Centre for Fish and Fisheries Research

ANNUAL REPORT 2008
CONTENTS

1. MANAGEMENT BOARD ............................................................................................................. 3

2. ADMINISTRATIVE DETAILS .................................................................................................. 3
   Centre members as at 31 December 2008 ............................................................... 3
   Director’s report ............................................................................................................. 5
   Committee membership/ Community service ......................................................... 7

3. RESEARCH ACTIVITIES ......................................................................................................... 11
   3.1 Ecosystems and Fisheries Management ............................................................................ 12
      3.1 a) Marine, estuarine and freshwater systems ............................................................. 12
      3.1 b) Oceanographic processes ...................................................................................... 14
      3.1 c) Resource partitioning and trophic interactions ..................................................... 14
      3.1 d) Fisheries dynamics ................................................................................................ 14
      3.1 e) Modelling ecosystems and fisheries .............................................................. 15
      3.1 f) Socio-economics of fishing ................................................................................... 16
      3.1 g) Sustainable aquaculture, fish health and stock enhancement .... 16
   3.2 Biodiversity and conservation of aquatic systems .......................................................... 19
      3.2 a) Shallow water habitat classification and faunal assemblages ..... 19
      3.2 b) Studies on macroalgae diversity ............................................................................ 21
      3.2 c) Marine protected areas ......................................................................................... 22
      3.2 d) Population viability of species of conservation significance ......... 23
   3.3 Biological Processes and Evolution .............................................................................. 30
      3.3 a) Growth, reproduction and feeding ....................................................................... 30
      3.3 b) Genetics and evolution ......................................................................................... 30
      3.3 c) Lamprey physiology and evolution ....................................................................... 32

4. PUBLICATIONS for 2008 ........................................................................................................ 33

5. POSTGRADUATE STUDENTS AND THEIR RESEARCH TOPICS ..................................... 43

6. SUMMARY OF RESEARCH FUNDING ............................................................................... 48
   6.1 List of projects and research income for 2008 ............................................................ 48

7. ACKNOWLEDGEMENTS ....................................................................................................... 53
## 1. MANAGEMENT BOARD

<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chair</td>
<td>Professor Stuart Bradley</td>
</tr>
<tr>
<td>Director</td>
<td>Professor Neil Loneragan</td>
</tr>
<tr>
<td>Centre member</td>
<td>Professor Norm Hall</td>
</tr>
<tr>
<td>Centre member</td>
<td>Dr Howard Gill</td>
</tr>
<tr>
<td>Centre member</td>
<td>Dr Jennie Chaplin</td>
</tr>
<tr>
<td>Centre member</td>
<td>Associate Professor Lynnath Beckley</td>
</tr>
<tr>
<td>Centre member</td>
<td>Associate Professor Alan Lymbery</td>
</tr>
<tr>
<td>Head of School</td>
<td>Associate Professor Max Cake</td>
</tr>
<tr>
<td>External representative</td>
<td>Associate Professor Rod Lenanton</td>
</tr>
<tr>
<td>Postdoctoral representative</td>
<td>Dr David Morgan</td>
</tr>
<tr>
<td>Postgraduate student representatives</td>
<td>Mr Peter Coulison</td>
</tr>
<tr>
<td></td>
<td>Mr Andrew Rowland</td>
</tr>
</tbody>
</table>

## 2. ADMINISTRATIVE DETAILS

Centre members as at 31 December 2008

**Director**
- Neil Loneragan PhD (DSE)

**Academic staff**
- Lynnath Beckley PhD (SELS)
- Stuart Bradley PhD (SELS)
- Kate Bryant PhD (SELS)
- Max Cake PhD (SELS)
- Jennie Chaplin PhD (SELS)
- Stan Fenwick PhD (HS)
- Howard Gill PhD (SELS)
- John Huisman PhD (SELS)
- Carolyn Jones (SELS)
- Halina Kobryn PhD (SELS)
- Alan Lymbery PhD (HS)
- Philip Nicholls PhD (HS)
- Ian Potter PhD (SELS)
- Peter Rogers PhD (SELS)
- Malcolm Tull PhD (LB)
- Fiona Valesini PhD (SELS)
- Mike Van Keulen PhD (SELS)
- Graham Wilcox PhD (HS)

**Adjunct appointments**
- Zaven Arzoumanian PhD
- Bob Clarke PhD
- Jeffrey Dambacher PhD
- Rob Doupé PhD
- Nick Dunlop PhD
- Daniel Gaughan PhD
- Jason Holmburg MA
- Greg Jenkins BSc
- Rod Lenanton PhD
- Michael Krützen PhD
- Hector Lozario Montes PhD
- Peter Madsen PhD
- Stephen Newman PhD
- Gavin Partridge PhD
- Margaret Platell PhD
- Jeremy Prince PhD
- Magnus Wahlberg PhD
- Richard Warwick PhD

**Research Fellows**
- Simon Allen MPhil (SELS)
- Stephen Beatty PhD (SELS)
- Lars Bejder PhD (SELS)
- Belinda Cannell PhD (SELS)
- David Fairclough PhD (SELS)
- Hugh Finn PhD (SELS)
- Alex Hesp PhD (SELS)
- Steeg Hoeksema PhD (SELS)
- David Morgan PhD (SELS)
- Nicole Pinnel PhD (SELS)

**Visiting Research Associates**
- Brad Norman MPhil (SELS)

**Research staff**
- Florian Mayer (SELS)
- Gordon Thomson (SELS)
- Kristin Wouters (SELS)
ADMINISTRATIVE DETAILS cont...

PhD students

Mark Allen (SELS)  Karen Marshall (SELS)
Doug Bearham (HS)  Sally May (LB)
Farhan Bokhari (HS)  Fiona McAleer (SELS)
Samantha Bridgwood (SELS)  Shannon McCluskey (SELS)
Amanda Buckland (SELS)  Fraser McGregor (SELS)
Janja Ceh (SELS)  Glenn Moore (SELS)
Warren Chisholm (SELS)  Gavin Partridge (HS)
Benjamin Chuwen (HS)  Matthew Pember (SELS)
Natasha Coen (SELS)  Nicole Phillips (SELS)
Peter Coulson (SELS)  Mahmoud Rashnavadi
Rainbo Dixon (SELS)  (HS/SELS)
Bryn Farmer (SELS)  Rebecca Roberts (SELS/LB)
Sarah Fretzer (SELS)  Andrew Rowland (SELS)
Susan Gibson-Keuh (HS)  Emilia Santos-Yap (SELS)
Chris Hallett (SELS)  Claire Smallwood (SELS)
Matthew Harvey (SELS)  Holly Smith (SELS)
Marina Hassan (HS)  Zoe Spiers (HS)
David Holiday (SELS)  Natalie Toon (SELS)
Matthew Hourston (SELS)  Michael Travers (SELS)
Michelle Ingram (HS)  James Tweedley (SELS)
Gary Jackson (SELS/DoF)  Lauren Veale (SELS)
Kelsie Jackson (SELS)  Corey Wakefield (SELS/DoF)
Anne Lif Lund Jacobsen (LB)  Fiona Webster (SELS)
Ashlee Jones (SELS)  Kristel Wenziker (SELS)
Mark Langdon (SELS)  Michelle Wildsmith (SELS)
Elaine Lek (SELS)  Andrew Winzer (SELS)
Thea Linke (SELS)

Masters students  MSc  MPhil
Jessica Bunning (SELS)  Jeff Whitty (SELS)
Dennis Rouillard (SELS)

Honours students

Alan Cottingham (SELS)  Natalie Millar (SELS)
Brett Crisafulli (SELS)  Anna Reid (HS)
Kenneth Fraser (SELS)  Tracey Rodwell (SELS)
Michelle Gardner (SELS)  Julian Tyne (SELS)
Renae Larsen (SELS)
Rob Michael (HS)

DoF  Department of Fisheries
HS  Faculty of Health Sciences
LB  Faculty of Law and Business
SELS  Faculty of Sustainability, Environmental and Life Sciences
Director’s report

The research areas of staff and students in the Centre for Fish and Fisheries Research incorporate the activities of people across four Schools in the University (Biological Sciences and Biotechnology, Environmental Sciences, Veterinary and Biomedical Sciences and the School of Business), and include population and community biology, biological oceanography, systematics, fisheries and ecosystem modelling, recreational fishing, biology of wildlife species, conservation biology, marine protected areas, restocking, aquaculture, genetics and fish health.

In 2008, the staff and students of the Centre have continued to publish a substantial number of papers in international journals (36 in 2008 and 31 in press for 2009), book chapters (1), a book, 26 technical reports and/or popular articles and editing a special issue for Fish and Fisheries Research on stock enhancement and sea ranching. The activities of research students continue to be a vital part of the Centre’s success, with the completion of eight PhD, two Masters and seven Honours theses in 2008.

Some of the research highlights in marine fisheries and ecosystem research include: the development of approaches to classify hyperspectral data in marine habitats and documenting the detailed spatial patterns of reef use at Ningaloo for marine conservation and development planning; developing Ecopath/Ecosim ecosystem models for the central west coast to evaluate the effects of spatial closures on food webs in this system; rigorous sampling in estuaries on the south and west coast of Western Australia to provide information on changes in the assemblages and biology of some key species in three of these systems (the Swan, Peel-Harvey and Leschenault) across three decades. Research on the biological oceanography of the Leeuwin Current continued, particularly larval fish recruitment. Centre members were successful in gaining funding from the Fisheries Research and Development Corporation (FRDC) to establish a training facility in quantitative methods for fisheries and develop models of recruitment and recreational fishing. We have been fortunate to attract Professor Ken Pollock to join Murdoch University in October 2009, to lead the quantitative training initiative, supported by FRDC, the Department of Fisheries and Murdoch.

Research on aquatic conservation was also very active with continuing research on the dolphin populations of Leschenault Inlet and the Swan River, the Whale Sharks of Ningaloo, Freshwater Sawfish movement and home range in the Kimberley and the Fairy Penguins of the Cockburn Sound region. Remote sensing and tagging technology have been used to understand the movement and home ranges of Whale Sharks, Fairy Penguins and...
Freshwater Sawfish. Monitoring of Australia’s only critically endangered (EPBC Act 1999) freshwater fish species, Western Trout Minnow, has continued as has work on the vulnerable Balston’s Pygmy Perch and fishway utilization and assessments. Centre members were also successful in gaining funding from the FRDC, Department of Fisheries and Fishing Industry to investigate ways of reducing the catch of dolphins in the Pilbara Finfish Trawl fishery. In freshwaters, the issue of invasive species, such as Eastern Mosquitofish and Goldfish, and their impacts on biodiversity and system function have also been an important focus of activity, with a number of control programs in place.

Research on fish health includes the health of cultured and wild aquatic species and the environments in which they are found. Current research projects in this area are addressing the causes and consequences of stream salinisation, the role of invasive species in disrupting food webs and transmitting diseases, the development of sustainable inland saline aquaculture and understanding parasitic diseases of wild and cultured aquatic species.

Centre members have been key organising people for international and local symposia including; the International Whaling Commission workshop on investigating the possible effects of whale watching; the joint 8th Indo-Pacific Fish Conference / the 2009 Australian Society of Fish Biology conference and workshop and the 2nd Ningaloo Research Symposium. We have also hosted a number of international visitors (Professor John Hoenig – Virginia Institute of Marine Science, Dr Michael Krüetzen – University of Zurich, Dr Pilar Olivar – Institute of Marine Science, Barcelona, Dr Zeb Hogan – University of Nebraska / National Geographic, Dr Richard Warwick – Plymouth Marine Laboratories) and national visitors (Assoc. Prof. Greg Skillett – University of Queensland, Assoc. Prof. William Sherwin – University of New South Wales, Dr Margaret Platell – University of Newcastle, Dr Brendan Ebner - Griffiths University) to the University. After eight years at Murdoch University and many years at the Department of Fisheries, Professor Norm Hall retired towards the end of 2008. We are fortunate that Norm is continuing his very active research career as an Emeritus Professor at Murdoch and acknowledge the wonderful contribution that he has made to the research directions and staff and students in the Centre.

Neil Loneragan

Director
Committee membership/Community service

Stephen Beatty
- 8th Indo-Pacific/Australian Society for Fish Biology Conference organizing committee
- Margaret River Hairy Marron Recovery Team
- Bennett Brook Cichlid Taskforce

Lynnath Beckley
*School of Environmental Science:*
- Honours Committee
- School Executive Committee
- School Advisory Committee
- Co-Editor – School Annual Report
*Faculty of Sustainability, Environmental and Life Sciences:*
- Marine Science Deputy Programme Chair
- Board member, Centre for Fish and Fisheries Research
*Organisations:*
- African Journal of Marine Science (Editorial Board)
- Australian Marine Sciences Association (Vice-President National Council)
- Australian Marine Sciences Association (WA Branch Committee member)
- Rottnest Island Authority (Environmental Advisory Board member)
- Australian Society for Fish Biology (Recreational fishing research committee member)
- Indo-Pacific Fish Conference 2009 (International Scientific Advisory Committee member)
- Sustained Indian Ocean Biogeochemical and Ecological Research (International Scientific Committee member)
- Monitoring Recreational Fisheries - Victoria DPI and FRDC (Technical Committee member)

Lars Bejder
- Editorial board of Tourism in Marine Environments (TiME).
- Board of Management for the Bunbury Dolphin Discovery Centre, Bunbury, Western Australia.

- Scientific Program Committee of the 17th Biennial Conference on the Biology of Marine Mammals (South Africa, November 2007).
- Board member of the Society for Marine Mammalogy (Chair of the Education Committee).
- Host and co-organiser International Whaling Commission Workshop: Large-scale whalewatching research initiative, Australia.

Belinda Cannell
- Member of Shoalwater Islands Marine Park focus group
- Invited speaker for Shoalwater Islands Marine Park Discovery Series
- Department of Environment and Conservation - advice on effect of different management activities on Little Penguins

David Fairclough
- International Union for the Conservation of Nature and Natural Resources (IUCN) - member of the specialist group for groupers and wrasses
- WA Member of the Executive Council of the Australian Society for Fish Biology

Howard Gill
- Recfishwest Committee and Executive
- Murdoch University Animal Ethics

Norm Hall
- Editorial Advisory Committee of *Marine and Freshwater Research*
- Northern Prawn Fishery Resource Assessment Group
- Department of Fisheries - Advice on matters relating to the stock assessment and management of fisheries
AWARDS/COMMITTEE MEMBERSHIP cont...

Matt Harvey
- WA Branch Committee member of Australian Marine Sciences Association

John Huisman
- Editor in Chief – Cryptogamie, Algologie

Halina Kobryn
- Board and Standing Committee member of Western Australian Satellite Technology and Applications Consortium (WASTAC)

Neil Loneragan
- BSB Research Committee
- WA Fisheries Research Advisory Board
- WA Rock Lobster Ecosystem Effects of Fishing Scientific Reference Group
- Research Subcommittee, Rock Lobster Industry Advisory Council
- Western Australian Marine Science Institute Steering Committee for Ecosystem Based Fisheries Management (Node 4)
- Ningaloo Research Coordinating Committee
- Invited co-editor for Special Issue of Reviews in Fisheries Science, 3rd International Symposium on Stock Enhancement and Sea Ranching

Alan Lymbery
- Zoological Parks Authority Research Board
- Associate Editor, Pacific Conservation Biology
- Managing Editor, Biodiversitas
- School of Veterinary and Biomedical Sciences, Honours Committee

Brad Norman
- National Geographic Emerging Explorer 2008
- CEO, Ecocean (Australia)
- Director, Ecocean (USA)

Ian Potter
- Editorial Board of Environmental Biology of Fishes
- Western Australian Fish Foundation

Malcolm Tull
- Joint Editor of The International Journal of Maritime History
- Vice-President, Economic Society of Australia, Western Australian Branch
- Appointment by Minister for Fisheries in a three-person panel – Development of management strategies for the pearling industry.

Mike van Keulen

University Administration:
- Program Chair: Marine Science (University level) – effective July 2006
- Member of the BSB Senior Executive Committee
- Member of Classroom Management Committee (University-level)
- DSE and Classroom Management Committee representative on the Learning Technologies Steering Group (university level) – established October 2006 with meetings approximately monthly

David Morgan
- 8th Indo-Pacific/Australian Society for Fish Biology Conference organising committee
- Executive Council of the Australian Society of Fish Biology - WA representative
Chair of BSB Marketing committee (School level)
Director of the Coral Bay Research Station
University Dive Officer (University level)
Building Warden – Biological Sciences Building (School level)
Member of the School of Biological Sciences & Biotechnology Risk Assessment Management committee (School level)

General Community Service
President: North West Research Association
Member: Australian Marine Sciences Association (WA Branch) Committee
Member: WA State Marine Policy Stakeholder Group
Member: Marine Reserve Council of WA
Maintain and coordinate two high-profile international e-mail research discussion lists: Seagrass Forum and Mangrove

Editorial contributions
The Editorial Advisory Board for Pacific Conservation Biology
Reviewer for numerous scientific journals
Reviewer (INTREADER) for ARC Discovery Projects and NSF Research Projects (USA)

William White
International Union for the Conservation of Nature and Natural Resources (IUCN) - Member of the Shark Specialist Group for the Asia-Northwest Pacific and Australian Regions
National Shark Recovery Group (NSRG) - Department of Environment and Heritage member (DEH)
3. RESEARCH ACTIVITIES

Research objectives

The main ongoing objectives of the Centre for Fish and Fisheries are to:

1. Undertake high quality research that addresses questions fundamental to understanding biological, ecological and evolutionary processes in aquatic ecosystems.

2. Communicate the results of our pure and applied studies to the wider scientific community through publishing in international journals and presentations at relevant national and international conferences.

3. Provide research students with rigorous and intellectually-stimulating training in contemporary biological, ecological and genetic approaches to fish biology, fisheries and conservation science, with particular emphasis on developing their quantitative skills.

4. Maintain strong research collaboration with scientists both within and outside Australia.

5. Undertake the research required to provide managers with sound quantitative data that can be used to develop policies for conserving fish resources and the environment, and also marine conservation planning.

6. Communicate, through peer reviewed technical reports, papers, seminars and discussions, the implications of the results of the above studies to scientists, managers and stakeholders.

7. Continue to attract the funding required to undertake the high quality research that is essential for this group to remain at the forefront of fisheries science and to provide the data required by fisheries, conservation and environmental managers to develop appropriate management plans.

The wide range of studies undertaken by the staff in the Centre are aimed at enhancing our knowledge of particular fundamental biological processes in fishes and of aquatic ecosystem function in general, as well as addressing urgent management issues. These studies have been planned to involve postgraduate students and thereby ensure that the Centre produces fish biologists, fishery scientists and ecologists and conservation biologists with the relevant and high quality research training required to help fulfil the future needs of resource management and scientific agencies.

The research activities in the Centre have been organised into three inter-related and overlapping themes:

1. **Ecosystems and Fisheries Management** (including fish health and sustainable aquaculture);

2. **Biodiversity and Conservation of Aquatic Systems** (including studies of species of conservation significance); and
3. **Biological Processes and Evolution** (including population biology and genetics), to better reflect the role of our research in providing knowledge for Ecosystem Based Fisheries Management and marine and freshwater conservation planning.

The research activities of the Centre are reported under these themes below:

### 3.1 Ecosystems and Fisheries Management

#### 3.1 a) *Marine, estuarine and freshwater systems*

**Fish communities of five estuaries on the south coast of Western Australia**

Ben Chuwen, Steeg Hoeksema and Ian Potter are continuing their studies of the nearshore and offshore fish communities of five estuaries on the south coast of Western Australia, which vary in the extent to which they are connected with the ocean. These estuaries are the seasonally-open Broke, Irwin and Wilson inlets, the permanently-open Oyster Harbour and the normally-closed Wellstead Estuary.

Although the fish communities of nearshore waters are dominated by estuarine species and those of offshore waters by marine species, both communities are influenced, to some extent, by the degree to which the estuary is connected to the ocean, the percent cover of macrophytes in each system and salinity. The composition of the fish communities in the basin and riverine regions of each estuary were found to differ markedly. Indeed, in the case of offshore waters, these regional differences were greater than those between estuaries.
PhD and Honours students undertook studies on the biology of Black Bream, Estuary Cobbler, King George Whiting, Australian Herring, Yelloweye Mullet and Sea Mullet in the above five estuaries. PhD student Ben Chuwen and Norm Hall are continuing to develop methods for determining the factors that influence recruitment success and growth of Black Bream.

Ben Chuwen and Steeg Hoeksema presented the results and implications of the study on the environment and fish communities at the 44th Estuarine and Coastal Sciences Association conference in Bahia Blanca, Argentina.

Brett Crisafulli and Tracy Rodwell recently completed their Honours studies with Ian Potter and Alex Hesp at the CFFR on the biology of mullet (*Mugil cephalus* and *Aldrichetta forsteri*) and King George Whiting (*Sillaginodes punctata*). Ben Chuwen, who is also working on Black Bream (*Acanthopagrus butcheri*) and Cobbler (*Cnidoglanis macrocephalus*), is close to completing his PhD. The studies are focusing on elucidating the ways in which the size and age compositions, growth characteristics (and where applicable, reproductive biology) of these important species are influenced by estuary type. Their work is being funded by South Coast Natural Resource Management, Western Australian Fishing Industry Council and Fisheries Research and Development Corporation. The data acquired for these important species will be provided to environmental and fisheries managers.

**Fish community, biological and ecosystem modelling studies in the Peel-Harvey and Leschenault Estuaries**

Lauren Veale has just started a PhD with Ian Potter and Steeg Hoeksema at the CFFR on the ichthyofaunal communities in different regions of the Peel-Harvey and Leschenault estuaries. Lauren is investigating how the compositions of fish fauna in the two estuaries, which are both highly modified, differ. She will then investigate how the fish communities in these two estuaries have changed over the last three decades. Data from the Peel-Harvey Estuary will be compared with information from previous studies conducted in 1980 and 1981 just prior to the opening of a large artificial entrance channel (Dawesville Channel), and in 1996 and 1997, in the two years following the opening. Lauren will also investigate the biology of the Six-Lined Trumpeter (*Pelates sexlineatus*) which, historically, was one of the most abundant species in the Peel-Harvey estuary, but has now declined markedly in abundance. The study is being funded by WAMSI and the South West Development Commission (SWDC).

As part of her PhD with Norm Hall and Jeff Dambacher (CSIRO), Sarah Fretzer is using ecosystem modelling to investigate the dynamics of the Peel-Harvey Estuary in Western Australia. Sarah is using qualitative ecosystem modeling approaches to investigate the factors which have led to changes in abundance of Blue Swimmer Crab (*Portunus pelagicus*) and Common Blowfish (*Torquigener pleurogramma*) populations, and the fish communities. A quantitative ecosystem model, Ecopath, will also be applied to compare the biomass fluxes between the trophic levels of the estuary before and after the opening of the artificial channel. Subsequent use of Ecosim will enable predictions to be made of how the crab and fish populations in the estuary are likely to change in the future in response to changes in fishing pressure and climate. Sarah’s studies form part of a larger WAMSI ecosystem modelling project and Sarah has received a WAMSI top-up scholarship.
RESEARCH ACTIVITIES cont...

3.1 b) Oceanographic processes

David Holliday continued his PhD research examining cross-shelf transport of larval fishes during the formation of Leeuwin Current eddies using depth-integrated and depth-stratified samples collected from the RV *Southern Surveyor*. He has matched these data with water mass characteristics and trajectories and velocities of currents measured with oceanographic drifters and the shipboard Acoustic Doppler Current Profiler. He has started writing up in earnest for a 2009 thesis submission. Natalie Millar commenced her honours project mid-year sorting and identifying the material collected from the northern parts of the Leeuwin Current during the 2007 RV *Southern Surveyor* cruise. Dr Pilar Olivar of the Institute of Marine Science in Barcelona visited our Murdoch marine laboratories again in 2008 for several weeks and assisted Dave and Natalie with identification of the difficult deep sea family of lanternfishes (Family Myctophidae).

Associate Professor Lynnath Beckley enjoyed a busy sabbatical in the first semester of 2008 presenting seminars at the Scripps Institution of Oceanography and Woods Hole Oceanographic Institution in the USA and the Plymouth Marine Laboratory in the UK before basing herself at the University of Cape Town Oceanography Department for a few months of solid paper and book writing. She also assisted in developing an international science plan for Sustained Indian Ocean Biogeochemical and Ecological Research. The draft plan has six focal areas for biological oceanography including Indian Ocean boundary currents and equatorial circulation.

3.1 c) Resource partitioning and trophic interactions

Resource on trophic interactions and food web structure and function is being carried out in the upper Swan estuary and the Perth metropolitan waters, both supported by WAMSI. The research in the Swan forms part of the PhD studies of Thea Linke, supervised by Fiona Valesini and Ian Potter, and involves using dietary analysis and tracer studies to identify the prey and primary sources of food for three species in this region (for details see section 3.2a below). The research in the Perth metropolitan waters is led by Ian Potter and Margaret Platell, and will synthesise dietary information from previously funded FRDC studies and collect new information on the diets of Pink Snapper and Trevally, to develop an understanding of the demersal food web and trophic flows in this region. This will provide the basis for assessing how the depletion of key demersal species, such as Dhufish and Pink Snapper, is impacting ecosystem structure and function.

3.1 d) Fisheries dynamics

Composition of elasmobranch species in commercial bycatch and reproductive studies of four species

PhD student Ashlee Jones is studying with Ian Potter and Norm Hall, the species composition of elasmobranchs in the fisheries of south-western Australia, and the biology of four shark and ray species (the Port Jackson Shark *Heterodontus portusjacksoni*, the Australian Angelshark *Squatina australis*, the Western Shovelnose Ray *Aptychotrema vincentiana* and the Southern Eagle Ray *Myliobatis australis*). Her studies have concentrated on the reproductive biology of these species, which are abundant in the
bycatch of commercial fisheries of south-western Australia.

In September 2008, Ashlee and Ian Potter published a paper entitled ‘Description of the reproductive tract and gonad histology of a second form of hermaphroditism in the Port Jackson Shark *Heterodontus portusjacksoni*’ J.Mar.Biol.Ass.U.K. in which they described a hermaphroditic shark which possessed an ovotestis and also complete ovaries and testes.

**Behavioural studies of rock lobster *Panulirus cygnus***

For her PhD with Neil Loneragan, Natalie Toon is investigating environmental, biological and fishery effects on the behaviour of the Western Rock Lobster (*Panulirus cygnus*). The behaviour of lobster affects their catchability (‘q’), which is an important component of any wild caught fishery and is a parameter that is utilised in stock assessments for the Western Rock Lobster fishery. She is studying lobster behaviour within and around commercial fishing pots and the factors that influence this behavior, including water temperature, moon phase (light intensity), lobster size and pot neck type (stick and plastic neck). Video observations have been used in both a controlled aquarium environment and *in situ* field environment to observe the behaviour of the Western Rock Lobster around commercial fishing pots.

Nick Konzewitsch has started an Honours project with Neil Loneragan and Natalie Toon, examining the behaviour of lobsters in the field during the migration phase (whites – November) and more stationary phase (reds – March). He will be using the equipment developed by Natalie during her PhD study to record observations of behaviour around pots.

**3.1 e) Modelling ecosystems and fisheries**

Ecosystem modelling work has focussed on developing both qualitative and quantitative ecosystem models for marine and estuarine systems in Western Australia. The qualitative modelling work has been guided and lead by Dr Jeffrey Dambacher (CSIRO) to develop conceptual understanding and test hypotheses about the Jurien Bay ecosystem. This work, funded by the FRDC, is examining the Jurien Bay FRDC project and the impact of spatial closures on the food webs of the region, and has been progressing well. Dr Hector Lozano-Montes, in collaboration with Neil Loneragan and Russ Babcock (CSIRO), has developed an Ecopath model for 2005, based largely on data gathered by the CSIRO Jurien Bay collaborative study, and the model is now being used to evaluate different management options. A spatial model is currently being developed and interviews are being completed with people who have a long experience in the region to develop an understanding of the state of the system in the early 1980s. The Ningaloo Collaboration project and WAMSI Node 3 are planning the third Ningaloo Research Symposium to take place in 2009 on May 25, 26th in Exmouth in the week before the 8th Info Pacific Fish Conference and Australian Society of Fish Biology Conference and Workshop (May 31 to June 5, 2009).
Qualitative and quantitative models are being developed for the Peel-Harvey estuary through the PhD studies of Sarah Fretzer, supervised by Norm Hall and Hector Lozano (CSIRO) (see 3.1.a above). These studies are supported by the Western Australian Marine Science Institution.

Alex Hesp and Norm Hall have submitted proposals to FRDC to investigate recruitment dynamics of fish in the metropolitan waters and the behaviour of recreational fishers in the region.

3.1 f) Socio-economics of fishing

Associate Professor Malcolm Tull has led the development of a WAMSI project to examine the socio-economics of fishing in the west coast bioregion. This project involves a collaboration with Associate Professor Paul McLeod at the University of Western Australia and will investigate the significance of commercial and recreational fisheries in the region. It will also examine how fishers respond to changes in management for the demersal species in the Perth Metropolitan waters.

The History of Marine Animal Populations Asia project (HMAP) reached an advanced stage during 2008. A seventh project was also added to HMAP Asia, with the addition of Joseph Christensen’s research project on the history of the Shark Bay recreational snapper fishery. An existing project, Kenneth Macpherson's research on the Madras Fish Curing Yards, also evolved into a collaborative exercise involving Professor Peter Reeves. All seven research projects are now at an advanced stage, and the principal output of HMAP Asia, a research monograph devoted to the results of the project, is now under development.

HMAP Asia project is planning a workshop ‘The History of Marine Animal Populations in Asia - Towards a Regional Synthesis’, to be held at Murdoch University on 11 February 2009.

Malcolm Tull and Joseph Christensen, HMAP Asia researchers, will present papers at the Oceans Past II conference at the University of British Colombia in May 2009.

HMAP Asia has recently secured an agreement with the Asia Research Centre at Murdoch University, which will allow existing research papers to be published as part of the Centre’s “Working Papers” series. It is anticipated that several papers incorporating the results of HMAP Asia case-studies will appear in the coming months.

3.1 g) Sustainable aquaculture, fish health and stock enhancement

Fish health continues to be included as a new initiative in the fifth year rotation in pathology for the veterinary course at Murdoch University. All final year veterinary students spend a day with Susan Gibson-Kueh learning about theoretical and practical aspects of fish diseases. Also, 2008 saw a final year elective in aquatic health, organised by Susan Gibson-Kueh, which allowed a small group of interested veterinary students to spend two weeks extending their knowledge of fish health. The elective included a programme of invited speakers, field trips to Perth Aquarium & Display centre, AQWA, Watergarden World, Armadale Koi farm and Challenger TAFE aquaculture unit, as well as masterclasses in fish health held by Susan Gibson-Kueh. Additionally, one student spent a period in Vietnam visiting the Research Institutes in Aquaculture.
The research focus of the Fish Health Unit is the health of cultured and wild aquatic species and the environments in which they are found. We currently have research projects addressing the causes and consequences of stream salinisation, the role of invasive species in disrupting food webs and transmitting diseases, the development of sustainable inland saline aquaculture, and understanding parasitic diseases of wild and cultured aquatic species.

**Stream salinisation**

Michelle Ingram and Farhan Bokhari continued their PhD projects on the effect of salinisation in the Collie River on the diversity and resilience of riparian plant and associated invertebrate communities. These two projects, with funding assistance from the Australian Flora Foundation, have found dramatic effects of stream salinity on species diversity at several trophic levels (producers, first-order consumers, second-order consumers). Michelle and Farhan are now undertaking a series of experimental manipulations of the system to determine causative processes behind these changes in diversity.

Mahmoud Rashnavadi is examining the effect of salinity on fish biology and parasitism in the Blackwood River, in a PhD project supported by the Australia and Pacific Science Foundation. Mahmoud has found evidence of differences in growth rates, reproductive activity, diets and parasitism in populations of a number of fish species exposed to different salinity regimes.

The disappearance of many populations of freshwater fish, as a result of salinisation, from south-western Australian rivers has been cause for concern, and this work by David Morgan and Stephen Beatty has highlighted the importance of groundwater in the maintenance of several rare species.

Stephen Beatty, Dave Morgan and the freshwater team are continuing the long term study into the relationships between the ecology and biology of freshwater fishes of the Blackwood River and environmental variables. They have revealed considerable spatial and temporal differences within and between species in terms of habitat use, upstream and downstream migrations, growth and reproductive biology. Many of these differences have been demonstrated to be driven by surface and groundwater hydrology of the main channel and various tributaries. For example, the EPBC listed Balston’s Pygmy Perch has been shown to breed only in a single, groundwater-maintained tributary and the Western Minnow has a two month difference in spawning periods between nearby tributaries as a result of different flow regimes. Fiona McAleer and the team have shown that Freshwater Cobbler have undergone only localised migrations over riffle zones in the Blackwood River during groundwater fed baseflow periods. The strength of these migrations is strongly influenced by the levels of discharge during these periods. These findings have been important in the development of sustainable levels of aquifer extractions and the study is the most intensive and longest running of its kind in W.A.

Salinity trials conducted have shown that Balston’s Pygmy Perch is far more susceptible to being lost from salinised systems than the Western Minnow or Western Pygmy Perch yet continues to seasonally utilise the main channel of the Blackwood River. Long-term predictions of population viability of these species in this and other salinised rivers are
being formulated based on this research and the projected future environmental conditions in south-west rivers.

**Invasive species**

Marina Hassan completed her PhD project, supported by Fishcare Western Australia, on the parasites of native and introduced freshwater fishes in the south west. A number of new species of parasites have been described in this study. Two important outcomes from Marina’s work are the documentation of a number of exotic parasite species affecting native fish, and her finding that native fish species are in general much more highly parasitised than exotic fish species; this may be a contributing factor to the superior competitive ability of exotics. Marina successfully submitted her PhD thesis in 2008.

During 2008 David Morgan and Stephen Beatty conducted a number of control programs of feral fish populations in Western Australia. Goldfish control in the Vasse River, Margaret River and the Warren River were implemented, as was a control program for Rosy Barbs in Jingarmup Brook near Eagle Bay. Much of this work was funded through Geocatch, Cape to Cape Catchment Groups, Southern Forests Landcare, Department of Fisheries WA and South West Catchments Council. They also discovered the introduced parasitic copepod *Lernaea* sp. in the Murray River near Pinjarra.

Stephen and David maintain a database on the introduced (and native) freshwater fishes of Western Australia. This is from their survey work since 1992 of over 2000 sites throughout the State, but also from accounts of feral fishes provided by colleagues at the Department of Fisheries and community groups.

**Inland saline aquaculture**

Our work on new production systems for inland saline aquaculture, funded by FRDC, is led by Gavin Partridge. Gavin successfully completed his PhD research on the economic feasibility of new floating tank systems, and the effects of variable ionic composition on fish cultured in inland saline groundwater, confirming that low potassium concentrations and elevated manganese concentrations typical of inland saline ground water may have major impacts on fish health and production. Gavin’s work will have important implications for the developing inland saline aquaculture industry.

Previous work by our group has demonstrated the efficacy of a cultivated form of the halophyte *Distichlis spicata* (NyPa Forage) in removing nutrients from inland saline aquaculture effluent. In 2008, we continued a project, funded by RIRDC, to determine the potential of irrigated NyPa Forage as a livestock feed. *In vitro* laboratory tests have been encouraging and we are currently preparing a major livestock feeding trial to test the results in the field.

An alternative approach to removing nutrients from inland saline aquaculture effluent is to bind them in algal cells and use filter feeding organisms, such as the brine shrimp *Artemia*, to ingest the algae. The *Artemia* can then be harvested and sold for fish food. Rob Michael completed his Honours project on this topic in 2007, gaining a First Class Honours degree.
Parasitic diseases of aquatic species

Anna Reid completed her Honours project on gastrointestinal protozoan parasites, Cryptosporidium and Giardia, in wild and cultured finfish in Australia. Anna found these parasites for the first time in native freshwater fishes, as well as in cultured fishes, and identified a potential new species of Cryptosporidium. Anna was awarded a First Class honours degree.

Doug Bearham and Zoe Spiers successfully completed their PhD research on parasites of pearl and rock oysters. Zoe and Doug have worked very closely with an industry steering committee, and developed excellent links with industrial and government partners. Their work was supported by the Fisheries Research and Development Corporation.

Susan Gibson-Keuh began a PhD on infectious diseases of cultured barramundi. Susan has been collecting samples from barramundi farms in Australia and throughout South East Asia and busily examining pathology slides.

Following on from our successful training workshop (master class) in fish health in Bangkok in 2007, we have established a Fish Health discussion group with all the presenters and participants at the workshop. This e-mail based discussion group is extremely active and pathology cases, case notes and diagnoses are shared on a regular basis.

3.2 Biodiversity and conservation of aquatic systems

3.2 a) Shallow water habitat classification and faunal assemblages

Development of indices of health for the Swan River Estuary and its fish species, and a detailed food web.

Chris Hallett, who is into the second year of a PhD study with Fiona Valesini, Steeg Hoeksema and Ian Potter at the CFFR, is developing and evaluating a multi-metric, biotic index of estuarine health for the Swan River Estuary, based on a suite of characteristics of the fish assemblages in this system. Chris is currently testing the suitability of each of an extensive suite of fish assemblage parameters (metrics) for incorporation into the index. These metrics reflect a range of ichthyofaunal characteristics, including species diversity and community composition, dominance, abundance and nursery and trophic function.

Meaningful reference conditions for each selected metric will be established using a number of historical data sets for fish assemblages in the Swan River Estuary, spanning back to 1977. The index developed in this study is intended to provide managers with a reliable, rapid and affordable method for quantitatively assessing the environmental health of the estuary and for monitoring future changes in ecosystem health. This, in turn, will facilitate more informed and preventative management actions. Index values will also provide a simple method for communicating the health status of the estuary to the public, possibly as part of a report card system incorporating a suite of such indicators.
For his Honours, Alan Cottingham is working with Ian Potter, Alex Hesp and Norm Hall to develop an index for assessing the status of the stock of Black Bream *Acanthopagrus butcheri* in the Swan River Estuary based on biomass production. Alan's biological studies of Black Bream in the Swan River Estuary have shown that a number of its biological characteristics have changed drastically from what was recorded by Dr Gavin Sarre, a little over a decade ago. For example, its growth and typical length at maturity have declined markedly, as also has body condition. However, the abundance of Black Bream in catches has increased. Alan is exploring ways of assessing the status of black bream (and similar species) with highly plastic biological characteristics.

Thea Linke, who completed her undergraduate degree in Biology at Hamburg University, subsequently undertook an Honours degree and is now undertaking a PhD at the CFFR. Having worked on dietary analyses of fish species for her Honours, Thea became keenly interested in studying trophic interactions in aquatic ecosystems. For her PhD, Thea is investigating the trophic relationships between three species of fish and their prey in two south-western Australian estuaries (Swan River Estuary and Wilson Inlet). The three species include an omnivore (Black Bream *Acanthopagrus butcheri*), a benthivore (Bluespot Goby *Pseudogobius olorum*) and a planktivore (Western Hardyhead *Leptatherina wallacei*), all of which constitute important parts of the food chain in the two estuarine systems.

Thea is using three different approaches to fish dietary studies, which will enable her to gain a very sound understanding of the pathways of material transfer (including sources of primary production) in the two estuaries. The resultant data from the three approaches, i.e. stomach content analyses, carbon and nitrogen stable isotope analyses (of fish and their prey) and fatty acid analyses (of fish and their prey), will be integrated to construct detailed food webs for the two ecosystems. Thea has maintained strong links with researchers at Hamburg University, and has just returned from a 3 month trip to that university where she was able to undertake many analyses for her PhD. Thea is supervised by Ian Potter, Fiona Valesini and Luke Twomey (Swan River Trust). Chris, Alan and Thea's studies are being funded by the Department of Fisheries, Department of Water and Swan River Trust. Chris and Thea are also the recipients of WAMSI top-up scholarships.

**Relationships between faunal assemblages and habitat type in Broke Inlet**

James Tweedley is focusing his PhD studies on Broke Inlet, a picturesque estuary located within the D’Entrecasteaux National Park on the south coast of Western Australia. During the recent National Land and Water Resources Audit carried out in 2001, the Broke Inlet was identified as the only estuary out of all 45 in south-western Australia in a near-pristine state. The main aims of James’ PhD study, which is being funded by FRDC and DEC, are: to (i) quantitatively classify the habitat types present in Broke Inlet, using data for a suite of enduring environmental variables that have been measured from mapped sources in a Geographical Information System (GIS); (ii) from seasonal sampling over two years of the ichthyofauna, benthic macroinvertebrate fauna and a suite of in-situ environmental variables in each of the identified habitat types, ascertain the extent of the “match”
between the faunal assemblages and habitat types. These analyses will be used to help to develop a model for predicting those species that are likely to typify any site of interest within the system; (iii) investigate trophic linkages between fauna using gut content analysis in order to produce a food web for the different habitat types within the estuary. James is working with Fiona Valesini and Ian Potter.

**Marine habitat and reef use**

Major research is being completed on the spatial analysis of the marine habitats of Rottnest Island and the Ningaloo Reef (see also section 3.2 c) – Marine protected areas).

Considerable GIS work is underway to prepare maps of the spatial and temporal distribution of activities such as fishing, snorkeling, diving etc. at Ningaloo Reef. Florian Mayer, from Munich, has recently joined the team to work on spatial modeling of these data. The second project, led by Dr Halina Kobryn and Dr Mike van Keulen, involves the use of a large hyperspectral data set for the entire Ningaloo Reef to map bathymetry and habitats of the Marine Park. Kristine Walters has also recently joined the group to work on some of these data.

Matt Harvey is nearing completion of the write up of his PhD thesis titled “Development of techniques to classify benthic habitats using hyperspectral imagery in oligotrophic, temperate waters” on the use of remotely sensed hyperspectral data for mapping subtidal habitats in Rottnest Island Reserve (see section 3.2 c).

**3.2 b) Studies on macroalgae diversity**

John Huisman continues his studies on Western Australian marine macroalgae, with a focus on the north-west. Recent or in-press publications have included an annotated checklist of the species occurring on the offshore atolls, rediscovery of an extremely rare alga from near the Perth region, an ultrastructural study of an unusual endophyte, and two publications examining the effects of the Leeuwin Current (Phillips & Huisman, 2009; Westera et al., 2009). In addition, Wells et al. (2009) makes a major contribution to the recognition of invasive marine species by presenting them in a field guide format.

Ongoing works include a book describing the marine flora of north-western Australia, which should be completed in 2010 and will be published as part of the ‘Algae of Australia’ series, plus taxonomic studies of the marine red algae of the Great Barrier Reef.

Ph.D. student Rainbo Dixon is continuing her studies of the brown alga *Sargassum*, incorporating DNA sequence analyses in an attempt to clarify the species relationships in this difficult genus.

In late 2008 John Huisman was a plenary speaker at the ‘Asia Pacific Phycological Forum’ in Wellington, New Zealand, where he presented a talk describing the present state of taxonomic phycology in Australia.
3.2 c) Marine protected areas

The two large projects being conducted at Ningaloo Marine Park under the auspices of the CSIRO Wealth from Oceans Ningaloo Collaborative Cluster progressed well during 2008 and several presentations were made at the 11th International Coral Reef Conference in Fort Lauderdale, USA. The prime focus of the project on high resolution mapping of human use of Ningaloo Reef, led by Associate Professor Lynnath Beckley, focused on analysis of the vast amount of field data collected in 2007. PhD student, Claire Smallwood, prepared drafts of several thesis chapters incorporating aerial and coastal survey data and results from interviews with users of the Ningaloo Marine Park. Substantial GIS work has been undertaken to prepare the aerial and coastal survey data into a set of standard products that management agencies can use. The clear seasonality in use of the marine park and the dramatic spatial expansion of recreational activities during the winter tourist season are hallmarks of the data set. Late in 2008, Florian Mayer joined the group to work on modeling the usage of the marine park relative to a range of environmental, socio-economic and infrastructure factors. Lynnath Beckley worked with Dr Mandy Lombard (Nelson Mandela Metropolitan University, South Africa) on a systematic evaluation of the incremental increase in protection provided to marine habitats under the current zoning plan for the Ningaloo Marine Park.

After the appropriate water and atmospheric corrections were completed on the high resolution remotely-sensed hyperspectral dataset, considerable progress was made with the spatial mapping of the habitats of Ningaloo Reef. This project, led by Dr Halina Kobryn, underwent a staff change when post-doctoral researcher, Dr Nicole Pinnel, was lured away to industry. Her replacement, Kristin Wouters, also trained in hyperspectral analysis in Germany, has brought her extensive skills to the project and numerous data products have now been produced. Five field trips were conducted during the year to validate marine habitat data and enable MSc students Dennis Rouillard and Jessica Bunning to work on the terrestrial components of the dataset and collect spectral measurements of soil and sediment types. Several presentations and posters on the Ningaloo studies were given at the International Coral Reef Symposium held in Fort Lauderdale, USA, in July 2008.

Matt Harvey has done considerable work on separability of reflectance spectra of subtidal substrata and species (e.g.: Sargassum, Ecklonia, seagrasses, etc) and has completed a comprehensive habitat map for the reserve. The main outcomes of his thesis are the development of new techniques for processing hyperspectral data for habitat mapping applications and the production of high resolution maps of the distribution of the shallow water marine benthic habitats (<15 m depth) for the Rottnest Island Reserve.

Work has continued at Ningaloo Reef as part of the CSIRO Wealth from Oceans Ningaloo Collaboration Cluster “Integrating knowledge of reef use, biodiversity and socio-economics into management strategy evaluation for the Ningaloo Marine Park”. The project, which is led by Associate Professor Lynnath Beckley, has made good progress toward mapping the spatial and temporal distribution of human usage of the reef. PhD student, Claire Smallwood, has analysed the 1200 on-site questionnaires that were conducted with people using the reef.
3.2 d) Population viability of species of conservation significance

Population viability analysis of the Perth metropolitan population of Little Penguins

This research involves Professors Stuart Bradley and Ron Wooller, and Dr Belinda Cannell at Murdoch University, in collaboration with Professor William Sherwin and Dr Jennifer Sinclair at UNSW.

Little Penguins in Perth Metropolitan waters are an important ecotourism and natural resource for WA. They breed on Penguin and Garden islands. They forage in waters heavily impacted by commercial and recreational vessels, and bounded by heavy industry. This project is using genetic, demographic and movement data to model the population and predict its viability in the face of a range of threats from human activities. The model will enable management strategies to be evaluated to secure the future of the population.

The project has been funded by the Australian Research Council Linkage Scheme, Department of Environment and Conservation, Fremantle Ports, Department of Defence, Tiwest and Winifred Violet Scott Estate Trust Fund.

The following activities were completed in 2008:

1. Nestboxes on Penguin Island were checked fortnightly to obtain information including timing and success of breeding, body condition and mortality rates.

2. Satellite tags were successfully deployed on 16 penguins from Penguin Island and 11 penguins from Garden Island. For the first time, tags were attached to penguins during the incubation period, giving insight into the foraging areas of penguins when they can remain at sea for five or more days.

3. Beach captures of penguins returning at night were conducted from September - November for the Mark-Release-Recapture program, necessary for determining the size of the population. Unmarked penguins found during the beach captures and in nest boxes are marked with a microchip. Since the project began, 1076 penguins have been microchipped.

4. We are investigating the genetic diversity between various populations of Little Penguins in WA. Additional blood samples were collected from penguins inhabiting Woody Island in the Recherche Archipelago. Blood samples were also collected from parents and chicks on Penguin Island for assessing genetic parentage.

5. We have recruited many volunteers to walk the majority of the foreshore from Woodman Point to Halls Head, looking for dead penguins. Autopsies were performed to determine cause of death if the carcasses were in good condition. 36 dead penguins were found at sites either on Penguin Island or on the foreshores of the mainland. Autopsies were performed on 9 penguins.
Endangered freshwater fish research

The Freshwater Fish Group has been a leader in endangered freshwater fish research throughout the State. Their work has focused on many of WA’s endangered fishes from monitoring the endangered Northern River Shark (Glyphis sp. C) and the vulnerable Freshwater Sawfish (Pristis microdon) and Dwarf Sawfish (Pristis clavata) in the Kimberley, to Australia’s only critically endangered freshwater fish, the Western Trout Minnow (Galaxias truttaceus) near Albany and a number of other species of conservation significance, including Balston’s Pygmy Perch (Nannatherina balstoni), Western Mud Minnow (Galaxiella munda) and Pouched Lampreys (Geotria australis).

David Morgan and Stephen Beatty also discovered a new species of pygmy perch in the south-west, and are currently working on a Water Corporation funded project looking at genetics and migration patterns of endangered and endemic fishes in the Denmark Region.

David also compiled a review of the freshwater fishes of the Kimberley for the Northern Australian Freshwater Fish Project. This review has proved extremely valuable in identifying species of conservation concern and highlights the rarity and highly endemic nature of fishes in the Kimberley. David, Stephen and Brendan Ebner (Griffiths University) also monitored the fishes of two rivers in the Pilbara and discovered what may be a further two new species in the Fortescue River (an eel-tailed catfish and a terapontid). This work, which was funded by the Department of Water, has highlighted the importance of groundwater in relation to species diversity and population stability in these desert systems.

The importance of groundwater in Kimberley systems was also highlighted by a study of the fishes of Snake Creek in the Fitzroy River, an area with high diversity and an important nursery for many species of fish. This work was funded by Liveringa Pastoral Co. and involves the Yiriman Rangers from Jarlmadangah. These rangers have also continued to be involved in the Freshwater Sawfish Project in the Fitzroy River and one of the rangers, Travis Fazeldean, joined the Freshwater Fish Group at Murdoch as a trainee for much of 2008. Travis has now been appointed as a Nyikina-Mangala Ranger hosted by the Kimberley Land Council and continues to work on the sawfish project. The Freshwater Sawfish Project has been extremely successful and has strong community support throughout the north. The team includes David Morgan, Jeff Whitty (acoustic tracking), Nicole Phillips and Jennie Chaplin (genetics of sawfishes in Australia (see Genetics section)), Stirling Peverell (Qld DPI&F), Dean Thorburn, the Yiriman Rangers, many people of the West Kimberley, and a host of national collaborators, including Colin Simpfendorfer (JCU) and Rory McAuley (DoF) and is funded largely by the Department of the
Environment, Water, Heritage and the Arts. The NSW Aquarium also kindly donated funds to the project, and some fieldwork was supported by National Geographic. A number of members of the team met in Brisbane for a workshop to develop a multispecies issues paper on the known ecology, distribution and issues impacting Australia’s endangered sawfishes and river sharks. The Freshwater Sawfish work has also led to David and Jeff aiding Stirling Peverell in the Leichardt River (Qld) to monitor Freshwater Sawfish. A number of publications have been produced as a result of these collaborations, and the strength of the project lies in the long history (2001-2008) of the freshwater fish work in the West Kimberley and the iconic nature of the species in question, which is one of the world’s largest fish found in freshwater. As such, Dr Zeb Hogan (National Geographic), who is on a quest to film the world’s largest freshwater fishes team ed up with David, Jeff, Nicole and the rangers to film their project during 2008. This will be aired in 2009 on the National Geographic channel in the Monsterfish series.

The data generated during the Freshwater Sawfish Project was also largely responsible for the formation of a Fitzroy River Fishway Steering Committee in 2008. The Committee organised a number of projects such as a scoping study and community engagement for a fishway on the river at the Camballin Barrage; the only major artificial barrier to fish migration in one of the world’s most ecologically important systems. David also presented an overview of the many Murdoch fish related projects in the Fitzroy River and West Kimberley at the Australian Society for Fish Biology’s annual conference, Bondi Beach, 2008 and to the newly formed FitzCAM group in Fitzroy Crossing. David and Stephen also presented at a number of workshops and community meetings on fishways in Western Australia in general. The team completed a Fishway Prioritisation Review for the Department of Water and this work has led to a great deal of interest in fishway development in Western Australia, particularly by the Department of Water. Fishways have now been constructed and monitored on a number of systems and are often crucial in the conservation of endangered freshwater fishes. Other recent fishway work has occurred in Margaret River, the Goodga River and fishway requirement studies have been conducted in the Gingin region, on the Pinjarra Weir, the Harvey irrigation Area and in the Angove River.

**Whale Shark research**

Adjunct Senior Lecturer Brad Norman established the multi-award-winning ECOCEAN Whale Shark Photo-identification Library (www.whaleshark.org) as part of his long-term study of the whale sharks at Ningaloo Marine Park (NMP). This database became an online resource in 2002 and continues to receive Whale Shark sighting information and identification photographs from stakeholders in 43 different countries. In 2008, the reports and images from Whale Shark sightings at NMP provided by eco-tourists and Whale Shark tour personnel were collated and processed by ECOCEAN staff and Earthwatch Institute volunteers. As a result, a total of 133 individual Whale Sharks were recorded at NMP during the Whale Shark season. Many of these were sharks that had been sighted at NMP in previous seasons, returning again in 2008. It was also encouraging to see many ‘new’ sharks – individuals not before recorded at NMP nor in the global database (61 out of 133).
RESEARCH ACTIVITIES cont...

Several ‘regular’ visitors showed up in 2008, including A-001 (‘Stumpy’) who has been seen at NMP since 1992. A-013 was seen several times in 2008, having been first recorded in the Library in 1996, while A-093 which was first sighted in 1997, was photographed at NMP in May and July 2008. Another, A-076 first sighted in 1999 (dorsal fin intact), was the shark presumably attacked by another predatory shark (dorsal fin bite in 2003), and was sighted at NMP in both April and June 2008. Many sharks in 2008 remained at NMP for an extended period, with the longest period between re-sightings of an identified shark (A-227) being 83 days.

Brad Norman was named as one of US magazine National Geographic’s 2008 class of Emerging Explorers. He was the first Australian to be so honoured. National Geographic’s Emerging Explorers Program recognises and supports uniquely gifted and inspiring adventurers, scientists, photographers and storytellers making a significant contribution to world knowledge through exploration while still early in their careers.

Murdoch University Cetacean Research Unit

The members of Murdoch University’s Cetacean Research Unit (MUCRU), within the Centre for Fish and Fisheries Research, work on both applied and empirical conservation-based research projects. This includes assessing abundance and habitat use of a variety of dolphin populations, analysing cetacean social structure and mitigating against dolphin by-catch. Other areas of research include foraging ecology, population genetics and assessment of anthropogenic impacts on cetaceans through development and tourism. In 2008, we further expanded our research program and collaborations, and strengthened existing partnerships with industry and government agencies.

Group members and collaborators:

As of December 2008, Murdoch University’s Cetacean Research Unit consisted of Simon Allen (Research Fellow), Dr Lars Bejder (Research Leader), Gin Swen Ham (Honours student) Shannon McCluskey (PhD candidate), Deirdre McElligott (Research Assistant); Holly Smith (PhD candidate), Julian Tyne (Honours student) and Kristel Wenziker (PhD candidate).

Murdoch University collaborators include: Profs. Stuart Bradley and Neil Loneragan; Dr Kate Bryant; Ms Bec Donaldson; Dr Hugh Finn; Assoc. Prof. Carolyn Jones; Dr Carly Palmer.

External collaborators include: Dr Michael Krützen (University of Zürich; Adjunct Prof. Murdoch University), Associate Prof. Peter Madsen (University of Aarhus, Denmark; Adjunct Prof. Murdoch University), Assoc. Prof. Doug Nowacek (Duke University); Dr Chandra Salgado (Curtin University), Assoc. Prof. William Sherwin (University of New South Wales) and Dr Magnus Wahlberg (University of Southern Denmark; Adjunct Prof. Murdoch University).

Research Activities undertaken by MUCRU are as follows:

Dolphin population abundance, habitat use, conservation genetics and prey species in the south-west:

Photo provided by Simon Allen – Bowriding dolphins
The majority of our research in 2008 focused on bottlenose dolphins (*Tursiops* spp.) in the south-west. The overall aim here is to assess the long-term viability of dolphin populations by building an understanding of their biology and ecology, including gene flow with other geographic areas and interactions with the environment, food resources and human activities (tourism, port activities and port development). Four synergistic research projects targeting the Bunbury region are contributing to achieving this overall aim: 1) Document abundance and habitat use of bottlenose dolphins (PhD candidate Ms Holly Smith); 2) Investigate the factors affecting the distribution of dolphin prey species (PhD candidate Ms Shannon McCluskey); 3) Investigate the population and conservation genetics of dolphins in Albany, Augusta, Busselton, Bunbury and Cockburn Sound (PhD candidate Claire Daniels; UNSW); and 4) Evaluate the viability of the local dolphin population using models and results from Projects 1-3 (PhD student TBA).

**Fisheries interaction:**

Research Fellow Simon Allen is working with Neil Loneragan and Lars Bejder on the FRDC, WADoF and industry-funded project ‘Reducing dolphin bycatch in the Pilbara finfish trawl fishery’. The primary objectives of this research are: (1) to conduct a fine-scale analysis of spatial and temporal aspects of dolphin bycatch and fishing effort; (2) to evaluate dolphin behaviour around trawl nets and the efficacy of different net designs in reducing the chance of harm and mortality to dolphins; and (3) to assess dolphin species identity and population structure across the fishery-impacted area.

![Photo provided by Simon Allen – dolphins foraging around trawl net](image)

**Cultural transmission of tool-use in bottlenose dolphins:**

Tool use in cetaceans has only been documented in one population – the bottlenose dolphin population in Shark Bay, WA. Some of these dolphins use marine sponges as a protective glove to protect their rostra when they probe for prey in the substrate. All “spongers” are maternally related – they share the same mitochondrial DNA, which is transmitted only through the female line. Dr Bejder and Simon Allen of MUCRU are collaborating with Dr Michael Krützen (University of Zürich) and Assoc. Prof. William Sherwin (University of New South Wales) to discern whether tool-use is a genetic trait, governed by ecological factors or transmitted culturally (through social learning by offspring from their mothers). In 2008, Mr Julian Tyne completed his Honours thesis, exploring possible correlations between locations of the sponge-carrying dolphins and the density and distribution of marine sponges along transect lines in the western gulf of Shark Bay.
**Population assessment of bottlenose dolphins (Tursiops sp.) in Cockburn Sound**

Investigators: Rebecca Donaldson, Hugh Finn, Lars Bejder  
Honours Student: Gin Swen Ham

This consultancy assessed the current status of the resident community of bottlenose dolphins in Cockburn Sound, Western Australia and the potential impacts of the proposed Kwinana Quays port development at the eastern margin of Cockburn Sound. Photo-identification surveys from July-November 2008 identified more than 160 individual dolphins and indicated significant turn-over in the composition of the resident community since 1997. Analyses of photo-identification images indicated low rates of shark scarring, although two fresh wounds were observed in October 2008. Although previous studies have documented at least 10 instances of entanglement within Cockburn Sound, few scars indicative of entanglement were observed, suggesting that observations of scars do not accurately reflect the incidence of injury and mortality from entanglement in monofilament fishing line, particularly for calves. Analyses of photo-identification images also suggested that various forms of skin lesions occur, and that the incidence of lesions may differ between age-sex classes and vary seasonally.

**Population consequences of acoustic disturbances**

Acoustic disturbance of marine mammals has become a topic of great concern and interest to biologists and managers worldwide. In August of 2008, Ms Deirdre McElligott and Dr Bejder began a literature review into the effects of noise on wildlife. Previously, National Research Council developed a conceptual framework, the Population Consequences of Acoustic Disturbance (PCAD), to tackle the difficult task of tracing acoustic disturbance through the life history of a marine mammal and then to determine the consequences for the population. The concept of the model was designed to serve as a guideline which may eventually enable researchers to relate marine mammal behavioural responses caused by man-made noise to long term viability of the exposed population. This literature review aims to identify current knowledge and data gaps in each section of the PCAD model and illustrate where research is most needed. We are collaborating with Associate Prof. Doug Nowacek and Dr Dave Johnston (Duke University, USA) on this research project.

**Other cetaceans highlights**

In March 2008, a new dolphin research and volunteer building was opened at the Bunbury Dolphin Discovery Centre. It houses students and staff from the Murdoch University Cetacean Research Unit (MUCRU) alongside the Centre’s 100-plus volunteers. The MUCRU facility provides Murdoch students with a wet lab, office space for eight people, including PhD students and visiting scientists. The facility also has a large shed that houses MUCRU’s field equipment and research vessels.
Official launch of dolphin research and volunteer building.

From left to right: Dr. Lars Bejder (Murdoch University Research Leadership Fellow); Prof. Stuart Bradley (Murdoch University Faculty Dean); Hon. Barry House (South West MLC); David Trench (Chairman, Bunbury Dolphin Discovery) and Phil Couthard (Operations Manager, Bunbury Dolphin Discovery.

In April 2008, MUCRU hosted a workshop in Bunbury for the International Whaling Commission (IWC) on the “Strategic Planning of Large-scale Whalewatching Research”. The IWC workshop involved thirty-five leading scientists from North America, South America Europe and Australia. The workshop participants discussed sustainable levels of whale and dolphin watching to establish world-best practice for marine-based tourism. The participants produced a report with research recommendations that was presented at the annual IWC meeting in Chile in June 2008. The outcomes of this work are on-going and will be further discussed at the annual IWC meeting in Madeira, June 2009.

International Research Collaborations:

Our research has attracted significant interest and engagement from international research scientists. Through research collaborations with MUCRU, Dr Michael Krützen from the University of Zürich, Associate Professor Peter Madsen from Aarhus University in Denmark and Associate Professor Magnus Wahlberg from University of Southern Denmark have been appointed Adjunct Professors within the Centre for Fish & Fisheries Research.

Sponsors:

South West Development Commission, Western Australian Government, Bunbury Port Authority, City of Bunbury, Department of Environment and Conservation, Bemax Cable Sands, Iluka Worsley Alumina, WA Plantations, Crystal Global, Millard Marine, Bunbury Dolphin Discovery, Winifred Violet Scott Estate, Department of Fisheries, Western Australia. Fisheries Research and Development Corporation, the Joint Industry Program – Oil and Gas Producers.
3.3. Biological Processes and Evolution

3.3 a) Growth, reproduction and feeding

Biology of the octopus, \textit{Octopus tetricus}

Renae Larsen completed her Honours studies with Martin de Graaf (Department of Fisheries, Western Australia, DoF) and Neil Loneragan and Alex Hesp (CFFR) on \textit{Octopus tetricus}. Renae’s studies, which are funded by the Department of Fisheries, are focused on determining the size composition, growth characteristics and reproductive biology of this species in the waters off Fremantle. The results of the study will be invaluable to managers for refining their management plans for this increasingly important commercial species in Western Australia.

3.3 b) Genetics and evolution

During 2008, research into the population and evolutionary genetics of a range of fish and shellfish species was conducted. Some of the highlights are indicated below.

Bryn Farmer (supervised by Professors Norm Hall and Ian Potter and Dr Jennie Chaplin) completed his PhD research on the “Biology, stock structure and mortality of the mulloway, \textit{Argyrosomus japonicus}, in Australian waters”. Among other things, Bryn’s research has documented the presence of an isolated and genetically depauperate assemblage of the mulloway, that may be exhibiting signs of inbreeding depression, in the Oyster Harbour on the south coast of Western Australia.

Glenn Moore (supervised by Dr Jennie Chaplin and Professor Ian Potter) continued his PhD study of the “Phylogeography of marine fish species of the genus \textit{Arripis} with sympatric and allopatric breeding populations in Australian waters”. Thus far, Glenn’s genetic results, together with life-history information, suggest that each of the Eastern Australian Salmon, Western Australian Salmon and Australian Herring is panmictic (i.e., individuals move and mate at random) over their entire Australian range.

Nicole Phillips (supervised by Drs Jennie Chaplin and David Morgan) continued her PhD research into the conservation genetics of three species of sawfish (\textit{Pristis microdon}, \textit{P. clavata} and \textit{P. zijsron}) in Australian waters. Thus far, Nicole’s results indicate that the freshwater sawfish, \textit{P. microdon}, exhibits a high degree of matrilineal structure, which may be due to philopatric behaviour in the females, in Australian waters. Nicole is now using microsatellite markers to collect additional information to investigate whether \textit{P. microdon} exhibits male-biased dispersal. The research is generating information that can be used to help develop plans for the conservation of these critically endangered species. It is partially funded by grants from the Department of the Environment, Water, Heritage and the Arts, and is being conducted in collaboration with Stirling Peverell (Queensland Department of Primary Industries and Fisheries) and Dean Thorburn. Aspects of this research were filmed for inclusion in an episode of the television program ‘Snake Busters’ and in 2009 will appear on the National Geographic’s Monsterfish series.

Michelle Gardner (supervised by Dr Jennie Chaplin and Professor Ian Potter) was awarded first class honours for her research into the genetics and biology of restocked versus wild Black Bream, \textit{Acanthopagrus butcheri}, in the Blackwood River Estuary. This research continued the monitoring, commenced in 2000, of the growth and reproduction of
restocked Black Bream in this system, and also compared the genetics of the wild versus the restocked fish for the first time. The results indicate that essentially all of the restocked fish had attained maturity, and can thereby potentially be incorporated into the breeding population, by five years of age. Preliminary genetic data indicate that rare alleles may have been lost from the pool of restocked individuals, although differences in growth performance between restocked and wild Black Bream do not appear to have a genetic basis. This research was conducted in collaboration with Dr Alex Hesp (CFFR) and Greg Jenkins (Challenger TAFE) and was partly funded by the Western Australian Fish Foundation.

Ertug Sezmis and Jennie Chaplin completed a microsatellite-based investigation into the relationships among the assemblages of the Blue Swimmer Crab, *Portunus pelagicus*, in Cockburn Sound, the Swan River Estuary and Warnbro Sound. This project was funded by the Department of Fisheries WA and was motivated by concerns over the status of the assemblage of this commercially and recreationally important species in Cockburn Sound. The results, when considered in combination with other evidence, suggest that the assemblages of *P. pelagicus* in the three water bodies probably comprise a series of overlapping biological stocks.

Jennie Chaplin, assisted by Ertug Sezmis, Glenn Moore and Nicole Phillips, undertook a preliminary assessment of the number, abundance, distribution and characteristics of lineages of *Thenus* slipper lobsters in selected regions for Lobster Harvest. Jennie also commenced a WAMSI funded study of the population genetics of Pink Snapper (*Pagrus auratus*) and Baldchin Grouper (*Choerodon rubescens*) that, among other things, will provide information about the appropriate spatial scales for the management of these two heavily fished species. This research project will ultimately form the basis of Michelle Gardner’s PhD study, which will commence in 2009.

**Genetics of Arripidae**

PhD student Glenn Moore is working with Jennifer Chaplin and Ian Potter to compare the phylogeographic structure of three species of *Arripsis* (Arripidae) in Australian waters using mtDNA and nuclear DNA. The data that Glenn is collecting will be used to infer aspects of the origins and recent evolutionary histories of these three species in relation to various population-level phenomena and possible environmental correlates. In Australian waters, the Arripidae is represented by the Australian Herring (*A. georgianus*) and the western and eastern Australian Salmon (*A. truttaceus* and *A. trutta*, respectively). A fourth species, the Northern Kahawai (*A. xylabion*) occurs off northern New Zealand. All species appear to have complex life histories involving impressive spawning migrations for sexually mature individuals. While young salmon are broadly sympatric in Tasmanian waters, discrete allopatric spawning aggregations occur along the south-west (*A. truttaceus*) and along the northern Victorian/New South Wales coasts (*A. trutta*), with no documented interbreeding between the populations – hence their currently recognised specific status. Similarly, young *A. georgianus* appear to inhabit nursery grounds along the South Australian/southern Victorian coasts and migrate westwards into a single spawning assemblage in the south-west. Glenn’s results will have broad significance because they will provide comparisons of (i) geminate species on the west and east coast of Australia (*A. truttaceus* versus *A. trutta*) and (ii) closely related species with virtually identical geographical distributions (*A. truttaceus* versus *A. georgianus*).
3.3 c) **Lamprey physiology and evolution**

Howard Gill and Ian Potter, together with Claude Renaud of the Museum of Nature in Ottawa, completed their studies of the main components of the unique feeding apparatus of adult lampreys. Comparisons between these structures in the full suite of Southern Hemisphere and Northern Hemisphere lampreys emphasised that the adults of those species that feed on blood contain larger buccal glands, finer teeth and a more restricted number of small velar tentacles than is the case with those adults that feed on flesh. The larger buccal glands in blood-feeding lampreys reflect the requirement by such species to produce a continuous flow of anticoagulant. In contrast, the greater number and size of velar tentacles in flesh-feeding lampreys prevent the solid food of these species entering the branchial chamber and thus potentially clogging the gills. The possession of more robust teeth by flesh-feeding than blood-feeding species facilitates the removal of substantial amounts of flesh. Indeed, in the case of the Southern Hemisphere *Geotria australis* the large teeth on the tongue-like piston interlock with the equally large teeth on the disc to act as jaws.

Ian, Howard and Claude have completed the chapter on lampreys for the definitive treatise on the freshwater fishes of North America. They were also involved in a study of the phylogeny of all extant lampreys using sequence data for CytB, the results of which were very similar to those that were obtained by Ian, Howard and Claude using morphology and other non-molecular characters. Howard and Ian, in collaboration with Dave Berryman, Mike Bunce and post-graduate students, have nearly completed sequencing the entire mitochondrial genome of *G. australis* and *Mordacia mordax*. The resultant data will be invaluable in determining the relationships of Northern and Southern Hemisphere lampreys, a relationship which was not resolved by the cladistic studies involving the morphological and CytB matrices. The mtDNA data will also enable the time of divergence of the two Southern Hemisphere families of lampreys (Geotriidae and Mordaciidae) from each other and from the single family of Northern Hemisphere lampreys (Petromyzontidae) to be estimated.

Ian Potter is continuing to work with Helmut Bartels on the ultrastructural characteristics of the gills of larval and adult lampreys. Current work is aimed at elucidating whether chloride cells, which are essential for osmoregulation in adult lampreys in marine environments, are present in the land-locked and nonparasitic juvenile forms of anadromous parasitic lampreys from which they have been derived. Ian is also continuing his studies with Shaun Collin on the eyes of the two Southern Hemisphere families of lampreys, which differ markedly in their characteristics.
4. PUBLICATIONS for 2008

Books


Refereed publications in 2008


**Refereed publications in 2009 and in press**


Bearham, D., Spiers, Z., Raidal, S., Jones, J.B. and Nicholls, P.K. In press. Detection of *Minchinia occulta* in samples of pearl oysters *Pinctada maxima* (Jameson, 1901) infected by
Haplosporidium hinei. Australian Veterinary Journal (accepted 8 May 09).


Hoeksema, S.D., Chuwen, B.M. and Potter, I.C. In press. Factors influencing the characteristics of the fish faunas in nearshore, shallow waters of permanently open, seasonally-open and normally-closed estuaries. Estuarine, Coastal and Shelf Science.


**Other publications in 2008**


Chaplin, J. and Sezmis, E. 2008. *A genetic assessment of the relationships among the assemblages of the blue swimmer crab, Portunus pelagicus, in Cockburn Sound, the Swan River Estuary and Warnbro Sound*. (Centre for Fish and Fisheries Research Murdoch University) Report to the Department of Fisheries, Western Australia.


Environment and Conservation, Western Australia, pp. 46-51.


Morgan, D.L. 2008. *Freshwater fishes of the Kimberley region of Western Australia*. Centre for Fish & Fisheries Report, Murdoch University for the Northern Australian Freshwater Fish Project to the Department of the Environment and Heritage.


Morgan, D.L. and Beatty, S.J. 2008. *Check structures and fish and crayfish fauna in the Harvey Irrigation Area*. Centre for Fish & Fisheries Research, Murdoch University report to Department of Water.


Conference and workshop presentations


PUBLICATIONS cont...

Norman, B.M. 2008. Whale sharks: a threatened species we can save with a collaborative approach - Research by ECOCEAN and the Centre for Fish & Fisheries Research, Murdoch University. University of Madrid, Spain.


5. POSTGRADUATE STUDENTS AND THEIR RESEARCH TOPICS

PhD students (awarded in 2008)

Dr Douglas Bearham  
*Identification and characterisation of two haplosporidian parasites in oysters in North Western Australia.*  
Supervisor: Phil Nicholls (HS)

Dr Peter Coulson  
*The biology of three teleost species with divergent life cycle characteristics and their implications for fisheries management.*  
Supervisors: Ian Potter, Alex Hesp and Norm Hall (SELS)

Dr Bryn Farmer  
*Biology, stock structure and mortality of the mulloway Argyrosomus japonicus in Australian waters.*  
Supervisors: Norm Hall, Ian Potter and Jennie Chaplin (SELS)

Dr Gary Jackson  
*Fisheries biology and management of pink snapper, Pagrus auratus, in the inner gulfs of Shark Bay, Western Australia.*  
Supervisor: Norm Hall (SELS)

Dr Gavin Partridge  
*Inland saline aquaculture: overcoming biological and technical constraints towards the development of an industry*  
Supervisor: Alan Lymbery (HS)

Dr Matthew Pember  
*Characteristics of fish communities in coastal waters of north-western Australia, including the biology of the threadfin species, Eleutheronema tetradactylum and Polydactylus macrochir*  
Supervisor: Ian Potter (SELS)

Dr Corey Wakefield  
*Latitudinal and temporal comparisons of the reproductive biology and growth of snapper, Pagrus auratus (Sparidae), in Western Australia.*  
Supervisor: Norm Hall (SELS)

Dr Fiona Webster  
*Coral reef resilience: balancing production and herbivory.*  
Supervisors: Mike van Keulen (SELS) and Russ Babcock (CSIRO)

Dr Michelle Wildsmith  
*Changes in the benthic macroinvertebrate fauna of a large microtidal estuary following extreme modifications aimed at reducing eutrophication.*  
Supervisors: Ian Potter and Fiona Valesini (SELS)

Dr Andrew Winzer  
*The biology and prevalence of Cirolana hesperia and their effect on the Western Rock lobster fishery.*  
Supervisor: Howard Gill (SELS)

PhD students (enrolled/examined/submitted/pending correction in 2008)

Mark Allen  
*Balancing artisanal fishing and conversation goals in a newly established network of marine protected areas in Raja Ampat, Papua.*  
Supervisors: Neil Loneragan (SELS) and Mark Erdmann (Conservation International)

Farhan Bokhari  
*The effects of salinity on riparian arthropod communities.*  
Supervisor: Alan Lymbery (HS)

Samantha Bridgwood  
*Physical factors determining the structure of seagrass meadows in Warnbro Sound, Western Australia.*  
Supervisors: Mike van Keulen (SELS) and Marion Cambridge (UWA)
Amanda Buckland
*Trophic interactions of fish species in the Swan-Canning Estuary and Peel-Harvey Estuary.*
Supervisors: Steeg Hoeksema, Ian Potter, Fiona Valesini and Luke Twomey (SELS)

Janja Ceh
*Coral-associated microbial communities of Ningaloo Reef, Western Australia.*
Supervisors: Mike van Keulen (SELS), David Bourne (AIMS)

Warren Chisholm
*The stability of shallow coastal sediments with and without seagrasses.*
Supervisors: Eric Paling, Mike van Keulen and Jennifer Verduin (SELS)

Ben Chuwen
*Fish faunas of deeper, offshore waters in estuaries on the south coast of Western Australia, including aspects of the biology of Black Bream Acanthopagrus butcheri.*
Supervisor: Ian Potter (SELS)

Natasha Coen
*Implications of habitat type for the hyperbenthos for four morphologically divergent estuaries in south-western Australia.*
Supervisors: Ian Potter and Fiona Valesini (SELS)

Rainbo Dixon
*A taxonomic revision of the brown algal genus Sargassum (Fucales: Sargassaceae) from Australia.*
Supervisor: John Huisman (SELS)

Sarah Fretzer
*Analysing the effects of anthropogenic activities on different aquatic ecosystems in Western Australia and identifying ecosystem-based management policies that provide long-term sustainability.*
Supervisors: Norm Hall (SELS), Jeffrey Dambacher (CSIRO), Hector Lozano-Montes (CSIRO), Brent Wise (DoF)

Susan Gibson-Keuh
*Diseases of Asian seabass and Barramundi.*

Supervisors: Phil Nicholls (HS) and Alan Lymbery (HS)

Chris Hallett
*Development of an estuarine health index for the Swan-Canning Estuary and Wellstead Estuary.*
Supervisors: Ian Potter, Fiona Valesini and Steeg Hoeksema (SELS)

Matt Harvey
*Development of techniques to classify benthic habitats using hyperspectral imagery in oligotrophic, temperate waters.*
Supervisors: Lynnath Beckley and Halina Kobryn (SELS)

Marina Hassan
*Parasites of native and exotic freshwater fishes in the south west of Western Australia.*
Supervisors: Alan Lymbery (HS), David Morgan and Stephen Beatty (SELS)

David Holliday
*Cross-shelf transport induced by mesoscale eddies of the Leeuwin Current: Implications for larvae of neritic biota.*
Supervisors: Lynnath Beckley (SELS) and Ming Feng (CSIRO)

Matthew Hourston
*The ecology of free living nematodes in nearshore marine and estuarine sediments on the microtidal lower west coast of Australia.*
Supervisor: Ian Potter and Fiona Valesini (SELS)

Michelle Ingram
*The effect of salinity on the resilience of riparian ecosystems.*
Supervisor: Alan Lymbery (HS)

Kelsie Jackson
*Developing ecosystem models of Jurien Bay, Western Australia: A comparison of modelling approaches and model uses* Supervisors: Neil Loneragan (SELS)
Ashlee Jones
Characteristics of the elasmobranch fauna in the bycatch of commercial fisheries in south-western Australia.
Supervisor: Ian Potter (SELS)

Mark Langdon
The trophic ecology of the grazing sea urchin Echinometra mathaei within Ningaloo Marine Park, Western Australia.
Supervisors: Mike van Keulen and Eric Paling (SELS)

Elaine Lek
Comparisons between the biology of three temperate species of wrasse (Labridae) in different habitats and different regions.
Supervisors: Ian Potter and David Fairclough (SELS)

Anne Lif Lund Jacobsen
The south-east (trawl) fishery in Australia from 1915 to 1980
Supervisors: Elaine Stratford (UTas) and Malcolm Tull (LB)

Thea Linke
Trophic interactions in the faunas of the Swan Estuary and Wilson Inlet, Western Australia.
Supervisors: Ian Potter, Fiona Valesini and Luke Twomey (SELS)

Karen Marshall
Enzymatic mechanism(s) involved in the partitioning of fatty acids into either catabolic or anabolic processes.
Supervisors: Max Cake and Ian Potter (SELS)

Sally May
Conflict and cooperation: a history of the Western Australian Fishing Industry
Supervisor: Malcolm Tull (LB)

Fiona McAleer
Fish and fish migrations in the Blackwood River Yarragadee discharge zone – including the age growth reproduction of Tandanus bostoki.

Supervisors: David Morgan, Howard Gill and Stephen Beatty (SELS)

Shannon McCluskey
Diet and foraging patterns of bottlenose dolphins in relation to prey composition and abundance in South Western Australia.
Supervisors: Neil Loneragan, Lars Bejder (SELS) and Miles Logsdon (UW)

Fraser McGregor
The trophic ecology & habitat requirements of the Manta Ray (Manta birostris) in lagoonal systems of Ningaloo Reef, Western Australia.
Supervisors: Mike van Keulen, Luke Twomey (SELS), Anya Waite (UWA) and Mark Meekan (AIMS)

Glenn Moore
Phylogeography of marine fish species of the genus Arripis with sympatric and allopatric breeding populations in Australian waters.
Supervisors: Jennie Chaplin and Ian Potter (SELS)

Nicole Phillips
Conservation genetics of Pristis species in Australian waters.
Supervisors: Jennie Chaplin and David Morgan (SELS)

Mahmoud Rashnavadi
The effects of salinity on the fish fauna of the Blackwood River.
Supervisors: Alan Lymbery (HS), David Morgan and Stephen Beatty (SELS)

Rebecca Roberts
Supervisors: Lynnath Beckley (SELS) and Malcolm Tull (LB)
Andrew Rowland
The biology of Samson fish Seriola hippos with emphasis in the sport fishery in Western Australia.
Supervisor: Howard Gill (SELS)

Emilia Santos-Yap
Genetic structure of natural and cultured populations of Black Bream, Acanthopagrus butcheri
Supervisors: Jennie Chaplin and Ian Potter (SELS)

Claire Smallwood
Spatial patterns of human usage in the Ningaloo Marine Park.
Supervisors: Lynnath Beckley and Susan Moore (SELS)

Holly Smith
Population dynamics and habitat utilisation in bottlenose dolphins, Bunbury, Western Australia.
Supervisors: Lars Bejder, Halina Kobryn, Stuart Bradley (SELS)

Zoe Spiers
Ciliate protozoa in pearl oysters
Supervisors: Shane Raidal and Mandy O’Hara (HS)

Natalie Toon
Catchability of Western Rock Lobster (Panulirus cygnus); the influence of temperature, light intensity, lobster size, moult stage and commercial fishing apparatus.
Supervisors: Neil Loneragan and Howard Gill (SELS)

Mike Travers
Comparisons between the species compositions of the fish faunas over reefs and soft substrates in tropical waters of north-western Australia.
Supervisors: Ian Potter (SELS) and Steve Newman (DoF)

James Tweedley
Fish faunas and habitat classification of the seasonally-open Broke Inlet.

Supervisors: Ian Potter, Fiona Valesini, and Steeg Hoeksema (SELS)

Lauren Veale
The characteristics of the fish faunas of the Peel-Harvey Estuary and Leschenault Estuary with comparisons over a thirty-year period.
Supervisors: Ian Potter, Steeg Hoeksema, Alex Hesp and Peter Coulison (SELS)

Kristel Wenziker
The population dynamics and habitat usage of Sousa chinensis and Tursiops truncates found in the Ningaloo area.
Supervisors: Mike van Keulen, Lars Bejder (SELS), Kelly Waples (DEC), Guido Parra (UQ)

MSc students (awarded in 2008)

Jessica Bunning
Spatial quantification of the impacts of off-road vehicles (ORVs) along the remote Ningaloo coastline of Western Australia.
Supervisors: Dr Halina Kobryn and Dr Viki Cramer

Dennis Rouillard
The use of hyperspectral imagery in detecting linkages between soils and marine sediments at Ningaloo.
Supervisors: Halina Kobryn (SELS), Viki Cramer and Peter Hausknecht (Woodside)

MPhil students
(enrolled/examined/pending correction in 2008)

Jeff Whitty
Movement & habitat utilization of Pristis microdon & Glyphis sp. C.
Supervisors: David Morgan (SELS) and Colin Simpfendorder (JCU)
**Honours students** (awarded in 2008)

**Alan Cottingham**  
*The current state of the stock of Black Bream, Acanthopagrus butcheri, in the Swan-Canning Estuary.*  
Supervisors: Alex Hesp and Ian Potter (SELS) - Class I.

**Brett Crisafulli**  
*Biology of two fish species of Mullet (Mugilidae) in five estuaries on the south coast of Western Australia.*  
Supervisors: Alex Hesp and Ian Potter (SELS) - Class IIa.

**Michelle Gardner**  
*Comparison of the genetics and biology of restocked vs wild Black Bream, Acanthopagrus butcheri, in the Blackwood River Estuary.*  
Supervisors: Jenny Chaplin, Alex Hesp and Ian Potter (SELS) - Class I.

**Renae Larsen**  
*The Western Australian developmental octopus fishery: species composition and aspects of morphology and biology.*  
Supervisors: Neil Loneragan, Alex Hesp (SELS), Martin de Graaf (DoF) – Class I

**Rob Michael**  
*Investigations into the potential use of Artemia (brine shrimp) to control microalgal blooms in inland saline aquaculture ponds.*  
Supervisors: Alan Lymerby and Gavin Partridge (HS) – Class I.

**Anna Reid**  
*Cryptosporidium and Giardia in cultured and wild finfish in Australia.*  
Supervisors: Una Ryan and Alan Lymerby (HS) – Class I.

**Tracy Rodwell**  
*The biology of King George Whiting Sillaginoides punctata (Teleostei: Sillaginidae) in five estuaries on the south coast of Western Australia.*  
Supervisors: Alex Hesp and Ian Potter (SELS) Class IIa.

**Julian Tyne**  
*Does sponge distribution lead to sponging behavior by bottlenose dolphins in Shark Bay?*  
Supervisors: Lars Bejder, Neil Loneragan (SELS) Class I.

**Honours students** (enrolled/examined/submitted/pending correction in 2008)

**Natalie Millar**  
*Latitudinal study of larval fish assemblages in the Leeuwin Current, Western Australia.*  
Supervisor: Associate Professor Lynnath Beckley

**Gin Swen Ham**  
*Population biology of bottlenose dolphins (Tursiops sp) in Cockburn Sound.*  
Supervisors: Lars Bejder, Neil Loneragan, Hugh Finn (SELS)
6. SUMMARY OF RESEARCH FUNDING

6.1 List of projects and research income for 2008

<table>
<thead>
<tr>
<th>Name</th>
<th>Project</th>
<th>Funding Body</th>
<th>Duration</th>
<th>2008 prop’n $</th>
<th>Total funding ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allen, Simon; Neil Loneragan and Lars Bejder.</td>
<td>Pilbara bycatch reduction</td>
<td>FRDC, DoF and industry</td>
<td></td>
<td>$50,000.00</td>
<td>$150,000.00</td>
</tr>
<tr>
<td>Beatty, Stephen; and David Morgan</td>
<td>Influence of surface and groundwater on fish migrations in the Blackwood River</td>
<td>Department of Water</td>
<td>2008-2010</td>
<td>$99,000.00</td>
<td>$243,000.00</td>
</tr>
<tr>
<td>Beatty, Stephen; and David Morgan</td>
<td>Assessment of the fish and crayfish communities of the tributaries of the Margaret River and implications for management</td>
<td>Cape to Cape Catchments Group</td>
<td>2008</td>
<td>$7,000.00</td>
<td>$7,000.00</td>
</tr>
<tr>
<td>Beatty, Stephen; and David Morgan</td>
<td>Aquatic biodiversity assessment of the Carbanup and Buayanyup River</td>
<td>Geocatch (Department of Water)</td>
<td>2008</td>
<td>$16,000.00</td>
<td>$16,000.00</td>
</tr>
<tr>
<td>Beckley, Lynnath; and David Holliday</td>
<td>Influence of Leeuwin Current eddies on cross-shelf transport of pelagic larval biota</td>
<td>WAMSI Node 2</td>
<td>2007-2009</td>
<td>$8,000.00</td>
<td>$24,000.00</td>
</tr>
<tr>
<td>Beckley, Lynnath; and Matt Harvey</td>
<td>Hyperspectral imagery for marine planning in SW Australia</td>
<td>Rottnest Island Authority</td>
<td>2005-2008</td>
<td>$1,000.00</td>
<td>$3,000.00</td>
</tr>
<tr>
<td>Beckley, Lynnath; Halina Kobryn and Sue Moore</td>
<td>Human usage in Ningaloo Marine Park</td>
<td>CSIRO Wealth from Oceans Ningaloo Collaborative Cluster</td>
<td>2006-2009</td>
<td>$162,000.00</td>
<td>$490,000.00</td>
</tr>
<tr>
<td>Bejder, Lars</td>
<td>Dolphin Monitoring Program at Monkey Mia, Shark Bay, WA</td>
<td>Dept of Environment and Conservation</td>
<td>2007-2011</td>
<td>$20,139.00</td>
<td>$109,354.00</td>
</tr>
<tr>
<td>Bejder, Lars</td>
<td>International Whaling Commission Workshop 2008</td>
<td>International Whaling Commission</td>
<td>2008</td>
<td>$18,000.00</td>
<td>$18,000.00</td>
</tr>
<tr>
<td>Murdoch University</td>
<td></td>
<td>2008</td>
<td>$12,500.00</td>
<td>$12,500.00</td>
<td></td>
</tr>
<tr>
<td>Perth Convention Bureau</td>
<td></td>
<td>2008</td>
<td>$10,000.00</td>
<td>$10,000.00</td>
<td></td>
</tr>
<tr>
<td>Austr Federal Dept. of Env &amp; Water Res</td>
<td></td>
<td>2008</td>
<td>$30,000.00</td>
<td>$30,000.00</td>
<td></td>
</tr>
<tr>
<td>International Fund For Animal Welfare</td>
<td></td>
<td>2008</td>
<td>$15,000.00</td>
<td>$15,000.00</td>
<td></td>
</tr>
<tr>
<td>City of Bunbury</td>
<td></td>
<td>2008</td>
<td>$10,000.00</td>
<td>$10,000.00</td>
<td></td>
</tr>
<tr>
<td>South West Development Commission</td>
<td></td>
<td>2008</td>
<td>$5,000.00</td>
<td>$5,000.00</td>
<td></td>
</tr>
<tr>
<td>US National Marine Fisheries Service</td>
<td></td>
<td>2008</td>
<td>$6,000.00</td>
<td>$6,000.00</td>
<td></td>
</tr>
<tr>
<td>Oil and Gas: Joint Industry Funds</td>
<td></td>
<td>2008</td>
<td>$15,000.00</td>
<td>$15,000.00</td>
<td></td>
</tr>
<tr>
<td>Bunbury Port Authority</td>
<td></td>
<td>2008</td>
<td>$2,000.00</td>
<td>$2,000.00</td>
<td></td>
</tr>
</tbody>
</table>

| Bejder, Lars | PCAD literature review | Joint Industry Program. Oil and Gas Producers | 2008 | $20,000.00 | $34,000.00 |

| Bejder, Lars; Neil Loneragan and Stuart Bradley | Large-scale dolphin research program in south-west Australia | Bunbury Ports Authority | 2007-2010 | $12,000.00 | $60,000.00 |
| Worsley Alumina | | 2007-2010 | $12,500.00 | $50,000.00 |
| WA Plantations | | 2007-2010 | $6,000.00 | $24,000.00 |
| Cable Sands | | 2007-2010 | $7,500.00 | $30,000.00 |
| City of Bunbury | | 2007-2010 | $10,000.00 | $60,000.00 |
| Lyondell Millenium Chemicals | | 2007-2010 | $1,500.00 | $6,000.00 |
| Dept of Environment and Conservation | | 2007-2010 | $10,000.00 | $30,000.00 |
| Millard Marine | | 2007-2009 | $3,000.00 | $9,000.00 |
| Iluka | | 2008-2010 | $7,000.00 | $21,000.00 |
| South West Development Commission | | 2007-2009 | $9,000.00 | $27,000.00 |

| Chaplin, Jennie | A preliminary assessment of the number, abundance, distribution and characteristics of lineages of *Thenus* from selected geographic regions | Lobster Harvest | 2008-2009 | $24,000.00 | $35,706.00 |

<p>| Chaplin, Jennie; and Ertug Sezmis | A genetic assessment of the relationships among the assemblages of the blue swimmer crab, <em>Portunus pelagicus</em>, in Cockburn Sound, the Swan River Estuary and Warnbro Sound | Department of Fisheries, WA | 2007-2008 | $32,413.00 | $32,413.00 |</p>
<table>
<thead>
<tr>
<th>Name</th>
<th>Project Description</th>
<th>Funding Body</th>
<th>Start Year</th>
<th>Total Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chaplin, Jennie; and Ian Potter</td>
<td>Genetic (microsatellite) determination of the stock structures of snapper <em>(Pagrus auratus)</em> and baldchin grouper <em>(Choerodon rubescens)</em> in Western Australian waters</td>
<td>WAMSI node 4</td>
<td>2008-2011</td>
<td>$36,015.00</td>
</tr>
<tr>
<td>Huisman, John</td>
<td>Name that Seaweed: preparation of an interactive key to the genera of Australian marine macroalgae</td>
<td>Australian Biological Resources Study (ABRS)</td>
<td>2008</td>
<td>$38,000.00</td>
</tr>
<tr>
<td>Kobryn, Halina</td>
<td>Application of hyperspectral imagery to maps tracks and sediments at Ningaloo</td>
<td>Department of Environment &amp; Conservation</td>
<td>2008</td>
<td>$4,000.00</td>
</tr>
<tr>
<td>Kobryn, Halina</td>
<td>Sediment mapping at Ningaloo</td>
<td>Woodside</td>
<td>2008</td>
<td>$7,500.00</td>
</tr>
<tr>
<td>Loneragan, Neil; Simon Allen and Lars Bejder</td>
<td>Reducing dolphin bycatch in the Pilbara Finfish Trawl Fishery</td>
<td>Fisheries Research and Development Corporation</td>
<td>2008-2009</td>
<td>$45,000.00</td>
</tr>
<tr>
<td>Lymbery, Alan</td>
<td>Integrating inland saline aquaculture and livestock production</td>
<td>RIRDC</td>
<td>2006-2010</td>
<td>$47,557.00</td>
</tr>
<tr>
<td>Morgan, David</td>
<td>Fish fauna of Snake Creek (Fitzroy River)</td>
<td>Liveringa Pastoral Co.</td>
<td>2008-2009</td>
<td>$15,000.00</td>
</tr>
<tr>
<td>Morgan, David</td>
<td>Freshwater fishes of the Kimberley</td>
<td>NAFF Project, james Cook University</td>
<td>2007-2008</td>
<td>$30,000.00</td>
</tr>
<tr>
<td>Morgan, David</td>
<td>Freshwater Sawfish Project</td>
<td>NSW Aquarium</td>
<td>2008</td>
<td>$2,000.00</td>
</tr>
<tr>
<td>Morgan, David; and Stephen Beatty</td>
<td>Fishes in groundwater dependent pools of the Yule and Fortescue Rivers</td>
<td>Department of Water</td>
<td>2008-2009</td>
<td>$10,000.00</td>
</tr>
<tr>
<td>Morgan, David; and Stephen Beatty</td>
<td>Assessing fish migrations in the Harvey Irrigation District and determination of the impact of irrigation check structures</td>
<td>Department of Water</td>
<td>2007-2009</td>
<td>$10,000.00</td>
</tr>
<tr>
<td>Morgan, David; and Stephen Beatty</td>
<td>Interbasin transfer in the Warren and Donnelly Rivers</td>
<td>Water Corporation</td>
<td>2008</td>
<td>$21,000.00</td>
</tr>
<tr>
<td>Morgan, David; and Stephen Beatty</td>
<td>Goldfish Control Program in the Vasse River</td>
<td>Geocatch (Department of Water)</td>
<td>2004-2008</td>
<td>$8,000.00</td>
</tr>
<tr>
<td>Morgan, David; and Stephen Beatty</td>
<td>Fishway assessment for the Pinjarra Weir</td>
<td>Peel-Harvey Catchment Council</td>
<td>2008-2009</td>
<td>$7,000.00</td>
</tr>
<tr>
<td>Morgan, David; Stephen Beatty and Alan Lymbery</td>
<td>The distribution of the freshwater mussel <em>(Westralunio carteri)</em> in the catchments of Geographe Bay. Water Corporation of Western Australia</td>
<td>Water Corporation</td>
<td>2008</td>
<td>$23,000.00</td>
</tr>
<tr>
<td>Name</td>
<td>Project Title</td>
<td>Funding Details</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morgan, David; and Jennie Chaplin</td>
<td>Habitat associations of Freshwater Sawfish (Pristis microdon) and Northern River Shark (Glyphis sp. C) in the Kimberley, including genetic analysis of P. microdon across northern Australia</td>
<td>Department of the Environment, Water, Heritage and the Arts 2007-2008 $37,000.00 $87,000.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nicholls, Phil</td>
<td>Aquatic Animal Health Subprogram: development of diagnostic tests to assess the impact of Haplosporidium infections in pearl oysters</td>
<td>FRDC 2006-2009 $34,540.00 $148,574.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paling, Eric; and Mike van Keulen</td>
<td>Seagrass Rehabilitation Studies</td>
<td>Seagrass Research and Development Plan (industry-funded research programme) 2008-2011 $202,608.00 $651,147.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partridge, Gavin; Gavin Sarre, Alan Lymberry, Greg Jenkins, and Rob Doupé</td>
<td>New technologies for sustainable fish culture</td>
<td>FRDC 2005-2008 $5,025.00 $460,147.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potter, Ian; Fiona Valesini, and Steeg Hoeksema</td>
<td>Development of Biotic indices for establishing and monitoring estuarine health</td>
<td>Department of Fisheries WA; Department of Water; Swan River Trust 2007-2010 $146,844.65 $433,865.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potter, Ian; and Fiona Valesini</td>
<td>Relationships between fish faunas and habitat type in south-western Australian estuaries</td>
<td>Fisheries Research &amp; Development Corporation 2004-2008 $96,056.18 $480,278.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potter, Ian; and David Fairclough</td>
<td>Ecological interactions in coastal marine ecosystems: the fish communities and main fish populations of the Jurien Bay Marine Park</td>
<td>Strategic Research Fund for the Marine Environment 2004-2007 $21,456.00 $196,456.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potter, Ian; Norm Hall, Ben Chuwen, and Steeg Hoeksema</td>
<td>Estuarine Fisheries Research Project</td>
<td>SCNRM South Coast Natural Resource Management Inc. 2006-2009 $73,422.00 $294,918.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potter, Ian; Ben Chuwen, and Steeg Hoeksema</td>
<td>Implications of environmental change and morality estimates for sustaining fish populations in South Coast Estuaries.</td>
<td>Fisheries Research &amp; Development Corporation; WAMSI Western Australian Marine Science Institution 2006-2009 $18,898.08 $100,768.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potter, Ian; Norm Hall, Peter Coulson, and Steeg Hoeksema</td>
<td>Development of bioregional level assessments of the status of community structure based on fishery dependent and/or fishery independent data</td>
<td>WAMSI Western Australian Marine Science Institution 2007-2011 $124,930.00 $281,610.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name(s)</td>
<td>Project Description</td>
<td>Funding Source</td>
<td>Years</td>
<td>Amount (2008)</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>------------------------------------------</td>
<td>--------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Potter, Ian; Norm Hall, Peter Coulson, and Steeg Hoeksema</td>
<td>Leschenault Estuary Fish Habitat Research Project</td>
<td>South West Development Commission</td>
<td>2008-2010</td>
<td>$20,000.00</td>
</tr>
<tr>
<td>Potter, Ian; and Ben Chuwen</td>
<td>Tagging Black Bream, King George Whiting and Mulloway in the Albany area.</td>
<td>Department of Fisheries WA</td>
<td>2008</td>
<td>$2,717.00</td>
</tr>
<tr>
<td>Thompson, Andrew; Alan Lymbery, Peter Spencer, Keith Morris and Adrian Wayne (DEC)</td>
<td>The nature, diversity and potential impact of infectious agents in Western Australian threatened mammals</td>
<td>ARC Linkage</td>
<td>2007-2009</td>
<td>$153,118.00</td>
</tr>
<tr>
<td>van Keulen, Mike; Eric Paling, P. Ridd, and D. Fotheringham</td>
<td>The stability of shallow coastal sediments with and without seagrasses</td>
<td>ARC Linkage</td>
<td>2004-2008</td>
<td>$29,034.00</td>
</tr>
<tr>
<td>van Keulen, Mike; Halina Kobryn and Lynnath Beckley</td>
<td>Biodiversity and Habitat Mapping</td>
<td>CSIRO Wealth from Oceans Collaborative Cluster project, node 1</td>
<td>2006-2010</td>
<td>$63,200.00</td>
</tr>
<tr>
<td>van Keulen, Mike; and Jennifer Verduin</td>
<td>Seagrass hydrodynamics research</td>
<td>REGS funding</td>
<td>2008</td>
<td>$2,500.00</td>
</tr>
</tbody>
</table>

**2008 TOTAL FUNDING - $1,976,972.91**
7. ACKNOWLEDGEMENTS

CFFR would like to acknowledge ongoing support from the following sponsors and collaborators:
ACKNOWLEDGEMENTS cont...
Ningaloo Flagship Collaboration Fund Cluster
South West
Marine Research Program

PROUDLY SPONSORED BY

BUNBURY DOLPHIN DISCOVERY
WESTERN AUSTRALIA

CITY OF BUNBURY

BUNBURY PORT AUTHORITY

bhpbilliton
resourcing the future

Worsley Alumina

CRISTAL
Global

SOUTH WEST
DEVELOPMENT COMMISSION

WAPRES

ILUKA

MILLARD
MARINE

BEMAX
INTEGRATING CABLE SANDS

Department of Environment and Conservation
Our environment, our future

Murdoch University