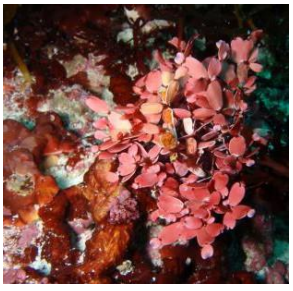
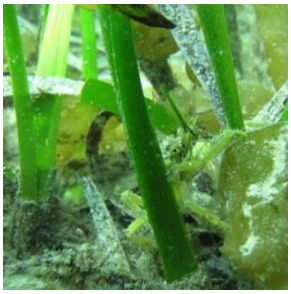
MARINE PROJECT PORTFOLIO
LEVELS 4 and 5

Projects suitable for:

HONOURS in MARINE SCIENCE,
MASTERS IN MARINE BIOLOGY,
OCEANOGRAPHY, GEOSCIENCE, or
ENVIRONMENTAL SCIENCE
2022








Schools of Biological Sciences, Earth Sciences,
Agriculture & Environment and Oceans
Graduate School

The University of Western Australia
35 Stirling Highway
PERTH WA 6009

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

At UWA, majors in Marine Science, Marine Biology and Marine & Coastal Processes are offered within the Bachelor of Science, and taught across three schools: the School of Biological Sciences, the School of Earth Sciences and the School of Agriculture and Environment. They are three-year degrees with the possibility of a fourth, research focused year, Honours, for high performing students who are aiming to progress to a PhD.

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 Marine Biology, the Master of Oceanography, 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. Students may be asked to join a research group and work on data already collected or 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 have your project settled before the year starts so you can hit the ground running onDay 1.

This booklet contains a list of potential projects for level 4 and 5 students available for 2022. Most are biological topics and students seeking additional topics in oceanography or coastal processes should enquireto 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 or Masters coordinators who are **Jane Prince** (jane.prince@uwa.edu.au) and Renae Hovey (renae.hovey@uwa.edu.au) for Marine Science Honours and the Master of Marine Biology, **Jeff Hansen** (jeff.hansen@uwa.edu.au) for Marine and Coastal Processes projects and the Master of Oceanography and Master of Geoscience or **Matthew Hipsey** (matt.hipsey@uwa.edu.au) for the Master of Environmental Science (Marine and Coastal Management).

Project topics included in this booklet include (with page numbers in parenthesis):

RESEARCH PROJECTS AVAILABLE FOR MARINE STUDENTS IN 2022

A. Projects in Ocean and Coastal Processes

COASTAL PROCESSES

Project title	**Use of natural and nature-based reef structures to mitigate coastal flooding and erosion**
Supervisors	Ryan Lowe, ryan.lowe@uwa.edu.au, Oceans Graduate School and School of Earth Sciences, UWA
Description	Coastal erosion and flooding due to extreme storms and sea level rise poses a major threat to coastal populations and infrastructure. Traditional strategies to mitigate coastal hazards have focused on use of hard ('grey') infrastructure (e.g. seawalls, breakwaters, etc.), which despite being effective, generally have many negative impacts on coastlines (e.g. degrading coastal ecosystems, losses of coastal amenities, etc.). Alternative nature-based forms of coastal protection are increasingly being considered for future use in coastal mitigation and adaptation strategies, which can have many additional benefits due to the range of ecosystem services reefs provide. Within WA, coastal flooding erosion has become particularly severe in a number of locations (e.g., erosion hotspots), with the impacts expected to accelerate with sea level rise. There is thus urgency to develop a range of new coastal protection strategies that will help to mitigate and adapt to future coastal hazards. This project will assess the feasibility of using different types of natural and/or artificial reefs as potential solutions to WA's coastal flooding and erosion problems, including identifying suitable locations, optimum design/placement and assessing likely future shoreline responses. Within the project scope there is the flexibility to develop a specific project around a range of currently funded projects. Examples for specific projects could include: • Investigating the capacity of shellfish reef restoration to mitigate wave-driven flooding and erosion along the Swan River foreshore; • Assessing the capacity of multi-function artificial reef structures to mitigate coastal erosion for Perth metropolitan beaches; • Investigating the potential for coral reef restoration, including hybrid artificial structures, to sustainably protect tropical coastlines.
Start	Feb or July start
Requirements	Comfortable with computer-based data analysis. Optional depending on specific project: modelling, ability to conduct field work.

Project title	**Mass mortality of Exmouth Gulf's fringing reefs; timing, drivers, and future recovery**
Supervisors	Mick O'Leary: mick.oleary@uwa.edu.au, School of Earth Sciences, UWA Nicola Browne, School of Molecular Sciences Curtin University Joe Christensen, School of Humanities, UWA
Description	A low tide reconnaissance along the eastern shores of Cape Range have revealed an extensive fringing reef system comprising almost entirely of dead coral rubble. Given the areal extent of this reef structure, it is highly significant that this reef system is no longer ecologically functional, and the lack of reporting of a mass coral die-off along the eastern shores of Cape Range raises question around the timing of the event, whatwere the possible drivers of ecological decline (e.g., bleaching, cyclones, water quality),and if coral mortality occurred during a single event or if there was a gradual reductionin reef health. There are also questions as to why there has been no recovery of corals following the mass die-off. This project will attempt to answer these questions through a combination of surficial mapping, palaeoecological analysis, and radiometric dating of corals collected from boreholes that will be cored into the reef. In addition, the student has the potential to undertake historical research investigating the observed and written accounts of environmental change in Exmouth Gulf following the first charting of the region during early 19th century and accounts from the pearl divers and pastoralists which settled theregion during the middle and late 19th century.
Start	Feb or July start
Requirements	Reef Coring; Drone Survey; U-Series Dating; Palaeoecology; Historical Research

Project title	**Drones for coral reef monitoring**
Supervisors	Dr Sharyn Hickey (sharyn.hickey@uwa.edu.au ; Dr Ben Radford (AIMS) (b.radford@aims.gov.au
Description	Increasing sea surface temperature (SST) is the single largest threat to coral reefs globally. Advancing remote sensing technological capabilities (e.g., drones) have the potential to provide relatively fine-scale information on a reef flat across a large spatialarea. This project would utilise existing drone and infield data from the Rowley Shoals to model broadscale coral reef communities.
Start	Feb or July start
Requirements	Comfortable with big data, computer use, modelling

Project title	**Remotely monitoring mangroves**
Supervisors	Dr Sharyn Hickey (sharyn.hickey@uwa.edu.au ; Dr Ben Radford (AIMS) (b.radford@aims.gov.au
Description	Mangroves provide an opportunity for climate change mitigation and adaptation through their ability to store and sequester large quantities of carbon, and protect the coast from wave and storm surge, while sustaining fisheries through the provision of habitat. This project will utilise spatial modelling, cloud processing, and remote sensingtechniques to develop a West Australian assessment of mangrove condition.
Start	Feb or July start
Requirements	on-line/remotely (potential for some fieldwork opportunity)

Project title	**Understanding the drivers of coastal morphodynamics in Western Australia usingnovel remote sensing techniques**
Supervisors	Jeff Hansen jeff.hansen@uwa.edu.au, Ryan Lowe ryan.lowe@uwa.edu.au
Description	The coastline of Western Australia (WA) is complex due to its geomorphology (e.g. many coral and rocky reef) and is exposed to a unique range of wave and water level conditions. For example, the south of the state is exposed to large waves and small tides with the opposite occurring in the north of the state. This project aims to developa more detailed understanding of the coastal dynamics at a particular site or region of WA. Historical (1980s- to present) shorelines will be mapped using a combination of satellite imagery and aerial photography. The variability in the mapped shorelines overtime will then be linked to records of waves and water levels to understand the primary drivers of coastal change. For example, during La Niña years, the Leeuwin Current is stronger than normal which causes sea levels to be elevated. Some existing research has suggested the elevated sea level associated with La Niña conditions results in additional beach erosion- but this link needs to be further explored at additional locations. A greater understanding of how the coastline responds to variations in sea level and waves will increase our ability to manage the coast and mitigate the effects of climate change.
Start	Flexible
Requirements	Comfortable with computer analysis

Project title	**Measuring the variability of the southwestern Australian coastline from obliqueaerial imagery**
Supervisors	Jeff Hansen (jeff.hansen@uwa.edu.au), Michael 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 inwinter. 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 limitedaccess which limit the applicability of typical survey methods. 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 4 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 variabilityof this coastline.
Start	Flexible
Requirements	Comfortable with computer analysis

Project title	**Quantifying coastal morphodynamics through community-sourced imagery**
Supervisors	Jeff Hansen (jeff.hansen@uwa.edu.au), Michael Cuttler, (michael.cuttler@uwa.edu.au)
Description	With the proliferation of smart phones and social media, capturing and sharing imagesof the coast has never been easier. A new coastal monitoring program, CoastSnap, hasrecently been created to analyse community-sourced imagery to provide quantitative data on coastal morphology. CoastSnap was recently established at nine sites along WA's south west (between Rockingham and Busselton, see facebook.com/coastsnapwa). This project will involve analysing the imagery from each of the new CoastSnap WA sites to examine a range of coastal dynamics questions (e.g. magnitude of shoreline change) and social science questions (e.g. who is taking photos,what social media platform is the photo from, etc.).
Start	Flexible
Requirements	Comfortable with computer analysis

Project title	**Wave runup and rock fisher safety along the Great Southern coastline**
Supervisors	Jeff Hansen (jeff.hansen@uwa.edu.au), Michael Cuttler, (michael.cuttler@uwa.edu.au)
Description	The Great Southern region of WA is renowned for its rugged coastline, with commontourist attractions included locations such as 'The Gap and Natural Bridge'. A popular activity amongst locals and visitors to the Great Southern is rock fishing. However, thisactivity puts fishers in direct contact with the large Southern Ocean swells that are prolific along this coastline. When these large waves break, they cause up-rushes of water (wave runup) that surge over the rock platforms where fishers are located. In the worst cases, anglers can be knocked over, pulled into the sea, and drown. Furthermore, the remoteness of the Great Southern means that most common fishingspots are unpatrolled by lifesavers. Thus, there is a need to better understand the physical processes that drive wave runup along this coastline. This project will use video imagery collected at Salmon Holes (near Albany, WA) to develop a quantitative understanding of wave runup at rocky coastlines that will contribute to the development of a warning system for assessing rock fishing risk.
Start	Flexible
Requirements	Ability to go into the field

OCEANOGRAPHY

Project title	**Ocean drifters off Western Australia**
Supervisors	Prof C Pattiaratchi; chari.pattiaratchi@uwa.edu.au
Description	The Coastal Oceanography have deployed more than 50 surface current drifters along the West Australian coast over the past 12 months. Ocean drifters have a GPS locator that transmits their location every 5 minutes and from this information, we can track the paths of the drifters and calculate velocities. Surface drift patterns are used to define ocean circulation at the surface and used to define pathways of buoyant material such as plastics. The student(s) will be able to use selected ocean drifter datato identify and document different flow features in the surface ocean such as eddies and fronts.
Start	Feb or July start
Requirements	Computer literate

Project title	**Analysing fluorescence quenching in ocean glider data**
Supervisors	Prof C Pattiaratchi; chari.pattiaratchi@uwa.edu.au Dr Paul Thomson; paul.thomson@uwa.edu.au
Description	Measurements of chlorophyll as a proxy for phytoplankton biomass uses optical methods such as fluorescence sensors. Here, the sensors emit a light signal in a particular frequency that stimulates the phytoplankton to emit a light signal at a different frequency. Fluorescence quenching occurs when strong sunlight affect the light signals. This results in a diurnal signal in fluorescence and therefore in chlorophyllthat is not correct. This project will use data collected from ocean gliders to develop and implement a methodology to correct the fluorescence quenching.
Start	Feb or July start
Requirements	Computer literate

Project title	**Analysing underwater light climate in Western Australia**
Supervisors	Prof C Pattiaratchi; chari.pattiaratchi@uwa.edu.au Dr Paul Thomson; paul.thomson@uwa.edu.au
Description	Underwater light is a critical parameter for primary productivity in the water column. In Western Australia, due to an absence of large sediment input from land we have very clear water that penetrate to water depths > 150 m. An almost a decade of underwater light data from ocean glider deployments that will allow for the definitionof the light climate at seasonal and inter-annual time scales as well as examining the impacts of different events such as storms, marine heat waves and cold water episodes.
Start	Feb or July start
Requirements	Computer literate

Project title	**A climatology of sea breezes in south west Australia**
Supervisors	Prof C Pattiaratchi; chari.pattiaratchi@uwa.edu.au Dr Jatin Sala; J.Kala@murdoch.edu.au
Description	Sea breezes or the 'Fremantle Doctor' dominates the weather conditions alongsouth-west Australia. It also has a strong influence on the oceanography. This project will analyse a long-term (~30 years) simulation of winds along the WA coast to determine the exact nature of the sea breeze and year-to-year changes.
Start	Feb or July start
Requirements	Computer literate

Project title	**Physical and biological oceanography of the Perth canyon**
Supervisors	Prof C Pattiaratchi; chari.pattiaratchi@uwa.edu.au Dr Paul Thomson; paul.thomson@uwa.edu.au
Description	Perth Canyon, located to the west of Rottnest Island is the largest undersea topographic feature along the WA coast and one of the most productive. Over the last 2 decades a large amount of data on physical and biological oceanography have been collected from different cruises, ocean gliders and oceanographic moorings. This project will analyse data to determine the links between physical processes, nutrients and biological production within the canyon.
Start	Feb or July start
Requirements	Computer literate

Project title	**Tsunami impacts on the Perth Metropolitan coastline**
Supervisors	Prof C Pattiaratchi; chari.pattiaratchi@uwa.edu.au
Description	Tsunamis are extreme events that can have devastating impacts. Western Australia is susceptible tsunamis originating from the Sundra Trench off Indonesia. In this project you will use a web-based tsunami forecasting tool examine the impact of tsunamis in the Perth region – in particular in the Fremantle, Swan River and Cockburn Sound regions. The availability of high resolution bathymetry data allows for detailed impacts to be determined.
Start	Feb or July start
Requirements	Computer literate

Project title	**Long-term changes in coastal currents in Western Australia**
Supervisors	Prof C Pattiaratchi; chari.pattiaratchi@uwa.edu.au Dr Ivica Janekovic; ivica.janekovic@uwa.edu.au
Description	A database that include 3 dimensional currents for the period 2000-2020 and 2050-2070 is being developed. This is a unique opportunity to examine changes in the Leeuwin Current System in the past 2 decades as well as in the future under climate change scenarios.
Start	Feb or July start
Requirements	Computer literate

B. Projects in Marine Biology

MARINE ECOLOGY GROUP – FISHERIES RESEARCH

Project title	**Using fishers' Local Ecological Knowledge to understand Western Australia's marinesystems**
Supervisors	Dr Tim Langlois (tim.langlois@uwa.edu.au) Dr Matt Navarro (matthew.navarro@uwa.edu.au)
Description	Recreational and commercial fishers possess an abundance of untapped knowledgeabout marine environments. Recognising and incorporating this knowledge into management can address critical scientific knowledge gaps and has been shown to increase acceptance of management. In this project, you will work with commercial and recreational fishers, conducting workshops to document knowledge about marine ecosystems in Western Australia. You will also work to validatethis knowledge against scientific understanding.
Start	Feb start
Requirements	Outgoing personality, excellent communication skills

Project title	**Monitoring recruitment habitats of the western rock lobster**
Supervisors	Dr Tim Langlois, tim.langlois@uwa.edu.au Dr. Kingsley Griffin: kingsley.griffin@uwa.edu.au Dr Simon de Lestang Simon.deLestang@fish.wa.gov.au Dr Jason How jason.how@fish.wa.gov.au
Description	What are the habitat requirements of juvenile western rock lobster? 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 along thecoast of WA. We have a project to evaluate patterns in settlement, recruitment and habitat change that occurred after the 2010/2011 marine heatwave. This project will include a large amount of time on the water using novel methods to surveys shallow water habitats where juvenile lobster are found.
Start	Feb or July
Requirements	Experience on boats would be beneficial

Project title	**Monitoring highly targeted mesophotic fish populations: optimising stereo-video monitoring of large offshore no-take marine reserves**
Supervisors	Dr Tim Langlois: tim.langlois@uwa.edu.au Dr. Matt Navarro: matthew.navarro@uwa.edu.au Dr. Kingsley Griffin: kingsley.griffin@uwa.edu.au
Description	Large offshore no-take marine reserves have recently been created around Australia andNew 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.
Start	Any

Project title	**Designing recreational fishing policies using representative fisher preferences**
Supervisors	Dr Matt Navarro, matthew.navarro@uwa.edu.au Dr Tim Langlois tim.langlois@uwa.edu.au Dr Dave Fairclough: David.Fairclough@fish.wa.gov.au
Description	Whilst recreational fishing policies are designed to meet biological based managementobjectives, 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.
Start	Any

Project title	**Spatial usage of the Australian Marine Parks network**
Supervisors	Dr Matt Navarro, matthew.navarro@uwa.edu.au Dr Tim Langlois tim.langlois@uwa.edu.au Dr. Kingsley Griffin kingsley.griffin@uwa.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 atboat 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.
Start	Any

Project title	**Designing recreational fishing policies using representative fisher preferences**
Supervisors	Dr Matt Navarro, matthew.navarro@uwa.edu.au Dr Tim Langlois tim.langlois@uwa.edu.au Dr Dave Fairclough David.Fairclough@fish.wa.gov.au
Description	Whilst recreational fishing policies are designed to meet biological based managementobjectives, 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.
Start	Any

Project title	**Spatial usage of the Australian Marine Parks network**
Supervisors	Dr Matt Navarro, matthew.navarro@uwa.edu.au Dr Tim Langlois tim.langlois@uwa.edu.au 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 atboat 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.
Start	Any

Project title	**Developing Sea Country management protocols through combining traditional ecological knowledge of Indigenous Australians and Western Science.**
Supervisors	Harriet Davies harriet.davies@uwa.edu.au Dr Tim Langlois tim.langlois@uwa.edu.au
Description	Indigenous Australians have a profound connection to nature and a cultural obligation totake 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.
Start	Any

Project title	**Investigating the economic impacts of no-take marine reserve establishment**
Supervisors	Dr Matt Navarro, matthew.navarro@uwa.edu.au 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 beyondBACI experimental designs to determine the impact the establishment no-take marine reserves in Australia have had on local economies.
Start	Any

SEAGRASS RESEARCH (https://www.seagrassresearch.net/)

Project title	**Seed- based restoration of seagrasses**
Supervisors	Prof Gary Kendrick (gary.kendrick@uwa.edu.au)
Description	There are opportunities for two Masters students to work closely with a multi-institutional team on seagrass restoration. 1. The first project will work with the highly successful "Seeds for Snapper" *Posidonia* restoration program to address the assessment of seeding success in Owen Anchorage and Cockburn Sound. It will develop the science behind collection, seeding and successful recruitment of *Posidonia* seeds. 2. The second project will investigate the design and placement of hessian tubes to capture naturally dispersing *Amphibolis antarctica* seeds. This will require the set up and monitoring of a large subtidal experiment and potentially work with hydrodynamic modellers to design best placement.
Start	February or July
Requirements	SCUBA diving (Advanced with Rescue course), driving (2WD essential, 4WD desirable)

Project title	**Saving seagrass from climate change**
Supervisors	Prof Gary Kendrick (gary.kendrick@uwa.edu.au) Dr Elizabeth Sinclair (elizabeth.sinclair@uwa.edu.au)
Description	This project will address fitness in Posidonia seagrass meadows and how it can be improved through inter-population genetic connectivity. This research will target range edge seagrass meadows, with a focus on the World Heritage site Shark Bay. There are several opportunities to develop projects around genomic diversity and genetic regulation of flowering and testing outcrossing in range edge populations.
Start	February
Requirements	Snorkelling, driving (2WD essential, 4WD desirable)

ALGAL AQUACULTURE

Project title	**Optimise sporophyte density of *Asparagopsis taxiformis* to enhance seedingonto cultivation string**
Supervisors	Dr John Statton (john.statton@uwa.edu.au) Prof Gary Kendrick (gary.kendrick@uwa.edu.au)
Description	Seaweed is one of the most attractive emerging aquaculture industries Australia-wide. The Red Seaweed, *Asparagopsis taxiformis*, when fed to cattle in small quantities, can mitigate harmful methane emissions from the livestock industry byup to 98%. Asparagopsis could become the 'wheat crop' of Australia's oceans, andis on track to be grown and processed here in Australia. This project will determine the density that optimises attachment, survivability and growth of sporophytes prior to transfer to grow-out trials. This project will bebased at the Watermans Bay Marine Research Facility (30 minutes north of UWA crawley campus), successful candidates need to be part-time located at this facility to undertake the research trials.
Start	Feb start
Requirements	Snorkelling, strongly lab-based project, desire to learn about aquaculturetechniques and seaweed.

Project title	**Optimising sporophyte growth for commercialisation of the methane mitigatingseaweed, *Asparagopsis taxiformis***
Supervisors	Dr John Statton (john.statton@uwa.edu.au) Prof Gary Kendrick (gary.kendrick@uwa.edu.au)
Description	Seaweed is one of the most attractive emerging aquaculture industries Australia-wide.The Red Seaweed, *Asparagopsis taxiformis*, when fed to cattle in small quantities, can mitigate harmful methane emissions from the livestock industry by up to 98%. Asparagopsis could become the 'wheat crop' of Australia's oceans, and is on track to begrown and processed here in Australia. This project will focus on optimising cultivation techniques to produce high quality seed stock for Western Australian conditions. This project is aquaculture focussed and will usedose:response testing of environmental variables (light, nutrients) to optimise this life stage. This project will be based at the Watermans Bay Marine Research Facility (30 minutes north of UWA crawley campus), successful candidates need to be part-time located atthis facility to undertake the research trials.
Start	Feb start
Requirements	Snorkelling, strongly lab-based project, desire to learn about aquaculture techniquesand seaweed.

Project title	**Enhance gametophyte fecundity of *Asparagopsis taxiformis* for aquaculture**
Supervisors	Dr John Statton (john.statton@uwa.edu.au) Prof Gary Kendrick (gary.kendrick@uwa.edu.au)
Description	Seaweed is one of the most attractive emerging aquaculture industries Australia-wide. The Red Seaweed, *Asparagopsis taxiformis*, when fed to cattle in small quantities, can mitigate harmful methane emissions from the livestock industry byup to 98%. Asparagopsis could become the 'wheat crop' of Australia's oceans, andis on track to be grown and processed here in Australia. This project aims to enhance fecundity of gametophytes by testing dose:responserelationships of environmental conditions (nutrients x light x temperature). Enhanced fecundity of gametophytes is a necessary pathway to developing thecommercialisation potential of this seaweed species. This project will be based at the Watermans Bay Marine Research Facility (30 minutes north of UWA crawley campus), successful candidates need to be part-time located at this facility to undertake the research trials.
Start	Feb start
Requirements	Snorkelling, strongly lab-based project, desire to learn about aquaculturetechniques and seaweed.

WERNBERG LAB (https://wernberglab.org/)

Project title	**Export of blue carbon from kelp forests to deep marine sinks**
Supervisors	Dr. Thomas Wernberg-thomas.wernberg@uwa.edu.au, Dr. Karen Filbee-Dexter-karen.dexter@uwa.edu.au,
Description	One approach to combat climate change is to increase carbon storages and sinks.Recent research suggests that large seaweed forests may sequester substantial amounts of carbon in the deep sea. Key unknowns remain about the fate of this carbon once it leaves the shallow reefs; especially how much is transported across the shelf and reaches deep marine sediments. This project will use an underwater camera system to track kelp detritus moving from shallow reefs (<20 m) to deeper areas (20 - 100 m) off Western Australia. Laboratory flume trials willbe used to measure deposition and resuspension thresholds of different types of kelp detritus, which are essential to predict movement along the seafloor. This research should help assess the carbon storage potential of kelp forests. The project will involve work in the field and the lab. A background in field ecology and/or oceanography would be helpful but not essential.
Start	Feb or July start, Feb preferred
Requirements	Diving, driving (2WD/4WD)

Project title	**Developing a novel restoration tool for threatened kelp forests**
Supervisors	Dr. Thomas Wernberg-thomas.wernberg@uwa.edu.au, Dr. Karen Filbee-Dexter-karen.dexter@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 byalgal turfs. This project will help develop and test a novel restoration tool 'greengravel' 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. This project can be field based or laboratory based. There are also opportunities for this project to include social-ecological research and science communication, such as engaging with communities to evaluate and test this restoration tool.
Start	Feb or July start, Feb preferred
Requirements	Diving, driving (2WD/4WD)

Project title	**Thresholds for kelp forest loss and turf expansion**
Supervisors	Dr. 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 and aquarium experiments on kelp and turf dynamics 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 acollaborative project between UWA and the NSW Department of Primary Industries. This project can be field based (SCUBA) and/or laboratory based (Aquarium experiments).
Start	Feb or July start, Feb preferred
Requirements	Diving, driving (2WD/4WD)

Project title	**Using strong genotypes to boost resistance or restore threatened kelp forests**
Supervisors	Dr. 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.
Start	Feb or July start, Feb preferred
Requirements	Diving, driving (2WD/4WD)

STABLE ISOTOPE STUDIES

Project title	**Stable isotope studies of marine food webs**
Supervisors	Greg Skrzypek: grzegorz.skrzypek@uwa.edu.au Mark Meekan
Description	Marine food webs are often very complex, and individual interactions are challenging to detangle. However, tracking particular behaviour, e.g. reasons for changing food web positions, could be very informative for understanding ecological processes occurring. The isotope tracer approach provides an opportunity to better understand who is eating who. Some projects in this research area can be available as part of the ongoing collaboration between UWA and WAMSI.
Start	Feb or July start
Requirements	

DEEP SEA ECOLOGY

Project title	**Diversity and dynamics of key Philippine and Mariana Trench species.**
Supervisors	Alan Jamieson: alan.j.jamieson@uwa.edu.au) Todd Bond: todd.bond@uwa.edu.au
Description	The ultra-deep subduction trenches are home to several large key bait-attending species that inhabit depths of 5000 to 8000 m. These are the prawns, snailfish, cusk-eels, and supergiant amphipods. In the last 2 years 30 full ocean depth baited camera deployments have been done in the Philippine and Mariana Trenches, with additional data from the nearby Sui Shin Hole. This project will be video based and will focus on abundances and sizes class of these key species, and how they compare between large geomorphological features, and within partitioned areas of the same features. Evidence for a putative breeding ground of the deep-sea penaeids prawns in the Mariana Trench will also be investigated.
Start	Feb or July start
Requirements	A strong interest in video analysis, ecological statistics, life history.

Project title	**Colonisation of the RMS *Titanic* wreck by deep-sea benthic fauna**
Supervisors	Alan Jamieson: alan.j.jamieson@uwa.edu.au) Todd Bond: todd.bond@uwa.edu.au
Description	The RMS *Titanic* famously sank to a depth of 3200 m in the NW Atlantic in 1912. In the proceeding 110 years the wreck has provided a hard substrate for many deep-sea benthic fauna. Since its discovery in 1986 the wreck has been explored several times. The latest expedition to film it was in 2019. This project will utilise this new HD video footage and focus on the deep-sea benthic community that now colonise the wreck and how this compares to historical records, and potentially how these data could be used to measure growth in sessile organisms over extended periods of time in the deep-sea.
Start	Feb or July start
Requirements	A strong interest in video analysis, ecological statistics, life history.

PREDATOR/PREY INTERACTIONS

Project title	**Detection of prey by fish predators**
Supervisors	Jennifer Kelley: jennifer.kelley@uwa.edu.au Jan Hemmi: jan.hemmi@uwa.edu.au
Description	Predation risk is one of the most important factors affecting the behaviour and survival of prey animals. However, we know surprisingly little about the factors that influence the foraging behaviour of predators. The likelihood of a prey being detected depends on the colouration of the prey relative to the background. However, backgrounds can be 'noisy', consisting of complex colours and patterns, which can present a significant challenge for predators. To avoid issues of animal ethics, this project will use live fish as predators and virtual prey to examine the effect of background complexity of visual detection. The work will increase our understanding of the role of vision and colouration in predator-prey interactions.
Start	Feb or July start
Requirements	A strong interest in working with fish (note - this is time consuming). Strong analytical skills using platforms such R, Matlab.

Project title	**Decision-making and predator evasion in wild damselfish shoals**
Supervisors	Jennifer Kelley: jennifer.kelley@uwa.edu.au Jan Hemmi: jan.hemmi@uwa.edu.au
Description	One of the main advantages of group living is a reduction in the risk of predation due to effects such as risk dilution and predator confusion. As a result, animals in smaller groups tend to display stronger antipredator responses than those in larger groups. However, defensive strategies also depend on other factors, such asnearest-neighbour distance and the distance to shelter. This project will investigate how shoals of wild damselfish respond to a looming visual threat (computer-simulated object approach) depending on the social organisation (e.g. distance and orientation of nearest-neighbour) and the size of the shoal.
Start	July (note that this project requires animal ethics approval)
Requirements	Snorkelling. Strong analytical skills (e.g. Matlab, R).

Project title	**Selective attention in the context of escape**
Supervisors	Zahra Bagheri: zahra.bagheri@uwa.edu.au Jan Hemmi: jan.hemmi@uwa.edu.au
Description	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.
Start	Feb start

Project title	**Escape responses in fiddler crabs**
Supervisors	Jan Hemmi: jan.hemmi@uwa.edu.au
Description	How do animals decide when to escape from an approaching predator? We are trying to understand the sensory information animals underlying this decision. The results will tell us how animals measure risk and how they manage to avoid being eaten while still being able to feed and find mates. Fiddler crabs are highly visual animals that live under constant threat of predation from birds. Field experiments have shown that the crabs are not able to measure a predator's distance or their direction of movement – a problem they share with many other small animals. You will bring fiddler crabs into the laboratory and their escape decisions will be tested in our artificial mudflat (at UWA) and/or on a custom made treadmill controlled conditions. Depending on your interests, you can use a combination of behavioural and physiological measurements to understand the mechanisms underlying the crab's escape behaviour.
Start	Feb start

PHYSIOLOGY and VISUAL ECOLOGY

Project title	**Heart rate monitoring of aquatic invertebrates**
Supervisors	Jan Hemmi: jan.hemmi@uwa.edu.au
Description	Heart rate is well known as an indicator of physiological 'state', activity and stress in animals such as mammals, including humans. Heart rate varies similarly in invertebrates such as crabs and molluscs, providing a method to monitor the animals to determine their state of physiological stress (e.g. in response to pollutants), to optimise husbandry for welfare reasons, or to maximise growth rates in aquaculture. We have constructed a small electronic package comprising an infrared (IR) light emitting diode (LED) and IR detector that can be mounted on the shell of a mollusc or carapace of a crab and used to monitor heart rate with minimal impact on the animal. We will use this to measure the affect of physico-chemical environmental conditions such as dissolved oxygen tension, temperature, and pH on aquatic invertebrates including farmed animals such as abalone and marron. We will also investigate heart rate in the context of marine invertebrates with complex behavioural repertoires and/or that live in environmentally highly varying conditions (e.g. fiddler crabs).
Start	Feb start
Requirements	

Project title	**Taking the pulse of crustaceans – monitoring heart rate in response to environmental changes**
Supervisors	Jan Hemmi: jan.hemmi@uwa.edu.au Tim Langlois: tim.langlois@uwa.edu.au Callum Donohue: callum.donohue@uwa.edu.au
Description	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. The focus of this project is to 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).
Start	Feb start
Requirements	

Project title	**How fiddler crabs see the world**
Supervisors	Jan Hemmi: jan.hemmi@uwa.edu.au
Description	This project aims to understand how animals, in particular fiddler crabs, see their world. Using a mix of behavioural, physiological and anatomical experiments, we seek to understand how these animals see colours, patterns and polarisation, and how these visual capabilities influence how these crabs interact with their environment, their predators and conspecifics. Experiments will be conducted using our resident UWA fiddler crab colony, housed in a 4 m2 fully-functional artificial mudflat. You will discover how sensory information underpins animal behaviour, learn how to probe the visual capabilities of animals and, depending on your interests and abilities, learn different combinations of behavioural and physiological and possibly genetic techniques. Come and talk to me about the many questions we would like to answer in this context.
Start	Feb start
Requirements	

Project title	**Vision in deep sea animals**
Supervisors	Jan Hemmi: jan.hemmi@uwa.edu.au Karen Osborn: osbornk@si.edu Zahra Bagheri: zahra.bagheri@uwa.edu.au
Description	Hyperiid amphipods, small crustaceans that live in the deep, open ocean worldwide, have some of the most fascinating eyes seen in animals. In some species the eye accounts for up to 30% of the body, others have replicated their eyes, resulting in multiple eye pairs. Using our newly developed micro-CT-based technique, you will reconstruct the detailed structure of the compound eyes of representative hyperiids. You will then use that data to predict what these animals can see and which behavioural tasks have most likely driven the evolution of their eyes. There are projects here for at least three students - any number of eye forms could be studied in detail, several eye forms could be compared, or you could investigate the steps leading to one of the more extreme eye forms, such as replicated eye pairs. You will work in a multidisciplinary team that is trying to understand what life in the largest habitat on earth (the midwater) is like in order to better understand the open ocean. You will learn about vision, phylogenetics and how to relate the structure of animal eyes and brains to their behaviour.
Start	Feb start
Requirements	

Project title	**Sampling the visual world**
Supervisors	Jan Hemmi: jan.hemmi@uwa.edu.au Zahra Bagheri: zahra.bagheri@uwa.edu.au
Description	Visual systems are under strong selection pressure because they are often crucial in guiding the behaviour of animals. Physical constraints mean that an eye of a given size cannot simultaneously maximise both its resolution and sensitivity while maintaining the extent of its visual field. As a consequence, most eyes show distinct regional differences in how they allocate resolution and sensitivity. A new method, based on micro-CT, we have developed, predicts that fiddler crabs, have two parallel streaks of high resolution located just above and below the visual horizon. This is in stark contrast to previous results that such streaks of high resolution, which are very common in flat-world inhabitants, are centred on the horizon. We would like to confirm this exciting result with physiological recordings. You will learn how to measure the visual resolution of fiddler crab in different parts of the eye, using electrical recordings from the surface of the eye.
Start	Feb start
Requirements	

Project title	**The role of polarisation in navigation**
Supervisors	Jan Hemmi: jan.hemmi@uwa.edu.au Zahra Bagheri: zahra.bagheri@uwa.edu.au
Description	Polarisation vision is used by a variety of species in many important tasks, including navigation and orientation, communication and signalling, and as a possible substitute for colour vision. Fiddler crabs possess the anatomical structures necessary to detect polarised light and occupy environments rich in polarisation cues. Unlike many insects, however, polarisation vision is not confined to the dorsal part of the eye, but crabs have full field polarisation vision. However, it is unknown whether they can use polarisation to find their direction back home. The aim of this project is to investigate the role of polarisation vision in path integration and homing in fiddler crabs using a modified polarisation monitor in an artificial mudflat. You will learn how animals use vision to navigate and how to "ask" animals what information they use to make important decision by performing well balanced experiments in a realistic environment.
Start	Feb start
Requirements	

SEXUAL SELECTION

Project title	**Testing Bateman curves on broadcast spawning marine invertebrates**
Supervisors	Prof. Jon Evans (Jonathan.evans@uwa.edu.au) Dr. Rowan Lymbery (rowan.lymbery@uwa.edu.au) Ms Jessica Hadlow (Jessica.hadlow@uwa.edu.au)
Description	Sexual selection can be viewed as the ultimate scientific paradigm; given certain expectations about patterns of reproductive investment (males typically invest less per reproductive event than females), we expect sexual selection to target males more strongly than females. The origins of the sexual selection paradigm can be found in Angus Bateman's classic studies of fruit flies, which showed that the relationship between reproductive success and the number of mates differed between the sexes, which Bateman attributed to the fact that female fertility is limited by egg production while males are rarely limited by the ability to produce sperm. However, theoretical models challenge these predictions for marine broadcast spawners, where sperm limitation is common and females likely compete for fertilisation opportunities. This project will provide a timely and critical re-evaluation of Bateman's principles using a series of innovative experimental approaches on broadcast spawning invertebrates (either sea urchins or mussels).
Start	Feb or July start: The start date is negotiable, as mussels commence spawning in late May and typically finish in late September while urchins spawn from March to May. A student working on mussels might therefore commence in either semester, although it is recommended that those who choose semester 2 commence practical work earlier than the scheduled start. Students working on urchins would ideally commence in semester 1.

Project title	**Egg competition in a broadcast spawning marine invertebrate**
Supervisors	Prof. Jon Evans (Jonathan.evans@uwa.edu.au) Dr. Rowan Lymbery (rowan.lymbery@uwa.edu.au) Ms Jessica Hadlow (Jessica.hadlow@uwa.edu.au)
Description	When we think about sexual selection, and particularly competition among gametes from different individuals for fertilization opportunities, we rarely if ever think about 'egg competition'. Yet both theory and empirical data strongly support the idea that egg competition should be a pervasive evolutionary force in the sea, where gametes from both sexes are often limiting and eggs may need to compete to ensure that they are fertilized. This project is designed to fill a critical gap in our knowledge of sexual selection in marine invertebrates, many of which exhibit the ancestral mating strategy of broadcast spawning (releasing both spermand eggs for external fertilization). The results from this study, performed on the mussel *Mytilus galloprovincialis*, will therefore also have far-reaching implications for sexual selection in more 'familiar' mating systems, where most studies of gamete ('sperm') competition have focused.
Start	Feb or July start: The start date is negotiable, as mussels commence spawning in late May and typically finish in late September. A studentmight therefore commence in either semester, although it is recommended that students who choose semester 2 commence practical work earlier than the scheduled start.

POPULATION GENETICS

Project title	**Assessing stock structure in nearshore and estuarine finfish.**
Supervisors	Dr Jason Kennington (jason.kennington@uwa.edu.au) and Dr Rodney Diffy (DPIRD).
Description	The catch of nearshore and estuarine finfish from commercial and recreational fisheries in Western Australia is composed of many different species from distinctpopulations and sub-populations. Management of these stocks, and the definitionof what constitutes a stock, is based on information related to movement, biologyand existing fisheries management practices. Traditionally, a number of different techniques have been used to identify stocks, from tagging studies to determine movement and mixing, to various genetic methods. Whilst effective, these methods can prove costly and time consuming, and can lack fine scale resolution. Often these investigations have focussed on species of high value or high abundance caught within a single, or small number of fisheries. Species that are caught by many fisheries, but that don't dominate the catch of any, have been forgotten, despite the overall catch of these species being significant. To address this shortfall, we are interested in understanding stock structure of three finfish species: sea mullet (*Mugil cephalus*), yelloweye mullet (*Aldrichetta forsteri*) and tailor (*Pomatomus saltatrix)* using modern, cost effective techniques (SNPs), that offer fine scale resolution to understand stock structure. The outcome of this workwill be of direct relevance to fisheries management within Western Australia.
Start	February 2022. Also opportunity to do preliminary sample preparation at DPIRD over the end of year break.
Requirements	None other than an interest in fisheries management and conservation.

Project title	**Assessing stock structure in deep sea crabs**
Supervisors	Dr Jason Kennington (jason.kennington@uwa.edu.au), Dr Jason How (DPIRD) and Dr Simon de Lestang (DPIRD).
Description	Effective management of commercial fisheries requires an accurate delineation of self-sustaining subpopulations or stocks. When information on stock structure is lacking or based on arbitrary anthropogenic boundaries, stocks are susceptible to overexploitation. This can lead to a collapse of the exploited stocks, which may take considerable time to recover. The recent stock assessment of crystal crab in the SCCMF indicated an unacceptable level of stock depletion. Catches in this area have been highly cyclical unlike those on the west coast. This pattern is very similar to that of rock lobster and blue swimmer crab, whereby the main spawning stock resides on the west coast with large and consistent catches, while those on the south coast are sporadic with recruitment only flowing down in strong Leeuwin Current years. These south coast areas are considered a resource sink. Irrespective of the similarities, the south coast deep-sea crab fisheries are still managed conservatively under the assumption of self-recruiting (they are not treated as sink populations). Determination of the recruitment linkages between the west and south coast fisheries will have marked implications on the management arrangement required for both fisheries. Similarly, the WCDSCMF, which retains catch predominantly from 23-29°S, is currently managed as a single

	stock. However, the boundaries of the fishery extend well beyond this range, and with increasing interest in expanding the fishery, understanding any possible genetic sub-structuring within the fishery is critical to ongoing stock assessment and management. The aim of this project will be to assess stock structure in both species using genetic data generated using a genotype-by-sequencing approach.
Start	February 2022. Also opportunity to do preliminary sample preparation at DPIRD over the end of year break
Requirements	None other than an interest in fisheries management and conservation.

INTERTIDAL AND SPATIAL ECOLOGY – Prince-Hovey lab

Project title	**Geographical variation in the ecology and morphology of gastropod molluscs:**
Supervisors	Jane Prince (jane.prince@uwa.edu.au), Matilda Murley (matilda.murley@research .uwa.edu.au)
Description	Some species of molluscs have an extensive distribution down along the western coast of Western Australia spanning from the Kimberley to the Capes crossing recognised biogeographic regions. Each species could be the topic of a research project. These projects aim to investigate the morphological and ecological characteristics of these species at various points along the coast, looking for natural transitions. Tissue samples will be collected for DNA analysis either in these projects or at a later stage.
Start	Feb start
Requirements	Driving (2WD essential, 4WD desirable), multivariate statistics and the use of other specialist software. This project will require one extended trip to the Kimberley and Pilbara in June 2022 and numerous trips closer to home in spring/summer 2022/2023

Project title	**The effect of sampling method on the interpretation of field surveys: implications for citizen science.**
Supervisors	Jane Prince (jane.prince@uwa.edu.au), Matilda Murley (matilda.murley@research .uwa.edu.au)
Description	Quadrat sampling to determine the assemblage structure of intertidal invertebrates is a time consuming process that requires considerable expertise. This makes it unsuitable for citizen science projects where participants may be unskilled or have limited time. This project will firstly re-examine data collected over five years by indigenous rangers in the Kimberley to see how different methods of scoring the invertebrates in the quadrats affects the outcome and interpretation of the analysis. The second phase will involve field trials of different methods to gauge efficiency
Start	Feb start
Requirements	Driving (2WD essential, 4WD desirable), multivariate statistics and the use of other specialist software. Must be comfortable with computers and willing to "play" with data.

Project title	**Biology and spatial ecology of the "living fossil" *Campanile symbolicum* in the Capes Ngari Marine Park**
Supervisors	Jane Prince: jane.prince@uwa.edu.au Renae Hovey: renae.hovey@uwa.edu.au Sahira Bell: Sahira.Bell@dbca.wa.gov.au
Description	*Campanile symbolicum* is gastropod mollusc, endemic to south-western Western Australia, whose range and distribution is threatened by climate change. We believe that its range has contracted significantly since it was first recorded in WA. It persists in high numbers in the Capes Ngari Marine Park and we want to use these populations in an attempt to understand its population biology, mating and breeding behaviours and movements between intertidal and shallow subtidal environments within the park. This will lead to a better understanding of its habitat requirements in the face of environmental change.
Start	Feb start. Ideally a student would choose this project before the end of the year and participate in field trips to the capes over summer.
Requirements	Driving (2WD essential, 4WD desirable), snorkelling required, SCUBA qualifications desirable. This project will involve field work and a project spread over three semesters of a masters.

Project title	**Biological responses to an upgrade of the Coogee dive trail**
Supervisors	Jane Prince: jane.prince@uwa.edu.au 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. 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 installed additional structures and this provides an excellent opportunity to record the colonisation of these new structures in relation to the current marine growth on established structures.
Start	Feb start. Ideally a student would choose this project before the end of the year and participate in field work over summer.
Requirements	Driving (2WD essential, 4WD desirable), snorkelling required, SCUBA qualifications desirable. This project will involve field work and a project spread over three semesters of a masters.

SEA AROUND US – INDIAN OCEAN NODE (http://www.seaaroundus.org/)

Project title	**The largest freshwater fishery data challenge in Africa: Lake Victoria**
Supervisors	Dirk Zeller dirk.zeller@uwa.edu.au Jessica Meeuwig jessica.meeuwig@uwa.edu.au
Description	Tanzania, Kenya and Uganda are the major stakeholders in the largest freshwater body in Africa, Lake Victoria, which has the biggest freshwater fishery in Africa. Much of the regional food security, domestic livelihoods and local economic benefits are derived from this freshwater fishery, yet it is heavily under-valued and under-represented in fisheries science and policy at the national and regional level, as it is largely dominated by marginalized small-scale fishers that do not feature adequately or accurately in national data used for decision making. As part of the international Sea Around Us - Indian Ocean research initiative (www.seaaroundus-io.org), the student will engage in a fisheries data science project to improve and update the globally available data on freshwater fisheries catches and fishing effort of Lake Victoria's freshwater fisheries. This research builds on a successful freshwater project in 2020 for Kenya, and may directly contribute to and participate in a regional capacity enhancement workshop and training initiative for the Lake Victoria scientific community being held in late 2022 or early 2023. These projects generally do not involve field-based data collection, as we emphasize the utility of pre-existing data sets and close international collaborations with in-country experts for enhancement through data gap assessments and large-scale meta-analyses. Such collaborations require sensitivity and diplomatic interpersonal skills due to the sensitivity associated with the colonial history in East Africa. An open, curious and keen mind, critical thinking skills, self-drive and a curiosity about fisheries data science is crucial. While not crucial, if you also have some R programming skills …. all the better.
Start	Feb or July start
Requirements	Good basic skills with Excel (including Pivot Table) Good literature searching skills Willingness to read extensively Ability to digest a wide diversity of reading material

Project title	**Using satellite-data from the Global Fishing Watch to infer likely catches by foreign fleets inside EEZs and on the High Seas in the India Ocean**
Supervisors	Dirk Zeller dirk.zeller@uwa.edu.au Jessica Meeuwig jessica.meeuwig@uwa.edu.au
Description	Recent technological advances in remote monitoring technology are increasingly being used to assist broad-scale marine conservation and fisheries management objectives. These technologies are particularly useful for fisheries monitoring in low-income regions and on the High Seas, where the lack of resources for adequate monitoring and surveillance and the vast extents of ocean make it difficult to track fishing activity. To address this issue, the Global Fishing Watch initiative has developed a fisheries monitoring tool that enables the estimate of fishing effort by registered commercial fishing vessels anywhere in the world. The proposed project will adopt a novel approach to expand the use of this tool by combining the *Sea Around Us* fisheries catch reconstructed approach with the Global Fishing Watch fishing effort dataset to generate

	estimates of foreign fishing catches within EEZs of low-income countries and on the High Seas in the Indian Ocean region. Thus, despite potentially high uncertainty, this project will generate urgently needed estimates on foreign and distant-water fisheries, which are hard to monitor, to enable national and regional decision-makers to better manage fisheries. This research does not involve field-based data collection, as we emphasize the utility of pre-existing databases and data sets. Students are expected to have R programming skills, exercise use of their critical thinking skills, be self-driven and have curiosity about fisheries data science. Good and collegial communication, networking and collaborative skills are also required, as this project forms part of the *Sea Around Us'* international collaboration with the Global Fishing Watch initiative.
Start	Feb or July start
Requirements	Good skills with Excel (including Pivot Table)Good R-programing skills Good literature searching skillsWillingness to read extensively Ability to digest a wide diversity of reading material

Project title	**Fisheries in Indian Ocean Rim countries**
Supervisors	Dirk Zeller dirk.zeller@uwa.edu.au Jessica Meeuwig jessica.meeuwig@uwa.edu.au
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 at the national and regional level, as they are often dominated by marginalized small-scale fisheries with substantial data gaps. 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 using big-data approaches. These types of projects could be especially interesting for students that are excited by data mining and historical ecology, or wish to be challenged by big-data approaches in an interdisciplinary 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 secondary data and databases for enhancement through secondary data mining, data harmonization, data gap assessments and large-scale data approaches. An open and keen mind, critical thinking skills, team work abilities and a curiosity about fisheries data science is all that is required, but if you also have programming skills (e.g., R) or even advanced computing skills for big-data approaches …. all the better.
Start	Feb or July start
Requirements	Good basic skills with Excel (including Pivot Table) Good literature searching skills Willingness to read extensively Ability to digest a wide diversity of reading material

PROJECTS FROM THE ALBANY CAMPUS

RECREATIONAL FISHING

Project title	**Improving rock fishing safety. Has the communication of the dangers of rock fishing been effective?**
Supervisors	Barbara Cook: barbara.cook@uwa.edu.au Paul Close: paul.close@uwa.edu.au
Description	Recreational fishing is a popular activity globally. Although an enjoyable pastime, recreational fishing, particularly rock fishing, can be dangerous, with many deaths recorded in Australia and New Zealand. Although Recfishwest has invested in extensive fishing safety campaigns, knowledge of how much of this communication is accessed by high risk fisher groups is limited. Measurement of the performance of this rock fishing safety strategy is critical. Using intercept surveys, this project will identify what forms of communication are commonly used by fishers, how much of the fishing safety material has been viewed, and how this has affected risk taking behaviours.
Start	Feb or July start
Requirements	This project will be conducted in Albany.

FRESH WATER ECOLOGY

Project title	**Microplastic ingestion by aquatic fauna**
Supervisors	Paul Close: paul.close@uwa.edu.au Barbara Cook: barbara.cook@uwa.edu.au
Description	Pollution of aquatic ecosystems by plastic is a growing worldwide problem. Ingestion of microplastics by freshwater biota can be influenced by feeding strategies and habitat use. This project will examine how microplastic ingestion varies among taxa and functional feeding groups and will target fish and invertebrates such as mussels and crayfish..
Start	Feb or July start
Requirements	The project will involve field sampling in the Albany region

Project title	**Influence of climate change on fish life cycles**
Supervisors	Paul Close: paul.close@uwa.edu.au Barbara Cook: barbara.cook@uwa.edu.au
Description	A study of a freshwater fish that occurs near Albany showed that these animals are capable of shifting the timing of reproduction to match suitable environmental conditions. Over the past 20 years, a period of significant drying, these fish delayed spawning and migration to match stream discharge. There are a number of opportunities for projects aimed at further exploring whether flexibility in life history characteristics in aquatic fauna offers some resilience to changes in climate.
Start	Feb or July start
Requirements	The project will involve field sampling in the Albany region

Project title	**Environmental influence on mussel growth**
Supervisors	Paul Close: paul.close@uwa.edu.au Barbara Cook: barbara.cook@uwa.edu.au
Description	Long-lived species experience variations in environmental conditions over temporal scales ranging from decades to days. In some animals, bone-like structures formed over the animal's entire life contain structure that provide information on age and growth rates. Where historical environmental data exists, these structures can provide detailed information on an animal's response to a chronology of environmental change. This project will use growth structure in the shells of freshwater mussels (*Westralunio carteri*) to investigate environmental influence on growth over the life of animals that span a period of major change in climate.
Start	Feb or July start
Requirements	This project will be conducted at Albany.

Project title	**What eats mussels?**
Supervisors	Paul Close: paul.close@uwa.edu.au Peter Speldewinde: peter.speldewinde@uwa.edu.au
Description	Freshwater mussels can be highly abundant, and exceed the combined biomass of all other benthic aquatic fauna by orders of magnitude. It is possible, where abundances are high, that they contribute substantially to the diet of terrestrial-based predators such as water rats. In turn, they may contribute to broader ecosystem processes by contributing aquatic sourced energy to riparian/terrestrial food webs. This project will use camera traps to identify predators and stable isotope analysis to investigate their contribution to energy flux/foodwebs.
Start	Feb or July start
Requirements	This project will be conducted at Albany

Project title	**Habitat preference of the fresh water mussel *Westralunio carteri***
Supervisors	Paul Close: paul.close@uwa.edu.au Barbara Cook: barbara.cook@uwa.edu.au
Description	An understanding of the habitat requirements for imperilled species can inform conservation and restoration activities. Current knowledge of southwestern Australia's only freshwater mussel (*Westralunio carteri*) is limited, and derived from field survey of habitats where mussels are most abundant. Whether mussels actively select these habitats, or passively accumulate there during periods of high river flow is unclear. This project will investigate the movement capabilities of a freshwater mussel, assess their capacity to actively 'select' spatially distributed microhabitats and identify those habitats likely to support the species
Start	Feb or July start
Requirements	This project will be conducted at Albany