
The Victorian Marine Science Consortium is a collaborative venture between:



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Front cover photography by Rod Watson, VMSC.

- Dusky morwong, *Dactylophora nigricans*
- Australasian gannet, *Morus serrator*
- Soldier crab, *Mictyris platycheles*
- *Rivularia firma*
- Harpacticoid copepod

INTRODUCTION & BACKGROUND

In 1989 four major marine research and teaching agencies in Victoria established the *Queenscliff Marine Station* to provide a facility dedicated to marine research and tertiary education in south-eastern Australia.

Foundation partners were the universities of Melbourne, Monash and RMIT, along with the statutory body of the Victorian Institute of Marine Sciences (VIMS). In 1992 Deakin University and Victoria University joined the consortium. In 1996 VIMS became part of the Victorian Government's marine research institute. Two years later the VIMS Act was repealed. The Fisheries Research Branch (Fisheries Victoria) is now the State Government partner (formerly Primary Industries Research Victoria up until December 2007).

In early 2004, after fifteen years, the *Queenscliff Marine Station* was relaunched as the *Victorian Marine Science Consortium (VMSC)*.

VMSC operates by pooling resources and working collaboratively. It embodies an active research community from a range of institutions, facilitating relevant and sustainable research to effectively manage Victoria's coastline.

Queenscliff is at the tip of the Bellarine Peninsula where Port Phillip Bay meets Bass Strait. It is an area offering a diverse range of marine habitats, from high-energy ocean beaches to low-energy sheltered beaches, rocky intertidal platforms and sub-tidal reefs, estuaries, mud flats, seagrass meadows, mangroves, salt marshes, and bay and shelf waters. It is a geographical area offering a unique combination for marine research and teaching.

Visiting researchers and educators have easy access to field locations with boats available for general work or diving.

Researchers at VMSC have strong links to other state and federal marine agencies together with interstate universities. A wide range of grants from national competitive funds, state sources and private sector contracts supports research. Current research fields include: fisheries biology and ecology, environmental biology, ecotoxicology, animal physiology, aquaculture, climate change, molecular ecology, ornithology, natural products, Marine Protected Areas and introduced species.

VMSC is utilised by all partners for undergraduate courses in marine science at all levels. Some courses are taught collaboratively between members of the consortium.

In 1994, construction began on a new ecotoxicology laboratory, replacing the original small, field-based buildings. The new facilities resulted in a remarkable increase in the range of research conducted, and in the overall general use of the facility.

In November 2004, VMSC relocated to the new DPI Queenscliff Centre, a state-of-the-art marine research facility, along with its state government partner, Fisheries Victoria, and the Marine Discovery Centre.



DIRECTOR'S REPORT



I am pleased to present the 2010 Director's Report for the Victorian Marine Science Consortium.

This year was our twentieth year of operation since establishing basic field station facilities at

Queenscliff. Over these years, the consortium has provided infrastructure and support to more than 215 postgraduate students, and facilitated a range of undergraduate teaching across the marine sciences. Today, many of those 'undergraduates' are now actively and significantly contributing to our knowledge and better management of the marine environment.

During 2010 a total of 185 undergraduate students attended field courses in marine ecology, biology, botany, marine and coastal ecosystems and ocean engineering at Queenscliff. Postgraduate research projects included thirty-three PhD's, 7 Masters by Research and 5 Honours projects. Four PhD theses were submitted during the year.

The consortium places high priority on providing encouragement and support to young scientists. In 2004, the VMSC Management Committee initiated the *VMSC Postgraduate Award*, a stipend judged annually and awarded to the most outstanding student based at VMSC.

The winner of the 2010 *VMSC Postgraduate Award* was **Zoe Squires**. Zoe is undertaking her PhD through the University of Melbourne, jointly supervised by Monash University and Museum Victoria. Zoe is investigating the evolution of female multiple mating (polyandry) in dumpling squid, *Euprymna tasmanica*.

VMSC further extends its support to young scientists through the professional associations – AMSA (Australian Marine Sciences Association), and ASFB (Australian Society for Fish Biology), in sponsoring annual conference prizes for best temperate presentation.

Dan Coleman (University of Wollongong) received the VMSC / AMSA award for his talk on : *Shell repair in an acidifying ocean: impacts on gastropod shell growth and integrity*. **John Ford** (University of Melbourne) received the VMSC / ASFB award for his presentation titled *Manipulative fish*

experiments on artificial reefs: a lesson learned about acclimatisation.

The VMSC's Technical Officer, **Rod Watson**, received the AMSA 2010 Technical Award for outstanding technical support to students and researchers working at our Queenscliff laboratories. Rod's dedication and input over the past twenty years in his position of VMSC Technical Officer has immensely value added to the knowledge of Port Phillip Bay, its marine life, and the research that has been generated out of the VMSC laboratories at Queenscliff.

VMSC and the Marine Discovery Centre (MDC) co-hosted the 3 day *SCIENCE Experience* program, which aims to provide Year 9 students the opportunity to discover more about the world of science. The marine science program offered at Queenscliff is highly regarded and promptly books out each year. VMSC postgraduate students and early career researchers contribute extensively to the program's success.

VMSC and MDC again coordinated the *Certificate 111 Tourism (Guiding)* course offered to undergraduate students from VMSC member universities. The streamlined course content takes into account prior learning in marine ecology, biology or marine botany delivered at VMSC through member institutes. Fifteen students gained accreditation in 2010.

Two *Marine Career Discovery Days* were held in July and September. Both days delivered a diverse range of career options across the marine sciences to the enthusiastic students in attendance.

I would like to thank VMSC staff members – Liz McGrath and Rod Watson for the administrative and technical support given throughout the year.

I especially thank each member representative of the VMSC Management Committee for their commitment and cooperation into this unique enterprise – sustaining and fostering marine science research and teaching in south-eastern Australia.



Professor Michael J. Keough
Director

FIELD OPERATIONS

VMSC's *Pelagia* carried out the majority of boat work assignments in Swan Bay and Port Phillip Bay in 2010. The punt was used in Port Phillip Bay, the Barwon River, Lake Connewarre, Anderson Inlet and Lake Tyers.

To help offset fuel and maintenance costs, a nominal fee is charged to consortium members for vessel use. Users are charged at the following rates :

- *Pelagia* : students and researchers \$15 and \$30 per engine running hour, respectively. Night use is charged at \$20 (students) and \$40 (researchers).
- The punt is charged at a flat daily rate of \$5 to students, and \$50 to researchers. An additional overnight charge of \$25.00 is charged to researchers over continuous days use.

\$4906.00 was recovered from vessel users in 2010.

Field trips and activities relating to the following projects were conducted from the two vessels:

- Reef fish ecology – Port Phillip Bay
- Introduced species – Port Phillip Bay
- Flathead physiology – West Channel Entrance
- Fish-seagrass associations – Swan Bay, Grassy Point, Blairgowrie
- Meiofauna ecology – Barwon River and Lake Connewarre
- Fouling species on mussel farms – Port Phillip Bay
- Introduced algae recruitment – Port Phillip Bay
- Crab parasites – Port Phillip Bay
- Plankton tows – Port Phillip Bay
- Collection of material for laboratory work
- Reef fish larval collection – Port Phillip Bay
- Asterias collection – Port Phillip Bay
- Acoustic tagging – Swan Bay and Port Phillip Bay
- Undergraduate field excursions – Port Phillip Bay, Swan Bay, Barwon Heads, Barwon River
- Stingaree physiology – Swan Bay
- Parasite ecology and sea-jellies - Port Phillip Bay
- Elasmobranch physiology and stress - Swan Bay and Port Phillip Bay

- Ecology of Hulafish, a reef fish - Port Phillip Bay
- Introduced algae ecology - Swan Bay
- Dumpling squid collection - Port Phillip Bay
- Gannet foraging - Pope's Eye
- Dolphin movement - Port Phillip Bay

DIVING

During 2010, 101 dives were logged. The majority of dives were shallow, in less than 10 metres.

Dives involved research into:

- Algae settlement plates
- Fouling species on mussel farms
- Collection for natural products
- Various species collection for ecotoxicology and undergraduate classes
- Introduced species collection
- Reef fish ecology
- Photography
- Fish 'attractors' placement
- Hydroid settlement plates
- Temperature loggers
- Artificial seagrass units placement
- Acoustic tagging
- Dumpling squid collection
- Chlorophyll logger placement

Undergraduate snorkelling trips were conducted during some field courses. Classes involved reef assemblages, modular organisms, fish diversity and fouling organisms.

RESOURCES AND FACILITIES

VMSC is located at the DPI Queenscliff Centre, with the Fisheries Research Branch, Fisheries Victoria, and the Marine Discovery Centre. This outstanding facility allows access to the following infrastructure available to all VMSC users:

TEACHING

- A conference room equipped with the latest in audio visual and video conferencing; accommodates up to 50
- A General/Teaching lab with bench space for 45 students. Ambient seawater on-tap

RESEARCH

- Comprehensive range of scientific equipment
- Ecotoxicology lab with bench-top aquaria individually serviced with compressed air, ambient and temperature controlled seawater. Separate bench space is also available
- Separate preparation and washrooms are adjacent to the ecotoxicology lab
- Controlled temperature room supplied with ambient seawater and compressed air
- Aquarium equipped with dissecting table, 6 double-tiered and 4 single aquarium stands. Ambient and temperature controlled seawater, freshwater, and compressed air
- Bench space is available in the general/teaching lab
- Storage area for dive gear

OTHER

- Office space for visiting researchers and postgraduate students
- WIFI access

VESSELS

- *Pelagia* – VMSC's 6.5-metre, purpose-built research vessel
- A 4.2-metre punt
- Various other small craft are available

ACCOMMODATION

- Accommodation for visiting researchers can be arranged at The University of Melbourne research residence in Ocean Grove. Bookings are essential and can be organised through the Zoology Department at The University of Melbourne, or through VMSC
- A range of accommodation options are available in Queenscliff and Point Lonsdale and listed on the VMSC website

COURSES, USE AND OTHER INITIATIVES

2010	Institute	Course	No.
<i>Undergraduate teaching</i>			
8-13 Feb	University of Melbourne	Experimental marine ecology	26
15-19 Feb	Monash University	Marine biology	30
26-28 Mar	RMIT University	Marine biology	35
30 Aug-3 Sept	RMIT University	Earth and oceanic systems	10
11-12 Sept	Deakin University	Marine and coastal ecosystems	55
29 Nov-4 Dec	University of Melbourne	Marine botany	29
			185
<i>Other</i>			
19-21 Jan	<i>The SCIENCE Experience</i>	Years 9 and 10 students	16
2 Mar	Carleton College USA	Lab session	27
22-29 Mar	University of Tokyo	Research	1
1-2 May	AMSA	Postgraduate mini-conference	30
10-15 May	University of Tokyo	Research	1
2 Jul	Marine Careers Discovery Day	VMSC and MDC	25
24 Sept	Marine Careers Discovery Day	VMSC and MDC	13
9-10 Oct	Postgraduate Retreat	ZooPA University of Melbourne	30
6-10 Dec	Undergraduates	Certificate 111 Tourism (Guiding)	20
Various	Marine Discovery Centre	Lab sessions x 6	120

POSTGRADUATE AWARDS

VMSC POSTGRADUATE AWARD 2010

The VMSC Management Committee offer support and encouragement to young scientists by awarding an annual stipend to the student they consider being the most outstanding applicant. Students based at Queenscliff in the early stages of their degree, are eligible to apply. The committee strongly supports and encourages relevant research leading to increased scientific knowledge of Port Phillip Bay and surrounding coastlines and habitats.



Congratulations to **Zoe Squires** recipient of the 2010 VMSC Postgraduate Award. Zoe was presented with the award by the Minister for Environment and Climate Change, The Hon. Gavin Jennings MLC, at the *Victorian Coastal Awards for Excellence* ceremony held in April.

A PhD candidate at The University of Melbourne, Zoe's research is investigating why female dumpling squid, *Euprymna tasmanica*, a squid native to Port Phillip Bay and the southern coast of Australia, mate with multiple males (polyandry)? Little is known about sexual selection of cephalopods and investigating the benefits of polyandry has important implications for the maintenance of genetic variation, an important issue in evolutionary biology.

Zoe gained some valuable research and work experience during her undergraduate degree, including working at the Dolphin Research Institute in Hastings and volunteering at the Marine Discovery Centre (Queenscliff). She completed Honours at Monash University investigating the effects of salinity on native frog populations, then stayed on as a research assistant in the field of freshwater ecology. When the opportunity to move into the field of marine biology and work on a cephalopod came up, Zoe jumped at the chance and started her PhD late in

2009. Her supervisors are Dr Devi Stuart-Fox (University of Melbourne), Dr Bob Wong (Monash University) and Dr Mark Norman (Museum Victoria).

The VMSC Management Committee further extends support to young researchers through marine science professional associations with prize sponsorship at annual meetings. The VMSC/AMSA, and VMSC/ASFB award winners in 2010 were :

VMSC / AMSA AWARD 2010

Dan Coleman from the University of Wollongong (UOW) was awarded the VMSC prize at the 47th Annual AMSA Conference held at UOW from 4-8 July 2010. His oral presentation: *Shell repair in an acidifying ocean: impacts on gastropod shell growth and integrity* was judged best talk focusing on temperate marine science.



After completing his Honours degree, Dan received the UOW Bachelor of Marine Science Award for Best Performance in the Bachelor of Marine Science Honours Year 2009.

VMSC / ASFB AWARD 2010

John Ford from the University of Melbourne received the inaugural VMSC sponsored prize at the 2010 ASFB annual conference held at the Melbourne Museum in July.



John's presentation on *Manipulative fish experiments on artificial reefs: a lesson learned about acclimatisation* - was judged best oral presentation.

John commenced his PhD in 2008 focusing on rocky reef fish and identifying important pathways for fish movement and areas of reef with high productivity and high conservation value. Port Phillip Bay is John's passion and he spends a great part of the year under the surface observing the marine life.

AMSA 2010 TECHNICAL AWARDEE

VMSC's Technical Officer, Rod Watson, was the recipient of the *AMSA 2010 Technical Award* for outstanding technical support to students and researchers working at our Queenscliff laboratories.

Rod Watson has been employed as the consortium's Technical Officer since the inception of VMSC in 1990 (then named the Queenscliff Marine Station). During this period Rod has supported over 210 postgraduate students whose research has covered a diverse range, including marine biology, ecology, ecotoxicology, botany, aquaculture, fisheries ecology, physiology, ornithology, geomatics, marine protected areas, introduced species, oceanography and marine chemistry.

Rod has a wide-ranging knowledge of Port Phillip Bay and the surrounding areas and habitats. His advice to researchers and students on suitable fieldwork sites and species location is invaluable. Rod also works extensively with researchers from member institutions, as well as visiting national and international scientists - all researching a variety of fields within the marine sciences.

Rod's dedication and input over the past twenty years in his position of VMSC Technical Officer, have immensely value added to the knowledge of Port Phillip Bay, its marine life, and the research that has been generated out of the VMSC laboratories at Queenscliff.



RESEARCH

A range of projects involving environmental biology, fisheries biology and ecology, ecotoxicology, aquaculture, marine botany, ornithology, introduced species and animal physiology were undertaken throughout the year. Project funding was derived from national competitive funds, state sources and private sector contracts.

The following researchers and postgraduate students were actively involved through research at Queenscliff during 2010 (some project abstracts are listed and commence on page 11).

ACADEMIC RESEARCHERS / SUPERVISORS

Deakin University

Associate Professor John Arnould
Dr John Donald
Professor Marcel Klaassen
Associate Professor Laurie Laurenson
Dr Paul Lewandowski
Dr Ty Matthews
Professor Gerry P. Quinn
Dr Craig Sherman
Dr Giovanni Turchini
Dr Tes Toop
Associate Professor Geoff Wescott
Dr Michael Weston

RMIT University

Professor John Buckeridge
Dr Andreas Lopata
Professor Dayanthi Nugegoda
Dr Jessica Reeves
Dr Jeff Shimeta
Dr Sylvia Urban

The University of Melbourne

Dr Jan Carey
Dr Rob Day
Dr Sebastian Gornik
Dr Greg Jenkins
Professor Michael J. Keough
Professor Marilyn Renfree
Dr Devi Stuart-Fox
Associate Professor Stephen E. Swearer
Dr Jan Watson

Victoria University

Dr Carol Scarpaci
Dr Xiao Su

Monash University

Professor John Beardall
Dr Richard Reina
Dr Bob Wong

CSIRO

Dr David Smith

DPI Fisheries

Dr Matias Braccini
Mr Simon Conron
Dr Patrick Coutin
Dr Jeremy Hindell
Dr Brett Ingram
Dr Greg P. Jenkins
Dr Greg Parry
Dr Terry Walker

Australian Institute of Marine Science

Ms Susan Codi King

Flinders University

Dr Charlie Huveneers

Griffith University

Dr Rod Connolly
Dr Kylie Pitt

Museum Victoria

Dr Mark Norman

Parks Victoria

Dr Anthony Boxshall

University of Tasmania

Dr George Jackson

University of Tokyo

Professor Susumu Hyodo

University of Waikato

Professor Kerry Black

Centre for Aquatic Pollution Identification and Management (CAPIM)

Dr Mayumi Allinson
Dr Kathryn Hassell
Dr Jackie Myers

POSTGRADUATE RESEARCH PROJECTS 2010

Deakin University

PhD candidates

Emi S Ab Rahim
Justin Bell
Meagan Dewar
Daniel Grixti
Grant Leeworthy
Kade Mills
David Phillips
Tania Pyk
Fabian Trinnie
Megan Underwood

Honours

Amy Geels
Amanda Pettersen
Kim Weston

The University of Melbourne

PhD candidates

Rachael Bathgate
Isla Fitridge
John Ford
Christian Jung
Jodie Kemp
Malcolm Lindsay
Kim Millers
Hannah Murphy
Matthew Reardon
Bastien Rochowski
Michael Sams
Zoe Squires
Joel Williams

Masters

Carlie Alexander
Julian Atchison
Natalie Calder
Emma Ferguson
Amanda Franklin
Jessica Smith

Monash University

PhD candidate

Lorenz Frick
Camila Martins
Benjamin Wegener

Honours

RMIT University

PhD candidate

Fatemeh Hazeribaghdadabad
Lisa Toogood

Honours

Thelma Vlamis

Victoria University

PhD candidate

Nicole Filby
Annett Finger
Hints Mateos

Honours

Zac Lewis

Other

Flinders University

Matthew Heard (Honours)

Griffith University

Joanna Browne (PhD candidate)

University of Tasmania

Corey Green (PhD candidate)

RESEARCH ABSTRACTS

STAFF RESEARCH

The occurrence of the dinoflagellate parasite *Hematodinium* sp. in Australian crustaceans - a new threat to Australian fisheries?

Dr Sebastian Gornik, Professor Geoff MacFadden and Dr Ross F. Waller

The University of Melbourne, School of Botany

The blood-borne dinoflagellate parasite *Hematodinium* sp. has in the last three decades emerged as an important and damaging pathogen of crustaceans. It has been reported with an increasing prevalence in more than 20 crustacean species including crabs and lobsters from the North Atlantic, the North and South Pacific, and Indian Oceans. The life cycle of the parasite alternates between a host-specific stage and a transmissive free-living motile spore stage. Within many host the parasite causes a significant disease and reproduces to a sufficient density to render the haemolymph thick and milky. An unknown cue then induces mass sporulation, and the spores evacuate the moribund individuals. In some host species alteration of muscle texture induced by the presence of the parasite result in mushy and bitter tasting meat. Diseased animals also lose performance in general motility, foraging, and predator avoidance. Fatality rates upon infection are measured at 100% in aquarium trials, and the impact of the disease is likely exacerbated by greater susceptibility to predation in the ocean. Hence, *Hematodinium* causes a significant loss to fisheries and related markets around the world. In Australia the parasite has previously been described in Mud crabs, *Scylla serrata*, a coral crab species, *Trapezia areolata*, and in blue swimmer crabs, *Portunus pelagicus*. A major epizootic event was reported in 2007 in blue swimmer crabs, *Portunus pelagicus*, in Shark Bay, WA. A study conducted in response to industry complaints of poor flesh quality affecting 10-20% of the catch after cooking identified the parasite in up to 70% of crabs sampled.

In 2010, we analysed over 1000 crustacean samples from various locations around Australia (in WA, QLD, VIC) using a sensitive molecular-biological method to test for the presence of *Hematodinium*. This way we have so far identified three previously unknown host species; the Sand crabs, *Ovalipes australiensis*, Red bait crab,

Plagusia chabrus, and the Spider crab, *Leptomithrax gaimardii*. Fortunately prevalence and occurrence of the parasite were generally low at all sample locations with one exception: Port Phillip Bay.

In June 2010 we found that 80% of Sand crabs caught were infected with *Hematodinium*. Interestingly although the parasite was present with a high prevalence, we have not yet found any individuals that exhibit signs of the associated disease. The research is ongoing.

Osmoregulation in elephant fish, *Callorhynchus millii* (Holocephali)

Professor Susumu Hyodo¹, Dr A. Kawakoshi¹, Mr Justin Bell², Dr John A. Donald², Professor Y. Takei¹ and Dr Tes Toop²

University of Tokyo, Ocean Research Institute¹ / Deakin University, School of Biological and Chemical Sciences²

Osmoregulatory mechanisms in holocephalan fishes are unknown except that they conduct urea-based osmoregulation as in elasmobranchs. We therefore examined changes in plasma parameters of elephant fish, *Callorhynchus millii*, after gradual transfer to concentrated (120%) or diluted (80%) seawater (SW). In control fish, plasma Na and urea concentrations were about 300mM and 450mM, respectively. These values were equivalent to those of sharks and rays, but the plasma urea concentration of elephant fish was considerably higher than that reported for chimaeras, another holocephalan. After transfer to 120% SW, the plasma Na concentration markedly increased, while a conspicuous decrease in plasma urea concentration was observed following transfer to 80% SW. In elephant fish, we could not find a discrete rectal gland. Instead, approximately 10 tubular structures were located in the wall of post-valvular intestine. Each tubular structure was composed of a putative salt-secreting component consisting of a single-layered columnar epithelium, which was stained with anti-Na⁺,K⁺-ATPase serum. It is most likely that the tubular structures in the posterior intestine represent a primitive form of the rectal gland in elephant fish.

In addition, we have identified two C-type natriuretic peptides (CNP) from the heart and brain of elephant fish, which may contribute to the control of NaCl excretion from the rectal gland of elephant fish as it does in elasmobranchs.

Endocrine disruption in estuarine fishes

Associate Professor Stephen Swearer / Dr Kathryn Hassell

The University of Melbourne

Funded by Victorian Centre for Aquatic Pollution Identification and Management (CAPIM)

In 2010 CAPIM was allocated funding by the Department of Innovation, Industry, and Regional Development (DIIRD) Victorian Science Agenda Investment Fund (VSA IF). CAPIM is a collaboration between The University of Melbourne, Melbourne Water, RMIT, DPI (Vic) and EPA (Vic). CAPIM's vision is to improve and secure aquatic ecosystem health by developing innovative approaches to pollution detection in inland waters and estuaries, and working with environmental management practitioners to reduce pollution impacts.

This project, led by Assoc. Professor Steve Swearer and involving Dr. Kathryn Hassell is part of the estuarine research program and has been initiated with the aim of examining the effects of endocrine disrupting chemicals in estuarine fishes.

In Victoria there are several potential sources of contaminants entering estuaries, such as stormwater runoff, wastewater effluents, agricultural and industrial discharges. Some of these chemicals are capable of interfering with the normal functioning of the hormonal (endocrine) system, and are called endocrine disrupting chemicals (EDCs). EDCs are a broad group of chemicals that can negatively impact a variety of physiological processes, especially ones related to reproduction, such as gonad formation, gamete production, fertility and fitness in offspring. To assess this issue in Victoria, Steve and Kathryn will be combining field surveys with controlled laboratory experiments, and will use histological and biochemical methods for identifying potential impacts.

Experiments are currently underway in the lab using the Eastern bluespot goby (*Pseudogobius* sp. 9) to look at how exposure to EDCs affects early life stage development, while field collections of both the Eastern bluespot goby, as well as the introduced yellowfin goby (*Acanthogobius flavimanus*), are being conducted to look for differences in growth and reproductive characteristics that might be linked to differences in pollution and environmental conditions at the different field locations.

Aquatic ecotoxicology at the Victorian Centre for Aquatic Pollution and Identification Management (CAPIM)

Dr Jackie Myers

In 2010 I began a new position as an Aquatic Ecotoxicologist with CAPIM and The University of Melbourne. My research at CAPIM focuses on two main areas. Firstly to investigate and develop methods to measure the effects of environmental stressors in both water and sediments using microalgae, which in turn can be used for assessing aquatic health in freshwater systems. Currently I have developed a single species microalgal bioassay using the green alga, *Scenedesmus* sp. We have used the bioassay to determine the effects of a number of pesticides commonly detected in Victorian freshwaters and the next stage of testing will involve using the test to examine the toxicity of field collected water samples.

My second research focus is in the assessment of endocrine disruption in freshwater fish. I am using the mosquitofish, *Gambusia holbrooki*, to assess for signs of endocrine disruption impacts in Victorian freshwater environments. Mosquitofish have been used across Australia and the world as bioindicators of endocrine disruption, however not in Victoria. Mosquitofish were collected from around 40 sites across Victoria and examined for morphological signs of reproductive abnormalities. Results indicated that fish reproductive development was correlated with land use activities and this will led to the development of a further investigation into this correlation for 2011.

Aquatic ecotoxicology and environmental biology at RMIT University

Professor Dayanthi Nugegoda and Dr Jeff Shimeta

RMIT University, School of Applied Sciences

The Ecotoxicology and Environmental Biology research group at RMIT University has been an integral part of the Victorian Marine Science Consortium since its establishment in 1990. It is currently led by Professor Dayanthi Nugegoda and Dr Jeff Shimeta of the School of Applied Sciences with a number of Honours, postgraduate and postdoctoral researchers based at VMSC. The ecotoxicology component includes a number of research projects evaluating the effects of toxicants and environmental stressors on native aquatic organisms with special emphasis on biomarkers of exposure to toxicants and developing new methods of assessing risk to

biodiversity. The marine ecology and environmental science component investigates coastal processes involving invertebrates, microbes, and marsh plants, focusing on environmental issues.

In 2010, the research group consisted of two postdoctoral fellows, 7 PhD, two Masters and three Honours students. One postdoctoral fellow was from Germany on a German research fellowship and one an APDI funded through the ARC Linkage Scheme. The group operates out of the VMSC laboratories, a research laboratory on the RMIT Bundoora campus with an adjacent aquatic facility and an aquatic lab at the RMIT centre on Bullock Island in East Gippsland.

Current aquatic ecotoxicology projects within the group include bioaccumulation of toxicants in little penguins in collaboration with Victoria University and Parks Victoria; the effects of pollutants on the endocrine physiology of Australian fish including a collaborative ARC grant; a native fish bioindicator for Endocrine Disrupting Chemicals in Victorian waters in collaboration with the Centre for Aquatic Pollution Identification and Management (CAPIM), Melbourne University, DPI and EPA; Trace metal pollution from mining in Papua New Guinea in collaboration with the CSIRO; reproductive hormones and Vitellogenin in native fish in collaboration with Fisheries Victoria; developing toxicity tests using native species and the toxicity of nanoparticles. For further details on ecotoxicology research activities contact dayanthi.nugegoda@rmit.edu.au.

Marine ecology projects currently in progress include the consequences of ocean acidification for molluscan shellfish biology; larval settlement of invertebrates and their interaction with protozoa in marine biofilms; and impacts of the invasive salt marsh grass, *Spartina anglica*, on infaunal communities in Victoria. For further details contact jeff.shimeta@rmit.edu.au.

Marine and geological systems at RMIT University

Professor John Buckeridge and Dr Jessica Reeves

Research continues on the Industrial Past - Urban Futures project in the Lower Barwon. This project is looking at the evolution of the estuary and wetlands and particularly differentiating between background climatic change and anthropogenic impacts over the past 170 years. A successful Marine and Geological Systems field course was held in September 2010 at VMSC Queenscliff.

Ecology and environmental management at Victoria University

Dr Carol Scarpaci

Victoria University, School of Engineering and Sciences

The Ecology and Environmental Management research group at Victoria University has expanded their research on anthropogenic impacts on marine megafauna. The marine research team at Victoria University is currently led by Dr Carol Scarpaci and encompasses collaborative work with academics from within Australia (eg Port Stephens Fisheries Institute), and overseas (Massey University, New Zealand). The research team includes both Honours and postgraduate students. The current research projects evaluate the impact that tourism exerts on marine animals (primarily bottlenose dolphins, common dolphins, Australian fur seals and grey nurse sharks), and trace metal uploads in little penguins in Victoria. The research team has also evaluated the impact that the recreational pipi harvest exerts on pipi stock structure. Research publications on these topics have been well accepted in the peer reviewed literature and feature in both international and national journals. Research projects have been funded by a range of research bodies and grant schemes that include, Birds Australia, Earthwatch, Holsworth Wildlife Research Endowment, Department of Primary Industries and DolphinCom. For further details on ecotoxicology research activities contact please contact Carol.Scarpaci@vu.edu.au.

Marine ecology and evolutionary biology at Deakin University

Dr Craig Sherman

Deakin University, Centre for Integrative Ecology, School of Life and Environmental Sciences

In 2010, my research group carried out project work based at the VMSC labs in Queenscliff. This work involved an Honours student and myself and included investigations into understanding the importance of genetic compatibility in determining fertilization success in a number of marine invertebrates, the effect of mating system on population genetic structure, and the effect of thermal tolerance on reproductive success. The Honours project investigated the effects of different dietary microalgae on survival, growth, settlement and fatty acid composition of blue mussel, *Mytilus galloprovincialis*, larvae. While substantial research has been dedicated to determining the most cost-effective and optimal

feed for mussels in aquaculture hatcheries, the specific dietary requirements for larvae through development remain unclear. The objective of the study was to optimise algal multispecies diets for larvae of the blue mussel, *Mytilus galloprovincialis*, with particular focus on reducing the use of *Chaetoceros calcitrans*. Results showed that the micro-algae composition of the diet is crucial to the viability and fitness of the larvae and that mussel larvae will preferentially consume certain algal species. The subsequent results were accepted for publication in the international journal *Aquaculture*.

Ecology of aquatic protozoans, including their roles in biofilms and settlement of invertebrate larvae

Dr Jeff Shimeta

RMIT University, School of Applied Sciences

Protozoans such as flagellates and ciliates play key roles in aquatic food webs by consuming microbes, recycling nutrients, and serving as prey for invertebrates. We are studying several aspects of protozoan species assemblages, distributions, activities, and interactions with environmental factors and other species in aquatic habitats. A current focus is on protozoa in microbial biofilms, and their interactions with settling larvae of invertebrates. Most marine invertebrates have a free-swimming larval stage that selects a suitable substratum site on which to settle and metamorphose into the adult form. Interactions between larvae and microbial biofilms on substrata are important for determining invertebrate recruitment and adult distributions. We are investigating the roles of protozoa in microbial biofilms and their influences on settlement rates and survival of marine invertebrates, focusing on fouling species (e.g. tube worms, bryozoans, mussels, etc.) that colonise hard substrata including rocks, boat hulls, and marine infrastructure. We are also investigating new technologies for anti-fouling coatings on marine infrastructure that will inhibit larval settlement.

Impacts of ocean acidification on marine invertebrates

Dr Jeff Shimeta

RMIT University, School of Applied Sciences

Anthropogenic, atmospheric CO₂ is being absorbed into the oceans where it forms carbonic acid, reducing the pH of seawater as well as the dissolved carbonate available to marine organisms that manufacture calcium carbonate

skeletons (corals, shellfish, plankton, etc.). Detrimental impacts of ocean acidification have already been documented in tropical coral reefs, and there is great concern that major areas of the oceans will become corrosive in the near decades. We are investigating the impacts of reduced pH and elevated temperature on molluscan shellfishes of commercial importance (e.g. abalone, oysters, scallops, mussels). Using controlled laboratory experiments with manipulated CO₂ levels and temperature in aquaria, we are measuring threshold levels of acidification that disrupt various aspects of shellfish biology.

Impacts and control of the invasive salt marsh grass, *Spartina anglica*, in Australia

Dr Jeff Shimeta

RMIT University, School of Applied Sciences

Spartina, known commonly as rice grass or cord grass, was introduced to Australia intentionally to stabilise estuarine sediments, but its extensive spread is altering intertidal habitats and native ecosystems across Victoria and Tasmania. Large-scale control programs are underway to spray these habitats with herbicides, but little research has been done on the specific impacts of *Spartina* in Australia or the environmental consequences of herbicide application. We are investigating the ecological changes in sedimentary communities associated with *Spartina* invasion, and we will begin ecotoxicology studies on herbicide impacts. This research will improve our understanding of invasive species dynamics and will help to inform local management decisions.

PhD

Genetic diversity and mating system in the Australian Blue Mussel

Emi Sherizan Ab Rahim

Deakin University / Fisheries Research Branch (Fisheries Victoria)

Supervisors - Dr. Craig Sherman and Associate Professor John Donald

The Blue mussel, *Mytilus* is one of Australia's rising stars of the aquaculture industry which has significant economic importance. In 2008/09, *Mytilus* was listed among the ten most valuable sectors/species: valued at \$9.4 million, an increase in production value of 13.4% from the previous year (O'Sullivan and Savage, 2011).

Due to a paucity of work about Blue mussel in Australian waters, we conducted components 1 to 4 to enrich the knowledge of this species.

1) *Fertilization success and sperm competition*

Determining the importance of good genes versus genetic compatibility in determining fertilization success in hatchery reared marine mussels, *Mytilus sp.* Another sub component is to conduct paternity test by genotyping six microsatellite markers in order to assign mussel larvae to their parents who were used in a sperm competition experiment.

2) *Species identification*

Mytilus sp. used in (1) and samples obtained from Australian populations (Southern Hemisphere), Japan and United Kingdom (Northern Hemisphere) were subject to molecular species identification using four independent markers; Me, ITS, Glu-5' and 16s rRNA. Unique fingerprints for each individual generated via PCR-RFLP were identified, scored for the presence and absence of RFLP fragments and analysed to determine the identity of all individuals collected. This data is being used to determine if Australian populations have resulted from the introduction of individuals from the Northern Hemisphere or represent a Southern Hemisphere variety.

3) *Population genetic structure and phylogeography for the Australian mussel*

For this, the COI mitochondrial gene from 13 Australian populations and a single population from Mediterranean (Northern Hemisphere) were sequenced. Sequences have been checked for ambiguity and aligned based on their populations. Further analysis to assess phylogeography and genetic diversity parameters are ongoing.

4) *Genetic diversity in mussels reared under hatchery conditions*

There are a number of selective stages during the entire rearing period in a mussel hatchery. While selective culturing is progressively ongoing, only those that are well adapted to the selective hatchery environment will survive selection and thus, will remain in the culturing medium until the larvae will be transferred into the sea. The objective is to determine at which stage within the hatchery rearing period there is the greatest selective effect/ highest or best fit genetic diversity level. Thus, this project will assess levels of genetic diversity (allelic diversity, genetic richness and heterozygosity) at different stages in the hatchery process. This will then be compared to expected levels of diversity based on simulations of the adult genotypes assuming random mating.

Connectivity of intertidal gastropod populations in a system of marine protected areas

Rachael Bathgate

The University of Melbourne, Department of Zoology

Supervisors - Professor Michael J. Keough and Associate Professor Stephen E. Swearer

My project focuses on gastropod assemblages found on intertidal rocky reefs in marine protected areas (MPAs) in Victoria. The overarching objective of my PhD research has been to determine how the recently proclaimed Marine National Parks and Marine Sanctuaries may act as larval sources or sinks for gastropods with different larval dispersal potentials. One of the ways that highly protected MPAs may help to conserve biological diversity is by protecting and enhancing resident spawning stocks. An increase in the size and number of reproductive individuals may result in increased production of gametes or larvae than then disperse to other areas or are retained locally. For most species of marine gastropods, the extent and direction of larval dispersal, and degree of connectivity between local populations are unknown. The creation of a system of MPAs in Victoria (Marine National Parks and Marine Sanctuaries) provides a unique opportunity to investigate these processes in a local context. I am combining biological data (e.g. abundance of adults, recruits, reproductive output, larval duration and abundance) and physical measures (e.g. wind direction, current direction and speed) to see if populations within MPAs are likely to be self-replenishing and the extent to which they act as recruitment sources or sinks.

I have completed the field work component of my project and am focusing on finishing laboratory tasks such as plankton sorting, dissection of specimens for gonad indices and analysing egg masses. I have also undertaken a genetic study to determine the extent of population differentiation in 3 gastropod species having short, long or no larval dispersal.

Thesis submitted December 2010.

Age, growth and reproduction of southern Australian holocephalans (*Rhinochimaera*, *Chimaera* and *Hydrolagus spp.*) and the white-fin swell shark (*Cephaloscyllium spp.*)

Justin D Bell

Deakin University, School of Ecology and Environment / Fisheries Research Branch (Fisheries Victoria)

Supervisors - Dr Laurie Laurenson / Dr Terry Walker

Holocephalans are an ancient lineage of cartilaginous fishes (chondrichthyans) closely related to elasmobranches (sharks, skates and rays). Holocephalans typically inhabit waters beyond the continental shelf and in consequence have received little scientific research, despite being a regular commercial catch. Similarly, the white-fin swell shark (*Cephaloscyllium spp. A*) is one of the most commonly caught bycatch species in Australia however has received no biological research.

My PhD research aims to gain biological information relating to age and growth, diet, reproductive biology and fishery interactions of all southern Australian holocephalan species and the white-fin swell shark, thus providing a basis for sustainable management.

Parasites of Jellyfish

Joanna Browne

Griffith University / Museum of Victoria

Supervisors - Dr Kylie Pitt and Professor Rod Connolly / Dr Mark Norman

My project involves the study of parasites of gelatinous zooplankton. Jellyfish are increasingly being recognised as an important part of the marine ecosystem. In regions around the world jellyfish are increasing in abundance and frequency of occurrence, however, their parasites are poorly studied. One part of my project is investigating the relationships between parasitic hyperiid amphipods, isopods, parasitic anemones and the blue blubber, *Catostylus mosaicus*, in Port Phillip Bay. I am studying temporal variation in abundances of the parasites, whether they are also found on other hosts in the Bay.

The other parts of my project involve studying digenean flukes (Platyhelminthes) which use jellyfish as in intermediate host, between their first host (a mollusc) and their final host (a fish). I am studying the spatial variation of the digeneans from the upside-down jellyfish *Cassiopea sp.* from 4 locations in Queensland, as well as studying diversity of digeneans across a range of jellyfish and ctenophore hosts. I have collected samples from reefs off Townsville, Cairns and Lizard Island as well as in Port Phillip. This has been the first study of digeneans in jellyfish in Australia since an observation was made in 1886. Using DNA

analysis I am linking the larval digeneans found in the jellyfish with the adult form found in fish.

I attended the *Third International Jellyfish Blooms Symposium* from the 14th – 16th July 2010 in Mar Del Plata, Argentina and presented a talk entitled “Investigating life cycles and host specificity of digenean parasites of gelatinous zooplankton using DNA”, for which I was awarded the prize for “Best Student Oral Presentation”. In the week prior to the conference I visited the laboratory of Dr Sergio Martorelli at CEPAVE (Centro de Estudios Parasitológicos y Vectores) in La Plata, a town 3 hours north of Mar Del Plata. At the laboratory learnt new techniques and was able to share my knowledge of DNA editing software with students at the lab.

Gastrointestinal microbiota of seabirds

Meagan Dewar

Deakin University - School of Exercise and Nutrition Sciences

Supervisors - Dr Stuart Smith (School of Exercise and Nutrition Sciences), Associate Prof. John Arnould (School of Life and Environmental Sciences)

Collaborators - Dr Peter Dann, Phillip Island Nature Park; Dr Phil Trathan, British Antarctic Survey; Dr Rene Groscolas, CNRS, France

My research focuses on identifying the phylogenetic diversity of the microbiota of penguins and Procellariiforme seabirds and exploring the variations that occur within the GI tract of different species of seabird, at different life stages and from various locations. To achieve this quantitative Real Time PCR and 16S rRNA pyrosequencing is used to identify and profile the members of the microbial community that occur in the GI tract of seabirds. My results so far have shown that there are significant differences in the microbial community composition of king penguins from different geographical locations, indicating that environmental location and host genetics might be two of the major influential factors shaping the microbial composition of penguins. This research has also identified that there are significant differences in the microbial composition of king, little, gentoo and macaroni penguins. This data adds a third potential factor “diet” to the list of potential influential factors shaping the microbial composition.

I am completing the final analysis of my data that examines (a) development of the gastrointestinal microbiota of little penguins and short tailed shearwaters; (b) gastrointestinal microbiota of short tailed shearwaters, common diving petrels

and fairy prions; and (c) variations in the gastrointestinal microbiota of moulting and non-moulting king, gentoo and little penguins.

Management of the dolphin-swim industry in Port Phillip Bay, Victoria

Nicole Filby

Victoria University

Supervisors – Dr Carol Scarpaci and Dr Karen Stockin

Rapid growth in demand for tourist interactions with free-ranging cetaceans constitutes a major challenge to management (Higham et al. 2009). Many studies have documented the short-term effects of cetacean tourism on behaviour, however the long-term biological consequences for individuals and their populations remain largely unknown (Lusseau & Bejder 2007). This study will document the short and long-term effects of the dolphin-swim industry on bottlenose dolphin, *Tursiops aduncus*, in Port Phillip Bay (PPB) Victoria, Australia, by assessing vocal and non-vocal behaviour.

This population of bottlenose dolphins in PPB is considered vulnerable to extinction due to its small size, genetic distinctiveness, restricted home range, female natal philopatry, high levels of human activity in the area, and a non-compliant commercial dolphin-swim industry (Charlton et al. 2006, Dunn et al. 2001, Hale 2002, Warren-Smith & Dunn 2006, Weir et al. 1996). Outcomes will include the recommendation of appropriate management strategies to maintain the population's viability and development of educational material to increase tourist's biocentric values.

Trace metals in little penguin (*Eudyptula minor*) populations along the Victorian coastline of Australia

Annett Finger

Victoria University

Supervisor – Dr Carol Scarpaci

Determining levels of toxicants in little penguins is of importance due to their trophic status as a top predator. Little penguins accumulate toxicants via their food and can act as a proxy for the health of their local ecosystem. We are collecting non-destructive samples (blood, faeces, feathers, eggs, eggshells and carcasses) to be able to gauge recent exposure levels of several colonies along the Victorian coastline.

The main objectives of this study include: (1) trace metals in little penguins - current exposure;

(2) food link in Port Phillip Bay - bioaccumulation in little penguins at the St Kilda colony; (3) detoxification / offloading - St Kilda and Phillip Island colonies; (4) compartmentalisation of trace metals in little penguins.

This study will become the most comprehensive long-term research on trace metals in little penguins and will provide important information on the conservation of little penguins.

The ecology of hydroids (Hydrozoa: Cnidaria) in Port Phillip Bay, and their impacts as fouling species in longline mussel culture

Isla Fitridge

The University of Melbourne, Department of Zoology

Supervisors – Professor Michael J. Keough and Dr Jan Watson

Hydroids are an important and frequently abundant component of marine sessile communities associated with natural and artificial habitats. Many non-indigenous hydroids are known to exhibit 'invasive' behaviour and have the potential for economic impacts through extensive fouling of piles, pontoons, vessel hulls and aquaculture facilities. My PhD research documents how the hydroid communities of Port Phillip Bay are composed and how these communities change temporally and spatially. The study also examines hydroids as fouling species within local mussel culture operations, and the positive and negative role that non-indigenous hydroid species may play within farms in Port Phillip Bay.

In 2010 I completed all of my field studies and experimental work including monitoring of hydroid larval recruitment and adult populations at several sites around the bay, the effects of hydroids on recruitment of marine invertebrates, a study of the spatial and temporal patterns of recruitment of hydroids and mussels associated with mussel culture in the Bay, and the effects of biofouling by one species, *Ectopleura crocea*, on commercial mussel production.

I was invited to attend and present my research at the 15th International Congress on Marine Corrosion and Fouling in Newcastle (UK). I also undertook a 6-week 'mini-postdoc' in Trondheim, Norway, at the Centre for Research-based Innovation in Aquaculture Technology (CREATE), within the research organisation SINTEF. I was invited there to develop novel ways to tackle hydroid biofouling on nets used in salmon culture, the results of which will be submitted for

publication in 2011. The Norwegian study also provided an opportunity to consider methods to avoid, prevent and treat biofouling outbreaks in Victorian mussel culture, which will be the focus of my postdoctoral research at The University of Melbourne, beginning in 2011 and funded by the Fisheries Research and Development Corporation, on behalf of the Australian Government.

Meta population dynamics in temperate reef fish

John Ford

The University of Melbourne, Department of Zoology

Supervisor – Associate Professor Stephen E. Swearer

I commenced my candidature in late 2008 and am involved in a project identifying rocky reef habitats of high conservation value in Port Phillip Bay, Victoria. Principally I am investigating connectivity of reef fish populations, their productivity and the role of artificial reefs in increasing more persistent and biodiverse assemblages.

To understand productivity, I have surveyed population sizes, fish condition and fecundity in our target species the Southern Hulafish, *Trachinops caudimaculatus*, on 20 rocky reefs in Port Phillip Bay. Like many reef fish this species has larvae which spend up to two months developing in the open waters of the Bay. To identify where these larvae go, and the level of exchange between different reefs, I will use natural elemental markers (otolith microchemistry) to trace the origin of newly settled fish. With knowledge of dispersal pathways, connectivity and dynamics of individual populations, I will develop a metapopulation model of reef fish in Port Phillip Bay. This can be used to identify important source populations, which are crucial to the survival of less productive populations. This will better enable managers to target productive source habitat of high conservation value.

I have also been working with artificial reefs I deployed off Altona in the northwest and Carrum in the east of Port Phillip Bay. I am investigating the factors driving survival in juvenile *T. caudimaculatus* in order to understand why populations are so variable on natural reefs and what determines population persistence or extinction in *T. caudimaculatus*. I have studied colonisation of artificial reefs by benthic and mobile fauna and am investigating whether artificial reefs act as bastions for biodiversity or invasion hubs for invasive species.

Capture-related stress physiology and post-release survival of sharks

Lorenz Frick

Monash University, School of Biological Sciences / Fisheries Research Branch (Fisheries Victoria)
Supervisors – Dr Richard Reina and Dr Terry Walker

Only a few shark species are targeted by commercial fisheries in Australia, but many more are caught as by-catch, and subsequently discarded dead or alive. The fate of sharks released alive is an essential factor for the assessment of the impact of fisheries on shark populations, but is so far completely unknown.

A few studies have addressed the effects of capture on sharks caught in the wild. However, an unambiguous interpretation of results obtained in the wild can be difficult, because many factors, such as water temperature or dissolved oxygen, affect exercise-related physiological processes. To avoid these uncertainties, fisheries capture in this study is simulated in a controlled setting with captive sharks.

The primary aim of this study is to establish reference curves of physiological parameters relevant to the sharks' stress reaction in the lab, demonstrating the change of these parameters over time. Sharks are subjected to various durations of capture stress exposure using longline, gill-nets and trawling.

Aside from providing insight into a poorly understood aspect of elasmobranch biology, the results will help increase the accuracy and power of large scale tagging studies by providing information on a so far unknown, but important factor influencing the probability of recapture of an animal. Data on the post-capture fate of sharks will refine mathematical fisheries management models, and being able to account for the effect of initial capture will benefit other studies that interact with animals in the wild.

Thesis submitted : March 2010

Influence of environmental factors on population structure of arrow squid *Nototodarus gouldi*: implications for stock assessment

Corey Green

University of Tasmania / Institute for Marine and Antarctic Studies / Fisheries Victoria / CSIRO

Supervisors - Professor Natalie Moltschanivskyj / Dr Patti Virtue / Dr George Jackson / Dr Terry Walker / Dr David Smith

My research revolves around studying population dynamics of the arrow squid *Nototodarus gouldi* from southern Australia. The project focuses on the use of squid statoliths which are paired calcareous structures found in the cranium. From a fisheries management perspective, statoliths are considered valuable and routinely used in acquiring biological and population based parameters. Statoliths are like an aeroplanes 'black box', capable of recording and storing information over time. They can be prepared to reveal daily growth increments, and may be capable in providing life history information. Ensuring sustainability of separate stocks within a population or fishery is fundamental when establishing or refining management regulations, but this relies on estimates of biological and ecological processes in response to environmental factors. The aim of this study was to analyse population stock structure, recruitment variability, migratory characteristics, and catch composition of the arrow squid *Nototodarus gouldi* collected in the Great Australian Bight (GAB) and Victoria from 2007 – 2009 which will be used for future assessment of the resource. This research contributed to a larger FRDC project which is presently in the final stages of completion.

Estimating and improving the survival of recreationally caught and released fish

Daniel Grixti

Deakin University /Fisheries Research Branch (Fisheries Victoria)

Supervisors – Professor Gerry P. Quinn / Mr Simon Conron

Legal minimum length (LML) and daily bag limit (DBL) are widely used management tools for recreational fisheries. The use of a LML and DBL is based on the presumption that released fish survive. If survival rates after capture and release are low then the total kill in the fishery will be under-estimated and the value of management measures will be compromised. Snapper, *Pagrus auratus* and black bream, *Acanthopagrus butcheri*, are two principal target species in Victorian marine and estuarine recreational fisheries and both are managed by LML and DBL. The National Recreational and Indigenous Fishing Survey (NRIFS) (Henry and Lyle 2003) reported that 401,000 snapper and 840,000 black bream were caught and released by anglers fishing in Victorian waters in 2000/01.

My PhD is investigating the survival of recreationally caught snapper and black bream

after their release to the water. Experiments are based on capture and holding methods commonly used in this type of research. I am also exploring ways of improving this release survival through hook and angling technique changes. A post mortem procedure has been developed to enhance outcomes of this released fish survival research.

My project is part of the National Released Fish Survival program initiated by Fisheries Research and Development Corporation (FRDC). FRDC and Fisheries Victoria have jointly funded this research.

Effects of ocean acidification on calcifying marine animals (abalone and blue mussels)

Fatemeh Hazeribaghdadabad

RMIT University, School of Applied Sciences
Supervisors – Dr Jeff Shimeta and Professor Dayanthi Nugegoda

Ocean acidification has already started over the past 200 years as a result of rapid increase in atmospheric CO₂ concentration. The effect of it has been investigated on both non-calcifying and calcifying organisms. All of them agree that the ocean acidification has detrimental effect on sea creatures. Mussels are one group of the marine calcifying animals that showed detrimental effect on their growth and health facing ocean acidification.

Abalone and blue mussels are marine calcifier organisms that have not been studied yet. They have a broad distribution around the world and are important commercial species due to their usefulness as a food source, tools and equipments and wealth. They are ecosystem engineers, carbonate producers, food source for other marine organisms and important indicator species for pollution.

The effect of ocean acidification on these important species has not been investigated yet. Knowing how the effect will be like, we will be able to find the way to avoid them.

This research will be conducted on two species of abalone and blue mussel. Abalone at both life stages of larvae and juvenile, and blue mussels at the larval stage.

Anthropogenic effects on the fish fauna in Port Phillip Bay, Victoria

Christian Jung

The University of Melbourne, Department of Zoology

Supervisors – Associate Professor Stephen E. Swearer and Professor Michael J. Keough

My PhD studies, involve working on anthropogenic effects on the fish fauna in Port Phillip. Studies assessing the spatial and temporal variation of ichthyo-assemblages on shallow rocky reefs around the Bay are concluded. Studies assessing whether any evidence for impact of boating and angling on fish communities can be found, will be concluded by the end of 2008. Simultaneously I am analysing whether those impacts, or 'natural' habitat features seem to be of more importance in shaping the fish communities in the areas I survey. To assess the angling and boating activity I am using time lapse photography. This enables me to gather direct empirical data of those disturbances.

Of all the anthropogenic impacts, I am particularly interested in noise pollution. Contrary to popular belief, the underwater world is a noisy environment. Fishes utilise sound as a source of information about their immediate surroundings and actively communicate via sound. Yet growing input of sound from anthropogenic sources, i.e. noise pollution from boats, ships etc., threatens to mask natural sound signals or otherwise disturb the reef fish communities. I am currently compiling a 'soundscape' of Port Phillip, recording and analysing sound, both natural and anthropogenic. Experiments around the effect of such noise pollution are under way and will continue until mid 2009.

Finally my studies entail a sociological component. I am conducting qualitative interviews with long time bay divers and anglers, about their perception of changes in and around the waters of Port Phillip.

Thesis submitted September 2010.

Population and trophic dynamics of red cod, *Pseudophycis bachus*

Jodie Kemp

The University of Melbourne, Department of Zoology

Supervisors – Associate Professor Stephen E. Swearer and Dr Greg P. Jenkins

Otolith shape is often used to facilitate the identification of teleost prey species in marine diet

studies. However, fine-scale variation in otolith shape among different species, and the added effect of partial digestion of otoliths, can often limit the ability to identify prey species.

The objective of this research was to evaluate the potential use of 1) fine-scale shape differences using Fourier shape analysis and 2) microchemical differences using laser ablation inductively coupled plasma mass spectrometry (LA-ICPMS), in digested otoliths to identify fish prey species within the diet of predators. Belonging to the family Moridae, red cod, *Pseudophycis bachus*, and bearded rock cod, *Pseudophycis barbata*, are found in the shelf waters of south-eastern Australia and New Zealand. *Pseudophycis* species are important to a range of predators including the Australian fur seal, *Arctcephalus pusillus doriferus* at Phillip Island Australia.

Both techniques revealed that the abundance of red cod is higher in the diet of the seals relative to bearded rock cod. The use of otolith shape analysis techniques to identify prey species where otoliths have fine-scale shape differences were found to be effective, however, should be used with caution as the effects of digestive processes can be significant. The use of core-region otolith microchemistry as a method to distinguish prey species was also found to be effective, and shows potential to provide a means to establish more direct links between predators and the geographical source of their prey.

Thesis submitted November 2010.

Advancing the sustainable management of benthic invertebrate fisheries

Grant Leeworthy

Deakin University, School of Life and Environmental Sciences

Supervisors – Associate Professor Laurie Laursen and Dr Paul Jones

Invertebrate fisheries management requires particular emphasis through further research to determine the most appropriate means by which production can be optimised sustainably. Fisheries for sea cucumber will be studied to determine potential improvements to the stock assessment, harvesting and management regimes. Advancements in the assessment and management of these resources will also have application to other invertebrate species. The study will follow the following key themes:

- Spatial management : a set of spatial management regimes will be developed through the use of GIS software and habitat

mapping; this method of management will then be compared to a fine scale adaptive approach.

- Output management : spatially relevant population assessment and modelling will be developed for sea cucumbers.
- Assessment improvement : further development to the survey methods employed for abalone, sea cucumber and crown of thorns starfish populations will be completed. A high-speed quantitative assessment method will be developed and applied for sea cucumber populations.
- Ecosystem management : ecosystem impacts from the removal of a sea cucumber (burrowing blackfish) will be investigated. A management strategy for the mitigation of any detected effects will be devised and applied.

Larval recruitment patterns in Victoria's marine reserves

Malcolm Lindsay

The University of Melbourne, Department of Zoology / Parks Victoria

Supervisors – Associate Professor Stephen E. Swearer, Professor Michael J. Keough / Dr Anthony Boxshall

Worldwide, marine reserves are being widely advocated as a tool for the conservation and management of biodiversity and fisheries. The successful siting and management of a marine reserve is dependent on the biological processes of the species involved. Of these processes, larval dispersal and recruitment is critical yet difficult to manage due to knowledge gaps and logistical difficulties. My project aims to investigate the recruitment patterns of different taxa at a number of Victoria's marine reserves, through quantifying both the oceanographic and recruitment conditions within and around the marine reserves. Oceanographic data collected using Acoustic Doppler Current Profilers (ADCP) and temperature loggers will be matched to weather conditions to look for commonly occurring oceanographic patterns. This will then be linked to recruitment data, gathered from different larval collectors, to model links between the oceanographic and recruitment patterns. Different areas within and around the reserves can then be given dispersive indices, which directly relate to management goals. Through the linkage of this project with Parks Victoria, Victoria's reserve management body, the results will directly aid the management of the current reserves and the siting of any in the future.

The effects of fishing on target, byproduct and bycatch chondrichthyan species in southern Australia

Camila Martins

Monash University / Fisheries Research Branch (Fisheries Victoria)

Supervisors – Dr Richard Reina / Dr Terry Walker

The aim of this research is to better understand the effects of fishing on target, byproduct and bycatch chondrichthyan species; and to provide information for fishery stock assessment and ecological risk assessment from the effects of fishing needed for effective conservation and management of populations of this group.

As known, fishing procedures, which involve capture in fishing gear, subsequent handling and exposure to air for discarded catch, can cause physical injuries and acute stress to the fish, affecting consequently their physiology, reproduction, behaviour and survival. With the intention of obtaining comprehensive results, the objectives of the present study are: investigate the effects of fishing using different types of fishing gear; document handling practices; assess the extent of external physical injuries; assess stress-related physiological, reproductive and behavioural changes; and investigate short and long-term post-release survival of discarded catch.

To achieve the objectives of this research, two procedures have been conducted. Procedure 1 is a field survey on commercial and recreational fishing boats; and Procedure 2 involves laboratory experiments followed by acoustic tracking in the wild. Handling practices and condition of each animal, including external physical injuries, have been recorded in datasheets and classified according to predetermined categories. Physiological and reproductive stress response variables for each animal have been measured by haematological and biochemical analyses of blood samples. Short and long-term post-release survival of some animals will be studied using acoustic manual tracking and automated monitoring.

The effects of fishing will be assessed on chondrichthyan species in captivity and in the wild, and then results of both will be compared. The combination of laboratory and field procedures is required to better assess post-release survival of the fish. Laboratory experiments will be used to assess fish response to different stressors, with stress responses and recovery being measured. In the field, post-release survival will be investigated by animal

condition, sampling blood of wild fish from a variety of fisheries, and by acoustic tracking.

The effect of feed supplemented with Omega – 3 polyunsaturated fatty acids on cultured abalone

Hints Mateos

Victoria University, School of Biomedical and Health Sciences / Deakin University, School of Medicine

Supervisors – Dr Xiao Su / Dr Paul Lewandowski

Abalone is a rich source of omega -3 long chain polyunsaturated fatty acids (n -3 LC PUFA). There is an increasing interest in these fatty acids because studies have shown that they can reduce the risk of cardiovascular disease as well as a range of other disorders.

Abalone is an important fishery in Australia and its production accounts for more than 50% of the global market. Currently the Australian wild abalone fishery earns about AU\$200 million each year. However, due to rapidly increasing demands from local and global markets, the wild fisheries are under strict and limited production quotas, and there is now growing investment and research interest in aquaculture production of abalone.

Previous studies showed that cultured abalone contained lower level of n-3 PUFA than wild abalone. The similar results have also been reported on fish. Therefore concern has been expressed in recent years worldwide that consumption of cultured marine species would not give the same nutritional value as the wild species.

The proposed research will investigate the effects of feed incorporated with fish oil on the lipid profiles of cultured adult hybrid abalone. The study also aims to examine the growth and development of cultured abalone fed by different concentrations of fish oil supplements. In addition this project will investigate the effects of replacement of fish oil with vegetable oils on the growth performance and lipid profiles of cultured abalone. Furthermore the effects of fish oil and vegetable oil supplementation on mRNA proteins associated with lipid metabolism in abalone will be investigated. The study will provide useful information for aquaculture and food industries as well as to nutrition and consumer groups.

Searching for the Stars: Assessing searcher efficiency, monitoring and management for an introduced marine species, *Asterias amurensis*

Kimberley Millers

The University of Melbourne, School of Botany
Supervisors –Dr Michael McCarthy and Dr Jan Carey

Globally, extensive survey programs have been undertaken in marine environments to document the distribution of invasive marine species. Our ability to manage a spreading introduced marine species is often impeded by the lack of scientific information and limited resources. Therefore, management strategies aimed at controlling marine invasive species are often continuously under review and updated. The use of mathematical modelling to assist in wildlife management problems has allowed the incorporation of ecological, socio and economic factors in making better-informed decisions. The northern Pacific seastar, *Asterias amurensis*, is an example of where assessing and incorporating factors into monitoring and management decisions can aid in reducing the spread of this invasive species in Victoria. This study aims to determine and evaluate; (i) the influences of detection (ii) the search strategy used during monitoring, (iii) the allocation of time and financial resources to monitoring and (iv) the current and previous monitoring strategies undertaken for *A. amurensis* in Victoria. The findings of this study will assist managers utilise resources when managing incursions of *A. amurensis* and other similar species across the southern Australian coast.

Colonisation and usage patterns of fish, invertebrate and algal communities on artificial reefs in Port Phillip Bay and an evaluation of their benefits to recreational anglers

Kade Mills

Deakin University / Fisheries Research Branch (Fisheries Victoria)

Supervisors – Professor Gerry P. Quinn, Dr Daniel Ierodiaconou / Dr Paul Hamer

This study will describe changes in fish, selected invertebrate and algal communities resulting from the deployment of artificial reefs for enhancing recreational fishing in Port Phillip Bay. It will also investigate the response and perceptions of recreational fishermen to the reefs. The aims are to: 1) describe changes in fish, invertebrate and fouling communities following deployment of

artificial reefs; 2) investigate the colonisation and usage patterns of artificial reefs by key recreational species; 3) compare and contrast movement and usage patterns of snapper (*Chrysophrys auratus*) on natural and artificial reefs; and 4) contrast actual with perceived socio-economic benefits of artificial reefs.

Throughout the year I gave presentations to: St Olaf (USA) students; MDC staff and volunteers; AMSA post-graduate 'mini' conference; Radio Marinara on RRR, and *Reefwatch* at the Melbourne Aquarium.

Using larval ecology to investigate recruitment variability in snapper (*Chrysophrys auratus*, Sparidae)

Hannah Murphy

The University of Melbourne / Fisheries Research Branch (Fisheries Victoria)

Supervisors – Associate Professor Stephen E. Swearer / Dr Greg P. Jenkins and Dr Paul Hamer

Snapper, *Chrysophrys auratus* (Sparidae), are the basis of important recreational and commercial fisheries in southern Australia. Snapper have high juvenile recruitment variability, which is considered the major driver of the dynamics of snapper fisheries. In Port Phillip Bay, Australia, snapper larvae have been surveyed annually from November to January since 2004/05.

Despite a consistently strong adult fishery over the last 5 years, the number of pre-metamorphic snapper larvae sampled each year has varied by 10 fold. Furthermore, the interannual variation in larval abundance closely matches variation observed in the number of older juveniles of the same year groups (cohorts). This project aims to test the hypothesis that the observed high recruitment variation of snapper in Port Phillip Bay is driven by inter-annual variation in zooplankton prey abundance and/or composition, which may affect the diet, growth, and mortality of snapper larvae. To assess whether variable larval growth and feeding conditions are important in influencing high recruitment variation, I will firstly describe larval snapper diets, age and growth across seven cohorts in Port Phillip Bay (2004/05 to 2010/2011). Secondly, I will compare zooplankton densities to larval diet, growth and recruitment patterns. Finally, I will investigate diurnal vertical behaviour of snapper larvae in the water column. The outputs from my studies will provide essential information on larval behaviour, growth, and feeding of a key temperate fishery species and will contribute towards the development of a bio-physical model of snapper recruitment in Port Phillip Bay.

Ecological risk assessment from the effects of fishing for batoids in south-eastern Australia

David Phillips

Deakin University, School of Ecology and Environment / Fisheries Research Branch (Fisheries Victoria)

Supervisor – Dr Terry Walker

Declines have been reported in chondrichthyan by-catch populations around the world. Chondrichthyan populations are particularly vulnerable to harvesting pressure because of the life history traits they exhibit, such as low fecundity, low natural mortality, delayed maturation and slow population growth. Most population analyses require large data sets collected over an extended period. In the case of many chondrichthyan species, management action is required long before such data sets can be available. Rapid assessment of ecological risk should be applied to chondrichthyan species to evaluate and rank on their need for immediate management and further research. Such assessments require information about the basic biology of species, such as age at maturity, average fecundity and maximum age. These variables can be used to rate species in their ability to withstand harvesting pressure.

This project aims to collect biological information about the basic biology for the purpose of ecological risk assessment for three species of large batoid chondrichthyans; southern eagle ray, *Myliobatis australis*, smooth stingray, *Dasyatis brevicaudata* and the black stingray, *Dasyatis thetidis*.

Animal movements are being studied with manual acoustic tracking, and 24 Vemco VR2 passive acoustic listening stations set up in Swan Bay (Port Phillip Heads Marine National Park), and off Queenscliff and St Leonards. Southern fiddler rays, *Trygonorrhina fasciata* and eastern shovelnose stingray, *Trygonoptera sp.* have been both manually tracked to study detailed habitat preference and movements. Passive monitoring has revealed broader differences in habitat preference, emigration rates and site fidelity. The degree of protection provided by the marine protected areas has been quantified. Smooth stingray and southern eagle ray are also to be tagged, tracked and monitored. The existing ecological risk assessment framework is being adapted to include these data.

Variation in individual quality of Australasian gannets, *Morus serrator* : implications for seabird conservation and management

Tanya Pyk

Deakin University, School of Ecology and Environment

Supervisor – Dr Mike Weston

A series of recent long-term studies have indicated that only a few 'high quality' individuals within a population may contribute most to subsequent generations. Protecting these 'high quality' individuals is therefore of critical conservation importance in ensuring the long-term survival of a population. However, identifying these individuals and defining what distinguishes them has proven difficult due to technical limitations in studying the foraging behaviour and energetics of marine predators at sea. Recent developments in technology have enabled the creation of 'bio-loggers', small recording devices capable of collecting detailed information on the foraging behaviour and energy expenditure of marine predators at sea. Taking advantage of this recent advance in technology, this project is using multiple recording devices attached to free-ranging Australasian gannets breeding in Port Phillip Bay to measure the foraging performance and movements of individuals of differing parental quality. Therefore, this project will improve our ability to identify and protect those 'high quality' individuals within a population that will make a significant contribution to subsequent generations. Such information is of critical conservation importance, particularly for populations of threatened or endangered species.

The fieldwork for this study is being conducted at the colony of Australasian gannets, *Morus serrator*, established at Pope's Eye marine Reserve (38°16'42"S. 144°41'48"E.). This site is part of the Port Phillip Heads Marine National Park, located near the entrance to Port Phillip Bay, approximately 3km southeast of Queenscliff, Victoria. The colony was established in the mid 1980s and all suitable nesting space is now fully occupied, with approximately 200 pairs breeding annually.

Uterine accommodations for gestation and ecological risk assessment in the southern fiddler ray, *Trygonorrhina fasciata*

Matthew Reardon

The University of Melbourne, Department of Zoology / Fisheries Research Branch (Fisheries Victoria) / The University of Indiana

Supervisors – Professor Marilyn Renfree / Dr Terry Walker / Dr W.C. Hamlett

The southern fiddler ray presents an interesting case study of myriad reproductive modes of chondrichthyans. My project is investigating what role the uterus plays in nutrient transfer, waste disposal and gas exchange during gestation, through histology, electron microscopy and analysis of uterine fluids. This will uncover what function the uterus performs at various stages of gestation by looking at cell morphology, and identifying any secretory activity and its composition. The southern fiddler ray is viviparous yet the embryos are contained in a substantial tertiary egg envelope similar in appearance and thickness to some egg-laying, or oviparous species. This species may represent a kind of transitory phase between viviparity and oviparity and will provide an interesting insight into the modifications of uterine function if this is the case.

This project is part of a larger project assessing the ecological risk of chondrichthyans affected by commercial and recreational fishing activities. By taking length and weight measurements and classifying the reproductive state of animals through the use of both validated and unvalidated indices, we can construct models of the populations being studied to understand the relative risk each species faces from a particular fishing activity.

I will incorporate my reproductive studies as a means to validate assumptions of the stage of maturity, essential to the accuracy of these population models. This will determine if previously used indices are accurate for the southern fiddler ray.

Life history traits of dogfishes inhabiting the continental slope of south-eastern Australia

Bastien Rochowski

The University of Melbourne, Department of Zoology / Fisheries Research Branch (Fisheries Victoria)

Supervisors – Dr Rob Day / Dr Terry Walker

As archetypal K-strategy animals with low biological productivity, sharks exhibit wide diversity among their life history strategies. They are a successful group tending to occupy high trophic levels during the past 450 million years. South-east Australian stocks of slope dogfish

species are heavily exploited. While little is known about their biology and ecology, they are highly lecithotrophic and have particularly low biological productivity, and thus be vulnerable to effort of fishing. Life history parameters are being estimated to provide a basis for fishery stock assessment, species extinction risk, and ecological risk assessment. The present study focuses on the life history patterns of dogfish comparing new data on *Deania calcea* and *Squalus chloroculus* with published information on other Squalid species and groups. Improved understanding of the reproduction, growth and mortality of these species will provide a basis for better fishery management and sustainability of the resource.

The influence of variable recruitment on the structure and development of marine epifaunal communities

Michael Sams

The University of Melbourne, Department of Zoology

Supervisor – Professor Michael J. Keough

The presence of planktonic larval life stages in many marine animals creates great variability in the timing and location of recruitment. This variation in recruitment is considered to have important consequences for marine populations and communities. Whilst the sources of variation in recruitment and its consequences on populations have been relatively well studied in many marine environments, the influence of variable recruitment on the structure and development of whole communities is poorly understood. I am adopting an experimental approach that examines how variation in recruitment influences the development and structure of local communities of sessile invertebrates (epifauna) at three sites in Port Phillip Bay, Australia.

Using artificial substrates, I am manipulating the recruitment patterns of common species of sessile invertebrates and following the subsequent development of communities. More specifically, I am examining a) how variation in initial recruitment of single species influence community structure; b) how different temporal patterns of recruitment influence community structure (including the influence of ongoing recruitment); and c) how variation in recruitment interacts with the properties of established communities (e.g. species diversity, structural complexity etc.) to influence changes in community structure. By separating out these various factors I hope to elucidate the complex

ways that variation in the recruitment can influence marine community development.

Sexual selection in the sea: the evolution of multiple mating (polyandry) in dumpling squid, *Euprymna tasmanica*

Zoe Squires

The University of Melbourne, Department of Zoology / Monash University / Museum Victoria
Supervisors – Dr Devi Stuart-Fox / Dr Bob Wong / Dr Mark Norman

Sex differences in reproductive investment play a crucial role in sexual conflict. One especially intriguing and controversial aspect of sexual conflict is the evolution and maintenance of female multiple mating (polyandry), particularly in systems where females receive no obvious direct benefits (such as a nuptial gift) from mating multiply, and where mating is highly costly.

Under such scenarios, theory predicts that polyandrous females may be able to increase their reproductive success by taking advantage of the genetic benefits of mating with multiple males. These benefits can be in the form of 'good' genes obtained by trading-up partners, or 'compatible' genes obtained by females hedging their bets. Determining the benefits of polyandry has important implications for the maintenance of genetic variation and the evolution of mating strategies. Cephalopods exhibit a diverse array of reproductive behaviours from sexual cannibalism to spermatophore implantation and all species mate multiply.

Despite the potential for strong sexual selection to be occurring in this group, very few studies directly test it. My research focuses on determining the benefits of polyandry using a species of squid native to Port Phillip Bay and the coast of Southern Australia, the Dumpling Squid, *Euprymna tasmanica*.

I received the following awards and grants in 2010:

- VMSC postgraduate award
- Holsworth Wildlife Endowment (\$7000)
- International Society for Behavioural Ecology Poster Prize
- Melbourne University Study Abroad Award (MATS).

Sublethal effects of mercury and DDE on Australian black bream, *Acanthopagrus butcheri*

Lisa Toogood

RMIT University, Department of Biotechnology and Environmental Biology

Supervisor – Professor Dayanthi Nugegoda

Current age structures of *Acanthopagrus butcheri* within the Gippsland Lakes suggest that recruitment have been episodic since 1981 and low for three years in succession. There has been an absence or low abundance in commercial catches of the Gippsland Lakes black bream cohorts spawned in 1988, 1990 and 1991. This indicates poor spawning success and/or low survival of early life history stages of the fish spawned in these years. Toxicants can exert a direct effect on fish, which can range from death (where concentrations are high) to impaired reproduction and growth (as a result of chronic or intermittent exposures). Organochlorine pesticides (such as DDT and its derivatives) are known to have mild oestrogenic effects on fish, leading to reproductive impairment, however, scientific knowledge relating to the endocrine disruptive properties of this pesticide are still developing. As mercury and DDT are present in the Gippsland Lakes, it is important to understand their physiological effects on the reproductive and thyroid hormone concentrations of *A. butcheri*.

Evidence from toxicological literature suggests the gamete (eggs and sperm), embryo and larval stages of many fish species are the most sensitive to pollutants. There has been little or no biological or physiological assessment of the impacts of contaminants on the early life stages of fish in the Gippsland Lakes. Specific tolerances of *A. butcheri* eggs and larvae to waterborne contaminants (such as heavy metals and organochlorine pesticides) are not known. Thyroid hormones have been implicated as important regulators of early developmental rates in the embryos and larvae of teleosts.

It is important to examine these hormones and the effects of mercury and organochlorine pesticides on these hormones, as a possible explanation for the recruitment failure of *A. butcheri* in the Gippsland Lakes.

Reproductive biology of Urolophids (stingarees) found in south-eastern Australia

Fabian Trinnie

Deakin University, School of Ecology and Environment / Fisheries Research Branch (Fisheries Victoria)

Supervisors – Dr Paul Jones, Dr Laurie Laurenson / Dr Terry Walker

Studies of the reproductive attributes such as maturity, maternity and litter size of the sparsely-spotted stingaree, *Urolophus paucimaculatus*, eastern shovelnose stingaree, *Trygonoptera sp B.*, banded stingaree, *U. cruciatus*, wide stingaree, spotted stingaree, greenback stingaree, *U. viridis*, and sandyback stingaree, *U. bucculentus*, of south eastern Australia will be undertaken during this project.

Commercial fisheries including Danish seiners, trawl netters and beach seiners that catch these animals, discard them as bycatch as they have no commercial value, but it is unknown as to whether these fishing techniques have an impact on their populations. The aim of this project is to compare between each species for future fisheries stock assessments, ecological risk assessments and threatened species evaluations.

The breeding biology of the white-faced storm petrel, *Pelagodroma marina*, in Victoria

Megan Underwood

Deakin University, School of Life and Environmental Sciences

Supervisor – Professor Marcel Klaassen

The white-faced storm petrel, *Pelagodroma marina*, is restricted to three breeding colonies within Victoria: Mud Islands and South Channel Fort in Port Phillip Bay, and Tullaberga Island off Mallacoota. Numbers of storm petrels breeding on Mud Islands have declined considerably since early last century possibly a result of the significant vegetation changes, together with increases in local populations of other species of birds, most notably, silver gulls, *Larus novaehollandiae*, Australian white ibis, *Threskoirnis molucca*, and straw-necked ibis, *T. spinicollis*. The breeding area available to the storm petrels appears to be limited by the recent arrival of the ibis which now breed on the islands in large numbers (approximately 50,000 pairs). The impact of these changes on the storm petrels is poorly understood, and knowledge of the breeding biology of this species is currently limited. This study aims to examine the interactions between the storm petrels, ibis, and vegetation through experimental manipulation of different habitat types and recording of the breeding success, burrow density, and chick

growth. In addition, further information regarding the breeding biology and ecology of the storm petrels will also be obtained. This information will assist in appropriate management and conservation of this species in the future.

Reproductive behaviour in the Southern Bottletail Squid

Benjamin Wegener

Monash University

Supervisor – Dr Bob Wong

In 2009 I started my PhD at Monash University, studying the male reproductive strategies of the Southern Bottletail squid, *Sepiadarium austrinum*. Using this species as a model organism my research focuses on (a) how male investment decisions can be influenced by physical condition and the risk and intensity of sperm competition, and (b) what impact these investment decisions have on eventual reproductive success.

My current experiments running between 2010/12 involve laboratory mating trials and paternity analysis. Juveniles are caught in the wild between the months of February and May and raised in the lab until sexually mature. Male reproductive effort during mating events is then being assessed through the manipulation of male and female physical condition and mating history. This reproductive effort is then being correlated with eventual reproductive success by comparing mating strategy with the proportion of offspring sired. Through this research I hope to further the recent developments made by male mate choice and sperm competition models on current sexual selection theory.

Funding for this project is being provided by Monash University, the Hermon Slade Foundation, the Holsworth Wildlife Research Endowment, the Linnean Society of New South Wales and the Ecological Society of Australia.

The influence of freshwater flow on salt-wedge dynamics and fisheries productivity in the Gippsland Lakes

Joel Williams

The University of Melbourne, Department of Zoology

Supervisors – Associate Professor Stephen E. Swearer, Dr Greg P. Jenkins and Dr Jeremy Hindell

Acanthopagrus butcheri, black bream is the only estuarine dependant sparid species in the world. There are large commercial and recreational fisheries for black bream and over the past

decade CPUE data from the commercial fisheries has shown a decline. A potential reason for this decline could be due to a decrease in freshwater flow into the estuaries resulting in decreased optimal spawning habitats. Freshwater flow into estuaries is an important component as it supplies nutrients and sediments that are important to productivity as well as maintaining necessary levels of dissolved oxygen and salinity.

My research aims were to determine the spatial and temporal patterns of black bream eggs and larvae and relate this to physico-chemical structure of the estuary and prey availability. The Gippsland Lakes were chosen as my study site as it is Australia's largest estuarine lagoon system with high environmental significance as well as supporting Australia's largest black bream commercial fishery. In 2007 I surveyed 23 sites in the Mitchell, Nicholson and Tambo Rivers and selected sites in the lakes. I found that although black bream eggs were collected at all 23 sites, more than 99 % for larvae collected came from river sites, in particular upper river sites. In 2008, stratified plankton tows in the Mitchell River revealed there was clear spatial coupling between location of the halocline, and high abundances of black bream larvae and their prey. These results demonstrate the importance of the freshwater / saltwater interface, therefore freshwater flow, to successful production of black bream eggs and larvae.

Masters

Effects of near-future ocean acidification and sea surface temperature warming on the abalone *Haliotis rubra-laevigata*

Julian Atchison

The University of Melbourne, Department of Zoology / RMIT University

Supervisors – Dr Rob Day / Dr Jeff Shimeta

Given that even conservative estimates predict a fall in the pH of surface seawater of between 0.4 and 0.5 units from current levels by the end of this century, the level of impact on marine life affected by such a change must be assessed quickly and thoroughly. To date most ocean acidification studies have been short term and focused on at best one or two physiological responses of an organism to the changing conditions, but we need to deduce more fundamental response mechanisms that allow us to predict the impact of long term ocean acidification, including on species other than the study organism. A first step

will be to integrate various physiological and biochemical responses into a total or “whole-organism” picture of ocean acidification that may allow us to at least assess the viability of the target species under future conditions, and possibly species closely related to it. A raft of responses of the abalone *Haliotis rubra-aevigata* (an aquaculture hybrid) to future surface seawater pH levels and temperature will be assessed and integrated, among them haemolymph chemical composition, condition of kidney and gill tissues, immune function and shell mineral content, microstructure, and fracture strength. Preliminary results indicate a significant effect of acidified seawater on several haemolymph chemistry parameters, as well as visible degradation of shell surface and loss of shell color with long exposure times (>3 months). Given that most, if not all abalone aquaculture facilities source their seawater directly from the ocean with no chemical treatment, the results of this project could shed light on the future viability of these aquaculture setups, as well as potential effects on the wild abalone industry, moving towards 2100. Assuming similar responses to ocean acidification throughout the *Haliotis* genus, the results would also have implications for abalone industries in about a dozen abalone producing countries with similar temperature ranges to southern Australia.

An investigation of two introduced species in Swan Bay, Victoria

Carlie Alexander

The University of Melbourne – School of Botany
Supervisor – Dr Jan Carey

Introduced marine species pose a threat to their recipient environment, and have an impact on the native species living there. The introduction of such species is one of the biggest threats to marine biodiversity worldwide. Swan Bay is located north of Queenscliff, and is a small marine bay that opens into Port Phillip Bay. This habitat is one of the most diverse along the Victorian coastline, and is very ecologically important. In 2008 two invasive species *Codium fragile* ssp. *fragile* (Dead Man’s fingers) and *Asterias amurensis* (the Northern Pacific Seastar) had spread into Swan Bay, warranting an investigation into the introduced and invasive species found within Swan Bay. In two separate studies, I examined these species as well as other native inhabitants.

My first study investigated the different invertebrates and algae settling in three sites within Swan Bay and Queenscliff harbour, as well as one site at the Queenscliff boat ramp to use as

a comparison, to determine whether there was a difference in the number and types of species present within these three locations.

My second study was a survey of Swan Bay that concentrated on the two invasive species, *Codium fragile* ssp. *fragile* (Dead Man’s fingers) and *Asterias amurensis* (the Northern Pacific Seastar). My aim was to determine whether their abundance and location had a relationship with the manmade structures present in Swan Bay.

Identifying early life history traits that influence the dispersal of larvae in live-bearing temperate reef fishes

Natalie Calder

The University of Melbourne, Department of Zoology

Supervisor – Associate Professor Stephen E. Swearer

Weedfish are cryptic fishes inhabiting temperate marine waters worldwide. Of the 36 species known to occur in southern Australian waters all but three are Australian endemics. Weedfish are viviparous fishes, meaning that they give birth to live young, and larval weedfish are developmentally advanced at birth. Although viviparity within the family has been found to contribute to both species, diversity and the high degree of sympatry amongst Australian weedfishes, little is known about larval biology and the importance of larval dispersal to population connectivity. My project aims are to explore larval dispersal in Victorian weedfish species using a combination of field, behavioural and morphological studies. The results of my study will be useful in interpreting the systematic relationships and biogeography of weedfishes within Victoria and may also provide insights for conservation and resource management.

Energetic, predation and lifetime costs incurred during mating in dumpling squid, *Euprymna tasmanica*

Amanda Franklin

The University of Melbourne, Department of Zoology

Supervisor – Dr Devi Stuart-Fox

Despite the benefits of sexual reproduction, various costs are associated with mating such as injury and a reduced lifespan, yet these costs have been comprehensively examined in very few taxa. Cephalopods (squids, octopus and cuttlefish) exhibit a variety of costly mating strategies, such as extended copulation (>1

hour). All species studies to date are polyandrous (females mate multiply), which may compound the costs associated with mating. I investigated three potential costs of mating in dumpling squid (*Euprymna tasmanica*); energy expenditure, increased predation risk and reduced female longevity. Squid were able to swim against a current for significantly less time after mating than prior to mating, regardless of sex, mating duration or mass, demonstrating a clear energetic cost of mating. I then investigated predation costs of mating by measuring the behavioural response of mating pairs to three different predation environments (no predator, predator introduced before mating commenced and predator introduced during mating). Preliminary results indicate that squid mate for a similar duration in all three situations but are much more likely to exhibit defensive and escape behaviours in response to a predator. Given that the species is semelparous, dumpling squid may prioritise current reproductive opportunities because future reproductive opportunities may be limited. Lastly, I will quantify female longevity costs by comparing the adult lifespan of virgin, singularly and multiply mated females. Because virgin females lay eggs, this experiment will disentangle the cost of mating from the cost of reproduction (mating, egg production and parental care), which few studies have achieved. Together, these experiments will provide insight into the trade-off between costs and benefits of mating frequency, an area of evolutionary biology that has far reaching consequences for understanding sexual conflict and the evolution of mating strategies.

Effects of endocrine disrupting chemicals on early development in an estuarine fish species

Emma Ferguson

The University of Melbourne, Department of Zoology / Victorian Centre for Aquatic Pollution Identification and Management (CAPIM) / Marine and Freshwater Fisheries Institute

Supervisors – Associate Professor Stephen E. Swearer, Dr Kathryn Hassell / Dr Mayumi Allinson, Dr Graeme Allinson

Endocrine disrupting chemicals (EDCs) are an increasing concern worldwide, with multiple studies showing widespread endocrine disruption within organisms inhabiting affected environments. The aquatic environment is primarily affected by EDCs due to the large number of sources that contribute EDCs directly into these environments. Presently, Australia is severely underrepresented in the global research

of EDCs and there is very little information available on the levels of EDCs within local waterways and the subsequent effects these are having on native fish species/populations. This study quantified the levels of an especially potent estrogenic EDC 17 α -ethinylestradiol (EE2) in a local estuary potentially exposed to one of the main contributors of estrogenic EDCs into the aquatic environment; waste water treatment plant (WWTP) discharge. In combination with this, the effects of EE2 ranging from environmentally relevant concentrations upwards on the critical early life stages of a native fish species, *Acanthopagrus butcheri* (black bream), was investigated. It was revealed that EE2 was present within the local estuary in levels that are known to elicit endocrine disruption within fish species. However, the environmentally relevant concentrations as well as the higher concentrations were found to have no consistently significant effect on the hatchability, survival or growth of early life stage black bream. These results highlight the desperate need to sample estuaries, rivers and lakes nationwide to get a better picture of the areas being potentially affected by EDCs and in what levels EDCs are occurring. Furthermore, it reveals the need to investigate the effects of EDCs on a range of different fish species/types to establish in which fish species and at which life stages endocrine disruption is likely to occur. This is necessary to predict future population trends, and is especially important for species such as black bream which are a valuable species to both the commercial fishing industry as well as recreational fishermen.

This project has been funded by CAPIM.

Transgenerational marking of *Gambusia holbrooki* (Mosquitofish) using stable barium and strontium isotopes

Jessica Smith

The University of Melbourne, Department of Zoology

Supervisor – Associate Professor Stephen E. Swearer

Quantifying the extent to which populations are connected by larval dispersal is vital to furthering our understanding of the dynamics of aquatic populations. Few empirical estimates of larval dispersal and population connectivity exist due to the difficulties associated with conducting mark-recapture studies on species that produce large numbers of small offspring that experience extremely high rates of mortality.

Transgenerational marking offers an opportunity to mass-tag large quantities of larvae in situ before birth with a unique mark. Providing the ability to directly estimate larval dispersal and gather knowledge essential for predicting population responses to environmental change, management strategies, and harvest.

The aim of my project is to conduct a series of laboratory experiments to validate whether unique signatures created from enriched stable isotopes (^{135}Ba , ^{137}Ba , ^{86}Sr , ^{87}Sr) can be maternally transferred and detected in the embryonic otoliths of *Gambusia holbrooki*. Specifically, we aim to determine the minimum dose of single and double signatures for successful marking of *G. holbrooki* larvae and evaluate the period over which females continue to produce marked larvae. Effects of barium and strontium injections on clutch size, larval growth and mortality will also be assessed.

This will be the first study to validate the application of multiple isotopic labelling in fish otoliths and the first investigation with a live bearing species. This validation study will pave the way forward for future investigations using chemical batch marking via maternal transmission in studies of fish movement in a range of aquatic environments. The Mosquito fish will be used as a model studies species.

Honours

Gametic compatibility and fertilisation success in the invasive Northern Pacific sea star, *Asterias amurensis*

Amy Geels

Deakin University, School of Life and Environmental Sciences

Supervisor – Dr Craig Sherman

For the vast majority of marine invertebrates that release their gametes into the water for external fertilisation the general absence of complex mating behaviours has meant that mate choice was thought to be absent. However, biologists now recognise that mate choice can continue to operate after the release of eggs and sperm into the water via sperm competition and gametic compatibility between eggs and sperm from different individuals. Thus a female may increase her reproductive success if her eggs are preferentially fertilised by sperm from males with either good genes (i.e. where males with good genes have higher fertilisation success across all females), or by males that are more genetically compatible (i.e. where specific male female combinations result in higher fertilisation success). These effects were investigated on the invasive Northern Pacific sea star, *Asterias amurensis*, within Port Phillip Bay. Varying fertilisation trial results showed that sexes could not be distinguished based on morphology and males and females could only be identified from their gametes. Analyses of individual male and female effects on fertilisation success showed no significant effect of male identity; however, there was a trend towards a significant male x female interaction effect on fertilisation success. This suggests that genetic compatibility amongst individuals may be important in mediating fertilisation success. The analysis also showed a significant effect of female identity, indicating that maternal egg effects may be important in determining fertilisation success. The sperm viability analysis found no differences in viability amongst males and thus differences in sperm viability among males may not be an important factor in determining fertilisation success. The results from this study show that fertilisation success varies among different male female combinations (i.e. genetic compatibility effects) and that maternal egg effects may play an important role in mediating fertilisation success.

Completed 2010.

Post-release stress physiology and mortality associated with trawl capture of stingarees (Family: Urolophidae)

Matthew Heard

Flinders University, School of Biological Sciences

Supervisors - Dr Charlie Huveneers and Dr Richard Reina

Research on physiological stress and post-release mortality of threatened species caught as by-catch is critical for the management of fisheries. The present study used laboratory simulations of trawl capture to examine the physiological stress response of stingarees subjected to the different trawl durations as well as ancillary stressors of air exposure and crowding. Physiological indicators (plasma lactate, urea, potassium, and glucose and haematocrit) measured from blood samples taken throughout a 48-hour recovery period were compared between simulations and were related to mortality. Plasma lactate and urea concentrations were identified as reliable indicators of physiological stress while haematocrit, plasma glucose and plasma potassium did not cause changes that would be expected to have biological consequences for stingarees. High levels of lactate and depressed urea were recorded in the air exposure treatment indicating that this is the primary source of stress in stingarees caught in trawling operations. Mortality was low throughout this study (15 % overall), only occurred after more than 48 hours following simulations, and was linked to substantial decreases in plasma urea concentration.

Completed 2010.

Recreational harvest: characteristics and impacts on the pipi, *Donax deltoides*, at Venus Bay, Victoria

Zac Lewis

Victoria University / Fisheries Research Branch (Fisheries Victoria)

Supervisor – Dr Carol Scarpaci

Over the last decade there has been considerable growth in the recreational fishing sector, particularly surf clam harvesting, which has placed surf clam fisheries at increasing risk of over-exploitation. Recreational harvest of the pipi, *Donax deltoides*, has been increasing in Venus Bay, Victoria (Australia), with potential impacts on pipi stock unknown. The Department of Primary

Industries has reduced recreational catch limits within this area to mitigate potential impacts from this increasing recreational harvest.

This study investigated the potential effects that recreational harvest may exert on pipi stock abundance, distribution and age structure. It also evaluated the harvesting habits, regulatory knowledge, biocentrism and Catch Per Unit Effort (CPUE) of recreational harvesters within the fishery. Results were used to gauge the effectiveness of current management of Victorian pipi fisheries.

Survey results indicated that CPUE at Venus Bay was 0.426 kgp-1h-1 (n=20); 95% of harvesters were first-time pipi collectors. Harvest effort was highly localised, with all harvesters collecting pipis solely within Venus Bay. Comparisons of response between harvester and non-harvesting beach users demonstrated no difference in regulatory knowledge or biocentrism between user groups. Harvesters exhibited poor knowledge of regulatory catch limits and evaluated their harvesting actions as not significant on the sustainability of pipi stock. Furthermore, harvester pipi catch was significantly composed of sexually immature pipis posing a potential risk on population recruitment.

These findings highlighted that recreational harvest has a significant impact on pipi stock structure. Therefore, it is vital that appropriate management strategies are implemented to ensure the sustainability of this activity. It is recommended future management strategies include: continuation of reduced pipi catch limits at Venus Bay and implementation of minimum size limits to protect adult stock and alleviate recruitment pressure within this fishery. Biocentric and regulatory knowledge results indicate there is a need for harvester education to promote sustainable practise and more effectively communicate regulatory catch limits.

Completed 2010.

Effects of different dietary microalgae on survival, growth, settlement and fatty acid composition of blue mussel, *Mytilus galloprovincialis* larvae

Amanda Pettersen

Deakin University / Fisheries Research Branch
(Fisheries Victoria)

Supervisors – Dr Giovanni Turchini and Dr Craig Sherman

The diatom *Chaetoceros calcitrans* is a major component of many bivalve hatcheries, yet it is

expensive and notoriously difficult to culture on a commercial scale. In an attempt to reduce dependence on the diatom *C. calcitrans*, mussel larvae (*Mytilus galloprovincialis*) were subjected to feeding experiments which altered levels of the diatom under controlled hatchery conditions. Growth, survival and settlement success of mussel larvae were determined in response to five mixed algal diets in which the relative contributions of *C. calcitrans* was varied over the experimental period (30 days). Fatty acid profiles of the larvae and algal diets were also assessed. The exclusion of *C. calcitrans* from the diet had no significant differences on larval growth and only minor differences in total fatty acid content were found between treatments. Fatty acid analysis revealed that larval survival was strongly influenced by the proportions of dietary docosahexaenoic acid (DHA), while settlement was positively correlated with higher ratios of the n-3 long-chained polyunsaturated fatty acid (n-3 LCPUFA) (namely, DHA and eicosapentaenoic acid, EPA), to the n-6 LC-PUFA (arachidonic acid, ARA). Despite similar relative and absolute n-3 LC-PUFA levels in the larvae under different dietary treatments, the larvae receiving high levels of *C. calcitrans* performed significantly better in terms of survival and settlement success. These results indicate that the (DHA+EPA)/ARA ratio is a key factor in determining larval performance, rather than the actual total amount of these fatty acids.

Completed 2010.

Processes influencing settlement of marine invertebrate larvae: Microbes in marine biofilms and antifouling chemicals

Thelma Vlamis

RMIT University – School of Applied Science
Supervisor – Dr Jeff Shimeta

Much interest has focused on the role of bacteria and diatoms in biofilms and their influence on larval settlement of marine invertebrates on either submerged marine surfaces in the field or in a controlled environment in the laboratory. This study investigates two main subjects; 1) the influence of a biofilm containing ciliates on larval settlement of marine invertebrates under controlled conditions, and 2) whether gallic acid is an effective antifouling chemical in the natural environment.

In a controlled environment larvae of two species of biofouling invertebrates were exposed to surfaces (in petri dishes) that either had no biofilm, bacteria biofilm without ciliates or biofilm

with ciliates. The present study demonstrated that larval settlement of the bryozoan *Bugula neritina* was inhibited by biofilmed surfaces after 1 h and 24 h of being exposed to the experimental treatments. Biofilms with ciliates did not influence larval settlement of *B. neritina* after being exposed to the treatments for 24 h. Larval settlement of the mussel *Mytilus galloprovincialis* was significantly influenced by biofilms with ciliates after 48 h, and dishes with no biofilm or a biofilm without ciliates had no effect on larval settlement. In the field, invertebrate larvae were exposed to surfaces that were either treated with gallic acid or clean (no gallic acid). There was no significant difference of invertebrate abundance between the treated and untreated surfaces after 159 d of being submerged in sea water.

These results suggest that biofilms with ciliates influence larvae when choosing a substrate to settle. This may vary across different invertebrate taxa and indicates the potential for further research on ciliates and their role in marine biofilms. These results also concluded that the plates coating that contained gallic acid was not effective and did not influence invertebrate abundance. The coating needs to be further researched to establish whether it has the capability of being an effective antifouling chemical, and points out a new area of inquiry for biofouling research.

Completed 2010.

Factors affecting settlement, growth and metamorphosis of mussel larvae, *Mytilus galloprovincialis*, in a commercial hatchery

Kim Weston

Deakin University Life and Environmental Sciences / Fisheries Victoria

Supervisor – Dr Craig Sherman

Settlement and metamorphosis are crucial stages of development for mussel larvae in commercial hatcheries. Variable patterns observed during settlement can result in inconsistent yields, affecting hatchery productivity. This study looks to improve hatchery production by examining the effects of feed density, flow rate, rope type and stocking density on mussel larvae, *Mytilus galloprovincialis*, under hatchery conditions. All experiments were conducted in static systems over an eight day period with growth, metamorphoses and settlement assessed in response to each treatment. Feed density had little effect on growth, metamorphoses or settlement, which was attributed to consistently

low feeding rates. High, intermediate and low flow rates were investigated with high flows able to maintain larvae and food particles in suspension which significantly increased size, metamorphoses and settlement. Three different rope types (black green and christmas-tree) were tested in isolation (no-choice treatment) and in combination (preference experiment). None of the different rope types affected mussel size however, the highly filamentous christmas-tree rope had the greatest settlement success. Finally, high, medium and low larval stocking density treatments were compared. A strong inverse relationship between increasing density and decreasing size was detected which was due to density dependent competition. As a result of these experiments it was concluded that optimal conditions for settlement in hatcheries may be achieved by decreasing feed density and increasing flow rates, however further trials with rope type and stocking density are still required.

Completed October 2010.

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- Van Rijn J.A. and Reina R.D. (2010). Distribution of leukocytes as indicators of stress in the Australian swellshark, *Cephaloscyllium laticeps*. *Fish & Shellfish Immunology* 29: 534-538
- Vlavis T. (2010). Processes influencing settlement of marine invertebrate larvae: Microbes in marine biofilms and antifouling chemicals. *Thesis - Honours, Bachelor of Environmental Science - RMIT University*
- Weston K. (2010). Factors affecting settlement, growth and metamorphosis of mussel larvae, *Mytilus galloprovincialis*, in a commercial hatchery. *Thesis - Honours, Bachelor of Environmental Sciences - Deakin University*
- Winkelmann K., Buckeridge J.S., Costa A.C., Dionísio M.A.M., Medeiros A., Cachao M. and Ávila S.P. (2010). *Zullobalanus santamariaensis* sp. nov. a new late Miocene species of the family Archaeobalanidae (Cirripedia: Thoracica), from the Azores. *Zootaxa* 2680: 33-44

CONFERENCE AND OTHER PRESENTATIONS

Joanna Browne

PhD candidate, Griffith University

▪ *Investigating life cycles and host specificity of digenean parasites of gelatinous zooplankton using DNA.*

Oral presentation : Australian Marine Sciences Association (Victoria) Mini-symposium; Queenscliff, 1-2 May 2010

▪ *Parasites of gelatinous zooplankton in Australia*

Visiting speaker seminar : Centro de Estudios Parasitológicos y Vectores; La Plata, Argentina, 8 July 2010

▪ *Investigating life cycles and host specificity of digenean parasites of gelatinous zooplankton using DNA*

Oral presentation : Third International Jellyfish Blooms Symposium; Mar Del Plata, Argentina 14-16 July 2010. AWARDED BEST STUDENT ORAL PRESENTATION

▪ *Spatial variation of digenean parasites in the “upside-down jellyfish” Cassiopea sp. 1*

Oral presentation : XIIth International Congress of Parasitology; Melbourne, 15-20 August 2010

▪ *Oh no, my jellyfish has worms! Investigating life cycles and host specificity of digenean parasites of gelatinous zooplankton using DNA*

Oral presentation : Melbourne Systematics Forum Seminar Series; Melbourne, 2 September 2010

▪ *My marine career*

Oral presentation : Marine Careers Discovery Day; Queenscliff, 24 September 2010

Meagan Dewar

PhD candidate, Deakin University

*The gastrointestinal microbiota of king penguins (*Aptenodytes patagonicus*) and the influence of geographical separation*

Oral presentation : The 7th International Penguin Conference; Boston, Massachusetts, 29 August-3 September 2010

Changes in the gastrointestinal microbiota during fasting in penguins

Poster presentation : The World 1st Seabird Conference; Victoria, British Columbia, 7-11 September 2010

Nicole Filby

PhD candidate, Victoria University

*Distribution and population demographics of common dolphins (*Delphinus delphis*) in Gulf St. Vincent, South Australia*

Poster presentation : Australian Marine Sciences Association S.A. Branch Mini Conference, Adelaide 2010

Isla Fitridge

PhD candidate, The University of Melbourne

▪ *Foul play or facilitation? The impact of hydroid biofouling on mussel aquaculture in Port Phillip Bay, Australia*

Oral presentation : 15th International Congress on Marine Corrosion and Fouling; Newcastle UK, 25-29 July 2010

Dr Kathryn Hassell

Research Fellow, CAPIM

▪ *Assessment of gonad histopathology in smooth toadfish (*Tetractenos glaber*) exposed to a dioxin pollution gradient in Sydney Harbour, Australia*

Oral presentation : 20th Symposium on Environmental Chemistry, Japanese Society of Environmental Chemistry, Kumamoto, Japan, July 2011

▪ *Identification of pollution sources and biological effects in an urban stream in Victoria: a CAPIM case study*

Oral presentation : Envirotax 2011 – 1st Conference of Society for Ecotoxicology and Chemistry Australasia (SETAC-AU), Darwin, Australia, April, 2011

▪ *Development of bioindicators for endocrine disrupting chemicals in south-east Australian estuaries*

Oral presentation : What's in our Water Conference, Australasian Society for Ecotoxicology (ASE) – CSIRO Symposium, Canberra, Australia, November 2010

Jodie Kemp

PhD candidate, The University of Melbourne

My journey through the marine world

Oral presentation : The SCIENCE Experience; Queenscliff, 20 January 2010

Hints Mateos – Victoria University

PhD candidate, Victoria University

▪ *Effects of diets supplemented with fish oil on fatty acid composition in Jade Tiger hybrid abalone*

Oral presentation : 101st AOCS (American Oil Chemists' Society) Annual Meeting and Expo; Phoenix, Arizona USA, 16-19 May 2010

The effect of feed supplemented with fish oil on fatty acid composition of Jade Tiger abalone

Oral presentation : Victoria University Postgraduate research conference; Victoria University, St Albans Australia, July 2010

The effect of feed supplemented with fish oil on fatty acid composition of Jade Tiger abalone

Poster presentation : 101st AOCS (American Oil Chemists' Society) Annual Meeting and Expo; Phoenix, Arizona USA, 16-19 May 2010

Diets containing flaxseed oil can improve omega-3 polyunsaturated fatty acid content similar to fish oil supplementation in cultured abalone

Poster presentation : 34th Annual Scientific Meeting of Nutrition Society of Australia; Perth, Western Australia, December 2010

The effect of replacing dietary fish oil with canola oil on fatty acid composition of Jade Tiger abalone

Poster presentation : International Seafood and Health Conference; Melbourne Convention Centre, November 2010

Kimberley Millers

PhD candidate, The University of Melbourne

Estimating detection probability of established non-indigenous marine species

Oral presentation : 47th Annual Conference of the Australian Marine Sciences Association, Wollongong NSW, July 2010

Factors that affect the detection of the Northern Pacific Seastar

Oral presentation : Ecological Society of Australia Annual Conference, Canberra, 6-10 December 2010

Kade Mills

PhD candidate, Deakin University

▪ *Recreational Fishing Reefs: If you build them, the fish will come*

Oral presentation : ASFB Conference – Melbourne Museum; 12 July 2010

▪ *Processes and patterns of colonisation of recreational fishing reefs by fish*

Oral presentation : Australian Marine Sciences Association Victoria Mini-symposium; Queenscliff, 1-2 May 2010

My journey into marine science

Oral presentation : Marine Careers Discovery Day; Queenscliff 24 September 2010

Hannah Murphy

PhD candidate, The University of Melbourne

- *Diel vertical migratory behaviour in snapper larvae*

Oral presentation : Larval Biology Symposium Wellington, New Zealand, August 2010

- *Diel vertical migratory behaviour in snapper larvae*

Oral presentation : ASFB Conference – Melbourne Museum; 12 July 2010

Dr Jackie H Myers

Research Fellow, CAPIM

- *Assessment of endocrine disruption in Victorian freshwaters using *Gambusia holbrooki* (common name: Mosquitofish)*

Poster and snap shot presentation : What's in Our Water Symposium, Canberra, ACT, Australia, November 2010

- *Biomonitoring Endocrine disruption in *Gambusia holbrooki* (Common name: Mosquitofish) in Victorian Freshwaters*

Oral presentation : Australasian Society for Fisheries Biology 2010, Melbourne, Victoria, Australia, July 2010

- *Physiology to fish morphology: assessment of health of Victorian freshwaters*

Oral presentation : CAPIM Research Summit; Melbourne, Victoria, Australia, June 2010

- *Photosynthetic capacity of *Nodularia spumigena*: effects of salinity and light*

Poster presentation : SETAC Europe 2010; Seville, Spain, March 2010

- *Toxin production in *Nodularia spumigena*: effects of salinity, phosphorus, nitrate and light*

Poster presentation : SETAC Europe 2010; Seville, Spain, March 2010

- *Uptake and depuration of Nodularin in seafood species: A Human Health Risk Assessment*

Oral presentation : 2nd National Cyanobacterial Workshop 2010; Melbourne, Victoria, Australia, August 2010

Dr Dayanthi Nugegoda

Professor, Applied Sciences, RMIT University

- *Uptake and depuration of Nodularin in seafood species: A human health risk assessment*

Oral presentation : 2nd National cyanobacterial Workshop; Melbourne, July 2010

- *A fish sentinel for EDC's in Victorian Coastal freshwaters*

Oral presentation : What's in Our Water? : Symposium on Pharmaceuticals and Micropollutants in the Environment. CSIRO and ASE, Canberra, November 2010

- *Exposure to trace metals in larvae and juveniles of the abalone (*Haliotis rubra*) affects development and ATPase activity*

Oral presentation : SETAC Europe, Seville, Spain, May 2010

- *Effects of Chlorpyrifos on growth and feed utilisation of Australian native catfish, (*Tandanus tandanus*)*

Oral presentation : First International Conference on Environmental Pollution, Restoration, and Management; Ho Chi Minh City, Vietnam, March 2010

- *Quick and approximate toxicity tests using many species to improve community level risk assessment: pesticide sensitivity of stream macroinvertebrates*

Keynote presentation : First International Conference on Environmental Pollution, Restoration, and Management Ho Chi Minh City, Vietnam, March, 2010

- *Prospective and retrospective risk assessment of salinity on stream macroinvertebrate communities in eastern Australia*

Oral presentation : SETAC NA Portland, USA, November 2010

Zoe Squires

PhD candidate, The University of Melbourne

- *What do female squid gain from mating multiply?*

Poster presentation : The 13th Congress of the International Society for Behavioural Ecology, University of Western Australia, 26 September – 1 October 2010

Sexual selection in the sea

Oral presentation : The SCIENCE Experience; Queenscliff, 20 January 2010

My journey into marine science

Oral presentation : Marine Careers Discovery Day; Queenscliff 2 July 2010

Thelma Vlamis

Honours, RMIT University

My journey into marine science

Oral presentation : Marine Careers Discovery Day; Queenscliff 2 July 2010

Benjamin Wegener

PhD candidate, Monash University

A journey from ants to squid

Oral presentation : The SCIENCE Experience; Queenscliff, 20 January 2010

My journey into marine science

Oral presentation : Marine Careers Discovery Day; Queenscliff 2 July and 24 September 2010