

PROGRESS REPORT ON PROJECT SUPPORTED BY PADDY PALLIN SCIENCE GRANT

Instructions to Project Leaders for Completing This Form

Progress reports are required to be submitted 12 months after the start of the project, and then at 18-24 months as a final report. Grants usually begin on the 15TH September in the year in which the grant was awarded. Payment of the second grant installment is contingent upon the receipt of this material. Updates are to be provided during the tenure of the grant, and at the time the final report is submitted. Payment of the final grant installment is contingent upon receipt of the final summary which is to summarize the outcomes of the project during the tenure of the grant.

1. PROJECT IDENTIFICATION

1.1 The Secret Garden: Discovering Wollongong's deep-water (40-60m) animal forests & examining anchor scour as a disturbance agent to these assemblages

1.2 University of Wollongong

1.3 Lead Investigator: Allison Broad

2. PROJECT DESCRIPTION & OBJECTIVES

2.1 100- Word Project Summary

Rocky reef 'animal forests' comprise sponges, bryozoans, octocorals and hydrozoans that provide essential food, structural habitat and vital ecosystem services for marine environments. In the Wollongong region, ships currently anchor on these reefs and it is vital we have an understanding of the biodiversity in the area and the impacts they are exposed to so we can manage them sustainably wherever possible. Using a Remotely Operated Vehicle (ROV) we are documenting the biodiversity and distribution of these groups in the region and further examining the effects of anchor and chain scour from ships (100-300m length) to inform management.

2.2 Summary of original objectives (150 words max)

Originally the main objectives of this work were to;

- (1) *Increase our knowledge of the diversity, abundance & distribution of fish assemblages & sessile invertebrates; including sponges, bryozoans & branching hydro-coral communities along this coastline using remote imagery & collection techniques;*
- (2) Use a world-first 'anchoring experiment' to investigate the effects of anchor & chain scour from large merchant ships to these communities, comparing them with control locations & follow their trajectory to recovery;
- (3) Improve marine spatial planning by providing evidence-based outputs to a range of Australian stakeholders at the local (Wollongong) state (NSW Ports / Port Authority of NSW, Marine Estate Management Authority (MEMA)) & federal levels (Australian Maritime Safety Authority & Australian Marine Sciences Association);
- (4) To communicate my findings to the NSW state government & then globally to the International Maritime Organisation (IMO) the United Nations organisation responsible for sustainable shipping.

3. PROJECT OVER DURATION OF FOUNDATION GRANT

3.1 Have there been any changes to the project? If yes give details

This could include changes to the research Project resulting from funding from the Foundation being at a lower level than requested. By indicating changes to the budget, aims and research plan in the Report, you are requesting approval from the Foundation for a revision of the Project. A 'satisfactory' assessment of the Report and the Project by the Paddy Pallin Grants Committee means that the revision has been approved.

The project has had significant disruptions with the 2019/2020 bushfires, the global COVID-19 Pandemic and related flow-on effects of these issues. These delays and my PhD timeline has meant that I have had to abandon the 'recovery' element of the project. Encouragingly however, the 'anchor experiment' fieldwork is half completed, all other project aims are progressing well and are on schedule.

We have redirected some of our research funds into increasing our understanding of the biodiversity of marine invertebrates in the region. In late 2019 we collected 15 sponges using the ROV which has yielded 14 Operational Taxonomic Units (OTU's), 6 species unknown to science and excitingly a new genus! All sponge samples have been lodged with and are being catalogued at the Queensland Museum. Given this region has a very limited understanding of its deep water marine invertebrates (two environmental assessments; 1 in early 1900's by the fisheries vessel *the Thetis* and second work by Roberts et al. 1996) we have decided to invest in further collections and taxonomic resolution

of this group. We will collect another 30-40 specimens, have them taxonomically resolved and once again lodged at the relevant Australian Museums.

3.2 What were your research plans and objectives for the period covered by this report? (150 words max) *(The answer to this question should be consistent with the original Application or the preceding Progress Report).*

Milestone Timetable	2019	2020	2021	2022
INITIAL ASSESSMENTS OF ANCHORING EVENTS - sessile invert. assessment using ROV				
COLLECT & ID SESSILE INVERTEBRATES - Sponges, Bryozoans & Gorgonians				
AFTER ASSESSMENTS IE. RECOVERY - x3 intervals over 2 years (using ROV)				
PUBLICATIONS in (i) <i>Ecological Applications</i> ; (ii) <i>Diversity & Distributions</i>				
DISSEMINATE RESEARCH FINDINGS & suggestions to appropriate stakeholders				

3.3 Did the research project proceed as planned? What have you achieved over this period? Outline the research findings to date (200 words max)

The research has largely proceeded as planned; however, with significant disruptions of 2019/2020 (described in section 3.4) there have been some alterations to the project (see section 3.1) and half the fieldwork is complete to date.

Whilst there were obstacles with fieldwork, I focused much of my time on writing and published a literature review on anchor scour (see section 4).

I have initiated a collaboration and secured in-kind support from the **NSW Department of Primary Industries (NSW DPI)** for offshore field work (10 days) including vessel hire, two NSW DPI staff members to support my field work and speed up my video processing of benthic assemblages. This collaboration not only supports the fieldwork and financial element of the project, but also one of the key aims and objectives to deliver this evidence-based research directly to managers of the marine estate.

3.4 Have you experienced any difficulties that have affected the progress of the research project? If yes give details (150 words max)

In 2019/2020, two extraordinary events; the NSW bushfires and the COVID-19 Pandemic have resulted in significant disruptions, restrictions and flow-on effects preventing this research to proceed as planned. Also, weather is always an issue with offshore fieldwork. The ROV requires light winds, low swell and no rain for operations, which can be very difficult to achieve all 3 requirements offshore.

Smoke from the bushfires was a health hazard for fieldwork and also reduced light penetration in deep-water that is vital for successful filming in deep water (>50m). Additionally, our ROV contractor lives in Batemans Bay and the fires were extreme in the area causing concerns and road-blocks that reduced his availability.

COVID-19 lockdowns for several months, social distancing requirements, flow-on effects and a year of uncertainty prevented fieldwork to take place.

3.5 What are your research plans and objectives, including publication plans, for the coming year? (150 words max) (Please note that in your next Report you should report progress against these plans and objectives)

We have 5 additional field days to complete in the remainder of 2020. Subsequently, all video data will be processed, diversity and distribution quantified and analysed for impacts from anchor disturbance.

In addition to this, as indicated in section 3.1, I aim to collect further sponges and if possible other marine invertebrates for taxonomic resolution.

The research outcomes of the anchor experiment and invertebrate collections will be written up for publication (2) and further contribute to two chapters of my thesis;

Chapter 4: Collection and taxonomic identification of deep-water (40-60m) temperate rocky reef marine sponges of the Wollongong region. To be published in *Checklist*

Chapter 5: An 'anchoring experiment' assessing the effects to reef heterogeneity, benthic biota and its subsequent recovery. To be published in *Ecological Applications*

4. ACADEMIC OUTPUTS

4.1 Publications and other academic outputs directly related to this project. (Please list all publications and those manuscripts accepted for publication, for the period covered by this report)

Outcomes related to this work include 1 peer-reviewed publication, 3 presentations and 4 media outputs;

Publications

Broad A, Rees MJ, Davis AR (2020) Anchor and chain scour as disturbance agents in benthic environments: trends in the literature and charting a course to more sustainable boating and shipping. *Mar. Poll. Bull.* doi.org/10.1016/j.marpolbul.2020.111683

Presentations

- Dec 2020** **Remote Technologies reveal Wollongong’s sponge gardens: classification approaches for diversity & ecological assessments**
Ecological Society of Australia’s Annual National Conference, Virtually in Wollongong
- 2020** **Investigating ‘Anchor Scour’: collaborative partnerships and the applications of seabed mapping.**
AusSebed National Webinar Series (September Chapter)
- 2019** **Deep temperate reefs: assessing anchor scour by merchant vessels as a disturbance agent**
Environmental Protection Authority (EPA) Annual Branch Meeting, Wollongong

4.2 Evidence of scholarly impact and contribution. Is there evidence that this research project is having/has had an impact in the research field or the broader public domain? *Include examples of formal training (PhD /Masters) as well as other training.*

If yes, give details *(For instance, standard citation data on articles published in ISI journals, citations to books, re-publication, translations, reviews, invited keynote addresses, other invitations, newspaper/media/expert commentary).*

A key aim of this research is to **communicate with stakeholders of the marine environment** the importance of investigating and mitigating the impact of anchor scour to seabed environments. I have endeavored to engage with the public, industry, government and policy makers – see section 4.1.

NSW & QLD stakeholders of the marine estate

- We have secured collaborative support with Fisheries scientists from NSW DPI to address the threat and risk of anchoring on deep reefs, which has been identified as a key knowledge gap in the Hawksebury Shelf Marine Bioregion (HSMB) statewide threat and risk assessment. Filling these gaps will inform management.
- I continue to attend and contribute to **Port Kembla Harbour Environment Group** Meetings and sustained contact with industry (NSW Ports and the NSW Port Authority) to update further progress and propose future research.
- Our **review** on anchoring (in 4.1) has been **shared** with Queensland and Federal stakeholders of the ‘**North East Water Space Management Working Group**’ (**NE WSM WG**) to be tabled for discussion at their next meeting (Nov, 2020) for actions relating to the Shipping Management Plan for Queensland Ports and the Great Barrier Reef Marine Park.
- I have **proposed an APR Internship with the Australian Academy of Sciences**. The internship would aim to promote science policy impact towards sustainable anchoring

practices with Marine Law Professor Warwick Gullett as my mentor (Nov, 2020). I am awaiting the outcome of this application.

In the Media

A media interview I did in December 2019, was finally released in June after bushfire AND COVID disruptions.

Local ABC Radio; Fuller K (2020) Dragging the chain: what is the impact of shipping anchors on seabeds? June 30, 2020. Available at: <https://soundcloud.com/kelfuller/dragging-the-chain-what-is-the-impact-of-shipping-anchors-on-seabeds> [Accessed 13 July, 2020]

ABC Radio, Australia Wide; Fuller K (2020) Dragging the chain: what is the impact of shipping anchors on seabeds? June 30, 2020. Available at: <https://soundcloud.com/kelfuller/dragging-the-chain-what-is-the-impact-of-shipping-anchors-on-seabeds> [Accessed 13 July, 2020]

Glyde, I (2020) Vital marine environments at risk from ship anchors amid growing global trade: New paper from UOW researchers argues framework is needed to help preserve ocean floor. October 13, 2020. Available at: <https://www.uow.edu.au/media/2020/vital-marine-environments-at-risk-from-ship-anchors-amid-growing-global-trade.php> [Accessed 19 May, 2020]

Illawarra Mercury Newspaper; Glyde, I. (2020) **Impact of bulk carrier anchors on the seabed is a knowledge gap, expert says**. Illawarra Mercury. October 14, 2020. Available at: <https://www.illawarramercury.com.au/story/6968445/bulk-carriers-impact-on-the-seabed-is-the-knowledge-gap-expert-says/> [Accessed 19 May, 2020]

4.3 End-user interaction and other project outcomes **If there are examples of the impact of this research Project not covered in item 4.2 above please provide details.** *For example, introduction or modification of standards/protocols within an industry sector, preparation of proposals for funding from other agencies as a result of outcomes from this project.*

We are communicating with shipping stakeholders and government agencies with the aim of having positive ways forward in marine spatial planning for industry and the environment.

5. ATTACHMENTS & OTHER MATERIAL

Please provide, as separate files, any figures, graphs, images and other material that cannot be included in this form. Please also provide updated material (text and images) that can be used to revise your project summary on the Foundation's web site. Please provide text in Microsoft Word format and images in JPEG format with a minimum size of 600 x 400 pixels. If this is the final project report, the web page summary must be updated to reflect the outcomes of the project. Is any material being forwarded as additional attachments?