SUPERVISORS

Below is a list of people involved in marine science, marine biology and coastal and marine science at UWA who are prepared to be involved in honours and masters supervision. Their area of research is also briefly described. The list is not exhaustive and if there are other potential supervisors please approach them direct, or contact your course coordinator (euan.harvey@uwa.edu.au). It is also not uncommon to have a supervisor who is external to the university.

Animal Biology

Shaun Collin is a Western Australian Premier’s Fellow. Western Australia has an exceptionally rich biodiversity that is ranked second in the world in terms of its endemism. The habitats for native animals are unsurpassed, from arid deserts to rainforests to estuarine mangroves to deep ocean canyons. Management of these different ecosystems is dependent on a sound understanding of the diverse fauna and how it is likely to fare in the face of coastal development, farming, recreation and climate change. Within every ecosystem, the ability to detect light by all living things is crucial for survival - for example, for setting circadian rhythms, avoiding predation, finding food and reproductive success.

Shaun’s research falls broadly into the field of comparative neurobiology with emphasis on the neural basis of behaviour. Using models from the extant relatives of the first vertebrates (agnathans) to elasmobranchs and teleosts, various aquatic sensory systems (including vision, olfaction and electroreception) are investigated to establish broad concepts of plasticity and adaptation to environments as diverse as coral reefs and the deep-sea. Anatomical, electrophysiological, molecular and behavioural techniques are currently being used to trace the prehistoric origins of colour vision, the visual ecology of deep-sea fishes and sharks, the regulation and patterned expression of visual pigments in the vertebrate retina and the development of sensory input to the shark and teleost brain. Recently funded projects on using sensory indicators to improve the diet and growth of finfish for the aquaculture industry and the exploration of the sensory systems of deep-sea organisms off Australia’s continental shelf continue to expand the breadth of species we examine.

See [http://www.animals.uwa.edu.au/research/neuroecology](http://www.animals.uwa.edu.au/research/neuroecology)

Associate Professor Nathan Hart studies the evolutionary adaptations and underlying mechanistic processes of the vertebrate visual system, with particular emphasis on elasmobranchs (sharks and rays) and teleost fishes. Using a range of physiological, anatomical, behavioural and genetic techniques, he is able to characterise the visual abilities of an animal and relate these abilities to habitat and behaviour, within a phylogenetic context. His most recent work has focused on the ability of sharks and rays to see colour. This research has potential applications in reducing shark bycatch in long-line fisheries and preventing shark attacks on humans. For more information see: [http://www.uwa.edu.au/people/nathan.hart](http://www.uwa.edu.au/people/nathan.hart)
David Hunt is a molecular biologist with interests in the evolution of visual and circadian systems in aquatic and terrestrial vertebrates. The main focus of his work has been on the molecular evolution of visual pigments in a range of different species that includes agnathans, cartilaginous fishes, teleosts, birds and mammals. Recently funded projects have included a molecular study of the processes of phototransduction in early aquatic vertebrates and the molecular basis for spectral shifts in the visual pigments of species adapted to differing photic habitats that include the deep sea fish. See http://www.uwa.edu.au/people/David.Hunt

Jon Evans has broad interests in sexual selection and evolutionary ecology, using both freshwater fishes and broadcast spawning marine invertebrates as model systems. Jon is also interested in applying the principles of experimental quantitative genetics to explore patterns of genetic variance for life-history traits that are impacted by rising sea temperatures and changing ocean chemistry. Any students wishing to undertake projects in these and related subjects should contact Jon directly. See http://www.ceb.uwa.edu.au/our_people/jon_evans for more information.

Monica Gagliano’s research is broadly based in evolutionary ecology with particular emphasis on the responses of individuals to changing environmental conditions and the proximate factors influencing these responses in the wild. Most of her work takes place on coral reefs and she is involved in research on fluctuating asymmetry, compensatory growth, oxidative stress and senescence (mostly in coral reef fishes, but not exclusively) to determine the direction and strength of selection acting on the morphological and life history traits that contribute to fitness. Email: monica.gagliano@uwa.edu.au

Jason Kennington uses both molecular and quantitative genetic approaches to investigate factors that determine the fitness and evolutionary potential of populations. He is especially interested in the genetic bases of traits involved with variation in fitness, the importance of genetic variation in populations and the effect of gene flow on local adaptation. He also has an ongoing interest in the genetic threats of extinction posed to small populations. He has interest in the genetic variation in populations of marine fishes and invertebrates. See http://www.uwa.edu.au/people/jason.kennington

Jessica Meeuwig is the Director for the Centre for Marine Futures. Current areas of research include fish and fisheries conservation (biogeography, marine protected areas, population modelling, biochronology, fish and habitat modelling and some behavioural ecology), cetacean ecology, and shark ecology. Integration of policy and economics with ecology are also explored. See http://www.uwa.edu.au/people/jessica.meeuwig

Jane Prince has broad interests in marine biology, but in particular in the processes determining structure in the macro-invertebrate assemblages of rocky intertidal platforms and intertidal sand flats. She currently works on the intertidal rock platforms at Rottnest
Island and in the Ningaloo Marine Park, where the focus is to understand the extent and cause of spatial and temporal variation in assemblage structure. Population studies on individual species such as the sea urchins, cowries and giant clams on the rock platforms have concentrated on understanding patterns of recruitment and mortality. Work on the fauna of the sandy intertidal flats at Cable Beach, Broome, and Princess Royal Harbour, Albany, has also focused on spatial variation, with emphasis on the effects of human impacts. An up-coming project will be looking to link patterns in the distribution and abundance of sandy intertidal infauna to movement and feeding patterns of intertidal waders on 80-mile beach in the Pilbara.

Kara E. Yopak’s research interests have focused on comparative neuroanatomy within sharks, skates, and rays (collectively known as cartilaginous fishes), particularly how the development of major brain areas vary between species in conjunction with the adaptive evolution of their sensory and motor systems. She has uncovered that the different regions of the shark brain scale in a similar way to all other vertebrate brains, including mammals. There are limitless questions waiting to be answered in this field, but her main goals are to provide insight into 2 major questions: (1) *When and why have brains remained the same?* In other words, what structures have remained conserved within and across a taxonomic group and are these trends consistent across an entire subphylum? (2) *How and what makes the brain different?* What phylogenetic, developmental, ecological, and physiological processes are contributing to these differences and can we attribute these differences to functionality? Using a variety of established and novel quantitative techniques, including histology, magnetic resonance imaging, and isotropic fractionation, the goal of her research is to establish allometric and cellular scaling rules governing brain growth and evolution in early vertebrates.

Agricultural Resource Economics

**Michael Burton** is a Professor in the School of Agricultural and Resource Economics, with interests in the use of non-market valuation techniques to value marine ecosystems, including marine reserves, protected species and human recreational activity. Current research in the area is being supported by the Marine NERP, where there is a particular interest in understanding values associated with marine offsets by both the public and marine scientists. I am also interested in looking at whether the public have a good understanding of the complexities of marine systems, and how those compare to experts.

Biomedical, Biomolecular and Chemical Sciences

**David Sutton** is a microbial ecologist specializing in marine microbiology and applied environmental microbiology. Research interests include marine viruses and their potential as biological control agents in aquaculture; the symbiosis of bacteria with marine invertebrates, including the production of unique chemicals with biotechnological applications; and marine microbial diversity and distribution.
Centre for Excellence in Natural Resource Management, Albany

Paul Close is a fish ecologist based at the Albany UWA Centre of Excellence in natural Resource Management. Paul has broad interests in tropical-temperate estuarine and freshwater fish, and more particularly, habitat and hydrological requirements of native fishes. Paul’s research has addressed the role of aquatic habitats in structuring fish communities and the effect of threatening processes on fish populations including alterations to natural hydrological regimes, increased salinity and degradation of structural in-stream habitats. Paul is also interested in the ecology of larval and juvenile stages, particularly the environmental influence on recruitment success and variability. Current projects Paul is involved with include climate change effects on temperate and tropical rivers, wetlands and estuaries, the role of connectivity in ephemeral tropical rivers, and biodiversity values of wetland ecosystems in north-western australia. Past projects of particular interest also include investigations of environmental influence on the movement dynamics of estuarine fish. Example projects for interested students include:

1. Importance of upstream permanent refugia for recolonisation of ephemeral wetlands in a tropical endorheic system.

2. Impact of river regulation on river-floodplain connectivity and associated ecological values in a large tropical river.

3. Development of a decision support tool for managing the ecological, social and economic effects of sand bar management in intermittently open-closed estuaries.

4. Movement dynamics of freshwater cobbler (Tandanus bostocki).

5. Early life history of night fish (Bostockia porosa): recruitment dynamics and habitat requirements.

6. Physical and hydraulic constraints on the distribution of decapod burrows in sandbed streams of south western Australia.

7. Advection of larval fish during aseasonal breaching of estuarine sandbars.


9. Climate change impact on native fish (temperature and salinity sensitivity).

Any students interested in these projects, or wishing to discuss opportunities for other potential projects should contact Paul directly (paul.close@uwa.edu.au, 98420833)

Professor Peter Cook spent a major part of his working career at the University of Cape Town (UCT) in South Africa where he headed a very active mariculture research group, concentrating particularly on shellfish such as abalone, mussels and oysters. Between
1998 and 2001 he was Head of Department of Zoology at UCT but then left South Africa to take up an Adjunct position at the Centre of Excellence in Natural Resource Management in Albany. Besides his interests in aquaculture, Peter has also been involved in projects on freshwater aquatic systems including the development of a Catchment Management Plan for the Fitzroy River in the Kimberley. Peter is currently working with the World Wildlife Fund on a project to develop and implement international environmental standards for the aquaculture industry.
See: https://www.socrates.uwa.edu.au/Staff/StaffProfile.aspx?Person=PeterCook

Earth and Environment

Bryan Boruff is Assistant Professor in the School of Earth and Environment at the University of Western Australia. His research focuses on the methodological development of risk and vulnerability assessments for environmental hazards. Whilst Bryan’s fundamental research is concerned with environmental hazards, he has expertise in the application of Geographic Information Systems and Remote Sensing technologies to a range of environmental management issues from environmental impact assessments to renewable energies. In terms of marine science, Bryan is interested in primarily coastal vulnerability and coastal management issues as they pertain to natural hazards and climate change.
Email: bryan.boruff@uwa.edu.au

Julian Clifton is a geographer with research interests focusing on marine conservation policy and planning, with focal areas including Western Australia, south-east Asia, the Coral Triangle region and island states of the Indian Ocean. His research includes topics such as ecosystem-based management, stakeholder participation, the implementation of comprehensive, adequate and representative marine protected areas, indigenous and artisanal fishing communities and aligning conservation with local communities’ development needs. Students with any interests in these areas are encouraged to contact Julian directly on julian.clifton@uwa.edu.au

Jim Falter is generally interested in how the growth and metabolism of benthic communities vary as a function of their physical and chemical environment. His current research is focused on understanding how fluxes of carbon, nitrogen, and phosphorus to coral reef, seagrass and kelp communities are differentially forced by light, water motion, and nutrient availability through the C:N:P of benthic primary producers. His goal is to understand how large-scale climatic variability influences the dynamics of benthic material fluxes at the community and ecosystem scales using a combination of targeted mesocosm experiments, field observations, and coupled hydrodynamic-biogeochemical models.
See http://www.uwa.edu.au/people/jim.falter

Ryan Lowe’s research involves the study of how oceanic and meteorological forcing drives the circulation and distribution of wave energy within a broad range of coastal systems (e.g., on beaches, coral reefs, rocky shorelines, and in estuaries). In most cases, this work is motivated by the need to improve our understanding of the coupling between...
hydrodynamics and other key processes occurring in marine environments, such as sediment transport, biogeochemical cycling and spatial ecology. As part of this work, he employs a wide range of field, laboratory and numerical modelling techniques. His research interests include coastal and estuarine hydrodynamics, numerical modelling of waves and coastal circulation, coastal sediment transport, remote sensing of coastal systems, benthic boundary layer and canopy flow dynamics, biophysical interactions in marine systems. See [http://www.uwa.edu.au/people/ryan.lowe](http://www.uwa.edu.au/people/ryan.lowe)

Malcolm McCulloch is a Western Australian Premier’s Fellow and an Associate Director of the ARC Centre of Excellence in Coral Reef studies. He is interested in climate change and corals. Using geochemical proxies preserved in the long-lived (300 to 400 year old) coral skeletons from the Great Barrier Reef he has been able to show how European settlement and associated land-use practices has led to a five to ten fold increase in sediment and nutrient fluxes entering the reef relative to 'natural' levels. This has provided important quantitative evidence to support enhanced National-State protective measures. Using a similar geochemical isotope-based approach his group has also been able to show that the effects of rapidly increasing levels of anthropogenic CO2 are now becoming evident in living corals, reinforcing the concerns about the impact of ocean acidity on coral reef systems. He has also undertaken research on fossil coral reefs, in particular those from the Last Interglacial, where he has demonstrated the realities of an ~4 metre higher sea-levels associated with warmer sea surface temperatures, providing a benchmark for likely future increases. See [http://www.uwa.edu.au/people/malcolm.mcculloch](http://www.uwa.edu.au/people/malcolm.mcculloch)

Cordelia Moore is a quantitative marine ecologist with expertise in spatial modelling. The main focus of her work is in the multidisciplinary modelling of species distribution, connectivity and resilience. With increasing concerns over the vulnerability of marine ecosystems to disturbances such as climate change, having an understanding of connectivity is key to understanding ecological resilience. By using a combination of species and community distribution modelling approaches we can identify biophysical processes shaping the distribution and extent of connectivity among biological communities and their resilience to disturbance. This allows for the identification of species, communities or areas of high risk, which in turn enables more targeted management.

Email: cordelia.moore@uwa.edu.au

Kimberly Van Niel's research is generally in spatial ecology and biogeography in both marine and terrestrial systems. Her key interest is in understanding the drivers of species distributions, full coverage modelling of benthic biota for understanding seascapes and as habitat for mobile species. She also combines modelling with field and experimental data to understand better how species deal with environmental stressors or key life stage processes. She is also interested in understanding the impacts of disturbance and climate change on species. She supervises projects in distribution modelling of marine organisms (seagrass, other benthic biota, lobsters and fishes) and remote sensing of near shore
marine and coastal environments. She also co-supervises marine Honours projects with an explicitly spatial approach.


**Jens Zinke** has been appointed as Research Assistant Professor with a co-affiliation to the UWA Oceans Institute. Jens has a strong focus on paleoclimatic studies of the southern Indian Ocean using massive, long-lived corals from various coral reefs along the WA coast and in the western Indian Ocean. Jens uses geochemical proxies to reconstruct sea surface temperature, salinity and river runoff changes along Indian Ocean coral reefs. Furthermore, his research addresses the link of ocean temperature change to circum-Indian Ocean terrestrial climate change and its connections with climate phenomena across the Indo-Pacific. Current research areas involve the Rowley Shoals and Houtman Abrolhos in WA and Madagascar, Kenya, Tanzania and the Mascarene Islands in the western Indian Ocean.


**Environmental Systems Engineering**

**Christine Hanson** is a researcher with the Australian National Facility for Ocean Gliders (ANFOG) and has particular interests in biological and physical oceanography, bio-optics, phytoplankton dynamics, and benthic-pelagic coupling, and she is happy to work with students who would like to develop projects along any of these research themes. See [http://www.uwa.edu.au/people/christine.hanson](http://www.uwa.edu.au/people/christine.hanson)

**Greg Ivey**'s research is in the area of geophysical fluid dynamics. In particular, the goal is to integrate field observations, numerical modelling and laboratory experiments in order to quantify the mechanisms responsible for transport and mixing in the coastal ocean. The motivation is to understand the impacts on the ocean environment but also to provide scientific understanding for the safe and reliable engineering operation of the current and future developments planned by the offshore oil and gas industry, particularly on the North West Shelf. His interests include internal waves, coastally trapped waves, upwelling, coastal flows, cyclone impacts on the ocean, tidal flows, small scale turbulent mixing, and the coupling of physical and biogeochemical processes.

See [http://www2.sese.uwa.edu.au/~ivey](http://www2.sese.uwa.edu.au/~ivey)

**Chari Pattiaratchi** is interested in coastal physical oceanography, circulation and mixing on the continental shelf, nearshore processes, remote sensing applications, island wakes and headland eddies and estuarine dynamics. He is the leader of the Australian National Facility for Ocean Gliders ([http://www2.sese.uwa.edu.au/~hollings/anfog/index.php](http://www2.sese.uwa.edu.au/~hollings/anfog/index.php)). Ocean gliders are autonomous vehicles designed to operate in water depths up to 1000 m. By changing its buoyancy, the glider is able to descend and ascend. This momentum is converted to forward motion by its wings. Pitch adjustments are made by moving an internal mass (battery pack) and steering is done using a rudder and/or battery packs. Moving at an average horizontal velocity of 25 - 40 cm s⁻¹ the glider navigates its way to a series of pre-programmed waypoints using GPS, internal dead reckoning and altimeter measurements. The glider path is also influenced by the prevailing current regime. The
gliders are programmed to provide data through satellite communication when it is at the surface and it is also possible to control the path of the glider during its mission. ANFOG deploys gliders across Australia, which are controlled remotely at UWA. See [http://www.uwa.edu.au/people/charitha.pattiaratchi](http://www.uwa.edu.au/people/charitha.pattiaratchi) See [http://www.sese.uwa.edu.au/research/researchstaff/charitha_pattiaratchi](http://www.sese.uwa.edu.au/research/researchstaff/charitha_pattiaratchi) See [http://www2.sese.uwa.edu.au/~pattiara/CoastalOceanography/](http://www2.sese.uwa.edu.au/~pattiara/CoastalOceanography/)

**Paul Thomson** is a marine microbial ecologist with expertise in flow cytometry and other microbial techniques used to study phytoplankton, protozoa (single celled animals), heterotrophic bacteria and marine viruses. His research interests include factors affecting the distribution and abundance of marine microbes in in the Southern Ocean and in Australian coastal waters. Previous research has also included minicosm (600 L tank) studies on the effects of ocean acidification and enhanced UVB on Antarctic marine microbes. Paul currently works for the Australian National Facility of Ocean Gliders at UWA and is interested in furthering the understanding of bio-optical data (fluorescence, backscatter and coloured dissolved organic matter) from ocean gliders. Paul is happy to develop projects with students within these themes. See [http://www.ecm.uwa.edu.au/contact/profiles?type=profile&dn=cn%3DPaul%20Thomson%2Cou%3DSchool%20of%20Environmental%20Systems%20Engineering%2Cou%3DFaculties%20of%20Engineering%20and%20Mathematics%2Cou%3DThe%20University%20of%20Western%20Australia](http://www.ecm.uwa.edu.au/contact/profiles?type=profile&dn=cn%3DPaul%20Thomson%2Cou%3DSchool%20of%20Environmental%20Systems%20Engineering%2Cou%3DFaculties%20of%20Engineering%20and%20Mathematics%2Cou%3DThe%20University%20of%20Western%20Australia)

**Anya Waite** is a biological oceanographer whose research focuses primarily on oceanic research in marine phytoplankton. The interests of herself and her team range from the study of algal blooms in fresh water, to microzooplankton grazing, and the modeling of the interaction of plankton with the global climate. The world's oceans and fresh waterways are under increasing environmental threat as human activities impinge on our marine and aquatic environment. From the local to the global scale, this means it is crucial to understand the biological dynamics of such systems and their broader role in global cycles. It is the tiny planktonic systems which are often the least understood components of such systems. Our aim is to understand the biogeochemistry of plankton as they interact dynamically with the chemistry and physics of their fluid medium, and to link this understanding to a broader grasp of regional and global-scale processes and fluxes. See [http://www.uwa.edu.au/people/anya.waite](http://www.uwa.edu.au/people/anya.waite) See [http://www.sese.uwa.edu.au/research/researchstaff/anya_waite](http://www.sese.uwa.edu.au/research/researchstaff/anya_waite)

**Michele Thums** ([michele.thums@uwa.edu.au](mailto:michele.thums@uwa.edu.au)) is a Research Associate in the School of Environmental Systems Engineering and the Oceans Institute. She is a biologist, with a research interest in animal behavioural ecology, with a focus on foraging ecology and vertical and horizontal movement behaviour of large marine vertebrates. She is particularly interested in understanding the context and motivations surrounding changes in movement (transiting, resting, foraging etc) and what oceanographic features drive these changes. Such questions are the focus of her postdoctoral research using data from
electronic tag deployments on a range of marine species such as sharks, turtles and
dugongs.
See http://www.uwa.edu.au/profile?dn=cn%253DMichele%2520Thums%2520School%2520Environmental%2520Systems%2520Engineering%2520Faculty%2520Computing%2520and%2520Mathematics%2520School%2520of%2520Environmental%2520Systems%2520Engineering%2520Faculty%2520Computing%2520and%2520Mathematics%2520School%2520of%2520Western%2520Australia

Julia Reisser is a PhD candidate in the School of Environmental Systems Engineering and the UWA Oceans Institute. For her PhD research she is using a bio-physical modelling approach to understand sea turtle population connectivity and plastic pollution hazards. Her main research aim is to strengthen the understanding of the links between physical oceanography and the spatial distribution of (1) sea turtles and (2) floating marine plastics. The specific objectives of her PhD are: i) Verify the influence of ocean currents on the spatial distribution of green turtle populations; ii) Develop a biophysical model to chart the pathways taken by young green turtles born at different rookeries around the globe and iii) Identify the types of floating plastics and its spatial distribution in waters close to the Australian continent.

Microscopy, Characterisation and Analysis

Peta Clode’s research interests include biological processes of biomineralisation in marine invertebrates (specifically molluscs and scleractinian corals), symbiont-host interactions in scleractinian corals, and structure-function relationships in biological tissues. Her fields of expertise include marine biology, ion transport and biological microscopy (SEM, TEM, SIMS, EELS, EFTEM).
See http://www.uwa.edu.au/people/peta.clode
See http://www.cmca.uwa.edu.au/staff_pages/peta

Jeremy Shaw is a member of the ‘Metals in Biology’ research group at the Centre for Microscopy, Characterisation and Analysis. The group utilises a range of 2D and 3D imaging techniques to characterise elements in a range of animal systems. Dr Shaw focuses on the study of iron’s structural and functional role in biology. Iron is thought to play a role in magnetoreception, where animals use the Earth’s magnetic field for navigation. This sense is exhibited by a range of marine and terrestrial species, such as turtles, fish, birds and bees. Despite the wealth of behavioural evidence for magnetoreception, the location and structure of the cells responsible for this sense are yet to be fully resolved. Projects centred on the use of cutting-edge light, electron, X-ray and magnetic imaging modalities are available. Similar techniques can be used to explore systems where iron is used for structural reinforcement, and projects are available that explore the fine structure of iron mineralised teeth in marine chitons (Mollusca).

See http://www.uwa.edu.au/people/jeremy.shaw
See http://www.cmca.uwa.edu.au/staff_pages/jeremy
Law

Erika Techera is an environmental lawyer in the UWA School of Law. Erika’s research interests include international and comparative marine environmental law. Her work involves analysing global treaties for oceans governance, marine species protection and fisheries regulation, as well as the ways in which these laws can be implemented at the state and local levels. In particular she focuses on the use of different regulatory tools such as species listing, equipment regulation and marine spatial planning (including MPA) legislation. She currently has research funding to examine best practice legal frameworks for marine-based tourism (specifically sharks and rays) in protected areas. She would be happy to consider supervising any students wishing to undertake projects related to marine protection law and policy, marine environmental planning or fisheries regulation. Potential areas for research projects include the history of fisheries law and policy in WA; legal frameworks for integrated marine spatial planning; overcoming tensions between conservation and utilisation of marine species such as sharks and rays; and approaches to the governance of marine research.

See http://www.uwa.edu.au/people/erika.techera

Oceans Institute

Carlos Duarte is a marine ecologist and oceanographer involved in the assessment of global changes in the marine environment. He is a marine ecologist with a broad range of interests, ranging from plankton ecology to the ecology of marine macrophytes (algae and angiosperms). Carlos’ current research focusses on impacts of global change on marine ecosystems, including hypoxia, eutrophication, acidification and warming, among others, as well as a new focus on solutions derived from the oceans, such as carbon sequestration, food production and the delivery of resources and tools for biotechnology applications. He is the director of the UWA Oceans Institute.

See http://www.uwa.edu.au/people/carlos.duarte

Tim Langlois is a Research Fellow who has a joint appointment between the Department of Fisheries and the University of Western. Tim’s previous research has focused on investigating the effects of fishing using marine reserves. Tim is currently involved in the development of monitoring programs for demersal fish assemblages, designed to detect both long-term changes associated with environmental variation and short-term changes resulting from management decisions.

See http://www.uwa.edu.au/people/Timothy.Langlois

Plant Biology

Marion Cambridge is an honorary research fellow. Her main areas of research include seagrass ecology and restoration and seagrass and algal biology and ecology.

See http://www.uwa.edu.au/people/marion.cambridge

Euan Harvey’s research focuses on documenting and understanding the distribution of demersal fishes and fish assemblages. He is interested in identifying the factors and
processes which influence the distribution of fish and is interested in Marine Protected Areas and the effects of fishing on fish assemblages. Over the last 15 years he has developed non-destructive video techniques for sampling fish and fish habitats. These included baited remote underwater stereo-video and diver operated stereo-video systems and trialling a modification of these two approaches to develop non destructive trawl technology. He collaborates with CSIRO Hobart, AFMA, BRS, Department of Fisheries WA and various marine conservation agencies from around Australia.


**Jean-Paul Hobbs** studies extinction risk in coral reef fishes using a multidisciplinary approach that involves genetics, life history, ecology and physiology. His research focuses on identifying which species are most at risk to human impacts (e.g. global warming, habitat degradation, pollution, overfishing) and what traits increase their vulnerability. He also has broad interests in coral reef ecology and has worked on a range of organisms (e.g. corals, crustaceans, anemones, clams, holothurians), particularly those that are most susceptible to anthropogenic impacts. A range of projects are available for highly-motivated students and usually involve fieldwork and laboratory experiments.

E-mail: jean-paul.hobbs@uwa.edu.au

**Gary Kendrick**'s research interests are in the study of the interrelationship between abiotic and biotic processes in the marine environment and their impact on the patterns of distribution and abundance of communities and populations of organisms. This general research interest has recently led me to concentrate on scaling of marine ecological processes. He is presently studying the links between vegetative growth and recruitment processes within seagrass populations and patterning of seagrass meadows across submarine landscapes. His other major interest is in the ecology of marine seaweeds and biological (fish and invertebrate grazing, space pre-emption by sessile filter feeding invertebrates) and physical (influence of waves and currents) processes influencing them.

Project topics for 2012-2013 include

1. reproductive and recruitment ecology of seagrasses
2. Ecology of benthos across the tropical-temperate transition zone from Rottnest to Houtmans Abrolhos
3. Restoration ecology of tropical and temperate seagrasses (with John Statton)
4. Population genetics of the kelp Ecklonia radiata (with Thomas Wernberg)
5. Population genetics and mating systems of seagrasses (with Liz Sinclair)


**Ben Saunders** is a research associate in the School of Plant Biology. He is interested in the ecology and behavioural ecology of marine fishes. His current research focuses on the ecology of temperate water herbivorous fishes, and the use of video techniques to sample fish assemblages.

Contact: Benjamin.saunders@uwa.edu.au

**Liz Sinclair** uses molecular genetic approaches to address issues in evolutionary biology and conservation including the application of population genetic data for conservation and management of threatened and endangered species, comparative phylogeography
(examining patterns of genetic variation across landscapes in terms of gene flow, distribution, landscape, and historical events), and molecular systematics. Her current research (based at Kings Park) focuses on population genetics, gene flow, mating systems, and hybridisation in Australian seagrasses, *Posidonia*, with a view to improving current restoration practices.


**John Statton** is a research associate in Plant Biology (Oceans Institute) and Kings Park and Botanic Gardens with interests in seagrass ecology. At present my research is centered in the Shark Bay World Heritage Region (SBWHR). SBWHR presents a unique climatic interface between temperate and tropical realms. The high species diversity of seagrass in this region coupled with representative species from each climatic realm delivers a rare opportunity to compare distinct reproductive strategies employed by each species and how these strategies contribute to the persistence and resilience of seagrass populations in this region and elsewhere. My research focuses on understanding how underlying abiotic processes influence seagrass reproductive ecology in the face of changing climatic conditions.

**Thomas Wernberg**’s interests in marine ecology are broad, but focus on the interactions between large marine plants, their environment and the animals that surround them. He is particularly interested in how marine ecosystems cope with stress and disturbance of both natural and human origin. His research has a strong empirical focus and uses surveys and both laboratory and field experiments to test how environmental and biological factors affect the distribution of species, the susceptibility of marine communities to perturbations, and their ability to recover when disturbed. Many, but not all, of his projects will require scuba diving, and many projects will require willingness to participate in field trips to remote coastal areas. He is open to new ideas and suggestions, but project topics could include:

- Impacts of ocean climate, eutrophication and sediments on the health and resilience of marine communities (including recruitment and survival of foundation species);
- Ecological costs of physiological adaptation to stressful conditions;
- The influence of heat waves and climate variability on marine organisms;
- The role of wave exposure in mediating environmental and biological interactions;
- The ecology of invasive species and their impacts on native communities;
- Identifying the mechanisms and roles of foundation species;
- Seasonal and environmental variation in seaweed reproduction and performance.

Email: thomas.wernberg@uwa.edu.au

Department of Fisheries, Western Australia.
Stephen Newman is a Principal Research Scientist and currently leads the North Coast and Gascoyne finfish research groups within the Finfish Branch of the Department of Fisheries Research Division. His research interests include many aspects of fisheries science, particularly in the tropics and include fish biology, ecology, population dynamics, biogeography, stock structure and connectivity, stock assessment, gear selectivity and management of fish and fisheries.

Stephen.Newman@fish.wa.gov.au

Michael Travers studies the fish and elasmobranch faunas of coral reef, soft substrate and seagrass habitats along the remote tropical and sub-tropical coast and offshore waters of north-western Australia. He has explored the ways in which the physical and environmental factors influence the characteristics of the faunas in these habitats and how the connectivity of marine populations can inform the management of marine resources in the region. His present focus is on developing studies of the marine fauna in the largely understudied Kimberley region and the environmental factors underlying the unique fauna found there. Students interested in working in the Kimberley would need to start midyear, and should contact Mike to discuss potential projects.

Mike.Travers@fish.wa.gov.au

Department of Environment and Conservation: Marine Science Program

The Marine Science Program (MSP) was established in the Science Division of the then Department of Conservation
The roles of the MSP are:
(i) To conduct, or cause to be conducted, scientific research and monitoring programs necessary to manage existing marine parks and reserves; conserve marine biodiversity generally; assist in identifying and planning for new marine parks and reserves; and contribute to regional marine planning;
(ii) To provide policy advice to DEC Corporate Executive and the Minister for the Environment, and scientific and technical advice and support to DEC’s regions and branches;
(iii) To provide a strategic focus for scientific and technical liaison with DEC’s clients and stakeholders in relation to marine conservation; and
(iv) To assist the Marine Parks and Reserves Authority in the performance of its statutory duties as required.
The Marine Science Program focuses on the ecological and social marine science projects (i.e. research, monitoring and science communication) needed to inform adaptive management of Western Australia’s marine protected area network, the conservation of large marine fauna and the conservation of the State’s marine biodiversity.

In its role as the primary Government agency responsible for the conservation of WA’s marine biodiversity, the Department of Conservation and Environment (DEC) is currently implementing a state-wide marine parks and reserves and threatened marine fauna monitoring, evaluation and reporting program. Within this program arise questions as to the best methods to use in understanding changes in asset condition, and questions of which scales sampling programs should be implemented for detecting shifts.
Kim Friedman is a Principal Research Scientist with the Marine Science Program responsible for establishing and learning from strategic monitoring of Western Australia’s marine protected areas and fauna. Kim has a broad range of survey experience across 18 Countries and Territories in the Pacific, New South Wales and both the north and southern coasts of Western Australia. Kim’s main areas of interest are in developing ‘thresholds’ to define the status of systems under a range of natural and anthropogenic pressures, understanding marine population recovery following exploitation, getting reliable signals of recruitment and the design, implementation and reporting of effective marine asset surveys.

Thomas Holmes is interested in the behavioural ecology of reef fishes, specifically the processes and mechanisms of predation on juvenile reef fish around the time of settlement. Other research interests include the dynamics of fish recruitment, the role of alarm signals in inducing anti-predator responses during early life-history stages, ontogenetic shifts in habitat associations in reef systems, and the ecological role of arid-zone mangrove communities in coastal ecosystems.

Alan Kendrick is Senior Temperate Research Scientist in the Department of Environment and Conservation’s (DEC’s) Marine Science Program. He conducts or coordinates research that contributes to the management of WA’s marine parks and reserves and protected marine fauna. Prior to this he worked as a Marine Planning Officer with DEC’s Marine Conservation Branch, as Manager of the Shark Bay marine reserves, and as Marine and Coastal Ecologist with DEC’s Pilbara Region.

Shaun Wilson is a senior research scientist for tropical marine systems at Western Australia’s Department of Environment and Conservation. Shaun’s previous research has examined the impact of habitat disturbance and fishing on coral reef fish. His work has examined the role of structural complexity in maintaining diversity, habitat associations and specialization of fish. In addition, he has worked on coral reef food webs, in particular the importance of detritus in fish diets and the implications for reef trophodynamics.

Scott Whiting is a Principal Research Scientist (marine turtles) with the Marine Science Program at the Department of Environment and Conservation (DEC). He has over 20 years experience working with sea turtles across Queensland, Northern Territory, Western Australia and Commonwealth Islands and was previously based in the NT for 15 years. His research experience includes nesting and foraging turtles and has experience in a number of specialized techniques such as satellite tracking, laparoscopy and gastric lavage. He is a member of the IUCN Sea Turtle Specialist Group and the National Marine Turtle Recovery Team. He has experience supervising students at Honours, Masters and PhD levels. His current role includes coordinating the North West Shelf Flatback Turtle Conservation Program (NWSFTTCP) and other sea turtle research and conservation activities for DEC. This includes overseeing research related to stranded turtles across the state.
CSIRO Marine

**Oliver Berry** is a population geneticist with CSIRO Marine & Atmospheric Research. He works in both marine and terrestrial ecosystems and has an interest in developing DNA-based methods for quantifying animal abundance and rates of dispersal. Past and present projects he is involved with include: dispersal in estuarine and marine fishes, effects of sealing on abundance of fur seals, non-invasive monitoring of wildlife, effects of landuse on population connectivity, evolution of pesticide resistance, speciation in troglofauna.

**Mat Vanderklift** is a marine ecologist based at CSIRO Marine & Atmospheric Research. His research is driven by the need to understand food webs, from the organisms that comprise the webs to the intensity of the interactions between them, and the influence of these interactions on the structure of ecosystems. He has conducted his research on food webs of seagrasses, temperate reefs and coral reefs of Australia, the Mediterranean and the Caribbean.

Australian Institute of Marine Science

**Martial Depczynski**’s current research activities revolve around science for the conservation and management of Ningaloo Reef in WA. Assessments of vertebrate and invertebrate group vulnerability and defining habitat correlates that mediate patterns of abundance and distribution within key functional groups are examples of these research activities. Alongside this, he continues to be involved in further understanding ecosystem function with an emphasis on how climate change may affect reef communities. This is very much aimed at the development of direct physiological indicators (ageing, development & reproduction processes) of climate change

Email: M.Depczynski@aims.gov.au
Potential Honours ‘projects’ for Marine Science for the second semester 2012 intake.

Below is a list of possible projects. Many staff have not listed projects, but have stated that they are happy to talk to students about possible projects. If you have an idea and see a potential match with a supervisor we strongly encourage you to talk with that person. The projects listed below also give you an idea about the types of projects staff might be interested in supervising.

The following nine projects are on offer through the Neuroecology Group School of Animal Biology and the UWA Oceans Institute. More information can be provided by Professor Shaun P. Collin (WA Premier’s Research Fellow), (shaun.collin@uwa.edu.au) and other Senior members of staff, Associate Professor Nathan Hart, nathan.hart@uwa.edu.au, W/Professor David Hunt, david.hunt@uwa.edu.au and Research Associate Kara Yopak, kara.yopak@uwa.edu.au can also be contacted by email for more information.

1. Inner ears of deep-sea myctophids: Structural adaptations for hearing. (Collin)
Little is known about whether deep-sea animals are able to communicate acoustically but previous work has indicated that some deep-sea fishes possess very large ears and are able to produce sounds via “drumming” muscles attached to the swim bladder. In this project, you will examine the anatomy of a range of species of lanternfishes (myctophids) that represent a large proportion of the mesopelagic fauna in the deep-sea. This anatomical study will be the first to investigate the potential for sound production and hearing in this group.


2. Circadian control of behaviour: the structure and function of the pineal organ in sharks and rays (Collin, Hart, Hunt)
All animals rely on light to set their circadian rhythms and sleep patterns. This non-visual form of light detection is generally mediated by the pineal organ. This project will investigate the structure and function of the pineal of sharks and rays with the hope of characterising the types of photoreceptors present and how they might be used for light entrainment in a variety of environmental light conditions and habitats. Techniques will include light and electron microscopy, microspectrophotometry, PCR and gene cloning.

3. Dim light vision in deep-sea fish (Collin and Hunt)
The visual systems of deep-sea fishes are tuned for detecting low levels of sunlight and/or bioluminescence. In many species, the eyes have become specialised to increase sensitivity and avoid predation. However, the eyes of some species have degenerated. In this project, you will investigate both ocular and retinal adaptations in a range of deep-sea fish species in an attempt to reveal the limits of vision and light detection. Techniques will include light and electron microscopy, modelling the optical sensitivity and gene cloning.

4. Sampling of colour space in the eyes of vertebrates: an in situ hybridization study of retinal photoreceptors (Hunt, Hart, Collin)
Photoreceptors in vertebrates are vital for vision and transform light energy into electrical impulses that can be interpreted by the brain via the process of phototransduction. These receptors form highly regular mosaics that sample the visual world, often in colour. In this project, you will investigate how each type of photoreceptor samples the world of a range of vertebrates including lampreys, stingrays and reef fishes. Techniques will include gene cloning, in situ hybridization, stereology and light and electron microscopy. Collin, S. P. and Shand, J. (2003) Retinal sampling and the visual field in fishes. In: Sensory Processing in Aquatic Environment. (eds. S. P. Collin and N. J. Marshall). Springer-Verlag, New York. pp. 139-169.

5. Quantitative measures of brain evolution in bony fishes (Collin, Yopak)
Brain and body size relationships have traditionally been used to infer cognitive abilities across a range of mammals (including humans), providing vital information about life history traits, behaviour and “intelligence”. This project will apply new methodologies to accurately assess total neuron number (rather than brain size) and processing power in bony fishes, using a traditional model species. The goal of this project is to understand the fundamental selection pressures underlying the evolution of the brain and its component parts and trace the evolution of cognitive capacity. Techniques will include isotropic fractionation, flow cytometry, and stereology. Gabi, M., Collins, C. E., Wong, P., Torres, L. B., Kaas, J. H. and Herculano-Houzel, S. (2010). "Cellular scaling rules for the brains of an extended number of primate species." Brain, Behavior, and Evolution 76: 32-44

6. Variation in neuron composition the shark cerebellum (Collin, Yopak)
Cerebellum size in cartilaginous fishes has been related to an increase in the processing of sensory input implicated in motor control and recent work has demonstrated emerging ecological patterns between both cerebellar organization and habitat complexity in sharks. This project hopes to reveal a more quantitative measure of neuronal cell number in the
cerebellum, to uncover whether variability in the number of main motor output neurons similarly correlates with habitat dimensionality and agile prey capture in these fishes. Techniques will include isotropic fractionation, flow cytometry, and stereology.


7. Escape responses in fiddler crabs. (Hemmi, Collin)
Fiddler crabs are highly visual animals that live under constant threat of predation from birds. Field experiments have shown that the design of the crabs’ eye limits their ability to measure a predator’s distance and their direction of movement. Results suggest that the crabs use different criteria to determine their response in the field than they do in the laboratory. In this project, you will bring fiddler crabs into the laboratory to test their escape decisions under controlled conditions. You will also test how these animals respond to the same stimuli in different environmental situations. You will learn to design and analyse carefully controlled behavioural experiments with the aim to understand the mechanisms underlying visually guided behaviour.


8. Learning in fiddler crabs. (Hemmi, Collin)
Fiddler crabs are often unable to recognise their predators accurately, but have been shown to learn to ignore moving objects that have proven harmless over time. This process, called habituation, is often thought to be a very simple form of learning. Experiments under natural conditions have shown that habituation is a more sophisticated process than previously thought. In this project, you will conduct learning experiments in the laboratory with the aim to determine the characteristics of the object (dummy predator) and the environment that are important for this learning process. You will learn to design and analyse carefully controlled behavioural experiments and discover how sensory information affects learning in animals.


Projects on invertebrates Jane Prince

Two projects on the sea urchin *Heliocidaris erythrogramma*

The purple sea-urchin *Heliocidaris erythrogramma* is a common temperate species occurring in the intertidal and shallow sub-tidal from Kalbarri to Northern NSW and including Tasmania. In all states except Western Australia, the species occurs only as a thin-spined morph with variably coloured test and spines. These individuals belong to the sub-species *H.e.erythrogramma*. In Western Australia, *H.e.erythrogramma* occurs, usually with a white test and green spines, but is much less common than a thicker-spined
form, *H.e.armigera*. This sub-species almost always has a purple test, and spines are usually purple or purple with green tips. Recent molecular work suggests the two sub-species have some differences although there is some overlap. Preliminary investigations also suggest there may be a temporal separation of their spawning seasons, affording some degree of reproductive isolation. There are at least two lines of investigation to continue this work.

9. **Reproductive cycles in two sub-species of *Heliocidaris erythrogramma***
   
   Supervisor: Jane Prince
   
   What is the timing of the reproductive cycles of the two subspecies in Western Australia? To answer this question, it will be necessary to obtain individuals of both subspecies over a six month period and compare the development of the gonads using histological techniques. Individuals can also be artificially spawned and the eggs and sperm used to perform crosses within and between sub-species. Larvae produced can be reared through to settlement to compare fertilization and settlement success in the different crosses.

10. **Distribution and habitat use by the two sub-species of *Heliocidaris erythrogramma***
    
    Supervisor: Jane Prince
    
    On the southern coast of eastern Australia, individuals of *H.e.erythrogramma* with different coloured tests, show strong associations with different habitats. This association is not seen on the eastern coast where there is little variation in test colour. Similar investigations in W.A. have been hampered by the patchy occurrence of individuals with white tests. This project would aim to increase our understanding of how and where *H.e.erythrogramma* is distributed along the west coast and what are the habitat variables that define where they occur.

    Both these projects would require snorkelling.

**Three projects on intertidal invertebrates in the Ningaloo Marine Park**

The macroinvertebrate fauna of the intertidal rock platforms in the Ningaloo Marine Park is a diverse assemblage spanning many phyla that includes both tropical and temperate species, indirect and direct developers and long and short lived species. The work to date has concentrated on spatial and temporal variation in assemblage structure, incorporating variation in the numbers of individual species such as cowries and giant clams.

11. **Distribution patterns of the giant clam, *Tridacna sp* across intertidal rock platforms into the shallow sub-tidal in the Ningaloo Marina Park.***
    
    Supervisors: Jane Prince with Bob Black, Mike Johnson and Anne Brearley
    
    Individuals of the giant clam (*Tridacna sp*) occur patchily across the intertidal rock platforms in the Ningaloo Marine Park. This project will aim to determine whether or not there are predictive patterns to this distribution, including across-platform patterns and differences in distribution between newly settled recruits and established adults.

    This project will require snorkelling.
12. Linking spatial and temporal variation in density to life history characteristics
Supervisors: Jane Prince, with Bob Black, Mike Johnson and Anne Brearley

Individual species within the intertidal assemblage show large fluctuations in densities within sites between years and between sites within years. To what extent can this be linked to the life history strategies and the geographic affinities of the species involved? For example, does a temperate broadcast spawner at the northern limit of its range show more variation in distribution and abundance than a tropical direct developer? This project will involve taking part in the third census of platforms in the marine park and then working with the data collected in 2007, 2009 and 2012 to test ideas and predictions.

Supervisors: Jane Prince with Bob Black, Mike Johnson and Anne Brearley

There are over 200 species of invertebrates recorded from the intertidal rock platforms in the Ningaloo Marine Park, including many congeners, fulfilling the same functional role, for example, the cowries (Cypraea spp), the cones (Conus spp) and the ceriths (Cerithium spp). The suite of cowry species in the northern section of the park were studied in 2009, revealing differences in micro-distribution and habitat preference. The same type of investigation could be applied to one or more of the groups.

All projects will involve a field trip in mid August- early September with the possibility of a second field trip in February-March if required

Other projects

14. Biology of the ghost crab, Ocypode sp or spp., on Rottnest Island.
Supervisor: Jane Prince

There is one common and possibly one less common species of ghost crab inhabiting the sandy bays at Rottnest Island. This study would attempt to look at factors that might affect their activity patterns, including human disturbance, to determine whether or not they may be suitable to use as an indicator species. This project would require field work from September to March and will require Animal Ethics approval.

Please also talk to Jane about any other projects you would like to do with marine invertebrates.

PROJECTS IN BIOLOGICAL OCEANOGRAPHY – A. M. Waite

15. Using Sediment Traps to Quantify Vertical Fluxes at Sea in the S. Ocean
Supervisors: Anya M Waite and Tom Trull, Australian Antarctic Division

The Southern Ocean is known as the “Climate Ocean”, modifying anthropogenic carbon emissions through carbon sequestration by phytoplankton. Sedimentation processes in the Southern Ocean will be investigated on an oceanographic research voyage where we deploy sediment traps to quantify this flux; gels will be included to quantify the particle types and size distribution.

Oceanography of Coastal Reefs
Reefs have been shown to be both strong sources and sinks for nitrogenous nutrients. An analysis of reef nutrient fluxes is possibly important for coastal nutrient budgets, and critical for understanding of reef ecosystem function.

16. Nutrient Fluxes on Coastal Reefs
Possible Supervisor(s): Anya Waite, Peter A. Thompson, CSIRO, Moninya Roughan, UNSW
Here we propose to measure nitrate gradients on coastal reefs, comparing processes in temperate reefs on the West Coast (Rottnest Island) and east coast (Coffs Harbour). Nitrate analyses will be compared with a continuous nitrate sensor whose sensitivity will be tested for its appropriateness to analyse reef fluxes. Data will be applied to an east-west comparison of reef function.

17. Indices of Coral Health in an Oceanographic Context
Supervisor: Anya Waite, Saskia Hinrichs
There are many indices of coral health which can be used to track the organisms’ responses to environmental change. This project involves applying one or more indices to Ningaloo Reef.

18. (TBC) : Plankton Populations associated with Whalesharks at Ningaloo
Supervisors: Anya Waite and Mark Meekan (AIMS)
Plankton dynamics offshore of Ningaloo are likely to be important drivers of whaleshark ecology. A field-based project will investigate links between oceanography, zooplankton, and whaleshark ecology.

The Oceanography of the Western Rock Lobster

19. Relationships between planktonic distributions and lobster larvae
Supervisors: Anya Waite, Christin Sawstrom
Western Rock Lobster Larvae (“phyllosoma”) spend 9-11 months at sea before their metamorphosis to puerulus. In a set of oceanographic research voyages off WA, we investigate the plankton and oceanography backdrop to changes in phyllosoma abundance. A number of different projects are available.

20. Impact of wind on rock lobster larvae
Supervisors: Ming Feng (CSIRO), Anya Waite
The day and night variations of winds at ocean surface impact the distribution of rock lobster larvae, including their ability to metamorphose into puerulus and settle into the new adult population. However it is suggested that only night time wind will affect the larval transport when they come to the surface. It is critical to understand the pattern of diurnal variation of the ocean surface winds, and how they vary on seasonal and year-to-year time scale if we are to predict the year strength of the Western Rock Lobster.

21. Impact of vertical mixing on rock lobster larvae
Supervisors: Ming Feng (CSIRO), Anya Waite
The rock lobster fishery is experiencing a historic crisis that may be driven by shifts in oceanographic processes. Using IMOS data (Radar and mooring measurements) we aim to understand the vertical shear of the near surface current (the Ekman drift) in response to the surface winds, and how the relationship vary on seasonal and interannual time scales. These understandings will help us developed improved larval tracking modelling, including an understanding how larval movement would respond to interannual climate variability.

D. Climate-driven oceanographic trends along the WA coast

22. Understanding variation in of continuous Water Quality Monitors (WQMs) against pigments and phytoplankton measures from in situ sampling.

23. Power comparisons of sampling strategies between historical monthly water sampling and modern 15 minute samples from sensors.
Supervisors: Anya Waite and Tim Lynch, IMOS
IMOS data provide continuous data sets of pigments and phytoplankton designed to understand background variability for the purpose of tracking climate-driven changes. Here we investigate oceanographic processes impacting the quality of these data sets. We propose to analyse preliminary field data and undertake laboratory experiments. Field data to be analysed will come from temperate, sub-tropical and tropical Australia and temperate and sub-tropical USA coastal waters. Laboratory experiments will be undertaken with cultures provided by the CSIRO national algal reference collection. Calibration and Quality Assurance of NRS Wetlabs Water Quality Monitors (WQMs) will be tested against pigments and phytoplankton measures from in situ sampling.

24. Biogeochemical modelling, from physics to a second trophic order, seasonal cycles in Australian coastal waters.
Supervisors: Anya Waite and Tim Lynch, IMOS and Peter A. Thompson, CSIRO
Recent climate trends in Australian coastal waters have the possibility of profoundly impacting the health and behaviour of higher trophic levels, particularly the plankton feeders. Here we will execute a multidisciplinary synthesis aiming to predict how seasonal cycles off Australia impact the planktivores (these include sardines, whalesharks and blue whales).

25. Surface current measurements using HF Radar
Supervisors: Chari Pattiaratchi and Christine Hanson
As part of the Integrated Marine Observation System (IMOS) several HF radar installations between Lancelin and Fremantle will provide high resolution surface currents at hourly intervals to a distance of 200 km off the coast. This is a great opportunity for a student to examine the variability in the surface currents adjacent to the
WA coast at unprecedented spatial and temporal scales. The radars are already deployed so the data will be available for analysis immediately.

26. Synthesis of the wave climate between Jurien Bay and Fremantle
Supervisors: Chari Pattiaratchi and Ivan Haigh
As part of the Integrated Marine Observation System (IMOS) several HF radar installations between Lancelin and Fremantle will provide high resolution direction wave data at hourly intervals to a distance of 200 km off the coast. This is a unique opportunity for a student to examine the variability in the wave adjacent to the WA coast at unprecedented spatial and temporal scales. The radars are already deployed so the data will be available for analysis immediately.

27. Field measurements of turbulence in estuarine and/or coastal waters
Supervisor: Chari Pattiaratchi
In this project we will collect high resolution (both space and time) current data using an Acoustic Doppler Current Profiler (ADCP) deployed at several locations (beach, coastal or estuarine) to examine the relationship between turbulence characteristics and sediment re-suspension.

28. Tsunami risk for west Australia
Supervisor: Chari Pattiaratchi
In this project we will examine the tsunami behavior along the WA coast (including Scott Reef, Kimberley, Geraldton, Jurien Bay, Fremantle) using a high resolution numerical model already developed. The availability of high resolution data sets along the south-west provide a unique opportunity to examine these effects.

29. Effects of coastal sea level rise on beaches
Supervisors: Chari Pattiaratchi and Ivan Haigh
Lidar is a technique for obtaining bathymetry and topographic data using a laser technique yielding high spatial resolution data. This type of data has not been available in WA previously. Lidar data from the coastline of southwest Australia, from Two Rocks to Cape Naturaliste will be available in late 2009. These data will provide a unique data set which can be used to identify regions which may be at risk due to climate change (eg coastal erosion, coastal flooding).

30. Ocean circulation using surface drifters
Supervisor: Chari Pattiaratchi
We have developed low cost GPS which are used to examine ocean circulation along the west coast and also in the north-west shelf. The student will analyse data from these drifters and historical data to examine the circulation patterns.

31. Matching bed stress and benthic habitats for specific regions (Geographe Bay, Rottnest etc)
Supervisors: Chari Pattiaratchi, Gary Kendrick, Kimberly Van Niel, Euan Harvey

32. Convective flushing of the North-West Shelf
Supervisor: Greg Ivey

Buoyancy driven currents on continental shelves provide a mechanism for the exchange of water between, shallow coastal regions, the adjacent shelf, and the deep ocean. In mid-latitudes, freshwater input and surface heating often provide a source of lighter fluid on continental shelves, while surface cooling and evaporation lead to the formation of dense water in shallow coastal regions. The proposed project will quantify the role of buoyancy driven currents in flushing the Australian North-West Shelf. This will be achieved by examining the output of two numerical models: the BLUELink Reanalysis global ocean model and the Regional Ocean Modelling System.

33. Boundary layer dynamics on the North-West Shelf
Supervisors: Greg Ivey and Cynthia Bluteau

When using numerical models to reproduce hydrodynamics in aquatic environments, one ultimately selects a turbulence closure scheme. Many closure schemes exist, each of them with their assumptions, limitations, and applicability to the physical question at hand. This choice can have significant consequences on mixing and circulation predictions. Furthermore, the dynamics of the bottom boundary layer, which are usually of smaller scale than a model’s grid resolution, must be properly parameterized to accurately simulate ocean circulation. For this project, field measurements taken in the boundary layer will be compared to the output obtained from the numerical model: Regional Ocean Modelling System (ROMS). The model has been run using different closure schemes, and the main objective is to establish if any of them can reproduce the features seen in the field observations.

34. Seasonal trends in the abundance of picophytoplankton from Australian National Reference Stations (IMOS)
Supervisors: Paul Thomson (paul.thomson@uwa.edu.au), Peter Thompson (CSIRO), plus oceanographer TBA.

Pico-sized phytoplankton (< 2 µm in diameter) such as Prochlorococcus and Synechococcus sp. make up most of the photosynthetic biomass in tropical waters. However, as these small species are difficult to study due to their size, little is known of their ecology in Australian waters. The aim of this project is to determine the distribution and abundance of picoplankton in Australian waters using flow cytometry, an instrument ideal for studying small cells. This project will utilise monthly samples and data available from the Australian National Mooring Network (http://imos.org.au/anmn.html), funded by Australia’s Integrated Marine Observing System (IMOS).

35. Environmental Benefits of Macroalgal Farms.
Supervisor: Carlos Duarte, UWA Oceans Institute (carlos.duarte@uwa.edu.au).

Aquaculture has the potential to provide a solution for the bottleneck in food production to feed the 9 billion people that will populate Earth by 2050, as agriculture is close to reaching a ceiling imposed by freshwater and arable land. Aquaculture does not require either freshwater nor arable land. However, the rise of aquaculture has caused significant environmental impact, so that future growth of aquaculture must be focused on practices that are sustainable. A major shift towards this end must be large scale increase in the
production of macroalgae, which has been argued to have the potential to act as a positive force in the environment. Macroalgae produce oxygen, provide habitat for organisms, remove nutrients and take up CO2. However, an assessment of the environmental benefits of aquaculture is still lacking.

The goal of this project is to conduct a meta-analysis on the environmental benefits of macroalgal production, based on a synthesis of existing data at the global scale. The outcome will be an honours thesis that can also be published in a high-profile international journal.

Background reading

(co-supervised by Carlos M. Duarte, Kylie Pitt, Griffith Univ., Rob Condon, DISL, USA, and Cathy Lucas, Univ. of Southampton, UK).

The scientific literature has recently conforms a paradigm for jellyfish blooms being on a global rise, however, a thorough analysis of global trends has not yet been attempted and scrutiny of the literature shows no evidence to support such paradigm, yet is a framework for most published research on jellyfish blooms to date.

An examination of the literature shows that the opening sentences of the introductions or abstracts have some form of statement that included a wider/global implications, based on only a few key references, possibly in an attempt to justify the relevance of the research to a wider audience. A quick check through web of science shows that Mills 2001 has been cited 222 times and several others have >100. A few of the key papers that seem to be cited often as 'evidence' of increasing jellyfish numbers include the Bering Sea, the Black Sea / and spread of Mnemiopsis in Europe story, as well as reviews by Mills, Purcell, Arai. Some of these might indeed be increases, but only at the regional scale, and many of these blooms declined since these reports.

The project will conduct a thorough review on the literature on jellyfish ecology and global changes in the ocean to follow the thread of citations in the literature for the past 10 years (using bibliometric search engines, such as the Web of Science and Scholar Google) to identify the sources of this paradigm and reconstruct how the original statements were altered through the citation thread, as a case of "Chinese Whispers" conforming an unsupported paradigm in the literature. The project will use tools from complex network analysis to depict three web of citations and examine the alterations in the cites with the number of steps from the original source through the citation chain. The outcome of the project will be an honours thesis and a publication in a high-profile scientific journal.

Background reading.

37. Biomineralisation projects
Supervisor: Jeremy Shaw, Centre for Microscopy, Characterisation and Analysis (CMCA).
The CMCA houses a range of state-of-the-art instrumentation for undertaking high-resolution microscopic investigations of biological structures. In particular, the CMCA’s facilities include transmission and scanning electron imaging capabilities together with cutting-edge instruments for measuring and mapping isotopes. Jeremy applies these techniques to a wide variety of biological material, particularly in marine-based research problems. He is a member of the CMCA’s Invertebrate Biomineralisation Research Group, which focuses on the study of mineral formation in mollusc and coral species (http://www.cmca.uwa.edu.au/biomineralisation) and he also manages the Centre’s cryo-facility, providing the most up to date means of preserving biological tissue for ultrastructural investigation.

Specific research projects
Any study that requires visualisation of the structural, chemical and immunological properties of marine organisms will be considered.
Microscope investigation of organic matrix structure and biomineralisation in the teeth of marine chitons (Mollusca: Polyplacophora)
Environmental contributions to elemental uptake and deposition in marine teeth and other body tissues.
Dietary analysis of the chitons Acanthopleura hirtosa, Plaxiphora albida and the limpet Patelloida alticostata: Animal/substrate interactions.
Structural studies of magnetic based sensory systems and their role in navigation in marine animals.

38. Phylogenetic relationships among planktonic and directly developing species within the genus Bembcium (Gastopoda: Littorinidae)
Supervisors: Jason Kennington (jason.kennington@uwa.edu.au) and Michael Johnson (msj@cyllene.uwa.edu.au)
The mode of reproduction can have major effects on population structure and likelihood of genetic divergence within marine species (Bohonak 1999). Species without larval dispersal tend to be more subdivided genetically than those with planktotrophic larvae. Littorine snails of the genus Bembcium include species that exhibit a planktonic larval stage and species that are direct developers (Johnson and Black 2006). The genus includes five species, two of which have planktonic dispersal, B. auratum and B. nanum, and three that are direct developers, B. vitattum, B. melanostoma and B. flavescens (Reid 1998).

Allozyme analyses of these five species across their geographical distributions have been conducted by Johnson and Black (2006). This study supported the current taxonomic treatment of the genus, but failed to resolve important historical relationships between species, which are fundamental to understanding the origin and evolutionary
significance of modes of reproduction. An investigation of mitochondrial DNA within *Bembicium* will allow finer resolution of genetic subdivision and provide the essential historical perspective needed to understand the effects of modes reproduction on the genetic structure of this genus. Specifically, the study will (1) test the hypothesis that direct development evolved only once in this genus, (2) allow comparison of amounts and patterns of genetic divergence in lineages with different modes of reproduction, and (3) determine the evolutionary history of populations of the direct developer *B. vittatum*, which has disjunct and genetically highly divergent populations over a range of 4000 km.

**Reading**

39. **Seagrass genetics (Posidonia)**
Supervisors Elizabeth Sinclair, Siegy Krauss, Gary Kendrick; Contact (elizabeth.sinclair@uwa.edu.au)
Seagrasses belong to a large group of marine flowering plants, adapted for an entirely submerged life. They produce flowers and seeds, with pollen and seed dispersal occurring within the water column. Seagrass meadows also exhibit extensive vegetative (or clonal) reproduction. The meadows are extremely productive ecosystems and play a vital role in providing fish nurseries and stabilising seaboards and coastal shorelines. Extensive decline in seagrass meadows has been documented around Australia, and globally, with experimental restoration efforts requiring donor plant material. Eight (of the nine) *Posidonia* species occur within waters of the south-west region of Western Australia. Ecological, morphological, and molecular tools are being used to address a range of issues relating to population structure, adaptation, and mating systems to contribute to the long-term success of restoration efforts. Microsatellite DNA markers are specifically being used to answer questions relating to clonal diversity, gene flow among meadows and the role ocean currents play in pollen and seed dispersal, and hybridisation. Several options for projects are available, and can be developed around student skills and interests.

40. **Connectivity, reproduction and recruitment of seagrasses in Shark Bay** –
Supervisors Gary Kendrick and John Statton
Connectivity, reproduction and recruitment of seagrasses in Shark Bay – Shark Bay World Heritage Region presents a unique climatic interface between temperate and
tropical realms. The high species diversity of seagrass in this region coupled with representative species from each climatic realm delivers a rare opportunity to compare distinct reproductive and recruitment strategies employed by each species and how these strategies contribute to the persistence and resilience of seagrass populations in this region and elsewhere. This research will focus on understanding how underlying abiotic processes influence seagrass reproductive ecology in the face of changing climatic conditions.

41. **Molecular/classical taxonomic, chemistry/taxonomic projects or symbiont/taxonomic projects involving sponges.**
Supervisors: Jane Fromont (WA Museum) + David Sutton

42. **Indicator of adaptive capacity for WA coastal communities.**
Bryan Boruff
This project is designed to link with the current national agenda to examine coastal vulnerability to the impacts of climate change. Coastal vulnerability assessments involve an understanding of the physical impacts of sea level rise as well as the ability of coastal communities to adapt to these changes. This project will attempt to develop a set of indicators of community/town adaptive capacity to compare spatial variations in risk along WA’s coastline. The study will use a mix of qualitative and quantitative methods including stakeholder interviews and statistical manipulation of census type data.

43. **Ecophysiology of wide-spread macroalgae.**
Supervisor: Thomas Wernberg.
This project will address the capacity of species to adapt and acclimatise to varied environmental conditions. The project will test and contrast physiological performance of species of macroalgae found across broad environmental gradients (e.g., temperature, wave exposure, light). The project will require both field and laboratory work.

44. **Ecophysiological traits if invasive and non-invasive Caulerpa species.**
Supervisor: Thomas Wernberg.
Several species of *Caulerpa* (a seaweed) are now considered invasive pests around the world. Many of these species originate from Western Australia, where there are also many non-invasive *Caulerpa*-species. Little is known about what ecological and ecophysiological traits determine whether a species becomes an invasive pest or not. This project will compare and contrast physiological and ecological properties of invasive and non-invasive *Caulerpa*-species from Western Australia. The project can be laboratory or field based, or both.

45. **Impact of ocean warming on the nutritional value of seaweeds.**
Supervisor: Thomas Wernberg.
Macroalgae adjust to warmer water by changing the cellular composition of pigments, enzymes and storage compounds. This implies that their nutritional value may change with potential flow-on effects on herbivores. This project will analyse the nutrient content
in seaweeds collected under different ocean conditions and test the influence of tissue nutrients on the performance of marine herbivores.

46. Ecological interactions in the Swan River.
Supervisor: Thomas Wernberg.
Estuaries such as the Swan River are a focal point for human activities, and they are therefore vulnerable to a range of stressors. This project will investigate the interactions between seagrasses, drift algae and the invasive mud snail *Batillaria*. The project will require both field and laboratory work. Field work would not need to be scuba based.

47. The influence of ocean temperature on reproduction, recruitment and growth of marine macroalgae.
Supervisor: Thomas Wernberg.
This project will quantify, either in the field or from samples already collected, patterns of reproduction, recruitment, growth or mortality of marine macroalgae in different ocean climates. This includes testing the temperature sensitivity and lethal temperatures of different species.

Supervisor: Thomas Wernberg (w Justin McDonald, Dept of Fisheries).
This project will study aspects of the population biology of the invasive ascidian *Didemnum*, which was recently discovered in WA. Relevant aspects include abundance and distribution around Perth, growth rates in different environments, reproductive biology and ecological impacts.

49. Blue-green algal blooms at Rottnest: what are the environmental drivers?
Supervisors: Dr Marion Cambridge
Increased nutrients (nitrogen and phosphorus) from human activities often lead to overgrowth of fast-growing nuisance algae. At Rottnest Is., a filamentous blue-green alga (*Lyngbya*, Cyanobacteria) has been found growing on the iconic coral and seagrass community at Parker Point. These levels of algal growth are cause for concern because they are a likely signal that nutrient loading is already having deleterious effects by promoting growth of a potentially toxic species. A study was carried out on the dispersion of nutrients at Parker Pt for an Honours thesis in 2002 and provides valuable background information about the likely sources of nutrients (septic tank disposal of effluent from toilet block, boats releasing sewerage or grey water).
This project is highly relevant from both a public health and an ecological perspective, and would combine field work at Rottnest over summer and growing the blue-green algae in culture to test the effects of nutrients, light and temperature.

50. Fish grazing pressure on tropical seagrasses in Shark Bay –
Supervisors: Gary Kendrick, Mat Vanderklift, Gavin Coumbes
This is an opportunity to build your research skills within a supportive and multi-disciplinary research team in a World Heritage Area. This project can answer questions relevant to the international scientific community.

Questions to be approached include:
How does fish grazing pressure change with time?
Over the day/night cycle?
Over the lunar/monthly cycle?
Over the seasonal/annual cycle?
How does grazing pressure change with seagrass species, density or nutrient content?
Do grazing fish exhibit top down control of seagrass abundance and distribution?

Techniques may involve underwater video analysis of fish species, activity and bite rates, stable isotope analysis of trophic links, fish trapping and seagrass tethering and transplant analysis. Fieldwork would occur in Shark Bay and will be supported by allied study into trophic links, nutrient dynamics and oceanography of Shark Bay. Honours students will have the opportunity to work with scientists from CSIRO, Department of Environment and Conservation and the Oceans Institute, UWA.

51. The effects of bait on sampling fish assemblages
Supervisors: Euan Harvey, Steve Newman Department of Fisheries
Baited Remote Underwater Stereo-Video Systems are becoming a common tool for sampling fish. The use of bait poses a number of challenges to the interpretation of the data, but bait has been shown to have a number of advantages for remote cameras including sampling higher number of species and individuals than unbaited cameras resulting in more statistical power than other comparable techniques. At this time we don’t know how the quantity of bait might affect the proportion of the fish population sampled.

52. Finescale differences in reef fish assemblages at Shoalwater Marine Park.
Supervisors: Euan Harvey, Ben Saunders, Tim Langlois
During surveys in the Marmion Marine Park it was noted that fish assemblages within the Marmion Lagoon differed as you moved from the near shore (~ 5m depth) to the outer reef (~10 m depth). These fine scale differences in fish assemblage were not expected. The Shoalwater Marine Park and the water outside the park has several different reef systems including the Murray reefs in the near shore and 5 fathom bank outside the Sepia depression. For this project we propose to investigate fine scale variability in fish assemblages both along and between the different reef systems.
To undertake this project you will need to be a Rescue diver, have your restricted coxswains and a valid WA drivers licence.

53. Fish behaviour
Supervisors: Euan Harvey and Ben Saunders
The use of remote underwater video allows us to make observations of fish assemblages over time periods of days or even weeks. This may be a powerful tool for testing hypotheses on cyclical patterns of fish behaviour that have not yet been described quantitatively.
a. Within day variability in fish assemblages

Are there patterns of activity in fish assemblages over the course of a day? Which species display such patterns?

b. Day and night patterns

Which species of fish are active during the night? Do these differ from those observed during the day?

c. Lunar cycles

Do lunar cycles really have an effect on the activity of fish?

d. Storm events and daily weather patterns

Is the activity of fishes affected by storm events? Do daily changes in weather have an effect on fish activity?

54. The effect of differing video camera resolutions on the fish assemblage measures collected using stereo Baited Underwater Videos. What are the implications for comparisons between data sets and for long term monitoring?

Supervisors: Ben Saunders and Euan Harvey

Video camera resolution is improving rapidly, and most organisations are quick to embrace advances in technology. However, as a result, within the last 10 years various technologies have been superseded and a variety of camera types, from HI8 to mini DV to Current digital HD, have been used to record fish assemblages. This project would aim to quantify the effect that using different camera systems has on the data collected, and to discuss the implications of this when comparing datasets collected using different video cameras.

55. Short term temporal variability in fish assemblages. Implications for monitoring reef fishes.

Supervisors: Euan Harvey, Tim Langlois, Ben Saunders

Short term temporal variability within and between days has the potential to greatly impact the design of monitoring programs. This study would investigate within and between day variations in the structure of a shallow water reef fish assemblage in South Western Australia. To undertake this project you will need to be a Rescue diver, have your restricted coxswains and a valid WA drivers licence.

56. Home range sizes and feeding rates of kyphosid fishes in temperate Western Australia.

Supervisors: Ben Saunders, Euan Harvey and Adrian Ferguson

Kyphosids are highly abundant on macroalgal dominated reefs worldwide. They are herbivorous schooling fishes and a school has the potential to impact the algal assemblage through intense feeding. Through snorkel observations of focal fishes this project will to investigate the feeding rates and home range size of kyphosids at multiple locations within Western Australia.
57. **Behaviour of fish in and around traps**  
Supervisors: Euan Harvey, Steve Newman, Corey Wakefield  
Examination of the rates of ingress and egress rates and what fish behaviours influence them. Further, what fish behaviours are evident in and around fish traps and how do they affect ingress and egress rates and thus potential effective soak times.

58. **Effect of soak time on trap and Baited Underwater Videos performance**  
Supervisors: Euan Harvey, Steve Newman, Corey Wakefield  
This project would be an examination of what would be the optimal soak time for fish trap and Baited Underwater Videos in the context of sampling for monitoring purposes. This project would examine species accumulation curves and so forth to determine the optimal soak periods for both traps and Baited Underwater Videos.

59. **How effective are traps and Baited Underwater Videos as sampling tools to characterize biodiversity – are one or both required for monitoring**  
Supervisors – Euan Harvey, Steve Newman, Corey Wakefield, Mike Travers  
Examination of detection probabilities over time for traps and Baited Underwater Videos for targeted species and also those rarer species that may be relevant to biodiversity – potential use of presence/absence data – examination of false negatives – i.e. absence of fish in traps does not mean proof of absence from demersal assemblage structure.

60. **Examination of species richness and related indices to provide an effective measure of biodiversity in an exploited north-west trap fishery**  
Supervisors – Euan Harvey, Mike Travers, Steve Newman, Corey Wakefield  
Using the species composition of both Baited Underwater Videos and trap data across the spatial extent of the NDSF, examine what indices are appropriate to characterize the diverse fish assemblages across the region and thus contribute to an effective monitoring program.

61. **Effect of temperature on fish feeding ecology: Implications for the management of exploited stocks**  
Supervisors: Dr Tim Langlois  
Effective fisheries management requires accurate estimates of fishing mortality, which is dependent upon species catchability. Catchability in fisheries that use bait is likely to be influenced by metabolic processes, habitat specificity and inter and intra specific competition. Using baited-video technologies this study will investigate how response to bait of representative species varies with temperature, habitat and the presence of conspecifics or other taxa, to investigate if patterns exist to suggest how catchability will change under expected climate change scenarios. This project will take advantage of existing video footage and data collected, but will provide the opportunity for field work experience.

62. **Understanding nearshore foodwebs through the DNA analysis of diet.**
What is the relative importance of different autotrophs in coastal food webs? A DNA-based approach (quantitative polymerase chain reaction – qPCR) can identify and measure the abundance of food particles within the digestive systems of marine organisms and in the surrounding environment. With this tool we can begin to answer important questions about the sources of nutrition for benthic animal communities, such as the relative importance of particulate seagrass, kelp and plankton to filter feeding organisms, and how this may vary with depth and among seasons. This project may combine fieldwork (involving diving or snorkelling), molecular labwork, and the design and execution of field and laboratory experiments. A student undertaking this project would not need to have experience with molecular biology, but would need to be willing to learn those skills.

Suggested reading:


### 63. Are all mangroves equal?
**Supervisors Dr Shaun Wilson, Dr Alan Kendrick, Thomas Holmes, Michael Rule**

Mangrove forests are an integral component of many tropical marine systems, providing refuge for many species, including juveniles of ecological and economic importance. Consequently, mangroves are often identified as essential habitat and incorporated into marine parks. However, the composition and structure of mangrove forests varies considerably, as may their functional role within the ecosystem. In this project we aim to examine the environmental factors that shape mangrove communities and how this influences the fauna associated with these communities. This will help identify which mangrove stands should be prioritized for conservation effort. The project will be based in the Montebello’s/ Shark Bay, and will be part of a larger project that examines mangrove structure along the West Australian coast.

### 64. Coral community associations across multiple spatial scales at Ningaloo
**Supervisors Dr Kim Friedman and Shaun Wilson**

DEC has just completed a re-survey of the health of coral communities across the length of Ningaloo Marine Park. Live coral cover and composition, coral diversity and colony size are key indicators of coral community health and these indicators are measured to determine the rates of change in these attributes caused by natural, human or climate change factors since the previous surveys. The question we would like to explore in this honours study is ‘On what spatial scale should corals and benthic taxa be examined to effectively assess change and be informative for asset management”. The project augment existing data with some field studies to examine which sampling regimes and
scales are best suited to detecting change in abundance and composition of organisms with different distribution patterns.

Reading: see Ningaloo Marine Park management plan attached (Coral community asset pg).

65. Trophic linkages in Perth’s coastal waters: a molecular probing approach.
What is the relative importance of different autotrophs in coastal food webs?

A DNA-based approach (quantitative polymerase chain reaction – qPCR) can identify and measure the abundance of food particles within the digestive systems of marine organisms and in the environment. With this tool we can begin to answer important questions about the sources of nutrition for benthic animal communities, such as the relative importance of particulate seagrass, kelp and plankton to filter feeding organisms, and how this may vary with depth or among seasons.

This project would combine fieldwork (involving diving or snorkelling), molecular labwork, and the design and execution of field and laboratory experiments. A student undertaking this project would not need to have experience with molecular biology, but would need to be willing to learn those skills.

Suggested reading:

Contact:
Oliver Berry, CSIRO Marine and Atmospheric Research (oliver.berry@csiro.au)
Mat Vanderklift, CSIRO Marine and Atmospheric Research (mat.vanderklift@csiro.au).

66. Budgeting life on coral reefs - senescence in tropical fishes
Supervisors: Martial Depezynski, Monica Gagliano
Senescence is the complex process of ageing by which organisms become less able to and less efficient in adapting to changes in their environment, hence experiencing increased vulnerability and ultimately death. Understanding the biological processes that lead to senescence, and why different organisms senesce at dramatically different rates is a long-standing problem in evolutionary biology.

By measuring the aggregation of "waste material" or lipofuscin that naturally accumulates in animals as a consequence of physiological stress (i.e. senescence) or damage, the project aims to quantify the cumulative costs of living in coral reef fishes. Specifically, this project aims to examine sex-specific variations in physiological ageing and whether the rate of accumulation of lipofuscin at a given chronological age differs between male and female of the tropical damselfish *Pomacentrus amboinensis*.

67. Climate change in the western Indian Ocean marine environment from geochemical
proxies in massive corals
Supervisor: Jens Zenke
To investigate changes in sea surface temperature and ocean salinity from coral reefs in the western Indian Ocean (NE Madagascar, Mauritius, Rodrigues). This project involves the determination of calcification changes and geochemical analysis of coral cores on yearly and monthly resolution in the new Advanced Geochemical Facility of UWA. Samples are drilled with an automated milling device and subsequently prepared for chemical analysis. The study involves training in coral sampling, chemical preparation and analysis with ICP-MS, Laser-Ablation ICP-MS and Gas Bench facility. Involves climate data analysis and advanced statistics (Matlab or R experience is a plus). Possible fieldwork at Western Indian Ocean reefs depends on funding success for overseas projects.

68. Global bycatch patterns of sharks, rays and chimaeras
Supervisors: Matias Braccini (DoF), Stephen Newman (DoF) and Euan Harvey
Fisheries bycatch is a driver of population declines of marine megafauna. Understanding the scope of global bycatch is essential for highlighting conservation priorities. Globally, chondrichthyans (sharks, rays, and chimaeras) are mostly taken as bycatch and are more vulnerable to population decline and extinction than other exploited marine groups. This study aims at compiling a comprehensive database of reported data on the bycatch of sharks, rays and chimaeras to provide a global perspective and highlight region-gear combinations that warrant urgent conservation action.

69. Evaluating community attitudes towards marine protected areas.
Supervisor: Julian Clifton
This project relates to the ongoing designation of marine protected areas around Australia’s coastline and fills a niche regarding stakeholder perceptions, concerns and desires regarding this process. Marine protected areas are intended to fulfil international obligations and national targets with respect to biodiversity conservation and therefore represent a vital element of conservation planning. This project will explore how the scientific rationale for conservation is reflected within various stakeholder groups and the implications of this for effective conservation management. The study will employ a range of qualitative and quantitative research techniques to explore opinions and attitudes within the Western Australian user community.

70. Using floating mussel rafts for wave attenuation and biodiversity benefits in mixed-use lower river ecosystems
Supervisor: Peter Cook
Removal of natural riparian vegetation, and modification of bank structures in the Swan River Estuary, have reduced natural wave attenuation. Consequently, many man-made structures, (e.g. jetties and boat pens) and river banks and their associated riparian vegetation, suffer damage or are eroded by natural wave action and from waves created by escalating numbers of fast-moving river craft. This damage and erosion can be reduced by the installation of artificial, floating, reef structures, strategically placed in front of sensitive infrastructure and/or eroding river banks.
Artificial reef structures have been used worldwide for a variety of different reasons. Of particular relevance to the current project will be to determine whether the floating artificial reef structures will act as Fish Aggregating Devices (FADs). Various designs of FADs are used extensively around the world for recreational fisheries enhancement. In Australia, NSW Fisheries (now known as Industry and Investment NSW) has been investigating FADs, designed to withstand the harsh coastal conditions of eastern Australia. The program was expanded recently, with more FADs being progressively deployed each season (Marine Parks Authority, 2009). Although most FADs are deployed offshore, I&I NSW is also constructing artificial reefs in estuaries to create new fish habitat and, in turn, improve recreational fishing opportunities. These reefs are being monitored to determine their effectiveness (www.dpi.nsw.gov.au/fisheries/recreational/saltwater/fads).

In the Swan River Estuary, it is uncertain whether artificial reefs composed of floating mussel rafts will act as FADs and, if so, whether they will merely concentrate existing fish biomass into aggregations, or whether, by providing new habitat, an additional food source, additional shelter, and additional recruitment opportunities, they may help to increase overall fish populations. The current project will attempt to answer these questions.

71. Organisms associated with floating plastics

Supervisor: Jeremy Shaw

Marine plastics have become a major hazard to marine life through ingestion and entanglement and are also leading to aesthetic degradation, economic losses and human health hazards. It can immediately sink to the seafloor or can float for variable periods of time before being cast ashore or kept in regions of convergence. The UWA PhD student Julia Reisser has a project that aims to estimate origin, composition and concentration (pieces/km²) of floating marine plastics at different locations around Australia. To archived her aims she has been conducting several trips around Australia to collect marine debris. Pilot studies have shown that these plastic pieces support a diverse range of microorganisms. An enthusiastic student could take this investigation further by using scanning electron microscopy (SEM) to study species composition and plastic/microorganism interactions. There is a growing interest in this subject as these organisms might have an influence in the buoyancy, mass and degradation of floating marine plastics in our oceans.

If you are interested, please contact Jeremy Shaw (jeremy.shaw@uwa.edu.au).

Additional information about the PhD project where these plastic pieces are being collected:
http://mission-blue.org/Reisser

Additional information on organisms attached to plastic:
72. Determining factors that increase extinction risk in Western Australia’s endemic reef fishes.
Supervisors: Jean-Paul Hobbs, Euan Harvey
Potential collaborators depending on the species and topic: Steve Newman, Mike Travers, Howard Choat, Martial Depczynski, Shaun Wilson, Jason Kennington.
This research topic includes a number of projects that determine which traits increase extinction risk in WA’s endemic reef fishes. Students will be able to choose the area(s) they wish to investigate (e.g. genetics, ecology, biology, physiology). Depending on the topic, projects will involve fieldwork and/or lab work and/or meta-analyses.

73. The structure of coral communities on oceanic islands and the effect of anthropogenic impacts.
Supervisors: Jean-Paul Hobbs, Euan Harvey
Potential collaborators: Morgan Pratchett, Zoe Richards.
There are a number of projects available that focus on describing the structure of coral communities at Christmas and Cocos Islands and examining anthropogenic impacts. This includes examining the effects of coral disease, coral bleaching and eutrophication on the coral community. Projects will involve fieldwork and/or meta-analyses.

74. The causes and consequences of hybridisation in reef fishes
Supervisors: Jean-Paul Hobbs, Euan Harvey
Potential collaborators: Morgan Pratchett, Steve Newman, Mike Travers
Christmas and Cocos Islands have the greatest number of hybrid reef fishes in the world. A number of projects are available that examine why there is so much hybridisation at these islands, and what are the consequences of this hybridisation to biodiversity and adaptation. Students will be able to choose the area(s) they wish to investigate (e.g. behaviour, sensory, genetics, ecology, life history). Depending on the topic, projects will involve fieldwork and/or lab work and/or meta-analyses.

75. Determining distribution, abundance, ecological requirements and life history of vulnerable and exploited reef fishes around Australia.
Supervisors: Jean-Paul Hobbs, Euan Harvey
Potential collaborators depending on the species: Steve Newman, Howard Choat, Martial Depczynski, Shaun Wilson, Morgan Pratchett, Mike Travers.
A number of projects are available and all focus on mapping the distribution and abundance of vulnerable or exploited species of reef fishes around Australia. In addition, projects will involve determining the resources (habitat and food) that these species rely on. Some projects will also involve determination of important life history traits (e.g.
maximum age, growth, maturation). This information will help to determine geographic ranges, population strongholds, critical resources, and life histories which are all fundamental elements to assessing the future of these species. Students will be able to choose from a range of species including coral trout, Maori wrasse, bumphead parrotfish, reef sharks, anemonefishes, butterflyfishes, angelfishes and various Australian endemics. Projects will largely involve meta-analyses but may involve some fieldwork and lab work.

76. **Using bio-physical modelling to predict the location and timing of release that maximises survival chances of rehabilitated neonate sea turtles.**

Supervisors: Chari Pattiaratchi, Julia Reisser, Michele Thums (michele.thums@uwa.edu.au) and Scott Whiting (DEC).

Annually, varying numbers of neonate sea turtles are stranded alive on shores in south-west WA. These turtles go into care and are released at northern locations (warmer) once rehabilitated. At this life stage, these turtles are oceanic and release locations and timing should promote a return to this habitat. Using potential release locations, animal behaviour and oceanographic dispersal parameters the student will develop a model that predicts the location and timing of release that will maximise the potential of rehabilitated turtles to return quickly to their preferred habitat and thus ensure the best chance of survival. A decision theory approach could also be used to provide preferential locations based on: 1) oceanographic parameters; 2) cost efficiency to release points and proximity to DEC staff resources and 3) biology of the turtle species and certain life stages.