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**For bringing aquaculture to life through a networked, authentic and career-focused curriculum**


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**OVERVIEW: SUMMARY OF CONTRIBUTION AND CONTEXT**

I was drawn to an academic position at James Cook University (JCU) in 2010 given its global reputation and dynamic academic strengths in marine biology and aquaculture. I was excited by the opportunity to teach and continue research in an area directly relevant to my expertise in aquatic animal health and sustainable aquaculture production. The position offered a unique challenge to coordinate and teach the two core subject offerings in the aquaculture major; *Introduction to Aquaculture* and *Sustainable Aquaculture*. At the time of my appointment the aquaculture discipline's core subjects were dated and did not reflect global scholarship in aquaculture. Successful completion of both core aquaculture subjects is a pre-requisite for student enrolment in all other aquaculture offerings. Consequently, my new role as subject coordinator and lecturer was central to student engagement and the ultimate success of the entire aquaculture teaching programme.

Compared to the University's average of <20%, the core aquaculture subjects comprise approximately 40% international fee paying students per annum (Fig. 1). Students are of diverse, multicultural backgrounds enrolled in a variety of disciplines including Aquaculture, Biotechnology, Business, Environmental Science, Law and Marine Science and include Master of Science, Exchange and Study Abroad students. In 2012 my teaching role expanded to include coordination of flexible-delivery aquaculture subjects to students enrolled at JCU's Singapore campus (JCUS) and in 2014 I developed the curriculum for a new, online *Certificate in Aquaculture*. I also teach outside of the aquaculture arena through a range of guest lectures in Marine Biology, Zoology and Veterinary Sciences (i.e. *Invertebrate Biology*, *Marine Invertebrates of Commercial Importance*, *Techniques in Marine and Tropical Biology*, *Biodiversity of Tropical Australia*, and *Biological Principles for Agricultural and Veterinary Sciences*).

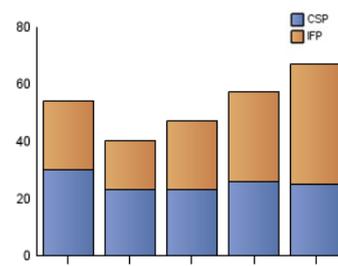


Fig. 1. Enrolments in *Introduction to Aquaculture* by fee type over the past six years. IFP = International fee paying and CSP = Commonwealth supported

To rise to the challenge of a dated curriculum, I made radical changes to the core aquaculture subjects in my second year of teaching. My strategy included a new pedagogic framework centred on Career Development Learning. In order to develop internationally career-relevant content, I built constructive collaborative relationships with local, national and international industry, government and academics. This network enabled me to integrate new field-directed learning and assessment, industry placements, student networks and expert invited guest lectures. My emphasis on learning outcomes that target knowledge and skills applicable to future careers has advanced graduate competitiveness against job selection criteria in aquatic sciences and aquaculture, ultimately resulting in outstanding student progression and employability. The success of the new curriculum is reflected in my 2013 and 2014 teaching and subject evaluations which were ranked *Outstanding* (i.e. in the top 10% of all JCU teaching staff and the top 10% of all subjects taught at JCU).

I wish to highlight my leadership in development of resources for building an innovative, career-skills oriented core aquaculture curriculum through four scholarly activities that show my passion to help students to *take charge of their careers*. These initiatives ensure the continued success of graduates and have had unanticipated flow-on impacts for the development of secondary and tertiary education through to placement in professional employment.

**CRITERION 2: DEVELOPMENT OF CURRICULA, RESOURCES OR SERVICES THAT REFLECT A COMMAND OF THE FIELD****1. Development of innovative curricula to incorporate industry best practice and career-relevant skills**

I embedded my approach in a new pedagogic framework centred on Career Development Learning. I themed theory (lectures) with practicals so that students developed a deep knowledge of the subject content as well as career-relevant skills. I was largely inspired by the leading text book, *Aquaculture: Farming Aquatic Animals and Plants* (Lucas & Southgate, 2012), and modelled the sequential delivery of topics on key book chapters, which subsequently serves as an important and up-to-date relevant study and reference resource. The editors, Prof John Lucas and Prof Paul Southgate, are leaders within the

aquaculture research environment. Based on my incorporation of the text into aquaculture teaching, the editors sought my advice to identify knowledge gaps and chapters that needed improvement for the launch of the second edition in January 2012. In recognition of my research and teaching expertise in aquatic animal health, the editors formally invited me to contribute a chapter on the topic for the forthcoming third edition in 2016.

In addition, I integrated new, career-relevant industry experiences into the curriculum by developing strong collaborative relations with local aquaculture industry. Specifically, the second year core subject, *Introduction to Aquaculture*, did not include any field directed learning prior to my appointment. In 2011, I introduced a *water quality* themed field trip to Pacific Reef Fisheries Pty Ltd, one of the largest prawn farms in Australia. I also incorporated a *biosecurity* themed field trip to Coral Coast Barramundi Pty Ltd, as part of *Sustainable Aquaculture*. The field trips have important associated learning objectives that are broadly applicable to careers in aquatic science (see text box below).

***“Linking what we were learning in class to real world industry was very important to me and the highlight for me was the two field trips which were both well organised and directly related to aquaculture industry”*** (*Introduction to Aquaculture Teaching Evaluation*, 2012).

***“The field trips were also of benefit to students with potential for future careers, partnerships and real life work experiences”*** (*Sustainable Aquaculture Teaching Evaluation*, 2013).

Through research-led teaching I ensure that the modern aquaculture curriculum reflects current industry practice nationally and internationally. Each year, I invite different national or international experts to contribute a guest lecture. I also seek opportunities to visit aquaculture industries where I can obtain new lecture content and insight into industry best practice (e.g. following professional conferences). By sourcing expertise from academics and industry, I am able to continuously adapt the aquaculture curriculum to address diverse and contemporary issues which ultimately lead to career-ready graduates. My infectious enthusiasm for up-to-date course material also translates into an empowered class environment (see text box below).

***“The opportunity to meet an international guest lecturer, Ken Cain was one of the best aspects of the subject. It allowed me to see the alternative uses of aquaculture for conservation purposes aside from profitability”*** (*Teaching Evaluation*, 2012).

***“Kate offered an excellent method in delivering content in lectures by adding industry based information, personal experiences and statistics that were directly related and greatly improved the concepts being taught”*** (*Teaching Evaluation*, 2013)

***“Kate’s enthusiasm is seriously contagious. Her passion is obvious and I can’t help but get tangled up in it”*** (*Teaching Evaluation*, 2013).

In 2011 I developed new and exciting online interactive modules for flexible-delivery to the Singapore campus (JCUS) as part of the new Bachelor of Environmental Science. Aided by a Teaching and Learning Grant, *Enabling distance-based learning and innovative computer laboratories for biology*, I developed online simulations and video to enable students to develop equivalent career-based skills to those I work with face-to-face. I communicate regularly with JCUS lecturer, Dr Rajee Olganathan, to ensure that equivalent field experiences are available to Singapore students. More recently, I facilitated the development of two subjects for the new online *Certificate in Aquaculture*.

Evidence of the impact of my modernised, career-relevant aquaculture curriculum is reflected in rising pass rates, high grade point averages, increasing international enrolments and high student satisfaction. Following reinvigoration of the *Introduction to Aquaculture* curriculum in 2011, I have had a steady increase in international student enrolments (Fig. 1) and high pass rates (Fig. 2). My Subject Evaluation and Teaching Evaluation scores, which ranked marginally above the University average when I commenced coordination of *Sustainable Aquaculture*, now show sustained satisfaction scores well above the University average (Fig 3). In 2013 and 2014 my teaching and core subject satisfaction for both subjects I coordinate was ranked *Outstanding*: in the top 10% of all JCU teaching staff and the top 10% of all subjects taught at JCU (Performance Analysis Data from Teaching and Subject Evaluation mean scores).

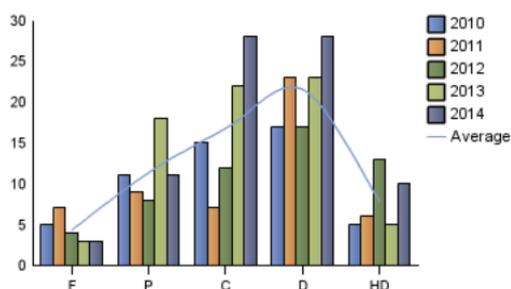


Fig. 2. *Introduction to Aquaculture* enrolments by grade distribution 2010-2014. Coordination of this subject commenced in 2010 with new curriculum development in 2011.

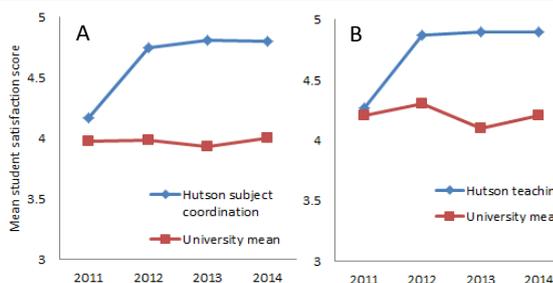


Fig. 3. Mean student satisfaction scores for Subject (A) and Teaching (B) for *Sustainable Aquaculture* 2011-2014. Coordination of this subject commenced in 2011 with new curriculum development in 2012.

## 2. Development of curricula to inspire career motivation and networking

I have developed the core aquaculture curriculum to include two exciting mechanisms to inspire students and to enable them to identify diverse career opportunities. In 2011, I integrated '*Jobs of the week*' into *Introduction to Aquaculture* lectures where I highlight two job opportunities in Australia or overseas. *Jobs of the week* (including current volunteer positions, student exchanges, fellowships, industry and government jobs) demonstrates how to search and identify a range of career opportunities in aquatic sciences. I show students how knowledge gained in the subjects is applicable to the key selection criteria in current advertised positions. I also identify potential gaps in student experience, skills or knowledge and encourage students to develop areas needing improvement. *Jobs of the week* continues to be a highlight of my lectures and since 2014 I also include a weekly biography of a previous aquaculture student.

*"This subject has really opened my world and made me reconsider other options in the field"*

(Teaching evaluation, 2012).

*"Kate does a great job showing us what future careers lie ahead for graduates of aquaculture programs as evident by her previous students"* (Teaching evaluation, 2014).

Networks ultimately lead to employment. In 2012, I integrated a career workshop '*Sustainable Careers*' into my subject *Sustainable Aquaculture* to give students an opportunity to build their network. Students have the opportunity to learn effective job application skills and have one-on-one engagement with five guest speakers (including potential employees) from various backgrounds including business, private industry, government and research. Guest speakers have included Dr Brett Herbert (Biosecurity, Department of Agriculture, Fisheries and Forestry, Canberra), Dr Leigh Gray (Great Barrier Reef Marine Park Authority) and Mr Ben Lawes (Good Fortune Bay Pty Ltd). Guest speakers have interactive discussions on their careers and highlight challenges and opportunities for future graduates. *Sustainable Careers*, now in its fourth year, is extremely valuable for students to network and receive honest perspectives of recruitment (see text box below).

*"I especially liked the way Kate was concerned with where this subject can take us/our future careers. As students are in their final years it's really great that we can have a teacher that is enthusiastic about where we are going, not just teaching the content of the course"* (Teaching evaluation, 2013).

## 3. Development of services for career-relevant work experience and employer-valued skills

I help individual students organise industry experience in their chosen field which enables them to develop skills valued by potential employers. In my lectures, I encourage students to contact me to arrange industry placements. When contacted, I identify the students' specific interests so that I can align them with an appropriate industry experience. My success at matching students to appropriate placements is shown in the following *selection of examples* where I secured the student the first named position:

- **Mr Thane Miltz (2010):** volunteer for PhD research on ornamental fish. Later employed by JCU to maintain a large ornamental display aquarium; later employed by JCU for video development for the online Certificate in Aquaculture.
- **Mr Ross Sumner Holzman (2011):** volunteer histopathologist for aquaculture postdoctoral fellow.

Later employed by JCU histopathology lab; later employed by MidWest Biodiesel Pty Ltd.

- **Mr Valentin The pot (2012):** *volunteer at Mainstream Aquaculture Pty Ltd.*  
Later employed full time at Mainstream Aquaculture; later employed by MidWest Biodiesel Pty Ltd.
- **Mr Brandon Panebianco (2013):** *placement at Coral Coast Barramundi Pty Ltd.*  
Later employed full time at Coral Coast Barramundi Pty Ltd.
- **Ms Danielle Griggs (2014):** *volunteer in aquatic animal health in my research laboratory.*  
Later employed full time at Seafarm Pty Ltd.
- **Mr Tahi Fu (2015):** *placement at Pacific Reef Fisheries Pty Ltd.*  
Later employed part-time at Pacific Reef Fisheries Pty Ltd.

Students that undertake career-relevant work experience understand their future profession and build their knowledge of employer expectations. I strive to develop short-term industry or research placements as a capstone component of the aquaculture offering. Industry placements serve to inspire students as well as complement researchers and national aquaculture enterprises that seek competent and skilled personnel. The value of the placements I facilitate is apparent in regular, unsolicited feedback (see text box below).

*“I’d like to express my appreciation for your generous efforts at getting me into the aquaculture scene at JCU and for solidifying my career aspirations in this field”* (Mr Ben Chen, international student, unsolicited postcard, 2011, in response to assistance with a voluntary placement at Mainstream Aquaculture Pty Ltd.).

#### 4. Development of services for secondary and tertiary educators

I am engaged in the wider community in order to develop curriculum services and promote careers in science and aquaculture. For the past three years, I have developed a collaborative relationship with Kirwan Sate High School where we have made considerable advances in developing their science and aquaculture curriculum. Initially I worked with science teachers to develop appropriate practicals for year 10 students and taught guest sessions at the school. More recently, I helped the school in their bid to develop a *Certificate II in Aquaculture*. This involved assistance with curriculum development and review as well as facilitating industry contacts to ensure that the certificate is in accordance with current industry best practice. Moreover, my invited book chapter on aquaculture pathogens and parasites for the 3rd edition of *Aquaculture: Farming Aquatic Animals and Plants*, will further contribute to curriculum resources for local students as well as international tertiary educators who use this resource.

My achievements in teaching, communication and curriculum development have been recognized by my peers and the broader community as highlighted in the following *selection of examples*:

- Named co-investigator on *Development of a national aquatic animal health curriculum for delivery by tertiary institutions*, a Fisheries Research and Development Corporation Research Grant (2014/403)
- Awarded a *JCU Citation for Outstanding Contributions to Student Learning (2015)*
- Showcased JCU marine and aquaculture research facilities and current research projects to representatives from the Embassy of the Socialist Republic of Vietnam, 2015
- Presentation and interactive display at the Science and Technology Expo, National Science Week, 2014
- Lectures and practicals as part of the JCU Science Experience Programme, 2012 and 2014

#### SUMMARY STATEMENT

Aquaculture is vital to future global food security. Subsequently, Career Development Learning assures graduates who are career-ready and globally employable. The new core aquaculture curriculum is now tailored to deliver essential knowledge and skills as well as foster work-readiness. The new curricular and extracurricular resources have had measurable impacts on the quality of student experiences, are far reaching in secondary and tertiary education, and have enabled direct recruitment into industry. Ultimately, the most powerful evidence as to my subjects’ influence on student learning comes from the students who credit the curriculum as being a key inspiration on life choices: *“Mostly I enjoyed how your teaching method makes learning aquaculture seem easy, relaxing, stimulating, inspiring and enjoyable. I am even considering changing my degree”* (Teaching Evaluation, 2012).

**Reference:** Lucas JS & Southgate PC (2012) *Aquaculture: Farming Aquatic Animals and Plants*, 2<sup>nd</sup> ed. Wiley-Blackwell.