Tropical Water Quality Hub

National Environmental Science Programme

Reef & Rainforest RESEARCH CENTRE

Annual Progress Report #3

1 January 2017 - 31 December 2017



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The Tropical Water Quality hub is funded by the Australian Government's National Environmental Science Programme



National Environmental Science Program
Tropical Water Quality Hub
ANNUAL PROGRESS REPORT 3
1 January 2017 – 31 December 2017

Hub Name: Tropical Water Quality Hub
Host organisation: Reef and Rainforest Research Centre

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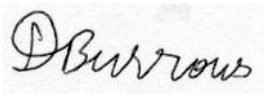
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Other consortium partners/subcontractors/research organisations: AIMS; CQU; JCU; Griffith University; CSIRO; UQ

Hub Leader Certification

As hub leader, I certify that I have taken adequate steps to reasonably assure myself that:

- each required report component is attached;
- the contents of each component of the report is complete and accurate in all material respects;
- funds have been used for the purpose for which they were provided and all funding conditions have been met, Recipient and Other Contributions have been received, and appropriate oversight has been maintained of hub projects, their progress, performance and budgets during the reporting period;
- all relevant risks to project delivery have been notified to the Department in this and previous reports and that appropriate steps are being taken to manage those risks;
- the Hub and its sub-contractors have current workers compensation and public liability insurances, as required under the Funding Agreement; and
- any carryover of project funds have been allocated to projects in the next reporting period or financial year in accordance with the approved Research Plan or funds identified for refund to the Department.

Signed : 

Hub Leader Name: Damien Burrows

Date: 23/04/18

Hub Steering Committee Chair Certification:

As steering committee chair, I certify that any issues of concern or matters raised during steering committee meetings where the draft progress report was discussed have been adequately resolved, amended or incorporated into the final report submitted to the department.

Signed: 

Hub Steering Committee Chair Name: Ms Leith Boully

Date: 23/04/18

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Letter from the Hub Leader

The year 2017 represented a point of significant change for the NESP Tropical Water Quality Hub (TWQ). First was the unprecedented second mass bleaching event, which came just one year after the 2016 mass bleaching event. Between the two bleaching events, a significant proportion of corals in shallow waters of the Great Barrier Reef (GBR), died. Whilst the first bleaching event was shocking enough, another bleaching event in the summer of 2017, followed by the impacts of Cyclone Debbie, heralded unprecedented responses from scientists, management agencies, industry groups and the concerned public. In response, the TWQ Hub altered its focus to include research into effective responses to bleaching and coral restoration. Whereas our 2015 and 2016 research portfolios were largely focused on improving water quality as a driver of reef health, our 2017 portfolio was approximately evenly balanced between improving water quality and supporting direct interventions in the marine environment in response to bleaching and cyclones. This balance is likely to be maintained in the remaining years of the TWQ Hub.

The ability to pivot and respond to such emerging events illustrates the value of the flexibility provided to the NESP Hubs in their administrative arrangements, their 6-year terms and our Hubs internal policy of retaining research funds into our last years to be able to respond to such emerging priorities, as we did during 2017.

After the second mass bleaching event in 2017, there quickly developed widespread recognition that the interval between such disturbance events was too brief to allow for desired levels of ecological recovery and that a range of active in-water interventions and restoration approaches would be required to actively assist reef recovery. This was a significant change in GBR management of the GBR and was reflected in the outcomes of the Reef Summit in May 2017 and the Blueprint for the Reef (both GBRMPA documents). The TWQ Hub response included commissioning a series of projects that matched this new doctrine. Of course, the TWQ Hub has been funding in-water interventions since its inception. Hub support for the Crown-of-Thorns starfish control program has been our largest single investment, with four separate projects funded to date. This investment has led to, and demonstrated significant improvements in CoTS culling efficiency and in 2017, was able to show for the first-time, improvements in reef health (coral cover) from the program. The federal government has since increased funding to the CoTS control program by $10.6M.

Our Hub investment in restoration already includes several wetland restoration projects in GBR coastal catchments. Like the CoTS projects, these are specifically linked to actual on-ground restoration projects, mostly out of other federal and state government funds. Our wetland research projects work closely with the major organisations restoring wetlands, such as Greening Australia, Jaragun and Mungalla Aboriginal Corporations and several regional natural resource management (NRM) bodies. To show leadership in restoration, and to assist with creating a community of restoration in the region, in August 2017, the TWQ Hub, in partnership with the Marine Biodiversity Hub, organized the inaugural Coastal Restoration Symposium, held in Townsville. This successful event subsequently led to the establishment of the Australian Coastal Restoration Network – partly organized and funded by the TWQ and Marine Hubs, along with The Nature Conservancy. The TWQ Hub has also taken the lead in organizing a GBR Restoration Symposium for July 2018 (see below). These events, in conjunction with our significant and growing profile in restoration and active interventions, position our Hub as leaders in the restoration and intervention space, something we will build upon in coming years.

Finally, I would like to take this opportunity to thank our end-users/stakeholders and the members of our Hub steering committee. I am constantly buoyed by the high levels of support and assistance the Hub's research program and other activities has received from those we aim to assist.

Research

Progress towards outcomes

During the reporting period of 1 January to 31 December 2017, the TWQ Hub funded projects to meet the Minister's research priorities and key end user and stakeholder research needs. During 2017, sixteen (16) RPv3 multi-year projects commenced and the selection of thirteen (13) RPv4 multi-year projects was finalised for commencement on 1 January 2018. All current projects completed their milestones for the 2017 period. Seven projects reached completion in 2017 from Research Plans 2&3.

As stated in the Tropical Water Quality Hub research scope, Activity Outcomes include:

- Coastal management (including rivers and streams) and risk abatement for environmental impacts on tropical water quality from infrastructure, agriculture, extreme events and biosecurity threats;
- Management, monitoring and reporting for coastal species including status, trends and threatening processes; and
- Practical delivery of tropical water quality trials.

The Tropical Water Quality (TWQ) Hub provides innovative research for practical solutions to maintain and improve tropical water quality across coastal catchments, especially in the Great Barrier Reef region. Research has continued to focus on mitigating water quality impacts, predicting indirect and cumulative effects of human activities, and providing optimised management by engaging research-users in a collaborative process to co-develop projects.

Current areas for research include:

- Crown-of-thorns (CoTS) starfish outbreak mitigation;
- Cumulative catchment, coast and marine impacts & habitat repair;
- Sediment and nutrient sources and dynamics;
- Indigenous co-management of species & habitats;
- Continued optimisation and prioritisation of investments: and
- Restoration of freshwater and marine habitats.

Due to the dramatic impacts from the dual bleaching events of 2016/2017, as well as from Cyclone Debbie, prioritisation of the research in RPv4 included a shift to direct management interventions in the marine environment in response to these stressors.

At the end of the reporting period (31 December 2017), the TWQ Hub had funded 59 projects across Research Plans 1-3 to meet the research priorities of the Hub and its stakeholders.

The Project Leader workshop for Research Plan v3 was conducted on the 27th February 2017 with all available Project Leaders. The objectives of the hub and collaborations between projects were emphasized. Specific end user and indigenous engagement strategies were addressed with a workshop on communications and knowledge brokering to assist projects in meeting their research goals over the next twelve months. The specific focus was ensuring all project all Project Leaders understood their roles and responsibilities within the Hub while providing an avenue for effective engagement and collaboration.

In late August, the TWQ Hub, in conjunction with the Marine Biodiversity Hub, organised the inaugural Coastal Restoration Symposium – a 2-day event held in Townsville. With nearly 40 invited speakers, the event was a great success showcasing methods for restoration in mangroves, seagrass, shellfish, estuary and freshwater wetland restoration. The event also attracted several overseas keynote speakers from USA and England and has subsequently led to the formation of an Australian Coastal Restoration Network, also supported by the TWQ and Marine Biodiversity Hubs.

A NESP TWQ Hub Science Day was held on 20 November 2017 in Townsville. This event was held in conjunction with the Reef Water Quality Science workshop convened by the Qld government, which maximised attendance by stakeholders and relevant scientists. Eight project leaders presented to a wide and diverse audience of over 90 scientists and stakeholders. Video recordings of presentations from several TWQ Hub project leaders have been uploaded to YouTube and are available on the NESP Tropical Water Quality Hub website. See http://nesptropical.edu.au/index.php/science-day/

The TWQ Hub, jointly with the NESP Northern Australia Environmental Resources Hub, has funded a project responding to the Gulf of Carpentaria mangrove dieback - the largest mangrove dieback event ever recorded in the world. The project has already generated considerable national and international media attention and will continue to do so as its fieldwork and outcomes progress. When the project was first funded, it was believed that the dieback extended along 2,000km of coastline but fieldwork in December 2017, showed that the true linear extent was twice that, extending from Weipa around the entire Gulf of Carpentaria coastline to Nhulunbuy.

TWQ Hub research on coral restoration, coral genetic traits and resilience-based reef management has contributed significantly to the Reef Restoration and Adaptation Program (RRAP) that was developed in late 2017. RRAP is a partnership between AIMS, CSIRO, JCU, UQ, QUT, GBRF and GBRMPA to develop a long-term funded research plan to develop bleaching prevention and coral restoration techniques that can be applied at scale on the GBR. The types of research being pursued include a focus on long-term, higher risk options such as manipulating coral genetics, geo-engineering options and mass coral production.

Upcoming highlights over the next 6 – 12 Months

- By December 2018, it is expected that fourteen RPv2 projects will finish; five RPv3 projects will finish; and two RPv4 projects will finish. The outcomes and outputs from these projects will be significant and of great interest to identified end users, stakeholders and others.

- Great Barrier Reef Restoration Symposium 16-19 July 2018 - The Great Barrier Reef Restoration Symposium will be held in Cairns Pullmans Reef Hotel Casino. It is hosted by the NESP TWQ Hub (plus logistical support from the Reef and Rainforest Research Centre - RRRC) and supported by AMPTO, RRAP, JCU, NOAA and others. Abstract submissions and registration are now open. This International Symposium will bring together reef restoration practitioners, scientists, engineers, environmental managers, NGOs and industry partners together to share experiences, insights and ideas to help the management and protection of the Great Barrier Reef. NESP TWQ Hub Researchers will be presenting at this event.

- Due to great success in encouraging practice change amongst cane growers, Project 25 was extended in RPv4 and the extension includes a formal assessment of the change in attitudes amongst the farming community as a result of the water quality monitoring activities of Project 25. The extension also includes a partnership with CSIRO Digiscapes platform to extend the broader monitoring effort and trial remotely-operated sensors and data-sharing networks.

- The Hub has invested heavily in research to support the Crown-of-Thorns Starfish control program with a project funded in each of the first four research plans. This research has greatly improved the search patterns and killing efficiency of the field control teams which work closely with Hub researchers in implementing research outcomes. A second CoTS control vessel has been funded by the federal government, enabling Hub research outputs to be even more effective. In turn, the second boat and field team has supplied more information back to Hub researchers. Particularly exciting is the announcement by the federal government in Feb 2018 of an additional $10.6M for additional boat and field team capacity. This will enable control activities over a much greater range of the GBR. Our research team will be working closely with the GBRMPA and AMPTO in devising effective field strategies for this additional effort, based on the outcomes of Hub-funded research.

- The Hub is, in conjunction with the Marine Biodiversity Hub and The Nature Conservancy is co-sponsoring the Australian Coastal Restoration Network. This network arose from the Hub's 2017 coastal restoration workshop and is an informal communication network of restoration professionals to share experiences and learnings and develop a sense of community amongst restoration practitioners.

- Hub research and researchers will continue to work in support of other federally-funded programs such as the Reef Integrated Monitoring and Reporting Program (RIMRep) and the Reef Restoration and Adaptation Program (RRAP), which received $6M in funding in early 2018. The TWQ Hub and these ventures are working closely together on several joint initiatives.

- *Project 2.1.1: Integrated Pest Management of Crown-of-Thorns Starfish* and *Project 3.1.1: Implementation of the Crown-of-Thorns Starfish research strategy: regional strategies*, both led by Dr David Westcott, CSIRO are giving direction to the GBRMPA CoTS control strategy utilising the surveillance and control strategy. In addition, an android app under these projects has been deployed for field trial to assist the CoTs control boats target their efforts and with some refinements being made will be field tested again in the near future.

- A key deliverable from *Project 3.1.3: Harnessing the science of social marketing in communication materials development and behaviour change for improved water quality in the GBR: a desktop review*, led by Prof. Lynne Eagle, JCU is the Best Practice Guide for the Development and Modification of Communication Material (received 28 April 2018). This product provides guidelines for the development and modification of communication material in the agricultural-environmental sector and incudes examples from material supplied by stakeholders (insider's view). The guide draws on learnings from past research to conduct a readability, message tone and visual imagery analysis of communications material from a selection of programme documents supplied by Australian and Queensland Governments and other program managers as well as extension service providers with the aim of increasing uptake of water quality improvement programmes in the Great Barrier Reef Basin. The findings confirmed results found in Project 2.1.3 (Hay & Eagle, 2016). The material supplied for analysis by stakeholders for both projects was found to be written in too complex language. Further, the message tone used in some material may be a barrier to communication and visual imagery may have unintended effects on communication. The output provides guidelines to improve communication materials for water quality programs. Improved communication within marketing material for water quality programs will help to achieve consistency in approach and message clarity, amongst the gamut of communication materials produced for projects that support the Reef 2050 Plan and wider Reef communication materials. Improving the way projects communicate and get buy-in from land managers can help to ensure greater project uptake, associated positive results and lasting behaviour change.

- *Project 3.3.3: Defining the values of the ecological systems that influence the GBR and lie outside the marine park and world heritage area boundaries*, led by Dr Johanna Johnson, JCU will deliver on 31 May 2018 a Summary Report for decision-makers that will include a brief overview of all project results that may be used for future policy and decision making by the four marine jurisdictions in the North East Australian Seascape. An eAtlas portal will also provide a connectivity map for 62 attributes and the nature of connections across jurisdictions, which can be used for future policy and planning with multiple jurisdictions.

- *Project 2.3.4: Working with Traditional Owners and local citizens to better manage GBR estuarine wetlands*, led by Dr Marcus Barber, CSIRO indicate outcomes from the research have directly influenced the CSIRO/JCU/AIMS consortium approach related to the mid-term review of the Reef 2050 Plan. Through the current RRRC Consortium, key outputs from this research are continuing to inform the development of a TO led policy response to the end term review associated with the Reef 2050 Plan.

- *Project 3.2.1: Deriving ecologically relevant load targets to meet desired ecosystem condition for the Great Barrier Reef: a case study for seagrass meadows in the Burdekin region*, led by Dr Catherine Collier, JCU has developed a draft seagrass habitat classification. It has been

trialled by the RIMReP working group to assess the representativeness of existing monitoring throughout the GBR. The final version of the Habitat classification is expected to be submitted to the NESP TWQ Hub in June 2018. The project is working with GBRMPA and the RIMReP team to adapt the proposed desired state to be compatible with RIMReP. Monitoring will report against this desired state in the future.

Research projects

The following projects have been funded by the TWQ Hub.

Project	Project Leader	Lead Institution	Start Date	End Date	Approved Extension	Status
RPv1 (25 projects)						
1.1	Westcott	CSIRO	01-Jul-15	31-Dec-15	30-Jan-16	Complete
1.2	Bartley	CSIRO	01-Jul-15	31-Mar-16		Complete
1.3	Lewis	JCU	01-Jul-15	31-Jan-16	01-Mar-16	Complete
1.5	Greiner	JCU	01-Jul-15	31-Dec-15		Complete
1.6	Uthicke	AIMS	01-Jul-15	31-Mar-16		Complete
1.7	Brooks	GU	01-Jul-15	31-Mar-16	29-Apr-16	Complete
1.8	Davis	JCU	01-Jul-15	31-Mar-16		Complete
1.9	Schaffelke	AIMS	01-Jul-15	31-Dec-15	30-Jan-16	Complete
1.10	Kroon	AIMS	01-Jul-15	31-Dec-15	15-Mar-16	Complete
2.1	Jones	JCU	01-Jul-15	31-Mar-16		Complete
2.2	Smart	GU	01-Aug-15	29-Feb-16	15-Mar-16	Complete
3.1	Coles	JCU	01-Jul-15	31-Dec-15	15-Feb-16	Complete
3.2	Marsh	JCU	01-Jul-15	31-Mar-16		Complete
3.3	Collier	JCU	01-Jul-15	31-Dec-15	15-Mar-16	Complete
3.4	Collier	JCU	01-Jul-15	31-Jan-16	20-Feb-16	Complete
3.5	Rasheed	JCU	01-Jul-15	31-Mar-16		Complete
3.6	Kingsford	JCU	01-Jul-15	28-Feb-16		Complete
3.7	Sweatman	AIMS	01-Jul-15	30-Dec-15		Complete
3.8	Addison	AIMS	01-Jul-15	31-Dec-15		Complete
3.9	George	CSIRO	01-Jul-15	31-Dec-15	30-Mar-16	Complete
3.10	Rolfe	CQU	01-Jul-15	31-Dec-15	15-Mar-16	Complete
3.11	Dale	JCU	01-Jul-15	31-Dec-15	15-Mar-16	Complete
3.12	Maron	UQ	01-Jul-15	31-Mar-16	10-Jun-16	Complete
3.13	Lawrey	AIMS	01-Jul-15	31-Dec-15	30-Mar-16	Complete
RPv2 (18 projects)						
2.1.1	Westcott	CSIRO	01-Jan-16	10-Dec-18		Active
2.1.2	Waltham	JCU	01-Jan-16	28-Feb-17	14-Apr-17	Complete
2.1.3	Eagle	JCU	01-Jan-16	10-Dec-18		Active
2.1.4	Bartley	CSIRO	01-Jan-16	10-Dec-18		Active
2.1.5	Lewis	JCU	01-Jan-16	10-Dec-18		Active
2.1.6	Uthicke	AIMS	01-Jan-16	10-Dec-18		Active
2.1.7	Davis	JCU	01-Jan-16	10-Dec-18		Active
2.1.8	Bell	UQ	01-Jan-16	10-Dec-18		Active
2.1.9	Jones, R	AIMS	01-Jun-16	10-Dec-18		Active
2.1.10	Brooks	GU	01-Apr-16	30-Apr-17		Complete
2.2.1	Waterhouse	JCU	01-Jan-16	30-May-18		Active
2.2.2	Apte	CSIRO	01-Feb-16	30-May-18		Active
2.2.3	Condie	CSIRO	01-Jan-16	10-Dec-18		Active

2.3.1	Fabricius	AIMS	01-Jan-16	10-Dec-18		Active
2.3.2	Becken	GU	01-Jan-16	31-Dec-17		Complete
2.3.3	Barber	CSIRO	01-Jan-16	10-Dec-17		Complete
2.3.4	Duke	JCU	01-Jan-16	10-Dec-18		Active
2.3.5	Lawrey	AIMS	01-Jan-16	31-Dec-18		Active
RPv3 (16 projects)						
3.1.1	Westcott	CSIRO	01-Jan-17	10-Dec-19		Active
3.1.2	Everingham	JCU	01-Jan-17	30-Jun-19		Active
3.1.3	Eagle	JCU	01-Jan-17	10-Dec-17		Complete
3.1.4	Paul, K	CSIRO	01-Jan-17	30-Apr-18		Active
3.1.5	Negri	AIMS	01-Jan-17	10-Dec-19		Active
3.1.6	Smart	GU	01-Jan-17	28-Jan-19		Active
3.1.7	Brooks	GU	01-Jan-17	10-Dec-19		Active
3.1.8	Thorburn	CSIRO	01-Jan-17	10-Dec-19		Active
3.2.1	Collier	JCU	01-Jan-17	30-Jun-19		Active
3.2.2	Dale	JCU	01-Jan-17	28-Jan-18		Complete
3.2.3	Becken	GU	01-Jan-17	28-Jan-18		Complete
3.2.4	Marshall	CSIRO	01-Jan-17	10-Dec-17		Complete
3.2.5	Schaffelke	AIMS	01-Jan-17	10-Dec-17		Complete
3.3.1	Bay	AIMS	01-Jan-17	10-Dec-19		Active
3.3.2	Waltham	JCU	28-Jan-17	10-Dec-19		Active
3.3.3	Johnson	JCU	15-Feb-17	28-Feb-18	31-May-18	Active
RPv4 (13 projects)						
4.1	Westcott	CSIRO	01-Jan-18	10-Dec-19		Active
4.2	Steinberg	JCU	01-Jan-18	10-Dec-20		Active
4.3	McLeod	JCU	01-Jan-18	10-Dec-20		Active
4.4	Bay	AIMS	01-Jan-18	10-Dec-20		Active
4.5	Mumby	UQ	01-Jan-18	10-Dec-20		Active
4.6	Mumby	UQ	01-Jan-18	10-Jun-19		Active
4.7	Maire	CQU	01-Jan-18	30-Jun-19		Active
4.8	Davis	JCU	01-Jan-18	31-Dec-20		Active
4.9	Brooks	GU	01-Jan-18	30-Sep-18		Active
4.1	Brooks	GU	01-Jan-18	10-Dec-20		Active
4.11	Burford	GU	01-Jan-18	30-Sep-18		Active
4.12	Rundle-Thiele	GU	01-Jan-18	10-Dec-20		Active
4.13	Duke	JCU	01-Jan-18	10-Dec-19		Active

Attachment A lists the projects funded under the NESP Tropical Water Quality Hub and provides information on the project status, information on outputs and links to products for all projects (where available). Exceptions to the NESP Data Management and Accessibility Guidelines are also noted there.

Performance against milestones

Performance against Funding Agreement Milestones

All milestones for the period and to date have been met as per Funding Agreement Milestones 1-17.

Performance against the Research Plan milestones

Information on project progress and performance is provided in Attachment A.

Measuring success

The National Environmental Science Program (NESP) is a long-term commitment to support environmental and climate research. The key objective of the NESP is to improve our understanding of Australia's environment through collaborative research that delivers accessible results and informs decision making. The focus of NESP is on practical and applied research that informs on-ground action and that will yield measurable improvements to the environment.

The Program builds on its predecessors - the National Environmental Research Program and the Australian Climate Change Science Program – in securing for decision makers the best available information to support understanding, managing and conserving Australia's environment.

The NESP is delivered through multi-disciplinary research Hubs or consortia, hosted by Australian research institutions.

The NESP seeks to achieve its objective by supporting research that:

- is practical and applied and informs on-ground action
- addresses the needs of the Australian Government and other stakeholders by supporting and informing evidence-based policy and improving management of the Australian environment
- is innovative and internationally recognised
- enhances Australia's environmental research capacity
- is collaborative and builds critical mass by drawing on multiple disciplines, research institutions and organisations to address challenging research questions
- produces meaningful results accessible to government, industry and the community
- includes synthesis and analysis of existing knowledge
- builds relationships between scientists and policy-makers to encourage collaborative problem solving on environmental issues.

NESP end-users will be a broad range of stakeholders whose decisions may impact on the environment, and include the Australian Government, state governments, industry, business, community groups and Indigenous land managers (or Indigenous Communities).

The intended outcomes of the NESP are:

- Enhanced understanding of, and capacity to manage and conserve Australia's environment.
- Improved climate and weather information for Australia through a greater understanding of the drivers of Australia's climate.
- Timely research that is used by policy and decision-makers to answer questions and provide solutions to problems.
- Research outcomes that are communicated clearly to end-users and the general public, and stored in a manner that is discoverable and accessible.

Table A: Quantitative performance measures

Key Performance Indicator	Hub Result for 12-month Period (numerical only)	Explanation (if any)
1. Percent of projects (active or completed in the reporting period) for which there is a research-user actively engaged in the project?	**100%**	This is a compulsory requirement for all projects.
2. Percent of projects approved under RPV4 in which research-users were actively involved in project design?	**100%**	This is a compulsory requirement for all projects.
3. Number of research outputs provided to end users **on time**[1] and as identified in the Research Plan	**23**	
4. Proportion of research outputs provided to end users **on time** and as identified in the Research Plan	**85%**	The Hub has had delays in finalising project technical reports and communication products for submission to the DoEE before upload to the Hub website. This will be rectified as soon as possible.
5. Number of instances of where the hub has used NESP-generated information from another NESP hub.	**8**	Uses of NESP generated information from another Hub Projects 2.3.1; 2.2.1; 2.2.2; 2.3.3, 3.1.3, 3.2.3, 3.1.8, 3.1.5
6. Number of peer reviewed NESP-funded publications during the reporting period	**18**	
7. Number of NESP research citations in other researchers' publications during the reporting period	**Total: 122**	
8. Number of researchers, including PhD and Post-Doc positions engaged as a result of NESP (total, Full-time equivalent) during the reporting period	**Total: 146** **FTE: 29.5**	
9. Number of data sets provided to the Hub, or made publicly available, by third parties for the purposes of informing NESP research	**New KPI**	Will capture this KPI in the next round of milestone reporting for active projects.
10. Percentage of data sets made publicly available under open licence by the Hub	**100%**	This is a compulsory requirement for all projects.
11. Percentage of NESP research outputs (including publications, data and metadata) that are discoverable and accessible in accordance with NESP data accessibility requirements and the funding agreement.	**95%**	All readily available NESP TWQ Hub research outputs are discoverable and accessible. Some elements may not yet be available for reasons of confidentiality, at least until project completion.
12. Number and FTE of Indigenous people employed in a project (separate into full and part time positions).	**1 x 0.2** **FTE: 0.2** **8 x 0.55** **FTE: 4.4**	Project 2.3.3 Project 2.3.4, Project 3.3.1, Project 3.3.2
13. Number of Indigenous researchers/graduates/post-	**3**	Project 3.3.2, 2.2.1,

[1] On time – delivered on the date the outputs were expected to be delivered

graduate/PhD/Post Doc Positions in projects.		
14. Number of Indigenous people trained in the use of environmental management tools and techniques.	**30**	Project 3.1.7, in partnerships with CYNRM (20) Project 2.2.1 – (6) TSRA Rangers were provided direct training, and a further 10-12 are involved in salinity monitoring. Project 2.2.3 (4) Gavin Singleton (Yirrganydji tribe) plus 3 Indigenous Rangers have been trained in the deployment of cameras and net sampling of Irukandji. Project 2.3.4 – Mangrove Management Plan
15. The number of management tools for Indigenous waters and land that benefitted from NESP research and outcomes (including but not limited to Plans of Management for IPAs, Co/Joint managed parks, Marine Park Plans of Management, Conservation Agreements).	**4**	Project 2.3.3 - Project activities support Kalan Enterprises strategic and operational plans, as well as future business development. Project 3.1.7 - directly contributing to the improved management of Crocodile Station.) Project 2.2.1 - TSRA Rangers from Boigu, Saibai, Masig, Erub and Warraber and now Poruma are participating in the weekly in situ salinity monitoring on these islands Project 2.3.4 – TO of the Port Curtis Coral Coast have developed and are beginning to implement Mangrove Management Plan. Project 3.2.2 – Several workshops with TOs and regional experts
16. Number and type of communication products that have been used to communicate research with Indigenous people.	**6**	Project 3.2.4 - Eg, Indigenous knowledge broking with GBRMPA Project 2.2.1 & 2.2.2 - 2 Separate fact sheets and salinity training manual used to communicate with relevant Indigenous participants. Project 3.1.5 – Oral presentations to students as well as Gudjuda and Girringun Rangers Project 2.3.4 – Mangrove Management Plan (development and implementation)
17. Number of research, knowledge sharing and communication events held with Indigenous communities.	**18**	Project 2.2.1, Project 2.3.3, project 3.3.3, Project 3.1.7 Project 3.1.8 (Meetings with Djunbunji Land and Sea Program – the Mandingalbay Yidinji Traditional Owners; Girringun Aboriginal Corporation and Yirrganydji Traditional Owners)

		Project 3.2.4 (3) Project 3.2.1 - Presentation to Turtle Health Symposium
18. Number of public events, conference presentations, jointly authored/published papers with Indigenous participants/contributors.	**8**	Eg Project 2.2.1 – regional presentations Project 3.2.1 – Turtle Health Symposium Project 3.3.3 stakeholder workshops Project 3.2.2 – Numerous meetings

Guidance

Tropical Water Quality Hub Annual Progress Report 2017

ATTACHMENT A

Project Number/ID	Project Name/Title	Approved RPV4 Funding			Start Date	Completion Date	Status *(Use dropdown)*	Outputs		Outcomes
		NESP Funding $'s	Total Other Contributions $'s	Total Budget				Outputs *(List outputs described in the project plan as well as any additional outputs the project delivered. Insert extra rows as needed)*	Link to output	Project Outcomes *(Describe how the project outputs will be used, linking them to policy, regulation, land management, direct stakeholder benefit eg Indigenous communities etc. Where and when will they be adopted, is there immediate impact or is impact still anticipated)*
1.1	Establishing the future NESP CoTS research framework including an ecologically-based approach to the management of CoTS at multiple scales	$100,000	$119,710	**$219,710**	1/7/15	31/12/15	Completed		N/A	
1.2	Developing an approach to evaluate the effectiveness of investments in riparian management in the GBR catchments	$99,972	$84,972	**$184,944**	1/7/15	30/3/16	Completed			
1.3	A validation of coral geochemical records to reconstruct suspended sediment loads to the Great Barrier Reef lagoon	$22,500	$38,950	**$61,450**	1/7/15	31/1/16	Completed			
1.5	Legacy of the Lower Burdekin Water Quality Tender	$39,795	$79,590	**$119,385**	01.07.15	31.12.15	Completed			
1.6	Multiple and cumulative impacts on the GBR: assessment of current status and development of improved approaches for management	$99,944	$109,507	**$209,451**	01.07.15	31.03.16	Completed	Uthicke, S., K. Fabricius, G. De'ath, A. Negri, R. Smith, M. Warne, S. Noonan, C. Johansson, H. Gorsuch, and K. Anthony. 2016. Multiple and cumulative impacts on the GBR: assessment of current status and development of improved approaches for management. Final Report Project 1.6. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (144pp.).		
1.7	Reducing sediment sources to the Reef: testing the effectiveness of managing alluvial gully erosion	$100,000	$380,000	**$480,000**	01.07.15	31.03.16	Completed			

1.8	Sub-catchment scale monitoring, modelling and extension design to support reef water quality improvement	$100,000	$160,000	**$260,000**	01.07.15	31.03.16	Completed			
1.9	The establishment of a future NESP dredging research investment framework	$25,000	$18,094	**$43,094**	01.07.15	31.12.15	Completed			
1.10	Identification, impacts, and prioritization of emerging contaminants present in the Great Barrier Reef and Torres Strait marine environments	$100,000	$139,340	**$239,340**	1/7/15	15/3/16	Completed			
2.1	Assessing the cumulative impacts of climatic disturbances on inshore GBR coral reefs, identifying key refuges and testing the viability of manipulative reef restoration	$85,000	$180,612	**$265,612**	01.07.15	31.03.16	Completed			
2.2	A tradable permit scheme for cost effective reduction of nitrogen runoff in the sugarcane catchments of the Great Barrier Reef	$99,721	$232,820	**$332,541**	01.08.15	29.02.16	Completed			
3.1	Seagrass mapping synthesis – A resource for marine park and coastal management	$36,000	$54,500	**$90,500**	1.07.2015	15.02.16	Completed	NESP Science Day Presentation	http://bit.ly/2v0cJeT	
								NESP Science Day Video	https://www.youtube.com/watch?	
3.2	Improving historical estimates of abundance and distribution of dugongs and large green turtles in western and central Torres Strait	$97,674	$342,236	**$439,910**	01.07.15	31.03.16	Completed			
3.3	Light thresholds for seagrasses of the GBR: a synthesis and guiding document for managing seagrass	$29,755	$51,308	**$81,063**	01.07.15	31.12.15	Completed			
3.4	Developing and refining biological indicators for seagrass condition assessments in an integrated monitoring program	$68,584	$201,665	**$270,249**	01.07.15	31.01.16	Completed			

3.5	Assessment of key dugong and turtle seagrass resources in the northern Torres Strait	$99,696	$149,768	**$249,464**	01.07.15	31.03.16	Completed			
3.6	Establishing a research framework for future NESP investment into better understanding of the presence of Box-Jellyfishes (Irukandji) and risks in the Great Barrier Reef	$30,000	$57,705	**$87,705**	01.07.15	28.02.16	Completed			
3.7	Monitoring the effects of zoning on coral reefs and their associated fish communities in the GBR Marine Park	$100,000	$225,450	**$325,450**	01.07.15	30.12.15	Completed			
3.8	Towards an integrated monitoring program: identifying indicators and existing monitoring programs to cost-effectively evaluate the Long Term Sustainability Plan	$100,000	$110,000	**$210,000**	01.07.15	31.12.15	Completed			
3.9	Indigenous capacity building and increased participation in management of Queensland sea country	$100,000	$100,000	**$200,000**	01.07.15	30.03.16	Completed			
3.10	Benchmarking costs of NRM improvements for the GBR	$29,487	$65,193	**$94,680**	01.07.15	31.12.15	Completed			
3.11	Monitoring and adaptively reducing system-wide governance risks facing the GBR	$55,537	$99,286	**$154,823**	01.07.15	15.03.16	Completed			
3.12	Development of an offset financial contribution calculator for Reef Trust	$80,595	$95,153	**$175,748**	01.07.15	31.03.16	Completed			

3.13	eAtlas 2015 - NESP data management, Torres Strait NRM plan delivery platform and Torres Strait reef mapping	$98,040	$110,741	**$208,781**	01.07.15	31.12.15	Completed			
2.1.1	Integrated Pest Management of Crown-of-Thorns Starfish	$604,722	$755,722	**$1,360,444**	01.01.16	10.12.18	Ongoing	• Review paper outlining preliminary ecologically-informed CoTS local-scale control strategy for individual reef sites (December 2016) • Report detailing refined ecologically-informed CoTS local-scale control strategy and rules of thumb for individual reef sites (December 2017) • Phone, tablet or PC-based field-deployable Decision Support Tool (December 2018) • Report and data describing detailed juvenile, sub-adult and adult surveys of key reefs (December 2017 and 2018) • Report and data describing CoTS adult movement data (December 2016 and 2017) • Report detailing the impact of CoTS predators, through a review of Green and Blue Zones, and a review of research into triton (December 2016) • Report outlining results of tests of eDNA for surveillance and recommendations based on these	http://eatlas.org.au/gbr-gateway-temp)	The end-user data entry and decision support tool has been extensively developed, presented to various on-water end-user and stakeholder groups, and workshopped with other researchers in the CoTS Working Group. Feedback has been received from AMPTO, GBRMPA and DoEE representatives. Throughout an extensive engagement period, it has received strong support from on-water end-users and managers, as well as funders and policy makers.
								Project 2.1.1 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/10/NESP-TWQ-Project-2.1.1-Factsheeta.pdf	
								Project 2.1.1 Interim Report: Strategies for Surveillance and Control: Using Crown-of-Thorns Starfish management program data to optimally distribute management resources between surveillance and control	http://nesptropical.edu.au/wp-content/uploads/2016/07/NESP-TWQ-2.1.1-INTERIM-REPORT-1.pdf	
								Journal Article - Pratchett MS, Cowan Z, Nadler LE, Caballes CF, Hoey AS, Messmer V, Fletcher CS, Westcott DA, Ling SD (2017) Body size and substrate type modulate movement by the western Pacific crown-of-thorns starfish, Acanthaster solaris. PLoS ONE 2(9): e0180805 doi: 10.1371/journal.pone.0180805	https://www.ncbi.nlm.nih.gov/pubmed/28877193	
								Journal Article - Pratchett MS, Cowan Z, Nadler LE, Caballes CF, Hoey AS, Messmer V, Fletcher CS, Westcott DA, Ling SD (2017) Body size and substrate type modulate movement by the western Pacific crown-of-thorns starfish, Acanthaster solaris. PLoS ONE 2(9): e0180805 doi: 10.1371/journal.pone.0180805	http://nesptropical.edu.au/index.php/round-2-projects/project-2-1-1/	
								Technical Report: The potential role of the giant triton snail, Charonia tritonis (Gastropoda: Ranellidae) in mitigating populations of the crown-of-thorns starfish		
2.1.2	Scoping options for low-lying, marginal cane land to reduce DIN in priority wet tropics catchments	$94,000	$158,404	**$252,404**	01.01.16	28.02.17	Completed	• Map showing low-lying, marginal cane land in the priority wet tropics catchments. This will be compatible with other platforms and provided for use by Terrain NRM, local, state and federal Government and other stakeholders. • At-source cost/benefit curves that outline water quality improvement and ecosystem service benefits for alternative land uses. The economic assessment will also quantify potential future income streams such as carbon, water quality credits and rate rebate options. • Report detailing the constraints and opportunities and cost/benefits of alternative		Research undertaken as part of this project has created an analytical framework capable of identifying areas of land currently used for the production of sugarcane that can be considered high risk from a nitrogen enrichment perspective and potentially suitable for conversion to alternative uses. The framework helps to identify candidate sugarcane land for conversion, and then provide an objective evaluation of the financial impact of converting high DIN risk sugarcane land to alternative land uses. The goal here is to choose land use that would result in DIN reduction at minimum cost to society.
								Project 2.1.2 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/10/NESP-TWQ-Project-2.1.2-Factsheet.pdf	

								Project 2.1.2 Final Report "Scoping land conversion options for high DIN risk, low-lying sugarcane, to alternative use for water quality improvement in Wet Tropics catchments"	http://nesptropical.edu.au/wp-content/uploads/2018/04/NESP-TWQ-Project-2.1.2-Final-Report-Complete.pdf	
2.1.3	Harnessing the science of social marketing and behaviour change for improved water quality in the GBR: an action research project	$480,000	$560,000	**$1,040,000**	01.01.16	10.12.18	Ongoing	Planned outputs include • Three 'factsheets' o one produced relatively early in the life of the project which outlines key objectives and proposed methods (including identification of programmes that will be evaluated as part of the research); o one part way through the project, providing an 'update' of insights gleaned; o a final one at the end summarising key findings and impacts. • Marketing materials/strategy guidelines and templates, including readability assessment tools and message framing guidelines to support the roll out of Programme X (the programme selected for focused research support and adaption). • A final report • Journal articles and conference papers		Specific recommendations have been made regarding the role of agricultural extension officers: "There is a potential to extend the key role of extension officers in potentially influencing increased uptake of BMP practices. There is a need to recognise the key role of extension officers and determine what professional development support might be beneficial in continuing to build trust and engagement with land managers". "There is a need to 'sell the science' to gain acceptance of the cause-effect relationship between farming practice and water quality. NRM groups should work with environmental science specialists to change views on the impact of farming practice on water quality". The final reports will have an impact on NRM regional bodies and will feed into the MIPS program.
								Project 2.1.3 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/12/NESP-TWQ-Project-2.1.3-Factsheetb.pdf	
								Interim Report 1 - Harnessing the science of social marketing and behaviour change for improved water quality in the GBR: Background review of literature	http://nesptropical.edu.au/wp-content/uploads/2017/01/NESP-TWQ-2.1.3-INTERIM-REPORT-1.pdf	
								Interim Report 2 -Harnessing the science of social marketing and behaviour change for improved water quality in the GBR: A documentary analysis of Reef Trust Tender (Burdekin) and Reef Programme	http://nesptropical.edu.au/wp-content/uploads/2017/01/NESP-TWQ-2.1.3-INTERIM-REPORT-2.pdf	
2.1.4	Demonstration and evaluation of gully remediation on downstream water quality and agricultural production in GBR rangelands	$600,000	$824,694	**$1,424,694**	01.01.16	10.12.18	Ongoing	The Planned outputs from this project include: • Reporting on the effectiveness (in terms of cover, erosion and water quality) of various gully remediation approaches in the Burdekin catchment • Reporting on the cost of various gully remediation approaches implemented (which will include site maintenance etc)		Participation in the Gully Terrain Analysis workshop and Reef Trust Erosion Control Forum has resulted in continual discussions with the Queensland Government Remote Sensing Centre, DAWR terrain analysis project, Reef Trust and regional NRM bodies to discuss 'scaling-up' of the project results from an individual gully to properties and sub-catchments for erosion control. It is important to keep in mind that several wet seasons of data will be needed to make any confident statements about the effectiveness of the results from this study. There has been considerable investment in monitoring equipment and infrastructure and it is hoped that these sites can be maintained for >3-5 wet seasons, or much longer, if suitable funding is available. This project is still underway and the project team is continuing to work with their end users to maximise impact on decion making and policy change.
								Project 2.1.4 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/10/NESP-TWQ-Project-2.1.4-Factsheet.pdf	
								Technical Report 1 - Quantifying the effectiveness of gully remediation on off-site water quality: preliminary results from demonstration sites in the Burdekin catchment	http://nesptropical.edu.au/wp-content/uploads/2017/10/NESP-TWQ-2.1.4-TECHNICAL-REPORT-1.pdf	
								NESP Science Day Presentation - Quantifying the effectiveness of gully remediation on off-site water quality: preliminary results from demonstration sites in the Burdekin catchment	http://nesptropical.edu.au/wp-content/uploads/2017/12/Project-2.1.4-Lo.pdf	
								NESP Science Day Video - Quantifying the effectiveness of gully remediation on off-site water quality: preliminary results from demonstration sites in the Burdekin catchment	https://www.youtube.com/watch?v=3UN6PT5N9gA	
								Jarihani, B., Sidle, R.C., Bartley, R., Roth, C.H. and Wilkinson, S.N., In review. Characterisation of the hydrological response to rainfall at multi spatio-temporal scales in savannas of semi-arid Australia. Water	https://www.preprints.org/manuscript/201706.0056/v1	
								Koci, J., Leon, J., Jarihani, B., Sidle, R., Wilkinson, S. and Bartley, R., Accepted. Assessment of UAV and ground-based Structure from Motion with Multi-View Stereo photogrammetry in a gullied savanna catchment. International Journal of Geo-Information	http://www.mdpi.com/2220-9964/6/11/328/htm	
2.1.5	What's really damaging the Reef? Tracing the origin and fate of the environmentally detrimental sediment	$600,000	$868,696	**$1,468,696**	01.01.16	10.12.18	Ongoing	• The project outcomes will be communicated through progress reports, a technical report, conceptual models and peer-reviewed publications. • With the assistance of the Knowledge Transfer component of the TWQ hub, other outputs such as the construction of conceptual diagrams, fact sheets and media releases will be developed as a further communication strategy for the research outputs.		The project leader participated in the GBR Water Quality Science Reef Synthesis Workshop in November 2017 and participated in a video to highlight research on sediment erosion, delivery and impacts from catchment to reef for the Major Integrated Project in the Bowen-Bogie-Broken catchments. The project has also been engaging with Traditional Owners of the sea country where the research has been taking place including the Gudjuda Reference Group, Woppaburra (Traditional Owners of Keppel Island) where sediment traps are placed within Keppel Bay and Yuku Baja Muliku Traditional Owners. It is an aspiration of Traditional Owners to be involved in Reef 2050 TO led water quality actions. This project is still underway and the project team is continuing to work with their end users to maximise impact on decion making and policy change.

								Project 2.1.5 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/10/NESP-TWQ-Project-2.1.5-Factsheet.pdf	
2.1.6	From exposure to risk: novel experimental approaches to analyze cumulative impacts and determine thresholds in the GBRWHA	$410,165	$410,165	**$820,330**	01.01.16	10.12.18	Ongoing	This project will produce a number of reports and publications, conference presentations, and material for fact sheets and reviews. It will also produce a range of datasets from the experimental work, and analyses of cumulative impacts for selected field sites. These outputs will be communicated to GBRMPA, the Department of the Environment and to the Queensland Office of the GBR on a six-monthly basis.		The development of species sensitivity distributions has progressed in a collaboration with DSITI. Ken Anthony co-authored two chapters for the Reef 2050 Plan Review Options report to DoEE: (1) Ecosystem Health and Biodiversity, and (2) GBR Future Trajectories. This project is still underway and the project team is continuing to work with their end users to maximise impact on decion making and policy change.
								Project 2.1.6 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/10/NESP-TWQ-Project-2.1.6-Factsheet.pdf	
								Journal Article: Cumulative Effects of Nutrient Enrichment and Elevated Temperature Compromise the Early Life History Stages of the Coral Acropora tenuis	http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0161616	
								Journal Article: Model fit versus biological relevance: Evaluating photosynthesis-temperature models for three tropical seagrass species	https://www.nature.com/articles/srep39930	
								Journal Article: Collier, C. J., Y. X. Ow, L. Langlois, S. Uthicke, C. L. Johansson, K. R. O'Brien, V. Hrebien, and M. P. Adams. 2017. Optimum Temperatures for Net Primary Productivity of Three Tropical Seagrass Species. Frontiers in Plant Science 8 . 10.3389/fpls.2017.01446	https://www.frontiersin.org/articles/10.3389/fpls.2017.01446/full	
								NESP TWQ Science Day Presentation	http://nesptropical.edu.au/wp-content/uploads/2017/12/Project-2.1.6-Lo.pdf	
2.1.7	Engaging with farmers and demonstrating water quality outcomes to create confidence in on-farm decision-making	$600,000	$645,500	**$1,245,500**	01.01.16	10.12.18	Ongoing	• The project outcomes will be communicated through progress reports, technical reports, conceptual models and peer-reviewed publications • With the assistance of the Knowledge Transfer component of the TWQ hub, other outputs such as the construction of conceptual diagrams, fact sheets and media releases will be developed as a further communication strategy for the research outputs.		A range of communication and engagement activities were undertaken over the course of the milestone reporting period. The Project 25 Grower group-Steering Committee itself was kept informed of sampling results on an approximate monthly basis via email communications. A range of additional broader communication events, that involved the stakeholder steering committee members, the sugarcane industry, QDAF, SRA and the broader community also occurred. There is ad hoc evidence of the larger pilot growers now influencing other cane growers to understand the science and impact of real-time monitoring on their properties. This project is still underway and the project team is continuing to work with their end users to maximise impact on decion making and policy change.
								Project 2.1.7 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/10/NESP-TWQ-Project-2.1.7-Factsheet.pdf	
								Project Video - Scientists and Farmers working together for Great Barrier Reef water quality	https://youtu.be/cuslOI8RD9o	
								NESP Science Day Presentation - "Project 25" - farmers, water quality and on-farm decision-making	http://nesptropical.edu.au/wp-content/uploads/2017/12/Project-2.1.7-Lo.pdf	
								NESP Science Day Video	https://youtu.be/IwCm-eztCXM	
								Article: Canegrowers Magazine "Growers gain valuable insig"ht into water quality monitoring projects	https://issuu.com/canegrowers0/docs/2018-03-12-australiancanegrower/20	
								Article: Canegrowers Magazine	https://issuu.com/canegrowers0/docs/2016-07-18_australian_canegrower_-_/7	
2.1.8	Improved water quality outcomes from on-farm nitrogen management	$700,000	$1,507,903	**$2,207,903**	01.01.16	10.12.18	Ongoing	• All datasets produced during the project will be uploaded onto the SSIMR (DSITI) corporate information system and made accessible to all project team members. The final technical report of the project will have, as an attachment, a metadata index indicating where project data are located. • Project data will comprise individual site details and records, and collated datasets for input into the models (APSIM/How Leaky) and decision support tools (SafeGauge for Nutrients). • The project outcomes will be communicated through progress reports, the final technical report and peer-reviewed publications.		NESP project staff (Bell, Moody, Webster) have participated in stakeholder workshops to ensure alignment of NESP and Reef Trust 4 (EEF) activities, provide technical input into the development of other Reef Trust projects, ensure the NESP project concepts are understood in the broader sugarcane N research agenda, and contribute to the understanding of sugarcane N management initiatives for the Reef Science Consensus Statement. Bell, Moody and Webster are members of the Reef Trust 4 TAG, contributing to treatment mix, site selection and fertilizer product decisions. The project leader is also involved in the Reef 2050 IEP meeting and workshop on coral bleaching and implecations for the Reef 2050 Plan including development of advice to the MInister. Disucssions have also been held with industry partners EcoCatalysts Pty Ltd, Solvay, Impact Fertilizers and Eurochemregarding experimental controlled release fertilizer products .
								Project 2.1.8 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/10/NESP-TWQ-Project-2.1.8-Factsheet.pdf	

								Media Release: New fertilizers to protect Reef and farm profitability	http://nesptropical.edu.au/wp-content/uploads/2017/01/New-Fertilizers-to-protect-Reef-farm-profitability-Project-2.1.8.pdf	
								Conference Presentation - Tracking nitrogen from the paddock to the reef - a case study from the Great Barrier Reef	http://nesptropical.edu.au/wp-content/uploads/2017/01/INI2016_Bell_Michael_PRESENTATION.pdf	
								NESP TWQ Science Day Presentation - Using production unit yield potential and enhanced efficiency fertilisers to improve the efficiency of sugarcane N use	http://nesptropical.edu.au/wp-content/uploads/2017/12/Project-2.1.8-Lo.pdf	
								NESP TWQ Science Day Video	https://youtu.be/RRy284Z58aY	
2.1.9	Risk assessing dredging activities	$515,806	$1,031,486	**$1,547,292**	01.06.16	10.12.18		Planned Outputs include scientific papers, algorithms for spectral light changes, websites including photographs and videos managed with metadata. Technical reports/synthesis Media releases		
								Project 2.1.9 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/11/NESP-TWQ-Project-2.1.9-Factsheet.pdf	
								Journal Article: James Whinney, Ross Jones Alan Duckworth, Peter Ridd (2017) Continuous in situ monitoring of sediment deposition in shallow benthic environments. Coral Reefs. 36: 521 ⁋ 533	https://link.springer.com/article/10.1007/s00338-016-1536-7	
								Duckworth, Alan & Giofre, Natalie & Jones, Ross. (2017). Coral morphology and sedimentation. Marine Pollution Bulletin. 125. 10.1016/j.marpolbul.2017.08.036	https://www.sciencedirect.com/science/article/pii/S0025326X17307063	
2.1.10	The application and adaptation of mine site rehabilitation approaches to alluvial gully rehabilitation in the Bowen Catchment	$100,000	$130,000	**$230,000**	01.04.2016	30.04.2017	Completed	• Communication materials (Youtube videos; media stories; plain English community outreach materials/factsheets) • Concept plans for large scale rehabilitation demonstration projects on at least 2 separate sites within the broader study area • An implementation plan for the demonstration sites, including consideration of commitments for cash and in-kind support from the project partners. • Collation of all existing baseline data for the identified sites – including datasets held by the mining companies • A detailed monitoring strategy for the demonstration project sites.		As a result of this project significant progress has been made towards the development of a major collaborative project that will take this forward into large field trials of the application of mine site rehabilitation strategies for alluvial gully rehabilitation (project 3.1.7)
								Project 2.1.10 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/11/NESP-TWQ-Project-2.1.10-Factsheet.pdf	
								Communique 1	http://nesptropical.edu.au/wp-content/uploads/2016/10/Project-2-1-10-COMMUNIQUE-Collinsville-Alluvial-Gully-Workshop-COMPLETE.pdf	
2.2.1	Identifying the water quality and ecosystem health threats to the high diversity Torres Strait and Far Northern GBR from runoff from the Fly River	$360,000	$366,200	**$726,200**	01.01.16	30.05.18	Ongoing	Expected outputs based on the project components: Review of existing knowledge: • Synthesis report on Fly River discharge plume behaviors in the Gulf of Papua and northern Torres Strait, and condition of receiving environments. Monitoring and modeling Fly River plumes: • Develop maps of estimated extent of plume intrusions • Visualisation of plume movement • Further development of available modelling tools • Incorporation of data into TS eAtlas Overall: • Final project report detailing the results of the project, including management recommendations and priorities for further investigations. Final Report: Due 30 May 2018		The project team is working closely with the Torres Strait Regional Authority Rangers and the Land and Sea Management Unit (Environmental Management Program) to conduct the salinity monitoring described above. To date, we have engaged with TSRA Rangers from Erub, Masig, Warraber, Poruma, Saibai and Boigu. TSRA have incorporated a data entry form into their Fulcrum reporting system which is a tablet-based system. Rangers enter the data through Fulcrum which provides an automatic notification and collates the data into a spreadsheet. This has assisted to provide consistent and more efficient data collection and submission. The project team has undertaken to meet with the island communities again towards the end of the project to share and discuss the results, including potential implications of the results. This would be done in conjunction with Project 2.2.2.
								Project 2.2.1 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/10/NESP-TWQ-Project-2.2.1-2.2.2-Factsheet.pdf	
								Interim Report 1 - Coral Core Records of the North-East Torres Strait	http://nesptropical.edu.au/wp-content/uploads/2017/01/NESP-TWQ-2.2.1-INTERIM-REPORT-1.pdf	
								NESP TWQ Science Day Presentation - Influence of the Fly River on the Torres Strait	http://bit.ly/2IDX9re	

2.2.2	Impacts of mine-derived pollution on Torres Strait environments and communities	$290,000	$290,000	**$580,000**	01.02.16	30.05.18	Ongoing	• A final report will be prepared towards the end of the project and made publically-available via web download. • At least three conference presentations at local and international conferences • It is envisaged that there will be at least three peer reviewed journal publications • Regular information sheets (one per year) will be prepared with the assistance of the CSIRO communications team. These will be available for download from the CSIRO, NESP TWQ Hub and eAtlas websites. Hard copies will be provided to the TSRA for distribution to local communities. • Regular contributions to the Tropical Water Quality Hub newsletter • A mid-project and end-of-project workshop will be held at a suitable location in the Torres Strait with a view to updating local stakeholders on project progress.		
								Project 2.2.2 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/10/NESP-TWQ-Project-2.2.1-2.2.2-Factsheet.pdf	
								NESP TWQ Science Day Presentation - Influence of the Fly River on the Torres Strait	http://nesptropical.edu.au/wp-content/uploads/2017/12/Project-2.2.1-and-2.2.2-Lo.pdf	
2.2.3	Early warning systems to minimize the risk of box jellyfish stings by empowering stakeholders	$250,000	$838,357	**$1,088,357**	01.01.16	10.12.18	Ongoing	• Robust early warning system for empowering stakeholders to forecast the risk of jellyfish stings; • The Venomous Jellyfish Database will be (in the public domain) used to build forecasting models and can be used to increase our understanding of jellyfish ecology; • Irukandji and stinger forecast models for sting hotspots at the three focal areas (FNQ beaches, FNQ reefs and islands, and Magnetic Island); • Real-time forecasts of predicted sting events at sting hotspots; • Identified stakeholder management needs, potential actions, and the most effective modes of delivery for our forecasting system based on stakeholder engagement; • Information sessions with stakeholders; • Greater understanding of the influence of water quality and associated factors on stinger/Irukandji occurrences		Yirrganydji Rangers have continued to be involved in the project after training was provided by Project 3.6. Initial deployment and testing of 'irukandjicam' and 'stingercam' cameras was also completed with support from Gavin Singleton (Yirrganydji tribe) and Indigenous Rangers. Field work is within the Yirrganydji TUMRA. The project is also collaborating with Cairns Regional Council, Yorkeys Knob Boat Club and Surf Lifesaving Queensland in field trials and field data collecton. The ability to predict chances of stings occurring will assist the Surf Lifesaving organisation and the tourism industry. This project is still underway and the project team is continuing to work with their end users to maximise impact on decion making and policy change.
								Project 2.2.3 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/11/NESP-TWQ-Project-2.2.3-Factsheet.pdf	
								Venomous Jellyfish Database	http://eatlas.org.au/data/uuid/09311b48-e6f1-484f-945b-8a5b5bfba232	
2.3.1	Benthic light as ecologically-validated GBR-wide indicator for water quality: drivers, thresholds and cumulative risks	$499,471	$504,871	**$1,004,342**	01.01.16	10.12.18	Ongoing	• A WQI as a reporting metric using benthic light availability, with well-defined drivers and thresholds applicable to coral health, seagrass, and ecological health indicators reported by MMP. • Incorporation of the developed bPAR algorithm into NASA's SeaDAS processing software, as an operational algorithm freely available to the scientific community. • Data on in-situ PAR measurements from the IMOS stations will be made freely available to the scientific community. • Data sets (netCDF format: monthly mean climatologies of benthic irradiance), metadata and maps of benthic irradiance (climatologies and monthly means), and cumulative pressures overlay with temperature, will be distributed through the eAtlas. • Scientific reports and publications on the use of benthic irradiance as a WQI for the GBR; • Scientific reports and publications on light requirements and thresholds for reef organisms		Discussions about how benthic PAR can be incorporated into the newly developed Water Quality Index for the 2017 and 2018 Report Cards (NESP 3.2.5) have been held. The project will continue to work towards benthic PAR as an integrated, responsive, and easy-to-measure water quality indicator, which can be related to specific WQ drivers, easily communicated to the public, and seamlessly incorporated into the Reef Plan Report Cards, and inform Outlook Report and future regional Water Quality Improvement Plans. The timeframe to deliver a final ecologically relevant light based indicator is late 2018.
								Project 2.3.1 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/10/NESP-TWQ-Project-2.3.1-Factsheet.pdf	
								NESP Science Day Presentation - Every bucket counts: New insights into the role of water clarity for the health of the GBR	http://nesptropical.edu.au/wp-content/uploads/2017/12/Project-2.3.1-Lo.pdf	
								NESP TWQ Science Day Video	https://www.youtube.com/watch?v=WZ87LCG3rcM	

								Marites Canto: PhD Confirmation Literature Review: "Developing benthic irradiance algorithm for the Great Barrier Reef shelf waters using MODIS satellite imagery". JCU		
2.3.2	'Human sensors' for monitoring Great Barrier Reef environmental changes and quality of marine waters through harnessing Big Data analysis	$227,145	$239,892	**$467,037**	01.01.16	10.12.17	Completed	The following outputs will be produced and shared: 1. Research publications: at least 3 journal articles in relevant environmental management journals and at least 2 journal articles in Computer Science journals 2. Popular articles on key findings (e.g. The Conversation and other outlets) 3. Development of an infographic to illustrate the use of micro-blog/social media data for environmental monitoring 4. Meta-data information made available to other researchers in this field. 5. Provision to the data as relevant to e-atlas (TWQ Hub)		An infographic has been developed and is made public on the GIFT website and via the Institute's social media channels. It will also be sent to stakeholders. The commes strategy has been implemented and findings have been shared via video, The Conversation, other media, and academic outputs. Jessica Hoey (GBRMPA) helped disseminate a stakeholder update to TUMRA coordinators and IRAC members. It was found that text-based social media itself in appear less suitable for environmental monitoring per se, but are useful for socio-economic monitoring. This has been discussed with stakeholders and future research opportunities to exploit social media for human-focused use cases are being developed. A preliminary analysis of images (also in conjunction with project 3.2.3), however, has revealed that photos/videos provide a substantial opportunity for environmental monitoring. Again, this insight has been shared with stakeholders and further research on automated image recognition is underway. Final Report initally submitted on 10/12/2017
								Project 2.3.2 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/10/NESP-TWQ-Project-2.3.2-Factsheet.pdf	
								NESP TWQ Science Day Presentation - Big Data Approaches to Reef monitoring	http://nesptropical.edu.au/wp-content/uploads/2017/12/Project-2.3.2-and-3.2.3-Lo.pdf	
								NESP TWQ Science Day Video	https://youtu.be/e7dPHrbE_Kw	
								Conference Presentation: Human sensors - monitoring the Great Barrier Reef	http://nesptropical.edu.au/wp-content/uploads/2016/08/SurreyGBRCitizenScience2.pdf	
								Conference Paper: Citizen science - exploring tourists' observations on micro bloags as a tool to monitor environmental change	http://nesptropical.edu.au/wp-content/uploads/2016/08/PaperBeckenSTanticGBRBigdataSurrey9.pdf	
2.3.3	Building Indigenous livelihood and co-management opportunities in the Northern GBR –ecosystem services and conservation governance for water quality	$250,000	$272,372	**$522,372**	01.01.16	10.12.17	Completed	The major planned outputs of the project are: • a co-authored Interim Summary Report at the end of year 1 • a co-authored Final Report at the completion of the project • 2 draft research journal papers, each led by a different member of the project team and focused on: o the application of ES products and frameworks to the Eastern Cape and Northern GBR, emphasizing watershed services, nutrient offsets, and/or livelihood co-benefits o regional governance and policy implications of the expansion of ES markets across Cape York Peninsula • supporting datasets encompassing: o literature review of ecosystem services watershed products, metrics and monitoring; o the relationship of ES frameworks to contemporary Indigenous livelihoods and to the co-benefits derived from conservation action; and o the applicability of novel water-quality focused ES products for Eastern Cape and Northern GBR		Outcomes from the research directly influenced the CSIRO/JCU/AIM consortium approach related to the mid-term review of the Reef 2050 Plan. Through the current Reef 2050 Traditional Owner Aspirations Project Consortium, key outputs from this research are continuing to inform the development of a TO led policy response to end term review associated with the Reef 2050 Plan. Project 2.3.3 has provided substantial additional value to the NESP TWQ Hub through synergies with related projects involving 2.3.3 team members funded through the NESP TWQ and NESP Northern Hubs, through biodiversity funding sources, through additional research partner contributions, and through CSIRO innovation programs. The project has been successful in undertaking Indigenous community-based evaluation of potential ecosystem services provision on Southern Kaantju territory in eastern Cape York. The need to secure non-government investment support for Indigenous ecosystem services provision represents both the problem and the opportunity for next steps in this research. The outcomes of this project are being relayed through Traditional Owner networks for community contributions to actively working on water quality in coastal regions of the GBR. Programs similar to this contribute to land and sea ranger programs, environmental management and custodianship and community benefits.
								Project 2.3.3 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/10/NESP-TWQ-Project-2.3.3-Factsheet-Stakeholder.pdf	
								Interim Report Number 1 - Scoping market-based opportunities for Indigenous provision of water quality services and associated conservation governance in the Northern Great Barrier Reef	http://nesptropical.edu.au/wp-content/uploads/2017/01/NESP-TWQ-2.3.3-INTERIM-REPORT-1a.pdf	
								Journal Article: Barber, M., and S. Jackson. 2017. Identifying and categorizing cobenefits in state-supported Australian indigenous environmental management programs: international research implications. Ecology and Society 22(2):11. https://doi.org/10.5751/ES-09114-220211	https://www.ecologyandsociety.org/vol22/iss2/art11/	
								Project 2.3.3 Video	https://vimeo.com/246704119?ref=em-v-share	

2.3.4	Working with traditional owners and local citizens to better manage GBR estuarine wetlands	$450,000	$476,260	**$926,260**	01.01.16	10.02.18	Ongoing	All reports from this project will be publically available via the TropWATER, JCU website https://research.jcu.edu.au/tropwater/publications and the NESP TWQ Hub website. Stakeholder engagement workshops will provide an opportunity for public feedback on the project outcomes. Results will be published in peer-reviewed journals. We envisage three publications as a result of this research around the following themes: • Traditional Owner engagement and value in estuarine wetland management • Estuarine wetland monitoring and evaluation toolkit to inform estuarine wetland repair • Post-flood recovery of estuarine wetlands		Mangrove management Plan workshop brought together JCU, Gidarjil Development Corportation, MangroveWatch, Fitzroy Basis Association, and the Burnett Mary Regional Group to reflect on project results and discuss future impacts of: The regional Mangrove Management Plan; Tidal Wetland Monitoring Strategies; Tidal wetland restoration works and oppportunities; and Local tidal wetland values, threats and changes. This project is still underway and the project team is continuing to work with their end users to maximise impact on decion making and policy change.
								Project 2.3.4 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/11/NESP-TWQ-Project-2.3.4-Factsheet.pdf	
								Journal Article: The Shoreline Video Assessment Method (S-VAM): Using dynamic hyperlapse image acquisition to evaluate shoreline mangrove forest structure, values, degradation and threats	https://www.sciencedirect.com/science/article/pii/S0025326X16303903	
								Journal Article: Oil spill impacts on mangroves: Recommendations for operational planning and action based on global review	https://www.sciencedirect.com/science/article/pii/S0025326X16304866	
								Journal Article: The state of legislation and policy protecting Australia's mangrove and salt marsh and their ecosystem services	https://www.sciencedirect.com/science/article/pii/S0308597X16304067	
								Progress Report 1: Southern GBR Coastal Habitat Archive and Monitoring Program	http://nesptropical.edu.au/wp-content/uploads/2016/07/NESP-TWQ-2.3.4-PROGRESS-REPORT-1.pdf	
								Progress Report 2 - Southern GBR Coastal Habitat Archive and Monitoring Program (S-GBR CHAMP)monitoring report.	http://nesptropical.edu.au/wp-content/uploads/2017/02/NESP-TWQ-2.3.4-PROGRESS-REPORT-2.pdf	
2.3.5	eAtlas - Data management for environmental research	$450,000	$450,000	**$900,000**	01.01.16	31.12.18	Ongoing	• Planned outputs are that datasets from NESP TWQ hub will be published on the eAtlas.		The Australian Marine Parks Science (AMPS) Atlas project has proceeded (co-funded by Parks Australia and AIMS). This project uses an extension of the eAtlas platform and has funded the development of a map based navigation module. This capability will be reincorporated into the eAtlas website as a mechanism for finding content for areas of interest. This incorporation will be performed by late 2018. The AMPS Atlas will also be a delivery mechanism for some of the NESP Marine Biodiversity Hub content.
								Project 2.3.5 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2016/10/NESP-TWQ-Project-2.3.5-Factsheet.pdf	

3.1.1	Implementation of the crown of thorns starfish research strategy: regional strategies	$682,542	$959,411	**$1,641,953**	01.01.2017	10.12.2019	Ongoing	• Annual recommendations on priority reefs for control activities. As the DST develops these recommendations will be based on the integration of an increasingly broad range of inputs. • Automated process for developing annual connectivity matrices to underpin DST beyond the life of this project. • Decision support tool to assist in the development and assessment of management objectives and the strategies available to achieve these objectives. This DST is intended to be developed to the point that it can be used and maintained by managers and to operate with data inputs currently being collected in on-going monitoring and management programs. • Reports outlining recommended objectives and strategies identified using the DST. • Report on the prospects for biocontrol and new gene technologies in future control technologies • Report on the distribution and extent of deep reefs in the Cooktown to Townsville region, their use by COTS and the implications of this for the design and success of the control program. • Report on the relationship between zoning and COTS predators and its implications for management		1) Employment of Indigenous Trainees is an integral and funded part of the operation of the GBRMPA and AMPTO Control Program. To date this has seen a number of trainees move through the program to time employment in the program and elsewhere. 2) Contact is being made with the relevant TUMRAs (Girringun, Yirrganydj and Ganggandji) with a view to establishing a conversation about the work, their involvement in CoTS management and, should they take the initiative, to exploring their traditional knowledge of CoTS. This project is still underway and the project team is continuing to work with their end users to maximise impact on decion making and policy change.
								NESP TWQ Science Day Presentation	https://youtu.be/rzP-aAmZaT8	
								Journal Article: Hock, K., N. H. Wolff, J. C. Ortiz, S. A. Condie, K. R. N. Anthony, P. G. Blackwell & P. J. Mumby (2017). Connectivity and systemic resilience of the great barrier reef. PLOS Biology 15: e2003355	http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.2003355	
								Biocontrol - Interim Report on prospects for biocontrol for use with COTS and disease in the Asteroidea [AIMS]		
								Deep Reefs Report		
								Pratchett MS, Cowan Z-L, Nadler LE, Caballes CF, Hoey AS, Messmer V, et al. (2017) Body size and substrate type modulate movement by the western Pacific crown-of-thorns starfish, Acanthaster solaris. PLoS ONE 12(9): e0180805. https://doi.org/10.1371/journal.pone.0180805		
3.1.2	Improving water quality for the Great Barrier Reef and wetlands by better managing irrigation in the sugarcane farming system	$458,103	$506,878	**$964,981**	01.01.2017	30.06.2019	Ongoing	• Productivity data: - will be stored on industry databases. • Farmer management records - water management records will be stored in either WiSA or IrrigWeb or both. • Surveys administered and collected by the project team: - Will be stored on JCU systems. • Press releases by SRA will be stored on SRA systems		Papers have been submitted and accepted for the 2018 Irrigation Australia Conference and Exhibition, and the 2018 Australian Society of Sugar Cane Technologies conference.
								Project 3.1.2 Factsheet - Improving water quality for the Great Barrier Reef and wetlands by better managing irrigation in the sugarcane farming system	http://nesptropical.edu.au/wp-content/uploads/2017/05/NESP-TWQ-Project-3.1.2-Factsheet.pdf	
								Video: Project 3.1.2 Grower tour, JCU	https://youtu.be/MhoG1XTF0WY	
								Conference Presentation: Sexton J, Everingham Y and Donald D (2017) A comparison of data mining algorithms for improving NIR models of cane quality measures. Proceedings of the 39th Annual Conference of the Australian Society of Sugar Cane Technologists. In: ASSCT 2017: 39th Annual Conference of the Australian Society of Sugar Cane Technologists, 3-5 May 2017, Cairns,	https://researchonline.jcu.edu.au/48855/	

3.1.3	Harnessing the science of social marketing in communication materials development and behaviour change for improved water quality in the GBR: a desktop review (Project 2.1.3 - Stage 2)	$19,000	$136,800	**$155,800**	01.01.2017	10.12.2017	Completed	• Planned outputs include: Individual 'factsheets' for each set of material analysed • A final composite factsheet at the end of the analyses, summarising key findings and impacts. • Marketing materials/strategy guidelines and templates, including readability assessment tools and message framing guidelines to support the fine tuning of existing material and the roll out of future communication material. • A final report encompassing the analysis undertaken as part of Project 2.1.3 and the additional analyses proposed in this extension of the project. • Journal articles, seminar presentations and conference papers as appropriate in conjunction with co-investigators.		Improved communication within marketing material for water quality programs will help to achieve consistency in approach and message clarity, amongst the gamut of communication materials produced for projects that support the Reef 2050 Plan. Improving the way projects communicate and get buy-in from land managers can help to ensure greater project uptake, associated positive results and lasting behaviour change.
								Project 3.1.3 Factsheet - Harnessing the science of social marketing in communication materials	http://nesptropical.edu.au/wp-content/uploads/2017/08/NESP-TWQ-Project-3.1.3-Factsheet.pdf	
								Hay, R., Eagle, L., & Chan, J., (2018) Harnessing the science of social marketing and behaviour change for improved water quality in the Great Barrier Reef: Final report best practice guide for development and modification of programme communication material		
3.1.4	Optimizing the management of riparian zones to improve the health of the Great Barrier Reef	$178,491	$178,833	**$357,324**	01.01.2017	30.04.2018	Ongoing	• A report that describes methods and summarizes results on what investments conditions and types were most successful; • Compendium or manual with recommendations to guide future investment in riparian erosion-control remediation works, and estimates of the likely co-benefits for carbon and biodiversity, and; • Communication products as per the projects communication strategy, which may include; (i) presentations and audio-visual materials for focus group discussions with service providers (e.g. Greening Australia) to evaluate their response to proposed measures of revegetation; and (ii) presentations for technical workshops with DEHP and DoEE programme managers to embed results into Government investment planning (e.g. Regional Body groups, Queensland State Government (Policy and modelling groups) and the Reef Trust Unit)		A clear opportunity has presented with regard to improving incentive for landholders with riparian zones to obtain carbon credits from revegetation or regeneration projects. Currently the Emission Reduction Fund Methods available for Reforestation and Human-Induced Regeneration require project proponents to obtain biomass estimates from the FullCAM model (the model used in Australia's National Greenhous Gas accounts). The project results so far clearly indicate that proponents should be gaining significantly more carbon credits than this model, and hence, Methods, currently estimate. The data obtained from this project will assist in getting the model predictions revised to contribute to ensuring landholders with riparian investments are able to claim much higher carbon credits than currently assumed.
								Project 3.1.4 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2017/06/NESP-TWQ-Project-3.1.4-Factsheet.pdf	
3.1.5	Ecotoxicology of pesticides on the Great Barrier Reef for guideline development and risk assessments	$602,839	$670,889	**$1,273,728**	01.01.2017	10.12.2019	Ongoing	In addition to key roles in the Research and Development and Extension Sub-groups of the Reef Plan PWG we will:- • Provide data (EC10, EC50 and NOEC) and advice from the research directly to key stakeholders for the development of water quality guidelines (National, State, GBRMPA) and risk assessments (APVMA, Department of the Environment and Energy, LTSP, Reef Plan, RWQPP); • Regularly brief key stakeholders at workshops, conferences and meetings and via reports and journal publications; • Present plans and results at GBRMPA Seminar series, through fact sheets and other NESP communication channels, and the eAtlas • Presentation of data and results to key industry support organisations including SRA, Productivity Services and QDAF. • Present at national and international conferences • Scientific	http://nesptropical.edu.au/wp-content/uploads/2017/06/NESP-TWQ-Project-3.1.5-Factsheet.pdf	Project Leader had several meetings with key stakeholders to prioritise the experiments and communicated the project plans to a wide range of government and industry stakeholders and to Indigenous groups. In the next 6 months the project will have completed further toxicity tests and will submit the first series of results to DSITI for guideline development. In the last 12 months the project has delivered oral presentations and hands-on demonstrations on pesticides to almost 100 Indigenous students as well as Gudjuda and Girringun Rangers.
								Project 3.1.5 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2017/06/NESP-TWQ-Project-3.1.5-Factsheet.pdf	

3.1.6	Exploring trading in water quality credits as a cost-effective approach for managing water quality in the Great Barrier Reef	$316,837	$414,170	**$731,007**	01.01.2017	28.01.2019	Ongoing	For Stakeholders: • Plain-English summary of what would / would not be likely to work in potential credit trading schemes for managing nitrogen and sediment. • Plain-English summary of key features of potential trading frameworks for water quality credits in Reef catchments. • Plain-English summary of potential innovative business opportunities around nitrogen and sediment mitigation in the Reef catchments • Presentations of research findings and project outputs at key locations (e.g. Wet Tropics, Dry Tropics, Brisbane and Canberra), webinar enabled • Summary content, video and slideshow for the NESP TWQ webpage For academia: • At least two peer-reviewed papers detailing research findings		Discussions with GreenCollar to determine the potential scale of demand for environmental investments in Reef Credits. Discussions with GreenCollar have also covered possible mechanisms for implementing and monitoring on-ground projects for supplying Reef Credits through changes in management practice and land use. The project team has met with the Office of the GBR and DSITI Paddock to Reef staff on several occasions.
								Project 3.1.6 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2017/06/NESP-TWQ-Project-3.1.6-Factsheet.pdf	
								NESP TWQ Science Day presentation - Exploring trading in water quality credits as a cost-effective approach for managing water quality in the Great Barrier Reef	http://nesptropical.edu.au/wp-content/uploads/2017/12/Project-3.1.6-Lo.pdf	
3.1.7	Reducing sediment loads to the Great Barrier Reef: developing optimal approaches for treating alluvial gully erosion	$600,000	$850,990	**$1,450,990**	01.01.2017	10.12.2019	Ongoing	• Project outputs will be published on several websites, including http://www.capeyorkwaterquality.info/, CYNRM, BDT, DSITI, Greening Australia and the NESP TWQ Hub website. • Dedicated policy briefing event • Peer-reviewed publications • Key findings 'brochure' prepared, targeted at the generalist reader • Presentation of results at relevant conferences • Communication of key findings in media releases (coordinated with the NESP)		All research is directly contributing to the improved management of Crocodile Station property (and others in the area). Springvale Station recently purchased by the Qld Govt Dept EHP is directly applying the lessons learned and techniques developed for the management of gully erosion processes on this property –through associated projects with CYNRM the project team will be abe to monitor several Indigenous owned properties that are applying the techniques developed through this research. Number of Indigenous people trained in the use of environmental management tools and techniques in the project - 20
								Project 3.1.7 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2017/08/NESP-TWQ-Project-3.1.7-Factsheet.pdf	
								NESP TWQ Science Day Presentation - Alluvial Gully Rehabilitation: where are we up to?	http://nesptropical.edu.au/index.php/round-3-projects/project-3-1-7/	
3.1.8	Innovative economic levers: a system for underwriting risk of practice change in cane-farming	$400,000	$404,330	**$804,330**	01.01.2017	10.12.2019	Ongoing	• Project outputs will be published on the NESP TWQ Hub website. • Dedicated policy briefing event • Peer-reviewed publications • Project brochure prepared, targeted at farmers/industry • Presentation of results at relevant conferences • Communication of key findings in public releases (coordinated with the NESP)		Feedback from insurance companies shows that insuring against an adverse outcome from a management practice change (i.e. changed N fertiliser) is both technically and culturally quite different from common agricultural insurance products, i.e. specified risk (e.g. hail) or multi-peril crop insurance. This difference means the insurance businesses do not intuitively have a sense for the risks associated with a management-based product, nor a clear idea of the information (data) needed to quantify the risk. The difference also means there is scepticism about the commercial viability of such a product. Despite this scepticism, some insurance companies are happy to collaborate in the project. Their contributions have been constructive and valuable. However, that is not the case for all companies (or all other stakeholders). Four key Traditional Owner groups have been contacted with regard to this project. • Dawul Wuru – Yirrganydji Traditional Owners • Abriculture – a company set up by a Yidinji Traditional Owner • Djunbunji Land and Sea Program – Mandingalbay Yidinji Traditional Owners. They are keen to be involved with connecting us to cane growers in the East Trinity catchment area. The Djunbunji Land & Sea program manage water quality monitoring in the East Trinity Reserve – with Hills Creek running through the park. They have good relationships with canegrowers in the area. • Girringun Aboriginal Corporation Jake at Mungalla Station (Nywaigi Aboriginal People) is keen to stay in touch via phone on the project progress.
								Project 3.1.8 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2017/08/NESP-TWQ-Project-3.1.8-Factsheet.pdf	

3.2.1	Deriving ecologically relevant load targets to meet desired ecosystem condition for the Great Barrier Reef: a case study for seagrass meadows in the Burdekin region	$497,765	$813,459	**$1,311,224**	01.01.2017	30.06.2019	Ongoing	Written outputs: • Plain English summaries of project progress as emails and fact sheets for end-users, including TOs • Manuscripts submitted to peer-reviewed journals • Final report including: o A protocol for establishing seagrass desired state o Desired state for the Burdekin region o ERTs for light and sediment loads in the Burdekin region o Benthic light and Kd at multiple seagrass sites in Cleveland Bay over multiple time periods General outputs: • Presentations that will be delivered to end-users, NESP TWQ annual conferences and at national conferences where appropriate • Press releases, social media postings (tweets, Facebook and website updates) and summary plain English information sheets coinciding with each report/paper release in accordance with		The project has expanded the scope of the work to include habitat classification and desired state targets for the entire GBR, and not just Cleveland Bay. This has been made possible by working with, and getting additional support from RIMReP and CSIRO. A complimentary activity occurred in June – September that focussed on clarifying information needs of environmental managers of the Great Barrier Reef. This information has been used to inform the NESP project to better understand how desired state of seagrass and trends of seagrass relative to desired state can assist managers.
								Project 3.2.1 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2017/08/NESP-TWQ-Project-3.2.1-Factsheet.pdf	
								NESP TWQ Science Day Presentation - Light, turbidity, seagrass and water quality targets	http://nesptropical.edu.au/wp-content/uploads/2017/12/Project-3.2.1-Lo.pdf	
3.2.2	The IMS 2050 Human Dimensions Project: cost-effective indicators and metrics for key GBRWHA human dimensions	$150,000	$251,693	**$401,693**	01.01.2017	28.01.2018		• This project will identify multiple data sets and lines of evidence of value in developing robust indices and indicators associated with benchmarking and monitoring change with respect to the human dimension and Indigenous indicators associated with management of the GBR and implementation of the Reef 2050 Plan. • A preliminary benchmark report (human dimensions) and the separately reported integrated framework for Indigenous indicator testing and benchmarking will be key synthesis products.	Journal article: http://dx.doi.org/10.1080/08920753.2017.1373455	Major Benchmarks of this Project Include: • A significant social license to operate needs to be built across the international and Australian community levels if policies that seek more urgent approaches to GBR protection and restoration in the face of climate change are to be considered; • The Australian and Queensland government could more actively explore policies that increase the economic diversity and adaptive capacity of GBR-dependent regions - particularly north of Gladstone. This is needed to avoid the worst impacts of climate change on GBR communities; • All government agencies and researchers will increasingly need to implement a stronger free, prior and informed consent-based approach in dealing with Traditional Owners of the GBR - particularly in Cape York Peninsula; • The Australian and Queensland governments need to continue building foundational partnerships with agricultural, tourism, fishing and recreational user communities and progress effective stewardship approaches; • The need for improved connectivity between environment, economic/regional development policy and social resilience programs of the Australian and Queensland governments and local governments. Effort needs to be aligned across portfolios and levels of decision-making to address social and economic wellbeing and ecological health in the GBR; • The need for Government agencies and research institutions significantly increase efforts to protect historical maritime heritage in the GBR; and • The need for Government agencies to progress system-wide approaches for continuous improvement of the wider system of governance affecting GBR outcomes. Efforts are particularly needed to align policy
								Project 3.2.2 Factsheet	http://nesptropical.edu.au/index.php/round-3-projects/project-3-2-2/	
								NESP TWQ Science Day Presentation - Light, turbidity, seagrass and water quality targets	http://nesptropical.edu.au/wp-content/uploads/2017/12/Project-3.2.2-Lo.pdf	
								NESP Science Day Video - Assessment and monitoring of human dimensions in reef management	https://youtu.be/X1Ggq81VkM8	
3.2.3	Monitoring aesthetic value of the Great Barrier Reef by using artificial intelligence to score photos and videos	$99,028	$209,275	**$308,303**	01.01.2017	28.01.2018		Stakeholder-focused outputs: • A report on the results from the eye tracking and biophysical measurement experiments to determine key dimensions and attributes of aesthetic value, differentiated by cultural or consumer segment, as appropriate. • An IT proof of concept and architecture with algorithms that can be extended to monitor expert material (e.g. through underwater cameras). • A workshop targeted at Indigenous groups who wish to become more involved in ecotourism opportunities (planned towards the end of the project, e.g. around November 2017). Academic outputs: • Popular articles on key findings (e.g. The Conversation) • At least two articles. • Meta-data information made available to other researchers in this field. • Provision of the data as relevant to e-atlas (TWQ Hub) (see below).		Meetings have been held with the Project 3.2.4 research team and discussed findings to date and steps from here. The dimensions identified by Dr Nadine Marshall's team as relevant to rating beauty aligned very well and confirmed the project's eye-tracking research to date. With the support of Jessica Hoey (GBRMPA) the project has disseminated stakeholder updates to TUMRA coordinators and remaining IRAC members. The project continues to ensure that the generic findings (e.g. on beauty rating and automated identification potentials) get widely communicated, including to indigenous groups. The final report (submitted but not ready for DoEE submission) concludes with six recommendations on the next steps and possible extensions of this work. One recommendation specifically suggests to engage with Reef managers to further advance the use of Big Data and artificial intelligence for cost-effective and real time monitoring. This project team is continuing to work with their end users, particularly the reef tourism indsutry to maximise impact on decion making and policy change.
								Project 3.2.3 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2017/06/NESP-TWQ-Project-3.2.3-Factsheet.pdf	
								NESP TWQ Science Day Presentation - Big Data approaches to Reef monitoring	http://nesptropical.edu.au/wp-content/uploads/2017/12/Project-2.3.2-and-3.2.3-Lo.pdf	
								NESP Science Day Video - Big Data and citizen science	https://youtu.be/e7dPHrbE_Kw	

3.2.4	Defining, assessing and monitoring Great Barrier Reef aesthetics	$105,336	$117,662	**$222,998**	01.01.2017	10.12.2017	Completed	• List of factors that contribute to Reef aesthetics that can be used in legal policies and processes and can meet UNESCO reporting requirement. These factors will be accompanied by a list of recommendations about how they can be measured and monitored • Science papers around: o Reef Aesthetics, and its relationship with Wellbeing in the region o The relationship between Reef health and Reef aesthetics o Is the beauty of coral reefs in the eye of the beholder? • Milestone reports as indicated above • Final technical report	workshop video https://www.youtube.com/watch?v=MRNST4p2HTQ	Outcomes from the workshop with Reef managers suggests that there is some interest in using aesthetic values to better engage with the public, but the highest urgency lies in reporting to RIMReP and Outlook. The research highlights only three robust indicators able to be identified, and more indicators need to be tested, both below and above the water, in order for comprehensive assessments, and monitoring of, aesthetic values to be undertaken. In moving this work forward, it is the project recommends new research must be commissioned if aesthetic indicators are to be confidently used in the management of the GBR including quantitative testing of further aesthetic indicators both above and below the water. It is highly relevant to reef restoration, as the social benefits of coral reef restoration are probably the primary reason for undertaking reef restoration activities.
								Project 3.2.4 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2017/06/NESP-TWQ-Project-3.2.4-FactsheetA.pdf	
3.2.5	Testing and implementation of the water quality metric for the 2017 and 2018 reef report cards	$140,000	$493,000	**$633,000**	01.01.2017	10.12.2017	Completed	• A revised marine water quality metric for Reef Report Card which addresses limitations of the existing metric in terms of sensitivity and response to changes; • A biogeochemical model assimilating remote sensing reflectance; • A collection, processing and integration process for marine water quality data collected in situ, via remote sensing and produced by the eReefs biogeochemical model; • Presentations to key stakeholders within the Reef 2050 Plan including RIMReP and Reef Water Quality Protection Plan • Scientific technical report on the outcomes of this research and recommendations on options for operational implementation		
								Project 3.2.5 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2017/06/NESP-TWQ-Project-3.2.5-Factsheet.pdf	
								NESP TWQ Science Day Presentation - Improvements to the marine water quality metric for Reef Report Card	http://nesptropical.edu.au/wp-content/uploads/2017/12/Project-3.2.5-Lo.pdf	
3.3.1	Quantifying the linkages between water quality and the thermal tolerance of GBR coral reefs	$590,264	$590,400	**$1,180,664**	01.01.2017	10.12.2019	Ongoing	• WQ modulated bleaching thresholds for key coral species that can be used for bleaching forecast monitoring • Scientific reports and publication of new numerical models of the processes of coral bleaching in leading journals. • Scientific reports and publication of the environmental drivers of variation in bleaching sensitivity and recovery on the GBR. • Final technical report		
								Project 3.3.1 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2017/08/NESP-TWQ-Project-3.3.1-Factsheet.pdf	
								NESP Science Day Presentation - Bleaching and Water Quality - What is the connection?	http://nesptropical.edu.au/wp-content/uploads/2017/12/Project-3.3.1-Lo.pdf	
3.3.2	Science evaluation of coastal wetland systems repair projects across GBR catchments	$536,932	$885,583	**$1,422,515**	01.01.2017	10.12.2019	Ongoing	• GIS mapping that captures completed, current and planned wetland system repair projects in the GBR catchment area; • Meta-analysis of available wetland system repair projects collated from the study area for storage in Wetlands Info website and E-atlas; • Access to scientific data collected by the project; • Report detailing the constraints and opportunities to improve coastal wetland restoration and repair for the nominated project sites; and • Scientific publications and presentations at community events. These outputs will include a communication closure plan, to inform end users specifically of the outcomes and success of the project. All end users will be included in this communication, including Indigenous groups involved in the project	1) http://nesptropical.edu.au/index.php/news-events/e-newsletters-2/october-2017/electrifying-methods-of-evaluating-wetland-rehabilitation/	The project team has been highly engaged with NQ Dry Tropics; Mungalla Aboriginal Corporation; Greening Australia; Jaragun NRM Babinda constructed wetland and adjoining farmers; farmers in Sheep Station Creek with NQ Dry Tropics; Reef Credits and wetlands (Green Collar); Terrain NRM; WWF; Green Fleet; Queensland Trust for Nature; Burnett Mary River Group NRM. This project is still underway and the project team is continuing to work with their end users to maximise impact on decion making and policy change.
								Project 3.3.2 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2017/08/NESP-TWQ-Project-3.3.2-Factsheet.pdf	

3.3.3	Defining the values of the ecological systems that influence the GBR and lie outside the marine park and world heritage area boundaries	$256,030	$257,366	**$513,396**	01.02.17	28.04.2018	Ongoing	The main project outputs include: • a synthesis of the ecological connectivity between the GBR and Coral Sea, • a synthesis of the physical drivers of ecological connectivity between the GBR and Coral Sea, • a description of important values in the systems adjacent to the GBRWHA, • an analysis of overlaps and synergies in values between systems, and • spatial characterisation of values and the connections and interdependencies across systems for the key values. • if the project identifies additional Biological Important Areas (BIA), the new/updated BIA will be provided to eAtlas for inclusion on the ERIN Conservation Values Atlas. These outputs will form the basis of a non-technical project report that delivers information that can underpin strategies, plans and programs to improve protection and management of important values, and improve coordination and efficiencies across management jurisdictions. In addition, the project will deliver informal progress reports to key stakeholders and workshop participants, through email and meetings as needed, and at least two project fact sheets (one at the start introducing the project		End-user engagement has included a video presentation to DoEE staff in Canberra (August 2017), and extensive discussions with a range of stakeholders at the expert workshop held in July 2017. The expert workshop was attended by 34 stakeholders from diverse fields including managers, policy makers, industry, scientists and indigenous representatives. The workshop used a participatory approach to map values and attributes (using draft maps generated through eAtlas), characterise connectivity (direction and magnitude) of values, and document current status and management regimes in the four marine areas. The workshop outcomes have been largely analysed and will inform development of the final values and attributes maps (including connections and inter-dependencies), the technical report, and recommendations for cross-jurisdictional management and monitoring.
								Project 3.3.3 Factsheet	http://nesptropical.edu.au/wp-content/uploads/2017/06/NESP-TWQ-Project-3.3.3-Factsheet.pdf	
4.1	Crown-of thorns starfish: surveillance and life history	$497,500	$553,770	$1,051,270	1/1/18	10/12/19	Ongoing			
4.2	Oceanographic drivers of bleaching in the GBR: from observations to prediction	$537,852	$832,480	$1,370,332	1/1/18	10/12/20	Ongoing			
4.3	Best practice coral restoration for the Great Barrier Reef	$607,000	$782,000	$1,389,000	1/1/18	10/12/20	Ongoing			
4.4	The traits of corals that survived recent bleaching events	$582,218	$713,276	$1,295,494	1/1/18	10/12/20	Ongoing			

4.5	Guidance system for resilience-based management of the Great Barrier Reef	$638,037	$698,835	$1,336,872	1/1/18	10/12/20	Ongoing			
4.6	Recommendations to maintaining functioning of the Great Barrier Reef	$299,583	$384,577	$684,160	1/1/18	1/6/19	Ongoing			
4.7	Indigenous coral reef tourism	$100,000	$200,000	$300,000	1/1/18	10/6/19	Ongoing			
4.8	Project 25' Farmers, water quality and on-farm decision-making	$600,000	$600,000	$1,200,000	1/1/18	31/12/20	Ongoing			
4.9	Gully characterisation framework to underpin GBR catchment water quality management	$53,429	$53,429	$106,858	1/1/18	30/9/18	Ongoing			
4.10	Evaluating the Costs and Benefits of Agricultural Land Conversion to Wetlands	$482,947	$525,083	$1,008,030	1/1/18	10/12/20	Ongoing			
4.11	Sources, transformations and fate of particulate and dissolved organic carbon – implications for the GBR	$26,470	$99,867	$126,337	1/1/18	30/9/18	Ongoing			

4.12	Measuring cost-effectiveness and identifying key barriers and enablers of lasting behavioural change in the cane industry	$404,985	$475,471	$880,456	1/1/18	10/12/20	Ongoing			
4.13	Assessing the Gulf of Carpentaria mangrove dieback	$200,000	$250,000	$450,000	1/6/17	1/9/19	Ongoing			
	Low budget projects						New			
Total Project Costs		**$19,941,797**	**$27,446,649**	**$47,388,445**						

On Track: The timeframes and milestones for the project are being met.
If you are collaborating with another Hub please only include your Hubs portion.
Significant: includes changes ≥10% of total project costs, changes in scope that impact on the outputs, milestones delayed by more than 3 months, changes to

NESP impact stories

NESP impact stories showcase the contribution of NESP funded research to the environment, the economy, society, culture, public policy, quality of life, beyond contributions to academia.

NESP Impact Story #1

Hub:

Tropical Water Quality Hub

Title

Building capacity of Traditional Owners to manage and monitor estuarine wetlands

Project number(s) and project title

Project 2.3.4: Working with Traditional Owners and local citizens to better manage southern Great Barrier Reef estuarine wetlands

Short version

Despite their importance as Traditional Owner sea country and in improving water quality for the Great Barrier Reef, not enough is known of the condition of degraded estuarine wetlands along the coast to enable repair. Indigenous rangers and citizen scientists were trained in field assessment methods and identified high-priority degraded shorelines in eight estuaries between Gladstone and Bundaberg. These collaborations and development of the resulting Mangrove Management Plans have enabled successful grant applications from State and federal governments to restore flood-damaged sites in two of these estuarine systems to date, as well as a successful tender for the Gladstone Healthy Harbours Program for the monitoring of healthy mangroves in and around Port Curtis.

Narrative

Poor understanding of the status and condition of estuarine wetlands in the southern Great Barrier Reef (GBR) is hindering their management. This project has focused on building the capacity of local Indigenous Rangers, citizen scientists and regional Natural Resource Management (NRM) groups to provide the first comprehensive assessment of estuarine health in the southern GBR region whilst also prioritising on-ground management and restorative actions.

Public workshops were conducted in Bundaberg and Rockhampton in conjunction with local NRMs (the Burnett Mary Regional Group (BMRG) and the Fitzroy Basin Association (FBA)) to build public support and enthusiasm for the project. Indigenous Rangers from the Gidarjil Aboriginal Development Corporation were then trained in the methods upon which the MangroveWatch (www.mangrovewatch.org.au) citizen-science program is based. The outcome of this was newly trained Indigenous Rangers working with mangrove scientists to undertake field assessments and repeat surveys in eight major southern estuarine systems of the southern GBR, including the Burrum, Elliott, Burnett, Kolan, Baffle, Boyne and Calliope.

The results of these surveys have been used to help describe the status and well-being of coastal waters of the region, have informed the development of Mangrove Management Plans, and have identified a number of potential management issues including the location of sites of severe erosion, and sections of damaged shoreline vegetation. The results are also being used to prioritise management actions in each estuarine system. This is essential information for local environmental managers and end users wanting to improve the management of estuarine systems for the best possible levels of coastal water quality.

As a result of this project's capacity-building and survey results, two large riverbank restoration projects in the region have now been funded and are underway, in cooperation with the Queensland Government (Joint Australian and Queensland Government Initiative STC Debbie 2017 NDRRA Category D), Bundaberg Sugar, and Bundaberg Port (Gladstone Ports Corporation).

Given the MangroveWatch method relies upon collection of large amounts of visual imagery (camera and video), being able to present this imagery to the general public provides a

powerful and easily-accessible tool for sharing this information. To this end, a portal for the public display of the visual imagery and condition assessments produced in this project is now in development (see a current prototype: http://shoreview.io/home/). The development of this portal was initially funded by local industry – Gladstone Ports Corporation – as a means to gain public access to imagery and other data collected by community members, Indigenous Rangers and researchers. As a follow on from this project, it will hold all currently obtained imagery, and enable public access via the internet.

Research outputs

Published Relevant & Related Reports

Duke, N. C. and J. Mackenzie. **2016**. Southern GBR Coastal Habitat Archive and Monitoring Program (S-GBR CHAMP: Progress Report December 2016. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited. Townsville, James Cook University TropWATER Centre**:** 68 pages.

Duke, N. C. and J. MacKenzie. **2016**. Southern GBR Coastal Habitat Archive and Monitoring Program (S-GBR CHAMP): Progress Report June 2016. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited. Cairns, James Cook University TropWATER Centre**:** 41 pages.

Mackenzie, J.R., N.C. Duke and A.L. Wood. **2016**. The Shoreline Video Assessment Method (S-VAM): using dynamic hyperlapse image acquisition to evaluate shoreline mangrove forest structure, values, degradation and threats. Marine Pollution Bulletin 109(2): 751-763.

Attributions

Project partners include:
Dr Norm Duke, JCU TropWATER - lead
Jock Mackenzie, JCU TropWATER
Kerry Blackman & Ric Fennessy, Gidarjil Development Corporation
Kirsten Wortel & Saranne Guidice, Burnett Mary Regional Group
Rebecca French & Shannon Van Nunen, Fitzroy Basin Association

NESP Impact Story #2

Hub

Tropical Water Quality Hub

Title

Wetland systems repair science evaluation

Project 2.1.1 – Scoping Options for low lying, marginal cane land to reduce DIN in priority wet tropics catchments – completed December 2017

Project 3.3.2 – Wetlands systems repair in the Great Barrier Reef catchments – scientific evaluation of project sites (Jan 2017 to Dec 2019).

Project 4.10 – Appraisal and synthesis of previously funded land conservation wetland-based nitrogen management projects: supporting current government funded and future private market investment schemes (Jan 2018 to Dec 2020)

Short version

State and Federal agencies are funding many Great Barrier Reef (GBR) wetland repair projects. However no scientific data provides improved direction or evaluates their success. Using advanced hydrological and ecological techniques, this project maximises the value of wetland repair efforts and provides surety to government funding agencies regarding these investments. This reassurance of effective outcomes is also providing a platform to attract significant private and philanthropic investors looking to fund large-scale wetland repair projects via emerging carbon, and nutrient trading schemes.

Narrative

Coastal wetlands are part of the broader Great Barrier Reef (GBR) seascape and hold incredible environmental, cultural and economic value too. Despite this, over 70% of GBR coastal wetlands have been modified, impacted or lost entirely because of continuing land use change. Many of those remaining are in poor condition, due to alien weed infestation and poor water quality. State and Federal government agencies are investing significant funding in coastal wetland repair, coordinated through Natural Resource Management (NRM) bodies, non-government organisations (NGOs) and more recently private companies.

The key problem is that there is a lack of scientific data to support and give surety that on-ground wetland repair investment achieves the desired water quality and biodiversity returns. Scientific data and long-term evaluation methods are therefore necessary to track progress against broader program objectives, in particular those contained in Queensland Government Wetlands Strategy 2013, Reef 2050 Long Term Sustainability Plan, Reef Water Quality Protection Plan 2013, and regional NRM plans and Water Quality Improvement Plans (WQIPs).

In consultation with relevant wetland repair project teams, research plan outputs have been prepared and enacted for five study sites across three regions, each representing a different funding program:

1) Babinda constructed wetland - Jaragun NRM
2) Mungalla wetland complex - Mungalla Aboriginal Corporation, Greening Australia;
3) Horseshoe Lagoon water management - NQ Dry Tropics;
4) Lilliesmere wetland complex - NQ Dry Tropics;
5) Roundhill Reserve feral pig exclusion - Burnett Mary Regional Group NRM.

Developing these research plans helped define expected values and goals for each user group. Maree Prior (Biodiversity Officer (Coastal) Burnett Mary NRM) recently assisted with field work in Roundhill Reserve, following the installation of a feral pig exclusion fence, "*a very interesting and exciting field trip, where I learnt far more than I expected about this wetland – I'm already thinking about our next round of wetland projects and possible data collection with this new knowledge*"

Due to numerous examples of biodiversity and water quality improvement being able to be demonstrated, this project has been promoted in numerous media stories, and also via a co-edited special issue in WetlandLink E-news (with Conservation Volunteers Australia) showcasing wetland repair projects.

Project staff have now been working closely with the Indigenous group Jaragun NRM to develop a water balance manual for a constructed wetland they have built. This manual will assist Jaragun NRM to estimate water quality improvements by controlling the intake and escape of water from this constructed wetland. Ms Liz Owen (Director Jaragun NRM) said that "*the assistance provided by Dr Waltham and his team has already been exciting, and we are looking forward to his data to assist us realise the full benefits of our constructed wetland towards improving water quality, particularly in light of private funding opportunities such as Reef Credits*"

This project's outcomes have assisted NQ Dr Tropics NRM to support rehabilitation projects in their region. Fish surveys carried out in October 2017 along Sheepstation Creek in the Lower Burdekin found three times more native fish species than the previous survey prior to rehabilitation in 2003, a promising outcome that will provide the basis for further positive impacts for water quality on the GBR as more end users adopt effective wetland rehabilitation practices and improve their waterways.

The robust and defensible information on cost-effectiveness provided through this project is already proving invaluable in the development and impact of initiatives involving carbon nutrient trading and reef-credit schemes to convert marginal farming land to wetlands. These projects would not be possible without the information generated through these NESP TWQ projects. Funding for these initiatives is being developed between government (Wet Tropics Major Integrated Projects) and private-public sponsors (Kilter Rural Group, WWF, GreenCollar, Greening Australia).

Research outputs

Public communication/media

- Fencing feral pigs out of a nationally significant coastal wetland – Burnett Mary Regional Group for NRM – July 2017 – click here)
- Estuarine Coastal Shelf Sciences E-News – Science evaluation of wetland system repair projects in the Great Barrier Reef catchments – August 2017 – click here)
- Expertguide.com.au – Scientist assess feral control and wetland restoration efforts – August 2017 – click here)
- Wetland Link Conservation Volunteers Australia – Great Barrier Reef Special Edition newsletter – August 2017 – click here)
- Greening Australia – Restoring the Reef's Kidneys at Crooked Waterhole – October 2017 – click here)
- Barretts lagoon – wetland system repair partnership –Terrain and TropWATER December 2017 – click here)
- Fish surveys to monitor effectiveness of weed control – NQ Dry Tropics 14 August 2017 – click here
- Sheep Station system repair electrofishing survey - NQ Dry Tropics 13 February 2018 – click here)

Attributions

Project Team

- Dr Nathan Waltham (James Cook University) – Principal Investigator
- Prof Jim Wallace (James Cook University) – Scientist – hydro-ecologist
- Dr Fazlul Karim (CSIRO) – Scientist – Hydrodynamic modeller
- Mr Brett Abbott (CSIRO) – Scientist – Spatial Analyst
- Dr Fernanda Adame (Griffith University) – Scientist – Biogeochemistry
- Mr Barry Butler (James Cook University) – Scientist – water quality and limnology
- Dr Cristina Buelow (James Cook University) – Scientist – wetlands ecology
- Associate Prof Jim Smart (Griffith University) – Economist – water trading markets
- Prof Michelle Burford (Griffith University) – Scientist – Water quality and biogeochemistry
- Prof Marcus Sheaves (James Cook University) – Scientist – tropical estuary ecology

Project Partners

- Dr Niall Connolly (Greening Australia)
- Ms Laura Dunstan and Mr Scott Fry (NQ Dry Tropics)
- Mr David Sartori (Lower Burdekin Water Board)
- Mr Bart Dryden and Ms Carole Sweatman (Terrain NRM)
- Mr Mike Ronan (Wetlands, Queensland Government)
- Mr Jacob Cassady (Director Mungalla Aboriginal Business Corporation)
- Ms Liz Owen (Jaragun Natural Resources Management)
- Ms Kirsten Wortel (Burnett Mary Regional Group)
- Ms Donna Audas (Great Barrier Reef Marine Park Authority)

New Project Partners

- Barretts Lagoon Wetland Project
- Cassowary Coast Regional Council
- Girrigun Aboriginal Corporation
- Queensland National Parks and Wildlife Services
- Department of Agriculture, Forestry and Fisheries
- Lilliesmere estuary wetland water quality
- NQ Dry Tropics
- Pacific Reef Aquaculture

NESP Impact Story #3

Hub

Tropical Water Quality Hub

Title

Engaging with farmers and demonstrating water quality outcomes to create confidence in on-farm decision-making

Project 2.1.7: Innovative water quality monitoring project rebuilds relationship between environment science community and sugar cane industry (also known as Project 25)

Short version

Research indicates that runoff containing pollutants originating from sugarcane farms are a major threat to the health of the Great Barrier Reef (GBR). There are many government and non-government programs that are aimed at farmers to help them reduce the nutrients moving off-farm whilst still maintaining profitability. However, uptake of these programs to date has been less than anticipated, with many farmers skeptical of the science behind the water quality programs being deployed. By working directly with cane farmers in the Wet Tropics region on water quality monitoring, this project has increased the trust framework between scientists and farmers, leading to wider acceptance of the need for water quality improvement and adoption of new farming practices, therefore achieving maximum benefits to GBR health.

Narrative

The Australian sugarcane industry is located mainly along Australia's eastern coastline, from Mossman in far north Queensland to Grafton in northern New South Wales. It is one of Australia's largest rural industries. Research indicates runoff containing pollutants originating from sugarcane farms are a major threat to the health of the Great Barrier Reef (GBR). There are many government and non-government programs that are aimed at farmers to help them reduce the nutrients moving off-farm whilst still maintaining profitability. However, uptake of these programs and subsequent practice change has been less than anticipated to date due to breakdown in communication and a loss of trust in the validity of water quality science. Many farmers remain unconvinced that their individual farming decisions impact on the quality of water entering the GBR system and are sceptical of science and scientists.

The successful implementation of a sub-catchment water quality monitoring plan developed and driven by the local sugarcane industry has resulted in an identified network of nine sites located throughout the Russell-Mulgrave catchment that differentiate a range of different catchment land-uses (native forest, bananas, sugarcane, urban) to allow discrimination of specific sugarcane contributions to local water quality issues (a key desire of the local cane industry). The sites have also been located to integrate as much as possible with the current GBR catchment loads monitoring program (GBRCLMP) to value-add to both programs in coming year's monitoring-modelling efforts.

Project 2.1.7 was funded after meetings with large-scale sugar cane farmers in the Russell-Mulgrave catchment in 2015 which identified the need for scientists to more directly engage with farmers and jointly undertake water quality monitoring in their local area. These growers provided permission for researchers to access their properties, suggested appropriate locations for water quality sampling sites and participated in field sampling. Many farmers have trouble accepting the science associated with farm water quality run-off and the need to adopt new farm management practices. A promising outcome of this project, after having scientists work together with key influential farmers in the catchment,

was the increase in rapport, trust and understanding between the two. In turn this is now leading to a greater acceptance of the science that underpins reef water quality programs and the need for adoption of improved farming practices that benefit water quality. The project is beginning to show broader impact as the four pilot influential growers are now using their peer networks and standing in the farming community to act as agents of change and enabling a wider adoption of beneficial farming practices.

Evidence of cane farmers' initial thoughts on research engagement can be found in an early media article in *Australian Canegrowers Magazine* on July 17, 2016 titled *"Project 25: Putting the future of water quality back in growers hands"* (accessible at: https://issuu.com/canegrowers0/docs/2016-07-18_australian_canegrower_-_/7), "We must have accurate measurements because we don't know whether the problem is ours or someone else's. That's one of the reasons farmers haven't come on board to date, because they don't believe that what they're getting of accused of is actually their problem", Barry Stubbs, cane farmer.

Evidence of increasing trust for the science through effective engagement with the cane farmers on the ground is noted by Canegrowers Environment and Sustainability Board chairman Joe Marano, "*this is more convincing than modelling because this is real-time stuff… it is giving growers real ownership of what they are actually doing in their own backyard"* - see YouTube video '*Project 25: CANEGROWER Environment Board tour'* accessible at https://www.youtube.com/watch?v=HAc6a1sEgXg. The 'Farmers teaching Farmers' field trip led by Dr Aaron Davis and Canegrowers Environment and Sustainability manager Matt Kealley, was also covered in Australian Cane Grower Magazine article titled *Growers gain valuable insight into water quality monitoring projects*), received a positive reception, noting the general feeling among participating farmers at the end of the two-day event was *"If there is a problem on my farm then I want to know about it, so I can fix it"* (accessible here https://issuu.com/canegrowers0/docs/2018-03-12-australiancanegrower/20)

Canegrowers Cairns district manager Sarah Standen stated that Project 25 was rapidly gaining attention and support amongst growers in the region:
"*There's been a major change in thinking from our growers, they've always been wanting real data instead of modelling and this project is giving it to them. There's be a whole change in the atmosphere around it. When [Project 25] was presented at the [2017] Canegrowers AGM, there were hard-line blokes from the district that would normally be jumping up and down that were instead hanging on every word Aaron said. The growers are definitely keen to get involved, there was a negativity before but that's gone now."*

Leading Babinda cane farmer Stephen Calcagno provides an example of at least two cane farmers in the Russel-Mulgrave catchment that have now changed their practices to reduce runoff impacts directly as a result of exposure to communications of Project 25 research outputs. One farmer has altered the timing of his application of nitrogen-based fertilizer and the other has implemented 'stool-splitting' sub-surface application of nitrogen fertilizer after recognizing that much of their previously-applied fertilizer was swept by rainwater into waterways during the 2016-17 wet season after a presentation delivered by Dr Aaron Davis. Mr Calcagno also advises that significant word-of-mouth about Project 25 outcomes is circulating among the cane farming communities in the Russel-Mulgrave and adjacent catchments.

Results from 2017 have demonstrated the scale of nitrate losses in one target catchment when surface applied fertiliser was spread on paddocks just prior to major wet season rainfall events. The outcomes of the sub-catchment monitoring efforts has also been used in discussion with the cane industry steering committee to begin informing and prioritising local targeting of cane industry extension-engagement efforts to key water quality 'hotspots' in the broader landscape. The growers involved in this project are now pushing for further expansion of the water quality monitoring project and fulfilling their role of leading farming practice change into the future, improving water quality on the GBR.

The project has provided ongoing advice and support to the Jaragun Natural Resource Management group in the submission of a recent project proposal submission 'Denitrification bioreactor trial in the Russell catchment of the Wet Tropics' to the Queensland Department of Environment and Heritage, which has now been funded. A potential ongoing role for Project 25 in provision of data to this project is anticipated.
Research outputs *Australian Canegrowers Magazine* on July 17 2016 titled *"Project 25: Putting the future of water quality back in growers hands"* (accessible at the following URL: https://issuu.com/canegrowers0/docs/2016-07-18_australian_canegrower_-_/7) YouTube video (August 31, 2016) "*Project 25: Scientists and Farmers working together for the future of Great Barrier Reef Water Quality"* (accessible at the following url: https://www.youtube.com/watch?v=cuslOI8RD9o). YouTube video '*Project 25: CANEGROWER Environment Board tour'* accessible at https://www.youtube.com/watch?v=HAc6a1sEgXg. Australian Cane Grower Magazine "*Growers gain valuable insight into water quality monitoring projects"* (accessible here https://issuu.com/canegrowers0/docs/2018-03-12-australiancanegrower/20).
Project Team: Dr Aaron Davis, JCU; Dom Henderson, DES; Chris Johnson, DES; Ryan Turner, DSITI; Carla Wegscheidl, DAF; Jack Robertson, DAF **Partners** CANEGROWERS Cairns Region - Stephen Calcagno; Barry Stubbs; Paul Gregory; Jeff Day; Sarah Standen

NESP Impact Story #4

Hub:
Tropical Water Quality

Title:
Evolution in effectiveness of crown-of-thorns starfish control on the Great Barrier Reef

Project number(s) and project title(s)/or Hub activity
Project 1.1: Establishing the future NESP COTS research framework including an ecologically-based approach to the management of COTS at multiple scales
Project 2.1.1**:** Integrated Pest Management of Crown-of-Thorns Starfish
Project 3.1.1: Implementation of the Crown-of-thorns research strategy: regional strategies
Project 4.1: Crown-of-thorns starfish: surveillance and life history

Short version
Crown-of-thorns starfish (COTS) are considered one of the worst threats to the health and integrity of the Great Barrier Reef (GBR) ecosystem. Taking a new direction, the application of science-based Integrated Pest Management (IPM) principles to control coral-eating COTS is enabling steady evolution in the efficiency and effectiveness of control efforts on the GBR. This ongoing successful collaboration between National Environmental Science Programme (NESP) Tropical Water Quality (TWQ) Hub scientists, marine managers and the tourism industry means that many more starfish can be eradicated (and much more live coral protected) per dollar invested in the Targeted Control Program.

Narrative
Outbreaks of coral-eating crown of thorns starfish (COTS) are one of the only the major causes of coral loss on Australia's Great Barrier Reef (GBR) that are amenable to direct management intervention. With active COTS outbreaks imperiling the economic, ecological and World Heritage values of the GBR – including the $6 billion pa tourism industry and the 70,000 jobs it supports – it has never been more urgent to ensure that control efforts are as effective and efficient as possible in protecting live coral cover from predation. The research is assisting with targeting culling efforts which has improved success of the program. As a result, additional funding has been secured for more control vessels. This has led to more cadetships being offered, including to Indigenous cadets. This is helping Indigenous people to manage their sea country and by extension, the GBR system.

In a world first, the outcomes of three consecutive National Environmental Science Program (NESP) Tropical Water Quality (TWQ) Hub funded research projects are contributing to active eradication efforts of COTS by applying IPM principles to target the marine pest of local, national and international significance. Beginning in 2015, the first NESP seed funding project established the research framework with expert input. This led to additional funding to refine an IPM strategy and subsequent funding to implement the strategies on a regional basis along the length of the Great Barrier Reef (GBR).

According to researchers' calculations, removal of ~637,000 starfish since 2015 has saved 12–13 million square metres of live coral cover from COTS predation on the GBR. Uptake of researchers' recommendations by managers at the Great Barrier Reef Marine Park Authority (GBRMPA) and on-water marine tourism operators has helped ensure that the COTS Control Program delivers the best possible outcomes. Subsequent impacts include:

- "There's a lot of reef out there and previously we had to plan our voyages based on pretty limited information," said Dr Mary Bonin, COTS Control Program Manager at GBRMPA. "For the past year we've been using outputs from the research program – such as the connectivity modelling - to ensure that we are putting effort into protecting reefs that are most crucial for coral recovery on the Great Barrier Reef."

- "Improvements suggested by researchers in the way we do surveillance during our control activities have already enabled us to better focus our operations on the locations on reefs where we can have the greatest impact," said Mr Col McKenzie,

CEO of the marine tourism peak body, the Association of Marine Park Tourism Operators. “This means that many more starfish can be controlled (and much more live coral protected) per dollar invested in the COTS Control Program.”

- Recent demonstration of the effectiveness of COTS control in providing long-term reductions in COTS densities and in the relationship between management effort and coral cover have improved confidence in the effectiveness of the program and have pointed to opportunities to further improve operations in order to achieve regional scale control objectives. These analyses are currently being refined and incorporated into the strategic approach of the soon-to-be expanded COTS Control Program.

This evolution in COTS control effectiveness – with several years of research and recommendations still to run – has been possible in part due to the way in which the projects have been structured to deliver useful products periodically throughout the life of the Program, rather than just at the end. The development of an android application has maximised the efficacy of each control vessel’s journey, supporting management actions. The success of this research, management and industry collaboration has been recognised by the provision of another $5.6 million for a second vessel for the Control Program in December 2016, and most recently by the announcement of a further $10.4 million in January 2018.

Research outputs

Westcott, D.A., Fletcher, C. S, Babcock, R., Plaganyi-Lloyd, E. (2016) A Strategy to Link Research and Management of Crown-of-Thorns Starfish on the Great Barrier Reef: An Integrated Pest Management Approach. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (80pp.).

Fletcher, C.S. and Westcott, D.A. (2016) Strategies for Surveillance and Control: Using Crown-of-Thorns Starfish management program data to optimally distribute management resources between surveillance and control. Report to the National Environmental Science Programme. Reef and Rainforest Research Centre Limited, Cairns (22pp.).

Attributions

i. Staff

Dr David Westcott, CSIRO
Dr Cameron Fletcher, CSIRO
Dr Karlo Hock, UQ
Ms Sheriden Morris, RRRC
Dr Suzanne Long, RRRC

ii. Others

Mr Col McKenzie, COTS Targeted Control Program
Mr Steve Moon, COTS Targeted Control Program
Dr Mary Bonin, Great Barrier Reef Marine Park Authority
Mr Darren Cameron, Great Barrier Reef Marine Park Authority

NESP Impact Story #5

Hub
Tropical Water Quality Hub

Title
Irrigation innovation for cane growers in Great Barrier Reef catchments

Project number(s) and project title
Project 3.1.2: Improving water quality for the Great Barrier Reef and wetlands by better managing irrigation in the sugarcane farming system

Short version
Excess application of irrigation water to sugar cane crops, resulting in irrigation water running off paddocks into drains and waterways, is one of the major contributors to poor water quality runoff in the Burdekin catchment. More efficient application of irrigation water would not only save water and farm costs but also improve coastal and reef water quality. This project is utilising new technologies to achieve greater efficiency of water use in irrigation. Internet-enabled sensors have been deployed on three working farms in the Burdekin, helping the irrigation system apply the right amount of water, at the right time, in the right paddock, with minimal fuss to the farmer. "It's helping my business and also helping the surrounding environment at the same time," said 3rd-generation cane grower Aaron Linton. "Personally I'd like to see [this new system] get up across the whole industry."

Narrative

The revised Burdekin water quality improvement plan has aspirations to achieve an 80% reduction in dissolved inorganic nitrogen (DIN) runoff. There is a strong linkage between irrigation management and losses of DIN into surrounding waterways from sugarcane farms. Managing DIN runoff requires managing irrigation practices as well as the rate at which nitrogen (N) is applied to crops. However, according to data from 2013/14, only 10% of cane farms in the Burdekin area are irrigating at the recommended level of efficiency. If the improved water quality targets specified in the 2016 Burdekin Water Quality Improvement Plan (WQIP) – 80% reduction in DIN runoff by 2025 – are to be achieved, growers will need to more readily capitalise on new technologies for improving irrigation efficiency.

This National Environmental Science Program (NESP) Tropical Water Quality (TWQ) Hub project is helping establish some of these pathways by working in partnership with growers, industry, natural resource management (NRM), research and government organizations to develop and deploy an irrigation system that is automatically controlled. Internet-enabled sensors have been deployed on three working farms in the Burdekin, that enable the irrigation system to apply the right amount of water, at the right time, in the right paddock, with minimal fuss to the farmer. Better irrigation practices lead to improved crop yields through less water stress, less waterlogging and reduced run-off to the Great Barrier Reef (GBR).

Aaron Linton, a third-generation cane grower from Leichhardt Downs in the Burdekin River Irrigation Area says participating in the project is vital to protect both the Great Barrier Reef and his bottom line. "What it's doing is taking the guesswork out of irrigation, which is a big thing for us considering how high electricity prices are," Aaron said. "On top of that if you're not putting more water downstream than you have to, you've got less of your nitrogen getting out to the Reef, so there's both an environmental and an economic benefit in it for growers."

"It's helping my business and also helping the surrounding environment at the same time," said Aaron. "Personally I'd like to see [this new system] get up across the whole industry."

Research outputs

Project factsheet: http://nesptropical.edu.au/wp-content/uploads/2017/05/NESP-TWQ-Project-3.1.2-Factsheet.pdf

Grower visit to JCU demonstration facility: http://nesptropical.edu.au/index.php/2018/03/14/nesp-twq-project-3-1-2-james-cook-university-grower-tour/

Sexton J, Everingham Y and Donald D (2017) *A comparison of data mining algorithms for improving NIR models of cane quality measures.* Proceedings of the 39th Annual Conference of the Australian Society of Sugar Cane Technologists. In: ASSCT 2017: 39th Annual Conference of the Australian Society of Sugar Cane Technologists, 3-5 May 2017, Cairns, QLD, Australia

Attributions

Project partners include:

- A/Prof Yvette Everingham, JCU
- Steve Attard, Agritech Solutions
- Burdekin Productivity Services
- SQR Software Limited
- Sugar Research Australia
- NQ Dry Tropics
- WiSA Global
- Growers

NESP Impact Story #6

Hub
Tropical Water Quality

Title
Characterising the values and connectivity of the northeast Australian marine seascape – Great Barrier Reef, Torres Strait, Coral Sea and Great Sandy Strait

Project number(s) and project title(s)/or Hub activity
Project 3.3.3: Defining the values of the ecological systems that influence the GBR and lie outside the marine park and world heritage area boundaries

Short version
The northeast Australian seascape includes four marine domains – the Great Barrier Reef, Coral Sea, Torres Strait and Great Sandy Straits – that contain values that are connected ecologically, culturally and socially. These connections include the movement of water, species, people and stories, and include inter-dependencies and drivers across jurisdictions. Understanding values and their connections across jurisdictional boundaries in the northeast Australian seascape can inform effective cooperative management and planning. The National Environmental Science Program (NESP) Tropical Water Quality (TWQ) Hub Project 3.3.3, has identified 4 value categories that have 10 components represented by 62 attributes. The connectivity of these attributes across jurisdictional boundaries have been characterised and the maps and information will be available in the eAtlas online information portal. Potential end-users that have already expressed interest in using the data include Parks Australia for the Coral Sea Marine Reserve and Great Barrier Reef Marine Park Authority.

Narrative
Effective protection of biodiversity and maintenance of natural, social, economic and Indigenous values requires a broad systems view that incorporates connections and cross-jurisdictional linkages. The need to understand values and manage for connections that span across boundaries in the broader northeast Australian seascape has been recognised for years. However, there has never been a structured review of values and their connections across the Torres Strait, Coral Sea, Great Barrier Reef and Great Sandy region to inform a more integrated and holistic approach to management.

This project has drawn on the extensive expertise in northeast Australia to develop a comprehensive list of 10 components (for example, coral reefs, seagrass meadows, Indigenous culture and industry sectors) from natural heritage; Indigenous heritage; social and historic; and economic values represented by 62 attributes (for example, barramundi, mangroves, historic places of significance and dugong). This information has been used to characterise the strength, direction and type of connectivity and interdependencies between and among jurisdictions that are important for maintaining and managing key values. The project documented the current status of attributes and management of the different jurisdictions in the broader northeast Australian seascape in relation to natural, social and historic, Indigenous and economic values. Ultimately, the project has identified opportunities and priorities for cross-jurisdictional co-operation in planning, policy and management to maximise effectiveness and efficiency of efforts to protect key values, including World Heritage values, for northeast Australia.

Importantly, the main project outputs have been driven by stakeholder needs to deliver an online platform (through eAtlas), a technical report with a supplementary synthesis of values, and a summary for decision-makers. The connectivity maps are available for decision-making and cross-jurisdictional management through the eAtlas. This information will allow end-users to identify where there are values that cross borders, how strong these connections are, the types of connections, and where different jurisdictions need to collaborate for effective management.

Engagement with Parks Australia, the Great Barrier Reef Marine Park Authority (GBRMPA), Department of Environment and Energy (DoEE) and the Torres Strait Regional Authority (TSRA) have identified a number of benefits and applications of the work. In particular, the information can now be used to:

1. Raise awareness and inform all levels of government and relevant authorities across all jurisdictions of the importance of coordinating management of marine values that cross jurisdictions.
2. Establish formal working relationships amongst management authorities in adjacent jurisdictions. For example, set up a Coordination Working Group that meets regularly.
3. Ensure trusting working relationships include Traditional Owners across all four marine jurisdictions.
4. Develop collaborative agreements for cross-jurisdictional management of connected priority values.
5. Identify mechanisms to align existing management (including zoning, policy and management plans) with adjacent marine areas.

Parks Australia have now expressed interest in using the project outputs to inform implementation of the newly released *Coral Sea Commonwealth Marine Reserve Management Plan* (2017), particularly for managing values that are connected with the Great Barrier Reef and Torres Strait.

The project is due for completion 31 May 2018.

Research outputs

1. eAtlas online platform: http://eatlas.org.au
2. Generic powerpoint outlining the values and attributes that cross boundaries and how understanding connectivity can inform management and planning
3. Technical report with a supplementary synthesis of values (in review)
4. Summary for decision-makers (in review)

Attributions

Project team:

Johanna Johnson, Principal Investigator, JCU; David Welch, co-investigator, JCU; Paul Marshall, co-investigator, UQ; Nadine Marshall, co-investigator, CSIRO; Jon Day, co-investigator, JCU; Jon Brodie, co-investigator, JCU; Helene Marsh, co-investigator, JCU; Mark Hamann, co-investigator, JCU; Colin Simpfendorfer, co-investigator, JCU; Craig Steinberg, co-investigator, AIMS; Jessica Benthuysen, co-investigator, AIMS; Eric Lawrey, co-investigator, AIMS; Chaojiao Sun, co-investigator, CSIRO

Expert workshop participants:

Attended by 34 stakeholders from diverse disciplines including managers, policy makers, industry, scientists and indigenous representatives.

Hub level risk management

All risks identified in the Hub risk management plan are being actively managed.

TWQ Hub processes in place for the ongoing management of risk are:

- The Hub Leader, Hub Steering Committee, Hub Science Advisory Committee and Hub Administrator work closely together to meet all deadlines.
- Processes are in place to link project milestone delivery to institutional payments.
- The demonstrated history of timely delivery in tropical conditions by project leaders is considered in the assessment of project proposals.
- Regular communication with project leaders and regional stakeholders provides opportunities to employ knowledge brokering opportunities as they arise.
- The Hub employs a professional communications officer for production and distribution of media, a skilled knowledge broker and a graphic design professional for multi-media (e.g. print, web, social).
- The Hub provides high quality communication product branding and assists projects to distribute varied communication outputs as outlined in project proposals.
- In February 2017, a Hub Project Leaders workshop was held in Townsville. The workshop outlined the contractual obligations of the Project Leaders, the Hub Administrator, Hub Steering Committee, Indigenous engagement expectations, data repository obligations, and collaboration and reporting requirements.