



Australian Government



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Submission to the Joint Select Committee on Northern Australia

Dear Dr Pender

Thank you for your letter regarding the Joint Select Committee on Northern Australia's inquiry into the development of Northern Australia. The Australian Institute of Marine Science (AIMS) welcomes the opportunity to contribute. This submission makes a case for the importance of maritime industries and the associated R&D sector to development in the North. Key industries such as the offshore oil and gas industry, mining (port development), tourism and fisheries are located in northern Australia and together with excellent education and marine research capacity provide major pillars for development across the region.

AIMS is a publicly funded research agency and an international leader in tropical marine science. For over 40 years, our research has supported the sustainable development and operations of marine industries across tropical Australia, and focussed on ensuring that Australia can successfully adapt to the growing challenges flowing from global change and regional threats to sustainability of marine ecosystems. Our strong commitment to linking science with users of marine research has allowed AIMS to develop effective links with industry and an understanding of issues and opportunities facing marine based industries. It is also the basis for development of regional research cooperation to enhance economic development and sustainable livelihoods in countries bordering Northern Australia (e.g. ATSEA¹).

Nationally, Australia's marine-based industries already contribute over \$42 billion² to the economy and this is predicted to grow to around \$100 billion by 2025³. The major contributors to this vibrant sector of our national economy are the offshore oil and gas industry (51.6%) and marine based tourism (27.5%), both of which are predominantly located in the tropics. The majority of Australia's bulk commodity ports - gateways for our primary industry exports - are also in the region. The planned expansion of mining across northern Australia is already driving expansion of these ports to accommodate the increase in coal and ore exports, and as other areas of northern Australia open up for mining and agriculture, the demand for capacity and number of regional ports is likely to grow (e.g. Bing Bong and Weipa in the Gulf of Carpentaria).

¹ [The Arafura & Timor Seas Ecosystem Action \(ATSEA\) Program](#) is funded by the Global Environment Fund. This program brings together researchers from Indonesia, Timor-Leste, Australia, and recently Papua New Guinea, to work on the transboundary marine issues, with the objective of ensuring integrated, cooperative, sustainable, ecosystem-based management and usage of the living coastal and marine resources, including fisheries and biodiversity of the Arafura and Timor seas. See Attachment 2.

² [The AIMS Index of Marine Industry 2012](#).

³ [Marine Nation 2025](#)

The tropical waters of Northern Australia are also home to valuable and vulnerable marine ecosystems such as the Great Barrier Reef and Ningaloo Reef. These are internationally-recognized national treasures that drive regional economies through tourism and associated industries. The projected growth in east-Asian tourism suggests this sector of the Northern Australian economy will grow if we can protect the assets tourists come to see.

Regional Development Plans areas across tropical Australia point to the significant role of the environment and natural resources in supporting the economic and social structure of the regions. As Australia seeks to grow the wealth generated from its North, we'd respectfully suggest that future policy and planning needs to ensure that coastal and marine ecosystems remain healthy, not just for long term economic prosperity but also to support the lifestyle and vibrancy of local communities.

Even in the Great Barrier Reef – arguably Australia's best managed marine asset - coastal and agricultural development has had very significant impact on neighbouring coastal marine environments. Comprehensive Strategic Assessments of the Great Barrier Reef World Heritage Area⁴ have recently provided a thorough account of the pressures on this iconic system from a range of impacts including rising sea temperatures, marine pests (e.g. crown-of-thorns starfish), catchment runoff, and port development. The increasing numbers of developments and the interaction between these and other factors like global change and runoff of pesticides and nutrients into coastal ecosystems can have a **cumulative impact**. These impacts can interact, and synergistically which amplifies the effect of individual activities. These cumulative impacts are currently poorly understood for the Great Barrier Reef, but need to be considered in developing plans for future development in Northern Australia, especially the impact of catchment development on vulnerable coastal ecosystems.

Balancing development and environmental health requires a strong evidence base (including environmental, social and economic data) and it is in this area that AIMS' capability and depth of experience can be used to support the national interest. My Institute stands ready to assist the Joint Select Committee in its work, and thereafter the Government in prosecuting an exciting development agenda.

Yours sincerely

John Gunn
Chief Executive Officer

⁴ [Great Barrier Reef Region Strategic Assessment Report : Draft for public comment](#) and [Great Barrier Reef Coastal Zone Strategic Assessment draft reports](#)

MARINE MATTERS: OPPORTUNITIES AND RISKS FOR THE DEVELOPMENT OF NORTH AUSTRALIA

Importance of the marine sector to the regional economies of north Australia

Australia is largely a marine nation with ocean territories more than 1.6 times its continental landmass. Australia's Exclusive Economic Zone includes valuable marine resources and iconic ecosystems such as the Great Barrier Reef, Torres Strait, Ningaloo Reef, the Kimberley Coast and the oceanic shoals of the Timor Sea and supports industries that are of substantial economic and social importance to Northern Australia.

In 2009-10 the value of economic activity based on the marine environment in Australia was over \$42 billion⁵. This was higher than the gross value of all agricultural production over the same period and is increased by a further \$25 billion if ecosystem services (the non-market value) are considered⁶. With the expansion of current industries and development of new opportunities, it is estimated that Australia's ocean territories will contribute around \$100 billion to the national economy by 2025.⁷

In Northern Australia, marine-based industries are a major contributor to regional economies as well as the national economy, and are rapidly growing. Despite the current and growing economic value of marine resources in Northern Australia they are largely unexplored and poorly understood. The following sections provide examples of where marine science can support sustainable development and protection of Australia's tropical marine resources.

Offshore Oil and Gas

A recent report by Deloitte Access Economics⁸ points to the importance of tropical northwest Australia to Australia's energy future. The report notes that this region was the focus of CAPEX investment valued at \$130 billion in 2012, and that the majority of new production of LNG (projected to increase from 12 million tonnes per annum (mtpa) in 2005 to 94 mtpa in 2016) will be delivered from offshore projects in northwest Australia. This development is occurring in a sector of our marine estate that we know very little about. As we saw in the PTTEP's Browse basin Montara well blowout in 2009, offshore oil and gas production comes with some risk to the environment. Gaps in information and processes were identified by the Borthwick Inquiry⁹ which was held following the spill. This led to the requirements for Operational Scientific Monitoring Plans (OSMPs) as part of the approval processes for offshore oil and gas developments and consideration of regional scale information. AIMS is working with the oil and gas industry to increase our knowledge of the NW Australian marine environment as part of a strategic initiative to build adequate environmental baselines for this huge region. Given the scale of investments, and the unique and diverse ecosystems in this region, we see this investment in robust science as a critical element of the development of northern Australia. Furthermore, by getting ahead of the curve – doing systematic and fit-for-purpose science before the development approval process starts – ensures that there are minimal regulatory delays, and the nation is assured of rigorous environmental risk assessments.

Tourism

Northern Australia is endowed with significant natural assets that support a regionally important tourism industry. The iconic Great Barrier Reef (GBR) is a major part of the economy. In 2012 its economic contribution was \$5.7 billion (value-added) and it employed 69,000 workers¹⁰ most associated with the tourism industry (\$5.2 billion and 64,000 jobs). The tremendous importance of long term environmental health of the GBR to local economies was shown in a study by Oxford Economics¹¹ which estimated the economic impact of loss of coral on the GBR. It

⁵ [The AIMS Index of Marine Industry 2012](#).

⁶ [Stocking Up: Securing Our Marine Economy](#), Eadie, L and Hoisington, C. (2011). Centre for Policy Development.

⁷ [Marine Nation 2025](#)

⁸ [Advancing Australia: Harnessing our Comparative Energy Advantage](#). Deloitte Access Economics (2012).

⁹ [Report of the Montara Commission of Inquiry](#). Borthwick, D (2010).

¹⁰ Deloitte Access Economics (2013). [Economic Contribution of the Great Barrier Reef](#).

¹¹ [Valuing the effects of Great Barrier Reef Bleaching](#). Oxford Economics August 2009. Great Barrier Reef Foundation

found the impact on the Cairns area would be \$16.3 billion over 100 years (applying a discount rate) or more broadly “a constant \$1.08 billion per year over the course of a century”.

The impacts of nutrients and sediments in river runoff on the water quality and coastal ecosystems of the Great Barrier Reef World Heritage Area highlight the need for integrated management of land-sea connections and in particular the proactive management of agricultural practices as we further develop Northern Australia. . In addition to its impacts on inshore ecosystems, nutrient runoff is also a significant factor in the catastrophic outbreaks of Crown-of-Thorns Starfish (COTS) that have been a major contributor to the loss over 50% of coral cover on the GBR over the last 30 years. This decline in the health of the GBR is currently constrained to regions south of Cooktown, where agricultural, industrial and urban development impact water quality. Given what we know about the links between water quality and coral reef health, it is essential that any development of agriculture in the northern Cape York region is carefully planned to avoid serious decline in the one sector of the GBR that remains relatively pristine.

Agricultural development – the importance of catchment management

The integrated nature of land-sea interactions plays a vital role in the health of coastal ecosystems which are highly valued by the community and support valuable industries (tourism and fisheries). The impact of catchment development on the health of the Great Barrier Reef provides an example of the potential impact of land-based activities and the challenge of managing these impacts in the face of a changing climate¹² and coastal development. The Great Barrier Reef is impacted by runoff from coastal catchments and significant investment by Government has been required to improve the quality of water entering the Reef. While areas in the far north of the Reef are currently in good condition due to the lack of agricultural runoff, further land clearing and increased agriculture development in the region north of Cooktown could have serious implications.

As in the Great Barrier Reef, the coastal marine environments across Northern Australia receive large, seasonal river discharges. A recent CSIRO report¹³ which assessed the opportunities for water and agricultural development in the Gilbert River catchment of north Queensland noted that “significant water use would, in the downstream environment, amplify the environmental and social challenges associated with dry years and would have impacts on commercial and recreational fishing catches that have not been quantified in this study”. Early consideration of the potential impacts of land-based activities on marine ecosystems over appropriate scales can reduce the need for, or costs associated with, mitigation and need to be part of plans to develop Northern Australia.

Port development

Already the ports of tropical Australia handle the majority of Australia’s exports. The development of iron ore and coal reserves will stimulate further coastal development as bulk commodity ports expand to meet demand across the north. Future development of ports needs to consider cumulative impacts. An example of the need to examine impacts over appropriate timeframes and scales is demonstrated by Dampier where there have been many dredging projects over the last 10-15 years. Each of these has left residual sediment loads for potential re-suspension. The broader issue in Dampier, is not the project-specific dredging, which has been the subject of dredging industry attempts to improve mitigation techniques and strategies, but the whole-of-life management of dredging operations (capital and maintenance), dredge spoil grounds and how they respond to local and regional phenomena (e.g. cyclone and storm driven suspension)

Improved models and protocols for identification and assessment of impacts of dredging activities over short and long timescales will benefit both regulators and industry. Hydrodynamic and sediment transport models developed by AIMS for Darwin Harbour have been used by industry to identify areas unsuitable for dumping of dredge spoil due to a tendency for spoil to migrate back to the area being dredged. Understanding long-term

¹² Climate shifts will impart environmental stress on many of Australia’s iconic marine ecosystems (including the Great Barrier Reef), which compromises the physiological fitness of marine animals and provides enhanced conditions for disease-causing microbes, thereby potentially increasing the prevalence of disease in marine systems.

¹³ [CSIRO \(2013\). Agricultural resource assessment for the Gilbert catchment. An overview report to the Australian Government from the CSIRO Flinders and Gilbert Agricultural Resource Assessment, part of the North Queensland Irrigated Agriculture Strategy.](#)

spoil migration can inform decisions about appropriate spoil disposal; in the case of Darwin, spoil was utilised for land reclamation.

The need for science based information to support management and port operations was recently demonstrated in Gladstone Harbour where the cause of a fish disease outbreak remains unknown. Lack of suitable baseline data has greatly limited the capacity of the port or the scientific community to answer questions posed by the general public and port stakeholders. While it is impossible to foresight all potential future issues, broader and better designed monitoring programs increase the likelihood that answers can be provided when unforeseen events arise. Inclusion of wildlife health (e.g. fish disease, turtle disease) in the baseline studies and monitoring would be beneficial.

Aquaculture

Given the global importance of seafood protein and the awareness of its importance in nutrition and healthy diets it makes sense to try to shift Australia from a net importer of seafood. This is especially important in the face of the predicted dramatic shift in demand for seafood driven by the rapidly expanding middle class in the Asian region (Kharas 2010¹⁴). In order to feed more people with the same or less land we need innovation. In order capture the growing market opportunities both domestically and in the rapidly expanding markets of Asia, we need a strategy for food production that includes seafood, especially as demand for this product will grow within the countries currently providing product for the Australian market).

Marine biosecurity

Marine biosecurity is a major significant challenge for Australia's north. Throughout the world introduced marine pests – carried in the ballast of the rapidly growing global maritime trade - have had serious impacts on marine industries (aquaculture, fisheries and tourism) and ecosystems.

An estimated 429 exotic species have been found living in marine waters around Australia, and some are already having a serious impact. Importantly, for every obvious, visible invader, there are 100s – 1000s of microscopic threats. Early detection is key to effective control and can reduce mitigation costs. With increased shipping projected over the next 50 years, the biosecurity threats to Australia's natural marine ecosystems and marine industries will only increase. Combined with climate related shifts, some exotic species are predicted to expand habitat ranges potentially impacting marine habitats in Australia either through natural population expansions, or increased risk of unintentional introduction.

Opportunities to support sustainable development

As noted previously, the lack of science based information is an impediment to sustainable growth (ecologically, economically and socially) of marine-based industries and the development of new opportunities from valuable marine resources across Northern Australia. Gaps that need to be addressed to manage planned development include:

1. Improved availability of and access to data

Improved availability of baseline data is fundamental to the Government's regulatory reform agenda and future productivity. While improved access to data collected by industry as part of the approvals process would assist¹⁵ we also suggest that associated with changes in access to environmental data, there is a need to improve the quality of data through increased standardization of sampling protocols and procedures, improved quality control, and greater attention to requirements for spatial and temporal replication. Collectively this will allow the aggregation of localised datasets into regional datasets allowing the identification of critical gaps in our understanding of regional status and trends which will be needed to establish fully comprehensive environmental baselines and cumulative impacts.

¹⁴ [The emerging middle class in developing countries](#). Kharas, H (2010). OECD Development Centre, Working Paper No. 285.

¹⁵ See [AIMS submissions to regulatory reform in offshore oil and gas industry](#).

2. Understanding the response of marine ecosystems to change - resilience

Tropical marine ecosystems are complex and vulnerable to change. The lack of information on how these ecosystems will respond to change, or their capacity to adapt, has a direct impact on Government efforts to develop policy and regulations that support growth and protection of the environment for future generations. An improved capacity to predict how tropical marine ecosystems will respond to natural and anthropogenic influences, including **cumulative impacts**, will reduce risks associated with decision-making and support development effective management plans.

New molecular tools now provide researchers with a capacity to look at the response of organisms at the cellular level; to try to enhance resilience; to develop early indicators of impact; and to develop tools to militate against impacts that cannot be avoided. The recently opened National Tropical Sea Simulator (SeaSim) at AIMS is a state of the art research aquarium which will be capable of experimental research of a nature and at a scale not previously feasible. The combination of these technologies, together with a field-based laboratory capability provide by our research vessels, positions Australia to unravel the complex interactions in tropical marine communities.

In order to address the scale of the challenge (geographic range and complexity) Australia needs to maintain a core research capability that can deliver long term data series/, national observation systems and an understanding of ecosystem processes together with an educational capacity to deliver relevant knowledge and skills to the region. Publicly Funded Research Agencies, such as AIMS, are essential in bridging the fundamental research of Universities and the needs of users across Government and industry.

3. Marine observing systems.

Australia's Integrated Marine Observing System (IMOS)¹⁶ provides the sustained observations of ocean physics and biology required to understand and predict the connections between ocean conditions and climate, and impacts of ocean variability on the productivity of regional and local ecosystems which support regional fisheries. The sparse observational system deployed across the north has established critical new information on ocean currents across the NW marine region and coastal moorings have supported the development of improved models of marine conditions to the benefit of shipping and port operations. In Darwin Harbour, real-time weather and ocean observations together with a model of water circulation developed by AIMS are used by the Darwin Port Corporation to manage shipping operations. However, despite the need to extend this observation system, especially the coastal real time moorings, the infrastructure is being reduced and the IMOS has no certainty of support beyond June 2015.

The role of AIMS

The scale of the challenge (geographic range and complexity) in exploring, mapping and understanding the potential and the vulnerabilities of North Australia's marine territories is immense and requires a coordinated national approach. AIMS is a regionally-based Commonwealth agency with over 40 years' experience working in tropical marine environments. Its research is focused on supporting sustainable development of high value industries across northern Australia. These include the offshore oil and gas, tourism, coastal industry and ports sectors that are the cornerstone of regional development strategies¹⁷.

The Institute conducts research to improve baseline information on the region's biodiversity and to better understand the processes that sustain these ecosystems and hence their capacity to respond to the growing challenges facing the marine ecosystems of the north. It builds capacity through the development of effective collaboration networks with other research providers and strong partnerships with industry in order to deliver regionally relevant research outcomes. The integration of science-based information into new decision support

¹⁶ IMOS was established in 2006 with funding from the National Collaborative Research Infrastructure Strategy and then the Educational Infrastructure Fund. It brings together universities and publicly funded research agencies in the marine sector in a highly successful cooperative model.

¹⁷ The Fitzroy and Central West Regional Roadmap 2013-16, Mackay-Isaac-Whitsunday Regional Draft Plan 2013-16, Townsville and North West QLD Draft Regional Road Map 2013-16, Far North Queensland and Torres Strait Regional Plan 2013-16, The NQ Strategy, the Northern Territory Regional Plan 2013-16, The Kimberley Regional Plan 2013-16, The Pilbara Regional Plan 2012-17, and The Midwest Gascoyne Regional Plan 2012-13.

tools such as e-Atlas¹⁸ and eReefs¹⁹ provide managers with relevant easy to access information for decision-making. A description of AIMS research capability and examples of activities and impact are provided in Attachment 2.

The location of AIMS in tropical Australia location provides significant benefit to regional Australia, and the nation. These benefits are broad and far reaching, from the skills and experience developed by AIMS and its collaborators which are applied to challenges facing the marine ecosystems of Northern Australia; to providing a national research capacity to respond to marine emergencies (e.g. grounding of the Shen Neng 1 on the Great Barrier Reef and the oil spill at the Montara Platform off north west Australia); and economic development of Northern Australia. An independent review of the impact of AIMS research²⁰ found that “research such as that conducted by AIMS has the potential to generate dramatic regional economic benefits”. Indeed the analysis showed that if AIMS had not been established, economic growth (Gross Value Add) in the far North region [of Queensland] would be halved by 2020.

AIMS has been working with regulators and industry involved in the **offshore oil and gas industry** for over 20 years to increase baseline data and understanding of the marine ecosystems of northwest Australia. This experience has allowed the provision of independent marine research expertise to both regulators and industry including: the assessment of impacts from the Montara oil spill; review of the Monitoring Plan for the Montara Well Release Timor Sea²¹; ongoing work with PTTEP Australasia to assess the long-term impact of the 2009 Montara oil spill on coral reefs and seafloor communities in the Timor Sea; and submissions to reviews and inquiries relating to offshore oil and gas regulation. In 2012, the Australian Petroleum Production and Exploration Association (APPEA) recognised the AIMS collaborative research partnership with Woodside Petroleum Limited, by awarding the APPEA Environment Award. Currently, AIMS is leading development of a scientific monitoring program associated with development of liquefied natural gas resources in the Browse Basin for Shell Australia and the INPEX Corporation. AIMS collaborations and partnerships in this region are providing important baseline data and improving understanding of isolated coral ecosystems off the Australian coast.

AIMS’ research provides critical input to **management of the Great Barrier Reef World Heritage Area** through provision of new understanding of this complex ecosystem and expert input to regulators (Great Barrier Reef Marine Park Authority, Department of Environment and Queensland Department of Environment and Heritage Protection) and industry (Australian Association of Marine Tourist Operators, Queensland Tourism Industry Council). Its regional scale research programs provided information for re-zoning of the GBR Marine Park and the development of water quality standards, and through its long-term monitoring programs and ecosystem studies AIMS has established itself as a trusted and authoritative advisor on reef health. It is currently providing assistance to the Australian and Queensland Governments in the Strategic Assessment process being undertaken in response to the concerns of the World Heritage Committee, and is testing the development of new techniques to control the numbers of Crown-of-Thorns Starfish.

AIMS monitors the impact on inshore environments of current human activity, and actively seeks to identify solutions for industry and government. With the rapid expansion of ports in Northern Australia to support industry growth (oil and gas; the mineral resources sector iron ore industry in Western Australia; the coal industry in Queensland; and naval and export facilities in Darwin Harbour). AIMS has become an important source of advice on **sustainable port development**. It heads a \$9 million research program on the environmental risks of dredging to be undertaken as part of the development of the export oil and gas industry and the iron ore industry in northwest Australia. It is also working with research and government partners to support more than \$34 billion of development activities in Darwin Harbour that will position the city as Australia’s northern export hub and provide

¹⁸ The [e-Atlas](#) uses a sophisticated mapping system to allow research data from different sources and projects to be combined together within one platform, allowing data to be viewed in a wider context. Its goal is to improve access and use of science for environmental management decision-making as well as fostering collaboration between researchers.

¹⁹ [eReefs](#) is a collaborative project focussed on the Great Barrier Reef. It will provide products akin to that provided by the Bureau of Meteorology for weather. This information will benefit government agencies, Reef managers, policy makers, researchers, industry and local communities. This five year project, commenced in January 2012, is the first step in building comprehensive coastal information systems for Australia..

²⁰ [Insight Economics \(2009\) Marine Imprint: the crucial impact of 33 years of AIMS research in the public interest.](#)

²¹ <http://www.environment.gov.au/coasts/publications/pubs/montara-monitoring-plan.pdf>

a marine supply base to service Australian and allied forces. In Queensland, AIMS is a member of the Gladstone Healthy Harbour Science Panel.

AIMS has collaborated and worked with Indigenous leaders and collaborators in the **Torres Strait** region for over 10 years to improve understanding of the marine communities and explore opportunities for new sustainable enterprise in this important region. Following substantial bleaching of corals around Thursday and Horn Islands in 2010, AIMS established coral monitoring sites in the central and eastern islands of the Torres Straits in 2013 as part of a 3 year collaboration with Torres Strait Regional Authority. The collaboration includes training of local indigenous rangers to enable them to conduct ongoing assessment of the health of their reefs into the future. The surveys are providing new information of coral and fish species for the region. In addition research is being undertaken to underpin sponge farming and oceanographic monitoring stations have been established to provide real-time weather information and prediction of coral bleaching conditions for the region.

The biodiversity and fisheries production on the continental shelf of Northern Australia is strongly influenced by regional circulation patterns driven by the Indonesian Through-Flow. This current is also has a strong influence on the coastal ecosystems of our nearest neighbours, Timor-Leste and Indonesia. A collaborative study being undertaken by researchers from AIMS, Timor-Leste and Indonesia - the **Arafura & Timor Seas Ecosystems Action (ATSEA)** Program (see Attachment 2) - is building understanding of this important region for mutual benefit. The sampling of benthos and fish and associated primary productivity measurements provided from this study will provide baseline data useful in determining changes potentially occurring as a result of differences in riverine circulation and upwelling-downwelling events within the Big Banks Shoals and along the southern coast of Timor Leste. As part of IMOS, oceanographic moorings have been deployed in this region to improve climate and current predictions. This will complement the ecological studies providing new regional knowledge.

Tropical knowledge for regional futures

In order to provide the evidence base required for sustainable development of the valuable marine ecosystems of the north, Australia must have relevant skills and expertise in the region. Ensuring future tropical research capacity not only positions Australia to address the challenges facing the sustainable development it builds on the competitive advantage of North Australia's location in the tropics with potential exports of tropical knowledge.

AIMS has played a vital role in building a regionally focussed capacity to address issues facing Australia's tropical marine ecosystems through its strong collaborative networks and links with industry. Together with James Cook University, AIMS has established Townsville as an international centre of excellence in tropical marine science.

The expertise and specialised research infrastructure at AIMS provides a valuable environment for training. The uptake of AIMS-trained researchers into industry (e.g. in environmental consulting companies and as environmental managers) and government roles together with training of postgraduate students makes a significant contribution to Australia's current and future capability in tropical marine. Currently AIMS has formal collaborative agreements forming hubs of marine science expertise in Townsville (**AIMS@JCU** with James Cook University), in Darwin (the **North Australian Marine Research Alliance** with Charles Darwin University, the Australian National University and the Northern Territory Government) and in Perth (the **Indian Ocean Marine Research Centre** with the University of Western Australia and CSIRO and the Western Australia Marine Science Institution). One of the key goals of the hubs is the development of early career scientists.

In addition to on-ground training of rangers in the Torres Strait (see previous section) AIMS is a partner in a new program to encourage Aboriginal and Torres Strait high school students to pursue a potential career in marine science will enhance future research capacity in the region. The Aboriginals and Torres Strait Islanders in Marine Science Program is a five-week program, which in addition to inspiring Indigenous students to continue with their studies aims bring together western science and traditional knowledge and hence potential new advances to enhance management of the coastal environment of Northern Australia.

A summary of AIMS activities relevant to Northern Australia

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|--------------------------|---|
| Area of focus | Tropical marine ecosystems across North Australia – from the Southern GBR in the east to the Aboholhos Islands and Ningaloo Reef in the west. |
| Skills | AIMS employs more than 200 science and support staff. Many of AIMS' scientists are world authorities in their field who have achieved international acclaim for their research. Support staff provide specialised skills in data management, information technology, engineering, field operations, information services, science communication and corporate services |
| Location | Townsville (north Queensland), Darwin and Perth |
| Laboratories | Sophisticated molecular laboratories together with AIMS sea-going capacity and aquarium facilities provide a unique juxtaposition of tools to assist researchers unravel the complexities of tropical marine ecosystems. The recent addition of the National Sea Simulator provides cutting-edge experimental capacity to allow researchers to control complex combinations of environmental variables. |
| Research vessels | AIMS has 2 purpose built research vessels (RV <i>Cape Ferguson</i> and the RV <i>Solander</i>) to support oceanographic and ecological studies of the continental shelf waters. This is supplemented by smaller coastal vessels providing access to all of Australia's tropical marine environments. |
| Key relationships | <p>Development of partnerships with universities, other research providers and state/territory governments to provide Hubs of expertise</p> <ul style="list-style-type: none"> • AIMS@JCU – Townsville recognised as an international centre of excellence in tropical marine science. • The Northern Australia Marine Research Alliance between AIMS, CDU, ANU and the Northern Territory Government – enhance marine science expertise focussed on regional issues. • The Indian Ocean Marine Centre between the University of Western Australia, AIMS and CSIRO. <p>Multiagency research programs</p> <ul style="list-style-type: none"> • The Western Australia Marine Science Institution. • The Tropical Ecosystem Hub. • The Marine Monitoring Program for Reef Rescue. • The Integrated Marine Observing System. <p>Working with industry</p> <ul style="list-style-type: none"> • Ongoing collaboration with Woodside Energy Limited. • Assess the long-term impact of the 2009 Montara oil spill with PTTEP Australasia. • AIMS leading development of a scientific monitoring program for Shell Australia and the INPEX Corporation. |
| Regional relationships | AIMS has developed significant international agreements that increase Australia's capacity to address issues facing the marine ecosystems of Northern Australia and support their use and protection. These collaborative agreements include: development of predictive coral bleaching models with the US National and Atmospheric Administration (NOAA); baseline biological data for the Arafura and Timor Sea region through the Arafura & Timor Sea (ATSEA) Program with Timor-Leste and Indonesia; shared research on COTS with the Prefecture of Okinawa; coastal ecosystems, integrated ecosystem modelling and observation systems with the Institute of Oceanology, Chinese academy of Science; and identifying new technologies to aid in marine science research with the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) |
| Contribution to capacity | AIMS is committed to training future marine researchers through both formal partnerships (e.g. AIMS@JCU, NAMRA and the Indian Ocean Marine Research Centre) all of which are focussed on advancing our understanding of tropical marine ecosystems. In addition, through both collaboration and training AIMS is improving capacity in indigenous communities with a current focus on the Torres Strait. |

AIMS – BACKGROUND AND RELEVANCE

AIMS provides the core national research capability to deliver the required environmental baselines, large scale and long-term data sets, observation systems and environmental risk assessments to support sustainable development. Publicly Funded Research Agencies, such as AIMS, are essential in bridging the gap between the fundamental research of Universities and the more strategic and applied needs of users across Government and industry.

The Australian Institute of Marine Science (AIMS) (www.aims.gov.au) is Australia's tropical marine research agency and works to generate and transfer knowledge to support the sustainable use and protection of the marine environment through innovative, world class research. Operating from bases in Townsville, Darwin and Perth AIMS conducts research across Northern Australia and targets problems of national significance. In the current research effort AIMS continues to:

- underpin Australia's environmental management of the Great Barrier Reef (GBR)
- support the sustainable development of coastal industries and ports across northern Australia from Gladstone to the Pilbara
- provide the environmental baselines and condition and risk assessments required for development of the offshore oil and gas industry in North Western Australia.

Research into these complex marine ecosystems requires specialist research capacity. AIMS' expertise in tropical marine ecosystems and multidisciplinary capability is enhanced by specialist marine science infrastructure. The AIMS research fleet provides access to all of Australia's tropical marine environments. Two large purpose-built ships, the *RV Cape Ferguson* and the *RV Solander*, and a number of smaller vessels, take researchers to the diverse habitats that make up our tropical marine environments. This field based capacity is complemented by state-of-the-art laboratory facilities that allow researchers to measure the molecular responses in animals. Recently, the opening of the National Sea Simulator (SeaSim) located at the Townsville headquarters, provides capabilities to precisely replicate ocean conditions in controlled laboratory settings, which will facilitate investigations into the cumulative pressures of climate change, ocean acidification, changing water quality on tropical marine environments.

From the molecular responses of microbes to whole-of-ecosystem studies AIMS is building new knowledge; it monitors the condition and trends in health of the marine environment; applies a broad spectrum of enabling technologies to deliver new insights; and develops predictive models to assist understanding processes and potential impacts. Through the utilization of decision support tools AIMS assists managers and other users in the interpretation of the data collected.

Building regional capacity through collaboration

AIMS builds national marine research capability and capacity through co-invested research programs, international research networks, and post-graduate training. Several large multiagency research collaborations/partnerships are providing enhanced research capacity in Northern Australia. These joint ventures and multi-agency programs combine the research strengths of universities, research organisations and industry partners ensuring the necessary skills, capabilities and infrastructure are efficiently and effectively applied to prioritised research. Current partnerships are:

- **The Arafura Timor Research Facility (ATRF)** is a joint venture initiated in 2006 between AIMS and ANU with a mission to support marine science across northern Australia and other countries bordering the Arafura and Timor Seas (Indonesia, New Guinea, and Timor). With construction funding as a Major National Research Facility provided by the Australian Government, ATRF consists of an office and laboratory complex located in Darwin, adjacent to the campus of Charles Darwin University (CDU).
- **The ARC Centre of Excellence for Coral Reef Studies (CoECRS)** was established by the ARC in 2005—creating a partnership between AIMS, ANU, GBRMPA, JCU, UQ and UWA. AIMS CEO John Gunn is a

member of the Centre's Advisory Board and three AIMS senior scientists are Partner Investigators in the Centre. AIMS and CoECSRS add further value to regional capacity through the co-funding of a postdoctoral fellowship focussed on bringing new skills to build knowledge about the marine ecosystems of Northern Australia.

- **The Indian Ocean Marine Research Centre (IOMRC)** is a joint venture that unites four Australian research organisations working in and around the Indian Ocean (AIMS, CSIRO, the UWA Oceans Institute and the Western Australian Department of Fisheries). The partnership evolved from a collaborative research agreement between AIMS and UWA that began when AIMS staff in Perth were co-located with UWA marine academics and students to form the UWA Oceans Institute. This venture also supports post-graduate training.
- **The Integrated Marine Observing System (IMOS)** was established in 2006 by the Australian Government funding and matching co-investment from partners including AIMS. The Institute is the major operator of IMOS infrastructure in northern Australia's north-west region, which includes the World Heritage listed Ningaloo Marine Park, the remote and pristine Kimberley region, and the vast amount of infrastructure deployed by the offshore oil and gas industry. AIMS is also the sole operator of IMOS infrastructure in the Northern Territory, where the Darwin Ports Corporation has co-invested significant cash and services in a real-time data network that provides information on sea states, current flows, and under-keel depths for large ships transiting the narrow approaches of Darwin Harbour.
- **The National Environmental Research Program Tropical Ecosystems (NERP TE) Hub** is the largest of five science programs undertaking applied environmental science research as a part of the National Environmental Research Program established by DOTE (then SEWPaC). The NERP TE Hub delivers research for north Queensland designed to: improve environmental decision-making processes in regionally-based natural resource management agencies (such as the Torres Strait Regional Authority, the Wet Tropics Management Authority and GBRMPA); influence the formation of environmental policy by Australian governments; and, inform and influence other stakeholders (industries, non-government organisations and Indigenous organisations). With co-investment from the major research partners (AIMS, CSIRO, JCU, and UQ), this joint venture represents expenditure on environmental research for North Queensland of more than \$63 million between 2011 and 2014. AIMS is also a partner in the **Marine Hub** and the **Northern Australia Hub**.
- **The North Australia Marine Research Alliance (NAMRA)** brings together AIMS, CDU, The Australian National University (ANU) and the Northern Territory Government to build marine research capacity and capability in northern Australia. It continues to grow and deliver on its goal under current director Edward Butler (from AIMS). As at June 2013 NAMRA had six postdoctoral fellows and two PhD scholars in place significantly increasing the marine science capacity in the region.
- **The Reef Rescue Marine Monitoring Program (MMP)** supports the Reef Water Quality Protection Plan (Reef Plan). The MMP is coordinated by GBRMPA as a partnership between AIMS, CSIRO, JCU and the National Research Centre for Environmental Toxicology (Entox), which is based at the University of Queensland. Since 2005, AIMS has monitored the quality of the receiving waters at 20 fixed sites along more than 1,000 km of coastline, using its research vessel, the RV Cape Ferguson. This is supplemented by small-boat-based diving operations to monitor the health of 32 coastal and inshore coral reefs within this region. Both elements are combined with results from the other partners into the *Paddock to Reef Integrated Monitoring and Reporting Program*, which is coordinated by the Reef Plan Secretariat within the Queensland Department of Premier and Cabinet. The most recent report card, giving progress towards targets up to June 2011, was published in 2013.
- **The Western Australian Marine Science Institution (WAMSI)** is a partnership to improve knowledge and understanding of Western Australia's marine environment for better resource development, management and conservation outcomes. It is a partnership of sixteen organisations including several Western Australian Government Departments, four Perth universities, two major resource companies, two publicly-funded research agencies (CSIRO and AIMS), the Western Australian Museum, the Bureau of Meteorology, the WA Chem Centre, and a regional ocean observing network for the Indian Ocean. AIMS researchers led and participated in detailed multi-institutional program and project proposal development for phase 2 of WAMSI which will focus on the Kimberley region and dredging.

AIMS also undertakes major collaborative projects with industry. For example, **the Scott Reef Research Project** with Woodside Energy Limited which built on long-term collaboration and has provided new understanding about the offshore reef environments of northwest Australia and will assist continued research into the extensive and biodiverse ecosystems of the region

Building international connections

AIMS has strong relationships with international research organisations. These relationships not only build capacity in multidisciplinary teams but also provide capacity to deliver more cost effective research outcomes through the use of complementary research infrastructure. In the longer term they can also provide a basis for enhanced regional relationships. Examples relevant to Northern Australia are:

- AIMS was represented on the Steering Committee of the Arafura and Timor Seas Expert Forum (ATSEF) which was to assist in achieving the goals of sustainable development and poverty alleviation in the Arafura and Timor Seas region, particularly for the coastal communities, who depend upon marine and fisheries resources for their livelihood. The Forum successfully developed the Arafura & Timor Seas Ecosystems Action (ATSEA) Program which was funded by the Global Environment Fund to improve information on the benthic and pelagic processes in the Timor Sea - a crucial body of water for Australia, Indonesia and Timor Leste. Two collaborative research cruises have been conducted as part of this program, one aboard the AIMS research vessel. This program has developed strong relationships between the collaborating agencies and is providing new information to support sustainable coastal development across the region.
- AIMS has entered into a Memorandum of Understanding with the US National and Atmospheric Administration (NOAA). Among other areas the two agencies have agreed to work together on developing high-resolution oceanic and climate models and on determining early warning signs of stress in marine ecosystems (e.g coral bleaching). This collaboration brings together AIMS' strong field capacity with NOAA's remote sensing capacity and will benefit management of the GBR.
- AIMS and the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) are exploring opportunities for collaboration in priorities areas identified at a joint Japan-Australia workshop held in 2013. The areas of priority focus are: ocean acidification; adaptability to climate change; and identifying new technologies to aid in marine science research. Complementary capabilities between these organisations will benefit the use and protection of Australia's tropical marine ecosystems.
- Recently AIMS signed an agreement with the Prefecture of Okinawa to collaborate on research on Crown-of-Thorns-Starfish which is also a problem of reefs in the Okinawa region. This collaboration is to share knowledge to enhance development of effective solutions in the control of these 'pests'. This research will complement efforts being undertaken on the GBR.
- The Institute of Oceanology, Chinese academy of Science and AIMS have signed a Memorandum of Understanding. This will increase and strengthen capacity in both Institutes and is to focus on several research areas that are relevant to sustainable development of Northern Australia – for example: coastal ecosystems; data management; integrated ecosystem modelling and observation systems.

Relevance and impact of AIMS research

Examples of the relevance and impact of AIMS current research impact include:

- AIMS' monitoring and science programs are underpinning efforts by regulators, policy-makers and industry in meeting the challenges of expanding port developments (National Ports Strategy) and the impacts of coastal agriculture, particularly on the Queensland and Northern Territory coasts (Reef Rescue Plan, Caring for Our Coasts). AIMS works closely with neighbouring states such as Indonesia, Timor Leste and Papua New Guinea in marine environmental research, and this experience and capability is of increasing relevance to Asian countries as they seek to manage the environmental impacts of their own expanding marine-based industries.
- AIMS is providing expert input to the regulators (Department of Environment, DOTE) and the National Offshore Petroleum Safety and Environmental Management Agency) in the development and implementation of regional risk assessment and guidelines for Operational and Scientific Monitoring Programs that are part of regulatory requirements post the Montara oil spill (see Recommendation 90, Report of the Montara Commission of Inquiry).

- AIMS' research is directly assisting the offshore oil and gas industry (e.g. Shell, INPEX, Woodside Energy Limited, PTTEP Australasia and ConocoPhillips) in its efforts to continuously improve environmental performance for existing and proposed developments in line with the requirements of the OPGGS (Environment) Regulations.
- AIMS is a regionally-based Commonwealth agency with research focused on supporting sustainable development of high value industries across northern Australia. The offshore oil and gas, reef-based tourism, coastal industry and ports sectors, are the cornerstone of regional development strategies making important contributions to these economies. The regional scale information provided by AIMS research will support decision-making by both regulators and industry and contribute to the Government's regulatory reform agenda to improve productivity and reduce business costs.
- AIMS' research is playing a central role in supporting the Great Barrier Reef Marine Authority (GBRMPA) and DOTE in their ongoing management of the Great Barrier Reef World Heritage Area and the Government's Great Barrier Reef World Heritage Area Strategic Assessment - a response to concerns raised internationally about the state of the Reef and approaches to coastal development.
- AIMS has longstanding and deep partnerships with industry (e.g. Woodside Energy Limited's 18 year collaboration with AIMS was recognised in 2012 through the APPEA environment award).
- AIMS leads the implementation of major national research programs (e.g. Queensland Integrated Marine Observing System and coastal observing stations across northern Australia under Australia's Integrated Marine Observing System); and is leading development of new multi-agency research programs with other oil and gas industry partners.
- AIMS multidisciplinary capabilities provide a unique national preparedness to respond to marine incidents across northern Australia. In recent times the Institute has been a first responder to disasters such as the Montara oil spill and a number of vessel groundings on the Great Barrier Reef.