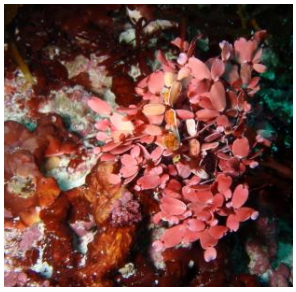
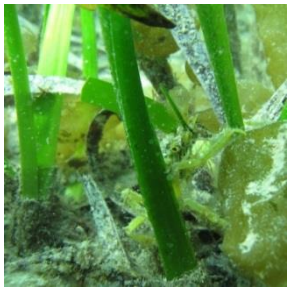
# MARINE PROJECT PORTFOLIO
# LEVELS 4 and 5

Projects suitable for:

**HONOURS in MARINE SCIENCE**
**MASTERS in GEOSCIENCE**
**MASTERS in BIOLOGICAL SCIENCE**
**MASTERS in ENVIRONMENTAL SCIENCE**
**2020**








**FACULTY OF SCIENCE**
The University of Western Australia
35 Stirling Highway
PERTH WA 6009

## Marine Science, Marine Biology, Geoscience and Marine and Coastal Management at UWA

At UWA, a major in Marine Science is offered within the Bachelor of Science, taught across three schools in the Faculty of Science: the School of Biological Sciences, the School of Earth Sciences and the School of Agriculture and Environment. This is a three year degree with the possibility of a fourth, research focused year, Honours, for high performing students. Up to this point, the degree is broad and covers both biological and physical aspects of the marine environment.

An increasingly popular alternative to completing an honours year is a masters by coursework which may include a research project identical to an honours project, but which also involves additional coursework units. At this level, the degrees become specialized. Marine students can choose between the Master of Biological Science, with the Marine Biology specialization, the Master of Geoscience and the Master of Environmental Science with the Marine and Coastal Management specialization.

To be eligible for Honours or to do a research project within the Masters degree, student must attain an average of 65% over 4 core subjects at either Level 3 or 4. The availability of projects will depend very much on the areas in which staff are currently working and the funding they have available for research. Often, students are asked to join a research group and work on data already collected. Alternatively, students may be able to design their own project, set up the experiments and/or observations.

Students should seek a project well in advance of their start date. Research projects generally run over 1 year, so it is best to have your project settled before the year starts so you can hit the ground running on Day 1.

This booklet contains a list of potential projects for level 4 and 5 students available for 2019. Most are biological topics and students seeking additional topics in oceanography or coastal processes should enquire to the School of Earth Sciences or Agriculture and Environment (see contact details below). It is important to realise that this list is not exhaustive; many of the projects are flexible and can be adjusted to your interests. We strongly suggest you use this booklet as a guide and contact potential supervisors to discuss the projects and your interests.

Use the provided projects to:
1) Gain an idea of the scope of appropriate projects
2) Be introduced to potential supervisors and their fields of study
3) Stimulate ideas about other projects that interest you

If you have further questions, please contact your Honours of Masters coordinators who are **Jane Prince** (jane.prince@uwa.edu.au) for Marine Science Honours and the Master of Biological Science (Marine Biology), **Jeff Hansen** (jeff.hansen@uwa.edu.au) for Ocean Systems projects and the Master of Geoscience or **Julian Clifton** (julian.clifton@uwa.edu.au) for the Master of Environmental Science (Marine and Coastal Management).

# RESEARCH PROJECTS AVAILABLE FOR MARINE STUDENTS IN 2020

## A. Projects in the School of Earth Sciences

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| Project | **Creation of a foraminiferal transfer function to reconstruct sea level along the West Australian Coast during the Holocene** |
| Level | Honours in Marine Science |
| Supervisors | Dr Mick O'Leary: mick.oleary@uwa.edu.au<br>Dr Nicole Khan (University of Hong Kong): nskhan@hku.hk |
| Description | This project seeks to construct a Holocene (8,000 yrs BP to Present) sea level curve from SW Western Australia in order to better understand the recent melting history of Antarctic ice sheets. This will be achieved through the use of proxy palaeosea level indicators, specifically benthic foraminifera preserved in sediment cores. Foraminifera typically exhibit high abundance, low diversity assemblages with affinities for particular tidal elevations within coastal marsh and lagoon environments. By measuring species-elevation relationships of living foraminiferal communities against the present day tidal prism, it becomes possible to develop a species/tidal height transfer function, that can then be applied to sediment cores collected from older elevated fossil shoreline features. Though the precise reconstruction of palaeosea level elevations along with accurate radiocarbon dating it will be possible to improve our understanding of past Holocene sea levels and by proxy Antarctic ice sheet behaviour. |

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| Project | **Determining the source of carbonate sediments to contemporary reef systems** |
| Level | Honours in Marine Science |
| Supervisors | Dr Mike Cuttler: michael.cuttler@uwa.edu.au<br>Dr Jeff Hansen: jeff.hansen@uwa.edu.au |
| Description | Reef systems are unique in that the sediment cycling through the system is derived from the organisms that inhabit the reef environment (e.g. corals, foraminifera, coralline algae, etc.). Although previous investigations in atoll systems have shown that reefal sediments are typically contemporary in age (i.e. <100 years old), recent research along Ningaloo Reef has suggested that sediment can be much older (i.e. 1000s of years). Determining whether the sediment currently cycling through the system and building landforms (e.g. reef islands) in reef environments is critical for assessing the future resiliency of these landforms to climate change. For example, if the sediment is derived from a modern source (i.e. <100 of years old) then the fate of landforms would be expected to be directly linked to the fate of the reef system. However, if the sediment source is from relic material, then landforms might be expected to be de-coupled from the contemporary reef system. This project aims to quantify the composition and age of sediment samples collected along Ningaloo Reef to determine future resiliency of the coastline fringed by Ningaloo Reef. |

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| Project | **Measuring variability of the southwestern Australian coastline from aerial imagery** |
| Level | Honours in Marine Science or Geophysics, Masters in Geoscience |
| Supervisors | Dr Jeff Hansen: jeff.hansen@uwa.edu.au<br>Dr Mike Cuttler: michael.cuttler@uwa.edu.au |
| Description | The Western Australian coastline is well known to exhibit seasonal variability in morphology. For example, WA beaches are typically wider in summer and narrower in winter. Typical methods for surveying beach morphology require accessing the beach at multiple times throughout the year. However, WA is one of the most remote and rugged coastlines globally. Thus, there are vast stretches of coastline that have limited access and typical survey methods are unable to be used. Recently, advancement in photogrammetry techniques have allowed aerial photography to be exploited for measuring coastal morphology with cm-scale accuracy. These advancements now provide an opportunity for measuring stretches of coastline previously unmeasurable with typical surveying techniques. UWA has partnered with the Peron-Naturaliste Partnership to capture oblique aerial imagery of the southwestern Australian coastline, from Rockingham to Cape Naturaliste. This project will employ photogrammetry techniques and 3 years of bi-annual oblique aerial photographs to measure coastal morphological change along 250 km of coastline. This large-scale analysis will identify erosion/accretion 'hot spots' and provide value insight into the interannual variability of this coastline.<br>Ideally the student will have experience with or willingness to learn matlab, python and R |

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| Project | **Response of Western Australia's coastline to non-tidal sea level variations** |
| Level | Honours in Marine Science |
| Supervisors | Dr Jeff Hansen: jeff.hansen@uwa.edu.au<br>Dr Mike Cuttler: michael.cuttler@uwa.edu.au |
| Description | The coastline of Western Australia (WA) is unique in that it features a poleward flowing warm water current, the Leeuwin Current (typically warm water currents occur on the eastern side of continents). The strength of the Leeuwin Current fluctuates seasonally and this fluctuation results in increases and decreases in the sea level along WA that can reach +/- 0.25 m and last for several weeks. These non-tidal sea level variations can be as large as the tide in many parts of Southwest WA. Analysis of seven years of shoreline positions collected at Garden Island, SW of Perth indicate that the shoreline responds more strongly to these non-tidal sea level variations than to seasonal variations in wave height (which typically drive seasonal shoreline changes). The aim of this project is to extend these results to a number of other beaches in WA and compare the shoreline response due to non-tidal sea level fluctuations between reef-fringed and sandy beaches. Shorelines will be extracted from high-resolution aerial photos taken approximately bi-monthly and available from 2009 onwards.<br>Ideally the student will have experience with or willingness to learn matlab, python and R |

## B. Projects in the School of Biological Sciences

**A project from the Centre for Evolutionary Biology** (http://www.ceb.uwa.edu.au/)

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| Project | **Can ocean pH influence gamete signalling mechanism in broadcast spawning marine invertebrates?** |
| Level | Honours in Marine Science or Zoology, Masters in Marine Biology or Zoology |
| Supervisors | A/Prof Jon Evans and Dr Rowan Lymbery (rowan.lymbery@uwa.edu.au) |
| Description | Mussels have proved to be superb models for understanding the role that egg chemoattractants (chemical cues realised by eggs to attract sperm) play in moderating gamete interactions. Evidence from our lab has shown that in M. galloprovincialis egg chemoattractants selectively attract sperm from genetically compatible males, a process we term 'differential sperm chemotaxis'. However, the efficacy of egg chemoattractants to effectively exert this form of 'gamete choice' may depend on the chemical environment in which sperm chemotaxis occurs. In this project, you will determine whether seawater pH (acidity) influences gamete signalling processes in mussels, and thus evaluate the extent to which predicted changes in ocean chemistry may disrupt critical processes that moderate reproduction in marine invertebrates. |

**Projects in Neuroscience and eco-physiology**

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| **Project** | **Risk assessment and decision making in fiddler crabs** |
| Level | Honours in Marine Science or Zoology, Masters in Marine Biology or Zoology |
| Supervisors | Dr Jan Hemmi (jan.hemmi@uwa.edu.au), Dr Zahra Bagheri, Mr Callum Donohue |
| | Risk assessment and decision-making is an essential process for animal survival. In natural environments, animals are constantly exposed to several threating stimuli at any one time. It is not clear how animals make escape decisions in these situations. Do animals identify the most dangerous threat and organize their escape accordingly? Or do they try to escape from all threatening stimuli at the same time? To answer these questions, this project aims to study fiddler crabs escape response to multiple simultaneous threats. The study will test the effect of different stimulus characteristics such as visibility and speed on the crabs' risk assessment and decision-making process. The results will not only improve our understanding of how animals escape predators, but may also contribute to technologies such as robotic rescue. |

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| **Project** | **Taking the pulse of crustaceans – monitoring heart rate in response to environmental changes** |
| Level | Honours in Marine Science or Zoology, Masters in Marine Biology or Zoology |
| Supervisors | Dr Jan Hemmi (jan.hemmi@uwa.edu.au), Dr Tim Langlois, Mr Callum Donohue |
| | Non-invasive measurements of physiological parameters can provide important insights into how short or long-term environmental changes impact on the health of species, populations, or individuals. This project will test whether it is possible to use a small-scale optical heart rate monitor to understand (1) the impact of changes in environmental conditions such as temperature, water salinity and PH, or (2) stress - brought about by handling, transportation or exposure to dummy predators on the heart rate of either fiddler crabs or western rock lobsters. The outcomes of the study will help improve animal husbandry and transportation (rock lobster) or aid our understanding of how species respond behaviourally and physiologically to environmental stressors (fiddler crabs). |

| **Project** | **Diurnal modulation of colour vision in fiddler crabs** |
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| Level | Honours in Marine Science or Zoology, Masters in Marine Biology or Zoology |
| Supervisors | Dr Jan Hemmi (jan.hemmi@uwa.edu.au), Dr Zahra Bagheri, A/Professor Julian Partridge, Miss Anna-Lee Jessop |
| Description | Unlike in humans, the colour vision of fiddler crabs has been shown to involve a shift in spectral sensitivity towards longer wavelengths over the course of each day, making them more sensitive to 'red' light in the late afternoon. At night their eyes reset to have more shortwave 'blue' sensitivity once again. We assume that coloured 'screening' pigments that move within the eye are responsible for this shift, but this has never been shown. This project will use Electron Microscopy to examine the position of these screening pigments within the crabs' eyes at different times of the day and will correlate their position with physiological measurements of the crabs' spectral sensitivities. The results will show how these animals adjust their perception of colour and light sensitivity throughout each day. |

| Project | **Reaction of marine invertebrates to sound** |
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| Level | Honours in Marine Science or Zoology, Masters in Marine Biology or Zoology |
| Supervisors | Dr Jan Hemmi (jan.hemmi@uwa.edu.au) and Professor Shaun Collin |
| Description | Sound travels well underwater and underwater sounds is increasingly recognised as a form of pollution that has impacts on a wide range of animals. Little is known, however, about the effect of sound on marine and estuarine invertebrates. This project will investigate the reaction of marine invertebrates such as crustaceans and aquatic insect larvae to sound. Experiments will include analyses of in situ natural sound recorded with hydrophones in the Swan River, observations of invertebrate behaviours in reaction to these sounds, and sound play-back experiments. |

| Project | **The function of the lobula plate in crustaceans** |
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| Level | Honours in Marine Science or Zoology, Masters in Marine Biology or Zoology |
| Supervisors | Dr Jan Hemmi (jan.hemmi@uwa.edu.au) , A/Prof Julian Partridge, Miss Anna-Lee Jessop |
| Description | The lobula plate is an optic neuropil (part of the brain) found in many species of arthropods. It has been extensively studied in dipterous insects such as blowflies, where its role is to process large-field motion information used for controlling gaze (optomotor responses). Blowflies use this information to stabilize themselves when moving, especially in flight. However, the functional significance of the lobula plate in crustaceans remains unknown. This study will aim to further understand the relationship between the lobula plate and the optomotor behaviour in crustaceans, by comparing behavioural measurements of eye stabilisation and Micro-CT (x-ray) measurements of the lobula plate structure in a range of crustacean species. |

**Projects from the Centre for Marine Futures** (http://www.meeuwig.org/)

| **Project** | **Changes in scale of coral bleaching in the British Indian Ocean Territory.** |
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| Level | Honours in Marine Science, Conservation Biology or Zoology |
| Supervisors | Professor Jessica Meeuwig (jessica.meeuwig@uwa.edu.au) |
| Description | The 2016 El Nino swept the world's oceans causing unprecedented rates of coral bleaching globally. Reports in October 2016 suggest that 80% of corals in the northern Great Barrier Reef are dead as a result of this warming event. Some evidence suggests that corals recover from bleaching faster when in fully protected marine protected areas (MPA). As part of a fish survey using baited remote underwater video systems (BRUVS) we have habitat data from the British Indian Ocean Territory MPA pre and post the 2016 bleaching event. This project would examine (1) whether BRUVS be used to detect bleaching and (2) the chance in incidence rate of bleaching pre event and at two points post bleaching |

| Project | **Detecting coral bleaching from baited remote underwater visual imagery** |
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| Level | Masters in Marine Biology, Conservation Biology or Zoology |
| Supervisors | Professor Jessica Meeuwig (jessica.meeuwig@uwa.edu.au) |
| Description | Assessment of coral bleaching largely relies on either aerial surveys of in situ underwater visual census. Our large data set of baited remote underwater video systems (BRUVS) provides an opportunity to score the scale of bleaching globally and also through time at key locations. This project involves developing a new technique for quantifying bleaching based on BRUVS and analysing spatial and temporal patterns. |

| Project | **Cross-shelf patterns in fish biodiversity at Bremer Basin.** |
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| Level | Masters in Marine Biology, Conservation Biology or Zoology |
| Supervisors | Professor Jessica Meeuwig (jessica.meeuwig@uwa.edu.au), Professor Christine Erbe (Curtin) |
| Description | The Bremer Basin has been identified as a "hotspot" of diversity, supporting an iconic aggregation of orcas. The degree to which this area also is a hotspot for area is a fish hotspot is however unknown. Towed video imagery has been collected at numerous locations in the area and this project will focus on (1) assessing the information generated by towed video and (2) interpreting this in terms of regional diversity. |

| Project | **Environmental DNA in pelagic environments** |
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| Level | Masters in Biological Science |
| Supervisors | Professor Jessica Meeuwig (jessica.meeuwig@uwa.edu.au) |
| Description | This project would develop a protocol for obtaining eDNA samples in Western Australiafor pelagic species, that would include contributing to a global library of bar codes for pelagic species |

**Projects at the KIMBERLEY MARINE RESEARCH STATION at CYGNET BAY**

The KMRS is a research facility attached to the Cygnet Bay Pearl farm on the Dampier Peninsula where three bio-regions converse, the Kimberley bio-region, the Canning Basin bio-region and the King Sound bio-region. They support a residential intern program for new university graduates allowing them to live and work on the pearl farm and become involved in the day to day operations as well as the many monitoring projects in progress at the research station (coral monitoring etc) and the farm. Students undertaking research at KMRS spend 50% of their time on intern duties and 50% on their own research project. These projects will require a long stay at the Kimberley Marine Research Station, interactions with volunteer interns and, in some circumstances, with traditional owners. This is a unique opportunity to contribute to a marine research station, experience an operational pearl farm, gain exposure to the aquaculture industry and spend time in the Kimberley marine environment which is dominated by the world's largest tropical tides.

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| Level | All projects are suitable for honours in Marine Science, Conservation Biology or Zoology or Masters in Biological Sciences. |
| Supervisors | Dr Jane Prince (jane.prince@uwa.edu.au), Dr Renae Hovey (renae.hovey@uwa.edu.au) |
| Project | **1. Survival of oyster spat following settlement** |
| Description | This project aims to understand the survival of rock oyster spat in the weeks following settlement and how this is influenced by the surrounding conditions, including the presence of its own and other species. |
| Project | **2. The effect of monsoonal inundation on the intertidal infauna** |
| Description | The project will follow seasonal changes in intertidal infauna at different tidal heights with varying sediment composition. How do these species survive changes in salinity and do we see a pattern of change in species composition from dry to wet to dry seasons. |
| Project | **3. Mark and recapture of trumpet shells** |
| Description | Trumpet shells (*Syrinx auranus*) are a favourite food item for indigenous people along the northern coastline of Western Australia. Very little is known about their recruitment, survival and growth and this project would be a preliminary attempt to address this knowledge gap. |

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| Level | All projects are suitable for honours in Marine Science, Conservation Biology or Zoology or Masters in Biological Science. |
| Supervisors | Dr Jane Prince (jane.prince@uwa.edu.au) |
| Description | The Rottnest Island Authority has several projects they would like students to work on. Marine projects include: distribution of invasive species at Rottnest Island, relative to boat moorings, population numbers of NZ fur seal, and relationship of intertidal and shallow subtidal invertebrate species. All projects would be subject to the support of the RIA and would be developed in conjunction with them. Please contact Jane Prince for more details |

**Projects with invertebrates**

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| Project | **Inferring environmental change through cross shore and long-shore abundance distribution pattern in macroinvertebrate assemblages associated with western rock lobster puerulus collectors.** |
| Level | Honours in Marine Science, Cons Biology or Zoology or Masters in Biological Science. |

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| Supervisors | Dr Jane Prince (jane.prince@uwa.edu.au), Dr Tim Langlois (tim.langlois@uwa.edu.au), Dr Simon de Lestang (simon.delestang@fish.wa.gov.au), Dr Jason How ( |
| Description | The western rock lobster fishery is the highest value single species fishery in Australia, worth over $500 Million per annum. An important metric used by fisheries scientists to monitor the health of this resource is the abundance of post-larvae (puerulus) that recruit each year to artificial collectors located along the coast of WA. In 2008 the historic settlement pattern of puerulus changed, with settlement occurring at lower numbers, further north, and in later months each settlement season. In addition to puerulus, the collectors also collect samples of a wide range of macroinvertebrate species. We have a project to evaluate patterns in the abundance distribution of the macroinvertebrates, investigate how these patterns may relate to puerulus counts and develop additional indicators based on species of macroinvertebrates that typically occur simultaneous to western rock lobster puerulus |

**Intertidal projects in collaboration with the Karijarri Indigenous Rangers**

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| Level | All projects are suitable for honours in Marine Science, Conservation Biology or Zoology or Masters in Biological Science. |
| Supervisors | Dr Jane Prince (jane.prince@uwa.edu.au), Dr Renae Hovey (renae.hovey@uwa.edu.au) |
| Description | A unique opportunity to engage with the indigenous custodians of the shore between Roebuck Bay and 80 mile beach. This ongoing project incorporates aspects of citizen science and science communication. At its inception, the project aimed to<br>1. Initiate activities to gain baseline biodiversity data on Karajarri sea country – primarily intertidal reefs (but also interested in mangroves, seagrass and intertidal creek systems).<br>2. Build capacity of rangers and community members to undertake these activities, and<br>3. Establish a monitoring program that could detect changes due to natural and anthropogenic events.<br>To date we have:<br>Established a baseline for biodiversity on intertidal rock platforms,<br>Produced a draft photographic guide to intertidal species<br>Assessed changes due to a direct hit by a tropical cyclone<br>Established plots to measure growth and survival of giant clams<br>Forged links between ranger groups with respect to intertidal monitoring<br>Future projects will include:<br>Ongoing monitoring and the refinement of the species guide.<br>Population dynamics of harvested species, including clams, trumpet shells<br>Developing a monitoring program for mangroves and/or seagrass<br>Comparing biodiversity and management practices at other locations in the West Kimberley |

**Projects from the Wernberg Lab (https://wernberglab.org/)**

| Project | **Developing a novel restoration tool for threatened kelp forests** |
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| Level | Honours in Marine Science or Conservation Biology, Masters in Biological Science |
| Supervisors | Thomas Wernberg (thomas.wernberg@uwa.edu.au) |
| Description | Human-driven impacts on our oceans are intensifying and there is urgent need for novel solutions to combat habitat loss and promote resilience in marine ecosystems. In warmer margins of their range kelp forests are being replaced by algal turfs. This project will develop and test a novel restoration tool 'green gravel' and evaluate its ability to restore kelp forests in Australia. Green gravel involves seeding kelp spores onto pebbles, where they grow into small sporophytes that can be scattered across an impacted area. This tool could be effective at overcoming reinforcing feedbacks (propagule and recruitment limitation) that prevent recovery of kelp forests after shifts to turf. This is a collaborative project between UWA and the NSW Department of Primary Industries. |

| Project | **Novel intervention-based solutions using strong genotypes to boost resistance or restore threatened kelp forests** |
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| Level | Honours in Marine Science, Zoology or Conservation Biology, Masters in Biological Science |
| Supervisors | Thomas Wernberg (thomas.wernberg@uwa.edu.au) |
| Description | Research on marine habitat loss has mainly focused on negative impacts and declining performance of foundation species, and the effectiveness of passive strategies for recovery (e.g. marine reserves). Instead, an innovative approach targets individuals and areas that perform well under stress ('bright spots') to discover mechanisms, traits and active interventions that promote persistence. This project will use cutting edge genetic analyses to identify strong genotypes in natural 'bright spots' where surviving kelps have resisted or adapted to degraded conditions. This will provide a foundation to develop innovative proactive restoration and conservation solutions to breed resistance or promote recovery of degraded systems. This is a collaborative project between UWA and the NSW Department of Primary Industries |

| Project | **Thresholds for kelp forest loss and turf expansion** |
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| Level | Honours in Marine Science, Zoology or Cons Biology, Masters in Biological Science |
| Supervisors | Thomas Wernberg (thomas.wernberg@uwa.edu.au) |
| Description | Pervasive habitat deterioration and destruction presents one of the biggest threats to species and global ecological function. There has been an accelerating loss kelp forests globally, and an associated rise and persistence of degraded seascapes of sediment-laden algal 'turfs'. This project will conduct field experiments on kelp and turf reefs across different environments to identify thresholds for collapse and mechanisms for recovery. Advances here will improve how we understand the stability of these marine habitats, and the reversibility of sudden changes in the context of ongoing climate change. This is a collaborative project between UWA and the NSW Department of Primary Industries. |

**Projects in collaboration with Fisheries WA (Department of Primary Industry and Resource Development)**

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| Project | **Pathogenicity of Vibrio spp. in pearl oysters Pinctada maxima from northern Australia** |
| Level | Honours in Marine Science, Masters in Biological Sciences |
| Supervisors | **Dr Cecile Dang:** cecile.dang@dpird.wa.gov.au<br>**Prof Jacqui Batley:** Jacqueline.batley@uwa.edu.au |
| Description | The pearl oyster industry is one of Australia's most valuable and iconic fisheries, creating significant economic and employment opportunities across Northern Australia. However, as with any major animal production industry, health issues are persistent obstacles inhibiting productivity. Since 2006, the pearl oyster (Pinctada maxima) farming industry in Western Australian has been hampered by health and productivity issues with no identified cause(s).<br>Bacteria belonging to Vibrio alginolyticus clade have been associated with moribund oysters and can harbour plasmids, which contain virulence genes and may be responsible for the pathogenicity of the bacteria. This project proposes to characterise the virulence factors of Vibrio alginolyticus and assess which environmental factors enhance the pathogenicity. This work will involve bacteriology (culture techniques), molecular biology (qPCR and next-generation sequencing), and microscopy techniques |

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| Project | **Investigation of microorganisms associated with health issues in pearl oysters Pinctada maxima from northern Australia** |
| Level | Honours, in Marine Science, Masters in Biological Sciences |
| Supervisors | **Dr Cecile Dang (**cecile.dang@dpird.wa.gov.au**)**<br>**Prof Jacqui Batley (**Jacqueline.batley@uwa.edu.au) |
| Description | The pearl oyster industry is one of Australia's most valuable and iconic fisheries, creating significant economic and employment opportunities across Northern Australia. However, as with any major animal production industry, health issues are persistent obstacles inhibiting productivity. Since 2006, the pearl oyster (Pinctada maxima) farming industry in Western Australian has been hampered by health and productivity issues with no identified cause(s).<br>This project aims to characterise active microorganisms (fungus, bacteria, virus) in moribund oysters in order to understand which ones are associated with health issues. Our laboratory has collected unique samples since June 2017 from moribund and healthy adult and spat pearl oysters, which will be used in this study. This molecular work will involve next-generation sequencing (extraction of nucleic acid, library preparation, etc. ) and bioinformatics analysis. |

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| Project | **Fertilization ecology and implications of sperm limitation in the western rock lobster** |
| Level | Honours in Marine Science, Master of Biological Science |
| Supervisors | Dr Tim Langlois: tim.langois@uwa.edu.au<br>Prof. Leigh simmons: leigh.simmons@uwa.edu.au<br>Dr Simon de Lestang: Simon.deLestang@fish.wa.gov.au<br>Dr Jason How: jason.how@fish.wa.gov.au |

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| Description | The western rock lobster fishery is the highest value single species fishery in Australia, worth over $400 Million per annum. Very little is known about the occurrence of sperm limitation for the fertilization ecology of western rock lobster, however it is assumed that the selective removal of larger males from the fishery could result in the occurrence of sperm limitation.This study will involve conducting mating trials to establish the mechanics of fertilization within western rock lobster. In addition, both laboratory and field investigations will be used to investigate the relationship between sperm abundance and spermatophore size, using methods to count sperm isolated from spermatophores and relate this data to field surveys of spermatophore size across areas of the fishery with contrasting adult body-size distribution. |

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| Project | **Designing recreational fishing policies using representative fisher preferences** |
| Level | Honours in Marine Science, Master of Biological Science |
| Supervisors | Dr Matt Navarro: matthew.navarro@uwa.edu.au<br>Dr Tim Langlois: tim.langlois@uwa.edu.au<br>Dr Dave Fairclough@fish.wa.gov.au |
| Description | Whilst recreational fishing policies are designed to meet biological based management objectives, fishers preferences are also incorporated into these decisions. At present there is a lack of transparency about how these preferences are measured and accounted for. This study will test the use of an economic technique known as choice experiments to measure fishers' preferences for suites of management interventions including bag limits, seasonal closures and size limits and attempt to combine these preferences with biological based management strategy evaluations to generate recommendations for policy interventions. |

**Projects in collaboration with the Department of Conservation, Biodiversity and Attractions**

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| Project | **What drives change in size spectra of fish assemblages?** |
| Level | Honours in Marine Science, Master of Biological Science |
| Supervisors | Dr Tim Langlois: tim.langlois@uwa.edu.au<br>Shaun Wilson: shaun wilson@dbca.wa.gov.au<br>Tom Holmes: thomas.holmes@dbca.wa.gov.au |
| Description | The structure of fish assemblages is influenced by both fishing pressure and habitat. Increased fishing typically removes large predatory species and allows proliferation of smaller bodied fish, whilst changes in structural complexity alter availability of refuge space for different sized fish. Consequently, the size distribution of fish assemblages can be linked to changes in both fishing pressure and habitat. On coral reefs habitat structure and complexity is often governed by the size and composition of the coral colonies which is also indicative of reef status with respect to disturbance history. This project will use information from stereo video to assess how the size distribution of fish and coral assemblages relate to each other. Using surveys from fished and unfished reefs and across reefs with different coral communities, the project will also explore the relative importance of fishing and habitat on the size distribution of fish. |

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| Project | **Assessing the vulnerability of fishes to spear-fishing in Western Australia** |
| Level | Honours in Marine Science, Master of Biological Science |
| Supervisors | Dr Jordan Goetze: jordan.goetze@dbca.wa.gov.au |
| Description | The Department of Biodiversity, Conservation and Attractions (DBCA) in Western Australia (W.A.) works to manage and conserve resources across a State-wide system of marine parks. One example is the Ningaloo Marine Park, which covers the majority of Ningaloo Reef (a World Heritage site) and is a popular tourist destination for recreational fishers. Due to the importance of this ecosystem there have not been any major commercial fishing activities within the marine park since the 1970s and recreational spearfishing has additional restrictions, e.g. the prohibition of spearing Labridae and Serranidae throughout the Park. These restrictions are additional to the recreational fishing rules set by the Department of Primary Industries and Regional Development (DPIRD) and rely on the ability of fishers to distinguish labrids and serranids from other fishes. Anecdotal evidence suggests that this has caused confusion and therefore a high degree of non-compliance with the restrictions. Research supporting the implication that Labridae and Serranidae are more vulnerable to spearfishing does not exist and it is likely that the spearfishing restrictions were set to protect select species only (e.g. Coral Trout and Baldchin Groper).<br>The student will first be asked to design a socioeconomic survey that assesses the ability of spearfishes to distinguish fish species belonging to the families Labridae and Serranidae from other common fish families in W.A. The DBCA has an extensive dataset on finfish across W.A. (including the Ningaloo Marine Park) collected using Diver Operated Stereo Video (stereo-DOV). It is now possible to extract information on the behaviour of fish from archived videos using a proxy for fish wariness known as minimum approach distance (MAD). The prospective student will also be asked to extract MAD data from archived videos across W.A. to provide state-wide, species specific information on the wariness of fishes which will provide insight into the vulnerability of species to spear fishing. This information can be used to inform future management decisions specific to restrictions on spearfishing (e.g. those outlined for Ningaloo) and potentially refine/streamline rules to focal species. The DBCA finfish monitoring program will be sampling the Shark Bay, Marmion and Shoalwater Bay marine parks in 2019 and the prospective student will be given the opportunity to participate in the collection of stereo-DOV data in the field provided they can meet the appropriate safety requirements (First Aid) and SCUBA qualifications (Rescue Diver and AS2299 Dive Medical). This project will provide the prospective student with skills in video analysis, statistical analysis, field work planning and scientific writing and experience working with a government organisation. |

| Project | **Temporal dynamics of coral at Bills Bay, Ningaloo** |
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| Level | Honours in Marine Science, Master of Biological Science |
| Supervisors | Dr Claire Ross: claire.ross@dbca.wa.gov.au |
| Description | The coral communities of Bill's Bay were first surveyed in 1989 to assess the impacts of an anoxic event caused by low oxygen levels during the presence of coral spawn slicks. The experimental design incorporates an array of 12 monitoring sites with different water residence times and locations spanning the inner, middle and outer reef sections of Bill's Bay. The historical time series of coral community data at Bill's Bay is multi-decadal (1989 to 2011), and thus provides a powerful dataset for assessing the response of coral communities to multiple pressures over time. Due to the high site replication, this monitoring design is not incorporated in the regular (annual to biannual) long term coral monitoring at NMP. As such, coral communities at the 12 sites in Bill's Bay have not been surveyed since 2011. Repeat sampling is therefore required to assess the current condition of the coral communities in Bill's Bay as well as the response and recovery of these communities to more recent localised pressures, including a recent anoxia event that resulted in unusually prolonged coral bleaching (> 4 months) at one of the 12 monitoring sites in the northern inshore section of Bill's Bay during April to August 2019. |

**A project in Fisheries Management: Sea Around Us** (www.seaaroundus.org)

| Project | **Fisheries in Indian Ocean Rim countries** |
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| Level | Honours, in Marine Science, Conservation Biology or Zoology, Masters in Marine Biology, Conservation Biology or Zoology, PhD. |
| Supervisors | Professor Dirk Zeller |
| Description | Science and policy on Indian Ocean fisheries are heavily skewed towards industrial tuna fisheries, yet most Indian Ocean Rim countries gain domestic food security, livelihoods and economic benefits from domestic non-tuna fisheries within their Exclusive Economic Zone waters. These coastal fisheries, however, are often heavily under-valued and under-represented in fisheries science and policy at the national and regional level, as they are often dominated by marginalized small-scale fisheries. As part of the international Sea Around Us - Indian Ocean research initiative (www.seaaroundus-io.org), students will engage in country-level or ocean-basin scale aspects of fisheries science. These types of projects could be especially interesting for students that have links to or interests in specific countries in the Indian Ocean basin, or have non-English language skills (any language may be useful), or are excited by the concept of big-data science or meta-analysis in an interdisciplinary and highly collaborative setting. The Sea Around Us – Indian Ocean collaborates closely with the global Sea Around Us initiative (www.seaaroundus.org) and the interdisciplinary Global Fisheries Cluster (http://global-fc.oceans.ubc.ca/) at the University of British Columbia in Vancouver, Canada, and with FishBase (www.fishbase.org) and SeaLifeBase (www.sealifebase.org) hosted in the Philippines. Most Sea Around Us research does not involve field-based data collection, as we emphasize the utility of pre-existing large databases for enhancement through data gap assessments and large-scale meta-analyses. An open, keen and critical mind and a curiosity about fisheries science and marine conservation at the grand scale is all that is required, but if you also happen to have meta-analysis, Bayesian statistical or computer coding skills…. all the better. |

**Other projects**

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| Project | **Investigating the economic impacts of no-take marine reserve establishment** |
| Level | Honours in Marine Science, Master of Biological Science |
| Supervisors | Dr Matt Navarro: matthew.navarro@uwa.edu.au<br>Dr Tim Langlois: tim.langlois@uwa.edu.au |
| Description | The impact of no-take marine reserves creation on local economies is the subject of much debate. Fisheries interest groups often claim these management actions have negative economic impacts due to impacts on fishing whilst some scientists have claimed benefits for local economies due to increased tourism. This study will use existing long term data from the ABS and Tourism Research Australia along with beyond BACI experimental designs to determine the impact the establishment no-take marine reserves in Australia have had on local economies. |

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| Project | **Developing Sea Country management protocols through combining traditional ecological knowledge of Indigenous Australians and Western Science.** |
| Level | Honours in Marine Science, Master of Biological Science |
| Supervisors | Harriet Davies: harriet.davies@uwa.edu.au<br>Dr TimLanglois: tim.langlois@uwa.edu.au |
| Description | Indigenous Australians have a profound connection to nature and a cultural obligation to take care of Country. As a result, Indigenous people have been sustainably managing their marine estates for millennia. There is an increasing interest in documenting and embedding traditional knowledge into marine management and monitoring yet little work has been done in developing methods and protocols to achieve these goals. This project will build upon participatory mapping methods to document knowledge of senior knowledge holders to help inform marine park and fisheries management in Western Australia. |

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| Project | **Monitoring highly targeted mesophotic fish populations: optimising stereo-video monitoring of large offshore no-take marine reserves** |
| Level | Honours in Marine Science, Master of Biological Science |
| Supervisors | Dr Tim Langlois: tim.langlois@uwa.edu.au<br>Dr Matt Navarro: matthew.navarro@uwa.edu.au<br>Dr Jacquomo Monk: jacquomo.monk@utas.edu.au |
| Description | Large offshore no-take marine reserves have recently been created around Australia and New Zealand. This project will involve field work to collect baited remote stereo-video samples within no-take areas within the Ningaloo and South-west Capes region. Existing data sets will be provided from New Zealand. This project will use novel methods of power analysis to design optimal future monitoring plans to detect differences in highly targeted mesophotic grouper populations (e.g. hāpuku Polyprion oxygeneios) that may occur after the cessation of fishing. The student will develop skills in field work and novel statistical analyses applicable to marine park monitoring design. |

| Project | **Spatial usage of the Australian Marine Parks network** |
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| Level | Honours in Marine science, Master of Biological Science, Master of Environmental Science |
| Supervisors | Dr Matt Navarro: matthew.navarro@uwa.edu.au<br>Dr Tim Langlois: tim.langlois@uwa.edu.au<br>Dr Jacquomo Monk: jacquomo.monk@utas.edu.au |
| Description | In 2019 44 new marine parks were implemented in offshore commonwealth waters around Australia as part of the Australian Marine Parks network. At present little is known about how boat based fishers and non-fishing recreators are using these areas. This project will analyse existing data and collect new data on spatial usage patterns at boat ramps adjacent to 13 of these new marine parks. These usage patterns will form baselines in Parks Australia's social and economic monitoring program and inform the planned 10 year review of the marine parks zoning. |

| Project | **Distribution of plastics in southern estuarine ecosystems, Western Australia** |
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| Level | Honours in Marine Science, Master of Biological Science |
| Supervisors | Dr Renae Hovey: renae.hovey@uwa.edu.au<br>Dr Harriet Paterson: harriet.pateson@uwa.edu.aur |
| Description | The impact plastic is having on the marine environment is rapidly becoming the issue of the millennium. It has negative impacts on biology and degrades the visible qualities of the ocean and the coast line. The south coast of Western Australia can be considered relatively pristine yet plastic has been found in unpopulated areas. We are offering 4 projects that investigate plastic distribution and ecological impacts in estuarine ecosystems which sit at the interface between land and sea. |

| Project | **Ecological links between coastal habitats and marine megafauna conservation** |
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| Level | Honours in Marine Science, Master of Biological Science |
| Supervisors | Dr Ana M Sequeira: ana.sequeira@uwa.edu.au<br>Dr Matthew Fraser: matthew.fraser@uwa.edu.au<br>Prof Gary Kendrick: gary.kendrick@uwa.edu.au |
| Description | The 2011 Western Australian marine heatwave associated with global climate change has strongly affected the Shark Bay World Heritage Area, known for its extensive seagrass meadows and unique marine megafauna. The aftermath of this heat wave highlighted that strong links exist between the habitat-forming dominant temperate seagrass, Amphibolis antarctica, in Shark Bay and the health and abundance of marine megafauna, such as green turtles and dugongs. Understanding these ecological links is crucial to predicting the effects of predicted seagrass loss in Shark Bay on the populations of marine megafauna species that contribute to its World Heritage status. This project will be a collaboration between UWA and DBCA and will be most suitable for a student passionate about remote iconic areas in the Western Australia coastline and with strong interest in investigating behaviour and movement of marine megafauna in relation to coastal habitats |

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| Project | **Understanding the iconic World Heritage Shark Bay using an ecosystem modelling framework** |
| Level | Honours in Marine Science, Master of Biological Science |
| Supervisors | Dr Ana M Sequeira: ana.sequeira@uwa.edu.au<br>Dr Matthew Fraser: matthew.fraser@uwa.edu.au<br>Dr Hector Lozano-Montes: hector.lozano-montes@csiro.au<br>Dr Ben Radford: B.Radford@aims.gov.au<br>Prof Gary Kendrick: gary.kendrick@uwa.edu.au |
| Description | Regional warming and extreme events such as the 2011 Western Australian marine heatwave associated with global climate change has promoted large ecosystem shifts to the marine ecosystem in the Shark Bay World Heritage Area including extensive loss of seagrasses, starvation in turtles and major effects on invertebrate fisheries and fish communities. Understanding how to predict and manage the impacts of climate change on marine ecosystems is a key emerging issue and it is imperative that we are prepared to effectively manage ecosystem scale shifts in Shark Bay to safeguard its World Heritage status. Extreme climatic events are predicted to increase in frequency, intensity and duration. Therefore, understanding the ecosystem impacts of water temperature changes and climate-related seagrass loss is particularly pertinent in ecosystems where foundation seagrasses grow near the edge of their biogeographical range, such as in Shark Bay. This project will pull together physical, habitat, and animal community data into an ecosystem modelling framework to examine physical and biological interactions in Shark Bay, and help predict the trajectory of this World Heritage Site under future climate scenarios.<br>This project will be a collaboration between UWA, AIMS and CSIRO and will be most suitable for a student with strong interest in understanding ecological links within ecosystems and with interest to develop quantitative skills |

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| Project | **Eavesdropping on the lives of shearwaters** |
| Level | Honours in Marine Science, Master of Biological Science |
| Supervisors | Dr Belinda Cannell: belinda.cannell@uwa.edu.au<br>Dr Harriet Paterson: harriet.pateson@uwa.edu.aur |
| Description | The objective of this study is to investigate the vocalizations of Flesh-footed Shearwaters on Muttonbird Island (Albany) while they occupy their burrows during their breeding season. This will increase our understanding of their behaviour during breeding. This project uses a novel sound recording device operated by a Raspberry Pi Computer, a credit-card-sized computer that can be used, amongst other things, for electronic projects. It is equipped with microphones and an infrared camera to observe birds arriving and leaving the burrow. Data have already been collected from the 2017/18 and 2018/19 seasons and we expect to collect more in 2019/20. The data will be interrogated as a desk top study, but the student will be expected to visit the site when the equipment is deployed or retrieved. The candidate will identify and describe vocalisations encountered and assign likely functions to them. The range of vocalisations encountered are likely to include those related to reforming pair bonds, mating, contact calls and sounds related to hatching of chicks, chicks begging and being fed .The candidate may be based at either the Crawley or Albany campus, but must be enrolled through CENRM at the Albany campus. The preferred start date is Semester 2 2019 or 2020. A top up of $500 will be offered to cover costs of the project |

| Project | **How big is the value of a little penguin?** |
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| Level | Honours in Marine Science, Master of Biological Science |
| Supervisors | Dr Belinda Cannell: belinda.cannell@uwa.edu.au<br>Dr Abbie Rogers<br>Prof Michael Burton |
| Description | Little penguins are the smallest penguin species. Their largest breeding colony in Western Australia is just off the shore of Rockingham, in the Perth metropolitan region. They face many threats given their co-location with a major human population base, including marine and coastal developments, predation, watercraft strikes, and pressures from ecotourism.<br>To balance the benefits and costs of coastal activities with the benefits and costs of conserving little penguins, decision makers need to identify what the value of the penguin colony is. This project will involve developing a non-market valuation survey to estimate how much people are willing to pay to protect little penguins through improved management outcomes. Applicants will need to have a background in economics (e.g. units in microeconomic theory, environmental and resource economics) or strong skills in statistical analyses. |

| Project | **Biological responses to an upgrade of the Coogee dive trail** |
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| Level | Honours in Marine Science, Master of Biological Science |
| Supervisors | Dr Jane Prince: jane.prince@uwa.edu.au<br>Dr Dianne McLean: d.mclean@aims.gov.au<br>Dr Renae Hovey: renae.hovey@uwa.edu.au |
| Description | The dive trail at Port Coogee was established in July 2016 and is the largest purpose built, coastal augmentation project in Australia, positioned adjacent to the Port Coogee Marina breakwater and the wreck of the Omeo. It consists of 33 individual concrete modules arranged in a linear formation east to west for 230 m adjacent to the southern breakwater at Port Coogee Marina. The reef module designs include Apollo, Abitat, Reef Matt, and Reef Temple structures, designed to create cryptic habitat, vertical relief, and nutrient upwelling (Subcon, 2018). The reef comprises an additional two sculptures; a 1 m high seal and a 6 m x 2 m concrete starfish.<br>The change in the marine plants and animals associated with these structures has been the subject of two student research projects to date, so we have a detailed time series of the structure of the assemblages on these structures. In the summer of 2019/20, the City of Cockburn will install additional structures and this will provide an excellent opportunity to watch the colonisation of these new structures in relation to the current marine growth on established structures. |