



**Postgraduate research Projects on offer** (as at 16/08/19)



## **1. Role of toxin genes in juvenile pearl oyster mortality syndrome**

**Advisor** [Professor Dean Jerry](#)

### **Summary of Project:**

A decade ago pearl farming was one of the major employers and contributors to the social-economic fabric of northern Australia, contributing \$189.7 million farm-gate to the national economy and generating another \$200 million in tourism related activities. However, in recent years Australian pearl production has been severely impacted by episodic and large-scale mortality events by an as yet unidentified causative factor. This causative factor impacts within the first few months of grow-out when juvenile oysters are stocked into the ocean and often result in upwards of 90% mortality. These mortality events, termed juvenile pearl oyster mortality syndrome (or JPOMS), have resulted in massive write-downs in production and economic value of the industry and led to uncertainty within the future of the industry.

The cause of JPOMS is unknown, but when an outbreak is first detected it generally sweeps rapidly through farm nursery areas suggesting a pathogenic agent is responsible for the syndrome. The causative agent has yet to be identified despite intensive investigation, but one possibility is that JPOMS is related to an organism that is always present but becomes pathogenic through the expression of toxin genes carried in bacterial plasmids under certain environmental conditions. In fact, plasmid transmitted toxin genes (Pir A & B) have been shown to be the causative agent for the recent pandemic of early mortality syndrome (or AHPND) in farmed shrimp and are associated with *Vibrio* spp. The occurrence of possible toxin genes, however, has not been extensively examined in pearl oysters subject to JOMS.

This project, which will be a collaboration between Prof Dean Jerry from JCU <https://research.jcu.edu.au/portfolio/dean.jerry/>, Cygnet Bay Pearls, and Clipper Pearls, will use next generation sequencing, bioinformatic analyses, and histological approaches to look for the occurrence of likely toxin genes and their association with onset of JOMS in Australian pearl oysters. Enquiries to: [dean.jerry@jcu.edu.au](mailto:dean.jerry@jcu.edu.au)

### **Would suit an applicant who**

Available to both domestic and international applicants wishing to undertake a PhD or Masters by research degree. Applicants will need to apply for a [JCU competitive Research Scholarship](#) and should be familiar with the [Higher Degree by Research Requirements](#).

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## **2. Maturation performance of sex-changed barramundi - Masters**

**Advisor** [Professor Dean Jerry](#)

### **Summary of Project:**

One of the constraining factors to the conduct of efficient selective breeding programs for barramundi is the inability to control their natural sex change process (as they are protandrous hermaphrodites). Recently, we have succeeded in precociously sex changing male barramundi into females. Now that this has been achieved the next step of research is to understand how sex-changed females undergo gonadal maturation, whether they undertake normal spawning behaviours and their fertility. This Masters Project will sex-change barramundi and track maturation of their eggs, induce spawnings and examine fertility. It may also incorporate gene expression analyses to better understand what is happening to key sex maturation genes in sex-induced fish. Enquiries should be directed to: [aquaculture@jcu.edu.au](mailto:aquaculture@jcu.edu.au)

### **Would suit an applicant who**

Available to both domestic and international applicants wishing to undertake a Masters by research degree. Applicants will need to apply for a [JCU competitive Research Scholarship](#) and should be familiar with the [Higher Degree by Research Requirements](#).

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### 3. AMRS in Australian aquaculture - PhD

Advisor [Professor Dean Jerry](#)

#### Summary of Project:

Due to the widespread use of antibiotics there are concerns about the build-up of antibiotic resistance in bacterial populations and the occurrence of antimicrobial resistance genes that pose significant human health concerns. Increasingly, these genes are being seen in bacteria from the environment and in animal production systems. In Australia there is currently no understanding of the occurrence and abundance of AMRs in aquaculture production systems. This project will use modern genetic sequencing approaches to for the first time characterise the type and prevalent of AMRs in Australian aquaculture. Enquiries should be directed to: [aquaculture@jcu.edu.au](mailto:aquaculture@jcu.edu.au)

#### Would suit an applicant who

Available to both domestic and international applicants wishing to undertake a PhD degree. Applicants will need to apply for a [JCU competitive Research Scholarship](#) and should be familiar with the [Higher Degree by Research Requirements](#).

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### 4. Microbiomes in barramundi – Masters or PhD

Advisor [Dean Jerry](#)

#### Summary of Project:

With the advent of high throughput next generation sequencing approaches we are gaining an increasing understanding of the importance of bacterial microbiomes to the health, well-being, and growth of animals. In aquaculture, microbiomes are being shown to be influencers of hatchery performance, productivity and occurrence of disease. They may change due to culture environment, diet, genetics or occurrence of pathogens. This project will examine the microbiome of barramundi throughout the hatchery culture phase and into different production systems. It also may look at influence of diet or bioactives on the microbiome. Enquiries should be directed to: [aquaculture@jcu.edu.au](mailto:aquaculture@jcu.edu.au)

#### Would suit an applicant who

Available to both domestic and international applicants wishing to undertake a PhD or Masters by research degree. Applicants will need to apply for a [JCU competitive Research Scholarship](#) and should be familiar with the [Higher Degree by Research Requirements](#).

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### 5. CRISPR knockout of myostatin, colour, DMRT, DND in barramundi - PhD

Advisor [Dean Jerry](#)

#### Summary of Project

With the advent of robust gene-editing technology such as CRISPR/CAS9 geneticists can now with precision target key genes and understand their role and/or induce desired phenotypes. One such gene in animals which has been shown to be a negative muscle growth regulator is that of myostatin. Knockdown or mutagenesis of myostatin in livestock and some fishes like zebrafish has shown that reducing the abundance of the myostatin protein leads to increased muscle growth and generally larger organisms. Since growth is one of the most important traits for aquaculture knock-out of myostatin through gene-editing offers potential to increase productivity. This project will develop and apply CRISPR/CAS9 technology in barramundi targeting myostatin, and possibly other genes related to melanin production and germ-cell line development. Through the use of CRISPR/CAS9 it will help understand the role of key genes in the growth, colour and sexual development of barramundi, all which are important traits for future targeted genetic improvement. Enquiries should be directed to: [aquaculture@jcu.edu.au](mailto:aquaculture@jcu.edu.au)

#### Would suit an applicant who

Available to both domestic and international applicants wishing to undertake a PhD. Applicants will need to apply for a [JCU competitive Research Scholarship](#) and should be familiar with the [Higher Degree by Research Requirements](#).

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## 6. Testing performance of polyphenols on growth performance in barramundi - Masters

Advisor [Professor Dean Jerry](#)

### Summary of Project

Polyphenols and favourlins have been shown to be a natural growth promoter in several livestock species. Their use as a bioactive in tropical aquaculture species such as barramundi and grouper haven't been trialled. This nutrition project will examine the effect addition of polyphenols into the diet of barramundi has on growth performance, the gut microbiome and gene expression of key growth regulatory genes. Enquiries should be directed to:

[aquaculture@jcu.edu.au](mailto:aquaculture@jcu.edu.au)

### Would suit an applicant who

Available to both domestic and international applicants wishing to undertake a Masters by research degree. Applicants will need to apply for a [JCU competitive Research Scholarship](#) and should be familiar with the [Higher Degree by Research Requirements](#).

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## 7. Family composition of grouper spawns and EBV estimation for traits (also do some fish not contribute over multiple spawns) - Honours or Masters

Advisor [Professor Dean Jerry](#)

### Summary of Project

Grouper is a mass spawning species where several males and females are usually involved in the production of seed stock. What is not known is how reliable are broodstock to produce repeatedly progeny in these mass spawns, what family compositions of a spawn look like, and how their reproductive performance relates to their genetic growth and survival performance. This project will use DNA parentage analysis and quantitative genetic approaches to better understand the breeding performance of grouper broodstock as well as estimating their breeding value relevant to a breeding program. Enquiries should be directed to: [aquaculture@jcu.edu.au](mailto:aquaculture@jcu.edu.au)

### Would suit an applicant who

Available to both domestic and international applicants wishing to undertake Honours or Masters by research degree. Applicants will need to apply for a [JCU competitive Research Scholarship](#) and should be familiar with the [Higher Degree by Research Requirements](#).