous review and updating of teaching material using current research projects and industry information



"It was really good having the option to complete a directed studies project instead of doing the practicals for the unit."

Thank you!

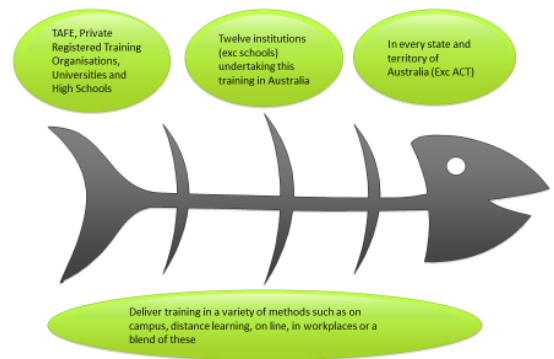


# THE WORLD OF AAH EDUCATION THROUGH THE EYES OF THE VOCATIONAL TRAINING SECTOR

By Mark Oliver



## Who Are We?



## Present: Our Curriculum

- 1<sup>st</sup> Half - Curriculum we use it
- 2<sup>nd</sup> Half – Training the AAH field
- We have one, and it has been around for 14 years and has gone through a series of reviews and updates during that time
- It is called the Seafood Industry Training Package
- It has nothing to do with a package
- We are encouraged/required to work together with other institutes and industry to enhance the quality of the curriculum and training methods

## What is a Training Package?

- A training package is a set of nationally endorsed standards and qualifications for recognising and assessing people's skills in a specific industry, industry sector or enterprise
- They are developed by or in close consultation with industry and are managed by an Industry Skills Council (Agrifood Skills Australia for our package)
- They also provide a framework for the delivery of training

## What Are We Teaching?

- Certificate III knowledge and skill areas
  - Water quality
  - Stock behaviour
  - Microscopy
  - Disease ID
  - Treatment
  - Calculations
  - Feeding

## What Units Are We Teaching?

Cert III in Aquaculture	Diploma in Aquaculture
SFIAQA317A Oversee the control of diseases	SFIAQA505C Plan stock health management
SFIAQA316A Oversee the control of predators and pests	SFIAQA501C Develop a stock nutrition program
SFIAQA303C Coordinate stock handling activities	SFIAQA509B Develop stock production plan
SFIAQA318A Coordinate feed activities	SFIAQA502C Develop and implement an aquaculture breeding strategy
SFIAQA308C Maintain water quality and environmental monitoring	BSBRK501B Manage risk
SFIAQA213C Monitor stock and environmental conditions	
AHCCH303A Prepare and apply chemicals	
SFIAQA209C Manipulate stock culture environment	



## What Are We Teaching?

- Diploma knowledge and skill areas
  - Biosecurity
  - Stock health management plans
  - Policy trends
  - Legal obligations
  - Communication and management
  - Feeding and nutrition
  - Genetics

## Conclusions

We have a Curriculum And are highly regulated to ensure we adhere to it	Our Curriculum is developed in close consultation with industry
We conduct the training in a variety of ways	We are encouraged to communicate with each other

## How We Assess

- As previously stated, we must address the Elements, Performance Criteria, Required Skills, Required Knowledge and Critical Aspects of Evidence for each unit.
- Can assess knowledge through traditional written assessment techniques such as exams and assignments. We can also use oral questioning.
- Can assess skills through practical demonstration in either a commercial or simulated environment. We can also use third party verification, recognition of prior learning and recognition of current competence.
- Remember, the student has to demonstrate they are competent in carrying out the specific skills and knowledge as outlined in the unit.

## Aquatic Animal Health:

Courses Provided by Schools of Veterinary Medicine



FACULTY OF VETERINARY SCIENCE

Dr Paul Hick | Professor Richard Whittington  
Department of Farm Animal Health, Faculty of Veterinary Science



## Overview

### Key Point: AAH is a diverse and rapidly growing field

- › Wide range of problems to solve and wide range of job titles
- › University education is a necessity in many AAH professional careers
- › There is no specific or single course or career path
- › Necessary skills can only be gained on-the-job
- › Undergraduate degrees are merely the start of the development of AAH professionals
- › Postgraduate training is where specialised AAH skills are acquired

51



## University training in aquatic animal health

› Veterinary School  $\neq$  AAH training

- There is often more than one relevant department within each institution.
- Of the 10 University entities that reported to SCAAH with interests in AAH, only half were veterinary schools (not a comprehensive list).

› Trend away from school level distinctions within the major universities

- e.g. multidisciplinary centres of excellence designed to solve complex problems such as global food security, antibiotic stewardship, sustainable production and animal welfare.



52



## Veterinary Schools in Australia

- › 7 Universities in Australia and one in New Zealand offer Veterinary Degrees  
(recent increase in size and intake)
- › Some veterinary schools offer non-veterinary degrees
- › AAH is increasing in importance in veterinary school training



53



## Range of training options relevant to AAH

(Based on the USyd template\*)

- › Undergraduate degrees
  - Bachelor of Veterinary Science (5 y)
  - Bachelor of Animal and Veterinary Bioscience (4 y)
  - NEW: Combined Bachelor of Veterinary Biology / Doctor of Veterinary Medicine (6 y)
- › Honours Programs
  - 1 year, focused on research
- › Postgraduate degrees
  - Post Graduate Coursework – Masters of Veterinary Public Health Management
  - Masters and PhD by research

› \* Reasonably generalizable; Universities are intrinsically independent and can differ in approach and philosophy, but the need for accreditation brings many similarities to the vet schools.

54

**Key Point 1. Undergraduate training relies on an integrated curriculum**

- › Coursework
- › Practical experiences
- › Research



**Key Point 1. Undergraduate training relies on an integrated curriculum**

- › Coursework
  - Discipline based training (the 'ologies')
  - Integration – AAH is dispersed over 5 years with relevant content in many units of study
  - Intensive medicine course in 4<sup>th</sup> year from an aquatic veterinarian

**NEW: Improved penetration of AAH with new DVM degree**

Unit	Unit of study name	Topics	Lectures	Prac
VETS1033	Animal Husbandry 1B	Introduction to aquaculture in Australia	2	1 x 3 hr
VETS2013	Principles of Disease	Host, pathogen and environment interactions	1	
VETS3038	Animal Disease	Case based learning (1 week interactive class)	1	
VETS3040	Microbiology	Viral, bacterial and fungal diseases of finfish and shellfish	2	
VETS3011	Pathology	Pathology of important organ systems of finfish, mollusc and crustacean pathology	2	1 x 3 hr
VETS3025	Veterinary Public Health	Emerging disease, epidemic behavior and disease control	2	
VETS4221	Intensive animal health and production	Medicine of fish in domestic and aquaculture contexts	10	1 x 3 hr
VETS5349	Rural Public Practice	Externship possible in government aquatic animal health laboratory	1 month	

**Key Point 1. Undergraduate training relies on an integrated curriculum**

- › Practical experience
  - Production/husbandry systems in the early years
  - Clinical rotations in the later years (e.g. diagnostic laboratory placement)
  - Internal resources - Teaching facilities eg recirculation systems
  - External resources - Industry partners
    - large barramundi aquaponics company located on campus at Camden
    - outplacement partners eg oyster farmers, large koi farm, DPI EMAI



**Key Point 2. Graduate attributes are generic outcomes**

- › Career ready professionals
  - Suitable for entry into a range of relevant careers
- › Aim to produce lifelong learners with problem solving skills and sound general methodological approaches
- › USyd top level graduate attributes are:
  - research enquiry;
  - information literacy;
  - personal and professional autonomy;
  - ethical professional and social understanding;
  - communication
- › i.e. the descriptive focus is not on specific content or facts
- › Vet schools then prescribe graduate attributes; these are heavily "regulated"

**Key Point 1. Undergraduate training relies on an integrated curriculum**

- › Coursework
- › Practical experiences
- › Research
  - A range of honours programs give chance to acquire deeper skills
  - Funded research projects provide a dynamic learning environment and academic culture around a critical mass of infrastructure, research staff and technicians
  - Research outcomes are integrated into undergraduate teaching



**University veterinary courses are subject to rigorous external accreditation**

- › Veterinary degrees need to be recognised by the Veterinary Surgeons Boards of each state
- › Most vet degrees are internationally accredited
  - › American Veterinary Medical Association
  - › Royal College of Veterinary Surgeons (EU)
- › There are international benchmarks
  - OIE "day 1 graduates" competencies

2. Specific competencies	.....
2.1 Epidemiology	.....
2.2 Transboundary animal diseases	.....
2.3 Zoonoses (including food borne diseases)	.....
2.4 Emerging and re-emerging diseases	.....
2.5 Disease prevention and control programmes	.....
2.6 Food hygiene	.....
2.7 Veterinary products	.....
2.8 Animal welfare	.....
2.9 Veterinary legislation and ethics	.....
2.10 General certification procedures	.....
2.11 Communication skills	.....

OIE 2012. "Recommendations on the competencies of graduating veterinarians ("Day 1 graduates") to assure National Veterinary Services of quality".

**University education is only the starting point**

- › Career competence is cumulative
- › Many skills can only be acquired 'on the job'
- › Post graduate training provides specific training in AAH
  - Masters by coursework and research degrees
- › Professional bodies provide systems for formal career development and to demonstrate competency through membership and fellowship
  - eg ANZCVS, American and European Colleges of Veterinary Pathologists, Australian Society for Microbiology
- › Formal career training through internships
  - eg pathology interns combine on the job training with formal recognition of skills through board certifications
  - AAH encompasses many disciplines that are specialties - not unique to AAH

**Key Point 2. Graduate attributes are general approaches and skills**

- › Career ready professionals

= ready for anything





## University training in AAH

### Synthesis

- › Veterinary and animal science training in veterinary schools aims to:
  - Teach the core of animal biology and animal health to enable understanding of principles applicable to all species
  - Provide instruction in the key differences between species groups
  - Provide an industry context
- › This is achieved through compulsory units of study in e.g. anatomy, microbiology, pathology followed by case studies specific to aquatic animals to wrap it together, and industry outplacements for context.
- › Students who wish to specialise can deepen their skills through an elective honours project and advance their training by completing a higher degree.

63

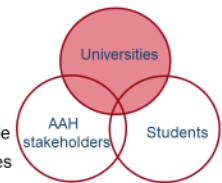
## Dynamics: Students, University training and the AAH profession

2.



## University

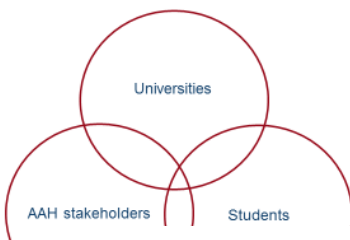
- › Within constraints of the business model, provide passionate teachers, and modern infrastructure
- › Teach the core competencies well and include exposure to AAH issues to all undergraduates
- › Support continued professional development with specific postgraduate training
- › Work in partnership with and are responsive to industry needs
- › Are a place where stakeholders with different interests can meet



64

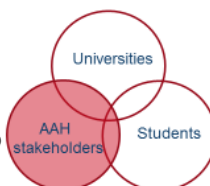


University education needs to be integrated with the other training and skills development opportunities through partnerships with all AAH stakeholders.



## AAH stakeholders

- › Only a very small proportion of students are able to find a career path in AAH
- › Good teaching and practical experience are essential for students to enter the industry
- › Universities and stakeholders need to provide opportunities and target specific areas of interest
- › Mentors and on-job training are essential
- › Committed ongoing partnerships between stakeholders and universities are needed for relevant, quality training
- › Interact to provide outplacements and develop training networks including high quality early career traineeships
- › Provide feedback to improve benchmarking, assessment and content
- › Recognise the difficulties with small/fledgling industries and different interest groups – there is a role for leaders and novel funding/strategies



45

68

### Concluding thoughts

- › The pipeline for AAH professional planning has been identified
- › Need to proactively provide information
- › Veterinary schools are aware (need up-to-date resources)
- USYD: Strategic plan develop several discipline experts with full-time career as an aquatic prominent AAH roles (Dr Jeff)
- › Development of a competent preparatory training to learn specialist post-graduate qualifications
- › More training options are needed



A curriculum should not be:

- regionally parochial
- overly prescriptive
- static





# FRDC FINAL REPORT CHECKLIST

<b>Project Title:</b>	Development of a national aquatic animal health curriculum (NAAHC) for delivery by tertiary institutions		
<b>Principal Investigators:</b>	Dr Stephen B. Pyecroft		
<b>Project Number:</b>	2014/403		
<b>Description:</b>	This report summarises the process and outcomes from an interactive workshop which was convened over 1.5 days in Adelaide in February 2014 to forward the possible development of a national aquatic animal health curriculum (NAAHC) for the education of undergraduate, postgraduate and vocational students, by representatives of the Australian aquaculture industry, state and federal governments, universities and vocational trainers..		
<b>Published Date:</b>	01/03/2016	<b>Year:</b>	2016
<b>ISBN:</b>	978-0-646-95826-2 (	<b>ISSN:</b>	XXXXXXXXXXXXXXX (if applicable)
<b>Key Words:</b>	Curriculum, Aquatic Animal Health, training, competencies, education, vocational, university, national, bench marked		

Please use this checklist to self-assess your report before submitting to FRDC. Checklist should accompany the report.

	<b>Is it included (Y/N)</b>	<b>Comments</b>
<b>Foreword (optional)</b>	N	
<b>Acknowledgments</b>	N	
<b>Abbreviations</b>	Y	
<b>Executive Summary</b>	Y	
- What the report is about		
- Background – why project was undertaken		
- Aims/objectives – what you wanted to achieve at the beginning		
- Methodology – outline how you did the project		
- Results/key findings – this should outline what you found or key results		
- Implications for relevant stakeholders		
- Recommendations		
<b>Introduction</b>	Y	
<b>Objectives</b>	Y	
<b>Methodology</b>	Y	
<b>Results</b>	Y	
<b>Discussion</b>	Y	
<b>Conclusion</b>	Y	
<b>Implications</b>	N	
<b>Recommendations</b>	Y	
<b>Further development</b>	Y	
<b>Extension and Adoption</b>	N	

<b>Project coverage</b>	N	
<b>Glossary</b>	N	
<b>Project materials developed</b>	N	
<b>Appendices</b>	Y	And addendum of delegate Power point presentations