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AUSTRALIAN INSTITUTE
OF MARINE SCIENCE

AIMS@JCU



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AUSTRALIA

Supporting marine and coastal decision making in an era of rapid change

AIMS@JCU Triennial Plan 2022 – 2024

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1. Executive Summary

- A renewed AIMS@JCU strategic alliance agreement took effect in January 2022 to build further capability for targeted world class tropical marine research; tackle important emerging science and capacity challenges; and respond to those challenges with evidence based solutions.
- This triennial plan covers the period 2022-2024 (inclusive) and provides a framework for allocation of the following research resources:
 - 5 x 3-year post-doctoral fellowship positions;
 - 16 years of research training program (RTP) scholarship awarded annually (e.g., 4 PhD students per year for four years, see section 4.2.1);
 - Additional \$100,000 cash and \$100,000 in-kind allocated in 2022;
 - Other operational investment.
- AIMS@JCU's Scientific Advisory Committee (SAC) has developed this triennial plan via a consultation process across four broad thematic areas: Social science and human dimensions; Coastal processes and dynamics; Technology development, big data and modelling; and Coral reef resilience.
- The resulting multi-disciplinary triennial plan is coalesced around the underpinning theme: *Supporting marine and coastal decision making in an era of rapid change.*
- The SAC identified significant opportunity for cross-disciplinary approaches to tackle capacity gaps and challenges, and to best capture these opportunities it was proposed that the post-doctoral fellows be recruited in cohorts and encouraged to work together on connected projects within cross-disciplinary teams.
- The 2022 cohort of three post-doctoral fellows will focus on the nearshore and often turbid environments of tidally dominated northern Australia, in the following discipline areas:
 - Social science and human dimensions – co-developing governance protocols and self-assessment tools for intervening in climate-impacted tropical systems;
 - Coastal processes and dynamics – to quantify the drivers of environmental change in northern coastlines and their sensitivity to coastal and catchment development along with climate change; and
 - Technology development and data science for environmental sensing in the nearshore, turbid environment.
- The 2023 cohort of two post-doctoral fellows will focus on the Great Barrier Reef in the following discipline areas:
 - Modelling and data science – to focus on integrating disparate data streams across multiple scales; and
 - Reef Resilience – to take a systems ecology approach to understand and predict rates of coral adaptation and evolution.
- While the proposed post-doctoral cohorts will be recruited in 2022 and 2023 under either AIMS or JCU employment arrangements, they will be expected to work across and interact strongly with both organisations, and to work with each other across disciplines.
- It is expected that further AIMS@JCU investment and activity will coalesce around the research programs of the post-doctoral fellows. In particular, AIMS@JCU will support cross-disciplinary workshops and a pipeline of future professional and research practitioners

through Higher Degree Research scholarships and professional Work Integrated Learning placements and internships.

- AIMS@JCU will also support programs designed to encourage participation of Aboriginal and Torres Strait Islander people in marine science training, such as ATSIMS and JCU's Indigenous Education Research Centre (IERC) Winter School.

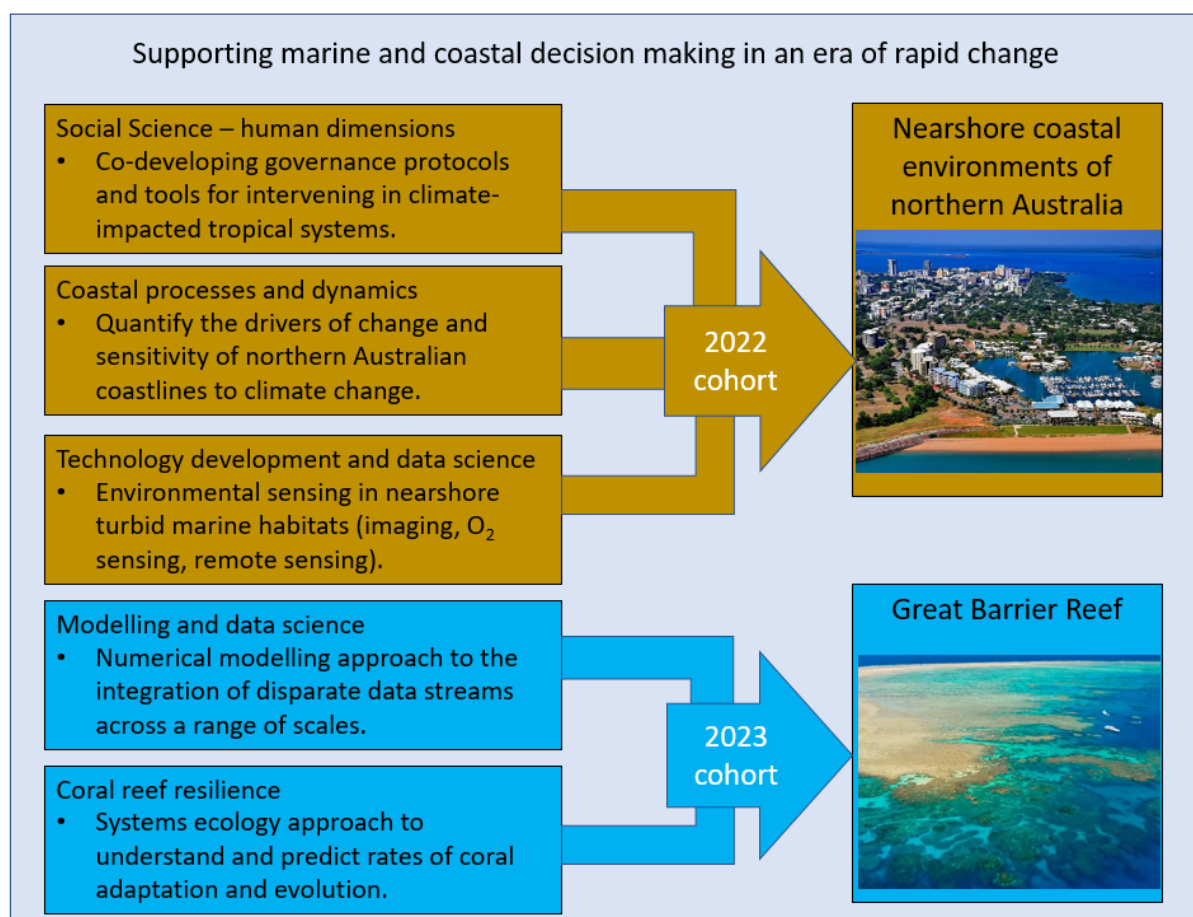


Figure 1 Disciplinary focus for the two cohorts of AIMS@JCU post doctoral fellows in the 2022-24 triennial plan.

2. Introduction/Background

AIMS@JCU was first established in 2004 by a special Commonwealth budget allocation to facilitate stronger collaboration between AIMS and JCU. Since then it has continued to foster synergies and integrate the expertise and infrastructure strengths of both organisations, and has contributed to establishing Townsville as a global hub for outstanding research and education in marine science.

The strategic alliance has been refreshed with a new agreement commencing 1 January 2022, to broaden and deepen the scope of the partnerships with the following purpose:

- To build further capacity for strategically targeted world class tropical marine research;
- To identify new and emerging marine science priorities and challenges of importance to AIMS, JCU, Australia and the tropical world; and

- To respond to these challenges with evidence-based solutions that develop beneficial impact to government, industry, the general community and Traditional owners.

AIMS@JCU will support training and development of the next generation of researchers through scholarships for cohorts of Higher Degree Research training candidates and Post-Doctoral Research Fellowships for early career researchers. It will also support associated training and employment pathways that promote greater participation of Indigenous Australians in marine science and associated careers. In addition to \$22M investment over the next 10 years, each organisation has committed to support the alliance through significant in-kind resourcing, along with project-based and infrastructure support.

To strategically align the multi-year investment, AIMS@JCU will establish a triennial plan every three years to broadly define focal themes. These plans will be formulated by the Scientific Advisory Committee (SAC), which is made up of discipline leaders from both organisations who are responsible for collating input from their colleagues and peers where appropriate.

To provide guidance for this first triennial plan covering 2022-2024 (inclusive), two workshops were held during 2021. The first workshop was held at AIMS to brain-storm collaboration topics associated with coastal processes and experimental research suited to the SeaSim. The second meeting was held at JCU and workshopped a wide range of topics across four thematic areas.

1. Social science and human dimensions;
2. Coastal processes and dynamics;
3. Technology development, big data and modelling; and
4. Coral reef resilience.

SAC members were then tasked with exploring these thematic areas further with their disciplinary peers, to identify research priorities, critical science challenges and capacity gaps that our collective strengths are well placed to address. The outcome of these deliberations was brought to a SAC meeting in April 2022 for discussion and resolution of focus for the next three years and allocation of resources:

- 5 x 3-year post-doctoral fellowship positions;
- 16 years of research training program (RTP) scholarship awarded annually (e.g., 4 PhD students per year for four years, see section 4.2.1);
- Additional \$100,000 cash from JCU and \$100,000 in-kind from AIMS allocated in 2022;
- Other operational investment.

This document summarises the key results of this process. The priority challenges identified within each of the four thematic areas coalesced around the underpinning objective of the AIMS@JCU triennial plan 2022-2024, which is **“Supporting marine and coastal decision making in an era of rapid change”**.

3. Challenges and capacity gaps in thematic areas

This section summarises the results of the four discipline-themed workshops and peer consultations led by Scientific Advisory Committee (SAC) members.

3.1. Social science and human dimensions

Discussion within this thematic area was led by Dr Lyndon Llewellyn (AIMS) and Prof Tiffany Morrison (JCU). A workshop to explore this theme was well attended by staff of both AIMS and JCU. JCU staff included decision scientists, social modellers, sociologists, political scientists, human geographers, and governance and ecosystem services experts. While social science is not currently a strength within AIMS, the need to include human dimensions as an object of study, as well as to translate biophysical science into real-world impact, is well understood amongst a group of dedicated 'social science sympathisers' who joined JCU experts at the workshop.

The group agreed on the following overarching goals for future research within this thematic area:

- Translating social, institutional and biophysical knowledge into real-world impact;
- Understanding, and learning from, the traditional ecological knowledge and environmental management practices of Indigenous Australians.
- Knowing if and when impact has been achieved;
- Measurement of all benefits (social, environmental, economic, cultural, institutional);
- Increased efficiency, equity and effectiveness of existing science uptake pathways;
- Identification of alternative pathways to science uptake; and
- Identify roadblocks to science uptake, and reduce them.

The group then identified the following gaps in our current collective capacity to move towards these goals.

- Lack of comparative science capability between the biophysical and social sciences. There is a lack of harmonised data, indicators, language and accessible data infrastructure. While there is significant infrastructure investment for biophysical data, this is lacking for social science data. How can we bring these different knowledge systems together?
- Lack of understanding of how human-nature relationships are changing under accelerated environmental change. Are we seeing different perceptions of what is a good environment compared to a bad environment? There is abundant biophysical evidence of environmental change, but little understanding of how the surrounding human systems are also changing, particularly within societies and communities that live near the ocean, and for Traditional Owners and First Nations peoples with deep cultural connections to country.
- Lack of understanding of the windows of opportunity to intervene and reduce environmental change. If it is possible to apply management interventions, how are decisions made regarding when, where, and how to intervene?
- Lack of understanding of the future beyond ecological changes.

We can predict what the biophysical future ecosystems might look like, but not the human consequences of those new systems. What would a different Great Barrier Reef look like in terms of communities that live near the reef and visit it? What are the other values that will change alongside ecosystem change? How will traditional use of reef and coastal habitats adapt to environmental change?

- Lack of knowledge about the scalability of interventions, engagement and translation. We may understand the impact of individual interventions at an experimental research scale, but not at a social-ecology-wide scale that will make a real-world difference.

Collectively, AIMS and JCU researchers bring a significant joint capability to this area.

- Long-term and well-established stakeholder relationships, and long-term partnerships with Traditional Owners, including knowledge of how they make decisions;
- An expert understanding of key tropical marine ecosystems (past, current and possible future scenarios) including underpinning processes such as within catchments and the land-sea interface;
- Engagement with tropical and coastal communities and an understanding of the hurdles for their uptake of science;
- Science excellence with a strategic focus on driving change; noting that Townsville is globally ranked 2nd behind Beijing as the coastal city with the highest output related to SDG14 “Life Under Water” (The Nature Index, natureindex.com).

Together, AIMS and JCU are well placed to develop systems that operationalise more effective evidence based environmental governance in a way that translates our growing understanding of multiple values associated with the environmental into useful and meaningful advice to stakeholders and decision makers. To achieve this, we need to use our understanding of how decisions get made to create better pathways for information and data to intersect with those decision making processes in a useful timeframe aligned with the pace of environmental change. We also need to better understand and deliver to the knowledge needs of decision makers, and the community receiving the decisions. Underpinning all of this is the need to integrate biophysical, cultural and social knowledge systems with the development of common agreed indicators and terminology (social, ecological, institutional) and appropriate data infrastructure.

Key areas for AIMS@JCU joint projects suitable for resource investment (joint workshops, post-doctoral position, Higher Degree Research candidates) include:

- Putting theory into practice by building a better understanding of how to influence governance and decision making;
- Integrating multiple cultures and data streams so that it is easier to connect diverse knowledge systems;
- Measuring the strength of the connection between ecosystem status and the scale of ecosystem services delivered.

3.2. Coastal processes and dynamics

A group to discuss research synergies and opportunities in the thematic area of coastal processes and dynamics was convened by Prof Damien Burrows (JCU) and Dr Claire Streten (AIMS). While the

earlier brainstorming sessions had identified water quality and ecotoxicology science as areas of strong synergy, the group felt that sufficient collaboration already occurred in those areas. They instead agreed to focus on the issue of coastal dynamics in an era of environmental change (including climate change). There is a pressing need to better understand how the coastline is affected by coastal and catchment development and climate change, the resulting impact on coastal societies, and potential solutions that may assist communities to adapt.

The overarching goals of research in this area are:

- To create societal and economic benefit by identifying high risk areas for coastal loss;
- To create economic benefit by de-risking investment in coastal development;
- To create government benefit by developing adaptive management plans informed by assessment of treatment options.

A number of current capacity gaps were identified:

- The Australian coastal erosion maps developed by Geosciences Australia have questionable relevance in the north, because they are based on assumptions and data relevant to conditions in southern Australia. There is a need to validate and update the maps in the context of the tidal dominated conditions of northern Australia.
- There is a lack of knowledge about the ecological, cultural and infrastructure values in coastal areas of northern Australia.
- There is a lack of knowledge about suitable treatment options to reduce or prevent coastal loss in the face of development and climate change.

Collectively, AIMS and JCU researchers bring a significant joint capability to address these gaps:

- Coastal morphology research expertise
- Hydrodynamic modelling expertise
- Data platforms for collection, analysis and reporting;
- Community engagement and expertise in values mapping;
- Expertise in measuring ecosystem services; and
- Expertise in coastal engineering solutions.

Together, AIMS and JCU are well placed to establish an understanding of ecosystem and societal values in coastal areas of northern Australia, and the biophysical drivers of change in the context of the north including the sensitivities of coastlines to predicted changes. Key areas for AIMS@JCU joint projects suitable for resource investment (joint workshops, post-doctoral position, Higher Degree Research candidates) include:

- Identification of priority coastal areas in Queensland and Northern Territory based on cultural, social and economic values;
- Establish coastal erosion maps that are fit for purpose in the northern Australian context, by validating and revising assumptions that are relevant to the tidally dominated coastlines of the north; and
- Investigate likely trajectories for restoration and recovery treatment options
- Develop scenarios and treatment options for adaptive management of coastal areas, to maximise benefits and minimise risks to priority values.

3.3. Technology development, big data and modelling

This thematic area was explored with AIMS and JCU researchers and practitioners under the leadership of Mr Dan Christie (Associate Dean, Industry, JCU) and Mr David Mead (Executive Director, Strategic Development, AIMS).

Together, AIMS and JCU are well placed to establish stronger collaboration and connection between engineers and research scientists. At a time when marine ecosystems are under increasing pressure, there is a need to develop and evolve technology to help researchers more rapidly and accurately understand the changing tropical marine environment. There is a need to develop next-generation sensors, marine robotics and autonomous systems, and to harness artificial intelligence and cloud computing, to provide more comprehensive knowledge more rapidly and in formats that efficiently inform decision makers, researchers and stakeholders.

Collectively, AIMS and JCU staff bring a significant joint capability in this disciplinary theme including:

- Expertise in development of sensing and sensors;
- Expertise in underwater Internet of Things and communications, including instrumentation development and networks of sensor data streams;
- Data science and the development of digital system models ('digital twins') to facilitate better contextual framing of big-data challenges; and
- High Performance Computing infrastructure

A current major capacity gap in sensor development is the ability to monitor the health of marine communities and the physical conditions in which they live within turbid environments with low water visibility, such as those that occur in the nearshore zone.

- Hyperspectral imaging – mapping the electromagnetic spectrum reflected by the environment and marine organisms; and
- Oxygen sensing – low oxygen conditions are a concern in nearshore environments particularly due to agricultural runoff and in poorly flushed coastal areas. Past studies that putatively link in-water oxygen data to remotely sensed water colour data, could be further developed to establish a scalable measure of this important issue.

Key areas for AIMS@JCU joint projects suitable for resource investment (joint workshops, post-doctoral position, Higher Degree Research candidates) include:

- Development of tools for marine sensing to monitor communities and conditions in turbid marine environments such as those that occur nearshore and within the land-sea interface;
- Data science and model development to integrate disparate data sets and knowledge systems across multiple disciplines.

3.4. Coral reef resilience

Discussion within this thematic area was led by Assoc Prof Mia Hoogenboom (JCU) and Dr Britta Schaffelke (AIMS). A workshop to explore this theme was attended by staff of both AIMS and JCU across a broad range of disciplinary strengths across a wide range of scales, including molecular biology, physiology, whole-organism biology, species interactions, ecosystem dynamics, and ecological modelling. The group agreed to sharpen its focus to develop priority research goals that

would promote new collaborations between AIMS and JCU; meet critical identified challenges but also allow flexibility to promote discovery and innovation; deliver new capability aligned with existing research strengths and critical mass; be achievable in the 3 year timeframe with existing infrastructure; and support research productivity and build capability at both AIMS and JCU.

Critical capacity gaps were identified as follows:

- Data integration. There is currently limited integration between the existing valuable data assets at a range of scales, from the molecular to whole ecosystems, and across disciplines. Guided by priority questions and hypotheses, there is an opportunity to integrate data streams in a way that creates important new knowledge. For example, population genetics and hydrodynamic modelling represent completely different spatial scales and approaches that are both essential for understanding patterns of population connectivity. Combining these disparate data streams presents data science, mathematical modelling/biostatistics, and conceptual challenges.
- Filling black boxes of 'missing data'. The process of evaluating and integrating multiple data streams will illuminate critical data gaps, which would inform future strategically targeted field and experimental studies.

The group identified the following four research priorities for AIMS@JCU joint projects that are suitable for resource investment (joint workshops, post-doctoral positions, Higher Degree Research candidates) and that will contribute to a broader understanding of reef ecosystems:

1. Understand and predict reef futures using a systems biology approach that builds upon existing data sets.

The immediate focus is on understanding natural rates of coral adaptation and evolution by linking genetics and physiology to demographic rates. This research will explore whether or not natural systems (corals and coral reefs) can adapt quickly enough to keep pace with environmental changes (increased temperature, ocean acidification, decreasing oxygen, etc). This work will link molecular science, genetics and physiology data to field demographic data such as growth, fecundity, recruitment and mortality. A secondary focus is to move beyond the study of single species response to a seascape approach, to better understand whole community dynamics. Both of these approaches lend themselves to ecological modelling (e.g. building upon EcoRRAP's emerging ecosystem modelling suite), complemented by empirical studies such as experiments in SeaSim to fill 'black boxes', for example coral temperature tolerance and rates of adaptation to heat stress.

2. Understand ecosystem resilience and recovery.

The focus of this research priority is to quantify transformations and directional shifts in species composition and the reef structures after major disturbances on coral reefs. We know the reef is changing, but we don't know exactly which processes or taxa are changing. This research should specifically focus on natural reef replenishment processes (fecundity, settlement, recruitment) in the life cycle of coral species. Such information is currently a major 'black box' in our collective understanding of how the reef naturally behaves after disturbance.

3. Understand the connectivity among populations, and the connections among seascapes. This work will unite hydrodynamic and population genetics data to gain a wholistic understanding how populations are connected to each other. It will help identify critical coral source reefs, sink reefs, and coral biodiversity refugia. There are currently numerous oceanographic studies, and

gene distribution studies of various species, but nothing that brings them together to better understand how seascapes work. There are also numerous hydrodynamic, nutrient, ecophysiology and animal movement data sets that could be brought together to better understand the flow of energy between reefs and other elements of the seascape.

4. **Understand the effects of climate change and declining water quality on reef accretion and carbonate budgets.**

This work would use ecological modelling to up-scale current knowledge of the growth of individual coral colonies to create carbonate budgets of whole reefs, including over geological timescales and after coral death. While the coastal protection role of reefs is well understood, the impact of reef degradation and death is not well understood. Some studies assume that the carbonate framework may persist for hundreds of years even after coral death, but this prediction is not based on validated evidence. Carbonate budget studies can help predict changes through time. This research would take a modelling approach to bring together multiple data streams that already exist and are continually collected.

5. AIMS@JCU Triennial Plan 2022-2024

A common underpinning theme emerged from discussion of capacity gaps and research priorities identified by the different thematic teams, and forms the foundation for this triennial plan:

Supporting marine and coastal decision making in an era of rapid change

Every thematic team identified opportunity for cross-disciplinary approaches to tackle capacity gaps and challenges. To best capture these opportunities it was proposed that the post-doctoral fellows be recruited in cohorts and encouraged to work together on inter-connected projects within cross-disciplinary teams. This is summarised in Figures 1 and 2.

It is proposed that in 2022, a cohort of three post-doctoral fellows be recruited to focus on the nearshore and often turbid environments of tidally dominated northern Australia, in the following thematic discipline areas:

- Social science and human dimensions – co-developing governance protocols and self-assessment tools for intervening in climate-impacted tropical systems;
- Coastal processes and dynamics – to quantify the drivers of environmental change in northern coastlines and their sensitivity to [coastal and catchment development along with climate change](#); and
- Technology development and data science for environmental sensing in the nearshore, turbid environment.

This cohort of early career researchers will be supported by their peers at both AIMS and JCU, and with additional research resource allocations to work together across their disciplines to address a range of inter-related topics which may include the following:

- Development of social data-bank infrastructure with common indicators and terminology;
- Understanding the link between ecosystem status and ecosystem services;
- Establishing linked human and nature knowledge systems;
- Identifying high risk areas across northern Australian coastlines, and options for de-risking them;

- Mapping multiple values of Australia's northern coastlines (infrastructure, economy, environment, governance, Traditional Owner, social, cultural); and
- Developing new scalable technology for effectively sensing turbid nearshore coastal environments.

It is proposed that in 2023, a further cohort of two post-doctoral fellows be recruited to focus on a more robust understanding of the coral reefs of the Great Barrier Reef, in the following thematic discipline areas:

- Modelling and data science – to focus on integrating disparate data streams across multiple scales; and
- Coral reef resilience – to take a systems ecology approach to understand rates of coral adaptation and evolution.

This cohort of early career researchers will be supported by their peers at both AIMS and JCU, and with additional research resource allocations to work together across their disciplines to address a range of inter-related topics which may include the following:

- Creation of data systems models and data science that integrates data sets across scales;
- Filling 'black box' data gaps with empirical studies;
- Understanding connectivity and connections between reefs and other habitats
- Modelling approaches to predict reef recovery and resilience;
- Improving understandings of coral life histories and demographics (fecundity, settlement, recruitment, mortality) in the face of disturbance and change; and
- Developing carbonate budgets at different scales.

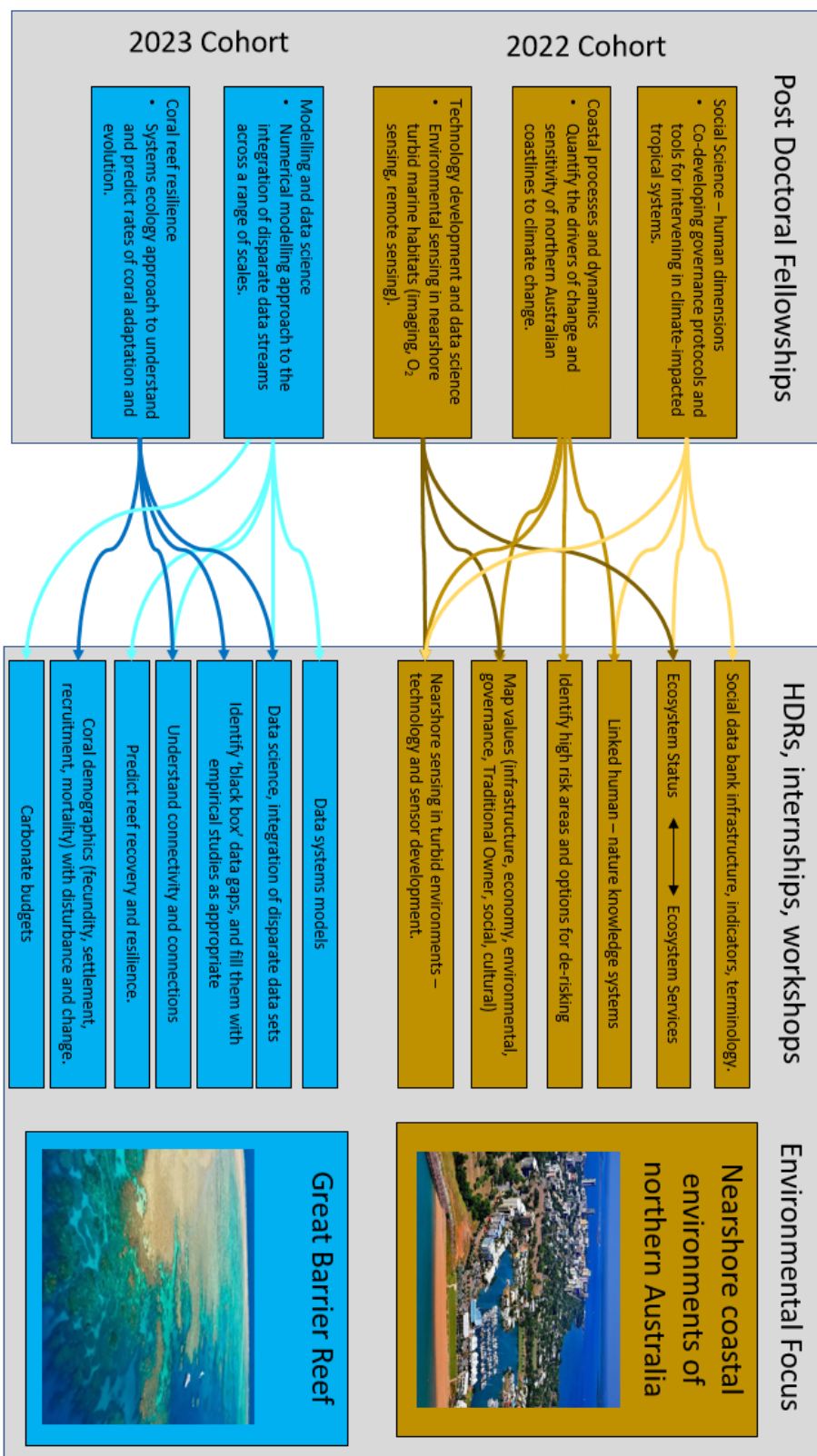


Figure 2: Disciplinary and habitat focus for the two cohorts of AIMS@JCU post-doctoral fellows, and related topic areas, in the 2022-24 triennial plan.

5.1. Fostering collaboration and cross-fertilisation

While the proposed post-doctoral cohorts will be recruited in 2022 and 2023 under either AIMS or JCU employment arrangements, they will be expected to work across and interact strongly with both organisations and indeed, work with each other across disciplines. The disciplinary themes have been deliberately chosen and linked by the Scientific Advisory Committee to facilitate this. Members of the SAC from both AIMS and JCU will act as Mentors for each post-doctoral fellow to ensure cross-Institutional communication and collaboration.

In 2022, a further \$100,000 cash and \$100,000 in-kind AIMS infrastructure support is available to be allocated to AIMS@JCU activities that will foster the research agenda identified in this triennial plan. In some cases, this may be allocated to an identified project, but in others it may be allocated to an activity such as a cross-disciplinary workshop to tackle a challenge and lead to an outcome such as an agreed resolution or publication. The Scientific Advisory Committee will consider proposals for allocation of these resources.

5.2. Supporting the pipeline

5.2.1. Higher Degree Research (HDR) scholars

The AIMS@JCU agreement provides for 16 HDR scholarship-years to be allocated each year to AIMS@JCU HDR candidates. Besides training the next generation of researchers within disciplinary areas of strategic priority to AIMS and JCU, the HDR projects delivered by these research candidates will make a significant contribution to the research outputs, outcomes and impact of the AIMS@JCU program. To facilitate participation of Indigenous researchers wherever possible, applications from Aboriginal and Torres Strait Islander candidates will be particularly sought in each scholarship round.

The mix of HDR candidates between research Masters and PhD levels and project areas will be determined each year by the SAC. For example, the annual allocation of 16 funded scholarship years could be assigned to 8 x 2 year research Masters; or 5 x 3 year PhDs; or some combination. Each year, applications from potential HDR candidates will be invited via the JCU scholarship round managed by the Graduate Research School (GRS), with the application deadline of 30 September each year. Each year, HDR applications will be strongly encouraged from candidates that propose projects that address the areas of priority in this triennium plan. However, the SAC may remain open to unexpected innovation in new areas and consider all applications on their merits.

The merit-based process of allocating scholarships will begin with application assessment and merit scoring via a transparent process managed by the JCU's Graduate Research School. Applications that are eligible for scholarship allocation will subsequently be assessed by the AIMS@JCU SAC against criteria including the proposed project's alignment to this triennium plan and the capacity of the candidate and their supervisory team. In addition to scholarship stipends funded through the Research Training Program and (where appropriate) tuition fee waivers, AIMS@JCU HDR scholars will receive an additional \$5,000 per year to be taken as either stipend top-up or project funds.

5.2.2. Internships and Work Integrated Learning

Through the AIMS@JCU alliance, both organisations are committed to facilitating internships and Work Integrated Learning (WIL) placement opportunities at AIMS for JCU-enrolled students. Such placements will be arranged for a JCU students across a range of levels including undergraduate,

HDR and professional post-graduate degree programs such as the new Master of Marine Biology. Besides providing candidates with real-world experience in a workplace such as AIMS, these placements will be aligned with delivery of this triennial plan.

JCU's new Master of Marine Biology degree involves one year of coursework for students followed by a second year in which the students choose either a research or professional major. In the research major, AIMS@JCU affiliated students will be provided with a research methods subject alongside an 18 credit-point (year-long) research project aligned with this triennial plan. A key purpose of this expanded research project is to better prepare students for further PhD studies compared to the traditional half-year research project. Within the professional major, AIMS@JCU affiliated students may also support this triennial plan through module-based practical skills subjects alongside a semester-long professional placement/internship aligned with specialist skills development in areas such as aquarium maintenance, advanced microscopy techniques, and coral tissue analysis.

5.2.3. Participation of Aboriginal and Torres Strait Islander people

AIMS@JCU recognises that research outputs and outcomes carry significantly greater value and impact when project are delivered in partnerships between western scientists and Indigenous people. To create more opportunity for this potential, there is a need to increase the participation of Aboriginal and Torres Strait Islander people in tertiary studies in vocational, professional and research-oriented areas. AIMS@JCU will continue to invest and participate in two programs that aim to foster interest within Indigenous high-school students in marine science and related disciplines and careers: ATSIMS and the JCU Indigenous Education Research Centre (IERC) Winter School.

Aboriginals and Torres Strait Islanders in Marine Science (ATSIMS) aims to inspire local Indigenous north Queensland high school students to pursue careers in marine science and management. The program was originally initiated by AIMS@JCU PhD student Joe Pollock in 2013 and has been supported by AIMS@JCU ever since. ATSIMS provides an engaging, field-based science program to students to create experience-based interest in marine-related careers. The students meet and hear from early-career researchers and Indigenous rangers, and learn about the breadth of research underway through visits to ReefHQ, JCU and AIMS. A highlight of ATSIMS is the annual visit to Orpheus Island Research Station where the young students learn to snorkel and meet and learn from Manbarra elders who share important cultural insights about connection to Country and the richness of Traditional Ecological Knowledge. ATSIMS has demonstrated significant improvements in students' school attendance and graduation rates, and in 2016 won first place in the education category of the Queensland Reconciliation Awards. AIMS@JCU will continue its long-standing sponsorship and support for ATSIMS within this triennium plan and beyond.

For the first time in 2022, AIMS@JCU has sponsored a marine science program within JCU's annual IERC Winter School which is a residential preparatory program for Australian Indigenous year 10-12 students. Unlike ATSIMS which targets local north Queensland students who may not yet have considered science-based careers, the Winter School targets students who are already choosing and doing well in their science studies. Acceptance to the Winter School is nationally competitive and awardees receive a generous scholarship that includes return travel to Townsville, all meals and on-campus accommodation and all costs associated with the program. Over five days, students live on-campus and take part in academic lectures and team-building activities in an interactive program



that includes a full-day visit to AIMS. The students get the opportunity to meet both JCU and AIMS staff and students and form bonds with other students in their cohort. The on-campus accommodation allows for a complete university experience within the JCU setting. AIMS@JCU will continue the annual sponsorship of the Winter School marine science program and we hope to see some alumni return in future as undergraduate students and as AIMS@JCU HDR candidates.

In addition to the above pipeline initiatives, AIMS@JCU will work with the IERC to proactively identify Indigenous students already enrolled in undergraduate studies in marine science and related disciplines at JCU, to provide mentorship and other support to promote their academic and employment success. Indigenous candidates will be especially encouraged to participate in the Work Integrated Learning opportunities, and AIMS@JCU will fund two paid internships each year for Indigenous undergraduates to obtain paid work experience for the equivalent of 12 full-time weeks per year, designed around semester breaks. These combined initiatives are designed to promote sufficient critical mass for Indigenous science to feature in the AIMS@JCU program for the next triennium (2025 – 2027).