



National Environmental Science Programme

Underpinning the repair and conservation of Australia's threatened coastal-marine habitats: Shellfish restoration research mid-project update

Ian McLeod, Chris Gillies and Colin Creighton

Project B4 - Underpinning the repair and conservation of Australia's threatened coastal-marine habitats

22 March 2017

Milestone 2 – Research Plan 3 (2017)



Enquiries should be addressed to:

Dr Ian McLeod

Centre for Tropical Water & Aquatic Ecosystem Research (TropWATER)

James Cook University

ian.mcleod1@jcu.edu.au

Project Leader's Distribution List:

Shellfish Reef Restoration Net via a news story on the Shellfish Restoration Website
(www.shellfishrestoration.org.au).

Melina Rafic – DOEE

Zoe Sinclair – DOEE

Gavin Hinten – DOEE

Greening Australia – Ross Andrewartha

Healthy Waterways and Catchments (now Healthy Land and Water) – Joel Bolzenius (now with
Quandamooka Aboriginal Association)

Kylie Russel – NSW DPI

Jamie Fitzsimons – TNC

Andrew Myers - OceanWatch

Preferred Citation

McLeod, IM, Creighton C and Gillies, C (2017) 'Underpinning the repair and conservation of Australia's threatened coastal-marine habitats: Shellfish restoration research mid-project update for 2016. Report to the National Environmental Science Programme, Marine Biodiversity Hub. Centre for Tropical Water and Aquatic Ecosystem Research (TropWATER) Publication, James Cook University, Townsville.

This report is licensed by the University of Tasmania for use under a Creative Commons Attribution 4.0 Australia Licence. For licence conditions, see <https://creativecommons.org/licenses/by/4.0/>

Acknowledgement

This work was undertaken for the Marine Biodiversity Hub, a collaborative partnership supported through funding from the Australian Government's National Environmental Science Programme (NESP). NESP Marine Biodiversity Hub partners include the University of Tasmania; CSIRO, Geoscience Australia, Australian Institute of Marine Science, Museum Victoria, Charles Darwin University, the University of Western Australia, Integrated Marine Observing System, NSW Office of Environment and Heritage, NSW Department of Primary Industries.

Important Disclaimer

The NESP Marine Biodiversity Hub advises that the information contained in this publication comprises general statements based on scientific research. The reader is advised and needs to be aware that such information may be incomplete or unable to be used in any specific situation. No reliance or actions must therefore be made on that information without seeking prior expert professional, scientific and technical advice. To the extent permitted by law, the NESP Marine Biodiversity Hub (including its host organisation, employees, partners and consultants) excludes all liability to any person for any consequences, including but not limited to all losses, damages, costs, expenses and any other compensation, arising directly or indirectly from using this publication (in part or in whole) and any information or material contained in it.

Contents

- 1. EXECUTIVE SUMMARY..... 1**
 - 1.1 Research goals 1
- 2. RESEARCH..... 2**
- 3. NATIONAL LEADERSHIP AND COORDINATION..... 5**
- 4. WORKING IN PARTNERSHIP WITH TRADITIONAL OWNERS..... 7**
- 5. MEDIA AND COMMUNICATIONS..... 12**

1. EXECUTIVE SUMMARY

Shellfish reef ecosystems were historically overfished to near extinction and their natural recovery is inhibited by a loss of suitable substrate and recruitment. Active repair is therefore required and efforts have begun with the promise of significant benefits. These projects (and future efforts), however, require a detailed understanding of the ecology and benefits to develop appropriate repair methods and to set targets based on natural reference conditions.

This research is focused on the reef-forming shellfish complex dominated by the Sydney rock oyster (*Saccostrea glomerata*) dominated reefs, which, of the eight known reef-forming species documented in Gillies et al. (2015), are, along with *Ostrea angasi* (native flat oyster) the most imperilled and have the highest restoration potential.

This work will directly support and underpin the management and restoration objectives of existing shellfish reef repair projects and will assist future projects and management decision-making by developing appropriate methods and setting of repair targets based on natural reference conditions. This work will also quantify some of the benefits of shellfish reefs to inform the business case for shellfish restoration in Australia being developed as part of this project.

1.1 Research goals

1. Describe the extent, morphology and size class of natural *S. glomerata* reefs (hereafter oysters) in order to develop nationally relevant methods for the construction and deployment of new shellfish reefs;
2. Quantify the biodiversity (fish, macro-invertebrates, algae and meiofauna) inhabiting *S. glomerata* reefs to determine their biodiversity value and to develop targets for current and future works projects;
3. Conduct preliminary investigations to quantify the benefits (supporting secondary productivity, providing habitat for fish and their food, water filtration and nitrogen cycling) of natural *S. glomerata* reefs.

2. RESEARCH

*Describe the extent, morphology and size class of natural *S. glomerata* reefs (hereafter oysters) in order to develop nationally relevant methods for the construction and deployment of new shellfish reefs.*

- Oyster reefs were described in Moreton Bay (Pumicestone Passage and North Stradbroke Island) in Queensland and the Richmond River in New South Wales. Descriptions were completed using a combination of aerial images sourced through the website Nearmap (with GPS groundtruthing) and on-ground measurements using transect tapes, quadrants and calipers. This research will allow for reasonably accurate estimates of extant oyster reefs distributions and a description of the structure and biomass of oyster reefs and the environmental context in which they exist.
- This work will be completed in 2017 with trips to The Hunter River and Port Stephens to describe oyster reefs there in partnership with New South Wales Department of Primary Industry.
- A new collaboration has been formed with a Historical Ecologist, Dr Ruth Thurston to describe the historical abundance, fishery and cultural services supplied by the former vast oyster reefs of southeast Queensland.



Oyster reefs in Pumicestone Passage, Queensland. Photo credit Ian McLeod.

Quantify the biodiversity (fish, macro-invertebrates, algae and meiofauna) inhabiting S. glomerata reefs to determine their biodiversity value and to develop targets for current and future works projects;

- The fish, macroinvertebrates, algae and meiofauna associated with oyster reefs were sampled in North Stradbroke Island in Queensland and the Richmond River in New South Wales.
- This work will be completed in 2017 with trips to The Hunter River and Port Stephens to describe the biodiversity supported by oyster reefs there in partnership with New South Wales Department of Primary Industry.
- Dr Ben Diggles has set up Australia's first oyster gardening project, where citizen scientists (pontoon owning canal estate dwellers) hang baskets of shellfish to grow to a useful size to be used for restoration projects. Each citizen scientist has two baskets, one with oysters, and one with oysters, leaf oysters (*Isognomon ephippium*) and mussels (*Trichomya hirsuta*) hung from their pontoon. After 6 months of deployment (May 2017) we will harvest these cages and quantify the fish and invertebrates associated with each treatment. This will give us an indication of the biodiversity values supported by oyster vs mixed shellfish reefs.



Many animals associate with oyster reefs. Here a colourful nudibranch found amongst the oysters in Pumicestone Passage. Photo credit Ian McLeod.

*Conduct preliminary investigations to quantify the benefits (supporting secondary productivity, providing habitat for fish and their food, water filtration and nitrogen cycling) of natural *S. glomerata* reefs.*

- Samples were taken to estimate the biomass and secondary productivity of mobile invertebrates associated with oyster reefs in North Stradbroke Island in Queensland and the Richmond River in New South Wales. Three habitats were sampled, the oysters themselves, under the oysters and in nearby reference sites (mud or sand). This will allow for estimation about whether the oysters facilitate or inhibit infauna communities.
- This work will be completed in 2017 with trips to The Hunter River and Port Stephens to describe the biomass and secondary productivity of mobile invertebrates supported by oyster reefs there in partnership with New South Wales Department of Primary Industry.
- The water filtration experiments will be run in Port Stephens in collaboration with New South Wales Department of Primary Industries in 2017.



Quantifying the benefits of natural oyster reefs requires measures of biodiversity and productivity of the system. Here oyster reefs in Moreton Bay are being assessed using transect tapes and 1 m² quadrants. Photo credit Ian McLeod.

3. NATIONAL LEADERSHIP AND COORDINATION

- The Hub Project has supported the Shellfish Reef Restoration Network through project leaders organising two national meetings in Sydney (May 2016) and Bribie Island, southeast Queensland (November 2016). Both meetings successfully brought together Government leaders, scientists, Traditional Owners, Non-Government organisations, NRM representatives, recreational fishing groups, shellfish aquaculture industry representatives, restoration practitioners and community members to discuss and prioritise national research, communication and policy priorities and to share knowledge about shellfish restoration projects. Supporting this network has led to burgeoning interest in shellfish restoration research including new investments in research in Queensland, NSW, Victoria, SA and Tasmania and restoration trials beginning in Queensland, WA, Victoria, South Australia and NSW.
- Dr Ian McLeod joined a The Nature Conservancy tour of coastal restoration sites in the US. There was a focus on visiting shellfish restoration projects and forming partnerships between researchers and practitioners in Australia and the US. Dr Ian McLeod attended the Restore America's Estuaries Summit in New Orleans and had a meeting with President and Board of Directors of Restore America's Estuaries to discuss opportunities for the two countries to work together. This meeting was organised by Dr Chris Gillies.
- Dr Ian McLeod won funding to host Australia's first Coastal Restoration Symposium to be run in Townsville in 2017.



Shellfish Reef Restoration Network meeting attendees - May 2016. Photo credit Ian McLeod.



Shellfish Reef Restoration Network meeting attendees - November 2016. Photo credit Marie Roman.

4. WORKING IN PARTNERSHIP WITH TRADITIONAL OWNERS

- The project funded a workshop with 21 Traditional Owners from Australia and New Zealand, which developed seven pearls of wisdom for working in partnership with Traditional Owners on shellfish reef restoration projects: and with support from the NESP Marine Biodiversity Hub and The Nature Conservancy Australia we organised a workshop with the following objectives:
 - Sharing knowledge amongst traditional owners from Australia and New Zealand;
 - To inform shellfish restoration projects around Australia and New Zealand about TO values and best practice for building partnerships with Traditional Owners;
 - To communicate aspirations for Sea Country Management around shellfish resources;
 - To capture some stories about shellfish resources/ coastal management through filming short interview videos.

Twenty-one Traditional Owners from Australia and New Zealand who were currently involved in or interested in coastal restoration projects came together for this workshop on Bribie Island, southeast Queensland in November 2016. The seven key outcomes derived through generating ideas and information and participative prioritisation were (1) recognition and acknowledgement of country and TO rights, (2) co-management and co-design of restoration projects, (3) a focus on local employment opportunities, (4) the importance of historical and current-day mapping of coastal resources and the role of Traditional Owner knowledge in this, (5) generating a vision of restoration and the potential benefits, (6) the importance of early engagement and long-term partnerships with TOs, (7) the importance of recognising the connections between land and sea and improving coastal water quality.

- The project supported Traditional Owner meeting attendance for Restore Pumicestone Passage meeting to plan for shellfish restoration in Moreton Bay.
- Researchers are working in partnership with Quandamooka Yoolooburrabee Aboriginal Corporation (QYAC) to describe the oyster reefs around North Stradbroke Island and their habitat value. Initially QYAC provided in-kind support to the project through providing field assistance, boat skippering and ecological knowledge. In future trips QYAC will be paid for the time that Rangers assist with research activities from project funds.



*QYAC staff and associates assisting with field research around North Stradbroke Island.
Photo credit Ian McLeod.*

INVITATION



Indigenous Australians have been enjoying and managing shellfish resources for thousands of years. However, since the late eightieth century over 99% of Australia's shellfish reefs have been lost through overfishing, pollution and disease.

Not only were shellfish reefs important food sources but they likely also provided environmental services such as providing habitat for other marine creatures, filtering and cleaning water and protecting shorelines. Shellfish restoration has proven to be successful overseas and restoration projects are starting in many locations around Australia. Restoration and protection are likely best achieved by linking Indigenous knowledge with science.

The objectives of this one-day workshop are:

- sharing knowledge amongst Traditional Owners across Australia and NZ;
- inform shellfish restoration projects around Australia and New Zealand about traditional owner values and best practice for building partnerships with traditional owners;
- communicate aspirations for Sea Country management around shellfish resources;
- capture some stories about shellfish resources/ coastal management through filming short interview videos.

When: 10am – 4:30pm (followed by a shared meal) on Wednesday 23rd of November 2016.

Where: Volunteer Marine Rescue Hall, Bribie Island, Queensland.

What: Group discussion in the morning, a boat trip in the afternoon and a shared meal in the evening.

Who: Traditional owners currently involved in or interested in coastal restoration projects.

Please RSVP by October 21st 2016 by emailing Ian McLeod at ian.mcleod1@jcu.edu.au

What are shellfish reefs?

Shellfish reefs are complex, three-dimensional living structures made up of oysters and mussels which provide food, shelter and protection for a range of invertebrate and fish species.



SHELLFISH REEF RESTORATION

This event is supported by the Marine Biodiversity Hub, a collaborative partnership supported through funding from the Australian Government's National Environmental Science Programme.

shellfishrestoration.org.au



Traditional Owners Shellfish Restoration Workshop – November 2016. Photo credit Ian McLeod.



Traditional Owners Shellfish Restoration Workshop attendees. Photo credit Marie Roman.

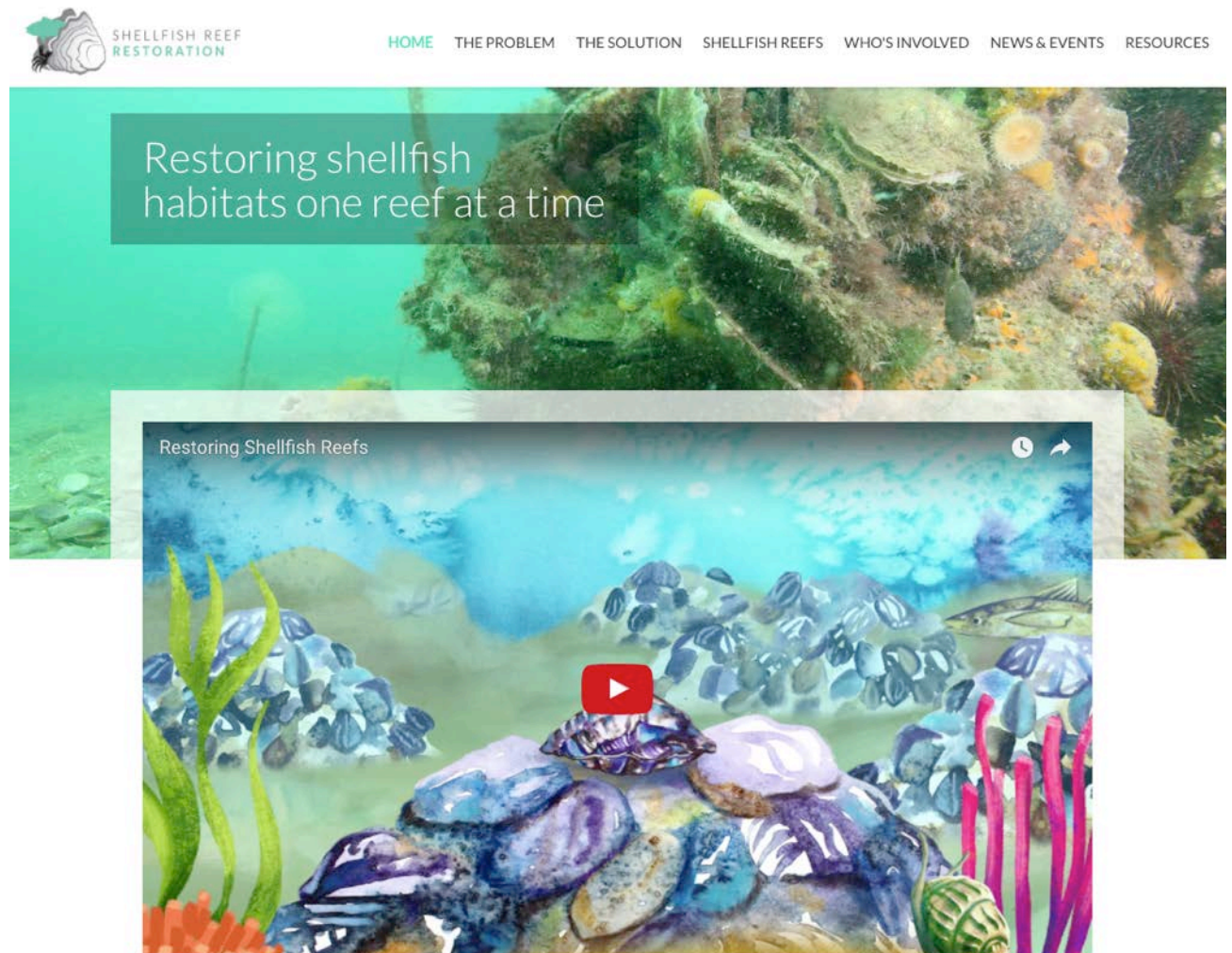


*Dr Stephen Miles and Mr Richard Williams attended the Traditional Owners Shellfish Restoration Workshop.
Photo credit Dr Ian McLeod.*

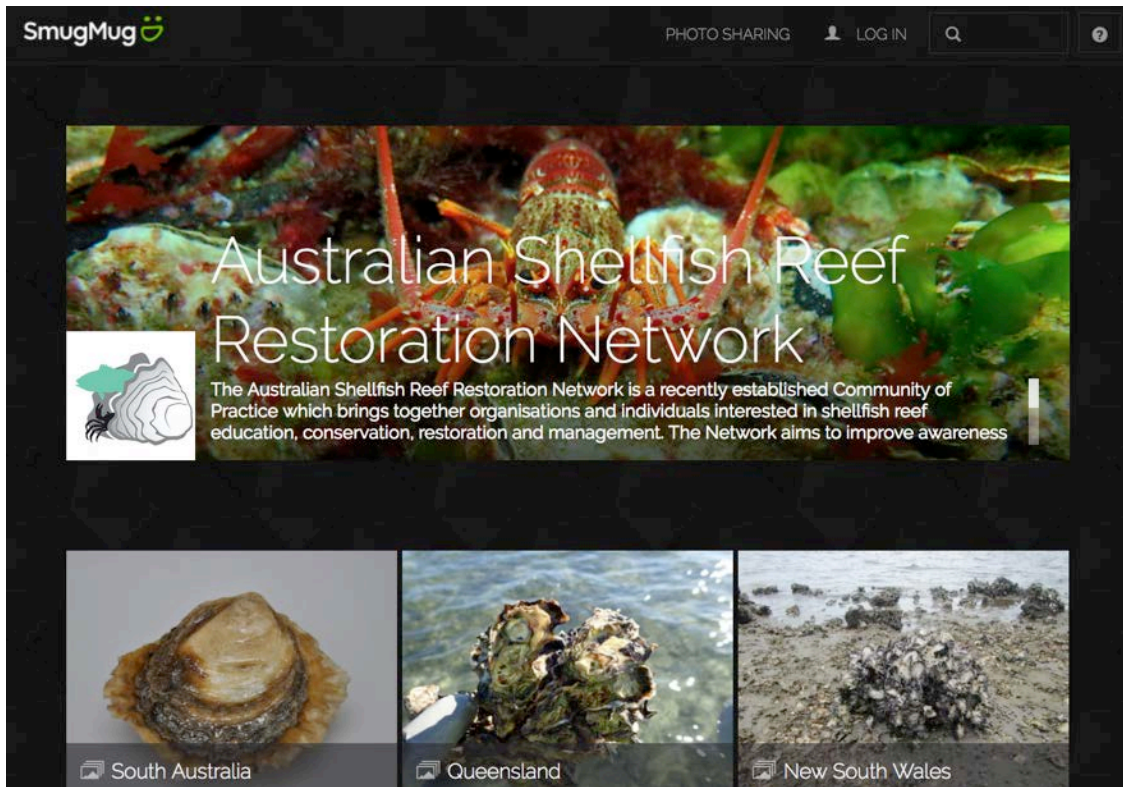
5. MEDIA AND COMMUNICATIONS

The Hub has supported shellfish restoration efforts and the Shellfish Reef Restoration Network by producing:

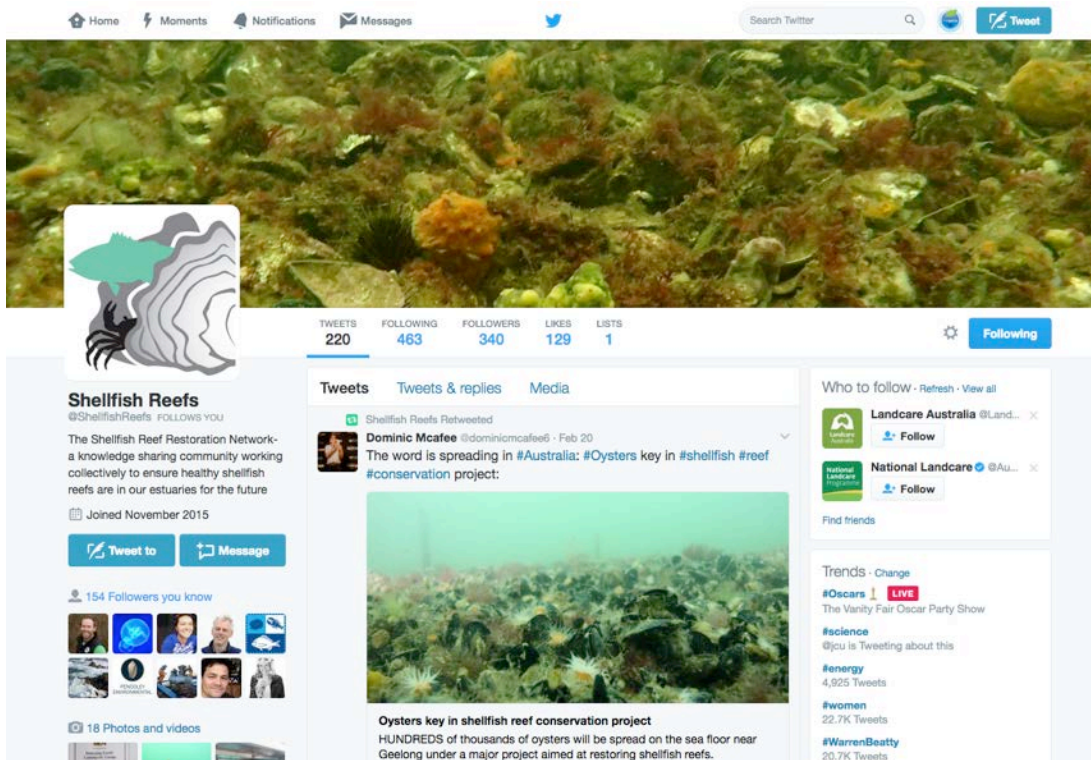
- A professionally type-set version of the Shellfish Reef Habitats report. This was widely distributed and supported by a JCU media release that led to 7 media stories.
- A website www.shellfishrestoration.com was built to showcase research outputs and increase knowledge of the potential benefits of shellfish reef restoration in Australia.
- Twitter (@shellfishreefs) and Instagram (@shellfishreefs) accounts were built to increase knowledge of Australia's shellfish reefs and increase research impact and engagement.
- A photo website (<https://shellfishreefs.smugmug.com/>) and Youtube (<https://www.youtube.com/channel/UC2YFf7EBZECrG4cQf9Je9kQ>) were built and populated to provide media outlets with imagery for new stories.
- An animated video was created and housed on the front page our website.



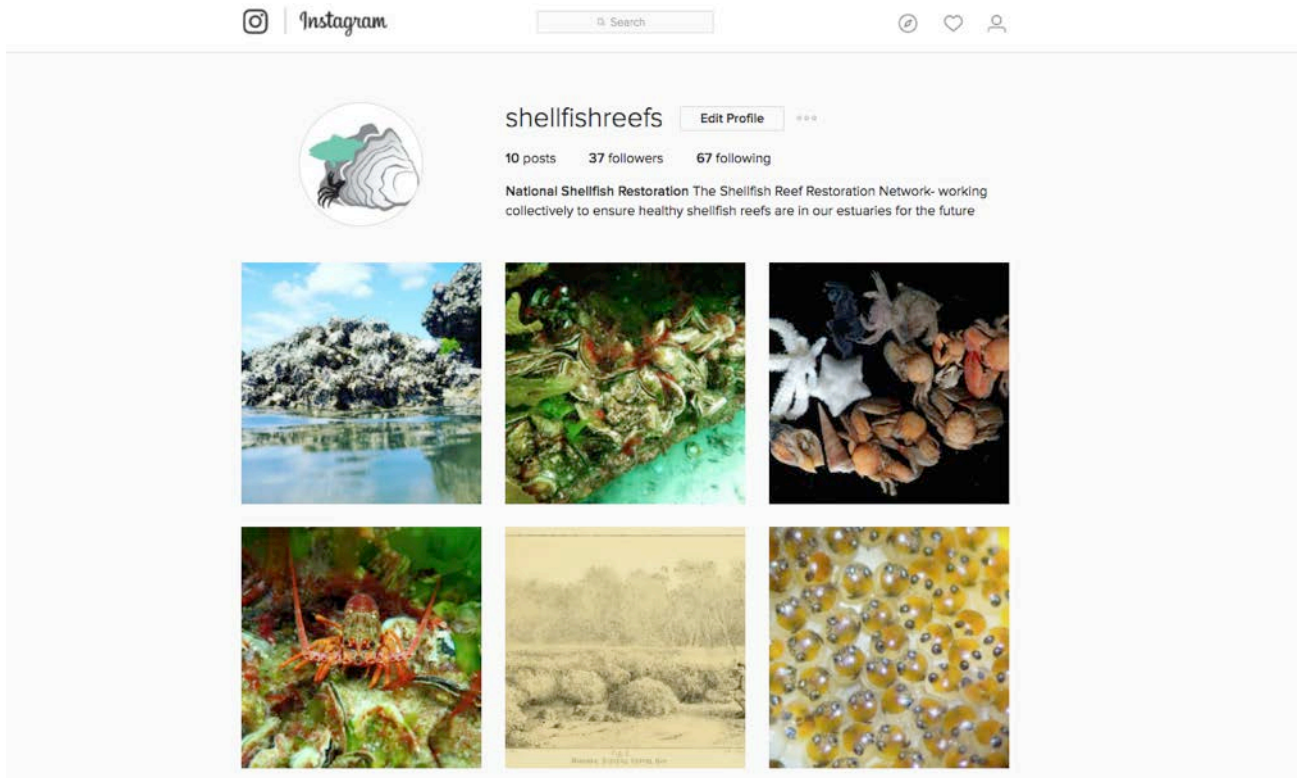
The website (www.shellfishrestoration.com) was created to highlight research outputs and increase awareness of shellfish reef restoration in Australia.



The photo website (shellfishreefs.smugmug.com) was created to provide media outlets with imagery for news stories about the project.



A Twitter account (@shellfishreefs) increases knowledge of Australia's shellfish reefs and allows people to connect and engage with the project.



An Instagram account (@shellfishreefs) raises awareness of Australia's shellfish reefs through compelling visual imagery and encourages engagement with the project.



www.nespmarine.edu.au

Contact:

Ian McLeod

TropWATER, James Cook University

Address | James Cook University | Townsville Campus

Email | Ian.mcleod1@jcu.edu.au

tel | +61 449 840 082