JAMES COOK UNIVERSITY
SINGAPORE

Aquaculture at James Cook University in Singapore

JAMES COOK UNIVERSITY

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1 university • 2 countries • 4 distinct locations

Creating a brighter future for life in the tropics world-wide through graduates and discoveries that make a difference

Aquaculture at James Cook University in Singapore

Tropical regions of the world face unprecedented challenges due to population growth and an associated demand for high-quality seafood. This population expansion will continue to pressure wild fisheries resources and dictate ever higher efficiencies from aquaculture production.

Capitalising on its location right in the middle of Asia, James Cook University in Singapore has research expertise that specialises in the sustainable production of tropical aquaculture species. With world-class experts in aquaculture genetics, nutrition, hatchery production, husbandry and aquatic animal health, researchers are ready to partner with commercial industry, government institutions, universities, polytechnics and other stakeholders, to conduct high-quality scientific R&D.

The university offers a teaching and industry-outcome R&D portfolio delivered by internationally renowned experts. With a comprehensive undergraduate offering in aquaculture, through to higher degree research options, JCU in Singapore trains the next global leaders in aquatic food production. Through the Tropical Futures Institute and Centre for Sustainable Tropical Fisheries and Aquaculture (CSTFA), JCU also partners with industry, NGOs, and government to tackle grand challenges associated with sustainable production of seafood. Our research is world-class, as evidenced by the Excellence in Research for Australia evaluations, where JCU was ranked "well above" world average in Fisheries Sciences.

For further information on how to work with James Cook University in Singapore please send an email to researchsupport-singapore@jcu.edu.au

Tropical Aquaculture

Research Capacity

James Cook University in Singapore through its Tropical Futures Institute has internationally recognized expertise in industry relevant, outcome driven research and development for a multitude of globally important farmed tropical species, including well-established aquaculture species such as barramundi, marine shrimp, pearl oysters, tilapia, sea cucumbers, cobia, malabar red snapper, tropical lobsters, and freshwater prawn.

With aquaculture research teams in both Singapore and Australia, James Cook University is perfectly positioned to continue to significantly contribute towards sustainable and productive aquaculture development in tropical zones of the world.

Research and Development

Researchers from James Cook University in Singapore have experience and expertise in all biological and industry aspects of tropical aquaculture, including hatchery and nursery techniques, aquatic animal health, nutrition and feed development, bioremediation, sustainable livelihoods and tourism, reproductive control and domestication, and the application of advanced selective breeding techniques. Recent examples of leading and industry-impactful research includes:

- Development and implementation of genomic-based breeding programs for barramundi, pearl oysters and marine shrimp (Pacific white shrimp, black tiger shrimp)
- Biosecurity audits for Australian shrimp farms
- Trialling new and sustainable aquaculture feeds
- Influence of microbial communities for health and productivity of marine shrimp
- Understanding the genetic basis of scale drop disease in barramundi

TROPICAL FUTURES INSTITUTE

Profile

Prof Dean Jerry

Director ARC Research Hub for Supercharging Tropical Aquaculture through Genetic Solutions
Director of Tropical Futures Institute
Tropical Futures Institute
James Cook University (Singapore)

PhD (Animal Genetics) Southern Cross University, Australia
BSc (Hons) University of New England, Australia

Background

Professor Jerry is a recognised leader in the application of genetic and genomic solutions for the aquaculture industry and leads one of the largest research teams globally devoted specifically to the application of genetic technologies to improve the productivity of aquaculture species. He has worked in the field of aquaculture genetics for 20 years and managed as Chief Investigator 30+ projects (valued at ~$41M). He has published 165+ peer reviewed scientific articles and served on the editorial boards of Aquaculture Environment Interactions, Agri-Gene and Gene. He has also supervised nearly 50 research students.

Prof Jerry possesses strong skill sets in quantitative genetics, along with molecular and genomic analyses. These skill sets have resulted in numerous translations of his research and direct industry consultancies from conducting genetic audits of foundation stocks, establishment of commercial genotyping and pathogen testing laboratories, through to the design and conduct of industrial-scale advanced genomic-informed selection programs. He has worked with the genetics of most of the major tropical aquaculture industries, including marine shrimp (*Litopenaeus vannamei, Penaeus monodon, Penaeus japonicus*), pearl oysters (*Pinctada maxima, Pinctada margaritifera*), barramundi (*Lates calcarifer*), Nile tilapia (*Oreochromis niloticus*), marine and freshwater crayfish (*Panulirus ornatus, P. homarus, Cherax quadricarintus, C. destructor*), and several other species.

Areas of expertise

- Design and implementation of advanced aquaculture selective breeding programs
- Development of genetic and genomic tools to assist selective breeding
- Genomic selection of aquaculture species
- Genetic audit of aquaculture breeding populations
- Epigenetics and microbiomes
- Sustainable aquaculture
- Professional development of researcher and industry capabilities

Impact of research

- Development of DNA parentage microsatellite and SNP marker suites for seven tropical aquaculture species. These marker suites are routinely applied to conduct genetic audits for industry, determine performance of families under commercial evaluation, and as a tool in advanced selective breeding programs
- Provided an understanding of the genetic basis of commercial traits for important aquaculture species. With this information selective breeding programs can be designed based on solid genetic parameters resulting in maximisation of genetic gains
- Enabled the capability of numerous companies to instigate selective breeding programs based on a sound understanding of the genetic basis of traits and the ability to incorporate genomic information to improve accuracy of selection
- Increased understanding of the role epigenetics and microbiomes have in the expression of phenotypic traits in aquaculture species
- Assembly of the first comprehensive genomes and transcriptomes for barramundi, the black tiger shrimp, and pearl oyster
- Commercialisation of an Illumina Infinium SNP array for the Pacific White tailed shrimp

Top five publications

- Jerry, D.R., Jones, D.B., Lillehammer, M., Massault, C., Loughnan, S., Cate, H.S., Harrison, P.J., et el. (2022). Predicted strong genetic gains from the application of genomic selection to improve growth related traits in barramundi (Lates calcarifer). Aquaculture 549, 737761
- Zenger, K.R., Khatkar, M.S., Jones, D.B., Khalilisamani, N., Jerry, D.R., Raadsma, H.W. (2019). Genomic selection in aquaculture: Application, limitations and opportunities with special reference to marine shrimp and pearl oysters. Frontiers in Genetics, Livestock Genomics 23;9:693. doi: 10.3389/fgene.2018.00693
- Huerlimann, R., Wade, N., Gordon, L., Montenegro, J., Goodall, J., McWilliam, S., Tinning, M., Siemering, K., Giardina, E., Donovan, D., Sellars, M., Cowley, J., Condon, K., Coman, G., Khatkar, M.S., Raadsma, H., Maes, G., Zenger, K.R. and Jerry, D.R. (2018). De novo assembly, characterization, functional annotation and expression patterns of the black tiger shrimp (Penaeus monodon) transcriptome. Scientific Reports 8:13553 | doi.org/10.1038/s41598-018-31148-4
- Jones D.B., Jerry D.R., Khatkar M.S., Raadsma H.W., van der Steen H., Prochaska J., Forêt S., and Zenger K.R. (2017). A comparative integrated gene-based linkage and locus ordering by linkage disequilibrium map for the Pacific white shrimp, *Litopenaeus vannamei*. Nature Scientific Reports 7, 10630. doi:10.1038/s41598-017-10515-7
- Budd, A.M., Banh, Q., Domingos, J., and Jerry, D.R. (2015). Sex control in fish: approaches, challenges and opportunities for aquaculture. Journal of Marine Science and Engineering 3(2), 329-355.

Further Information

JCU Research Profile

Assoc Prof Katheline Hua

Associate Professor, Aquaculture
Principal Research Fellow
Tropical Futures Institute
James Cook University (Singapore)

PhD University of Guelph, Canada
MSc University of Guelph, Canada

Background

Associate Professor Katheline Hua specializes in the field of aquaculture nutrition. She has more than 16 years of experience in working with both tropical and coldwater fish species.

A/Prof Hua holds a PhD in Fish Nutrition from the University of Guelph, Canada. She worked at the University of Guelph as a Post-doctoral fellow and Adjunct Professor where she conducted research on coldwater fish. Afterwards she worked as a Junior Professor at the Humboldt University of Berlin, Germany where she led the aquaculture nutrition research group. She joined James Cook University in Singapore in 2018.

A/Prof Hua's primary research interest is to develop cost-effective aquaculture feeds to promote growth and nutrient utilization of fish and crustaceans. Her research program encompasses basic and applied research topics in aquaculture nutrition. One of her expertise areas is nutritional modelling, exploring the synergy of empirical and modelling approaches to integrate and synthesize information related to optimum aquaculture diets.

Areas of expertise

- Feed formulations
- Ingredient evaluation
- Macronutrients and feed additives
- Nutrient requirement and utilization of fish
- Nutritional modeling

Impact of research

- Developed a series of nutrient digestibility models that represent significant progress from the conventional experimental approach to estimate digestibility values of lipid, starch and phosphorus. The models are being used as feed formulation tools by academic researchers and feed producers.
- Developed a model simulation-based approach that achieves broader and more flexible evaluations of nutritive values of feed ingredients than conducting individual feeding trials. This approach allows not only proper quantifications of the effect of alternative ingredients, but also simulations of growth and nutrient utilization.
- Elucidated the appropriate mode of expressing essential amino acids requirement, a fundamental issue in fish nutrition research, which contributes to a better understanding of underlying dietary factors that affect amino acid requirements of fish.

Research Projects:

- Optimizing feeds for red snapper
- Developing functional feeds for barramundi
- Refinement of methodologies in evaluating nutritive values of fish feed ingredients and development of mechanistic models to estimate nutrient digestibility
- Investigation of nutritive values of alternative raw materials for aquaculture species
- Nutrient requirement and development of low fish meal feed formulation for aquaculture species
- Requirement and utilization efficiency of amino acids in fish
- Nutritional modelling of amino acids nutrition in fish
- Quantification of the effects of alternative ingredients in fish feeds using meta-analysisand nutritional model simulation-based approaches

Top five publications

- Hua, Katheline (2021) A meta-analysis of the effects of replacing fish meals with insect meals on growth performance of fish. Aquaculture, 530.
- Hua, Katheline, and Bureau, Dominique (2019) Estimating changes in essential amino acid requirements of rainbow trout and Atlantic salmon as a function of body weight or diet composition using a novel factorial requirement model. Aquaculture, 513. 733440.
- Hua, Katheline, Cobcroft, Jennifer M., Cole, Andrew, Condon, Kelly, Jerry, Dean R., Mangott, Arnold, Praeger, Christina, Vucko, Matthew J., Zeng, Chaoshu, Zenger, Kyall, and Strugnell, Jan M. (2019) One Earth, 1(3). pp. 316-329.
- Hua ,Katheline, Koppe, Wolfgang, and Fontanillas, Ramon (2019). Effects of dietary protein and lipid levels on growth, body composition and nutrient utilization of Channa striata. Aquaculture, 501.pp. 368-373.
- Hua, Katheline, Suwendi, Erwin, and Bureau, Dominique P. (2019) Effect of body weight on lysine utilization efficiency in Nile Tilapia (Oreochromis niloticus). Aquaculture, 505. pp. 47-53.

Further Information
JCU Research Profile

Dr Susan Gibson-Kueh

Senior Research Fellow, Aquaculture
Tropical Futures Institute
James Cook University (Singapore)

Member, Australian and New Zealand College of Veterinary Scientists (Medicine and Management of Aquaculture Species)
PhD (Fish Pathology), Murdoch University, Australia
MSc (Aquatic Veterinary Studies), Institute of Aquaculture, University of Stirling, UK
BVSc, University of Sydney, Australia

Background

Dr Susan Kueh has extensive experience in aquatic animal health from roles in government and academia. Her research is based on an in-depth understanding of the Asian aquaculture industry. Dr Kueh's expertise in diagnostic fish pathology encompasses both finfish (marine and freshwater, food and ornamental species) and shellfish (shrimps, oysters, mussels, abalone), and the study of complex diseases in valuable food fish species. She has special interests in development of sustainable livelihoods based on aquaculture in remote communities in South-East Asia.

Dr Kueh was the first researcher to understand the causative agent of scale-drop in barramundi and has a strong interest to continue to understand this disease, along with other diseases like big belly disease, so that sustainable approaches can be developed for barramundi aquaculture.

Areas of expertise

- Diagnostic pathology, parasitology, bacteriology, virology, molecular biology and epidemiology
- Extensive knowledge of warm water aquaculture species; particularly diseases of Asian seabass or barramundi

Impact of research

- First report of Big Belly or Pot Belly in Asian seabass fry with high mortality in 2004, resulted in recognition of a novel bacterial gut disease with significant impact on production of Asian seabass
- First report of Scale drop disease in barramundi in 2012 paved the way for further work by De Groof et al. 2015, with the isolation of a novel virus with 60% homology to other known iridoviruses. SDD was originally thought to be caused by Tenacibaculum maritimum
- Correlated high incidences of an Eimeria infection in juvenile Asian seabass (barramundi) Lates calcarifer in small scale nurseries in Vietnam with low water exchange rates
- Suggested affinity of fish systemic iridovirus for cells of mesothelial origin in naturally infected fish via electron microscopy during her MSc at the Institute of Aquaculture, University of Stirling. This information correlated with better success when fibroblastic cell lines are used for viral isolation.

Top five publications

- Gibson-Kueh, S., Chee, D., Chen, J., Wang, Y.H., Tay, S., Leong, L.N., Ng, M.L., Jones, J.B., Nicholls, P.K., Ferguson, H.W. (2012). The pathology of 'scale drop syndrome' in Asian seabass, Lates calcarifer Bloch, a first description. Journal of Fish Diseases, 35, 19–27.
- Gibson-Kueh, S., Netto, P., Ngoh, G.H., Chang, S.F., Ho, L.L., Qin, Q.W., Chua, F.H.C., Ng, M.L., Ferguson, H.W. (2003). The pathology of systemic iridoviral disease in fish. Journal of Comparative Pathology, 129,111-119.
- Gibson-Kueh, S., Crumlish, M., Ferguson, H.W. (2004). A novel 'skinny pot-belly' disease in Asian seabass fry, Lates calcarifer Bloch. Journal of Fish Diseases 27. 731-735.
- Gibson-Kueh, S., Ngoh-Lim, G.H., Netto, P., Kurita, J., Nakajima, K., Ng, M.L. (2004). A systemic iridoviral disease in mullet, Mugil cephalus Linnaeus and tiger grouper, Epinephelus fuscoguttatus Forsskal – a first report and study. Journal of Fish Diseases, 27, 693-699.
- Qin, Q.W., Chang, S.F., Ngoh-Lin, G.H., Gibson-Kueh, S., Shi, C., Lam, T.J. (2003). Characterisation of a novel Ranavirus isolated from Grouper, Epinephelus tauvina. Diseases of Aquatic Organisms, 53, 1-9.

Further Information
JCU Research Profile

Dr Jose Domingos

Associate Professor, Aquaculture
Tropical Futures Institute
James Cook University (Singapore)

PhD (Aquaculture Genetics) James Cook University, Australia
MSc (Aquaculture) Federal University of Santa Catarina, Brazil
BSc (Oceanography) Federal University of Rio Grande, Brazil

Background

Dr Jose Domingos' research focuses on the development of efficient breeding programs for tropical aquaculture species. This involves the understanding and manipulation of endogenous and environmental factors affecting gonadal development and broodstock conditioning within appropriate maturation systems for reliable spawnings. Jose is passionate about marine finfish propagation (reproduction, genomics, selective breeding) and its integration with nutrition and fish health for the development of fast growing and disease resistant strains. Fingerlings of high quality and better genetics will improve farm productivity and allow aquaculture business in the tropics to achieve profitability and sustainability to feed our growing population.

Dr Domingos has a long involvement with commercial shrimp and marine finfish operations. Prior to joining the James Cook University (Australia) Aquaculture Genetics research team in 2008, Jose worked as a production manager for several shrimp farms in the South and Northeast of Brazil, where he supervised over 700 hectares of shrimp farming. Trained in Brazil (Oceanography, FURG; MSc. Aquaculture, UFSC) and Australia (PhD Aquaculture Genetics, JCU), Jose has 20 years of combined industry, government and academic background. As a new member of the James Cook University in Singapore Aquaculture Research team, Jose is excited about collaborating with industry partners in the development and use of genetically superior broodstock within reliable breeding and hatchery facilities, and in the training of students through hands-on experiences and discoveries that make a difference for life in the tropics.

Areas of expertise

- Aquaculture applied breeding and genomics for selective breeding programs
- Marine finfish broodstock systems and management
- Integrated shrimp farm management

Impact of research

- Estimation of heritability and discovery of SNPs associated with Scale Drop Disease Virus resistance in farmed barramundi
- Identification of molecular mechanisms downregulating immunity of barramundi when coinfected with Scale Drop Disease Virus and Lates calcarifer Herpes Virus
- Identification of molecular and cellular larval traits which are highly correlated with fish weight at harvest. This allows for the estimation of broodstock breeding values (EBV) based on their offspring performance at 18 days post hatch, and enables the by avoiding costs associated with rearing of slow-growing families.
- Identification of sex-specific epigenetic differences and alternatively spliced isoforms of dmrt1 and cyp19a1 genes in the protandrous hermaphrodite barramundi. This contribution to our understanding of the sex-determination mechanisms is the first step for improved sex-control strategies in Asian seabass broodstock populations.
- Demonstration, through the use of robust animal models traditionally used in animal breeding, of a high potential for adaptation in fitness-related traits of a coral reef fish acclimated to higher temperatures, which could enable reef fish populations to maintain their performance as ocean temperatures rise.

Top five publications

- Domingos J, Goldsbury J, Bastos Gomes G, Smith B, Tomlinson C, Bade T, Sander C, Forrester J and Jerry D (2021) Genotype by environment interactions of harvest growth traits for barramundi (Lates calcarifer) commercially farmed in marine vs. freshwater conditions. Aquaculture, 532.
- Domingos J, Shen X, Terence C, Senapin S, Dong H, Tan M, Gibson-Kueh S and Jerry D (2021) Scale Drop Disease Virus (SDDV) and Lates calcarifer Herpes Virus (LCHV) coinfection downregulate immune-relevant pathways and cause splenic and kidney necrosis in barramundi under commercial farming conditions. Frontiers in Genetics, 12, 666897.
- Nghia N, Van P, Giang P, Hanh N, St-Hilaire S and Domingos J (2021) Control of Vibrio parahaemolyticus (AHPND strain) and improvement of water quality using nanobubble technology. Aquaculture Research, 52 (6). pp. 2727-2739
- Domingos JA, Smith-Keune C, Harrison P, Jerry DR (2014) Early prediction of long-term family growth performance based on cellular processes – a tool to expedite the establishment of superior foundation broodstock in breeding programs. Aquaculture 428- 429, 88-96.
- Budd A, Banh Q, Domingos JA, Jerry DR (2015) Sex control in fish: approaches, challenges and opportunities for aquaculture. Journal of Marine Science and Engineering 3, 329-355.

Further Information
JCU Research Profile

Dr Xueyan Shen

Senior Lecturer, Aquaculture
James Cook University (Singapore)

PhD (Biochemistry & Molecular Biology), Ocean University of China, China
MSc (Aquaculture), Ocean University of China, China
BSc (Aquaculture), Hebei Normal University of Science & Technology, China

Background

Dr Xueyan Shen completed her postdoctoral work on the maintenance of genomic resources for the National BioResource Project Medaka at the National Institute for Basic Biology in Okazaki, Japan. From 2010-2018, she worked in the Temasek Life Sciences Laboratory (TLL), Singapore, where, as a Research Fellow, she led several research teams towards increasing Singapore's food fish supply through application of aquaculture genomics research and development. Now at James Cook University in Singapore, Dr Shen continues to apply her state-of-the-art teaching and genetic research approaches to help Singapore and other Asian countries achieve their aquaculture-related food security strategies.

Dr Shen's research focus is on the development of "robust" aquaculture strains to boost seafood production. She has conducted genomics-assisted selection on two economically important fish, namely Asian seabass/barramundi and Mozambique tilapia, and also the ornamental fish Asian arowana. Specific areas of her research interest include: 1) development and application of new genomic resources and genetic tools for selective breeding; 2) elucidation of the genetic basis underlying commercially important traits such as disease resistance, fast growth, and adaption to various environmental stressors through deep RNA sequencing, QTL mapping, and whole genome association studies (GWAS) as well as genomic selection (GS). As a Senior Lecturer at JCU in Singapore, Dr Shen is keen to continue to collaborate with partners from commercial industry, and government universities/institutes to create 'state of the art' genomic platforms to further improve the productivity and quality of food fish species.

Areas of expertise

- Aquaculture new genomic tools development and application
- Aquaculture genetics
- Aquaculture disease
- Selective breeding

Impact of research

- Dr Shen's research into the genetic improvement of Asian seabass and tilapia have allowed for a 'quantum leap' in generation of more superior broodstock leading to more efficient and greater productivity of foodfish products.
- In addition, tools Dr Shen has developed will be easily applicable and adaptable to the aquaculture systems of other tropical marine fish species, advancing their production systems from the current, mostly traditional methods into modern, science-assisted aquaculture.

Top five publications

- Shen, X., Ngoh, S.Y., Thevasagayam N.M & Orbán, L. (2016). BAC-pool sequencing and analysis confirms growth-associated QTLs in the Asian seabass genome. Scientific Reports, 6, 36647. doi:10.1038/srep36647
- Ngoh, S., Tan, D., Shen, X., Orbán, L. (2015). Nutrigenomic and nutritional analyses reveal the effects of pelleted feeds on Asian seabass (Lates calcarifer). PloS one, 10(12), e0145456. doi: 10.1371/journal.pone.0145456
- Domingos J, Shen X, Terence C, Senapin S, Dong H, Tan M, Gibson-Kueh S and Jerry D (2021) Scale Drop Disease Virus (SDDV) and Lates calcarifer Herpes Virus (LCHV) coinfection downregulate immune-relevant pathways and cause splenic and kidney necrosis in barramundi under commercial farming conditions. Frontiers in Genetics, 12. doi: 10.3389/fgene.2021.666897
- Orbán L, Shen X, Phua N and Varga L (2021) Toward genome-based selection in Asian seabass: what can we learn from other food fishes and farm animals? Frontiers in Genetics, 12. doi: 10.3389/fgene.2021.506754
- Poon Z. W. J, Shen X, Uichanco J, Terence C, Chua S. W. G, and Domingos J (2022). Comparative transcriptome analysis reveals factors involved in the influence of dietary astaxanthin on body colouration of Malabar Snapper (Lutjanus malabaricus). Aquaculture, 738874. doi.org/10.1016/j.aquaculture.2022.738874

Further Information
JCU Research Profile

Dr Neil Hutchinson

Senior Lecturer, Environmental Science
James Cook University (Singapore)

PhD (Marine Biology) The University of Hong Kong, Hong Kong SAR
BSc (Hons) (Environmental Biology) Sunderland University, UK

Background

Dr Neil Hutchinson has worked as a marine ecologist for over 20 years, predominantly in the Asia-Pacific region. He has experience in a diverse range of fisheries related projects examining environmental impacts such as climate change and habitat destruction, and developing understanding of how they affect fisheries and aquaculture species. His research has traversed a variety of taxonomic groups including sharks, invertebrates and algae, examining the processes governing their natural distribution patterns and abundance.

Neil has a PhD in marine ecology from The University of Hong Kong and prior to joining James Cook University in Singapore in 2012, was a fisheries research scientist at Fisheries Victoria, Australia. While there he worked on government and industry funded projects examining the impacts of coastal development on key fisheries habitat and the development of tools to assess the sensitivity of commercially important fisheries and aquaculture species to climate change. His current research on coastal fisheries encompasses at risk species, such as elasmobranchs, and the provision of ecosystem services by urban habitats. This builds on past projects on the ecology and behaviour of predatory fish at the Marine Biological Association of the UK, Kyushu University in Japan and in The Federated States of Micronesia. Additionally, through his research and consultancy on intertidal ecosystems in Hong Kong and Japan, Neil has developed an extensive suite of skills relevant to assessing human impacts on marine ecosystems. He leads the Environmental Science teaching program at James Cook University in Singapore.

Areas of expertise

- Movement and behavioural ecology of marine fish and invertebrates utilizing underwater video systems and acoustic telemetry
- Environmental impact assessment
- Climate change mitigation
- Ecosystem services
- Intertidal community ecology
- Predator-prey interactions

Impact of research

- Identification of key fishery habitat for at risk elasmobranchs and coastal fisheries. This research had implications in relation to management of coastal development.
- Developed assessment tools to aid the understanding of climate change sensitivity of fisheries and aquaculture species.
- Identified non-breeding habitat and home ranges of grouper in Micronesia, providing information relevant to management of a locally important fisheries species.

Top five publications

- Clark-Shen, N., Chin, A., Arunrugstichai, S., Labaja, J., Mizrahi, M., Simeon, B., & Hutchinson, N. (2022). Status of Southeast Asia's marine sharks and rays. Conservation Biology, e13962.https://doi.org/10.1111/cobi.13962
- Ng T, Lau S, Davies M, Stafford R, Seuront L, Hutchinson N, Hui T and Williams G (2021) Behavioural repertoire of highshore littorinid snails reveals novel adaptations to an extreme environment. Ecology and Evolution, 11 (12) ,7114-7124
- Benzeev R, Hutchinson N and Friess D (2017) Quantifying fisheries ecosystem services of mangroves and tropical artificial urban shorelines. Hydrobiologia, 803 (1), 225-237
- Doubleday Z, Clarke S, Li X, Pecl G, Ward T, Battaglene S, Frusher S, Gibbs P, Hobday A, Hutchinson N, Jennings S and Stoklosa R (2013) Assessing the risk of climate change to aquaculture: a case study from south-east Australia. Aquaculture Environment Interactions , 3 (2), 163-175
- Hutchinson N and Rhodes K (2010) Home range estimates for squaretail coralgrouper, *Plectropomus areolatus* (Rüppell 1830). Coral Reefs, 29 (2), 511-519

Further Information
JCU Research Profile

Dr Nguyen Thanh Vu

Senior Research Fellow, Aquaculture
Tropical Futures Institute
James Cook University (Singapore)

PhD (Aquaculture Genetics) University of the Sunshine Coast, Australia
MSc (Aquaculture Sciences) Norwegian University of Life Sciences, Norway
BSc (Biotechnology) Nong Lam University, Vietnam

Background

Dr Nguyen Thanh Vu is currently working as a Research Fellow at James Cook University in the application of practical genetic and genomic approaches for improving fish productivity. His background involved multidiscipline aquaculture sciences with an emphasis on genetic research for aquaculture species, especially on enhancing fish productivity and quality through selective breeding. From over ten years working in aquaculture research and industry, especially in Vietnam, he has gained invaluable experiences regarding propagation, breeding, nursing, diseases, and selection methodologies in diverse aquaculture species, including fish, freshwater prawn and shrimp. Graduating from the University of the Sunshine Coast, Australia, his PhD thesis aimed at understanding the genetic and genomic basis in mitigating the disease severity caused by a bacterial infection in striped catfish farming. Now, he is focused on genomics application for improving traits of commercial importance for Red Snapper and Asian Seabass in Singapore.

Areas of expertise

- Population genetics and genomics
- Aquaculture selective breeding: genetics and genomics of complex traits
- Aquatic science, and applied statistics
- Design and conduct of genetic improvement programs for aquatic species
- Statistics and bioinformatics methods applied to genetic improvement

Impact of research

- Routine genetic evaluations and management of practical genetic improvement programs for aquaculture species (striped catfish, tilapia, giant freshwater prawn, tiger shrimp).
- Assessment of genetic diversity among geographical populations of striped catfish within Vietnam and recommended the restructure or re-introduction of the most diverse stock into the current population to secure long-term breeding.
- Evaluation of different algorithms for genomic prediction on striped catfish breeding, especially for traits that are difficult to measure such as disease resistance. The breeding program will benefit from the power of modern prediction methods, i.e., machine and deep learning in the context of genomic selection.

Top five publications

- Nguyen, N.H., Vu, N.T., Patil, S.S. and Sandhu, K.S., 2022. Multivariate genomic prediction for commercial traits of economic importance in Banana shrimp Fenneropenaeus merguiensis. Aquaculture, 555, p.738229.
- Nguyen, N.H. and Vu, N.T., 2022. Threshold models using Gibbs sampling and machine learning genomic predictions for skin fluke disease recorded under field environment in yellowtail kingfish Seriola lalandi. Aquaculture, 547, p.737513.
- Vu, N.T., Phuc, T.H., Oanh, K.T.P., Sang, N.V., Trang, T.T. and Nguyen, N.H., 2022. Accuracies of genomic predictions for disease resistance of striped catfish to Edwardsiella ictaluri using artificial intelligence algorithms. G3, 12(1), p.jkab361.
- Vu, N.T., Sang, N.V., Trong, T.Q., Duy, N.H., Dang, N.T. and Nguyen, N.H., 2019. Breeding for improved resistance to Edwardsiella ictaluri in striped catfish (Pangasianodon hypophthalmus): Quantitative genetic parameters. Journal of fish diseases, 42(10), pp.1409-1417.
- Vu, N.T., Van Sang, N., Phuc, T.H., Vuong, N.T. and Nguyen, N.H., 2019. Genetic evaluation of a 15-year selection program for high growth in striped catfish Pangasianodon hypophthalmus. Aquaculture, 509, pp.221-226.

Dr Maria Nayfa

Research Fellow, Aquaculture
Tropical Futures Institute
James Cook University (Singapore)

PhD (Aquaculture & Genetics), James Cook University, Australia
MSc (Marine Biology), James Cook University, Australia
BSc (Environmental Science), Duke University, USA

Background

Dr Maria Nayfa's research focuses on the use of genetics in aquaculture selective breeding programs to improve global food security. In particular, she has experience in quantitative genetics (including, linkage mapping, quantitative trait locus analysis, and genome-wide association studies), population genetics, and the use of molecular data to correct paper pedigree records in selective breeding programs. Dr. Nayfa is a big proponent of international partnerships and has worked closely with collaborators on projects in Egypt, Malaysia, Fiji, Bangladesh, the United Kingdom, Australia, and the United States. She has worked on a number of species: including, red snapper, Nile tilapia, corals, pearl oysters, barramundi/ Asian seabass, and mola.

Dr Nayfa completed her BSc with Distinction at Duke University, USA in 2011, MSc at James Cook University in 2014, Australia, and her PhD on "Domestication in Aquaculture Fishes- Elucidating the Genomic Consequences in Nile Tilapia (Oreochromis niloticus)" at James Cook University, Australia in 2020. She recently joined James Cook University Singapore in January 2020, and is currently working on developing genetic resources for emerging aquaculture species in Singapore. Dr Nayfa is excited to continue to enhance and develop her areas of expertise, professional network, and aquaculture production in Singapore.

Areas of expertise

- Applied aquaculture genetics
- Genetic audits of aquaculture breeding populations
- Pedigree management
- Population genetics and genomics
- Quantitative genetics and genomics for selective breeding programs
- Food Security

Impact of research

- Established a unique workflow for optimizing the correction of pedigree records using genomic techniques for aquaculture selective breeding programs.
- Conducted genetic audits of established aquaculture ventures to assess program viability and make recommendations.
- Produced mating scheme/ broodstock recommendations for farms.
- Revitalized the management of well-established selective breeding programs to improve genetic gain.
- Conducted genomic assessments of wild populations of commercially important aquaculture species in order to better understand: population connectivity, genetic diversity, selection, local adaptations, and the effect of farm escapees on wild populations.

Top five publications

- Benzeev R, Hutchinson N and Friess D (2017) Quantifying fisheries ecosystem services of mangroves and tropical artificial urban shorelines. Hydrobiologia, 803 (1), 225-237
- Hutchinson N, Jenkins G, Brown A and Smith T (2014) Variation with depth in temperate seagrass-associated fish assemblages in Southern Victoria, Australia. Estuaries and Coasts, 37 (4), 801-814
- Pecl G, Ward T, Doubleday Z, Clarke S, Day J, Dixon C, Frusher S, Gibbs P, Hobday A, Hutchinson N, Jennings S, Jones K, Li X, Spooner D and Stoklosa R (2014) Rapid assessment of fisheries species sensitivity to climate change. Climatic Change, 127 (3), 505-520
- Doubleday Z, Clarke S, Li X, Pecl G, Ward T, Battaglene S, Frusher S, Gibbs P, Hobday A, Hutchinson N, Jennings S and Stoklosa R (2013) Assessing the risk of climate change to aquaculture: a case study from south-east Australia. Aquaculture Environment Interactions , 3 (2), 163-175
- Hutchinson N and Rhodes K (2010) Home range estimates for squaretail coralgrouper, *Plectropomus areolatus* (Rüppell 1830). Coral Reefs, 29 (2), 511-519

Aquaculture teaching programs at James Cook University

JCU's teaching programs in aquaculture have been designed to deliver the knowledge and skills required in the next generation of global leaders in aquatic food production and resource management.

The Singapore campus of James Cook University offers undergraduate and higher degree by research programs in aquaculture as follows:

Bachelor of Business and Environmental Science (Majoring in Aquaculture)

With aquatic food resources already under pressure and declining, it is essential to develop aquaculture products in a sustainable fashion to improve aquatic food security. With JCU's Bachelor of Business and Environmental Science (Majoring in Aquaculture), students will learn how to manage the delicate balance between profit, policy, conservation and aquaculture. This multi-disciplinary program provides students with core knowledge and training in the application of business and environmental principles, with particular attention to aquaculture.

Bachelor of Science (Majoring in Aquaculture Science and Technology)

Breeding, rearing, and harvesting of fish, shellfish, and aquatic plants is the main objective of aquaculture. This is an increasingly important area for developing a sustainable, food secure, future. Ensuring a consistent supply of food and associated products for human consumption, while also helping in the preservation of species in the wild, is key to solving real world problems. Throughout this major, students will explore the scientific and practical applications of breeding, rearing and harvesting of plants and animals in all types of water environments. You will understand the biodiversity of species and how they are farmed, the design of aquaculture systems, and the basics of nutrition.

Graduate Certificate of Research Methods (Tropical Environments and Societies) and Graduate Diploma of Research Methods (Tropical Environments and Societies)

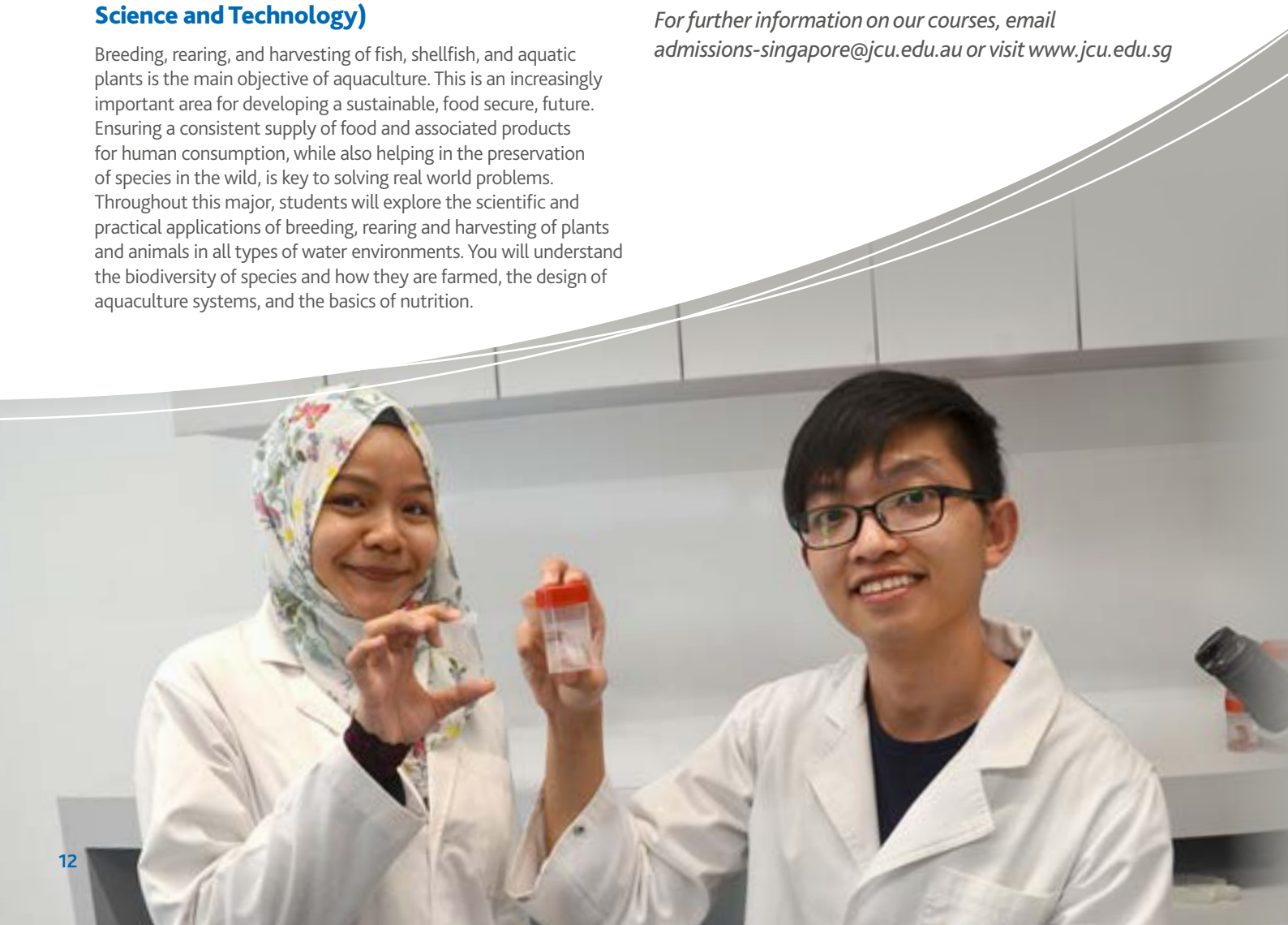
These courses are designed for those who want to gain the formal research training experience needed to begin an exciting higher research degree.

Doctor of Philosophy (PhD) and Master of Philosophy

The Doctor of Philosophy (PhD) is a program of supervised original research. It culminates in the submission of a thesis that demonstrates the ability for critical analysis and research that makes a significant and original contribution to the knowledge and understanding of the field of study.

The Master of Philosophy offers postgraduate research supervision on a smaller scale than the PhD, towards which it can provide a pathway.

For further information on our courses, email admissions-singapore@jcu.edu.au or visit www.jcu.edu.sg



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