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## Project A7 – Monitoring the population dynamics of ‘Western’ right whales off southern Australia

*Project length*: 3 Years

*Project start date*: 2015

*Project end date: 31/03/2021*

*Project current status:* submitted for re-approval

*Project Leader*: John Bannister (FTE – 25%)

*Lead research organisation*: The Western Australian Museum

*Project leader contact details:* Email [bannisj@bigpond.com](mailto:bannisj@bigpond.com); ph (WA Museum ) 089 212 3800; *(home) 089 295 4361; fax (WA Museum) 089 2123 882*

# Project Funding and Expenditure

Project funding table

|  | *2015* | *2016* | *2017* | *2018* | *2019* | *2020* | *2021* | ***TOTAL*** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *NESP funding* | *40000* | *40000* | *40000* | *40000* | *40000* | *40000* | *x* | *240000* |
| *Cash co-con* | *-* | *-* | *-* | *-* | *-* | *-* | *x* | *x* |
| *In-kind co-con* | *5000* | *5000* | *5000* | *5000* | *5000* | *5000* | *x* | *30000* |
| ***TOTAL*** | ***45000*** | ***45000*** | ***45000*** | ***45000*** | ***45000*** | ***45000*** | ***x*** | ***270000*** |

Expenditure statement

Funding will cover

a) Aerial survey – plane charter @ $550/hr for 40hrs including fuel, pilot and insurance: $22000/yr not including GST or inflation (estimated at ca $10 per litre per year); observer/photographer $3400/yr

b) Data extraction/analysis/databasing/report writing: $14600/yr

# Project Description

Project Summary

Now listed as endangered under the EPBC Act, unsustainable whaling during the 19th and 20th centuries reduced right whales to a few hundred animals but they now seem to be recovering slowly in most areas. This project is designed to continue aerial surveys to 2020 to monitor the recovery of the south-western population of southern right whales between Cape Leeuwin (WA) and Ceduna (SA) using photo-identification data collected by light aircraft. The outputs from this project will be provided to the Department of Environment and Energy to inform implementation of the Conservation Management Plan for the Southern Right Whale.

Project Description

#### Description of the specific problem

Southern right whales were reduced almost to extinction throughout the Southern Hemisphere, with up to 150,000 animals killed between 1790 and 1980. It is thought there might have been as few as 300 animals across the southern hemisphere in the 1920s, but this number could now be around 12,000. Right whales that calve, nurse and breed within Australian waters are thought to comprise two populations, each found close to the coast in winter and spring. The south-west population occurs off the southern coast, largely between Cape Leeuwin (WA) and Ceduna (SA) while the south east population occurs off the south-east coast of mainland Australia and around Tasmania. Evidence suggests these two populations differ greatly in size and rate of population growth. The south-west population has shown strong population growth of approximately 6% per year and in 2014 was estimated to be around 2,300 animals. However, lower counts in 2015 and 2016 have introduced more uncertainty into these estimates, suggesting the rate of increase observed since the early 1990s is now declining. In contrast, owing to challenges associated with monitoring a small, widespread population, there are no reliable trend data available for the south-east population, and the population size is probably in the low hundreds. Although there has been an observed increase in the number of right whales calving off Australia’s coast their current range is considerably smaller than it was prior to whaling and their current population size is substantially below their estimated pre-whaling abundance.

Southern right whales are listed as *endangered* under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and a Conservation Management Plan (CMP) has been developed for this species (2011-2021). This CMP and Marine Bioregional Plans (South-west and South-east Marine Regions) state right whales are potentially vulnerable to a range of threats including: entanglement in fishing gear, marine debris and marine infrastructure; marine noise pollution; vessel collision; changes in oceanography and ocean acidification as a result of climate change; oil pollution; bycatch; and physical habitat modification, which is pertinent for the near inshore shallow embayments where calving and nursing occurs. These threatening processes could inhibit the recovery of southern right whales in Australian waters if not managed adequately and the effectiveness of current practices not assessed.

#### How Research Addresses Problem

The data provided by these surveys will be used to assess the current status of this Threatened Species under the EPBC Act and assess the effectiveness of Federal and State management approaches that aim to facilitate this species’ recovery and range expansion.

This project in part addresses the **very high** priority action in the Australian Government’s *CMP for the Southern Right Whale (2011-21)* – Action Area B1: ‘Measuring and monitoring population recovery’. Population abundance and trend, and habitat occupancy were selected for being the most relevant attributes to assess the current conservation status, life history and population structure of right whales in Australian waters. Action Area B1 makes specific reference to ‘maintain[ing] long-term aerial survey and photo-identification monitoring of the south-west coastal region (Cape Leeuwin to Ceduna) on an annual basis.’

In addition to population size and trend, photo-identification can be used to estimate life history parameters, such as conception rates and calving intervals, and age of reproductive maturity. These life history parameters can be used as indicators for the influence of environmental/climatological variations on the recovery of this species (as an example, lower conception rates may be an indication of food shortages on the southern feeding grounds south of 40°S (i.e., amphipods and krill), which will then lead to a decrease in recovery rates).

In addition to its direct contribution to NESP Marine Biodiversity Hub proposed Project A14 “Listing Assessment Southern Right Whale” this proposed project will contribute data to the currently funded Project C5 “Quantification of risk from shipping to large marine fauna across Australia”, and the proposed Project E2 “Characterising anthropogenic underwater noise to improve understanding and management of acoustic impacts to marine life’. Both vessel strike and noise pollution have been identified as potential threats to southern right whales, as stated in the CMP for the Southern Right Whale (2011-2021) and the Marine Bioregional Plan for the South-west Marine Region (2012).

#### Alignment with NESP Research Priorities

* Improve our knowledge of key marine species and ecosystems to underpin their better management and protection.
* Determine and trial practical and repeatable methods for monitoring the status and trends of key coastal and marine species and environments.

### Research

#### Description of research

Objectives:

* Conduct annual aerial surveys between Cape Leeuwin (WA) and Ceduna (SA) over three years (2018 to 2020) to collect count and photo-identification data for the south-west population of Australia’s southern right whales
* Provide an assessment of the conservation status of Australia’s south-west population of endangered southern right whales
* Provide individual photo-identification data to the Australasian Photo-Identification Catalogue to facilitate the assessment of the conservation status of right whales in Australian waters and the demographic relationships between Australia’s two right whale populations
* Contribute to a future International Whaling Commission assessment of the recovery of right whale in the Southern Hemisphere

Details of related prior research:

Since 1993, annual inshore aerial surveys between Cape Leeuwin (WA) and Ceduna (SA) have provided count and photo-identification data throughout nearly the entire range of what is now considered the south-western population of Australia’s right whales (see Methods below). NESP has funded these surveys over the last three years (2015-2017; see Bannister 2017). The counts and associated photo-identification data from these surveys provide estimates of population size and trend for the south-west population (population size is currently obtained using a simple model based on the numbers of cow/calf pairs sighted) which *inter alia* are used to assess conservation status under the EPBC Act. The results of these surveys are also presented frequently to the Scientific Committee of the International Whaling Commission (e.g. Bannister JL, et al. 2016) to be used in hemisphere-wide population status assessments for this species.

Although these surveys only occur between Cape Leeuwin and Ceduna the photo-identification data also provide important information on the connectivity and demographic independence between the south-west and south-east populations. As such the data from the surveys will contribute to the CMP’s Action Area B2, investigating a two-population model. The relationship between the two Australian right whale populations remains poorly understood but photo-identification data facilitate the investigation of temporary or permanent movement between these groups. Indeed the data from the south-west surveys will be entered in to the Australasian Right Whale Photo-Identification Catalogue (ARWPIC) and used to assess the demographic independence of the Australia’s right whale populations. Unidirectional (east to west) migration between populations may explain the apparent lack of recovery in the south-east population; addressing this specific question is the subject of an associated NESP proposal (A14).

#### Methods

Following established protocols, all future surveys will be undertaken with a high wing, single engine aircraft (Cessna 172) crewed by a pilot/observer and photographer/observer. Each flight occurs follows the coastline between Cape Leeuwin WA and Ceduna, SA, searching an area *ca* 1 nmile wide offshore. Flights are only undertaken on ‘good’ days, when wind speeds are less than 15 knots. The flights occur between mid-August and mid-September when whale numbers are likely to be at close to the maximum given the known calving period. Each survey involves multiple legs between salient points on the coast and the legs could occur on the same day or spread across several days depending on the weather. Each leg is generally covered twice, once ‘outwards’ and once ‘inwards’.

A previous study has assessed the utility of annual over less frequent surveys (Bannister et al 2011). This study concluded:

* Any changes in parameters associated with recovery of this species in Australia will take much longer to detect (up from say 4 to 10 years) if annual surveys are discontinued
* Decreasing survey frequency will also substantially decrease precision of estimates of abundance of cow/calf pairs as compared with annual survey (but with some ‘recovery’ of precision expected if surveying for blocks of several years after annual gaps)
* Anything other than an annual survey frequency will make resolving any environmental/climatological influences much more difficult
* This dataset is becoming a key global dataset for informing population dynamic models for long-lived animals – including management models within the IWC.

There are also practical considerations associated with keeping the survey team consistent, trained, engaged and available when surveys become less predictable.

NESP 2017 Research Priority Alignment

It is directly relevant to the priories as listed above.

Pathway to Impact

|  |  |  |  |
| --- | --- | --- | --- |
| **Outcomes** | | | |
| The data delivered by this study will directly inform the assessment of the conservation status of this Threatened Species under the EPBC Act. The study will also address two key high priority actions under the Australian Government’s Conservation Management (Recovery) Plan for right whales and inform an assessment of the effective of current protection measures. The study will also contribute to a global assessment of the recovery of this species following the severe impacts of commercial whaling in the 19th and 20th centuries.  Engagement and communication for this project will be planned and implemented consistent with the [Hub’s Knowledge Brokering and Communication Strategy](https://www.nespmarine.edu.au/system/files/Knowledge%20Brokering%20and%20Communictions%20Strategy%20version%201.1%20.pdf). | | | |
| **Research-users**  Migratory Species Unit, Australian Government Department of Environment and Energy (Geoff Richardson)  Parks Australia Department of Environment and Energy (Amanda Richley)  Parks and Wildlife Service, Government of Western Australia Department of Biodiversity, Conservation and Attractions (Kelly Waples)  Government of South Australia Department of Environment, Water and Natural Resources (Vera Hughes)  Biodiversity Division, Victoria State Government Department of Environment, Land, Water and Planning (Mandy Watson)  Great Australian Bight Marine Park Authority  NOPSEMA (Tim Carter)  International Whaling Commission, Scientific Committee (Greg Donovan) | **Engagement and communication**  Provide progress reports to stakeholders after surveys are completed  Presentation and discussion direct to relevant Department sections and delivery of scientific papers and reports  Presentation and discussion at the ‘State Roundtable’ of cetacean conservation managers  Presentation of results to the Scientific Committee of the International Whaling Commission | **Impact on management action**  Assessment of the conservation status of Australian right whale  Results available to inform the Australian Government’s Conservation Management Plan for Southern Right Whales (2011-21 and associated management actions  Inform the Marine Park Management Plan and associated management actions  Inform Environmental Plans for seismic surveys  Inform international Conservation Management Plans  Contribute to procedures or assessments related to the management of commercial or scientific whaling | **Outputs**  Scientific paper on the exploitation, recovery and current population status of the south-west Australian right whale population.  Scientific paper reviewing the ‘two-population model’ for Australian right whales (with Project A14)  Scientific paper presenting the assessment of the conservation status of Australian right whales (with Project A14)  Scientific paper presented to the 2019 meeting of the IWC’s Scientific Committee Hemispheric assessment of the recovery and current conservation status of southern right whales  A summary report to indicate how the project data can inform and be used to update the Conservation Value Atlas and the identification or modification of Biologically Important Areas |
| **Additional outputs**  Media coverage in due course (through WA Museum) | | | |

### Indigenous Consultation and Engagement

Indigenous consultation and engagement for this project will be undertaken in a manner that is consistent with the [Hub’s Indigenous and Participation Strategy](https://www.nespmarine.edu.au/document/indigenous-engagement-and-participation-strategy). This project is considered a category three project for Indigenous engagement. This means the knowledge generated in this project will be effectively shared and communicated between relevant Indigenous peoples, communities and organisations.

While so far there has been no official engagement with indigenous groups given the nature of the survey and its location, the current survey passed through Head of Bight on 25 August 2017– Whale Day at the Yalata Community - who are therefore aware of its existence. In future, efforts will be made for the survey to pass through the area at the required time. In addition, Dr Claire Charlton, Curtin University, who will be there undertaking a long-term study of right whale population demographics, has agreed to present information on behalf of the proposed project.

The project leader will collaborate with the project leader for project A13 (i.e. Estimation of population abundance and mixing of southern right whales in the Australian and New Zealand regions) to ensure Indigenous consultation and engagement on the Hub’s southern right whale research is coordinated.

### Project Milestones

| **Milestones: previous projects** | **Due date** | **Milestone Status** |
| --- | --- | --- |
| Milestone 1 – Signing of contract | 19 May 2016 | Completed |
| Milestone 2 – detailed research plan developed and completed | 30 March 2017 | Completed |

| **Milestones: current proposal** | **Due date** | **Milestone Status** |
| --- | --- | --- |
| Milestone 1 – Signing of contract | Early 2018 | As proposed |
| Milestone 2 – detailed research plan developed | April 2018 |  |
| Milestone 3 – undertake survey | August-Sept 2018, ditto 2019, 2020 |  |
| Milestone 4 - select identification photos from aerial survey | By 30 Oct 2018, ditto 2019, 2020 |  |
| Milestone 5 - provide Progress Report on activities | Due 30 Dec 2018, ditto 2019, 2020 |  |
| Milestone 6: incorporate sightings data in the sightings database | By 30 January 2019, ditto 2020, 2021 |  |
| Milestone 7: provide Final Report on activities | Due 31 March 2019, ditto 2020, 2021 |  |

# Data Management and Accessibility

|  |  |
| --- | --- |
| **Project output** | **Data Management and Accessibility** |
| Aerial survey data – counts by class, number and location. Photo-identification data. | Annual survey datasets will be made available to the public through the Australian Antarctic Data Centre (<https://data.aad.gov.au/>). Associated metadata records will be submitted to the Global Master Change Directory (<https://globalchange.nasa.gov/>) and propagated to other metadata repositories including the [AODN catalogue](http://catalogue.aodn.org.au/geonetwork/srv/eng/home).  Individual photo-identification data will be submitted to the Australasian Right Whale Photo-Identification Catalogue (ARWPIC; <https://data.marinemammals.gov.au/arwpic/>) and reconciled with the full catalogue.  The data will also be a key component of proposed NESP project A14 – SRW population estimate |

All project outputs (including data) will be made publically available in accordance with the NESP Data Management and Accessibility Guidelines. To facilitate a consistent standards based approach, the Hub has produced a [Data Management Framework](https://www.nespmarine.edu.au/system/files/MBH%20Data%20Management%20Framework%20v1.2%20-%2005Dec16_AO.pdf). The framework provides project leaders with clear directions on publishing metadata, storing data and satisfying requirements for open access to journal articles.

A report will be submitted to the Scientific Committee of the International Whaling Committee in 2019 and later prepared for publication in the Commission’s Journal of Cetacean Research and Management. The report will also be submitted to the Department of the Environment and Energy to address an action under the Southern Right Whale’s Conservation Management Plan (EPBC Recovery Plan). All peer-research papers will be made available to the public through open access via the Hub’s website (in accordance with the NESP Data Management and Accessibility Guidelines).

Location of Research

Flying between Cape Leeuwin WA and Ceduna SA within 1 nmile of the coast, with an additional leg up the WA west coast between Cape Leeuwin and Perth.

Project Specific Risks

| **Risk to project** | **Potential impact on project** | **Risk rating (low, medium high, severe)** | **How will risk be managed?** | **Who is responsible for managing risk?** |
| --- | --- | --- | --- | --- |
| 1. Inclement weather during the allocated 4-week period (15 August-15 September), when maximum number of whales is to be expected in the area surveyed. | At the worst -impossible to undertake the survey in the allocated time period. In 2016 it was only possible to undertake an ‘outward’ survey between C Leeuwin and Ceduna, an ‘inward’ survey was not possible through bad weather. | Low | Careful review (daily) of local/State weather forecasts. | Schmidt (pilot) |
| 1. Breakdown in the computer–assisted matching program, which is sensitive to incorrect data entry | No matching possible | Low | Seek advice from e.g. Dr Vicky Rowntree, Uni of Utah, jointly responsible for development of the system | Bannister |
| 1. Loss of staff – possible incapacity of Project Leader (Bannister) | Project unable to continue | Moderate | A team of suitably qualified researchers from Murdoch University, WA Museum, the Australian Marine Mammal Centre and the Australian Antarctic Division have agreed to jointly manage the project to its conclusion should the need arise | J. Smith (Murdoch)  D. Jones (WA Museum)  M. Double (AMMC)  N Kelly (AAD) |

Project Keywords

Aerial survey, identification photos, right whales, ‘western subpopulation’, Australian south coast

Project contacts

Researchers and Staff

| **Name** | **Organisation** | **Project Role** | **FTE** |
| --- | --- | --- | --- |
| John Bannister | WA Museum | Project leader/manager | 25% |

Data Management

| Name | Organisation | Email | Phone |
| --- | --- | --- | --- |
| J Bannister advised by M Double | WA Museum/AAD | [bannisj@bigpond.com](mailto:bannisj@bigpond.com) | WA Museum - 089 212 3800  Home - 089 295 4361 |

Co-contributors

| Name | Organisation/ | Contribution |
| --- | --- | --- |
| Jenny Schmidt | Great Southern Aviation | Pilot |
| Andrew Halsall | Halsall Photography | Observer/photographer |

Key Partners **and** Research End Users

| **Key Partners (organisation/program)** | **Name/s** | Email (optional) |
| --- | --- | --- |
| The Western Australia Museum | John Bannister |  |
|  |  |  |

| Research Users (program/section/branch/organisation) | Name/s | Email (optional) |
| --- | --- | --- |
| DoEE Migratory Species | Geoff Richardson |  |
| Parks Australia | Amanda Richley |  |
| *Dpt of Biodiversity, Conservation and Attractions (Western Australian Government)* | *Kelly Walpes* |  |
| *Dpt of Environment, Water and Natural Resources (South Australian Government)* | *Vera Hughes* |  |
| *Dpt of Environment, Land, Water and Planning (Victorian Government)* | *Mandy Watson* |  |
| *NOPSEMA* | *Tim Carter* |  |
| *International Whaling Commission* | *Greg Donovan* |  |

**References:**

Bannister JL, et al. 2011. Monitoring population dynamics of right whales off southern Australia. Project 2009/41: Final Report to the Australian Marine Mammal Centre, 23 pp.

Bannister JL, et al. 2016. Population trend in right whales off southern Australia 1993-2015. Paper submitted for consideration by the IWC Scientific Committee. SC/66b/BRG09.

Bannister JL 2017. Monitoring Population Dynamics of ‘Western’ Right Whales off Southern Australia 2015-2018. NESP Marine Biodiversity Hub - Research Plan 1, Project A7Report to 30 March 2017.

## Project A10 – Conservation of spotted handfish and their habitat

*Project length*: *3 Years/0 Months*

*Project start date*: 01/01/2018

Project end date: 31/12/2020

*Project current status*: ~~Submitted for re-approval~~

Project Leader: Tim Lynch (FTE – 50%)

Lead research organisation: CSIRO

Project leader contact details: Dr Tim P. Lynch, Senior Research Scientist, CSIRO, GPO Box 1538, HOBART TAS 7001, Ph: (03) 6232 5239, Mob: 0416 089 749, [tim.lynch@csiro.au](mailto:tim.lynch@csiro.au)

# Project Funding and Expenditure

Project funding table

|  | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | TOTAL |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NESP funding | x | $40,000 | $40,000 | $145,414 | $140,828 | $127,501 | X | $493,743 |
| Cash co-con | x | $30,000 | $40,000 |  |  |  | x | $70,000 |
| In-kind co-con | x | $57,550 | $150,957 | $334,762 | $320,193 | $306,866 | x | $1,170,328 |
| TOTAL | x | $127,550 | $230,957 | $480,176 | $461,021 | $434,367 | x | $1,734,071 |

Expenditure statement



The annual cost of the handfish performance assessment surveys, reporting, design, permitting and outreach is approximately $120,000 and is propose to be funded by NESP ($60,000) and CSIRO ($60,000). This cost is similar across 2018-2020.

In 2018 and 2019 there will be costs for analysis of genetics from the previously collected fin clips. Labour is $14,572, while operations is $17 800, of which $12 800 will be going to AGRF for the SNP genotyping (one year only) as well as $5000 for bench fees (both years), extraction kits and plastic ware. We also plan to replace the degraded array of 6000 artificial plastic spawning habitats with 3000 new ceramic spawning habitat and 3000 plastic units in 2018 for a cost of $46,851. If the ceramics are not avoided for spawning, we will replace the remaining plastic ASH in 2019 for a similar cost and then in 2020 repair the array for the final year for a reduced cost of $34,800.

A PhD student has been identified, Mr Lincoln Wong, and is seeking a scholarship. Rick Stuart-Smith (0.10) FTE UTAS will be the primary supervisor of the PhD candidate (UTAS in-kind $15,379.70, Direct cost to hub $19,998) while Jeff Ross (0.05) FTE UTAS will be a co-supervisor of PhD candidate (UTAS in-kind: $9,983- Direct cost to Hub $0). A Masters student (UTAS) has been identified, Mr Alex Hormann, who will assist in the assessment of use of plastic versus ceramic ASH and research breeding behaviour. The Masters student will also be supervised by Neville Barrett (Total UTAS In-kind Masters: $9,983, Total Hub labour request: $0).

We undertook an audit of expenditure across 2016 figures which showed only minor adjustments were required for our 2018-20 budget request from NESP. In 2016 surveys of the 9 Derwent estuary sites required 62.5 FTE days of which 19 were by students and 43.5 FTE days of salaried staff. When two additional sites are added (abandoned sites for release) and support to the PhD and Masters student projects, we estimate this is 60 salaried FTE days.

Table 2. Labour breakdown in FTE days, excludes in-kind

|  |  |  |  |
| --- | --- | --- | --- |
| Activity | Days |  |  |
|  | 2018 | 2019 | 2020 |
| Survey/PhD operations | 60 | 60 | 60 |
| Planting/repair of ASH | 30 | 30 | 8 |
| Data entry | 10 | 10 | 10 |
| Reporting | 15 | 15 | 25 |
| Permitting | 10 | 10 | 10 |
| Consultation/outreach | 5 | 5 | 5 |
| Design | 5 | 5 | 5 |
| Holding facility maintain | 10 | 10 | 10 |
| Survey of ASH for fish | 10 | 10 | 10 |
| Genetics | 10 | 0 | 0 |
| PhD supervision | 20 | 20 | 20 |
| Total days | 185 | 175 | 163 |
|  |  |  |  |

**In kind contributions**

In-kind commitments are predominately the on-going provision of service by SEA LIFE Melbourne Aquarium and Seahorse World for maintaining captive breeding populations of handfish. Our industry partners have committed to providing care of captive fish until at least 2020.

Table 3. Captive breeding and husbandry cost breakdown



Melbourne aquarium costings are similar to Seahorse World.

|  |  |
| --- | --- |
| Table 4. In-kind industry contribution |  |
| |  |  |  |  | | --- | --- | --- | --- | |  | 2018 | 2019 | 2020 | | Sea horse in-kind aquarium | $ 82,000 | $ 82,000 | $ 82,000 | | Sea LIFE aquarium in-kind aquarium | $ 82,000 | $ 82,000 | $ 82,000 | | **Total** | **$164,000** | **$164,000** | **$164,000** | | |

The DEP is also providing in-kind assistance of 0.1 FTE for supporting the handfish recovery team and the eco-mooring work.

The Masters and PhD students are estimated to provide co-contributions of $10,000 and $25,000 per year in in-kind labour across their studies. Tas Govt (DPIPWE) can provide inkind support regarding processing of permit applications (estimated at 20 hours) and liaison with Commonwealth regarding EPBC permitting (estimated at 20 hours), data management via NVA (estimated at 20 hours) and Recovery team participation (estimated at 32 hrs based on 4x4hour meetings per year). This is estimates at 0.05 FTE or 10 FTE days which are estimate to be worth $10,000

Table 5. In-kind labour FTE days

|  |  |  |  |
| --- | --- | --- | --- |
|  | 2018 | 2019 | 2020 |
| Planting of ASH (student) | 10 | 10 | 10 |
| Survey of ASH (year 1) student | 5 | 5 | 5 |
| Eco-mooring student | 200 | 200 | 200 |
| Supervision Masters  (N. Barrett) UTAS | 10 |  |  |
| Supervision PhD  (J. Ross) UTAS | 10 | 10 | 10 |
| Masters student | 100 | 100 | 0 |
| Eco-mooring liaison  (I.Visby) DEP | 20 | 20 | 20 |
| DPIPWE | 10 | 10 | 10 |

# Project Description

Project Summary

Spotted handfish are critically endangered and in accordance with the signed recovery plan we will conserve them through various direct conservation actions guided by research. This includes replanting of the degraded plastic artificial spawning habitats (ASH) with a re-designed array of ceramic units, assessment of taut eco-friendly moorings in critical spotted handfish habitat, genetic and capture mark recapture studies, a population viability analysis (PVA) and performance assessment of management actions. We will also continue our captive breeding project with industry and engagement with the broader community through talks, outreach and publications and re-establishment of the handfish recovery team.

Project Description

1. *What problem the projects seeks to address and how it will do this*

Spotted handfish (*Brachionichthys hirsutus*, Lacepède, 1804) are critically endangered with a long history of conservation effort. Once widespread across Southern and Eastern Tasmania, spotted handfish were until the late 20th Century described as ‘common’. However in 1996, following declines first noticed in the late 1980s *B. hirsutus* had the dubious distinction of being the first marine fish to be listed as Critically Endangered on the International Union for the Conservation of Nature (IUCN) red list. They are also listed as Critically Endangered on the Environmental Protection and Biodiversity Conservation Act (EPBC). While extensive surveys across the historic distribution of spotted handfish have been undertaken only 10 small sites are now recognised to contain extant local populations. Local declines are continuing with no fish sighted in the 2017 surveys at one site (Ralphs Bay).

Unlike many marine species, handfish tend to directly recruit onto the benthos at the point of spawning. This excludes the potential for wide dispersal via plankton and when combined with a restricted range and sedentary benthic lifestyle this make handfish local populations both vulnerable to disturbance and makes re-establishment of locally extinct local populations unlikely. Over recent years there appears to be limited recruitment across most of the known meta-population of spotted handfish, with few juvenile animals observed. Adult handfish are also poor dispersers, they do not possess swim bladders and preferring to walk rather than swim. In the past, with large robust populations, emigration and connectivity between handfish local populations could have occurred over time through the small movement’s adult animals make over multiple months and potentially larger seasonal movements to form breeding aggregations. However, as a poor disperser that are closely associated with particular habitats they are vulnerable to habitat degradation and fragmentation. Local populations appear to be operating independently and could now be disjunct populations that rarely if ever connect. Spotted handfish hence may now require specific site remediation actions for their conservation and are at an increased risk of local sub-population extinction, similar to a documented collapse at Primrose Sands for spotted handfish in 2005 and the more recent decline at Ralphs Bay.

Threats

Current threats to the spotted handfish include habitat disturbance and ecosystem collapse from historic coastal scallop/bivalve and other demersal fisheries; siltation and nutrient from urbanisation; pollution; and swing moorings. One additional threat that has been consistently tackled by management are North Pacific seastars (*Asterias amurensis*) which were inadvertently introduced to Tasmanian waters via international shipping around 1986. While *A. amurensis* prefer to prey upon large bivalves they can exploit a broad range of food resources, including the stalked ascidians (*Sycozoa pedunculata* and *Sycozoa pulchra*). These ascidians are thought to provide critical breeding habitat for handfish, particularly in the Derwent estuary, following long-term declines in other spawning substrates such as seagrasses. Control efforts via trapping proved ineffective hence a recovery action has been the deployment of artificial spawning habitat (ASH). These are plastic, so are inedible to the starfish.

Demographic bottlenecks

Following mass plantings of ASH between 1998-2012 spotted handfish were repeatedly observed to use arrays for spawning. There is also now limited evidence that deploying ASH at sites is associated with near doubling of adult densities. Better performance assessment of this is required as statistically this may be co-incidental as non-ASH planting sites did not have adequate replication of surveys to be used as controls and sites were not randomised and were confounded by time. However, if this is an actual population scale effect - and if it was then the effect size was large - planting ASH may have off-set the ongoing threat of habitat modification and allowed handfish to persist at managed sites. The lack of suitable natural spawning habitat may thus be a demographic bottleneck. The functional life span of the light-weight plastic ASH arrays is also limited by sedimentary processes and bio-fouling.

Swing moorings

Swing moorings are a common method for securing yachts and larger non-trailer (>7.5m) motor vessels in Australian estuaries. Primarily used by the private and recreational sector, they work by the use of a long length of heavy chain anchored to the bottom, this is attached via a rope riser to the vessel which swings around the scope of the mooring on the surface. The chain provides most of the anchoring effect and also a catenary shock absorber to the effects of wind, wave and tide on the vessel.  However, the chain has direct, ongoing and fixed mechanical impacts on the benthos. This destroys the micro-habitat complexity preferred by many fish including the spotted handfish.

Swath mapping has shown that in dense mooring fields a high percentage of habitat is scraped away, with chain swings interconnecting and destroying habitat. Preliminary observations also suggest there is a strong interactions between swing moorings and the introduced marine pest, the North Pacific sea star, with starfish feeding off wrack from the mooring lines and also being large and robust enough to be one of the few macro-invertebrates to be able to survive within the mooring scrap.

1. *How the research will be undertaken, including what is in and out of scope*

Artificial Spawning Habitat

We will replace plastic ASH with new and more robust ceramic units. In the first year 3000 ceramic and 3000 of the proven plastic variety will replace the current degraded array across 6 sites. We will test if there is any difference in use between plastic and ceramic during the breeding season and replace all plastic with ceramics if they are used a) more or b) equally by handfish in the following year. Three sites will be left as controls with no management actions. These actions will commence after the 2017 breeding season and continue each year, so BACI ‘impact’ treatments would commence before the 2018 breeding season. This will allow for four years of temporal controls for all site and, if the ASH have an effect as hypothesised, provide an adult density increase at sites by the 2020.

Ambassador fish and Captive breeding

In partnership with Sea life Melbourne Aquarium, Seahorse World and the Zoos and Aquarium Association, and with permitting from CSIRO the State and Federal government, we have establish two captive populations spotted handfish (n=10 x 2). CSIRO has constructed a holding facility in Hobart that was used to or transfer brood stock into captivity and will also hold fish for settling and quarantine purposes prior to release for re-stocking.

Assessment and preparation of re-stocking sites for re-introduction will occur through 2018- 2020. We will continue to sample one site, Simpsons Point, which is a historic but now abandoned site, as well as commence sampling at Primrose Sands – another abandoned site. These sites and other low density sites, such as Ralphs Bay, may be considered for release of captive breed animals in the future.

The tentative time line for this work includes:

* 2018 - Raise the profile of the spotted handfish with the broader community through the captive fish program, media, talks, outreach, publications and interpretation materials
* 2018/19 - Prepare habitat for re-stocking by the planting of ASH
* 2018/20 - Have facilities on hand to receive and settle captive bred fish for release back into the wild for re-stocking
* 2018/20 - Restock areas and performance assess the results through the established survey

Replace Taut with Swing moorings

With our Derwent Estuary Program (DEP), Royal Hobart Yacht Club and Derwent Sailing Squadron partners we received $10,000 from NRM South in 2016 for eco-moorings, five of which have been purchased and deployed. We have used one of these moorings to develop a method of assessment - a video transect procedure based on a randomised spatially balanced sampling plan - to asset recovery of the benthos. We also have one bungee in stock to deploy another mooring. We are seeking funding and partners to deploy another 10 moorings in 2018.

We propose to provide PhD supervision, supporting labour and operational funds for a project assessing the ecological aspects of swing and taut moorings, interactions with north pacific sea stars and also handfish populations in regard to population viability analysis (PVA). Study sites would be in the Derwent estuary with UTAS as our partner.

Specific question may include:

* Identify the short term re-colonisation and long term succession of the benthic community after disturbance has ceased following deployment of taut moorings
* Using manipulative studies to identify the establishment of invasive species (North Pacific sea stars) following mooring disturbance and cleaning and its impact on native community succession
* Assess bio-fouling loads on taut vs swing moorings
* Model habitat impacts of mooring fields at regional scales for spotted handfish
* Undertake PVA of spotted handfish

Performance assessment

Methods are now well established and our proposal is to continue to survey 9 sites prior to the handfish breeding season (mid-August 2018), conducting 8-10 transects at each. We plan to also conduct 8-10 transects at 2 abandoned sites, one in the d’Entrecasteaux Channel (Simpson Point) and the other in Fredrick Henry Bay (Primrose Sands) to establish baselines for potential release of captive bred fish.

As part of the 2016 work we developed a statistical model for the performance assessment survey program through to 2020. This spatially balanced design was provided as an attachment to our August 2016 progress report and also considers assessment of ASH. The design includes aspects of both random and repeat measures as well as BACI. Half of all transect start location will be randomised within the study site’s boundary and the other half will be repeat measures in accordance with the sampling plan. The transect length is determined by the search speed and time spent searching, and maximised dependant on the available air. SCUBA divers swim along the bottom either 2 abreast, each diver independently searching a 1.5 m swath for handfish, the optimal search width for spotted handfish. One diver in the party will tow a small surface buoy with a GPS logger (Holux GPSport 245) inside a water resistant case.

Transect start and finish positions, in addition to all fish recorded, will be photographed, allowing accurate positions and distances to be determined post hoc from the GPS track with proprietary software (Holux™ ez Tour for Loggers v2.4). For each transect we will determine the density of handfish per hectare based on the UVC count of fish observed, transect width and length, which we multiply to an area in metres, and then calculate the density for transect per hectare.

This method will allow for the replication of surveys across multiple years at all known sites with the one methodology, addressing recovery plan actions 4a, 4b, 4d and 4e by forming a scientifically robust survey program to track performance of management actions.

Capture-mark-recapture and Genetic

Photo data from our geo-reference photographic method for cataloguing individual fish will allow for further development of a capture-mark-recapture model to determine local population size estimate. I3S pattern is being used, which automatically plots patterns from photos of fish for comparisons to a database. By the end of 2018 study we should have around ~500 individual observations of fish to work with from, with multiple images from each observation, often with both left and right sides of the fish photographed.

CSIRO has a collection of 241 fin clips of spotted handfish taken between 2006 and 2008 and three whole animal specimens. Fin clips samples were sourced from: Battery Point (9), Howrah (18), Sandy Bay (15), Mary-Anne Bay (15), Opossum Bay (20), Ralphs Bay (58) and Tranmere (106). DNA from spotted handfish will then be assessed to determine genetic diversity, connectivity and the effective population size of handfish from the sampled time period.

Effective of ASH and reproductive behaviour of handfish

A Masters project is proposed, in collaboration with the University of Tasmania that would focus on the effectiveness of the plastic vs ceramic ASH and the reproductive behaviour of spotted handfish.

This would include research questions such as:

* Effectiveness and choice of artificial spawning habitat (ceramics vs plastic) to increase population densities of the spotted handfish
* Egg survival and parental care, particularly in response to predators such as *A. amurensis* assessed via time-series videography for spotted handfish using time-shift video from Go-Pro recorders and CamDo blink controllers
* Capture-mark-recapture modelling of handfish populations based on I3S software
* Observations of breeding behaviour of captive populations

1. *How the project links to other research and/or the work of other Hubs.*

With Scott Foster we are implementing a balanced spatial design which has been widely used across other projects in theme D.

The genetic research has the same approach as for various other projects in Theme A, such as work on hammerhead sharks. Development of genetic markers for spotted handfish is part of a separate NCRIS hub project led by Dr Sharon Appleyard, with material opportunistically sourced from previously collected specimens for the development of co-dominant polymorphic nuclear markers.

The research builds on the 2014 ‘proof of concept’ work which increased statistical power and controlled costs, the 2015 larger pilot study and the 2016-17 sampling. The expanded pilot study was funded by the Threatened Species Commissioners Office to establish a baseline assessment across all known sites in the one year. The 2016-17 survey was funded by NESP, CSIRO the DoEE and the DEP. Prior to this, other research has included a recent honours project which established the consistency of spot patterns for individual identification of handfish. A small number of published taxonomic works and a wide variety of grey literature is also available on spotted handfish that extends back to 1996. Two papers from the 2015-17 work and unpublished historic data are currently in review.

The eco-mooring work looks to be scientifically novel both for soft sediment, larger scales and socio-economics with most previous work having been on impacts on seagrass. UNSW is currently undertaking work on assessing impacts via backscatter, microbes and cumulative impacts. We will liaise closely with our colleagues through our community of practise.

1. *Summary of how it is expected that the research will be applied to inform decision-making and on-ground action.*

The research and actions are all based on the signed recovery plan that is an agreement between Tasmanian state and Australian governments to provide a pathway to recovery of the species through tangible on-ground actions and their performance assessment.

Artificial Spawning Habitat.

The replacement of the aging array provides a solution to the demographic bottleneck of lack of breeding habitat at the level of local populations. We will design and replace the highly degraded array of plastic ASH with a staged substitution with more robust ceramic types (Actions 1c, 1d). The new ASH arrays will improve habitat for spotted handfish spawning as they are designed to provide prolonged benefits compared to the previous light weight plastic design, providing safe havens for breeding over 10 seasons rather than 1-5.

Ambassador fish and Captive breeding

Establishment of a captive bred populations of spotted handfish is a priority for both State and Federal governments (Actions 3b-c) to raise the profile of the species as ‘ambassador fish’ and as an intervention to avoid extinction. Our industry partners for captive husbandry are the Zoos and Aquarium Association (ZAA) their affiliate Sea Life Melbourne Aquarium, and Seahorse World. Both industry partner have provided assurances of in-kind support across the project and are well located to display ‘ambassador’ spotted handfish for public outreach and to undertake a captive breeding program. If successful in establishing a breeding program, animals will be available for re-stocking of populations that have gone locally extinct or for the enhancement of low density populations.

Community liaison

Besides work with the aquarium industry, liaison with other identified stakeholders will also occur across the entire project with an emphasis on habitat conservation (Action 6a). This will include discussion with relevant councils, scuba clubs, community groups, government, MAST, mooring owners, citizen scientist, schools and the indigenous community. A handfish recovery team (HRT) has been formalised by the DoEE and DPIPWE to oversee conservation for the species. The principle investigator is a member of the HRT and knowledge brokering and communication with end users at both state and federal levels will continue throughout the project through formal bi-annual meetings.

Replace swing moorings with taut eco-moorings

Replacement of traditional swing moorings with taut moorings, also known as ‘eco-moorings’, is a recovery plan action (2c) to minimise damage to critical habitat for spotted handfish. A taut mooring replaces the chain of a swing mooring with a much shorter and taut rubber elasticised bungee component. This has several effects: a) it removes mechanical destruction of the bottom, b) it reduces the amount of mooring tackle that can becomes bio-fouled and c) it halves the scope of the mooring, effectively meaning two moorings can be located in the place of one.

Though it is assumed that these taut mooring have a beneficial impact on the environment, assessment of this looks to be scientifically novel both for soft sediment and across larger scales with most previous work having been on impacts on seagrass. The increased density of moorings allowed by wide-scale uptake of taut systems may also have unforeseen environmental effects.

While taut moorings may have many environmental benefits, liaison with DEP, MAST, NRM South, Yacht Clubs and the insurance industry has identified a raft of potential issues with broad scale uptake of taut moorings. Concerns around taut moorings include: the integrity of the mooring and associated risk to vessels, mooring field behaviour in extreme weather – especially in mixed fields of swing and taut moorings, comfort of ride for those aboard moored vessels, community support, perception and economics relating to service schedules and costs. In previous plans we have deployed taut moorings and have developed methods for assessment of ecological recovery and this will be the focus of the PhD project.

Performance assessment

For scientifically robust performance assessment of management actions (ASH, restocking and eco-moorings) the tracking of local population trajectories of spotted handfish repeated at multiple replicate local populations are required (Actions 4a, 4b, 4d and 4e). In 2017 we established minimum replication (n<3) to track trends across multiple (9) sites without the confounding effects of time from previous work. We have also integrated historic data back to 1998 into our time-series and preliminary analysis suggest no statistical effect from our change in method. This ‘before’ data provides an exceedingly rare opportunity to measure performance assessment of management actions for a threatened marine species. For performance assessment via a statistically robust Before, After, Control, Impact (BACI) approach, a time-series dataset across multiple sites and years is required with some sites maintained as controls, and other sites receiving ‘on-ground’ actions as treatments (impacts).

Capture mark-recapture and Genetics

An alternative hypothesis to the fragmentation scenario is that local populations of fish are large, well connected and are migrating between sites/subpopulations or to undiscovered sites. We will examine these questions with two methods, capture-mark-recapture and genetics.

Fish have spot patterns that allow for individual identification with a high (100%) level of confidence for adult (>70mm) fish. We have taken geo-referenced photos of all fished and an initial trail of a new automatic recognition software, I3S pattern, was successful in 2017, We will use photographic capture-mark-recapture on our data base to ask three questions: 1) how many recaptures are there within sites, 2) how many recaptures between sites, 3) based on capture-mark-recapture estimates, what is the minimum population size?

Molecular genomic techniques have also advanced to the state were they are highly useful for assessing both effective population sizes and tracking and tracing individual movements among populations. Undertaking these analyses would be possible from a collection of handfish fin clip samples taken from approximately 10 years ago, as this occurred after the populations declined. As part of a NCRIS funded National Research Collections Australia (NRCA) and Bioplatforms Australia (BPA) project we have already developed co-dominant polymorphic nuclear markers for spotted handfish to undertake single nucleotide polymorphisms (SNPs) analysis. These will be used to calculate how genetically diverse the total and local populations are and whether there is one well connected meta-population or a larger number of fragmented sub-populations where gene flow has been restricted. The information will also allow for an understanding of the effective population size (Ne). As we already have the SNP handfish library generated we don’t need to test for the most appropriate restriction enzymes and just need to proceed to the ‘batch’ analyses of our DNA.

### Summary of changes since previous Research Plan

* Replacement of degraded plastic ASH arrays with new ceramic types
* Genetic analysis of previously collected fin clips
* Performance assessment of eco-moorings
* PhD study which includes a PVA
* A Masters study looking at use and effectiveness of ASH and breeding behaviour

NESP 2017 Research Priority Alignment

**Maximising the efficacy of managing Australia’s marine environment**

Both our ASH and eco-moorings work are methods that will be trailed to restore degraded habitats including mixed bivalve beds (scallop and oyster), seagrass and other sub-tidal habitats.

**Identify key social and economic values of the marine environment to build better stakeholder support and engagement in the management of marine and coastal environments**

Our ambassador fish program has attracted considerable support from industry. The use of fish as assets for aquarium businesses demonstrates their value and will build stakeholder support and engagement in the management of marine and coastal environments.

**Consider the social and economic value of the environmental asset/s and research outcomes, as appropriate**

The more general environmental issue of swing mooring is the concentrated and persistent destruction of ecological communities found within highly specific depth (6-20m) and shelter conditions (low wave intensity) across many estuarine and coastal environments across Australia and the world.

**Improving our understanding of the marine environment including biophysical, economic and social aspects**

We will improve our knowledge of key marine species (handfish) to underpin their better management and protection through our capture mark recapture and genetics research. A better understanding of handfish distributions and conservation is also important for marine planning as all infrastructure proposals must consider this EBPC listed species.

**Improve the management of marine and coastal biodiversity by evaluating and quantifying the results of management interventions**

The current density estimate database for spotted handfish at multiple sites provides a rare opportunity for performance assessment to evaluate management interventions for a rare and threatened marine species.

Pathway to Impact

|  |
| --- |
| **Outcomes** |
| The project will move to further secure the spotted handfish from extinction, stabilise existing populations and allow for the option of recovery. We will do this through tangible on-ground actions. These include the planting of >6000 artificial spawning habitats at multiple sites, which are known to benefit handfish populations. We will also work to assesses and deploy additional eco-moorings. These not only conserve handfish habitat but also have a wider beneficial role for the ecosystem. We will continue our ambassador fish program with our industry partners and look forwards to captive breeding and re-stocking of sites where fish have become locally extinct. More information on fragmentation and decline of the species will also be provided by genetic analysis of a large collection of historically acquired fin clips. We will also continue our surveys of local populations, which will allow for robust performance BACI assessment of the above management actions. We will also continue our outreach program with, scuba clubs, community groups, government, MAST, mooring owners, citizen scientist, schools and the indigenous community.  Engagement and communication for this project will be planned and implemented consistent with the [Hub’s Knowledge Brokering and Communication Strategy](https://www.nespmarine.edu.au/system/files/Knowledge%20Brokering%20and%20Communictions%20Strategy%20version%201.1%20.pdf). |

| **Research-user** | **Engagement and communication** | **Impact on management action** | **Outputs** |
| --- | --- | --- | --- |
| Handfish recovery team  (see list below)  Chair – Mr Andrew Crane (Director DPIPWE threatened species)  DoEE representative Mr Ashley Leeman (Assistant Director DoEE Marine and Freshwater Species Conservation Section), Ms Coughanowr, Christine (Director – DEP) | The work is based on the published Handfish Recovery Plan. This was developed in consultation between state and federal governments as well as a broad section of stakeholders represented now on the HRT. The HRT meets regularly (3-4 times per year) and also has out of session correspondence. All meetings and minuted. | The onground actions will implement policy while also assessing performance. | Annual progress reports to DoEE  Final report – Conservation biology of spotted handfish  Academic publications with research findings for recovery of handfish  Honours thesis (Tyson Bessell) – population estimates for spotted handfish  PhD thesis (Lincoln Wong) – Environmental effects of eco-moorings. |
| MAST – Mr Ian Ross (Moorings manager)  Derwent Sailing - Shaun Tiedemann  Royal Hobart yacht club - Nick Hutton  NRM South - Nepelle Crane  ZAA - Craig Thorburn  Woodbridge Marine Discovery Centre | The project was developed in consultation with the existing Eco-mooring Working Group. The project team will continue to engage with this working group to update and involve research-end-users in this project. The working group is expected to meet quarterly. | MAST are currently reviewing the right to privately sell mooring leases and also considering eco-moorings as part of a larger mooring review.  To successfully mitigate the impact of swing moorings on spotted handfish habitat and other species/habitat/ecosystems, thousands of taut moorings would need to be deployed. While our current research is focused on ecological recovery for more widespread up-take we must identify not only environmental value but also social and economic value. | Annual progress reports to DoEE  Final report – Conservation biology of spotted handfish  PhD thesis (Lincoln Wong) – Environmental effects of eco-moorings.  Presentations to communicate progress and findings  Communication materials for Seahorse World and SEA LIFE Aquarium (i.e. to enhance public awareness) |
| **Additional outputs**   * We will submit at least one publication to a high quality journals based on our research and also present at a professional conference. * Public seminars will be held with stakeholder groups * Regular postings to social media platforms | | | |

### Indigenous Consultation and Engagement

Indigenous consultation and engagement for this project will be undertaken in a manner that is consistent with the [Hub’s Indigenous and Participation Strategy](https://www.nespmarine.edu.au/document/indigenous-engagement-and-participation-strategy). This project is considered a category three project for Indigenous engagement. This means the knowledge generated in this project will be effectively shared and communicated between relevant Indigenous peoples, communities and organisations.

As part of the handfish project, NRM South has provided an avenue for consultation through their Indigenous community engagement officer. During engagement we develop with NRM South and their community contacts a culturally sensitive fact sheet to explain the work and facilitate engagement with Indigenous and other communities. The spotted handfish does not appear to be of specific individual interest to local indigenous groups, rather a broader perspective of the importance of considering the integration the entire marine systems was emphasised in our discussions. We will continue to seek opportunities to meet with NRM South and their indigenous representative throughout the project to inform them of progress. We have also worked extensively with schools across this project providing tours and talks to: Corpus Christie, Mt Nelson, Howrah, Fahn primary schools and also have planned talks with Friends senior schools. Additional schools that have a strong indigenous membership may be also targeted.

Indigenous engagement and participation contact:

Name: Tim Lynch

Email: tim.lynch@csiro.au

Phone: 0416 089 749

### Project Milestones

|  |  |  |
| --- | --- | --- |
| Milestones - 2016 | Due date | Milestone status |
| Milestone 1 - All research users and stakeholders have been engaged and understand the project and opportunities for further engagement | 1-Mar-16 | Complete |
| Milestone 2 - Permitting submitted | 1-Mar-16 | Complete |
| Milestone Outreach activity Handfish card memory game developed and trailed with the public | 20-Apr-16 | Complete |
| Milestone 3 - Liaison commenced with MAST/mooring stakeholder | 1-May-16 | Complete |
| Milestone 4 - Presentation at NZMSS/AMSA of preliminary results | 6-Jul-16 | Complete |
| Milestone 5 - Submission of detailed project plan (2017-2021) | August 2016 | Complete |
| Milestone 6 - Completion of dive surveys | 30-Aug-16 | Complete |
| Milestone – 7 final report | 30-Dec-16 | Complete |

| Milestones - 2017 | Due date | Milestone status |
| --- | --- | --- |
| Milestone 1 - Deployment of all eco-moorings NESP/DEP | 30th January 2017 | Complete |
| Milestone 2 – All research users and stakeholders have been engaged and understand the project and opportunities for further engagement | 1 March 2017 | Complete |
| Milestone 3 – Permitting submitted | 1st March 2017 | Complete |
| Milestone 4 – Signing of MoU for captive breeding - ZAA | 20th April 2017 | Delayed |
| Milestone 5 – assessment of minimum population size  ZAA | 15th May 2017 | Complete |
| Milestone 6 – Capture of brood stock  ZAA | 1st June 2017 | Complete |
| Milestone 7 - Development of a culturally sensitive fact sheet with NRM south and indigenous contacts  NESP | 30th June 2017 | Complete |
| Milestone 8 - Submission of detailed project plan (2018-2020)  NESP | 1st October 2017 | Complete |
| Milestone 8 – Completion of dive surveys  NESP for 6 sites and ZAA for 5 sites | 30th August 2017 | Complete |
| Milestone 10 – Final report | 30th December 2017 | On track |
| Milestone 11. All project outputs including sharing of the consolidated database to be made accessible to the public | 30th January 2018 | On track |

| Milestones - 2018 | Due date | Milestone Status |
| --- | --- | --- |
| Milestone 1 – All research users and stakeholders have been engaged and understand the project and opportunities for further engagement | 1 March 2018 |  |
| Milestone 2 – Completion of performance assessment surveys | 30th August 2018 |  |
| Milestone 3 – Check of ASH | 30th November 2018 |  |
| Milestone 4 – Annual report | 30th December 2018 |  |
| Milestone 5 – Completion of performance assessment surveys | 30th August 2019 |  |
| Milestone 6 – Check of ASH | 30th November 2019 |  |
| Milestone 7 – Annual report | 30th December 2019 |  |
| Milestone 8 – Completion of performance assessment surveys | 30th August 2020 |  |
| Milestone 9 – Check of ASH | 30th November 2020 |  |
| Milestone 10 – Final report | 30th December 2020 |  |
| Milestone 11 - All project outputs including sharing of the consolidated database to be made accessible to the public | 30th January 2021 |  |

# Data Management and Accessibility

All project outputs (including data) will be made publically available in accordance with the NESP Data Management and Accessibility Guidelines. To facilitate a consistent standards based approach, the Hub has produced a [Data Management Framework](https://www.nespmarine.edu.au/system/files/MBH%20Data%20Management%20Framework%20v1.2%20-%2005Dec16_AO.pdf). The framework provides project leaders with clear directions on publishing metadata, storing data and satisfying requirements for open access to journal articles.

This project will continue the development of time-series density estimates across 9 sites for spotted handfish and at two abandoned sites. It will produce reports that include response of local populations to management actions such as deployment of ASH and also, if possible, restocking by captive bred juveniles

| **Project output** | **Data Management and Accessibility** |
| --- | --- |
| A consolidated database of all available data on spotted handfish imagery, length frequency and GPS plots | We have consolidated all data and since 2015 and incorporated metadata and geo-referenced photographs into a Handfish Access database. Data management includes a manual and workflow for processing and entering data. The consolidated spotted handfish dataset and Access database is stored in long-term secure and backed-up storage at CSIRO: Public (\\fstas1-hba.nexus.csiro.au\CMAR-SHARE)(P:)  Metadata has been created that meets the Marine Community Profile for metadata and has been and will continue to be published on the Australian Ocean Data Network Portal (http://portal.aodn.org.au/aodn/). |
| Reports, publications and fact sheets | Publications, reports, factsheets, maps and images will be made publically and freely accessible and available on the Hubs website http://www.nespmarine.edu.au. All peer-research papers and publications will be made available to the public through open access via the Hub’s website (in accordance with the NESP Data Management and Accessibility Guidelines) |

Location of Research

### Location of Research

There are eleven sites: 9 in the Derwent, one in the D'Entrecasteaux Channel and one in Fredrick Henry Bay. Sites names and GPS locations are provided in Table 6.

Table 6. Location of research for spotted handfish

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Site | Code | Estuary | Lat | Long |
| Battery Point | BP | Derwent | -42.88944 | 147.33937 |
| Half Moon Bay | HMB | Derwent | -43.01396 | 147.40306 |
| Opossum Bay | OB | Derwent | -42.98298 | 147.39555 |
| Ralph Bay | RB | Derwent | -42.93350 | 147.42542 |
| Mary-Ann Bay | MAB | Derwent | -42.97004 | 147.40157 |
| Sandy Bay | SB | Derwent | -42.90749 | 147.34911 |
| Howrah Beach | HB | Derwent | -42.88295 | 147.39508 |
| Tranmere | TR | Derwent | -42.92501 | 147.41055 |
| Bellerive | BR | Derwent | -42.88010 | 147.37820 |
| Simpson Point | SP | D'Entrecasteaux | -43.24900 | 147.28700 |
| Primrose Sands | PS | Fredrick Henry Bay | -42.89987 | 147.68336 |

Risk assessment and management

| **Risk to project** | **Potential impact on project** | **Risk rating (low, medium high, severe)** | **How will risk be managed?** | **Who is responsible for managing risk?** |
| --- | --- | --- | --- | --- |
| 1. Sampling needs to occur outside of the species Austral spring (September) breeding season. As fish move from a solitary to an aggregated distribution this will confound the inter-annual density estimate statistics. Delays in signing contracts and hence starting the project, constrict the available time for surveying before the breeding season. | Not enough sampling is achieved within the year to have sufficient power to detect change in response to management actions. | Medium | We try to dive at least once every week so as not to fall behind schedule. We seek approval from the CSIRO BD to begin sampling prior to contracts being signed. | Tim Lynch  Andy Stevens  Nic Bax |
| 2. There are health and safety risks associated with the use small boats and diving. | Minor, moderate and catastrophic injuries and death | Low | This risk is mitigated by having adequate time and flexibility to choose good weather windows to operate. Continuous low intensity operations to maintain skills and readiness and reduce fatigue and a well-established, balanced (age/sex) and seasoned team.  While as many as 8 transects can be completed in one day of intense survey work, we found this rarely could be achieved. Due to weather, logistics, staffing availability and diver health we found that lower intensity sampling utilising small components of labour spread across a larger dive team was required to safely complete the work. This involved half FTE days (morning or afternoon diving) or, if conditions were ideal, full FTE days | Tim Lynch  Claire Davies (Dive officer)  Other CSIRO coxswains |
| Death of fish at all stages of the process. Death rates of between 5-50% have been expressed for different species during freight. | This is primarily a reputational risk. For the project if the brood stock die we will not have the possibility to breed fish and re-stock sites | Medium | We have mitigated this by transfer of information to all parties (reports, unpublished lab notes) from the previous captive breeding program. Assessment of all facilities, development of husbandry/capture/transfer protocols, building of a holding facility for pre-transport conditioning and being clear to all permitting and stakeholder parties that the risk of death of some fish is high – and death of fish will eventually occur in captivity inevitable with age. We are also permitted to take 40 fish but will aim to keep this to 20 fish | Tim Lynch  Tim Fountain |

Project Keywords

Spotted handfish, critically endangered, fish, eco-moorings, habitat restoration

Project contacts

Researchers and Staff

| Name | Organisation | Project Role |  |
| --- | --- | --- | --- |
| Tim Lynch (0.5 FTE) | CSIRO | Principal investigator | 0.5 |
| Sharon Appleyard (0.05 FTE) | CSIRO | Genetics | 0.05 |
| Jeff Ross (0.05FTE) | UTAS | Co-supervisor PhD | 0.05 |
| Rick Stuart Smith (0.1) | UTAS | Supervisor PhD | 0.1 |
| Neville Barrett (0.05) | UTAS | Supervisor Masters | 0.05 |
| Early career researcher – Tentative Mr Lincoln Wong (PhD), Mr Alex Hormann (Masters) | UTAS/CSIRO/UNSW/OEH | Post graduate students | 1 |
| Carlie Devine (0.1 FTE) | CSIRO | Diver and database officer | 0.1 |
| Claire Davies (0.1 FTE) | CSIRO | Dive Officer/Coxswain | 0.1 |
| Curt Chalk (0.1 FTE) | CSIRO | Diver/Coxswain | 0.1 |
| Tim Fountain (0.05 FTE) | CSIRO | Aquariums officer | 0.05 |

Data Management

| Name | Organisation | Email | Phone |
| --- | --- | --- | --- |
| Carlie Devine | CSIRO | carlie.devine@csiro.au | 03 6232 5478 |

Co-contributors

| Name | Organisation/ | Contribution |
| --- | --- | --- |
| Inger Visby | Derwent Estuary Program | In-kind labour (10K), assist with consolation with swing mooring owners and eco-moorings, secretariat to HRT |
| Napelle Crane | NRM South | Indigenous and community liaison |
| Rachelle Hawkins | Seahorse Pty Ltd | In-kind (82k), captive husbandry |
| Paul Hale | Merlin Pty Ltd | In-kind (82k), captive husbandry |

Key Partners **and** Research End Users

The project will report its findings on a semi-annual basis to the Handfish Recovery Team. This is a governance body that is constituted between the Tasmanian State and the Commonwealth government with other interested parties to make decisions about the fate of the fish. However, the Tasmania government retains ownership of the all fish.

| Key Partners (organisation/programme) | Name/s | Email (optional) |
| --- | --- | --- |
| Derwent Estuary Program | Coughanowr, Christine | Christine.Coughanowr@environment.tas.gov.au |
| Zoo and Aquarium Association (ZAA) | Craig Thorburn | Craig.Thorburn@kellytarltons.co.nz |
| Natural Resource Management (NRM) South | Nepelle Crane | ncrane@nrmsouth.org.au |
| MAST | Ian Ross | Ian.ross@mast.tas.gov.au |
| Royal Yacht Club of Tasmania | Nick Hutton | sailing@ryct.org.au |
| Derwent Sailing Squadron | Shaun Tiedemann | manager@dssinc.org.au |

| Research End Users (section/programme/organisation) | Name/s | Email (optional) |
| --- | --- | --- |
| The Handfish Recovery Team (HRT) | See list below | The chair is Mr Andrew Crane |
| Marine and Freshwater Species Conservation Section Wildlife, Heritage and Marine Division  Department of Environment (DoEE) | Ashley Leeman | Ashley.Leedman@environment.gov.au |
| Threatened Species Policy and Conservation Advice Branch Department of Primary Industries, Parks, Water and Environment (DPIPWE) | Andrew Crane | Andrew.Crane@dpipwe.tas.gov.au |
| Office of the Threatened Species Commissioner (DoEE) | Sebastian Lang |  |

Invited members Handfish Recovery Team

|  |  |
| --- | --- |
| Ashley Leedman | Department of the Environment (Commonwealth) |
| Andrew Crane | Department of Primary Industries, Parks, Water and Environment (Tas) |
| Tim Lynch | CSIRO scientist, running current surveys and substrate trials |
| Neville Barrett | University of Tasmania, handfish research |
| Rachelle Hawkins | Seahorse World |
| Mark Green | CSIRO |
| Lincoln Wong | UTAS |
| Nepelle Crane | NRM South |
| Inger Visby | Derwent Estuary Program |
| Craig Thorburn | Zoo and Aquarium Association of Australia |
| Paul Hale | Curator, Sea Life Melbourne Aquarium |
| Carolyn Hogg | Sydney University, population geneticist |
| Michael Jacques | Marine Life Tassie |
| Graham Edgar | University of Tasmania, Reef Life Survey Foundation |
| Sam Ibbott | Marine Solutions, marine consultant |
| Rick Stuart-Smith | UTAS |
| Joe Valentine | Aquenal, marine consultant |

## Project A12 – Australia’s Northern Seascape: assessing status of threatened and migratory marine species

*Project length*: *3 years*

*Project start date*: *01/01/2018*

*Project end date*: *31/12/2020*

*Project current status*: ~~Submitted for re-approval~~

*Project Leader*: *Peter Kyne (FTE – 0.5)*

*Lead research organisation*: *Charles Darwin University*

*Project leader contact details:* [*peter.kyne@cdu.edu.au*](mailto:peter.kyne@cdu.edu.au)*; 0477 306 344*

# Project Funding and Expenditure

Project funding table

|  | *2015* | *2016* | *2017* | *2018* | *2019\*\** | *2020\*\** | *2021* | ***TOTAL*** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *NESP funding* | *x* | *x* | *234,921* | *$408,145* | *$476,374* | *$446,424* | *x* | *$1,565,864* |
| *Cash co-con* | *x* | *x* | *18,195* | *$0* | *$0* | *$0* | *x* | *$18,195* |
| *In-kind co-con* | *x* | *x* | *256,726* | *$408,145* | *$476,374* | *$446,424* | *x* | *$1,587,669* |
| ***TOTAL*** | ***x*** | ***x*** | ***509,842*** | *$816,290* | *$952,748* | *$892,848* | ***x*** | *$3,171,728* |

\*2017 = Phase 1; 2018–2020 = Phase 2.

\*\* The full three year project to be agreed following a joint Hub/DoEE workshop in early 2018 to clarify project scope and focus; and after DoEE has the opportunity to review the outputs from the 2017 scoping project report

Expenditure statement

Funding will be used to provide salary for project leadership, sampling design and field surveying, species distribution modelling, molecular research, and communication of results. Field work costs include vehicle hire, fuel, accommodation, and sampling gear, however, a considerable amount of field equipment is available from previous NERP and NESP projects which will be provided as an in-kind contribution to this project. Access to a CDU research boat will also be provided as in-kind. An Indigenous Partnerships Officer will be engaged whose role is to co-ordinate and facilitate the field program on sea-country with project partners, research end-users, relevant Indigenous communities, ranger groups and other field partners. Funding will be provided to Indigenous Ranger Groups who partner with the rapid assessment SeaBlitzes (defined below), including for use of vessels.

# Project Description

Project Summary

Northern Australia has a relatively untouched natural environment and is the current focus of substantial economic development, which has the potential to impact biodiversity and cultural values. The Northern Seascapes Project Phase 2 will map the distributions of several *EPBC*-listed threatened and migratory marine species at a broad-scale, and develop and trial a cost-effective rapid assessment approach (‘SeaBlitzes’) to gather finer-scale spatial data on priority marine species of the northern seascape, including the critical habitats they depend on. SeaBlitzes will survey selected hotspots determined through scoping undertaken in Phase 1 of the Northern Seascapes Project (to be delivered end 2017). The data and knowledge generated by the rapid assessments will establish baselines, and grow the information base for decision-making on proposed activities under Commonwealth and Territory environmental regulations. This approach will deliver on actions in threatened species Recovery Plans, Sea Country Plans, and management plans for protected areas (e.g. Indigenous Protected Areas and Marine Reserves), and will develop capacity for continued data collection through a community-based participatory approach.

Project Description

1. **What problem the projects seeks to address and how it will do this**

The North Marine Bioregion is rich in natural assets, including Matters of National Environmental Significance (MNES), however, our overall understanding of the natural environment and biodiversity is poor. A risk is that decision-making to progress sustainable development could lead to unexpected impacts on MNES in the absence of key knowledge. The current ‘Developing the North’ agenda includes plans and potential for large-scale development activities such as agriculture, aquaculture, port development, mineral industry infrastructure, and water extraction, which have the potential to impact biodiversity and cultural values. The need to balance future development with existing industries (for example, commercial fisheries), protection of MNES, and Indigenous interests, drives the need for a regional seascape approach to collecting and analysing data to inform recovery of threatened and migratory marine species, and the assessment of proposed activities in the North Marine Bioregion.

1. **How the research will be undertaken, including what is in and out of scope**

The Northern Seascapes Scoping Project (Phase 1 of Project A12) assessed the current status of knowledge of *EPBC*-listed threatened and migratory marine species, and pressures, Indigenous priorities, habitats, fisheries bycatch, and *EPBC* referrals in relation to them. The focus of the seascape in Phase 1 was broad, extending across the entire North Marine Bioregion (estuaries and coast to the EEZ edge) and multiple taxa (all *EPBC*-listed threatened and migratory marine species, including sharks and rays, shorebirds, turtles, and marine mammals).

The seascape approach is structured to:

* Phase 1: Focus at the regional seascape scale to assess current status of knowledge, and identify knowledge gaps, priority species, and hotspots for finer-scale research
* Phase 2: Apply a toolbox of scientific approaches (including through species distribution modelling and surveys) at the sub-regional-scale focused on priority hotspots to fill in data and knowledge gaps to inform management
* Phase 3: Extend the seascape approach to new areas or regions, through establishing collaborations to accredit rapid assessment training, and fund rapid assessment surveys. This project will be used to identify and explore opportunities to extend the seascapes approach to new areas or regions. For example, the project team will engage with DoEE, Parks Australia, Universities, state and Territory governments and Prime Minister and Cabinet to discuss opportunities to extend or fund this work. Implementation of phase 3 is outside the scope of this current project.

Phase 2 of the Northern Seascapes Project (2018–2020) builds on the scoping undertaken in Phase 1 by directing research efforts on prioritised areas, species, and habitats. Seascape research will be conducted on a range of scales with two primary objectives: (1) fill regional-scale knowledge gaps on focal threatened and migratory species, including DoEE priority species such as sawfishes, sea turtles, and shorebirds using existing data; and (2) test, refine and extend a new rapid assessment survey approach (termed SeaBlitze) for ongoing, cost-effective, sub-regional-scale data collection on priority marine species in the North Marine Region. While BioBlitzes have gained popularity as a rapid terrestrial biodiversity survey approach with a high level of community participation, the concept of a similar application to the marine realm is novel, and presents an opportunity to refine a scientifically robust methodology which could be applied anywhere within Australia’s vast marine estate. Unlike terrestrial BioBlitzes, SeaBlitzes will not have a broad taxonomic inventory focus, but instead will have a biodiversity conservation focus, in particular those listed as threatened and migratory marine species.

The rapid assessment survey will be refined at one hotspot in the first year, before being applied at additional identified hotspots, i.e. areas in the northern seascape defined by the intersection of priority marine species, pressures, and existing Indigenous capacity to collect data. Hotspots will be selected by evaluating the results of the Scoping Project alongside the interests of research end-users and the capacity of project partners. Their selection will consider such factors as: (a) paucity of data on priority threatened and migratory species; (b) existing pressures acting on the local environment; (c) potential for future large-scale development proposals that may impact threatened and migratory species; (d) Indigenous interest and capacity to partner in a SeaBlitze; and, (e) presence of a Commonwealth Marine Reserve and/or Northern Territory Marine Park in the vicinity.

A project planning workshop (Milestone 2) will guide the selection of the hotspot surveys.

The SeaBlitze approach will follow these general steps:

1. Spatial mapping (broad-scale) to determine areas of interest, access, logistics, and feasibility
2. Indigenous traditional knowledge mapping to examine survey sites (fine-scale)
3. Survey planning (including species of interest, methodology, sampling design)
4. Field surveys (SeaBlitzes) including, but not limited to (which will be refined per steps I-III above):
   1. Turtle track and associated predation surveys (repeated track counts, nest marking, and camera trapping; initial surveys during SeaBlitze with return visit to retrieve camera traps/examine predation rates)
   2. Shorebird counts at high-tide roost sites (visual counts)
   3. Shark and ray surveys (fishery-independent sampling by line, net and baited remote underwater videos (BRUVs))
   4. Cetacean and Dugong surveys (visual counts)
   5. Seagrass surveys (turtle and dugong feeding areas; using established seagrass monitoring methods)
5. Survey reporting including fine-scale species mapping, habitat associations, data analysis
6. Communication of SeaBlitze results to Indigenous communities, the scientific community, and the general public. Each SeaBlitze will have a communications package (including plain English summary for managers).

Additionally, the project will address a suite of specific pressing management questions related to threatened and migratory marine species in the North Marine Bioregion, as well as consideration of emerging species of conservation concern:

1. *Question:* What is the long-term natural mortality and reproductive philopatry of Speartooth Sharks (*EPBC* Critically Endangered) in rivers of the North Marine Bioregion? *Approach:* Maintain existing acoustic receiver array in northern rivers to monitor acoustically tagged sharks (tagged under NESP A1); after the initial investment of deploying receivers and tags, this requires minimal ongoing support. *Outcomes:* Natural mortality and philopatry for close-kin mark-recapture population models and to address objectives of the Recovery Plan.
2. *Question:* Do recently discovered “new” populations (Daly River, Ord River) of the Speartooth Shark (*EPBC* Critically Endangered) represent distinct population units? *Approach:* Collect additional tissue samples from these two locations, and compare population structure with existing data (obtained under NERP/NESP) through molecular sequencing. *Outcomes:* Population connectivity and structure to understand if each population needs to be managed as a distinct management unit.
3. *Question:* Is the Northern Prawn Fishery interacting with a single population, or multiple populations, of the Narrow Sawfish (*EPBC* Migratory; IUCN Endangered; emerging species of conservation concern). *Approach:* Collect tissue samples through a partnership with the NPF, and compare population structure through molecular sequencing. *Outcomes:* Population connectivity and structure to delineate management units.
4. *Question:* What is the status of key species of emerging conservation concern in the North Marine Bioregion? *Approach:* Review knowledge and undertake a gap analysis for the globally threatened species for which Northern Australia is the remaining population stronghold: Narrow Sawfish (*EPBC* Migratory; IUCN Endangered), Winghead Shark (IUCN Endangered), and White-spotted Wedgefish (IUCN Vulnerable). *Outcomes:* Improved understanding of species occurrence, distribution, critical habitats to inform future conservation needs (for example, a similar species of wedgefish was recently listed on CMS).
5. *Question:* What management questions have been articulated by Indigenous groups in Phase 1 in relation to EPBC-listed marine species? *Approach:* Review outcomes of engagement in Phase 1. *Outcomes:* Incorporation of Indigenous management questions into project planning workshop, and subsequent project development.
6. **Trial programmes/case studies to improve physical environment, if relevant**

Project A12 is concerned with the collection and analysis of biological data, and does not include trial programmes or case studies that will directly improve the physical environment.

1. **Details of related prior research, if relevant**

The Northern Seascapes Scoping Project (Phase 1 of Project A12) assessed the current status of knowledge of *EPBC*-listed threatened and migratory marine species. The Seascapes approach applied in Phase 1 took a very broad view of Northern Australia to identify future research priorities through examining pressures, Indigenous priorities, habitats, fisheries bycatch, and *EPBC* referrals in relation to listed species. Scoping identified the need for broad-scale mapping of species distributions, and fine-scale baseline data collection.

The broad-scale species mapping will draw upon multiple sources of data, collected through multiple research projects, industry (including the commercial fishing industry), and citizen science. The project will continue to support the extensive acoustic receiver array in NT rivers, deployed and maintained through NERP Project 2.4 and NESP Project A1, which are providing long-term natural mortality estimates and philopatry data on subadult-adult Speartooth Sharks.

1. **How the project links to other research and/or the work of other Hubs.**

There are a range of links to existing NESP Marine Biodiversity Hub projects. The project will address research and management needs for threatened sharks and rays, as outlined in Project A11, the *Shark Action Plan*. The fine-scale mapping component has the potential to provide data on species complexes which are the subject of other Hub projects, in particular hammerhead sharks (Project A5: *Defining the connectivity of Australia’s hammerhead sharks*). The development of a protocol for threatened species SeaBlitzes provides a link to Project D2 (*Analysis, methods, and software to support Standard Operating Procedures for survey design, condition assessment, and trend detection*). There may be an opportunity to link to Project D3 (*Evaluating and monitoring the status of marine biodiversity assets on the continental shelf*) if that project focuses on surveying a Marine Reserve in the North Marine Bioregion. Also, there are links with the NESP Northern Australia Environmental Resources Hub project *Links between Gulf rivers and coastal productivity*, and the NESP Threatened Species Recovery Hub project *Recovering the Far Eastern Curlew*.

1. **Summary of how it is expected that the research will be applied to inform decision-making and on-ground action**

This research will significantly enhance decision-makers’ ability to assess potential impacts of development proposals in Northern Australia on Matters of National Environmental Significance, in particular threatened and migratory marine species. It will improve understanding of species at both the regional-scale in Northern Australia, and at the fine-scale of the rapid assessment surveys. Some of the improved knowledge will include species distribution, occurrence, habitat use, and population connectivity, which ultimately allow decision-makers to assess risk to MNES from proposed activities.

Significant research end-users are DoEE Wildlife, Heritage and Marine, Parks Australia, Environmental Standards Division, Indigenous Land Councils, NT Department of Environment and Natural Resources and NT Fisheries.

NESP 2017 Research Priority Alignment

This project aligns with the following NESP Research Priorities:

* 1. Improve our knowledge of key marine species and ecosystems to underpin their management and protection;
  2. Identify key opportunities to collaborate and build Indigenous participation and knowledge into the management and protection of marine species;
  3. Determine the causes of, and relationships between, pressures on the marine and coastal environment, to inform government investment;
  4. Identify past and current changes in and pressures on the marine and coastal environment, and understand their impact to better target policy and management actions; and,
  5. Better understand issues that are common to the fishing industry and the environment including identifying solutions of mutual benefit.

Pathway to Impact

|  |
| --- |
| **Outcomes**  The Northern Seascapes Project will improve our knowledge of key marine species, including *EPBC*-listed threatened and migratory marine species, and ecosystems of the North Marine Bioregion to underpin their management and protection. These outcomes will be met with the development of a rapid assessment approach (‘SeaBlitzes’) using a suite of tools, including spatial mapping, genetic analysis, and field surveys of *EPBC*-listed species, in collaboration with Indigenous organizations and groups, thus strengthening local interest and capacity building. The data and knowledge generated by the rapid assessments will establish baselines, identify hotspots and areas of critical habitat, and grow the information base for decision-making on proposed activities under Commonwealth and Territory environmental regulations. This approach will deliver on actions in threatened species Recovery Plans, Sea Country Plans, and management plans for protected areas (e.g. Indigenous Protected Areas and Marine Reserves), and will develop capacity for continued data collection through a community-based participatory approach. SeaBlitze results will be communicated to Indigenous communities, industry stakeholders, the scientific community, and the general public through a program of knowledge brokering and communication activities.  **Engagement and Communication**  The research-users listed below have been engaged in the development of project plans for phases 1 and 2 of the project. Numerous workshops and meetings have been used to develop and implement phase 1 and to develop the project plan for phase 2. A prioritisation workshop will be convened in the first quarter of 2018 to prioritise areas for applying the seablitz approach to collect data. Engagement and communication for this project will be planned and implemented consistent with the [Hub’s Knowledge Brokering and Communication Strategy](https://www.nespmarine.edu.au/system/files/Knowledge%20Brokering%20and%20Communictions%20Strategy%20version%201.1%20.pdf). |

| **Research-user** | **Engagement and communication** | **Impact on management action** | **Outputs** |
| --- | --- | --- | --- |
| *DoEE - ERIN* | *Initial project planning workshop*  *Draft models and maps provided for input/validation*  *Survey planning meetings*  *SeaBlitze reports (including plain English summary)* | *Distribution maps used to inform assessments against EPBC referrals*  *A standard operating procedure for the rapid assessment of threatened and migratory marine species* | *Scientific report on individual seablitz surveys*  *Species distribution models, species maps (fine and broad-scale)*  *SeaBlitze protocols* |
| *DoEE –Biodiveristy Conservation Division (Protected Species and Communications - Threatened Species)* | *Initial project planning workshop*  *Draft models and maps provided for input/validation*  *Survey planning meetings*  *SeaBlitze reports (including plain English summary)*  *Email/manuscripts* | *Distribution maps used to inform assessments against EPBC referrals*  *A standard operating procedure for the rapid assessment of threatened and migratory marine species*  *Population connectivity used to inform assessments against EPBC referrals*  *Identification of distribution, critical habitats, interactions for conservation planning* | *Scientific report on individual seablitz surveys*  *Species distribution models, species maps (fine and broad-scale)*  *SeaBlitze protocols*  *Speartooth Shark and Narrow Sawfish population structure plots, manuscripts*  *Knowledge review and gap analysis of emerging species of conservation concern, manuscript* |
| *DoEE –Biodiveristy Conservation Division (Protected Species and Communications - Migratory Species)* | *Initial project planning workshop*  *Draft models and maps provided for input/validation*  *Survey planning meetings*  *SeaBlitze reports (including plain English summary)*  *Email/manuscripts* | *Distribution maps used to inform assessments against EPBC referrals*  *Identification of critical habitat, nationally or internationally important roost sites*  *A standard operating procedure for the rapid assessment of threatened and migratory marine species* | *Scientific report on individual seablitz surveys*  *Species distribution models, species maps (fine and broad-scale)*  *Turtle beach nesting data*  *Shorebird count data*  *SeaBlitze protocols* |
| *DoEE –Environmental Standards Division* | *Initial project planning workshop*  *Draft models and maps provided for input/validation*  *Survey planning meetings*  *SeaBlitze reports (including plain English summary)*  *Email/manuscripts* | *Distribution maps used to inform assessments against EPBC referrals*  *A standard operating procedure for the rapid assessment of threatened and migratory marine species*  *Population connectivity used to inform assessments against EPBC referrals*  *Identification of distribution, critical habitats, interactions for conservation planning* | *Scientific report on individual seablitz surveys*  *Species distribution models, species maps (fine and broad-scale)*  *Speartooth Shark and Narrow Sawfish population structure plot, manuscripts*  *Knowledge review and gap analysis of emerging species of conservation concern, manuscript*  *Turtle beach nesting data*  *Shorebird count data*  *SeaBlitze protocols* |
| *Northern Territory Government* | *Initial project planning workshop*  *Draft models and maps provided for input/validation*  *Survey planning meetings*  *SeaBlitze reports (including plain English summary)*  *Email/manuscripts* | *Distribution maps used to inform assessments against listed species referrals*  *A standard operating procedure for the rapid assessment of threatened and migratory marine species*  *Population connectivity used to inform assessments against environmental legislation referrals*  *Identification of distribution, critical habitats, interactions for conservation planning* | *Scientific report on individual seablitz surveys*  *Species distribution models, species maps (fine and broad-scale)*  *Speartooth Shark and Narrow Sawfish population structure plot, manuscripts*  *Knowledge review and gap analysis of emerging species of conservation concern, manuscript*  *Turtle beach nesting data*  *Shorebird count data*  *SeaBlitze protocols* |
| *Parks Australia – Marine Protected Areas* | *Survey planning meetings*  *SeaBlitze reports (including plain English summary)* | *A standard operating procedure for the rapid assessment of threatened and migratory marine species* | *Scientific report on individual seablitz surveys*  *SeaBlitze protocols* |
| *NPF Industry* | *Email/manuscript* | *Population connectivity used to inform fisheries management* | *Scientific report on individual seablitz surveys*  *Narrow Sawfish population structure plot, manuscript* |
| *Northern Land Council* | *Initial project planning workshop*  *Survey planning meetings*  *SeaBlitze reports (including plain English summary)* | *A standard operating procedure for the rapid assessment of threatened and migratory marine species*  *Actions within Indigenous management documents addressed* | *Scientific report on individual seablitz surveys*  *SeaBlitze protocols*  *Culturally appropriate products and information* |
| **Additional outputs**   * Manuscript (plain English summary) for marine reserve managers in the NT and Commonwealth that provides a summary of the known use of threatened species and extent of important habitats such as seagrasses within these areas * Communication of outputs/engagement with the broader community through press releases, public and community seminars, regular postings to social media and websites, outreach, publications, and interpretation materials | | | |

### Indigenous Consultation and Engagement

This research project, especially the finer-scale species and habitat surveys, will be undertaken in direct collaboration with Indigenous organisations and groups as identified primary users of the research (i.e. this is a Category 1 project for Indigenous engagement and participation). An Indigenous Partnerships Officer employed on the project will drive partnerships with Indigenous communities and Ranger Groups in order to develop and undertake the rapid assessment SeaBlitze approach. The project will involve the direct participation of Traditional Owner groups through on-country work. Hotspots for SeaBlitzes will be determined alongside Indigenous partners.

Phase 1 of the project has included an engagement to determine Indigenous priorities with regards to EPBC-listed marine species in the North Marine Bioregion. This process included the exploration of sea-country plans and other documents, as well as on-ground engagement. Turtles and sawfishes are consistently being discussed by sea country groups and these taxa will be the subject of components of Phase 2. A full review of identified priorities will be included in the Phase 1 final report which will help to direct the planning of Phase 2, specifically where the identified priorities overlap with priority species for DoEE (as is the case with turtles and sawfishes).

The project will engage at both Land Council and community levels, ensuring opportunities for participation from interested parties across Northern Australia. The team will also develop a process for the generated knowledge, data, and results to be effectively shared and communicated between Indigenous peoples, communities and organisations. This will include communication to the Hub Research-user Committee and Steering Committee, the FRDC Indigenous Reference Group and the DoEE Indigenous Advisory Group.

The SeaBlitzes will provide training to Indigenous Rangers on identifying, surveying and monitoring threatened and migratory marine species. The project will explore opportunities, with education providers, to develop an accredited threatened and migratory marine species training course which includes species identification, survey and monitoring techniques, species handling and sampling, and rapid assessment protocols.

Indigenous project participants will be given opportunities to co-author project outputs (such as reports and papers arising).

**Contact person for Indigenous engagement:**

Name: Christy Davies

### Project Milestones

**PHASE 1**

| **Milestones** | **Due date** | **Milestone Status** |
| --- | --- | --- |
| ***Project planning*** |  |  |
| DoEE & partner planning meeting | Due 16 March 2017 | Complete |
| Indigenous priorities desktop review | Due 1 July 2017 | Complete |
| ***Data collation*** |  |  |
| Pressure data collation | Due 1 July 2017 | Complete |
| Species mapping & gap analysis data collation | Due 1 July 2017 | Complete |
| Fisheries bycatch workshop | Due 1 July 2017 | Complete |
| Indigenous priorities workshops | Due 1 July 2017 | Complete |
| 30 year Landsat data for selected key coastal habitats | Due 1 July 2017 | Complete |
| Collation of available coastal habitat data for selected areas | Due 1 July 2017 | Complete |
| ***Outputs*** |  |  |
| Species mapping & gap analysis | Due 1 September 2017 | Complete |
| Pressure mapping | Due 1 September 2017 | Complete |
| Indigenous priorities report | Due 1 September 2017 | Complete |
| Habitat change - Landsat time series analysis (maps & graphs for selected sites) | Due 1 September 2017 | Complete |
| Fisheries bycatch report | Due 1 September 2017 | Complete |
| EPBC referral analysis | Due 1 September 2017 | Complete |
| Remote sensing of coastal habitat change report | Due 1 October 2017 | Complete |
| Synthesis workshop (recommendations for RPV4) | Due 1 October 2017 | Complete |
| Project report | Due 31 December 2017 | On track |

**PHASE 2**

| **Milestones** | **Due date** | **Milestone Status** |
| --- | --- | --- |
| **YEAR 1** |  |  |
| Milestone 1 – Signing of contract | Due 01 Jan 2018 |  |
| Milestone 2 – Project planning workshop (presentation of Phase 1 results; SeaBlitze hotspot selection, target species and sampling approach) | Due 01 May 2018 |  |
| Milestone 3 – Meeting with ERIN to define broad-scale distribution mapping approach (species distribution models) and data management; and with Migratory Species Section to capture available data | Due 01 Jul 2018 |  |
| Milestone 4 – Surveying and sampling permits submitted (CDU Animal Ethics, CDU Human Ethics, NT Fisheries, NT Parks and Wildlife, Northern Land Council) | Due 01 Jul 2018 |  |
| Milestone 5 – Rapid assessment SeaBlitze methodology planning workshop (Darwin) | Due 01 Jul 2018 |  |
| Milestone 6 – SeaBlitze 1 planning meeting | Due 01 Sep 2018 |  |
| Milestone 7 – Establish partnership with NPF Industry for sample collection | Due 01 Sep 2018 |  |
| Milestone 8 – SeaBlitze 1 | Due 01 Nov 2018 |  |
| Milestone 9 – Scientific report on SeaBlitze 1 | Due 31 Dec 2018 |  |
| Milestone 10 – SeaBlitze 1 communications package development & release (including plain English summary for managers) | Due 31 Dec 2018 |  |
| Milestone 11 – Development of draft SeaBlitze protocols (based on refinements of SeaBlitze 1) | Due 31 Dec 2018 |  |
| Milestone 12 – Turtle predation rate survey data collection | Due 31 Dec 2018 |  |
| Milestone 13 – Sample collection for population genetic mapping | Due 31 Dec 2018 |  |
| Milestone 14 – Broad-scale distribution mapping data collation complete | Due 31 Dec 2018 |  |
| Milestone 15 – Identification of data sources on species of emerging conservation priority | Due 31 Dec 2018 |  |
| **YEAR 2** |  |  |
| Milestone 16 – SeaBlitze 2 planning meeting | Due 01 Jul 2019 |  |
| Milestone 17 – SeaBlitze 2 | Due 01 Nov 2019 |  |
| Milestone 18 – Scientific report on SeaBlitze 2 | Due 31 Dec 2019 |  |
| Milestone 19 – SeaBlitze 2 communications package development & release (including plain English summary for managers) | Due 31 Dec 2019 |  |
| Milestone 20 – Refinement of SeaBlitze protocols | Due 31 Dec 2019 |  |
| Milestone 21 – Turtle predation rate survey data collection | Due 31 Dec 2019 |  |
| Milestone 22 – Population genetic mapping sequencing | Due 31 Dec 2019 |  |
| Milestone 23 – Broad-scale distribution maps produced and delivered to DoEE | Due 31 Dec 2019 |  |
| **YEAR 3** |  |  |
| Milestone 24 – SeaBlitze 3 planning meeting | Due 01 Jul 2020 |  |
| Milestone 25 – SeaBlitze 3 | Due 01 Nov 2020 |  |
| Milestone 26 – Scientific report on SeaBlitze 3 | Due 31 Dec 2020 |  |
| Milestone 27 – SeaBlitze 3 communications package development & release (including plain English summary for managers) | Due 31 Dec 2020 |  |
| Milestone 28 – Turtle predation rate survey data collection | Due 31 Dec 2020 |  |
| Milestone 29 – Population genetic mapping | Due 31 Dec 2020 |  |
| Milestone 30 – Release of final SeaBlitze protocols | Due 31 Dec 2020 |  |
| Milestone 31 – Final report on species of emerging conservation concern | Due 31 Dec 2020 |  |
| Milestone 32 – All data and outputs made publicly available | Due 31 Dec 2020 |  |

# Data Management and Accessibility

All project outputs (including data and manuscripts) will be made publically available in accordance with the NESP Data Management and Accessibility Guidelines. To facilitate a consistent standards based approach, the Hub has produced a [Data Management Framework](https://www.nespmarine.edu.au/system/files/MBH%20Data%20Management%20Framework%20v1.2%20-%2005Dec16_AO.pdf). The framework provides project leaders with clear directions on publishing metadata, storing data and satisfying requirements for open access to journal articles.

| **Project output** | **Data Management and Accessibility** |
| --- | --- |
| Species distribution models | Models and maps, and associated data and metadata, will be stored on the Australian Ocean Data Network (AODN), and provided to ERIN |
| Population structure data | Molecular data will be submitted to Genbank, with associated metadata record on AODN |
| SeaBlitze protocols | Final protocols will be made publicly available on the Hub website (and uploaded to AODN) |
| SeaBlitze data (species records, biological data, habitat data, images) | Species records and any biological data will be stored on a dedicated database, with an associated metadata record on AODN. Additionally, shorebird count data will be deposited on Birdlife Australia’s Shorebird 2020 database, and on eBird. Research agreements and data-sharing agreements will be prepared between the project and Indigenous communities/Ranger Groups to explicitly outline data storage and use to meet NESP Data Management and Accessibility Guidelines |
| BRUV footage | Footage and associated metadata will be stored on AODN |
| Manuscripts | All peer-research papers will be made available to the public through open access via the Hub’s website (in accordance with the NESP Data Management and Accessibility Guidelines) |

Location of Research

Research (including broad-scale species distribution and population genetic mapping, and fine-scale species surveys) will be undertaken in the North Marine Bioregion, a vast area of the Australian marine estate from the Torres Strait, through the Gulf of Carpentaria, and across the Top End to the NT/WA border, encompassing coastal and estuarine habitats to the edge of the Australian EEZ. This region includes the North Commonwealth Marine Reserves Network, and Key Ecological Features and Biologically Important Areas of relevance to threatened and Migratory Marine species. The geographical scope also includes Kakadu National Park, given its importance to a number of threatened marine species identified during previous NERP and NESP Marine Biodiversity Hub projects. The primary focus of the research will be waters of, and adjacent to the Northern Territory.

Given the connectivity of threatened and migratory species, some research will also be undertaken in the Kimberley region of the adjacent Northwest Marine Bioregion.

The Northern Seascapes Scoping Project is identifying potential hotspots of knowledge gaps, pressures, Indigenous priorities, and development focus (through understanding EPBC referral triggers). Some of these areas will be the focus of fine-scale surveys to fill identified data gaps. All survey locations will be selected at the project planning workshop in early 2018 (Milestone 2) through consideration of the outcomes of Phase 1 of the project, research end-user needs and interests, and Marine Biodiversity Hub partner and collaborator capacity. The approach will be trialled and refined at one pre-determined area in the first year and then expanded in subsequent years based on stakeholder consultations.

Project Specific Risks

| **Risk to project** | **Potential impact on project** | **Risk rating (low, medium high, severe)** | **How will risk be managed?** | **Who is responsible for managing risk?** |
| --- | --- | --- | --- | --- |
| 1. Access to significant amounts of data for broad-scale distribution mapping (species distribution models) | Unable to develop accurate species distribution models | Low | Collaborate widely with project partners, DoEE and other non-NESP MBH partners (e.g. JCU for turtle data) to ensure available data is gathered | Viv Tulloch-McShane  Michele Thums |
| 2. Access to remote field sites for trialling and undertaking the rapid assessment survey approach | Unable to undertake surveys at selected locations | Low | Time field work for appropriate access (i.e. avoid wet season); seek local advice and knowledge from Ranger Groups; monitor weather; maintain appropriate research vessels at CDU | Christy Davies  Peter Kyne |
| 3. Lack of samples for population structure mapping | Unable to assess population structure and connectivity (a minimum of n=30 samples are required per location) | Low | Ensure ample time and budget for field sampling; partner with fishing industry to access samples | Peter Kyne  Pierre Feutry |
| 4. Possibility of low detection rates (or altogether missing) rare or cryptic species with rapid survey approach | Species occurrence and habitat data not collected for rarer species | Medium | Apply best-practice survey techniques for target species; engage and collaborate with appropriate experts to ensure correct sampling protocols are used; project team has extensive experience surveying for rare species | Peter Kyne  Rachel Groom  Grant Johnson |
| 5. Lack of adequate on-ground capacity from Indigenous Ranger Groups and communities to participate in rapid assessment surveys | Unable to partner with Ranger Groups at selected hotspot locations | Low | Scoping project (Phase 1) is identifying potential Indigenous partners; project team includes an Indigenous Partnerships Officer | Christy Davies  Peter Kyne |
| 6. Lack of clarity about priority information needs for Department of Environment and Energy | Reduced project impacts | Medium | Convene workshop with DOEE to finalise priority species and hotspot sites at Project Planning Workshop in 2018; engage with research end-users ahead of workshop | Peter Kyne  Nic Bax  Paul Hedge |
| 7. Remote field work safety | Minor, moderate and catastrophic injuries and death | Low | Annual field work risk assessments submitted to CDU; all CDU field OH&S protocols followed; adequate training for field participants; local weather and conditions assessed prior to any field activities | Peter Kyne  Christy Davies |

Project Keywords

Threatened species, migratory species, Indigenous sea-country, rapid assessment, marine turtles, shorebirds, sawfishes

Project contacts

Researchers and Staff

| **Name** | **Organisation** | **Project Role** | **FTE** |
| --- | --- | --- | --- |
| Peter Kyne | Charles Darwin University | Project Leader | 0.5 |
| Christy Davies | Charles Darwin University | Indigenous Partnerships Officer | 0.6 |
| Viv Tulloch-McShane | Charles Darwin University | Postdoctoral Fellow – species mapping | 0.4 |
| Pierre Feutry | CSIRO | Population genetics | 0.4 |
| Luciana Ferreira | AIMS | Species mapping | 0.1 |
| Michele Thums | AIMS | Species mapping | 0.1 |
| Rachel Groom | NT DENR | Species surveys (turtles, dugong, seagrass) | 0.2 |
| Grant Johnson | NT DPIF | Species surveys (sharks & rays) | 0.1 |
| Ruth Patterson | CDU | PhD Candidate (marine megafauna) | -- |
| TBD | UWA | BRUV support & analysis | 0.1 |

Data Management

| Name | Organisation | Email | Phone |
| --- | --- | --- | --- |
| Viv Tulloch-McShane | Charles Darwin University | viv.mcshane@mq.edu.au | 0415 326 040 |

Co-contributors

| Name | Organisation/ | Contribution |
| --- | --- | --- |
| Adrianne Laird | NPF Industry | Species occurrence data; biological samples |
| Rob Lindsay | Malak Malak Ranger Group | Biological samples; potential SeaBlitze partner |
| TBD | Indigenous Ranger Groups | SeaBlitze partners (to be determined through Phase 1 and 2018 project planning workshop) |
| TBD | Northern Land Council | Indigenous partnerships and engagement |

Key Partners **and** Research End Users

| **Key Partners (organisation/program)** | **Name/s** | Email (optional) |
| --- | --- | --- |
| NT Department of Environment and Natural Resources | Tony Griffiths | tony.griffiths@nt.gov.au |
| NT Department of Primary Industry and Resources | Thor Saunders | thor.saunders@nt.gov.au |
| NPF Industry | Adrianne Laird | adrianne@npfindustry.com.au |
| Northern Land Council | TBD |  |
| Birdlife Australia | Dan Weller  Connie Warren | [dan.weller@birdlife.org.au](mailto:dan.weller@birdlife.org.au)  connie.warren@birdlife.org.au |

| Research Users (program/section/branch/organisation) | Name/s | Email (optional) |
| --- | --- | --- |
| Department of the Environment and Energy – Biodiversity Conservation Division | Geoff Richardson  Lesley Gidding-Reeve  Ashley Leedman  Fiona Bartlett  Sylvana Maas  Karen Arthur  Mark Carey  Frances Knight | [geoff.richardson@environment.gov.au](mailto:geoff.richardson@environment.gov.au)  lesley.gidding-reeve@environment.gov.au  ashley.leedman@environment.gov.au  fiona.bartlett@environment.gov.au  sylvana.maas@environment.gov.au  karen.arthur@environment.gov.au  mark.carey@environment.gov.au  frances.knight@environment.gov.au |
| Department of the Environment and Energy – Heritage, Reef and Marine Division | Amelia Tandy | amelia.tandy@environment.gov.au |
| Department of the Environment and Energy – Commonwealth Environmental Water Office | Jenny Tomkins | jenny.tomkins@environment.gov.au |
| Department of the Environment and Energy – Environmental Standards | Matt Whitting | matt.whitting@environment.gov.au |
| Department of the Environment and Energy – Parks Australia | Amanda Parr  Zoe Cozens | amanda.parr@environment.gov.au  zoe.couzens@environment.gov.au |
| Department of the Environment and Energy – Environmental Resources Information Network | Carolyn Armstrong | carolyn.armstrong@environment.gov.au |
| Australian Fisheries Management Authority | Steve Bolton | steve.bolton@afma.gov.au |
| NT Department of Environment and Natural Resources | Tony Griffiths | tony.griffiths@nt.gov.au |
| NT Department of Primary Industry and Resources | Thor Saunders | thor.saunders@nt.gov.au |

## Project A13 – Estimation of population abundance and mixing of southern right whales in the Australian and New Zealand regions

*Project length*: 2 Years/24 Months

*Project start date*: 01/04/2018

*Project end date*: 30/03/2020

*Project current status*: To be approved under RPV4

Project Leader: Karen Evans

Lead Research Organisation: CSIRO

Project leader contact details:

GPO Box 1538, Hobart, TAS

(03) 62325007/0484328180

karen.evans@csiro.au

# Project Funding and Expenditure

Project funding table

|  | ***2018*** | ***2019*** | ***2020*** | ***TOTAL*** |
| --- | --- | --- | --- | --- |
| ***NESP funding*** | ***104,756*** | ***65,273*** | ***30,729*** | ***200,758*** |
| *Funding to CSIRO* | *19,756* | *25,273* | *30,729* | *75,758* |
| *Funding to project partners* | *85,00* | *40,000* | *0* | *125,00* |
| ***Cash co-con*** | ***0*** | ***0*** | ***0*** | ***0*** |
| *Cash CSIRO* | *0* | *0* | *0* | *0* |
| *Cash project partners* | *0* | *0* | *0* | *0* |
| ***In-kind co-con*** | ***48,605*** | ***39,744*** | ***24,696*** | ***113,044*** |
| *In-kind CSIRO* | *39,531* | *24,632* | *11,596* | *75,758* |
| *In-kind project partners* | *9,074* | *15,112* | *13,100* | *37,286* |
| ***TOTAL*** | ***153,361*** | ***105,017*** | ***55,425*** | ***313,802*** |

Expenditure statement

Funding expenditure will largely be associated with salaries for project staff to facilitate data migration into the ARWPIC, data preparation for population modelling, mark-recapture analyses and write-up of results ($176.5K). A small amount of funding ($10K) will support streamlining processes for migration of photographic data into the ARWPIC (database development). Remaining funds ($14.5K) will be used to hold a population modelling workshop, including travel expenses for an expert right whale population modeller to spend time with project staff in Australia and lead the workshop.

# Project Description

Project Summary

A comprehensive understanding of the population abundance and degree of spatial connectivity of southern right whales in Australian waters is currently lacking. This limits assessments of the species recovery and understanding of the nature and degree of difference between the south-eastern and south-western Australian populations. This project will provide, for the first time, an abundance estimate of the total Australian population of southern right whales. It will also investigate the connectedness of whales that utilise breeding areas on the eastern, southern and western coasts of Australia. Information provided by this project will allow the Australian government to better evaluate progress made against the Conservation Management Plan for southern right whales and ensure conservation efforts for the species are effectively coordinated at the regional level.

Project Description

#### Problem

The Australian Government Conservation Management Plan for the southern right whale, produced under the *Environmental Protection and Biodiversity Conservation Act 1999*(EPBC Act), sets out three key interim recovery objectives for the period 2011-2021. These are focused on identifying the population recovery of southern right whales in Australian waters and understanding the nature and degree of difference between the south-eastern and south-western Australian populations.

To date, monitoring of southern right whales across the whole of their range in Australian waters has not been consistent, with monitoring taking multiple forms at a number of locations. While we have learned much from this research, a comprehensive understanding of the population parameters, recovery rates movements and degree of spatial connectivity of southern right whales across the whole range of the species in Australian waters is lacking. There is therefore a need to bring together available datasets to resolve both the population abundance and population structure of southern right whales.

Key to being able to resolve the population abundance and the degree of movements and therefore spatial mixing of southern right whales between south-east and south-west Australia, is the substantial collection of unique photographs of individual southern right whales collected by a number of agencies, institutions, organisations and individuals from various locations around southern Australia. Using unique identifying patterns known as callosities located on the heads of individual whales, individual whales can be identified from a sighting event (the ‘mark’) and then re-identified temporally and spatially at additional sighting events (the ‘recapture’). Analyses of temporal and spatial matches of these photographs using mark-recapture methodology allows for the estimation of absolute population abundance and provides insights into the movements and spatial mixing of individuals.

Analysis of these data will provide the Australian Government with strategic information required for evaluating progress against the interim objectives of the Conservation Management Plan. They will also help guide any further research required for ensuring that the long-term recovery objective of the Plan is achieved, that is that the status of the southern right whale is improved to the degree “that it can be removed from the threatened species list under the EPBC Act”.

#### Description of research

The Australian Right Whale Photo-Identification Catalogue (ARWPIC) currently holds photographs from south-western Australia, Tasmania and southeast Australia. It also contains a number of photographs submitted by the general public. While the catalogue is extensive in nature, there are a number of additional datasets of photographs being collected from the Australian region that could be migrated into the ARWPIC to expand the spatial and temporal coverage of photographs and associated matches. Further, a photographic dataset from New Zealand (containing photographs from approximately 1,000 individuals) waters, currently held by the University of Otago, if also included would facilitate an investigation of the movements of southern right whales between the two regions.

Population modelling of species such as southern right whales is complex largely due to a non-annual breeding cycle, requiring the development of bespoke multi-stage mark-recpature models. Application of mark-recapture statistics to a catalogue of photographically identified individuals therefore requires some understanding of the population dynamics of the species and how these dynamics might influence survival and sightings probabilities (see Caswell et al 1999; Fujiwara and Caswell 2001). A number of specialist groups have developed specific extensions to generalised population models for application to right whale populations.

Via engagement with experts at the Scottish Oceans Institute at the University of St Andrews in Scotland and the British Antarctic Survey, an initial workshop will be held to bring the project team (which comprises the data holders) and at least one expert population modeller with experience in developing mark-recapture models for right whales based on photographic records together. It is recognised that migration of all outstanding photographic datasets into the ARWPIC is beyond the scope of this project. The workshop therefore will firstly assess the data currently held in the ARWPIC and the capacity of those data in supporting a population assessment of southern right whales. Based on this assessment, the workshop will identify what additional data might be required for the population component of the project and the spatial and temporal aspects of those data, thereby setting priorities for the data collation, curation and photo matching components of the project. Second, key biological and demographic parameters and aspects of the distribution and movement of southern right whales required to be incorporated into population models will be identified. The workshop will also engage relevant research users and stakeholders to ensure that the project analyses and outputs are communicated and focused in such a way to support policy and management. This engagement will also ensure that potential changes to policy and management measures are identified and discussed with the relevant agencies and the supporting information required from the project is identified.

Maximising the availability of the research expertise of the specialist modeller, a portion of the workshop will be opened up to the broader Australian research community to discuss population modelling methods and application to marine mammals, thereby providing an opportunity for capacity building for those attending.

The project team will also actively pursue any potential further funding sources to compliment this project that would facilitate the full migration of datasets of photographs from Australia and New Zealand into the ARWPIC. This will include applying to the International Whaling Commission at the meeting of the scientific committee in May 2018.

The project will employ a series of multi-stage mark-recapture (MSMR) methods to estimate the abundance and annual population growth rate of southern right whales. This will involve the use of a range of models that explicitly account for heterogeneity in capture. Utilising a range of models will allow for the performance of the models to be compared and an assessment of uncertainty associated with model results conducted. Models used will also estimate probabilities of movement amongst spatial locations to provide a measure of spatial mixing (see [[1]](#footnote-2)). Using the outputs from the modelling components of the project, an assessment of future data collection needs to ensure precise abundance and trend estimates can be made for ongoing monitoring of populations will be conducted.

As well as engagement in the initial workshop, regular updates on the project will be provided to research users and other relevant stakeholders, throughout the project to ensure that information for supporting policy and management measures and any changes to these that might be required is provided to those relevant agencies. This will also allow for input by relevant management agencies in identifying future data collection needs for supporting policy and/or management into the future and ensure that research users and relevant stakeholders, including Indigenous communities for whom southern right whales are totemic, are kept up to date with the project’s progress.

Regular monthly teleconference meetings of the project team will be held to ensure that all partners are kept up to date with the project’s progress, are aware of any risks or issues associated with the project, and that the decision making processes involved with the project are inclusive.

#### Prior research and linkages to other research projects

The project leverages off considerable effort by a number of research agencies and Universities involved in collecting photographs and related data from southern right whales both in Australia and New Zealand over more than two decades, as well as public submissions of photographs into the ARWPIC. Many of these projects have been supported through substantial funding provided by the Department of Environment and Energy’s Australian Marine Mammal Centre grants scheme.

The project also leverages off the substantial effort placed into the development of the ARWPIC, a research initiative developed through a partnership between the Department of Environment and Energy (Australian Antarctic Division), Tasmanian Department of Primary Industries, Water, Parks and Environment, Victorian Department of Environment, Land, Water and Planning and the Western Australian Museum, funded through the Department of Environment and Energy’s Australian Marine Mammal Centre grants scheme and developed by Skadia Pty Ltd.

The project has direct linkages with the Marine Biodiversity Hub project A7 “Monitoring population dynamics of ‘Western’ right whales off southern Australia”. Photographs of individuals collected by this project will contribute to those analysed by this project. The principal investigator on project A7 is a member of the ARWPIC steering committee and is one of the partners on this project.

The project will provide a series of logical next steps in progressing the ARWPIC to provide a comprehensive photo catalogue for the Australian region in the first instance and pending progress on the Australian datasets, the New Zealand region in the second. The project will ensure that the original drivers for development of the catalogue are achieved: providing information on the abundance, status and movements of southern right whales that can inform conservation management of the species. Further development of the ARWPIC will provide a key resource for the Australian Government and state managers particularly in relation to issues affecting matters of national environmental significance.

#### Application to decision making and on-ground action

Through the provision of an estimate of absolute abundance for southern right whales for the Australian region, the project will provide the Australian Government with a key index against which both past pressures and contemporary pressures on the population can be measured. This will allow for evaluation of policy and management actions currently in place, better targeting of policy and management actions for ensuring ongoing recovery of the species and ultimately, removal of the species from the threatened species list under the EPBC Act. Estimation of population abundance and structuring within the population will also reduce uncertainty in the assessment of current threats on population(s) and provide for better targeting of mitigation efforts aimed at reducing threats to the population(s) in the region.

NESP 2017 Research Priority Alignment

The research proposed aligns and directly contributes to a number of the NESP Research Priorities. These include:

***Maximising the efficacy of managing Australia’s marine environment***

By providing an estimate of absolute abundance and associated uncertainty for southern right whales for the Australian region, the project will provide the Australian Government with a key index against which recovery of the population can be measured and the current management plan for southern right whales evaluated. Improved insights into the population structure of southern right whales will allow for refocusing of the plan and associated research priorities to ensure monitoring efforts are appropriate, targeted and attainable. Results from the project will allow for any assessment and mitigation of threats to the population(s) in the region to be appropriately focused and ensure that research is targeted in such a manner that the most relevant information for assessment is collected.

***Improving our understanding of the marine environment including biophysical, economic and social aspects***

The proposed project will employ mark-recapture methodologies to establish an estimate of the total population abundance of southern right whales across Australia; exact information that is currently lacking. This will provide the Australian Government with a key index against which recovery of the population can be measured and future trends monitored. It will also provide improved insights into the population structure of the species across the Australian and potentially the Australian and New Zealand region, providing for improved information required for management at the population level.

In analysing a previously under-investigated dataset and employing cutting edge population modelling approaches, the project will allow for an evaluation of the method, provide for an assessment of the capabilities of current data collection efforts in providing for ongoing monitoring needs for the species and identify what may be needed in order to reduce uncertainty in assessments of the population and ongoing evaluation of trends.

The dataset proposed to be analysed under this project has been built on the basis of contributions of photographs from researchers and the public, with the ARWPIC database able to be explored and contributed to by public citizens. The project therefore provides an important opportunity for citizens, including Indigenous communities, to participate in knowledge gathering that has clear relevance and provides inputs into the management of southern right whales in Australian waters.

Pathway to Impact

|  |  |  |  |
| --- | --- | --- | --- |
| **Outcomes** | | | |
| By providing an estimate of absolute abundance and associated uncertainty for southern right whales for the Australian region, the project will provide the Australian Government with a key index against which recovery of the population can be measured and the current management plan for southern right whales evaluated. Improved insights into the population structure of southern right whale will allow, if appropriate, for the refocusing of the plan and associated research priorities to ensure monitoring efforts are appropriate, targeted and attainable. Results from the project will allow for any assessment and mitigation of threats to the population(s) in the region to be appropriately focused and ensure that research is targeted in such a manner that the most relevant information for assessment is collected.  In analysing a previously under-investigated dataset, the project will provide a power-based assessment of the capabilities of current data collection efforts in providing for ongoing monitoring needs for the species and identify what may be needed in order to reduce uncertainty in future assessments of the population and ongoing evaluation of trends.  Further development of the ARWPIC will provide a key resource for the Australian Government and state managers particularly in relation to issues affecting matters of national environmental significance.  Engagement and communication for this project will be planned and implemented consistent with the [Hub’s Knowledge Brokering and Communication Strategy](https://www.nespmarine.edu.au/system/files/Knowledge%20Brokering%20and%20Communictions%20Strategy%20version%201.1%20.pdf). | | | |
| **Research-user** | **Engagement and communication** | **Impact on management action** | **Outputs** |
| Migratory Species Unit, Australian Government Department of Environment and Energy  Queensland Government Department of National Parks, Sport and Racing  New South Wales National Parks and Wildlife Service  Biodiversity Division, Victoria State Government Department of Environment, Land, Water and Planning  Policy and Conservation Assessment, Natural and Cultural Heritage, Tasmanian Department of Primary Industries, Parks, Water and Environment.  Government of South Australia Department of Environment, Water and Natural Resources  Parks and Wildlife Service, Government of Western Australia Department of Biodiversity, Conservation and Attractions  Environment Protection and Assessment, Australian Government Department of Defence | Research-users were engaged by meetings and emails in the development and refinement of the project plan  Research-users will be engaged in project delivery (e.g. workshops and meetings for collating data and modelling). The project team will also provide periodic briefings in project progress and findings | Research results will provide a key index against which recovery of the population can be measured and the current management plan for southern right whales evaluated. Development of the ARWPIC will provide a key resource for the Australian Government and state managers particularly in relation to issues affecting matters of national environmental significance | An expanded ARWPIC.  Data summaries for populating models used to estimate abundance and connectivity  An estimate of population abundance at the national scale and associated uncertainty*.*  An evaluation of movement and spatial mixing across southern Australia.  An assessment of future data collection needs to ensure precise abundance and trend estimates can be made for ongoing monitoring of populations  A series of milestone reports and a final report  A paper for presentation to the International Whaling Commission  A peer –review paper for publication in a relevant journal |
| **Additional outputs** | | | |

### Indigenous Consultation and Engagement

Indigenous consultation and engagement for this project will be undertaken in a manner that is consistent with the [Hub’s Indigenous and Participation Strategy](https://www.nespmarine.edu.au/document/indigenous-engagement-and-participation-strategy). This project is a Category 3 project for Indigenous engagement because it is laboratory and desktop based and does not have direct collaboration with an Indigenous community, organisation, group or individual (i.e. it does not have a field component and will not involve direct participation or employment of an Indigenous organization, group or individual). The knowledge generated in this project will be effectively shared and communicated between relevant Indigenous peoples, communities and organisations.

In consultation with the Marine Biodiversity Hub Theme leaders and the Department of Environment and Energy, the project will develop a process for outputs from the project to be effectively shared and communicated to Indigenous peoples, communities and organisations. In particular, the communities and Traditional Owners of Mirning, Wirangu, Yalata, Kooyang and Yuin and Monaro, all of which have identified southern right whales as important components of their heritage and culture will be contacted by members of the project team, some of which are already engaged with these communities. Direct communication with these communities will allow for the identification of information is of relevance to the communities, Traditional Owners and ranger groups and also aid in identifying further relevant communities, Traditional Owners or ranger programs that should be engaged by the project and/or might be interested in information generated by the project. This engagement will also include direct provision of information on the project, its aims and progress to communities, Traditional Owners and ranger groups through on ground visits and involvement in relevant community events.

### Project Milestones

| **Milestones** | **Due date** | **Milestone Status** |
| --- | --- | --- |
| Milestone 1- priority setting and population modelling workshop complete, migration and curation of outstanding photographs into ARWPIC started | 01 October 2018 |  |
| Milestone 2 – Migration and curation of outstanding photographs into ARWPIC complete | 01 April 2019 |  |
| Milestone 3 - Model validation and preliminary model runs complete, paper presented to the International Whaling Commission | 01 October 2019 |  |
| Milestone 4 - Model runs complete, initial draft of peer review publication. | 01 February 2020 |  |
| Milestone 5 – Final report complete | 30 March 2020 |  |

# Data Management and Accessibility

All project outputs (including data) will be made publically available in accordance with the NESP Data Management and Accessibility Guidelines. To facilitate a consistent standards based approach, the Hub has produced a [Data Management Framework](https://www.nespmarine.edu.au/system/files/MBH%20Data%20Management%20Framework%20v1.2%20-%2005Dec16_AO.pdf). The framework provides project leaders with clear directions on publishing metadata, storing data and satisfying requirements for open access to journal articles.

| **Project output** | **Data Management and Accessibility** |
| --- | --- |
| Data summaries for populating models used to estimate abundance and connectivity | Data products generated by the project will be deposited, as per the Marine Biodiversity Hubs Data and Information Accessibility Guidelines, into the Australian Ocean Data Network with metadata records also deposited in the relevant data repositories of each of the project partners (e.g. Australian Antarctic Data Centre, CSIRO Data Access Portal). |
| An estimate of population abundance at the national scale and associated uncertainty | Data products generated by the project will be deposited, as per the Marine Biodiversity Hubs Data and Information Accessibility Guidelines, into the Australian Ocean Data Network with metadata records also deposited in the relevant data repositories of each of the project partners (e.g. Australian Antarctic Data Centre, CSIRO Data Access Portal). |
| An evaluation of movement and spatial mixing across southern Australia | Data products generated by the project will be deposited, as per the Marine Biodiversity Hubs Data and Information Accessibility Guidelines, into the Australian Ocean Data Network with metadata records also deposited in the relevant data repositories of each of the project partners (e.g. Australian Antarctic Data Centre, CSIRO Data Access Portal). |
| An assessment of future data collection needs to ensure precise abundance and trend estimates can be made for ongoing monitoring of populations | Communication products will be made available via the Marine Biodiversity Hub’s website and deposited into the relevant publications repositories of each of the project partners (e.g. CSIRO Research Publications Repository) where they will be searchable and available to access. |
| A series of milestone reports and a final report | Communication products will be made available via the Marine Biodiversity Hub’s website and deposited into the relevant publications repositories of each of the project partners (e.g. CSIRO Research Publications Repository) where they will be searchable and available to access. |
| A paper for presentation to the International Whaling Commission | Communication products will be made available via the Marine Biodiversity Hub’s website and deposited into the relevant publications repositories of each of the project partners (e.g. CSIRO Research Publications Repository) where they will be searchable and available to access. |
| A peer –review paper for publication in a relevant journal | Communication products will be made available via the Marine Biodiversity Hub’s website and deposited into the relevant publications repositories of each of the project partners (e.g. CSIRO Research Publications Repository) where they will be searchable and available to access. All peer-research papers will be made available to the public through open access via the Hub’s website (in accordance with the NESP Data Management and Accessibility Guidelines) |

Location of Research

The research covers the range of southern right whales in Australian waters. On-ground activities will occur across the project partner’s agencies and institutions.

Project Specific Risks

| **Risk Description** | **Likelihood**  **1 = very low 5 = very high** | **Impact**  **1 = very low 5 = very high** | **Mitigation Strategy proposed to reduce risk** |
| --- | --- | --- | --- |
| Photographic records not currently in the ARWPIC are not made available to the project | 1 | 4 | The project partners have a track record of working with all of the relevant data holders, with migration of photos into the ARWPIC already agreed upon and identified as a priority. Specific funds within the project have been distributed to major photographic record holders to ensure that migration of photos can be facilitated by those holders. |
| The time required for collation, deposit and verification of photographic records is underestimated | 1 | 2 | Progress on this activity will be regularly reviewed and any issues with timelines on this component actively managed. |
| Mark-recapture records are not adequate for generation of a population estimate | 1 | 2 | The project partners have discussed the viability of generating abundance estimates given current records in the ARWPIC and incomplete migration of outstanding datasets. The overall view is that a population abundance is achievable. A key part of the project will be the initial workshop which will firstly assess the data currently held in the ARWPIC and the capacity of those data in supporting a population assessment of southern right whales. Based on this assessment, the workshop will prioritise what additional data might be required for the population component of the project and the spatial and temporal aspects of those data, thereby setting priorities for the data collation, curation and photo matching components of the project. Models applied by the project will generate an estimate of uncertainty around model outputs that will be communicated clearly to research end-users and stakeholders. |

Project Keywords

Southern right whale, population abundance, population structure, population recovery, population status.

Project contacts

Researchers and Staff

| **Name** | **Organisation** | **Project Role** | **FTE (WoL)** |
| --- | --- | --- | --- |
| Karen Evans | CSIRO Oceans and Atmosphere | Principal Investigator | 0.3 |
| Mike Double | Department of Environment and Energy (Australian Antarctic Division) | Co-investigator, ARWPIC manager | 0.05 |
| Rachael Alderman | Tasmanian Department of Primary Industries, Parks, Water and Environment | ARWPIC steering committee, data contributor, data curator | 0.1 |
| Emma Carroll | Sea Mammal Research Unit, University of St Andrews | Population modeller | 0.1 |
| Claire Charlton | Claire Charlton – Environmental Consulting | Data contributor, data curator | 0.7 |
| Rob Harcourt | Macquarie University | Data contributor | 0.05 |
| Jen Jackson | British Antarctic Survey | Population modeller | 0.1 |
| Mandy Watson | Victorian Department of Environment, Land, Water and Planning | ARWPIC steering committee, data contributor, data curator | 0.02 |
| Research technician | CSIRO Oceans and Atmosphere | Data support and management | 0.2 |

Data Management

| Name | Organisation | Email | Phone |
| --- | --- | --- | --- |
| Karen Evans | CSIRO | karen.evans@csiro.au | (03) 62325007 |

Co-contributors

| Name | Organisation/ | Contribution |
| --- | --- | --- |
| John Bannister | Western Australian Museum | ARWPIC steering committee, data contributor |
| Steve Burnell | Eubalaena Pty. Ltd | Data contributor |
| Will Rayment | University of Otago | Data contributor |

Key Partners **and** Research End Users

| **Key Partners (organisation/program)** | **Name/s** | Email (optional) |
| --- | --- | --- |
| Migratory Species Unit, Australian Government Department of Environment and Energy | Sylvana Maas | Sylvana.Maas@environment.gov.au |
| Biodiversity Division, Victoria State Government Department of Environment, Land, Water and Planning | Nina Cullen | Nina.Cullen@delwp.vic.gov.au |
| Policy and Conservation Assessment, Natural and Cultural Heritage, Tasmanian Department of Primary Industries, Parks, Water and Environment. | Andrew Crane | Andrew.Crane@dpipwe.tas.gov.au |

| Research Users (program/section/branch/organisation) | Name/s | Email (optional) |
| --- | --- | --- |
| Migratory Species Unit, Australian Government Department of Environment and Energy | Sylvana Maas | Sylvana.Maas@environment.gov.au |
| Biodiversity Division, Victoria State Government Department of Environment, Land, Water and Planning | Nina Cullen | Nina.Cullen@delwp.vic.gov.au |
| Policy and Conservation Assessment, Natural and Cultural Heritage, Tasmanian Department of Primary Industries, Parks, Water and Environment. | Andrew Crane | Andrew.Crane@dpipwe.tas.gov.au |
| Queensland Government Department of National Parks, Sport and Racing | Amanda Delaforce | Amanda.Delaforce@npsr.qld.gov.au |
| New South Wales National Parks and Wildlife Service | Susan Crocetti | Susan.Crocetti@environment.nsw.gov.au |
| Government of South Australia Department of Environment, Water and Natural Resources | Dirk Holman | Dirk.Holman@sa.gov.au |
| Parks and Wildlife Service, Government of Western Australia Department of Biodiversity, Conservation and Attractions | Kelly Waples | Kelly.Waples@dpaw.wa.gov.au |
| Environment Protection and Assessment, Australian Government Department of Defence | Lloyd Woodford | lloyd.woodford@defence.gov.au |

## Project D1 – National Data Collation, Synthesis and Visualisation to support Sustainable Use, Management and Monitoring of Marine Assets

Project length – 3.5 Years

Project start date – 01/07/2015

Project end date – 31/12/2018

Project current status - Submitted for re-approval

Project Leader – Karen Miller (FTE – 20%); Scott Nichol (DIC FTE – 10%)

Lead Research Organisation – Australian Institute of Marine Science

Project leader contact details: - [k.miller@aims.gov.au](mailto:k.miller@aims.gov.au), 08-6369 4007; [scott.nichol@ga.gov.au](mailto:scott.nichol@ga.gov.au), 02-6249 9346

# Project Funding and Expenditure

Project funding table

|  | 2015 | 2016 | 2017 | 2018 | TOTAL |
| --- | --- | --- | --- | --- | --- |
| NESP funding | AIMS 221,000  GA 65,200  UWA 85,000 | AIMS 220,000  GA 130,000  UWA 159,000 | AIMS 160,350  GA 140,000  UWA 20,000  UTAS 30,000  CSIRO 30,000 | AIMS 160,350  GA 95,000  UWA 20,000  UTAS 30,000  CSIRO 30,000 |  |
| NESP total | 371,200 | 509,000 | 380,350 | 335,350 | 1,595,900 |
| Cash co-con | x | x | x | x |  |
| In-kind co-con | AIMS 174,112  GA 95,000  UWA 85,000 | AIMS 319,000  GA 135,000  UWA 170,000 | AIMS 140,350  GA 140,000  UWA 20,000  UTAS 30,000  CSIRO 30,000 | AIMS 140,350  GA 95,000  UWA 20,000  UTAS 30,000  CSIRO 30,000 |  |
| In-Kind Total | 354,112 | 624000 | 360,350 | 315,350 | 1,653,812 |
| TOTAL | 725,312 | 1,133,000 | 740,700 | 650,700 | 3,249,712 |

Expenditure statement

In 2018, funding will be used to support the deployment of staff resources from AIMS, GA, CSIRO, UTAS and UWA to provide requisite expertise in analysis and interpretation of physical and ecological data and predictions, plus data management and delivery. Funds will also support travel to facilitate interactions among researchers across partner organisations to ensure integration of data and predictive models to understand ecosystem processes. The budget request also factors in travel to attend workshops and Hub meetings as required.

# Project Description

Project Summary

Effective management of marine assets requires an understanding of ecosystems and the processes that influence patterns of biodiversity. Through collation and synthesis of existing data this project will improve access to, and the useability of, marine data to better inform management and improve public understanding of biodiversity in the marine estate. End-users and stakeholders will benefit from improved regional and national descriptions of biodiversity assets for the Commonwealth marine estate, including the Commonwealth Marine Reserve network and other high-priority marine areas. In turn, this will inform prioritisation of future investments in monitoring marine ecosystems and State of the Environment reporting.

Project Description

#### Problem

Knowledge of natural assets and their biological value is needed to underpin planning, monitoring and sustainable development throughout Australia’s Marine Estate. Essential to the dissemination of this knowledge is easy access to relevant, readily useable marine data and derived information. To begin to address this problem, in 2015-16 Project D1 focussed on characterising biodiversity and natural assets in Northern Australia through data collation and integration, with an initial focus on synthesising information to build on knowledge gained through previous investment in CERF and NERP. This has resulted in synthesised data products describing assets and key physical and biological processes for the Oceanic Shoals Marine Park and Glomar Shoal KEF being easily available for stakeholders and managers through the Northwest Atlas (see [www.northwestatlas.org](http://www.northwestatlas.org)) and has included visualisation of spatial data to facilitate understanding and uptake and will underpin decisions around monitoring and management at a marine park scale. The approach developed to date for the NW region and Oceanic Shoals Marine Park, which has had strong end-user uptake and endorsement, was discussed at the National Prioritisation Workshop (NPW) in March 2017 and this year’s research plan targets marine parks highlighted during the NPW as priority areas for information synthesis.

#### How research will be undertaken

The project leverages prior investment in data collection under CERF, NERP and through the research of Partner Organisations, to develop improved and more accessible descriptions of natural assets in the Marine Parks network that will enhance the knowledge base for managers and raise public appreciation of their environmental value. Based on the outcomes from research in 2015-2017 in NESP Theme D, we have been able to assess the extent of data availability and stakeholder priorities to refine targeted focal areas for ongoing work in 2018.The project will continue the collation and synthesis of physical and biological data to support the visualisation of key ecosystem attributes for selected Marine Parks including Kimberley, Bremer, Huon, Mermaid and/or Ashmore with synthesis information being made accessible through the Australian Marine Parks Science Atlas, Northwest Atlas and/or other web portals as relevant (e.g. Seamap Australia, ERIN). It will also integrate other online portals, where possible, by providing data syntheses within the AMP Science Atlas with direct links to metadata and/or data available through other web portals (e.g. FishMap, ARMADA, Global Archive, ALA).

#### Description of Research

Through the NPW in March 2017, we identified areas for which we have the greatest confidence that sufficient data exists and can be synthesised to address the information needs of Parks Australia. Through 2018 the approach adopted in previous years will be extended to incorporate data collation to provide targeted synthesis for selected AMPs based on the outcomes of the National Prioritisation Workshop. Specific tasks will include:

* Based on outcomes from National Prioritisation Workshop in March 2017 and in collaboration with Project D3, undertake data collation and synthesis exercises which would support the information needs of Parks Australia in management and monitoring in AMPs. Targeted marine parks will include Kimberley, Bremer, Huon, Mermaid and/or Ashmore. The outputs from this work will be reports on ecologically important features of selected AMPs (see also Planned Outputs below)
* Continue validity testing and refinement of benthic habitat modelling approaches, using Geographe Bay as a test case for understanding how input data availability can affect model confidence/uncertainty
* Reconvene with stakeholders through formal and informal meetings to disseminate research findings and to ensure project progress and direction remains relevant to management needs.
* Continue knowledge dissemination through E-Atlases (especially the Marine Parks Science Atlas) and upload relevant data layers as well as the inclusion of synthesis products. Produce updated maps, data syntheses, and communication tools for end-users that capture key environmental attributes of the focus areas.
* Undertake discussion/workshops with DoEE and other key stakeholders and end-users to disseminate the results from the project. Our communications into the department will focus on: describing assets within the AMP network and their regional context; the ongoing need for additional information based on new biological and physical data, and; the potential for developing new, targeted models to address key knowledge gaps and prioritise data collection needs.

#### What the project will deliver and how will it inform decision making

The approaches that we will use to synthesise information in this project will identify values and assets within Marine Parks that will underpin future monitoring and management initiatives across Australia’s marine estate. In particular, our synthesis will highlight data gaps that can be targeted in future surveys, but will also explore the utility of predictive modelling to address those data gaps. For example, the overlay of existing data, gap analyses and synthesis approaches could enable us to describe benthic habitats within Marine Parks, identify BIAs, develop and refine predictions of migratory corridors, foraging and breeding grounds, and characterise pelagic communities as well as prioritise areas for future investment in field surveys. This knowledge would underpin assessments of sensitivity to environmental variability and anthropogenic pressures, as well as improving our understanding of the value of Marine Parks and KEFs in a national context.

#### Changes since previous research plan

In 2018 this project will continue largely as for 2017, building on knowledge collation and synthesis for priority marine parks nationwide. The set of AMPs for data visualisation and synthesis products have been identified through consultation processes (including the National Prioritisation Workshop held in 2017), and include reserves from the Temperate East, South-east, North-west and South-west and North-west networks.

#### Inclusions (in scope)

The project will deliver data synthesis and visualisation products for the AMP network. For example, bathymetry (at best available resolution), seabed physical characteristics, sea surface properties (temperature, turbidity) and fish diversity. Application of predictive models of the nature and extent of benthic communities and pelagic hotspots, where information is available to support the models. Spatial data layers relevant to the management and monitoring of marine parks will be made available through the Australian Marine Parks Science Atlas.

#### Exclusions (out of scope)

Out of scope factors will be agreed upon with DoEE during ongoing consultation as guided by Department priorities.

NESP 2017 Research Priority Alignment

This project aligns with several key marine biodiversity research priorities identified by DoEE. Through increased knowledge generation based on the consolidation of existing data and synthesis approaches generated through significant past investments by CERF, NERP and collaborating institutions, this project will provide new integrated information on the marine assets to improve our understanding of the marine environment including biophysical, economic and social aspects. Specifically it will **improve our knowledge of key marine species and ecosystems to underpin their better management and protection** through the synthesis of existing and new information to ensure uptake. This knowledge will be accessible to end-users through E-Atlases, and through communication documents (e.g. fact sheets, full colour brochures, etc.). The work builds on other work (NW Shelf, Great Barrier Reef, Torres Strait and the South West of Australia), where regional approaches have provided significant steps forward in building a national picture of our marine environment.

This project also addresses the Clean Water component of the Cleaner Environment Policy, by providing information and tools to assess the significance and performance of CMRs, to identify and monitor KEFS, and to underpin the protection of marine environments.

Pathway to Impact

| Outcomes |
| --- |
| * Improved access to and utilisation of the Hub’s data and derived information products by the DoEE, industry and the community to better inform management of the marine estate and improve public understanding and value of the biodiversity of Australia’s marine environment. * A knowledge framework to support management plans for Marine Parks, particularly for maintaining patterns of marine biodiversity and associated ecosystem processes; * Guidance to end-users on uncertainty in our understanding of ecosystems and the implications of this uncertainty for decision making; * Maintenance and building of research and management capability within Australia, building on previous government and industry investment. * Improved access to information on the biodiversity assets and conservation values within the national AMP network to support new management plans and broader marine estate to inform approvals processes for sustainable use of marine resources; * Baselines for monitoring in previously surveyed AMPs to maximise information relative to return on investment; * An increased understanding of the distribution and structure of marine biodiversity in Australia, which will provide a greater bioregional context of their national significance. |
| Environmental Value The outcomes from this project will be of direct relevance for management of Marine Parks and will inform a range of management and policy actions. Approvals under the EPBC Act are binary decisions around whether or not a proposal poses acceptable risk. The notion of acceptable risk requires fundamental information on the spatial distribution of conservation values and assets, and their exposure to a proposal’s footprint. Likewise, prioritising management actions in Marine Parks requires core knowledge of the distribution of biodiversity, its exposure to threats, and the extent to which candidate actions insulate against pressures.  This project will lead to better informed EPBC Act approvals, more informed prioritisation of management actions and monitoring in Marine Parks and will assist industry in risk assessments and the refinement of its environmental plans (e.g. oil spill response plans). The value of the project can be demonstrated by comparing the costs and outcomes of informed decision-making with those of less informed approvals and management and by demonstrating the value of Marine Park implementation. Engagement and communication for this project will be planned and implemented consistent with the [Hub’s Knowledge Brokering and Communication Strategy](https://www.nespmarine.edu.au/system/files/Knowledge%20Brokering%20and%20Communictions%20Strategy%20version%201.1%20.pdf). |

| **Research-user** | **Engagement and communication** | **Impact on management action** | **Outputs** |
| --- | --- | --- | --- |
| DoEE- Parks Australia and Regional Marine Planning | A variety of mechanisms (e.g. meetings and emails) have been used to engage research-users in the development and refinement of the project plan Regular project updates and informal meetings; email; formal presentations will be used to keep research-users engaged and informed in progress | Information will be used to inform AMP management, including planning, and future monitoring program design.  Outputs can also be incorporated into the AMP Science Atlas to showcase and communicate the science and values in Marine Parks.  Information can be used to inform broader marine regional management (off-reserve) including KEFs | 1) Bathymetry at best available resolution for priority Marine Parks made available through the Marine Parks Science Atlas (e.g. Cod Grounds, Coral Sea, Huon, Lord Howe – Elizabeth and Middleton reefs, Ningaloo, Perth Canyon, Solitary Islands, Tasman Fracture, Bremer Canyon, Kimberley, Oceanic Shoals, Joseph Bonaparte Gulf, Geographe, Gifford) **(Milestone 15)**;  2) Data synthesis products and maps (e.g. geomorphic maps, habitat maps, sea surface properties (developed in collaboration with oceanographers at CSIRO, BoM and UNSW@ADFA) that depict key elements that potentially influence the spatial distribution of biodiversity across selected AMPs (e.g. Bremer, Tasman Fracture, Huon, Kimberley, Joseph Bonaparte Gulf, Lord Howe, Oceanic Shoals, Mermaid/Ashmore) (**Milestone 15**);  3) Science synthesis report on ecologically important features of well-sampled AMPs based on collated datasets and any new information available, provided as eco-narratives based on mapping and data collation, and with outputs targeted at the Marine Parks Science Atlas **(Milestones 16, 17).** |
| Dept Agriculture and Water Resources | As above | Where appropriate new knowledge gained will inform the development of fisheries policy | As above |
| NOPSEMA | As above | Where appropriate new knowledge gained may inform decision making on environmental assessments | As above |
| **Additional outputs**   * primary literature publications describing outcomes of habitat modelling, model testing and validation, and papers describing geomorphology of selected AMPs. * presentations at conferences and other relevant forums on the outcomes from data synthesis exercises, modelling and data visualisation. | | | |

### Knowledge Brokering and communication

The approach to interaction with research-users and stakeholders will be consistent with the Marine Biodiversity Hub’s Knowledge Brokering and Communication Strategy. The pathway to impact will rely on engagement of research-users in all stages of the project, in particular project scoping, communicating project progress and development and delivery of project outputs. Where appropriate, the project team will make use of existing effective engagement mechanisms and new engagement mechanisms will be used where none exist. The project team will also engage with research-users and stakeholders to discuss the development and delivery of synthesis products to ensure they are fit-for-purpose, in particular products for AMPs.

The project will develop a schedule for product delivery and stakeholder engagement in consultation with the Marine Hub Knowledge Broker, and this will be modified in consultation with research-users on an as-needs basis to maximise impact

Knowledge brokering and communication contact

Name: Scott Nichol

Email: scott.nichol@ga.gov.au

Phone: 02 6249 9346

### Indigenous Consultation and Engagement

Indigenous consultation and engagement for this project will be undertaken in a manner that is consistent with the [Hub’s Indigenous and Participation Strategy](https://www.nespmarine.edu.au/document/indigenous-engagement-and-participation-strategy).The ongoing project is a desk top study (i.e. it does not include a field work component – this potential element of project approved in the superseded 2016 Research Plan will be considered in project D3 of this research plan) and is therefore now considered a **category three** project for Indigenous engagement. Our approach to engagement will primarily involve provision of updates to the DoEE Indigenous Advisory Group the Fisheries Research and Development Corporation Indigenous Reference Group. These groups will also be asked for advice on opportunities to enhance Indigenous engagement for this project. The project team will also explore options for developing synthesis outputs targeted to Indigenous communities.

The team will continue to engage with Indigenous communities that were engaged in 2015-16 to ensure generated knowledge, data and results are effectively shared with and communicated to Indigenous peoples, communities and organisations.

Contact person for Indigenous engagement:

Name: Karen Miller

Email Address: [k.miller@aims.gov.au](mailto:k.miller@aims.gov.au)

Phone Number: 08-6369 4007

### Project Milestones

| **Milestones** | **Due date** | **Milestone Status** |
| --- | --- | --- |
| Milestone 1: All research users and stakeholders for this project have been engaged and understand project and how it relates to their interests | 30 April 2016 | Completed |
| Milestone 2: New maps and products based on existing data and knowledge from the North and NW available to all end-users through the NW Atlas to support development of CMR management plans and updates to KEF descriptions | 1 July 2016 | Completed  Outputs available at [www.northwestatlas.org](http://www.northwestatlas.org) |
| Milestone 3: **Activity Milestone**. Contribute to National Prioritisation Workshop in collaboration with Projects D3 (Shelf Reefs) and C1 (Pressures) and stakeholders | 31 March 2017 | Completed |
| Milestone 4: **Delivery Milestone.** Report summarising outputs from synthesis of datasets and predictive models for the North and NW, including priority areas identified through stakeholder consultation to support development of CMR management plans | 1 December 2016 | Completed  Report available at  [www.nespmarine.edu.au](http://www.nespmarine.edu.au) |
| Milestone 5: **Activity Milestone**  Development of qualitative model for Glomar Shoals KEF | January – March 2017 | Completed |
| Milestone 6: **Activity Milestone**  Collation of national datasets for all CMRs, including meetings of project team | January – June 2017 | Completed |
| Milestone 7: **Delivery Milestone**. Qualitative model(s) to end users for priority areas identified through consultation (e.g. Glomar Shoals KEF) to inform ecosystem understanding of priority KEFs in the North and NW | 30 April 2017 | Completed  Model provided to DoEE marine policy (Amelia Tandy). |
| Milestone 8: **Delivery Milestone**. Input to Draft report from the National Prioritisation Workshop to be delivered to DoEE for comment | 30 June 2017 | Completed |
| Milestone 9: **Activity Milestone**  Project meeting to review datasets available for data synthesis/analysis in selected CMRs | 1 July 2017 | Completed |
| Milestone 10: **Delivery Milestone**. Delivery of Final Report from the National Prioritisation Workshop | 30 August 2017 | Completed  Report available at  [www.nespmarine.edu.au](http://www.nespmarine.edu.au) |
| Milestone 11: **Delivery Milestone**. New maps and information based on existing data and knowledge for selected AMPs (Kimberley, Gascoyne and one other based on NPW) available through web portal. | 1 November 2017 | progressing |
| Milestone 12 – **Delivery Milestone**. National data layers for physical, biological and oceanographic data available through web portal for all AMPs | 1 December 2017 | Online accessibility delayed pending launch of MPA Science Atlas |
| Milestone 13: **Delivery Milestone**. Draft report on ecologically important features of selected AMPs (e.g. Perth Canyon, Geographe Bay, Gifford Seamount) submitted to DoEE for comment | 1 January 2018 | progressing |
| Milestone 14: **Delivery Milestone**. Final report on ecologically important features of selected AMPs (e.g. Perth Canyon, Geographe Bay, Gifford Seamount) | 30 April 2018 |  |
| Milestone 15: **Delivery Milestone**. New maps and information (e.g. geomorphic maps, habitat maps, species distribution maps, sea surface properties) based on existing data and new knowledge for selected AMPs available through Marine Parks Science Atlas. | 1 November 2018 |  |
| Milestone 16: **Delivery Milestone**. Draft report on ecologically important features of selected AMPs e.g. Kimberley, Bremer, Huon, Mermaid and/or Ashmore submitted to DoEE for comment | 1 December 2018 |  |
| Milestone 17: **Delivery Milestone**. Final report on ecologically important features of selected AMPs e.g. Kimberley, Bremer, Huon, Mermaid and/or Ashmore | 24 December 2018 |  |
| Milestone 18: **Delivery Milestone**. All project datasets made accessible to the public (see section on Data and Information management) | 31 December 2018 |  |

# Data Management and Accessibility

All project outputs (including data) will be made publically available in accordance with the NESP Data Management and Accessibility Guidelines. To facilitate a consistent standards based approach, the Hub has produced a [Data Management Framework](https://www.nespmarine.edu.au/system/files/MBH%20Data%20Management%20Framework%20v1.2%20-%2005Dec16_AO.pdf). The framework provides project leaders with clear directions on publishing metadata, storing data and satisfying requirements for open access to journal articles.

|  |  |
| --- | --- |
| **Project output** | **Data Management and Accessibility** |
| Spatial data layers describing benthic and pelagic ecosystems incorporating existing samples, observations and measurements. | Data and information will be managed in accordance with the data management framework for NESP Marine Biodiversity Hub. Species distribution datasets will be stored in a long-term secure storage, metadata will be created to meet the Marine Community Profile for metadata and published on the Australian Ocean Data Network Portal <http://portal.aodn.org.au/aodn/> . Species distribution datasets will be provided to ERIN and DoEE. |
| Publications, reports, factsheets, maps and images | Will be made publically and freely accessible and available on the Hub website <http://www.nespmarine.edu.au>. Web services interface will also be delivered through the Northwest Atlas <http://northwestatlas.org> and/or the Australian Marine Parks Science Atlas with spatial data layers and model outputs. The project will adhere to the NESP requirement that all journal publications be made publicly and freely available within 12 months of publication. All peer-research papers will be made available to the public through open access via the Hub’s website (in accordance with the NESP Data Management and Accessibility Guidelines). |

Location of Research

In 2018, collation and synthesis will become national in scope but with a continued focus on Marine Parks prioritised through Stakeholder consultations and the National Prioritisation Workshop held in 2017, and include marine parks from the Temperate East, South-east, North-west and South-west and North-west networks. Marine parks for detailed synthesis studies will include Kimberley, Bremer, Huon, Mermaid and/or Ashmore. Work will continue on focal studies of selected Marine Parks to directly address the outcomes from workshops held through 2015, 2016 & 2017, where high quality datasets can support the development of synthesis and visualisation products.

Project Specific Risks

| **Risk to project** | **Potential impact on project** | **Risk rating (low, medium high, severe)** | **How will risk be managed?** | **Who is responsible for managing risk?** |
| --- | --- | --- | --- | --- |
| 1. Project is potentially constrained by timely access to staff resources from the partners | Moderate – may require some alteration to milestone delivery dates | low | can be minimised through careful project management and setting of achievable objectives. | Project leader and project team |
| 1. Ineffective supervision and coordination of partner efforts affecting the development of synthesis outputs | Moderate – may require some alteration to milestone delivery dates | low | can be minimised through careful planning and regular communications with collaborators. | Project leader and project team |
| 1. Lack of effective engagement by research users, in particular a lack of clarity of user needs, preferences and use-case scenarios | High – may lead to irrelevance of project outputs | low | can be minimised by holding semi-regular catch ups with key end-users | Project leader |
| 1. Loss of key researchers from the project team | Moderate – may require some alteration to milestone delivery dates | low | effects could be minimised through additional collaborations or the timely replacement of key staff if needed | Project leader |

Project Keywords

Ecosystems processes, marine assets, marine environmental baselines, Australian Marine Parks, Key Ecological Features

Project contacts

Researchers and Staff

| **Name** | **Organisation** | **Project Role** | **FTE 2018** |
| --- | --- | --- | --- |
| Karen Miller | AIMS | Project leader, benthic ecologist | 0.2 |
| Ben Radford | AIMS | Ecological modeller | 0.1 |
| Marji Puotinen | AIMS | Spatial scientist | 0.3 |
| Claire Butler | AIMS | Ecologist | 0.25 |
| Ronan Galaiduk | AIMS | Ecological modeller | 0.2 |
| Scott Nichol | GA | Sedimentologist / link to D3 | 0.1 |
| Zhi Huang | GA | Spatial analyst/habitat modelling | 0.25 |
| Kim Picard | GA | Geoscientist/habitat mapping | 0.05 |
| Rachel Przeslawski | GA | Marine Ecologist/habitat mapping | 0.05 |
| Rachel Nanson | GA | Geomorphologist/habitat mapping | 0.25 |
| Alan Williams TBC | CSIRO | Fish ecologist | 0.1 |
| Dave Watts TBC | CSIRO | Data scientist | 0.1 |
| Vanessa Lucieer | UTas | Spatial scientist | 0.1 |
| Tim Langlois | UWA | Fish Ecologist | 0.1 |
| Gary Kendrick | UWA | Ecologist | 0.05 |

Data Management

| Name | Organisation | Email | Phone |
| --- | --- | --- | --- |
| Marji Puotinen | AIMS | [m.puotinen@aims.gov.au](mailto:m.puotinen@aims.gov.au) | 08 6369 4046 |
| Zhi Huang | GA | [zhi.huang@ga.gov.au](mailto:zhi.huang@ga.gov.au) | 02 62495876 |

Co-contributors

| Name | Organisation/ | Contribution |
| --- | --- | --- |
| TBA | IMOS | In-kind: data contribution |

Key Partners **and** Research End Users

| **Key Partners (organisation/program)** | **Name/s** | Email (optional) |
| --- | --- | --- |
| DoEE Parks Australia | Jason Mundy  John Lloyd  Amanda Richley  Cath Samson  Bianca Priest  Samantha Fox |  |

| Research Users (program/section/branch/organisation) | Name/s | Email (optional) |
| --- | --- | --- |
| DoEE/Parks Australia | Amanda Richley  Allyn White  Scott Francis |  |
| DoEE –Marine Policy | Amelia Tandy  Jillian Grayson |  |
| DOEE SoE reporting. | Boon Lim |  |
| Dept Agriculture and Water Resources | Emma Lowe |  |
| NOPSEMA (secondary beneficiary) | Christine Lamont  Cameron Sim |  |

## Project D2 – Standard Operating Procedures (SOPs) for survey design, condition assessment and trend detection

*Project length*: 4 years

*Project start date*: 01/07/2015

*Project end date*: 15/01/2019

*Project current status*: Submitted for re-approval

*Project Leader*: Scott Foster (2018 FTE – 22%) and Rachel Przeslawski (2018 FTE – 22%)

*Lead research organisation*: Geoscience Australia, CSIRO

*Project leader contact details:* [scott.foster@csiro.au](mailto:scott.foster@csiro.au), 03-6232 5178, [rachel.przeslawski@ga.gov.au](mailto:rachel.przeslawski@ga.gov.au) 02 6249 9101

# Project Funding and Expenditure

Project funding table

|  | *2015* | *2016* | *2017* | *2018* | *2019* | *2020* | *2021* | ***TOTAL*** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *NESP funding* | 100,000 | 111,700 | $226,521 | Geoscience Australia $63,500  CSIRO $63,880  University of Tasmania$13,000 | x | x | x | 578,601 |
| *Cash co-con* | x | x | x | x | x | x | x | x |
| *In-kind co-con* | 100,000 | 111,700 | $226,521 | Geoscience Australia $63,500  CSIRO $63,880  University of Tasmania$13,000 | x | x | x | 578,601 |
| ***TOTAL*** | $200,000 | $223,400 | $453,042 | $280,760 | **x** | **x** | **x** | **1,157,202** |
| ***Breakdown*** | X | X | X | Research $182,494  Admin $28,076  Comms $70,190 |  |  |  |  |

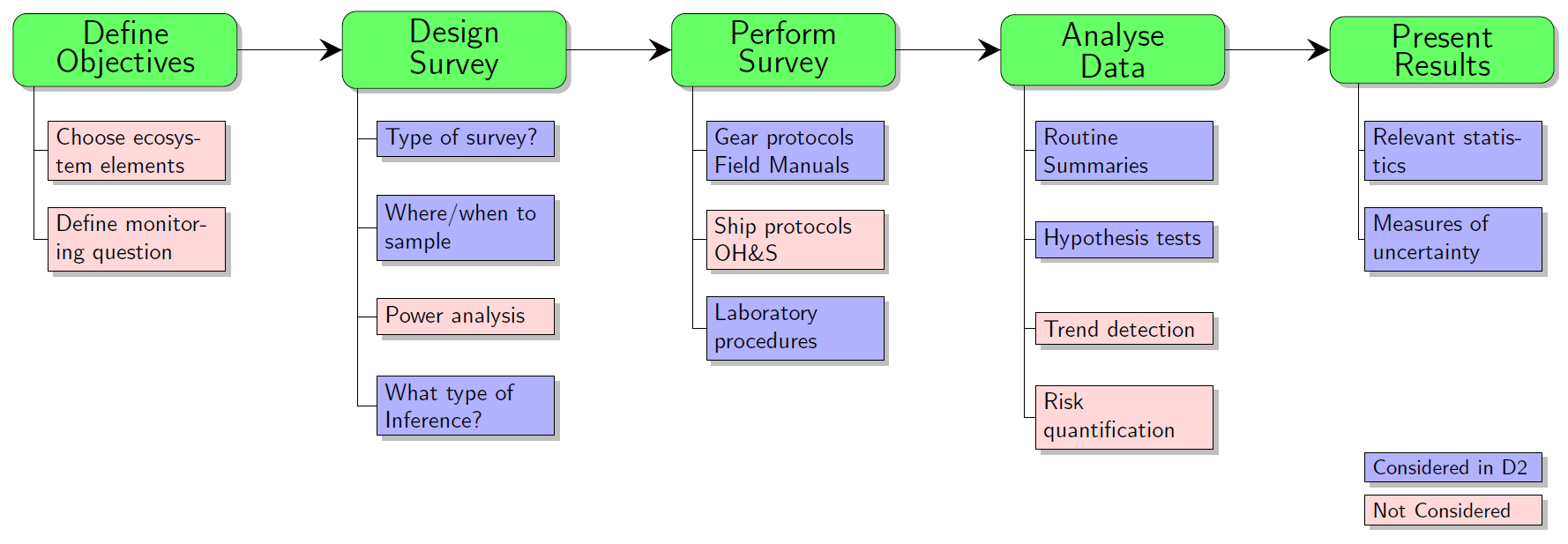
Expenditure statement

Funding will be used primarily to pay for participating researchers’ salary, including 0.1FTE of a post-doc salary (Monk). Remaining funds (~0.7 FTE salary) will be used for travel and administration costs associated with data discoverability and accessibility workshop and field manual promotion.

# Project Description

Project Summary

Understanding the status and trends of indicators in Australia’s marine environment requires standardised monitoring. This project aims to provide foundations for Standard Operating Procedures (SOPs) in the planning, collection, analysis, and reporting of monitoring data. In 2018 Project D2 will focus on the crucial aspects of adoption and implementation of protocols already developed in the project in 2015-2017 (see Figure 1). Without this extension the protocols run a risk of being ignored. In addition, there remain several issues related to sampling design and data discovery and accessibility to be explored and addressed.



*Figure 1: Survey pipeline for marine monitoring.*

Project Description

Reporting on the status and trends of environmental resources requires cost effective monitoring. In an area as large as the Commonwealth Marine Area, it is undesirable and unrealistic to expect monitoring activities to be conducted by any one single agency or organisation. It is important that when different organisations collect data to serve the same, or comparable, objectives that data are collected, analysed and reported in a consistent manner. Inconsistent survey design, data collection and analysis impedes analysis of status and trend detection. When data cannot be collected using the same methods, a comparative assessment of the method’s efficacy (including catchability etc.) relative to other methods must be made.

Theme 1 of the NERP Marine Biodiversity Hub demonstrated and implemented a standard approach to survey design. At the end of Hub, two things were clear: 1) designing a monitoring effort is technically demanding and requires highly specialised skills, and 2) the analysis of the resulting data is non-trivial because of the large variety of sampling tools, data scoring methods and analysis methodologies. This project will build on the lessons learnt in NERP Theme 1, and will demonstrate how to implement the essential monitoring functions listed in the Integrated Monitoring Framework (IMF) developed in the Theme for both benthic and pelagic habitats. The IMF was written for the Great Barrier Reef but the monitoring functions it lists are generic, and based on the procedures developed and implemented by the United State National Parks Service.

The overarching aim of this project is to develop Standard Operating Procedures in the collection and analysis of monitoring data to maximise the number of consistent and collatable datasets among time and space. This will be done through desk-top analyses of techniques that, if implemented correctly, will deliver consistent and reliable, nationally-consistent sources of information to inform management in making decisions affecting: 1) Status (of Australian Marine Parks, State Marine Reserves, and off reserve areas); 2) effect of pressures on environmental status; and 3) effectiveness of management interventions.

It is expected that this project will inform decision-making and on-ground action by:

1. Contributing to an improved information flow from survey through to management decision for the task of managing benthic and pelagic communities;
2. Facilitating stronger and more general inferences about ecological processes to further scientific understanding. This will be achieved by providing consistent sampling methodology (including statistical design) that will allow direct comparisons in space and time;
3. Aiding the cost-effective sampling of Australia’s EEZ (including Australian Marine Parks) – even when that sampling is performed by different institutions at different times. Software to aid cost-effective sampling will be developed and made available.
4. Providing a reference point for regulatory and management agencies with a requirement to monitor the trend and status of communities and individual species.

The project is limited to SOPs related to monitoring objectives drawn from the progress made, and outcomes of, Theme 1 and Theme 2 of the NERP Biodiversity Hub. It does not include a complete set of field manuals for all possible gear types, nor does it include a “rosetta stone” that quantifies the relationships between different sampling platforms in different environments.

**Changes for 2018:**

The project extension into 2018 will follow three lines of activities:

* First, and arguably most importantly, we will work to ensure the uptake of the methods already developed in this project, including an experimental design tool and field manuals. SOPs will be actively promoted for uptake and incorporation into existing and future monitoring activities in Commonwealth waters, as well as other related activities (state monitoring, baseline data acquisition). This will be done by describing the field manual package to potential users and detailing the national benefit of the SOPs to provide a common-good resource useful for marine monitoring, as well as a range of other scientific research that requires collatable and comparable datasets (e.g. SOP for baited underwater video can help assess impacts of recreational fishing at broad scales). The most direct way of encouraging uptake will be to continue to engage with researchers, groups and institutions with face-to-face and teleconference meetings. Continuation of these meetings will be with data commissioners (e.g. Parks Australia), data collectors (e.g. Integrated Marine Observing System (IMOS), state government, industry), data managers (e.g. Australian Open Data Network (AODN)) and data users (e.g. National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), plus all above). This process is ongoing, with targeted emails and discussions with key stakeholders (e.g. Amanda Parr from Parks Australia, Christine Lamont from NOPSEMA, and Roger Proctor). We will also use emails, newsletter articles, and the network of collaborators that we established in 2017 and prior. The previous production of field manuals (a collaborative process) will also aid researchers (within and without of the hub) to be aware of the manuals and even to feel a sense of ownership. These interactions will have the dual purpose of soliciting feedback for the revised v.2 field manuals (point 3 below). We will also encourage the use of SOPs (field manuals and sampling designs) for upcoming projects. Currently we are in discussions with the industry funded “North West Shoals to Shore” project. In addition, we will investigate the feasibility of developing an oversight committee responsible for ensuring institutional uptake of SOPs, rather than simply personal uptake. This committee may be a standalone group or part of the existing National Marine Baselines group of the National Marine Science Committee (NMSC).
* Second, we will improve the continuity of SOPs from data acquisition through to data release. We will do this by undertaking discrete tasks that leverage off existing D2 and external research initiatives. These tasks include:
  1. Improving data accessibility and discoverability by establishing data release workflows for researchers and end-users. This will be done in collaboration with AODN, IMOS, museums, and end-users. Initial discussions with AODN about this task are already complete;
  2. Providing robust and powerful statistical designs for more types of sampling platforms. Such designs were developed for point location sampling platforms (e.g. BRUVs and grabs) in the first years of project D2. These will be extended to transect-based platforms (e.g. AUV, towed video, sled, trawl). Thus, all point and transect methods will benefit from robust and powerful designs. The methods needed for this extension will be added to the project’s previously developed software.
  3. Assessing satellite imagery visualisation platforms as monitoring tools in Commonwealth waters. This will value-add off an existing government-funded program (Digital Earth Australia), which is independently developing its capability in the marine environment and has the potential be a significant source of data for marine researchers. The NESP contribution will provide an end-user perspective and ensure that the technical expansion of the platform currently underway incorporates marine monitoring needs. Initial discussions with Geoscience Australia and AODN about this task have already been completed with the aim of developing a collaborative approach to this task.
* Third, field manuals will be updated to include protocols for data accessibility (point 2a above), as well us any other revisions based on solicited feedback from the first version (point 1 above). As part of this, we will also scope the need for new field manuals (e.g. ROVs, plastics analysis) as informed by the comparative benthic and pelagic assessments to be completed at the end of 2017 and the development of a marine plastics project in Theme E. We will also develop a protocol for future updates of SOPs and scope a potential long-term repository for the field manuals (e.g. AODN). The development of update protocols will seek advice from the oversight committee to provide recommendations and buy-in, especially at the institutional level. However, if researcher and/or institutional buy-in is garnered, then these groups are likely to want to maintain the manuals themselves. Updating will further cement the field manuals as a highly collaborative product by incorporating suggestions received after version 1 release. It will also provide a case study for the first updates of the field manual, including version control and long-term management outside of NESP.

NESP 2017 Research Priority Alignment

This project aligns to two Department of the Environment and Energy research priorities that together seek to maximise the efficacy of managing Australia’s marine environment and call for an improved understanding of that environment, specifically:

* Determine and trial practical and repeatable methods for monitoring the status and trends of key coastal and marine species and environments to underpin management of Australian Marine Parks.
* Improve our knowledge of key marine species and ecosystems to underpin their better management and protection

Any successful standard operating procedure requires 'buy-in' from stakeholders and end-users. To this end, the project will actively engage key scientists and managers throughout all types of organisations. This will be done through individual discussions, conference presentations, workshops and publications.

The project also addresses one of the eight priorities identified in the National Marine Science Plan 2015-2025:

* Establish and support and National Marine Environmental Baselines and Long-Term Monitoring Program, to develop a comprehensive assessment of Australia’s EEZ, and form the basis for management of Australian Marine Parks and State Marine Reserve networks

The Marine Biodiversity Hub will work with the National Marine Science Committee to contribute our findings to meeting this priority. A member of IMOS staff will be involved in this project to provide links to the national marine observation infrastructure and researchers.

Pathway to Impact

|  |
| --- |
| **Outcomes** |
| The overarching outcome of this project is a set of the base tools required to sample the marine environment (e.g. via surveys or monitoring) in a nationally consistent way. The project will also encourage the use of the developed tools (SOPs) and communicate the benefits of nationally-consistent data collection, which allows scaffolding of information between surveys (in space and time).  In order to assess the success of achieving this outcome, we will document surveys in which our SOPs are use, assessing who has used them and what they were used for. We will do this by including clear citation instructions for field manuals and R scripts in each of these products. We will also use our existing and extensive network of D2 working group members to inform us of upcoming surveys in which our SOPs are included. Finally, we will open an online questionnaire for survey leaders and participants to document their use (or non-use) of the SOPs, as well as provide suggestions for version 2 field manual package. This will be included in Milestone 20 (executive summary of the entire project).  Engagement and communication for this project will be planned and implemented consistent with the [Hub’s Knowledge Brokering and Communication Strategy](https://www.nespmarine.edu.au/system/files/Knowledge%20Brokering%20and%20Communictions%20Strategy%20version%201.1%20.pdf). |

| **Research-user** | **Engagement and communication** | **Impact on management action** | **Outputs** |
| --- | --- | --- | --- |
| DoEE  John Lloyd (Parks Australia), Emma Hyland (Essential Environmental Measures), Dale Roberts (Environmental Standards Division) | Previous meetings have yielded a draft list of important ecological indicators and regions and habitats of interest. In combination with the recently released draft management plans for marine parks, these have informed proposed changes to 2018. Such meetings will continue to be held (as well as informal and regular email correspondence with Amanda Parr, Cath Samson etc) to guide the project. | Outputs of the project, once adopted by researchers and recommended by research funders, will provide a consistent methodology to implement the marine plans at a national scale in a cost-effective manner. This aids compatibility between surveys at different times, in different areas and performed by different staff.  A national set of SOPs for marine sampling will be useful to inform the review of the SE marine region over the next few years by facilitating nationally comparable datasets. | * Field manual package v 1 (milestone 17,18) and v 2 (milestone 31) * Stakeholder engagement meetings to promote results (milestone 23) * Promotional material (milestone 22) * A worked example from a partner project using SOPs (Project D3). |
| Industry & regulator  Christine Lamont (National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)), Andrew Taylor (Australian Petroleum Production and Exploration Association (APPEA)), consultants (TBC) | NOPSEMA has been engaged casually throughout D2 and to identify research priorities, as well as to share their knowledge of industry. Efforts have been made to engage APPEA, but there has been little response or interest. We will ramp up engagement with APPEA in 2018 through our existing NOPSEMA and private consultant contacts, but if that continues to fizzle, we’ll engage directly with individual industry representatives. | Contribute to an improved information flow for industry surveys through to regulator’s approval of environmental plans. | * Field manual package (v 2) incorporating solicited feedback from stakeholders and new protocols (e.g. data accessibility) (milestone 31). * Stakeholder engagement meetings to promote results (milestone 23) * Promotional material (milestone 22) * Workshop on data discoverability and accessibility (milestone 27) |
| Integrated Marine Observing System (IMOS) / Australian Ocean Data Network (AODN)  Tim Moltmann (IMOS), Roger Procter (AODN) | IMOS (Ana Lara Lopez) and AODN (Roger Procter, Seb Mancini) have been involved in D2, particularly regarding data discoverability and accessibility issues with marine imagery and biological data. Their input has been incorporated into proposed D2 changes for 2018 (e.g. workshop on data release) | Continued integration of IMOS, AODN, and NESP activities with resulting products from AODN and IMOS (e.g. meta-data entry tool, squidle+) and SOPs from NESP (e.g. data release protocols) appropriately cross-pollinating. | * Workshop on data discoverability and accessibility (milestone 27) * Field manual package v 1 (milestone 17,18) and v 2 (milestone 31) * A worked example from a partner project using SOPs (Project D3). * Stakeholder engagement meetings to promote results (milestone 23) * Scoping report on satellite imagery platforms for monitoring Commonwealth waters (milestone 28) |
| Australian Government Monitoring  Fergus Molloy (Great Barrier Reef Marine Park Authority (GBRMPA)) | More concerted efforts to engage GBRMPA via promotional meetings will be made in 2018 via promotional meetings and the field manual update. | The best case is the incorporation of SOPs into the GBR monitoring programmes (but not at the expense of “breaking” time-series. Another good pathway to success is collaboration with GBR researchers in the development of field manuals. | * Field manual package v 1 (milestone 17,18) and v 2 (milestone 31) * Stakeholder engagement meetings to promote results (milestone 23) * Scoping report on satellite imagery platforms for monitoring Commonwealth waters (milestone 28) |
| State Monitoring  Stefan Howe (Vic), Alan Jordan (NSW), Maria Zann (QLD), Tim Ward (SA), Tom Holmes (WA), TBC (TAS, NT) | All named state representatives are part of D2 working groups and contributors to the field manual package – they will continue to be engaged in 2018. More concerted efforts to identify and engage TAS and NT state monitoring representatives will be made in 2018 via promotional meetings and the field manual update. | The best case is the incorporation of D2’s SOPs into state monitoring programs, although we expect some modification may be needed for region-specific issues (e.g. turbidity in many inshore NT waters precludes useful imagery collection) | * Field manual package v 1 (milestone 17,18) and v 2 (milestone 31) * Stakeholder engagement meetings to promote results (milestone 23) |
| **Additional outputs**  Two outputs (extension of software to transect-based spatially balanced designs, comparative assessments) will aid stronger and more general inferences about ecological process to further scientific understanding. This will be of use to a broad range of end-users, including marine researchers, environmental managers (both state and commonwealth), regulators, and industry. | | | |

### Indigenous Consultation and Engagement

Indigenous consultation and engagement for this project will be undertaken in a manner that is consistent with the [Hub’s Indigenous and Participation Strategy](https://www.nespmarine.edu.au/document/indigenous-engagement-and-participation-strategy). This project is considered a category three project for Indigenous engagement. This means the knowledge generated in this project will be effectively shared and communicated between relevant Indigenous peoples, communities and organisations.

The team will leverage off Hub initiatives to ensure generated knowledge, data and results are effectively shared and communicated between Indigenous peoples, communities and organisations. This will include communication to the Hub Research-user Committee and Steering Committee, the FRDC Indigenous Reference Group and the DoEE Indigenous Advisory Group.

Contact person for Indigenous engagement:

Name: Rachel Przeslawski

Email Address: Rachel.Przeslawski@ga.gov.au

Phone Number: 02 6249 9101

### Project Milestones

| **Milestones** | **Due date** | **Milestone Status** |
| --- | --- | --- |
| Milestone 1: Identification of “no regrets” objectives to partners, and with partners, for finalisation and scene setting. | Due 1 October 2015 | Complete |
| Milestone 2: Prototype R-package for Spatial Survey Design to partners for trial use. | Due 15 January 2016 | Complete |
| Milestone 3: All end-users and stake-holders have been engaged and understand project and how it relates to their interests. | Due 15 January 2016 | Complete |
| Milestone 4: Initial draft manuscript regarding a description of monitoring for evidence-based management to end-users for input, feedback and discussion. | Due 30 June 2016 | Delayed |
| Milestone 5: Initial draft manuscript regarding spatial survey design (describing methods in the R-package) to end-users for input, feedback and discussion. This is expected to be a technical document, but the Abstract and Introduction will be assessable to all interested in monitoring. | Due 15 September 2016 | Complete |
| Milestone 6: Identification of analysis methods for status estimation and trend detection. Developed in collaboration with partners and for agreement to enable further forward movement. | Due 15 December 2016 | Complete |
| Milestone 10: **(Change 2017)**  Meeting to determine what survey platforms to target for field manuals. Partner presence required. D3 input mandatory. Activity milestone | Due 15 March 2017 | Complete |
| Milestone 11: **(Change 2017)**  Scoping report - Proposal and scoping for comparative assessment of benthic observation platforms, including remote sensing data. Output milestone. | Due 15 July 2017 | Complete |
| Milestone 12: **(Change 2017)**  Scoping report - Proposal and scoping for comparative assessment of pelagic survey platforms. Requires collaboration with IMOS. Output milestone. | Due 15 March 2017 | Complete |
| Milestone 13: **(Change 2017)**  A report describing a comparative, critical and quantitative assessment (where possible) of pelagic survey platforms. Output milestone. | Due 15 May 2017 | Delayed, merged with milestone 15 |
| Milestone 14: **(Change 2017)**  Knowledge brokering plan document. How partners and stakeholders going to get the outputs and how do we garner ‘buy-in’? Output milestone. | Due 15 May 2017 | Delayed, revised date very early 2018 |
| Milestone 15: **(Change 2017)**  A draft manuscript (or report) on the quantitative comparison of biogeographic analyses based on the different pelagic survey platforms. Use of existing data. Output milestone. | Due 15 Oct 2017 | Delayed |
| Milestone 7: Preliminary worked R-scripts (and R package for design *and* analysis) to act as a pattern for future researchers. Delivered to partners and all associates for comment in input. Activity milestone. | Due 15 October 2017 | On track |
| Milestone 8: Final R scripts and package to the end-users for use in future surveys. Output milestone. | Due 15 December 2017 | On track |
| Milestone 9: All project outputs and data will be made publically and freely accessible and available on the internet (see section on Data and Information Management. | Due 15 December 2018  (Change 2018 from 15 December 2017) | Change of due date proposed |
| Milestone 16: **(Change 2017)**  A report describing a comparative assessment roadmap and report on different benthic platforms completed. Output milestone. | Due 15 December 2017 | On track |
| Milestone 17: **(Change 2017)**  Finalised field manuals for selected benthic survey platforms. Output milestone. | Due 15 December 2017 | On track |
| Milestone 18: **(Change 2017)**  Finalised field manuals for selected pelagic survey platforms. Output milestone. | Due 15 December 2017 | On track |
| Milestone 19: **(Change 2017)**  Repository for SOPs created on Hub webpage and populated with design protocols and field manuals. Output milestone. | Due 15 March 2017  (Change 2018 from 15 December 2017) | Change of due date proposed |
| Milestone 20 **(Change 2018)**  Executive summary, in non-technical language, describing the progress made by the project. | Due 15 December 2018  (Change 2018 from 15 December 2017) | Change of due date proposed |
| Milestone 21 (**Change 2018**) prototype R-package implementing spatially balanced transect designs – extension of milestone 2. | Due 31 May 2018 | Proposed |
| Milestone 22 (**Change 2018**) Promotional brochure or draft manuscript to describe field manual package and other SOPs | Due 31 May 2018 | Proposed |
| Milestone 23 (**Change 2018**) Meetings in Hobart (Integrated Marine Observing System (IMOS), Parks Australia, Australian Antarctic Division), Canberra (Department of the Environment and Energy etc), Perth (Australian Petroleum Production and Exploration Australia (APPEA), National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), Indian Ocean Marine Research Centre (IOMRC), and teleconferences with state government reps to promote SOPs | Due 31 May 2018 | Proposed |
| Milestone 24 **(Change 2018)**  Documentation of the ongoing support needed for maintenance of SOPs, particularly field manuals (e.g. scoping report, establishment of oversight committee) | Due 30 June 2018 | Proposed |
| Milestone 25 (**Change 2018**) Workshop to discuss data accessibility and discoverability SOPs as related to version 2 field manuals | Due 31 July 2018 | Proposed |
| Milestone 26 (**Change 2018**) Draft manuscript describing the methods used to implement spatially-balanced transect designs. | Due 31 Aug 2018 | Proposed |
| Milestone 27 (**Change 2018**) Workshop report on data discoverability and accessibility (Milestone 24) | Due 31 October 2018 | Proposed |
| Milestone 28 (**Change 2018**) Scoping report on potential applications of satellite imagery (e.g. Digital Earth Australia) to marine monitoring of Commonwealth waters, including limitations and technical progress required | Due 31 October 2018 | Proposed |
| Milestone 29 (**Change 2018, joint milestone with project E3)**  Scoping report on SOP for marine plastics analysis (i.e. new field manual needed or integrate into existing ones via version 2?) | Due 16 Nov 2018 | Proposed |
| Milestone 30 (**Change 2018**) Worked examples of using the design software for transects. | Due 16 Nov 2018 | Proposed |
| Milestone 31 (**Change 2018**) Revised field manuals (i.e. version 2) completed incorporating revisions received during 2018 and outcomes from Milestone 24 | Due 15 Dec 2018 | Proposed |

# Data Management and Accessibility

All project outputs (including data) will be made publically available in accordance with the NESP Data Management and Accessibility Guidelines. To facilitate a consistent standards based approach, the Hub has produced a [Data Management Framework](https://www.nespmarine.edu.au/system/files/MBH%20Data%20Management%20Framework%20v1.2%20-%2005Dec16_AO.pdf). The framework provides project leaders with clear directions on publishing metadata, storing data and satisfying requirements for open access to journal articles.

This project will collate information to produce a standard operating procedure and develop a software package (see milestones). Information and data will be managed in accordance with the data management framework for NESP Marine Biodiversity Hub. In particular, this project will produce a field manual package, to be released on the hub’s website ([http://www.nespmarine.edu.au](http://www.nespmarine.edu.au/)), and a software package, to be released on a static online, open source software repository. Any additional reports and products will be made available through the hub’s website.

Publications, reports, factsheets, maps and images will be made publically and freely accessible and available on the Hubs website [http://www.nespmarine.edu.au](http://www.nespmarine.edu.au/). All peer-research papers will be made available to the public through open access via the Hub’s website (in accordance with the NESP Data Management and Accessibility Guidelines).

|  |  |
| --- | --- |
| **Project output** | **Data Management and Accessibility** |
| R scripts | *Available R repository, static product* |
| Field Manuals | *Available via Hub website, new versions uploaded as needed abiding by version control protocols to be completed in Dec 2017* |
| Scientific manuscripts | *Available via journal’s open access, static product* |
| Reports | *Available via Hub website, static product* |

Location of Research

Research impact is national. This study will be conducted on the computers of researchers in Canberra, Melbourne, and Hobart. On ground work will be conducted through associated NESP projects.

Project Specific Risks

| **Risk to project** | **Potential impact on project** | **Risk rating (low, medium high, severe)** | **How will risk be managed?** | **Who is responsible for managing risk?** |
| --- | --- | --- | --- | --- |
| 1. Department will not agree on a limited set of “no regrets” objectives | Project not relevant to Department | Low | Continued engagement with the Department of the Environment and Energy at various levels to identify their needs regarding marine monitoring, as well as to share project progress. In addition, state and international monitoring programs will be investigated to draw upon as needed and to appropriately place Australia’s monitoring objectives in an international context. | Project leaders |
| 1. Loss of key researchers from the hub (Foster, Hosack, Lawrence, Przeslawski, Monk) | Milestones unable to be completed | Low | Regular contact between all researchers to that all are aware of each other’s work and are able to take over or delegate to other appropriate staff as needed. | Project and Theme leaders |
| 1. Project outputs, particularly field manual package, will not be delivered on time | Field manual package release is delayed, stakeholder engagement including adoption may be negatively impacted | Low | Regular contact between all working groups and field manual collaborators, as well as between project leaders | Project leaders |
| 1. Failure to get partner and collaborator buy-in to develop, promote and use developed SOPs | Nationally collatable and comparable datasets limited or unavailable | Medium | A discrete milestone is proposed in 2018 to manage this risk (milestone 23) and work to ensure the uptake of the methods already developed in this project, including an experimental design tool and field manuals. We will do this using face-to-face meetings, emails, teleconferences, and promotional material. Several surveys currently proposed via NESP and MNF are including D2 SOPs. | Project leaders |

Project Keywords

Standard operating procedure, survey methods, analysis methods, core information, monitoring, field manuals, comparative assessment, inclusion of remote sensing

Project contacts

Researchers and Staff

| **Name** | **Organisation** | **Project Role** | **FTE** |
| --- | --- | --- | --- |
| Scott Foster | CSIRO | Project co-lead, Design & analysis | 0.22 |
| Rachel Przeslawski | Geoscience Australia | Project co-lead, Field ecologist | 0.22 |
| Emma Lawrence | CSIRO | Design and analysis | 0.05 |
| Geoff Hosack | CSIRO | Design and analysis | 0.05 |
| Alan Williams | CSIRO | Field ecologist | 0.05 |
| Zhi Huang | Geoscience Australia | Remote sensing | 0.05 |
| Andrew Carroll | Geoscience Australia | Field ecologist | 0.05 |
| Rachel Nanson | Geoscience Australia | Geologist | 0.05 |
| Kim Picard | Geoscience Australia | Seabed mapping | 0.05 |
| Claire Phillips | Geoscience Australia | Remote sensing | 0.05 |
| Jacquomo Monk | University of Tasmania | Quantitative and field ecologist | 0.10 |

Co-Contributors

| **Name** | **Organisation** | **Project Role** |
| --- | --- | --- |
| Neville Barrett, Vanessa Lucieer, Nicole Hill, | University of Tasmania | Contribute to field manuals |
| Renata Ferrari, Oscar Pizarro, Ariel Friedman | University of Sydney | Contribute to field manuals |
| Thomas Bridge | James Cook University | Contribute to field manuals |
| Alan Jordan, Joel Williams | NSW Department of Primary Industries | Contribute to field manuals |
| Daniel Ierodiaconou | Deakin University | Contribute to field manuals |
| Stefan Howe | Parks Victoria | Contribute to field manuals |
| Gary Kendrick, Renae Hovey, Tim Langlois | University of Western Australia | Contribute to field manuals |
| Russ Babcock, Franzis Althaus, Dan Gledhill | CSIRO | Contribute to field manuals |
| Malcolm Clark | National Institute of Water and Atmospheric Research (NZ) | Contribute to field manuals |
| Jamie Colquhoun | Australian Institute for Marine Science | Contribute to field manuals |
| Tim O’Hara | Museums Victoria | Contribute to field manuals |

Data Management

| Name | Organisation | Email | Phone |
| --- | --- | --- | --- |
| Scott Foster | CSIRO |  |  |

Co-contributors

| Name | Organisation/ | Contribution |
| --- | --- | --- |
|  |  |  |

Key Partners **and** Research End Users

| **Key Partners (organisation/program)** | **Name/s** | Email (optional) |
| --- | --- | --- |
| Australian Institute for Marine Science (AIMS) | David Souter, Michelle Heupel |  |
| Geoscience Australia (GA) | Adam Lewis |  |
| CSIRO | David Smith |  |
| University of Tasmania | Craig Johnston |  |
| Integrated Marine Observing System (IMOS) | Tim Moltmann |  |
| Other (AUV) | Attendees as AUV workshop for national approach |  |
| Other (BRUV) | Attendees as recent BRUV workshop for national approach |  |
| Other (MBS) | Attendees as recent MBS workshop for national approach |  |
| Other | Includes state govt parks representatives: Stefan Howe (Vic Parks), Maria Zann (QLD), Alan Jordan (NSW), Tim Ward (SARDI), TBA (WA, TAS, NT) |  |

| Research Users (program/section/branch/organisation) | Name/s | Email (optional) |
| --- | --- | --- |
| Department of the Environment and Energy (DoEE, Wildlife, Heritage and Marine Division (marine policy) | Amelia Tandy |  |
| DoEE, Environmental Standards Division (assessments) | TBA |  |
| DoEE, Environmental Resources Information Network (incl. State of Environment Reporting, Essential Environmental Measures Program and Protected Places Section) | Jeanette Corbitt (SoE)  Emma Hyland (EEM)  Carolyn Armstrong (PP) |  |
| Parks Australia, Australian Marine Parks | John Lloyd  Amanda Parr |  |
| Great Barrier Reef Marine Park Authority (GBRMPA), Integrated Monitoring | Fergus Molloy |  |
| National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), Environmental Effects | Christine Lamont |  |
| Australian Petroleum Production and Exploration Association (APPEA), Health, Safety & Environment | Andrew Taylor |  |
| Integrated Marine Observing System (IMOS) / Australian Ocean Data Network (AODN) | Tim Moltmann |  |

## Project D3 – Implementing monitoring of AMPs and the status of marine biodiversity assets on the continental shelf

Project length – 54 Months

Project start date – 01/07/2015

Project end date – 31/12/2020

Project current status - Submitted for re-approval

Project Leader – Neville Barrett (FTE – 30%)

Lead Research Organisation – University of Tasmania

Project leader contact details: - [Neville.barrett@utas.edu.au](mailto:Neville.barrett@utas.edu.au), 03-62268210

# Project Funding and Expenditure

Project funding table

2020 is indicative at this stage due to unknown funding support for MNF bid and refinement of SW Corner proposal (to be further developed through workshop in 2018)

|  | *2015-2017* | *2018* | *2019* | *2020* | *2021* | ***TOTAL*** |
| --- | --- | --- | --- | --- | --- | --- |
| *NESP funding* | 2015  $388,000  2016  $533,000  2017  $575,000 | GA $158,000 (Beagle $120k and Gulf prep $38k)  UTAS (Beagle) $200,000  CSIRO (Seamounts) $50,000  NSW DPI (Hunter) $53,000  NSW OEH (Hunter) $53,000  AIMS Gulf prep $24,000  Beagle vessel support $120,000 | GA $275,000 (Beagle $55k and Gulf $220k)  UTAS $205,000 ($105,000 Beagle, $100,000 Hunter/)  CSIRO (Seamounts) $100,000  CSIRO (Ningaloo) $81,000  NSW DPI (Hunter) $53,000  NSW OEH (Hunter) $53,000  UWA Ningaloo $38,000  AIMS Gulf survey $476,000 (jncludes vessel costs)  Hunter survey Vessel support. $50,000 | *GA $369000*  *(Gulf) $104k*  *SW Corner $165k; MNF survey support Lord Howe AMP $100k)*  *UTas (Hunter/Eliz Middleton/SW Corner/Hub synthesis), $210k*  *CSIRO (Ningaloo) $154,000*  *AIMS (Gulf) $98k*  *UWA, SW Capes ($130k)*  *UWA, Ningaloo*  *$76,000*  *NSW DPI (Elizabeth/Middleton survey) $53K*  *NSW OEH (Elizabeth/Middleton survey) $53K*  *SW Capes vessel support $100k est* | *TBD* |  |
|  | **Total $1,496,000** | **Total**  **$658,000** | **Total**  **$1,331,000** | ***Total***  ***$1,243,000*** |  | ***$4,728,000*** |
| *Cash co-con* | *x* | *x* | *x* | *x* | *x* | *x* |
| *In-kind co-con* | 2015  $526,000  2016  $692,500  2017  $666,000  **Total $1,884,500** | GA $158,000  UTAS $200,000  CSIRO (S) $50,000  NSW OEH $53,000  NSW DPI $53,000  AIMS $24,000  **Total $538,000** | GA $275,000  UTAS $205,000  CSIRO (S) $100,000  CSIRO (N) $81,000  NSW OEH $53,000  NSW DPI $53,000  UWA $38,000  AIMS $476,000 (includes vessel costs)  **Total $1,281,000** | GA $369,000  UTAS $210,000  CSIRO (N) $154,000  NSW OEH $53,000  NSW DPI $53,000  UWA (SW) $130,000  UWA Ningaloo $76,000  AIMS $98,000 (includes vessel costs)  **Total $1,143,000** | *x* | *$4,846,500* |
| ***TOTAL*** | 3,380,500 | 1,196,000 | 2,612,0000 | 2,386,000 | TBD | ***9,574,500*** |

Expenditure statement

The bulk of expenditure is used to support salary for researchers engaged in D3 projects. For UTas, DPI NSW, and UWA these funds support postdoc positions and associated technical support. For GA and CSIRO these support co-funded positions of core staff and operational costs for surveys. For NSW OEH these funds support field surveys. Additional funds, as specified, support vessel charter for surveys, equipment maintenance and minor equipment purchases.

# Project Description

Project Summary

There is a significant need to support Parks Australia in the establishment of an inventory and monitoring program for AMP networks, and ensure it is integrated within broader national monitoring frameworks. This project initiates a series of surveys, utilising SOPs, to demonstrate a sustainable path for a national survey program. By facilitating national approaches, including a standards-based approach to collecting new marine data, project outcomes will include key steps to assist Parks Australia to implement and initiate an AMP monitoring program, new knowledge to inform AMP management, a national integrated framework for SOE reporting, and collaboration between State-based and Commonwealth-based programs.

Project Description

### Summary of changes since previous Research Plan

This updated plan includes a major revision of the project. Notably, the project description here is a high level description of the overall survey program proposed. It is complemented by a series of detailed survey plans that each specify the finer details of each intended survey, including partnerships, survey scope, methods, costings, outputs and outcomes. These are appendices 1-6 of this proposal and have currently been developed to a stage that they provide a clear outline of the research proposed, however, once funding is confirmed, each will be developed to a full plan in consultation with DoEE and other stakeholders. Initial stages of this project involved collation of existing data to both inform knowledge gaps, and making the data more readily available to end users. It also established underpinning data management infrastructure, linked with the development and refinement of SOPs, and facilitated discussions on national prioritisation of survey needs within AMPs. The collated information was then able to be used to inform future research priorities and the SOPs to be used during surveys, while the prioritisation process aided in selection of suitable AMPs to target for the initial phase of the survey program. This research plan sets out the forward plan to initiate and undertake surveys throughout 2018-2020, including location, approximate timing, staffing, resource requirements, methods proposed, and central objectives. It is the first step in a ten-year plan to more comprehensively survey AMP network in shelf waters, establish a template and effective baselines for future programs, and a pathway for collaboration with PA and DoEE more broadly in developing a core focus for the next iteration of the Marine Biodiversity Hub.

Problem

***There is a significant and time critical need to support Parks Australia in the establishment of a baseline inventory and monitoring program for AMP networks, as well as initiating the integrated long-term monitoring program identified as a key need and recommendation in the National Marine Science Plan 2015-2025 (NMSP). Currently such programs do not exist in Commonwealth waters, and the new AMP network provides an appropriate national, regional, and bioregional framework around which such programs could be developed****.*

Hence, the proposed AMP inventory and monitoring program ideally integrates with, and sits within, the broader requirement to monitor and report on the marine ecosystem health of the Commonwealth marine area, and is complementary to state marine environment monitoring programs. A national approach is required to understand priority information needs and identify opportunities for cost-effective, national-scale collaborations that foster a standards-based approach to collecting new marine data and information. This approach should encourage innovative approaches to data collection, including learning by doing.

While addressing this need is a large task, one initial prioritisation has been to focus effort into environments where anthropogenic pressures are typically greatest (the continental shelf), and further during the initial phase of this project/program, onto hard substrates (reefs) that usually have greater biodiversity levels than soft substrates.

Currently, significant gaps remain in our knowledge of the distribution of key biodiversity assets of the marine estate on the continental shelf, their condition, and the management actions required to ensure these assets are adequately protected. This is equally the case for AMPs and off-reserve locations and conservation values identified in Marine Bioregional Plans.

How Research Addresses Problem/will be undertaken

The project will work with DoEE, Hub partners, IMOS and the wider research community to undertake eight AMP surveys that will apply, test and refine a minimum set of national standard approaches to collecting and analysing data for baselines and monitoring biodiversity in Australia’s marine estate. The specific details of each survey are given in a complimentary set of survey plans to be read in conjunction with this project description (see Appendices 1-6). Survey plans are included for the following surveys: Ningaloo AMP, SW Corner AMP, Huon and Tasman Fracture AMPs (deep seamount surveys), Beagle AMP, Hunter AMP, and Gulf of Carpentaria AMP. These are planned to provide broad regional representation, encompass areas of greatest pressures (shelf waters), develop regional capability, and complement national programs. They were developed following an extensive consultation and prioritisation process with DoEE and broader stakeholders, including a major prioritisation workshop. Survey plans for the Lord Howe AMP (i.e. Elizabeth and Middleton reefs) will be completed after the Hub receives advice from the Marine National Facility on its proposed survey (expected late 2017).

The proposed research will have a primary focus on monitoring to inform management of the new AMP network and working with Parks Australia to facilitate implementation of a national AMP monitoring program. It will link these approaches to facilitate development of a broader, nationally integrated monitoring program, including strong partnerships with state-based programs, RIMREP (Reef 2050 Integrated Monitoring and Reporting Program) and IMOS, developing a community of research providers to meet future needs and provide an ongoing reporting framework for AMPs, SOE, national estate and state-based information needs, including informed EPBC decisions on environmental protection. While the project will not specifically develop or manage the national integrated monitoring program envisaged in the NMSP, it will continue to facilitate this through coordination of key components (AUV and BRUV benthic monitoring) at a national scale, as well as further development of matching databases and providing a forum for collaboration across agencies and jurisdictions.

Importantly, the project will continue to link with the SOP project (D2), bringing the expertise of the biological domain represented by project participants to assess the adequacy of current State agency, and MBH/partner approaches to marine reserve monitoring for meeting AMP and national marine estate baseline and monitoring needs. Surveys will report using standard indicators to inform the monitoring approach, and further refine a standard surveys database and reporting template. The project will link with project B1 to validate model-based predictions of species distributions in AMPs where appropriate. We will also work with DoEE and the marine science community to explore avenues for undertaking additional priority AMP surveys, including via potential DoEE co-funding.

Details of related prior research.

A significant amount of prior research has led up to this research proposal. This includes development of SOPs and experimental designs during CERF/NERP and NESP Hubs, assessing the capacity of predictive models to fill knowledge gaps in D1, refinement of SOPs and survey designs in D2, development of national monitoring networks in D3, collation of existing biological and mapping data and identification of major gaps (D1/D3) and a prioritisation framework for AMP surveys (D1/D3), including a national prioritisation workshop with DoEE, Hub partners and major stakeholders.

How the project links to other research and/or the work of other Hubs

As above, the project links strongly to projects D1 and D2, is informed by pressures data from Theme B, and will have links with Theme E in developing further understanding of pressures, including recreational fishing and cumulative pressures.

Summary of how it is expected that the research will be applied to inform decision-making and on-ground action.

As outlined above, the research is designed to be directly applied to decision making and on-ground action in many ways. These include decisions on how to best and cost-effectively undertake inventory and monitoring within the AMP network, and once surveys are undertaken, how to best manage the resources discovered within these. At an individual AMP level, this may include decisions and actions related to managing impacts to sensitive fauna/habitats, while at the broader level, the combined knowledge from AMP surveys and other integrated monitoring programs, may inform decisions on climate change adaptation, mitigation of the impacts of pest species, and region-wide, off-reserve management of habitats and species. A central premise of the AMP focus, however, is that the research will add to the information required for the longer-term evaluation of the effectiveness of AMP zoning arrangements, with an aim of achieving improved conservation outcomes if/where current zoning is not effective in ensuring planned outcomes are achieved.

NESP 2017 Research Priority Alignment

This project aligns to at least five DoEE research priorities that together seek to maximise the efficacy of managing Australia’s marine environment and call for an improved understanding of that environment. Specifically, the project will provide shelf reef information necessary to:

1. ***improve the management of marine biodiversity through an evaluation of the results of management interventions*** on shelf reefs;
2. (ii) ***develop and apply methods for monitoring the status and trends of key marine species*** associated with reef habitats,
3. (iii) ***build the knowledge base of key marine species and ecosystems*** associated with reefs in waters of the Australian continental shelf, particularly within AMPs,
4. (iv) ***identify pressures on the marine environment, and understand their impact, including cumulative impacts and climate change, to better target policy and management actions*** ,
5. (v) ***better understand issues that are common to the fishing industry and the environment including identifying solutions of mutual benefit*** and
6. (vi)***The role of citizen science in the management of marine biodiversity****.* The work in the Gulf of Carpentaria will include collaborations with Indigenous Sea Rangers (building on the existing AIMS Indigenous monitoring program) to facilitate monitoring in sea country within and adjacent to the AMP.

This project is also strongly aligned with recommendation 2 in the National Marine Science Plan - Establish and support a national marine baselines and long-term monitoring program, to develop a comprehensive assessment of our estate, and to help manage Commonwealth and State marine reserves.

Pathway to Impact

|  |
| --- |
| **Outcomes** |
| Many of the project outcomes can be measured against the NESP research priorities for the Marine Biodiversity Hub. |
| * *Develop and trial decision making tools that will support managers to define and prioritise management actions in Australian Marine Parks.* New knowledge within AMPs generated by proposed surveys, coupled with existing data generated by the projects D1 & D3, will provide a robust understanding of shelf reef systems (a Key Ecological Feature), their representation in the AMP network, the biological assets associated with them, and the types of threats that these systems may be facing. This information will be critical to evaluating the management actions within the AMP network necessary to adequately protect the ecological values of this KEF. **– Outcome- Management decisions supported through knowledge availability.** |
| * *Identify past and current pressures on the marine environment, and understand their impact, including cumulative impacts such as climate change to better target policy and management actions. For example, identify the impact of cetacean ship strike.* The results from the proposed surveys, coupled with existing data collated by the D3 & D1 project, will allow evaluation of AMP shelf reef associated biological assets against potential threats. While AMP focussed, this information, coupled with patterns detected from comparisons of impacted vs protected areas, will inform analysis of the extent of the impact of a range of pressures on the marine environment, and potential management responses if these pressures are suspected to have adverse consequences. **Outcome- basis to understand pressures and impacts.** |
| * *Determine the causes of, and relationships between, pressures on the marine and coastal environment to inform government investment.* As above, by contrasting information from AMP surveys and models with off-reserve surveys and models, we will be able to inform management of the various pressures on shelf reef systems in general, and highlight issues, or regions of particular concern, e.g. introduced species, climate change, ecological effects of fishing in marine and coastal waters. **Outcome - basis to understand interacting pressures.** |
| * *Determine and trial practical and repeatable methods for monitoring the status and trends of key coastal and marine species and environments to underpin management of Australian Marine Parks.* A core focus of this project will be to bring expertise developed in the CERF/NERP and NESP Marine Biodiversity Hubs, and by partner agencies, to this task with a focus on shelf systems. This expertise is well developed and advanced in its application to the task of informing AMP management, and the intention of the current survey-focussed project is to refine this expertise, apply it to as broad a range of AMPs as practicable utilise SOPs refined in D2, and to be able to use this more generally to monitor the status and trends in both on-reserve and off-reserve environments. In addition, we propose to do this within the prioritisation framework developed with DoEE during D3 that allows for a planned, stepwise approach to support Parks Australia to develop and implement their AMP baseline and monitoring program. Via the proposed national MPA scientific monitoring forum, we will ensure methods are consistent with state programs, and that their outputs fully align with management needs. **Outcome - methods trialled and evaluated in on-ground application.** |
| * *Better understand issues that are common to the fishing industry and the environment including identifying solutions of mutual benefit.* The fishing industry, the marine environment and protection of biodiversity are intrinsically linked. This project better defines the shelf reef KEF, and shelf soft-sediment habitats that are critical habitats for many of our fisheries. Threats that impact these habitats (e.g. introduced pests, ecosystem effects of fishing) are equally important to understand for both on-reserve and off-reserve management, hence, knowledge gained here will be critical for co-management of fishing and conservation issues in the marine environment. **Outcome - Knowledge for improved ecosystem-based fishery management.** |
| * *Improve our knowledge of key marine species and ecosystems to underpin their better management and protection.* Key Ecological Features underpin marine regional plans and AMPs, yet many of these are shelf-based and with little sampling to provide a knowledge base. A range of KEFS will be surveyed during the proposed survey program, providing the knowledge necessary for improved protection actions.**Outcome - Improved knowledge of key species and ecosystems in shelf waters in particular.** |
| All of the above outcomes are both practical and tangible and are readily benchmarked against the DoEE research priorities above. They will inform a wide range of management and policy actions, including effective management of AMP conservation values and assets through development of an understanding of the nature and extent of these, their status, and the threats to them that may be addressed by management measures. In addition to informing on-reserve management, the outcomes are equally informative to managing off-reserve conservation values and assets in Commonwealth and coastal waters, such as through Marine Bioregional Plans, and providing benefits to both conservation and fishery management. |
| The environmental value that the project brings is essentially the **significantly enhanced understanding of the shelf habitat features of Australia’s waters and their associated biodiversity necessary to effectively manage AMPs and other spatial closures that represent this habitat, to manage the Commonwealth's off-reserve assets in this space, and inform national approaches to ecosystem-based management of a range of Key Ecological Features.** |
| This project will provide a key part of the approach to address the national challenge of marine biodiversity conservation and ecosystem health identified in the National Marine Science Plan. Specifically it will provide a cornerstone to establish and support a National marine biodiversity baseline and long-term monitoring program to develop a comprehensive assessment of the marine estate, and to help managed Commonwealth and State marine reserves. |
| *Specific management or policy outcomes*  **The core outcome of this project will be to assist Parks Australia with the key steps towards implementation of a national AMP monitoring program via initiation of baseline surveys within a standard framework**. Establishing this program is a central component of Management plans in place for the SE AMP network, and is anticipated to be a central component to management plans for the remainder of the AMP network. Information from these surveys will be essential for refining management plans and objectives of the AMPs in the future as a fuller understanding of the bio-physical assets they contain is made available. Hence the knowledge gained will flow directly into on-ground actions, such as adaptive changes to management prescriptions necessary to protect AMP values. Collaborative networks established by the project, coupled with strategically located surveys, will provide the framework for an integrated national marine monitoring program that will contribute directly to management objectives of effective and meaningful SOE reporting, and implementation of key recommendations in the National Marine Science Plan. Effective SOE reporting can also flow into on-ground actions, including adaptive changes to human activities at local to national scales to protect SOE values. |
| **The knowledge gained via these surveys will also be integral to development of an AMP equivalent of the RIMREP process being developed by GBRMPA.** By developing and refining a set of SOPs with broad regional representation, an initial understanding of the nature of habitats and the species they support will be vital to effectively informing this process, Whether an equivalent RIMREP is developed by the Hub in collaboration with Parks Australia or the next Hub, the need for such a process was discussed at the 2017 Theme D workshop and identified as an important management/policy outcome to work towards. |
| *Highlight the environmental value of this project, if it will be measured and how*  The project and surveys associated with it actually identifies the values of the marine environment across the shelf. Currently, many shelf areas within the Commonwealth marine estate have little to no mapping, including within existing and newly established AMPs. By identifying physical assets and their underlying biological values, we will be adding significant measurable value to all aspects of this estate, including conservation values managed through DoEE and fisheries values managed through AFMA. Moreover, through refining and developing baseline and monitoring approaches through new surveys and approaches to analysing acquired data, we will establish the mechanism through which these values can be benchmarked through time and tracked through SOE reporting using national standard approaches. |

| **Research-user** | **Engagement and communication** | **Impact on management action** | **Outputs** |
| --- | --- | --- | --- |
| DoEE- Parks Australia (AMPs) inc planning, management and operations  *Amanda Parr/ Jason Mundy/* *John Lloyd/Samantha Fox/Bianca Priest/Andrew Coleman* | *Needs of research users have been identified through ongoing engagement and consultation, including a specific workshop in 2016 to identify research survey priorities. The project leader will continue to engage research-users to refine survey plans and develop project outputs to ensure they are fit-for-purpose.* | *Information will be used to inform AMP management, including planning, and future monitoring program design.* | ***Key outputs will include:***   * ***detailed reports specific to each AMP survey, including a plain English summary*** * ***survey data stored in national databases and portals.*** * ***At least one presentation will be given to Parks Australia on the completion of each regional survey.***   ***The types of outputs and expectations have been discussed with end users over the D3 project development stages 2015-17.*** |
| DoEE- Marine Policy Section (Jillian Grayson) and Pacific and and Coral Triangle Section (Amelia Tandy) | *As Above, where engagement in steering groups is desired by end user* | *As above, with knowledge gained contributing to broader marine regional management (off-reserve), including KEFs* | *As above* |
| DoEE SOE reporting and Essential Environmental Measures and ERIN (Knowledge and Technology Division) Boon Lim, Jarrod Green and Carolyn Armstrong | *As above* | *As above, with knowledge gained contributing to broader marine regional management (off-reserve), including KEFs, SOE reporting, EEMs, and environmental information (ERIN)* | *As above* |
| NOPSEMA | *As above* | *As above* | *As above* |
| Department of Agriculture and Water Resources | *As above* | *Where appropriate new knowledge gained will inform the development of fisheries policy* | *As above* |
| IMOS/AODN | *As above* | *New information and data will inform future decisions on priorities and deployments of relevant IMOS infrastructure (e.g. AUV facility) and add biophysical datasets to the AODN portal for use and reuse by a broad spectrum of data users* | *As above* |
| State government fisheries and conservation agencies  TSRA | *As above* | *Where appropriate new knowledge will inform the policy development and management of the marine environment, including State marine parks* | *As above* |
| **Additional outputs**  ***At this stage the core outputs will be the overall survey reports****, however, information will also be generated for DoEE as requested, including timely contributions to the AMP atlas currently being developed by the department.*  *Further outputs include (i) new multibeam mapping data from AMP survey areas and adjacent waters to be stored and made available through data repository mechanisms currently being developed by project D2 and a Geoscience Australia working group (ii) new data on benthic invertebrate cover obtained from AUV imagery surveys to be added to national imagery platform Squidle+, and all imagery to be added to the AODN portal, (iii), new data on benthic fish abundance obtained by BRUV surveys to be added to the national Global Archive database, with data and original imagery linked to the AODN portal, (iv) primary literature publications (at least 4) describing national survey approaches and regional findings, (v) presentations (at least one per regional survey) to Parks Australia on each of the surveys upon completion.* | | | |

Knowledge brokering and communications activities

Engagement and communication for this project will be planned and implemented consistent with the Strategy. This project will involve ongoing knowledge brokering with Parks Australia in particular, given the primary focus on Australian Marine Parks. All individual surveys will involve extensive interaction with Parks Australia and regional management in the development, implementation and reporting phases. These phases will be brokered by the project leader, as well as individual survey leaders. Likewise, opportunities, including project annual reviews, will be used to disseminate learnings to broader stakeholder interests, both within DoEE, as well as externally to agencies such as NOPSEMA and AFMA. Communications activities will include an annual review (as part of a broader Theme D review) with additional communication via media opportunities arising from individual surveys.

Indigenous Consultation and Engagement

Indigenous consultation and engagement for this project will be undertaken in a manner that is consistent with the [Hub’s Indigenous and Participation Strategy](https://www.nespmarine.edu.au/document/indigenous-engagement-and-participation-strategy). The research detailed includes eight surveys that provide a range of opportunities for indigenous engagement. In this context some of the survey areas have clear overlaps with Indigenous interests and others may not. The category of Indigenous engagement will vary depending on the nature and location of each proposed survey (e.g. Southern Seamounts survey as Category 3 with lower engagement, and Gulf of Carpentaria AMP survey as Category 1, with a very high level of engagement).

At this stage, individual surveys have yet to be developed to full survey plan status, however, once project approval is given, and each survey is approved for further development, there will be extensive consultation with relevant stakeholders around the details of the final plans. While some details of likely indigenous consultation have been outlined in the current survey descriptions that accompany this proposal, we appreciate that in some cases the fuller and final survey details will be shaped through this engagement, process, and it is therefore appropriate to provide flexibility for this to occur. Hence, the final survey plans will include details of both how ongoing consultation and engagement will be maintained, as well as details of how engagement at the earlier planning stage has shaped the final proposal.

In all cases, individual surveys will include engagement well ahead of project refinement. This process has begun at the initial stakeholder consultation for the overall program (D3 prioritisation workshop in 2017), and will continue as projects are developed. The Gulf of Carpentaria project will have the greatest extent of engagement, and planning for this includes a six month stage of engagement prior to survey initiation.

Overall, the indigenous consultation and engagement will be consistent with the Hub’s Indigenous Engagement and Participation Strategy. At the broadest level engagement will be through provision of updates to the DoEE Indigenous Advisory Group and the Fisheries Research and Development Corporation Indigenous Reference Group. These groups will also be asked for advice on opportunities to enhance Indigenous engagement across individual survey plans as they are developed.

We will also be guided by DoEE engagement processes where appropriate, to avoid duplication and to develop mechanisms that may facilitate future survey consultation approaches. For example, we will engage with the SE AMP Network Forum established by Parks Australia for surveys relevant to the SE region (Southern Seamounts and Beagle AMP). The forum has Indigenous representation from Victoria and Tasmania, and it is anticipated this type of forum may be replicated in other regional AMP networks as Parks Australia develops and implements new AMP network management plans.

The project team is interested to explore how collated information on shelf reefs could be used to reveal Indigenous knowledge on ancient coastlines. Indigenous engagement with the project may provide opportunities to learn more about the values of sea country through the knowledge gained and/or participation in research programs. The research will be conducted according to the highest ethical standards and respects Indigenous priorities and values.

We will explore opportunities for Indigenous engagement, employment, skills transfer, sharing of knowledge and the increase of cultural awareness amongst all parties. Where opportunity exists, representatives of the community will be invited to participate in research cruises to gain first-hand experience of sea country. This is most likely to include involvement of the Sea Ranger program for the Gulf of Carpentaria survey,

Indigenous engagement and participation contact:

Name: Neville Barrett

Email Address: Neville.Barrett@utas.edu.au

Phone Number: 03-62268210

### Project Milestones

| **Milestones** | **Due date** | **Milestone Status** |
| --- | --- | --- |
| ***Initial plan milestones*** |  |  |
| Milestone 1 Completion of Y1 research plan | Due 1 June 2015 | Complete |
| Milestone 2. Completion of workshop on mapping and classification approaches | Due 30 October 2015 | Complete |
| Milestone 3. Completion of Workshop report | Due 30 Dec 2015 | Complete |
| Milestone 4 Completion of desk top study report and collation of all existing shelf reef mapping data, identification of gaps | Due 1 June 2016 | Complete |
| Milestone 5. Completion of report on national classification scheme for shelf reef systems | Due 1 June 2016 | Complete |
| Milestone 6. Completion of initial gap-filling survey and associated survey report | Due 1 June 2016 | Complete |
| Milestone 7. Data trawler developed to a national standard facility and incorporated within the national data infrastructure | 1 Dec 2016 | Complete |
| Milestone 8. Report on national database management protocols for acquired survey data, and links with data trawler | 1 Dec 2016 | Complete |
| Milestone 9. Report on collation of available biological and habitat inventory data for Commonwealth shelf waters and associated model development. | 20 Dec 2016 | Complete |
| Milestone 10. Completion of forward research plan with DOE for gap-filling research projects | 20 Dec 2016 | Complete |
| Milestone 11. Updated blueprint on monitoring reef KEFs | 1 June 2017 | Complete |

| ***Revised plan milestones 2017*** | **Due date** | **Milestone Status** |
| --- | --- | --- |
| Milestone 1: Completion BRUV national monitoring program workshop | 28 Feb 2017 | Complete |
| Milestone 2: Completion of prioritisation workshop | 31 March 2017 | Complete |
| Milestone 3: Completion of prioritisation workshop report | 30 June 2017 | Complete |
| Milestone 4: Completion of BRUV workshop report | 30 June 2017 | Delayed |
| Milestone 5: First National MPA scientific monitoring forum (management and science) | July 2017 | Complete |
| Milestone 6: Report on outcomes from the first national marine monitoring forum | 30 September 2017 | Delayed – 30 Dec 17 |
| Milestone 7: Report on national database management protocols for acquired survey data | 1 December 2017 | Complete |
| Milestone 8: Completion of agreed reporting template for CMR survey reporting | 1 December 2017 | Complete |
| Milestone 9: Completion of initial survey report from Hunter CMR surveys in 2017 | 30 December 2017 | Complete |
| Milestone 10: Report on analysis of current CMR/MPA datasets for power/suitability of a range of potential indicators for national level reporting (inc AUV and BRUV datasets). | 30 December 2017 | Complete |
| Milestone 11: Report on national progress towards a national integrated monitoring program and how CMR monitoring may sit within it | 30 December 2017 | Complete |
| Milestone 12: All project outputs and data will be made publically available and freely accessible on the internet | 30 December 2017 | Complete |

| ***New (2018-2020) milestones*** |  |  |
| --- | --- | --- |
| *Milestone 1 – Signing of contract* | *Due 1 Jan 2018* |  |
| *Milestone 2 – Detailed research plan developed- Beagle/Hunter stage 2 AMPs* | *Due 30 April 2018* |  |
| *Milestone 3 - Detailed research plan developed for Lord Howe AMPS survey (pending MNF approval)* | *Due 31 December 2018* |  |
| *Milestone 4 - Beagle, Hunter Stage 1 and AMP surveys completed, Seamounts survey completed* | *Due 31 December 2018* |  |
| *Milestone 5 - Detailed research plan for Gulf of Carpentaria and Ningaloo surveys completed* | *Due 1 April 2019* |  |
| *Milestone 6 – Gulf of Carpentaria AMP survey completed* | *Due 1 September 2019* |  |
| *Milestone 7 - Hunter stage 2 surveys completed* | *Due 1 September 2019* |  |
| *Milestone 8 – Detailed research plan developed for Elizabeth/Middleton survey completed* | *Due 1 September 2019* |  |
| *Milestone 9 – Draft survey reports for Beagle, Hunter stage 2 and Seamounts surveys completed* | *Due 1 November 2019* |  |
| *Milestone 10 – Final survey reports for Beagle, Hunter stage 2 and Seamounts surveys completed* | *Due 31 December 2019* |  |
| *Milestone 11 – Ningaloo survey completed* | *Due 31 December 2019* |  |
| *Milestone 12 – Hunter phase 2 survey completed* | *Due 31 December 2019* |  |
| *Milestone 13 – Detailed research plan developed for the SW Corner AMP survey* | *Due 31 December 2019* |  |
| *Milestone 14 –SW Corner AMP survey completed* | *Due 30 June 2020* |  |
| *Milestone 15 – Elizabeth/Middleton survey completed* | *Due 1 November 2020* |  |
| *Milestone 16 – Elizabeth/Middleton and Gulf of Carpentaria report drafts completed* | *Due 1 November 2020* |  |
| *Milestone 17 – Synthesis products from cross Hub analysis of survey results, effectiveness of SOPs, and potential to inform cumulative pressures* | *Due 31 December 2020* |  |
| *Milestone 18 – Elizabeth/Middleton and Gulf of Carpentaria and SW Corner and Ningaloo final reports completed* | *31 December 2020* |  |
| *Milestone 19 – Voyage report completed for Lord Howe AMP (pending MNF approval)* | *31 December 2020* |  |

# Data Management and Accessibility

All project outputs (including data) will be made publically available in accordance with the NESP Data Management and Accessibility Guidelines. To facilitate a consistent standards based approach, the Hub has produced a [Data Management Framework](https://www.nespmarine.edu.au/system/files/MBH%20Data%20Management%20Framework%20v1.2%20-%2005Dec16_AO.pdf). The framework provides project leaders with clear directions on publishing metadata, storing data and satisfying requirements for open access to journal articles.

Datasets will be stored in a long-term secure storage, metadata will be created to meet the Marine Community Profile for metadata and published on the Australian Ocean Data Network Portal <http://portal.aodn.org.au/aodn/>. Currently the project plans to have two main components to data management. The first is to work with the wider marine community to ensure data generated by key methods used in AMP surveys (BRUV, AUV, and multibeam) is able to be stored (or linked directly to) in national data facilities developed for each of these, and linked to an national integrated marine monitoring program. The second component will be new datasets generated by new AMP surveys outlined here. This data will be stored on the new data facilities (above) with metadata retained on the AODN portal.

Publications, reports, factsheets, maps and images will be made publically and freely accessible and available on the Hubs website http://www.nespmarine.edu.au. The Hub is also developing data access and visualisation methods in project D1, and we will work with that project to ensure all information products are readily discoverable and available to the department and are freely and openly available.

Name: Neville Barrett

Email Address: Neville.barrett@utas.edu.au

Phone Number: 0408334569

|  |  |
| --- | --- |
| **Project output** | **Data Management and Accessibility** |
| Survey report for each specified AMP survey | Survey reports will be made available publicly available via the Hub website upon completion of each report |
| Research papers | All peer-research papers will be made available to the public through open access via the Hub’s website (in accordance with the NESP Data Management and Accessibility Guidelines). |
| Communication products | Summaries of research voyages and major discoveries will be made available through the Marine Parks Science Atlas, including addition of new data layers with links to relevant data holdings for AMPs |
| BRUV datasets | All BRUV-based data will be added to the Global Archive database for public access on completion of the project. Metadata also available via AODN portal. |
| AUV datasets | All AUV imagery will be added to the AODN portal as per current practices. Scored data will be added to the Squidle+ archive developed by AODN, with metadata on the AODN and data publically available on Squidle+ on completion of the project |
| Multibeam sonar datasets | All data will be processed and stored with Geoscience Australia and/or CSIRO, with processed data publically available from their websites on completion of the project, and metadata on the AODN. |
| Towed video datasets | TBD |
| Taxonomic collections | TBD |

Location of Research

It is anticipated that research will be undertaken within the Ningaloo, Tasman Fracture, Huon, Beagle, Hunter and Gulf of Carpentaria AMPs during the 2018-2019 period, with possible research in the Elizabeth/Middleton AMP in 2020 (to be updated in the 2019 plan) and possible research in the SW Corner AMP (to be updated in the 2019/20 plans). Additional research will be undertaken in adjacent waters as part of seamounts research, and shelf-based studies in the Hunter and Beagle region (examining trawl impacts).

Project Specific Risks

The major constraints to the success of the project are outlined in the table below.

* Note, Table includes all project risks identified throughout the full life of the project, with many concurrent across project development through time.

In addition, the project team contains a mix of researchers with a proven record of project delivery and completion. Hence, while some elements may be less successful than others (e.g. a particular field survey), the demonstrated level of collaboration between partners is such that all intended outputs have a high level of success with low risk.

| **Risk to project** | **Potential impact on project** | **Risk rating (low, medium high, severe)** | **How will risk be managed?** | **Who is responsible for managing risk?** |
| --- | --- | --- | --- | --- |
| 1. Project approvals, i.e. not all surveys funded adequately | Moderate-may require project restructure | Low | Project mix, and specific project tasks will be adjusted for the available budget and capacity of researchers to engage. | Project leader |
| 1. Under-budgeted, resulting in inability to complete all tasks within a given survey | Moderate-will require some project restructuring | Low | Delivery of each survey will be closely coordinated with Parks Australia, and survey goals will be adjusted flexibly to balance tasks with priority outcomes. | Project leader in collaboration with individual survey leaders. |
| 1. Weather, staff, vessel and key equipment availability | Moderate, may result in delays or shortening of days at sea. | Low | Surveys will plan for contingencies, including flexible timing and as above, closely coordinate with Parks Australia to optimise outcomes if seatime is restricted. | As above. |
| 1. Day to day OH&S risks e.g. shipboard injury | Moderate-may impact days at sea for example | Low | Managed through the OH&S protocols in each institution/workplace. All partner organisations have national standard level protocols and procedures in place. | Project leaders on individual survey components, and associated delegated representatives within each collaborating institution. |
| 1. Coordination and cooperation across Hub partners | Moderate- may impact on extent of project deliverables | Low | Managed through a mix of face to face meetings, regular fortnightly phone meetings once project planning is initiated, clear within-survey plan milestones, and engagement with partners with a track record of collaboration. | Project and survey leaders. |
| 1. Insufficient Indigenous engagement. | Moderate- variable across projects. | Low | Managed via well-developed indigenous engagement across surveys (detailed in survey plans) with appropriate budgeting for engagement and adequate lead time for project planning in areas of highest indigenous interest. | Survey leaders |
| 1. Changing departmental priorities- e.g. emergence of higher priority survey areas from Parks Australia | Moderate- Will require significant restructuring of staff and resources | Low | Has been managed to date via extensive consultation with DoEE and Parks Australia in particular. Current plans are sufficiently flexible to allow some changes to target AMPs, and the project partners have capacity to undertake additional surveys if co-funding is available to meet emerging priorities. | Project leader and survey leaders |

Project Keywords

biodiversity, rocky reef, monitoring, AMP, Key Ecological Feature (KEF).

Project contacts

Researchers and Staff

***\*\*\*NOTE: Current FTE’s shown here are for whole of project across the years 2018-2020.***

| **Name** | **Organisation** | **Project Role** | **FTE** | **2018** | **2019** | **2020** |
| --- | --- | --- | --- | --- | --- | --- |
| Alan Williams | *CSIRO* | Survey Leader, ecology- Seamounts | 0.1 | 0.05 | 0.05 |  |
| TBA | CSIRO | Benthic ecologist- Seamounts | 1.0 | 0.5 | 0.5 |  |
| Darryn Sward | University of Tasmania | PhD student – ROV SOP development | 3.0 | 1.0 | 1.0 | 1.0 |
| Neville Barrett | University of Tasmania | Project leader, ecological studies | 0.9 | 0.3 | 0.3 | 0.3 |
| Jacquomo Monk | University of Tasmania | Postdoc-benthic ecology | 3.0 | 1.0 | 1.0 | 1.0 |
| Justin Hulls | University of Tasmania | Technical support, fieldwork, data analysis, GIS | 3.0 | 1.0 | 1.0 | 1.0 |
| Vanessa Lucieer | University of Tasmania | Spatial analyst co-ordinating | 0.3 | 0.1 | 0.1 | 0.1 |
| Scott Nichol | GA | Survey leader/geoscience | 0.75 | 0.2 | 0.25 | 0.3 |
| Ian Atkinson | GA | Multibeam engineer/operations\* | 0.6 | 0.15 | 0.2 | 0.25 |
| Justy Siwabessy | GA | Multibeam acquisition/processing\* | 0.6 | 0.15 | 0.2 | 0.25 |
| Kim Picard | GA | Multibeam acquisition/interpretation\* | 0.6 | 0.15 | 0.2 | 0.25 |
| Rachel Nanson | GA | Geomorphology/sediments interp | 0.65 | 0.10 | 0.35 | 0.20 |
| Andrew Carroll | GA | Benthic ecology – epifauna\* | 0.25 | 0.05 | 0.15 | 0.05 |
| Rachel Przeslawski | GA | Benthic ecology – infauna (tbc) | 0.45 | 0.15 | 0.15 | 0.15 |
| Zhi Huang | GA | Spatial analysis/modelling | 0.3 | 0.05 | 0.2 | 0.05 |
| Marcus Stowar TBC | AIMS | Voyage leader\* | 0.15 |  | 0.15 | 0.15 |
| Neill Roberts | AIMS | Towed video technician\* | 0.15 |  | 0.15 |  |
| Matt Birt TBC | AIMS | BRUVS technician\* | 0.15 |  | 0.15 |  |
| Mark Case TBC | AIMS | Field data management\* | 0.15 |  | 0.15 |  |
| Jamie Colquhoun | AIMS | Image analysis (benthic) | 0.3 |  |  | 0.3 |
| Kathy Cure | AIMS | Image analysis (fish) | 0.1 |  |  | 0.1 |
| Marji Puotinen | AIMS | Predictive modelling | 0.3 |  | 0.2 | 0.1 |
| Karen Miller | AIMS | Project Lead | 0.5 | 0.05 | 0.25 | 0.2 |
| Martial Depczynski | AIMS | Indigenous coordination | 0.3 | 0.05 | 0.15 | 0.1 |
|  |  |  |  |  |  |  |
| Russ Babcock | CSIRO | Project co-ordination, Ningaloo survey | 0.1 |  | 0.05 | 0.05 |
| Mat Vanderklift | CSIRO | Benthic ecology | 0.1 |  | 0.05 | 0.05 |
| Tim Langlois | UWA | BRUV and fish ecology | 0.1 |  | 0.05 | 0.05 |
| Emma Lawrence | CSIRO | Sampling design and biostatistics | 0.25 |  | 0.15 | 0.1 |
| Mick Haywood | CSIRO | BRUV and fish ecology | 0.25 |  | 0.2 | 0.15 |
| Stuart Edwards | CSIRO | Acoustics engineer/multibeam operations | 0.1 |  | 0.1 |  |
| Karl Forcey | CSIRO | Benthic video sampling | 0.3 |  | 0.15 | 0.15 |
| TBC | UWA | Video analysis | 1.2 |  | 0.6 | 0.6 |
| Mark Tonks | CSIRO | BRUV sampling | 0.2 |  | 0.1 | 0.1 |
| Mike Taylor | UWA | BRUV sampling | 0.2 |  | 0.1 | 0.1 |
| Simon Collings | CSIRO | Multibeam analysis and habitat modelling | 0.6 |  | 0.3 | 0.3 |
| Cindy Bessey | CSIRO | Tow video analysis | 0.4 |  | 0.2 | 0.2 |
| TBA | UWA | Biological surveys (Capes AMP 2020) | 0.5 |  |  | 0.5 |
| TBA | UWA | Biological surveys (Capes AMP 2020) | 0.5 |  |  | 0.5 |
| Peter Davies | NSW OEH | Mapping | 0.3 | 0.1 | 0.1 | 0.1 |
| Tim Ingelton | NSW OEH | Mapping | 0.3 | 0.1 | 0.1 | 0.1 |
| Alan Jordan | NSW DPI | Mapping/Ecological studies | 0.3 | 0.1 | 0.1 | 0.1 |
| David Harasti | NSW DPI | Mapping/Ecological studies | 0.3 | 0.1 | 0.1 | 0.1 |
| Joel Williams | NSW DPI | Mapping and BRUV collation, sampling and post processing | 1.8 | 0.6 | 0.6 | 0.6 |
| Technical Officer | NSW DPI | Field surveys for BRUVs and towed video/ROV | 0.3 | 0.1 | 0.1 | 0.1 |
|  |  |  |  |  |  |  |

Data Management

| Name | Organisation | Email | Phone |
| --- | --- | --- | --- |
| *Neville Barrett* | *University of Tasmania* | Neville.barrett@utas.edu.au | 0408334569 |

Co-contributors

| Name | Organisation/ | Contribution |
| --- | --- | --- |
| Dr Stefan Williams | IMOS AUV facility | Co-investment IMOS capacity |
|  |  |  |
| Roger Proctor | IMOS/AODN | National Database development (BRUV/AUV) |

Key Partners **and** Research End Users

| **Key Partners (organisation/program)** | **Name/s** | Email (optional) |
| --- | --- | --- |
| DoEE- Parks Australia (AMPs) | Amanda Parr/ Jason Mundy/ Cath Samson |  |
| DoEE- Parks Australia-SE AMP management | John Lloyd/Samantha Fox/Bianca Priest |  |
| DoEE- Regional Marine Planning | Jillian Grayson /Amelia Tandy |  |
| DoEE SoE reporting. | Boon Lim |  |
| DoEE Essential Environmental Measures | Jarrod Green | Jarrod.green@environment.gov.au |
| DoEE Knowledge and Technology Division- ERIN | Carolyn Armstrong |  |
| Department of Environment and Energy – Biodiversity Conservation Division – Biodiversity Policy Section | Tia Stevens | [Tia.Stevens@environment.gov.au](mailto:Tia.Stevens@environment.gov.au) |
| Department of Environment and Energy – Biodiversity Conservation Division – Reef Trust | Kevin Gale | [Kevin.Gale@environment.gov.au](mailto:Kevin.Gale@environment.gov.au)  [Ingrid.Cripps@environment.gov.au](mailto:Ingrid.Cripps@environment.gov.au) |
| Department of Agriculture and Water Resources | Emma Lowe | Emma.lowe@agriculture.gov.au |

| Research Users (program/section/branch/organisation) | Name/s | Email (optional) |
| --- | --- | --- |
| All DoEE Key Partners listed above | As per Key Partners |  |
| AFMA | Yvonne Zunic/Beth Gibson |  |
| NOPSEMA | Christine Lamont/Cameron Sim |  |
| Torres Strait Regional Authority | Stan Lui |  |
| State Fishery and Conservation agencies | e.g. Alan Jordan (NSW DPI- Fisheries), Dr Lynda Bellchambers, WA Fisheries. |  |
| IMOS | Tim Moltmann  Anna Lara-Lopez |  |
| AODN | Sebastien Mancini |  |
| Regional fishing and conservation groups |  |  |

# Project D3 – Appendix 1 – Survey Proposal: Benthic Habitats and Biodiversity of Gulf of Carpentaria Marine Park

Project length – 2.5 Years

Project start date – 1/7/2018

Project end date – 31/12/2020

Project approval date - TBC

Project current status - In progress

Project Leaders – Nichol/Miller

Lead Research Organisation – GA/ AIMS

Project leader contact details: - scott.nichol@ga.gov.au

### Project Funding

|  | 2018 | 2019 | 2020 | TOTAL |
| --- | --- | --- | --- | --- |
| NESP funding | AIMS $50,000  GA  $45,000 | AIMS $460,000  GA  $228,000  CSIRO tba  UTAS tba | AIMS  $88,000  GA  $104,000 | $975,000 |
| Cash co-con |  |  |  |  |
| In-kind co-con | AIMS $50,000  GA  $45,000 | AIMS $460,000  GA  $228,000  CSIRO tba  UTAS tba | AIMS $88,000  GA  $104,000 | $975,000 |
| TOTAL | $190,000 | 1,376,000 | $384,000 | $1,950,000 |

### Project Summary

This collaborative project will be centred on an 18-day field survey (including 4 days of transits) to build baseline information and test the effectiveness of SOPs for tropical benthic and demersal habitats in the Gulf of Carpentaria Marine Park, and intersecting Key Ecological Features (Fig. 1). Previous seabed mapping surveys of the area in 2003 and 2005 discovered submerged coral reefs (patch reefs) that support live coral and sponge communities (Harris et al., 2004; 2007). These reefs are recognised as a Key Ecological Feature but their true extent is unknown and they remain to be described from a biodiversity and ecological perspective. The survey will extend high resolution bathymetry and sampling coverage across the Park, targeting features such as the submerged reefs KEF within the proposed Special Purpose Zone (Trawl) of the GoC Park as well as representative areas of soft sediment habitat. The project will also assess the extent to which known benthic communities are represented within the proposed zones of GoC Marine Park (Special Purpose Zones & National Park), and the role of cyclones in structuring these communities. Data collected will be used to produce habitat maps for mapped areas, as well as predictive habitat models across the Park and adjacent Indigenous Protected Area around the Wellesley Islands. The survey will employ Standard Operating Procedures (SOPs) for all activities as developed in Project D2. These SOPs will include application of a spatially balanced sampling design informed by existing (legacy) data (i.e. high resolution bathymetry, benthic samples, Reef Life survey data), and testing/refinement of standardised procedures for multibeam sonar mapping, benthic sampling (sleds, grabs), towed video and BRUV deployment. Data processing and analysis will also adopt standard procedures (e.g. CATAMI for image scoring, SOPs for multibeam processing and lab analysis of samples; and predictive models). The project will incorporate available legacy data into analysis of new datasets, where possible (e.g. to identify change in benthic communities) and produce scientific outputs readily accessible to managers and the public.

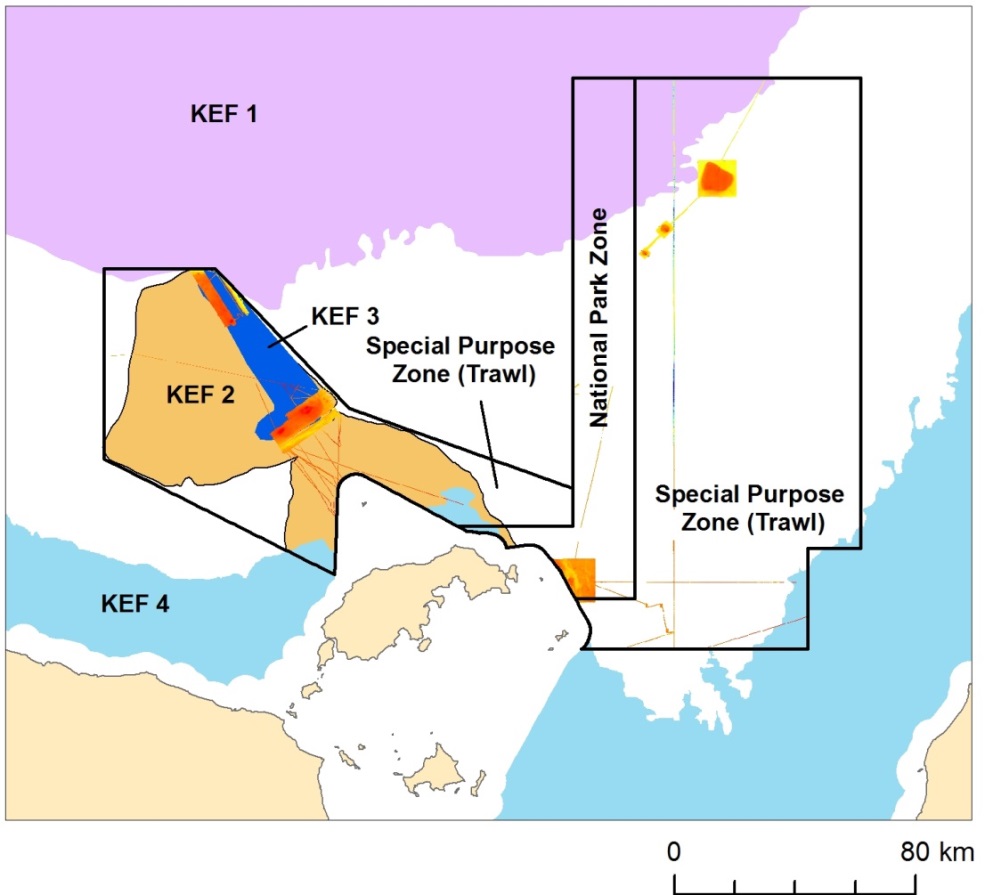
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Fig. 1: Gulf of Carpentaria Marine Park showing proposed zones and Key Ecological Features, including: KEF 1 – Gulf of Carpentaria basin; KEF 2 – Plateau and saddle north-west of the Wellesley Islands; KEF 3 – Submerged coral reefs of the Gulf of Carpentaria; KEF 4 – Gulf of Carpentaria coastal zone. Existing multibeam is overlaid on the map showing submerged coral reefs in red.

Indigenous engagement: During survey planning, the project leaders will engage with representatives from the Carpentaria Land Council Aboriginal Corporation and Traditional Owners of the Wellesley Islands (Thuwathu/Bujimulla) to align scientific objectives to the [management plan](http://www.clcac.com.au/sites/default/files/downloads/wellesly_islands_ipa_management_plan_web_ready_0.pdf) for this Indigenous Protected Area (IPA), which borders the GoC Marine Park. Importantly, the management plan includes reference to the submerged reefs mapped by Harris et al. (2007) as a key component to the local ecosystem in supporting a diverse and abundant marine fauna and flora. This engagement will include exploring opportunities for direct participation of indigenous representatives in the project, building on the Indigenous SOPs program currently underway within AIMS and being implemented with a range of Traditional Ranger Groups across Northern Australia. We would also look to extend the characterisation of benthic values into the IPA, through combining data collected in the Marine Park and the IPA to inform habitat modelling.

### Background and Research Questions

The Gulf of Carpentaria Marine Park is situated within the southern part of the semi-enclosed basin that forms the Gulf, where water depths range from 10 m to ~60 m across a low gradient shelf. The Park incorporates reef and soft sediment benthic habitats that support coral communities and diverse infaunal assemblages, respectively. Demersal and pelagic fish (sharks, snapper, tuna, mackerel) associated with these habitats are also represented in the Park. The Park is within 50 km of the mainland coast and adjacent to Mornington Island and is therefore influenced by freshwater and nutrient inflow from rivers on a seasonal basis, driving local productivity. Localised upwelling driven by tidal and wind driven currents also influences productivity. Cyclones play a key role in the oceanography of the Gulf, generating near-bed currents of sufficient strength to transport sand and coral debris, as evidenced by debris deposits that have been swept off the tops of reef pinnacles (Harris et al. 2009). Together, these characteristics define the GoC Marine Park as uniquely representative of the Northern Shelf Province with the overlay of a set of four Key Ecological Features (Fig.1).

Beyond the general understanding of the biodiversity and environmental processes outlined above, our knowledge base to inform the ongoing management of the Gulf of Carpentaria Marine Park is very limited. This was demonstrated in the ‘gap analysis’ of available data for the North and Northwest Marine Regions undertaken in Project D1 that identified the GoC Marine Park is the most data deficient Park across both regions (Miller et al. 2017). Key data gaps are in bathymetry coverage, benthic reef and soft sediment biological assemblages, and data to describe spatial variations in those communities. Stemming from this and in the context of the proposed re-zoning of the GoC Marine Park (that includes trawl zones), the following research questions will be addressed by this project.

* Do benthic communities vary in composition across the environmental gradients represented in the GoC Marine Park (i.e. with distance offshore, depth and substrate type)?
* How well are the known benthic communities represented across the extent of the GoC Marine Park zones (Special Purpose Zones & National Park)?
* What role do cyclones play in structuring benthic biological communities?
* Is there evidence for temporal change in the diversity or abundance of infaunal communities from patterns observed in the early 1990s (e.g. does the south-east margin remain more diverse than deeper areas outside the Marine Park)?
* How effective are available platforms (i.e. tow-video, BRUVs, grabs) for monitoring benthic communities in a tropical turbid setting, and what are the practical limitations?

### Leveraging Existing Initiatives

The key opportunity for leveraging existing work in the Gulf of Carpentaria is to link with work already being undertaken in the indigenous protected area that surrounds Mornington Island (and other islands in the Wellesley group) and overlaps with the GoC Marine Park. Importantly, this overlap includes the southern part of the proposed National Park Zone within the GoC Marine Park that incorporates shallow (<30m) reef habitat to the east of Mornington Island. Part of this reef has been mapped by multibeam sonar (Harris et al., 2007) and geologically sampled but its full extent and benthic community composition remains unknown. In response to the invitation offered in the Management Plan of the Wellesley Islands IPA to engage with scientists with common interests, this survey will seek to work with the rangers and traditional owners of the Wellesley Islands (Thuwathu/Bujimulla) to build the knowledge of this potentially high conservation value habitat. (Note: the area of common interest falls within Monitoring Zone 3 of the Wellesley Islands IP management plan).

There is also the opportunity to revisit survey locations within the GoC Marine Park set up by Reef Life Survey (RLS) in 2015. There are five RLS stations within the Park that are in water depths accessible by vessel for tow video deployment; two are on a reef that is partly within the proposed National Park zone.

### Legacy Data

A review of available data for the Gulf of Carpentaria Marine Park identified the following legacy datasets (sourced from ARMADA, AODN and Reef Life Survey):

* High resolution multibeam bathymetry (1316 km2; 5% of CMR)
* Single beam bathymetry (1118 km2; 4.6% of CMR)
* Seabed sediment samples (176 records)
* Infaunal samples (~20 records; Long and Poiner, 1994)
* Demersal trawl/sled samples (115 records)
* Oceanography (CTD casts, ADCP current profiles) (>700 records)
* Plankton (9 records)
* RLS Records (~10 records)

The majority of these legacy data were acquired on MNF voyages in 2003 and 2005 and are concentrated within mapping/sampling grids on the submerged reefs, and transits. There are also limited demersal sled/trawl fish data and infaunal data collected in the 1970s and 1990s (e.g. Long and Poiner, 1994).

The satellite imagery archive will also be utilised to provide additional context for assessing cyclone impacts in the GoC, including assessments of the spatial extent of turbid waters following cyclones and to track temporal trends in SST within the Gulf. This will leverage work underway in the Hub within Project A12 and D2 (in terms of SOPs for using remote sensing as a monitoring tool).

### Draft Project schedule:

The project will commence in July 2018 and run for two and a half years, to the following schedule:

**2018** July-Dec:

* Review & summarise legacy data (bathymetry, physical & biological samples, oceanography)
* Survey planning, including sampling design
* Indigenous stakeholder consultation
* Prepare permit applications to undertake research in Marine Park and to Access Biological Resources

**2019**

* Jan-June: Survey logistics planning, mobilisation
* July-Dec: Survey implementation, demobilisation, sample/data processing/archiving

**2020**

* Jan-June: Data processing/analysis, progress reporting
* July-Dec: Final reporting, data delivery/release

### Planned Outputs

The outputs for this project will include:

* Voyage report on activities, meta-data and preliminary interpretations;
* High resolution bathymetry and acoustic backscatter data and maps for targeted areas e.g. submerged reefs KEF within Gulf of Carpentaria Marine Park;
* Underwater images (video, still) of benthic communities, demersal and pelagic(tbc) fish assemblages;
* Species inventory for observed and sampled biological specimens (epibenthic and infaunal);
* Habitat map(s) and coverage estimates representing the submerged reefs KEF and adjacent area within the GoC Marine Park, including coral and sponge communities (maps will integrate data from previous CSIRO/MNF, RLS and GA surveys with results from this project);
* Maps of predicted habitat distributions for key benthic taxa (sponges, hard corals, octocorals, sponges, demersal fish) across the GoC Marine Park and IPA, including estimates of uncertainty.
* Publications in peer reviewed literature;
* Communications products (see below)

### Science Communication Plan

Products to publically communicate the conservation values of the GoC marine Park will be targeted on highlighting the undersea landscape of drowned reefs and associated biota, such as hard corals and fish communities. Products to include photos and videos of benthic communities, and a bathymetry flythrough. These products and linked data to made publically available on the Marine Parks Science Atlas and/or Northern e-Atlas. We will also actively engage the public during the survey (e.g. social media, blog, media release).

### Researchers and Staff

\* - denotes on survey

| Name | 2018 FTE | 2019 FTE | 2020 FTE | Organisation | Project Role: \* denotes on voyage |
| --- | --- | --- | --- | --- | --- |
| Nichol | 0.1 | 0.2 | 0.2 | GA | Project co-ordination, geoscience\* |
| TBA |  | 0.2 |  | GA | Multibeam engineer/operations\* |
| TBA | 0.05 | 0.2 |  | GA | Multibeam acquisition/processing\* |
| TBA |  | 0.2 | 0.1 | GA | Multibeam acquisition/interpretation\* |
| TBA |  | 0.2 | 0.1 | GA | Geomorphology/sediments interp |
| TBA | 0.1 | 0.1 | 0.1 | GA/Museum | Benthic ecology – epifauna\* |
| TBA |  | 0.1 | 0.1 | GA | Benthic ecology – infauna (tbc) |
| TBA |  | 0.1 | 0.1 | GA | Spatial analysis/modelling |
| TBA |  | 0.15 |  | AIMS | Voyage leader\* |
| TBA |  | 0.15 |  | AIMS | Towed video technician\* |
| TBA |  | 0.15 |  | AIMS | BRUVS technician\* |
| TBA |  | 0.15 |  | AIMS | Field data management\* |
| TBA |  | 0.3 |  | AIMS | Image analysis (benthic) |
| TBA |  | 0.1 |  | AIMS | Image analysis (fish) |
| TBA |  | 0.1 | 0.2 | AIMS | Predictive modelling |
| TBA | 0.1 | 0.2 | 0.2 | AIMS | Project Lead |
| TBA | 0.1 | 0.1 | 0.1 | AIMS | Indigenous coordination |
| TBA |  | 0.05 | 0.05 | CSIRO | Oceanography |
| TBA |  | 0.1 | 0.1 | UTAS | Benthic ecology |

Co-contributors – only list contributors who are not already identified as Researchers and Staff

| Name | Organisation/ | Contribution |
| --- | --- | --- |
| TBA | Carpentaria Land Council Aboriginal Corporation | Local knowledge of reefs and biota; input to survey objectives and outputs |
| TBA\* | Traditional Owners and sea rangers of the Wellesley Islands | Local knowledge of reefs and biota, input to survey objectives and outputs, collection of data from IPA; on voyage |
| TBA | CSIRO | Oceanography |

### References

Carpentaria Land Council, n.d. Thuwathu/Bujimulla Indigenous Protected Area Management Plan. <http://www.clcac.com.au/sites/default/files/downloads/wellesly_islands_ipa_management_plan_web_ready_0.pdf>

Harris, P.T., Heap, A.D. 2009. Cyclone-induced net sediment transport pathway on the continental shelf of tropical Australia inferred from reef talus deposits. Continental Shelf Research 29, 2011-2019.

Harris, P.T., Heap, A., Marshall, J., Hemer, M., Daniell, J., Hancock, A., Buchanan, C., Brewer, D., Heales, D. (2006). Submerged coral reefs and benthic habitats of the southern Gulf of Carpentaria: Post-Survey Report GA Survey 276, RV Southern Surveyor. Geoscience Australia Record 2007/02, 134 pp.

Harris, P.T., Heap, A.D., Wassenberg, T., Passlow, V. 2004. Submerged coral reefs in the Gulf of Carpentaria, Australia. Marine Geology 207, 185-191.

Long, B.G., Poiner, I.R. 1994. Infaunal benthic community structure and function in the Gulf of Carpentaria, Northern Australia. Aust J Mar Freshwater Res 45, 293-316.

Miller, K. Puotinen, M., Przeslawski, R., Huang, Z., Bouchet, P., Radford, B., Li, J., Kool, J., Picard, K., Thums, M., Meeuwig, J., Nichol, S. 2017. Ecosystem understanding to support sustainable use, management and monitoring of marine assets in the North and North-west regions: Final Report. NESP Marine Biodiversity Hub Report.

# Project D3 – Appendix 2 – Survey Proposal: Benthic Habitats and Biodiversity of The Beagle CMR shelf waters

Project length – 2 Years

Project start date – 1/1/2018

Project end date – 31/12/2019

Project approval date - TBC

Project current status - In progress

Project Leaders – Neville Barrett/Scott Nichol

Lead Research Organisation – (UTas, GA)

Project leader contact details: - [Neville.barrett@utas.edu.au/](mailto:Neville.barrett@utas.edu.au/) scott.nichol@ga.gov.au

### Project Funding

|  | 2018 | 2019 | 2020 | TOTAL |
| --- | --- | --- | --- | --- |
| NESP funding | UTas $200,000  GA  $120,000  CSIRO  MoV  Vessel charter (Agency independent) $100,000 | UTas $100,000  GA  $55,000  CSIRO  MoV |  |  |
| Total NESP  Funding | $420,000 | 155,000 |  | $575,000 |
| Cash co-con |  |  |  |  |
| In-kind co-con | UTas $200,000  GA  $120,000  CSIRO  MoV | UTas $100,000  GA  $55,000  CSIRO  MoV |  |  |
| TOTAL | $740,000 | $310,000 |  | $1050,000 |

### Project Summary

This project will undertake a field survey to build baseline information for benthic habitats in shelf waters of the Beagle CMR, in addition to establishing a sound monitoring baseline for ongoing monitoring of Bass Strait habitats. It applies a standard operating protocol (SOP)-based standard and consistent approach to inventory and monitoring as a model example of how such surveys should be undertaken more widely throughout the CMR network in shelf waters. The prioritisation of this CMR, and methods used, is based on (1) the need for additional baseline/monitoring within the SE CMR network as part of the current 10 year management plan; (2) known significant pressures, including commercial fishing (trawling and shark) on low profile shelf reef and sediment systems, (3) need for baseline biological data (despite listing on the basis of representation of sponge gardens there is no quantitative knowledge of their presence/distribution) (4) potential for SOE reporting based on condition of targeted fish stocks (including trawl species) and habitats, and climate-related shifts in benthic species distributions; (5) potential for linking surveys and SOPs with adjacent O&G developments and monitoring programs- including future assessment of impacts/benefits of O&G infrastructure and operations, leading to industry uptake of SOP approaches; (6) significant alignment with state interest, including adjacent (conjoining) MPA’s and MPA monitoring programs in Victoria (Wilsons Promontory Marine Park) and Tasmania (Kent Group Marine Reserve); (7) potential for engagement with the indigenous communities in the region based on improved understanding of land-bridge connections between Tasmania and Victoria, including migration pathways.

The intent of the survey is to apply the core benthic SOPs being developed by the Hub for inventory and monitoring programs (e.g. MBS, AUV, BRUV, TV) while also providing opportunity to trial use of IMOS tools such as passive midwater acoustics to map aspects of pelagic productivity.

There has been some limited previous seabed mapping of the area as part of Australian Hydrographic Office (AHO) surveys (including a recent charter of the MNF), that indicate that the area may be primarily dominated by soft sediments with some low-profile reef. The reefs are recognised as a Key Ecological Feature (KEF) but their true extent is unknown and they remain to be described from a biodiversity and ecological perspective. Preliminary mapping data from the AHO suggests there may be a narrow, elevated reef ridge running between the Hogan Island Group and the Kent Group, one that potentially formed part of a land bridge between Tasmania and Victoria during the last glacial period. Improving our understanding of the bathymetry of this region will allow modelling of this, leading to engagement with regional indigenous communities who have expressed significant interest in understanding migration pathways.

The Beagle CMR currently has category VI zoning which means demersal trawl, danish seine and scallop dredge fishing methods are not allowed. As this reserve will have been in place for a decade in 2018, it provides an opportunity to assess changes associated with protection from such fishing activities, by contrasting the condition of biological assemblages in it with those of adjacent fished areas, and potentially with those associated with O&G infrastructure (such as pipelines), that have had de-facto protection from fishing activities over a longer period. Hence, new surveys in this region will not only provide a biological baseline, but also establish a basis for a longer-term monitoring program, while undertaking a first assessment of the effectiveness of category VI zoning for benthic habitat protection.

The proposed survey will produce a full coverage, high resolution maps of representative habitats within the CMR, including areas of the rocky reef KEF, allowing these to be subsequently surveyed quantitatively using the SOP-based biological sampling activities, as developed in Project D2. Currently, proposed SOPs include MBES, AUV, Towed Video, BRUVs to provide broad scale to fine scale quantitative descriptions of the habitats, assemblages and fish species that represent the CMR. Biological surveys will follow best-practice spatially balanced designs developed during the NERP Hub and refined under project D2 in the NESP Hub. Data processing and analysis will also adopt standard procedures (e.g. CATAMI for image scoring of AUV and TV derived imagery, SOPs for multibeam processing and BRUV processing.

### Proposed outcomes include

A successful demonstration of the utility of a nationally consistent approach to survey and inventory of shelf habitats in CMRs, with a focus on shelf reefs, leading to longer-term uptake by Parks Australia in a well-structured monitoring program.

Successful uptake of SOPs and incorporation of outputs into national databases, demonstrating a data acquisition and management pathway to be adopted by long-term CMR monitoring programs, as well as by all agencies involved in inventory and monitoring by SOPs in state and commonwealth waters (including oil and gas industries-a key focus of the Beagle survey).

An improved understanding of the habitats and biota in a CMR region subject to heavy human pressures (fishing, O&G), leaving to an improved capacity to adaptively manage these pressures to meet planned conservation outcomes.

Improved integration of CMR inventory and monitoring programs with state programs based around standard methods such as AUV and BRUV (e.g. as used in adjacent MPAs).

Improved ability to report into the SOE, via enhanced regional coverage, analysis of decade-scale trends (AUV), and a focus on key reporting metrics such as biomass of target finfish species and lobsters (BRUVs and potentially limited lobster potting).

An initial evaluation of the effectiveness of Category VI protection of benthic habitats in the SE network, where benthic trawling has been prohibited for a decade.

### Planned Outputs

The outputs for this project will include:

* Post survey report describing data acquired on the survey and preliminary interpretations, in a format to be used as an example reporting template for subsequent CMR surveys (similar to existing Tasman Fracture survey report)
* Acquired data contributed to national databases (e.g. AUV-Squidle, BRUV- Global Archive, MBES –GA/AHO)
* High resolution bathymetry and acoustic backscatter data and maps for representative areas of shelf waters (including rocky reef KEF) within the Beagle CMR
* Underwater images (video, still) of benthic invertebrate and fish communities
* Species inventory for observed and sampled biological specimens (epibenthic and infaunal)
* Habitat map(s) and coverage estimates representing the submerged reefs KEF and soft sediment habitats within representative waters of the Beagle CMR, including sponge dominated low-profile reefs and higher profile reef ridges
* Qualitative model for the rocky reef KEF and associated soft sediment habitats within the Beagle CMR
* Publications in peer reviewed literature
* Communication products (images, bathymetry flythrough) highlighting submerged reefs and associated biota. Published in the proposed MPA/CMR atlas and MBH website.

### Overall justification against requested additional criteria

1. Likely uptake of results by Parks Australia: High. This survey addresses the need for initiation of baseline inventory and monitoring in the SE CMR network as outlined in the SE network management plan. This is currently the only network with a management plan in place. As there is currently no knowledge of the distribution of habitats and species within this CMR, the acquired knowledge will be essential to informing ongoing management planning and responses. More generally, by applying a broad set of SOPs specifically tailored to CMR monitoring, in a typical shelf setting, the demonstration of the efficacy of such approaches will be of significant interest to PA in evaluating the merit of such approaches for use in the longer-term.
2. Contribution to a 10 year monitoring strategy. High. Benthic shelf habitats have been assessed as those most under anthropogenic pressure, most likely to benefit from CMR protection, and under-represented in higher levels of protection with respect to other environments (slope, abyssal plains, seamounts). This survey will evaluate the effectiveness of SOPs specifically developed for benthic shelf habitats and their associated biodiversity in a regional context (SE CMR network), and form a component of a planned program intended to provide representative national coverage over a ten-year period. By also focussing on evaluating human impacts on these habitats (including benthic trawling) it will allow evaluation of the efficacy of current management strategies (Habitat protection zoning) in time for future reviews of management plans. Finally, part of the 10 year strategy is to assist PA in meeting inventory and monitoring goals, and this survey does so addressing needs within the current SE network management plan, including inventory and baselines in previously unsurveyed CMS in the network.
3. Opportunity for collaboration with industry partners. High. A primary determinant of the Beagle CMR survey proposal as a priority for the SE region (as opposed to other listed proposals such as the Huon and Freycinet CMS, or potential for other such as Apollo, Zeehan, Franklin or Boags, was the interest from Oil and Gas industries in understanding the Beagle region adjacent to offshore Gippsland O & G developments, and the potential to collaborate with industry in evaluation of the influence of O & G infrastructure in enhancing biodiversity values of the area (e.g. via protection from trawling, or provision of habitat structure). As part of this, there is potential for uptake of Hub-developed SOPs as part of industry0basedenviornmental monitoring of the broader Gippsland region.
4. Science excellence. High. In addition to a commitment to science excellence through undertaking surveys based on Hub-developed SOPs and statistically-based sampling designs, and subsequent publication of these approaches and results in the primary literature, the survey will have a core focus on assessing human impacts on soft sediment and low profile reef fauna and flora via trawl fisheries and scallop dredge fisheries, as this CMR will have been protected from these for over ten years by the time of the survey. By contrast with adjacent fished habitats, and those protected for longer periods via O & G infrastructure such as pipelines, and linking with quantitative effort data from VMS, we will develop the first quantitative assessment of the efficacy of habitat protection zonation in shelf waters subject to moderate trawl effort. This will not only be an excellent science outcome of international interest, it will significantly influence public and management understanding of human impacts and management responses.
5. Capacity of science communication from the survey to achieve high public interest - high. Many of the research activities lead to visually appealing communication products, including detailed bathymetric maps, BUV-based video footage, AUV based still and video imagery, and towed video imagery. In addition to public interest in the biodiversity values of waters near major population centres such as Melbourne, there is significant international interest in understanding the environmental impacts of trawl fisheries.

### Indigenous engagement:

During survey planning, the project leaders will engage with representatives from the Tasmanian and Victorian indigenous communities, including representatives from the Federation of the Victorian Traditional Owner Corporations and the Tasmanian Aboriginal Centre who currently represent these communities on the SE CMR Forum facilitated by Parks Australia. Initial discussions with members of the Tasmanian aboriginal community indicate a significant interest in gaining further knowledge of the migration pathways connecting Tasmania and Victoria during previous glacial periods as the Beagle CMR spans an elevated portion of the land-bridge that once connected the island groups of this region to the adjacent states. Improved bathymetry will reveal likely pathways as well as potential refuges in rocky outcrops, and there may be potential for grab sampling to target adjacent sediments for evidence of middens if distinct features are identified.

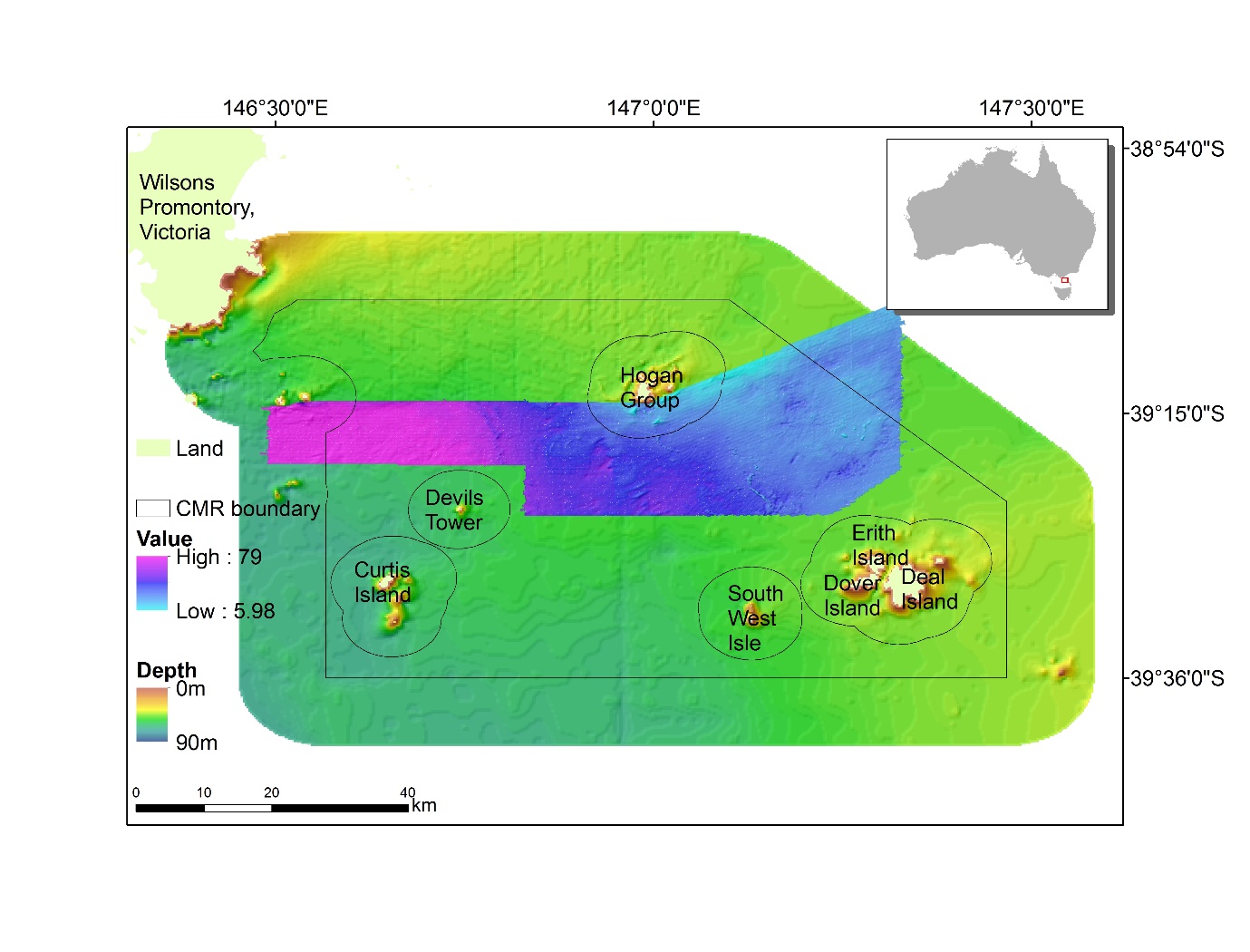
Researchers and Staff

\* - denotes on survey

| Name | 2018 FTE | 2019 FTE | Organisation | Project Role |
| --- | --- | --- | --- | --- |
| Scott Nichol | 0.1 | 0.05 | GA | Project co-ordination, geoscience\* |
| Ian Atkinson | 0.15 |  | GA | Acoustics engineer/multibeam operations\* |
| Andrew Carroll | 0.05 | 0.05 | GA | Benthic ecology / SOPs |
| Zhi Huang | 0.05 | 0.1 | GA | Spatial analyst |
| Rachel Nanson | 0.1 | 0.15 | GA | Geomorphology interpretation |
| Kim Picard | 0.15 |  | GA | Seabed acoustics/geomorphology\* |
| Rachel Przeslawski | 0.05 | 0.05 | GA | Benthic ecology / SOPs |
| Justy Siwabessy | 0.15 |  | GA | Seabed acoustics/mapping\* |
| Neville Barrett | 0.3 |  | UTas | Project leadership, benthic ecology |
| Jacquomo Monk | 1.0 | 0.5 | UTas | Benthic ecology – AUV and BRUV |
| Vanessa Lucieer | 0.1 | 0.1 | UTas | Acoustics-spatial analysis |
| Justin Hulls | 1.0 | 0.5 | UTas | Technical support |
| Scott Foster |  |  | CSIRO | Statistical support (from D2) |
| Rudy Kloser |  |  | CSIRO | Passive acoustics – mesopelagic productivity- From IMOS |
| Tim O’Hara | 0.1 |  | MoV | Benthic taxonomy – From D4 |

### Co-contributors

| Name | Organisation/ | Contribution |
| --- | --- | --- |
| Stefan Williams | USyd/IMOS | AUV facility support-IMOS |

Fig. 1: High resolution bathymetry coverage in Gulf of Carpentaria CMR

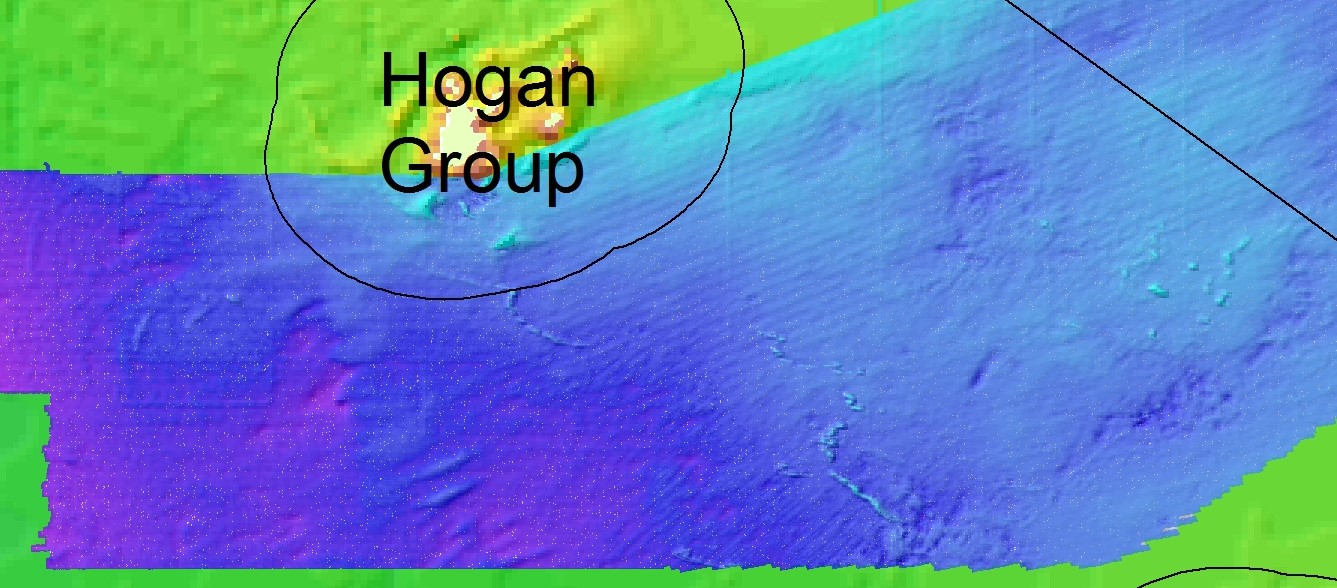


Fig. 2: High resolution bathymetry coverage in the Beagle CMR showing fine ridges between the Hogan Group and the Kent Group to the SE.

### References

Nil. No previous surveys have been reported from this area.

# Project D3 – Appendix 3 - Status and recovery of deep-sea coral communities on seamounts in the iconic Huon and Tasman Fracture Commonwealth Marine Reserves

### Project summary

Australia has gazetted an ambitious national network of Commonwealth Marine Reserves that includes the iconic Huon and Tasman Fracture reserves off Tasmania where seamounts (‘undersea mountains’) support unique deep-water coral reefs. These reefs are among the most bio-diverse globally.

Protection of deep-water coral reefs is a high-priority conservation concern nationally and internationally because deep-water corals are very fragile, easily impacted by human activities including bottom trawling, and are believed to recover very slowly. These corals may also be highly vulnerable to climate change because projected changes in water chemistry could limit the ability of corals to build calcareous skeletons.

Despite these concerns, and Australia’s significant investment in marine conservation, several fundamental ecological issues remain to be evaluated. These include defining the spatial extent of deep-sea coral communities inside and outside the Tasmanian reserves, and evaluating the resilience of the communities to bottom trawling. This information is important to understanding the dynamics of deep-sea communities globally, and for further developing and implementing Australia’s conservation management plans.

A 26-day survey aboard RV Investigator will determine the spatial extents of deep-sea coral communities in and adjacent to the Huon and Tasman Fracture reserves, and quantify changes in the communities by comparing samples taken in 2018 to samples taken, using similar methods, in 2007 and 1997. There will be supplementary sampling on the heavily trawled St. Helens Seamount which was surveyed in 2008, and analysis of comparable data from New Zealand. Remarkably, these are the only two sets of replicated surveys encompassing areas of contrasting conservation status and impact history in the world’s oceans.

Our results will be novel and significant by providing world-first recovery and resilience data to the Australian government and other national and international bodies that will help achieve effective monitoring and management actions to enhance the long-term survival probabilities of deep-sea corals.

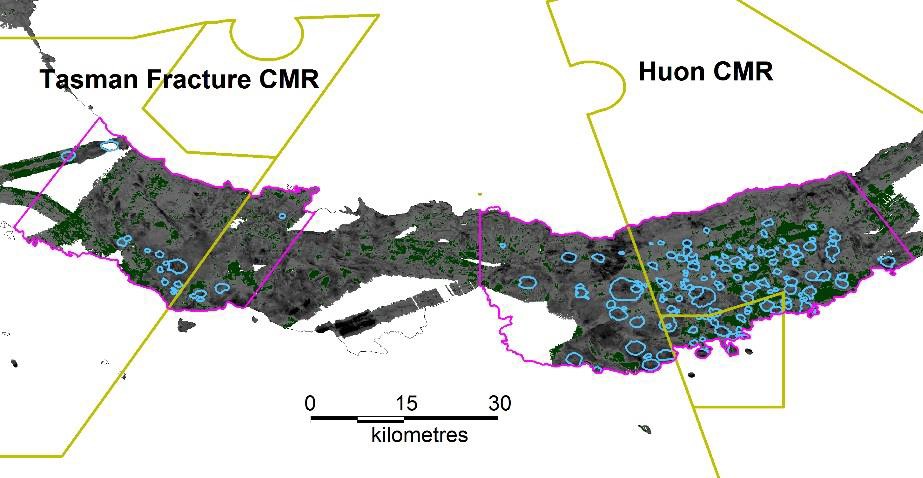


Figure 1. The two survey areas (pink boundaries) representing the areas containing the clusters of seamounts (blue outlines) off southern Tasmania, and bounded by the 500 and 2000 m isobaths. Map underlay shows high resolution MBS data coverage in the 500-2000 m depth zone.

Six types of sampling will occur: (1) Multi-beam sonar mapping of gaps in study area coverage; (2) Towed camera surveys of seamount and non-seamount areas to ground-truth predictive maps of coral community distributions; (3) Repeat towed camera surveys of previously sampled seamounts to extend the time-series dataset on the recovery trajectory of deep-sea coral communities; (4) CTD sampling of water chemistry; (5) BOAGS static camera deployments for very close and high resolution imagery, including of arrays of settlement plates on the ‘Sisters Seamount’; (6) Beam trawl and benthic sled collections of fauna to improve taxonomic understanding of the fauna, and to provide tissue samples for related studies.

### Planned outputs

The distributional extent, habitat associations, composition, biodiversity, and biological traits of deep-sea coral communities off Tasmania, both inside and outside the Huon and Tasman Fracture reserves, will be determined and mapped for the first time. This information will contribute to a status report on coral communities and provide context for the recovery study. The status report and an understanding of changes in coral communities through time will inform future planning by the Australian and other management agencies to monitor and manage deep-sea coral reefs as conservation assets. Our results also have international relevance to understanding and managing fishing impact on comparable deep-sea coral communities, including in High Sea areas beyond national jurisdictions.

New data will be combined with previous surveys of the seamounts in the Huon and Tasman Fracture CMRs in 1997 and 2007, the St. Helens Seamount in 2008, and parallel New Zealand studies in 2001, 2006, 2009 and 2015, to address three broad objectives:

1. Determine the extent, ecological characteristics, and conservation status of deep-sea coral reefs on Tasmanian seamounts inside and outside of existing reserves.
2. Measure recovery trajectories and dynamics of deep-sea coral communities (multi-species and successional changes) following cessation of bottom trawling.
3. Provide the first set of empirical data on conservation status, resilience and recovery potential to enhance management and conservation of deep-sea coral habitats nationally.

### Researchers and staff

There are opportunities to include NESP Hub staff, including students, in addition to staff listed below:

Alan Williams, Scott Foster, Franzis Althaus, Ron Thresher (CSIRO): establishing and managing the overarching project; designing and implementing the field survey; acquisition, analysis and write up of data, especially those related to climate change; spatial predictive modeling

Nic Bax (CSIRO/ UTAS): input to, and oversight of, the project’s links with stakeholders – especially Australia’s Dept. of Environment and Energy – and with the NESP Biodiversity Hub.

Malcolm Clark (NIWA): lead role in the acquisition, analysis and write up of data, especially those related to the complementary datasets from New Zealand.

Neville Barrett, Nicole Hill (UTAS): marine ecology and Hub linkage; spatial predictive modelling Tim O’Hara (MV): deep sea biodiversity

Karen Miller (AIMS): coral ecology

Thomas Schlacher (USC): lead role in the acquisition, analysis and write up of data, especially those related to the faunal recovery objectives.

### Resources

26 days on RV Investigator are secured (22 Nov to 17 Dec, 2018) (26 days @ 129K = 3.354 M); the proposal was reviewed by, and has strong support from, the Department of Environment and Energy

NESP contribution: 415K: initial estimate - 50% of 3 FTE (e.g. pre-survey predictive mapping, survey implementation, post survey analysis, reporting, outreach, peer-reviewed papers) plus consumables

Co-investment by CSIRO and NIWA: agreed in principle

# Project D3 – Appendix 4 - Assessment of ecological assets and condition of shelf habitats in the Hunter CMR

**Project Timeframe:** January 2018 - December 2019

**Project Leaders:** Alan Jordan, Peter Davies, Neville Barrett

**Project Partners:** NSW OEH, NSW DPI, University of Tasmania

### Indicative project cost

$106K NESP cash contribution in each of years 1 and 2 with matching in-kind for NSW DPI and OEH, with $100k NESP Cash contribution to UTas in 2019 with matching in-kind. Total $312,000.

### Project Summary

There is a significant and time critical need to support Parks Australia in the establishment of a baseline inventory and monitoring program for CMR networks, and ensure it is integrated within a broader national monitoring framework. Previous seabed mapping surveys of the mid-shelf areas of the Hunter CMR have identified areas of shelf rocky reefs. These reefs are recognised as a Key Ecological Feature but their extent is unknown and their biodiversity remain to be described. The proposed surveys will extend high resolution bathymetry and benthic invertebrate and fish sampling coverage across the CMR, targeting features such as the shelf rocky reefs and adjacent areas targeted by demersal trawlers. By facilitating national approaches, including a standards-based approach to collecting new marine data, the project outcomes will include key steps to assist Parks Australia to implement and initiate a CMR monitoring program, new knowledge to inform CMR management planning, a national integrated framework for SOE reporting, and strong collaboration between State-based and Commonwealth-based programs.

### Description of the problem

While work so far in theme D has improved our knowledge of the distribution of key biodiversity assets on the continental shelf within the Hunter CMR, the coverage represents a very small fraction of the marine park. In particular, the seabed habitats on the inner shelf of the CMR adjacent to mapped features in the adjacent Port Stephens Great Lakes Marine Park are expected to contain both extensive shelf rocky reefs and sand habitats that are regularly fished by both demersal trawl and ocean trap and line fisheries. There are also known features that are targeted by recreational fishers. Previous seabed mapping in the CMR in project D3 has identified such features, which differ in structure to the inshore reefs.

Much of the area of the mid-shelf in the Seal Rocks and Broughton Island region was considered during the CMR review process to provide a suitable area for the only no-take zone in the reserve, but information gaps on ecological assets and recreational and commercial values resulted in this area remaining as open to all activities.

This proposal aims to address these significant knowledge gaps in conjunction with the pressures assessment identified in the Hub proposal in Theme E that is examining recreational fishing in the region. It would also include an initial assessment on the potential impacts associated with demersal trawling in the mid shelf region of the CMR, and examine this in the context of ecological risk using established methodologies. The surveys would also allow further baseline information to be collected on the current condition of the shelf rocky reefs, with the adjacent PSGLMP no-take zones being used as the CMR reference sites. This includes an assessment of the significance of these habitats for threatened and protected species. This area provides a unique opportunity to conduct this condition analysis on reef fish assemblages on a shelf CMR in the temperate east region given the significant no-take zone datasets in state waters that can be compared. It would also allow a unique opportunity to compare reef fish assemblages using BRUVs with that landed in the recreational fishery in the related project in Theme E. Such a complimentary dataset would provide key information to inform short term needs on ecological assets and provide longer term data to inform future zonings to allow enhanced conservation outcomes for the Hunter CMR.

### Project Objectives

* Map and quantify the extent, distribution and structure of seabed habitats, fish and benthic assemblages in priority areas in the Hunter CMR using standard operating procedures
* Establish the condition of benthic invertebrate and fish assemblages on CMR shelf reefs
* Integrate data into a national framework (SOPs, spatial distribution), including:
  + Build further knowledge of KEFs and TEPs
  + Applying the SOPs and working within limits of targeted sampling platforms (e.g. towed video, BRUVs, ROVs)
  + Conduct discovery surveys that double as a baseline

### Project methods

The project proposes to implement are wide range of survey methods to map and quantify the extent, distribution and structure of seabed habitats, fish and benthic assemblages using standard operating procedures currently being developed in theme D. This includes:

* Bathymetry data and digital elevation models
* Habitat maps
* Habitat coverage estimates
* Assessment of fish assemblages using stereo BRUVs
* Mapping sponge dominated community distribution and abundance using ROV’s and AUV’s
* Application of SOE data and indicators to CMRs
* Integration and analysis of biological data, pressures data and climate/other models

### What solutions will the research provide

The project will work with DoEE, Hub partners and the wider research community to test and implement a minimum set of national standard approaches to collecting and analysing data for baselines and monitoring biodiversity in Australia’s marine estate with a primary focus on monitoring to inform management of the new CMR network and working with Parks Australia to facilitate implementation of a national CMR monitoring program. It will link these approaches to facilitate development of a broader, nationally integrated monitoring program, including strong partnerships with state-based programs.

Baselines/discovery, SOPs (MBES, BRUVs, towed video) and continuation of ongoing work in the only Temperate East CMR with significant shelf representation. It will build on existing knowledge developed during NESP studies to extend our understanding of shelf habitats across shelf waters, with a focus on benthic invertebrate and fish assemblages. We will also contrast condition between adjacent MPA/CMR on reef fish assemblages, with potential for co-management and monitoring. There will also be a focus on trawling impacts by contrasting habitats within the CMR shelf region open to trawling with similar habitats in adjacent waters where trawling is excluded.

### Planned outputs

The outputs for this project will include:

* + Survey report on design, methods and preliminary findings
  + High resolution bathymetry and acoustic backscatter data for targeted areas made available through the AODN
  + Underwater images of benthic invertebrate and fish communities
  + Habitat map(s) and coverage estimates representing the shelf rocky reefs KEF made available on the SeaMap Australia web portal
  + Detailed baseline information on invertebrate and fish communities in the CMR
  + Communication products (images, bathymetry flythrough) and data to made available through the NESP website
  + Publications in peer reviewed literature

### Staff - per calendar year

|  |  |
| --- | --- |
| Alan Jordan (NSW DPI) | 0.1 FTE |
| David Harasti (NSW DPI) | 0.1 FTE |
| Joel Williams (NSW DPI) | 0.6 FTE |
| Technical Officer (NSW DPI) | 0.1 FTE |
| Peter Davies (NSW OEH) | 0.1 FTE |
| Tim Ingleton (NSW OEH) | 0.1 FTE |
| Neville Barrett (IMAS) | 0.2 FTE |
| Jac Monk (IMAS) | 0.5 FTE |
| Justin Hulls | 0.5FTE |

# Project D3 – Appendix 5 – Survey Proposal: Benthic Habitats and Biodiversity of the South-west Corner CMR

*Project length – 2 Years*

*Project start date – 1/1/2019*

*Project end date – 31/12/2020*

*Project approval date - TBC*

*Project current status - In progress*

*Project Leaders – Tim Langlois/Gary Kendrick/Neville Barrett/Scott Nichol*

*Lead Research Organisation – (UTas, GA)*

*Project leader contact details: - timothy.langlois@uwa.edu.au/gary.kendrick@uwa.edu.au/* [*Neville.barrett@utas.edu.au /*](about:blank)*scott.nichol@ga.gov.au*

### Project Funding

Indicative at this early stage of proposal development. While the bulk of the project will be completed in 2020, some pre-planning, including for indigenous engagement will be needed in 2019.

|  |  |  |  |
| --- | --- | --- | --- |
|  | *2019* | *2020* | *TOTAL* |
| *NESP funding* | *UTas $20,000*  *UWA $20,000*  *GA*  *$10,000* | *UTas $130,000*  *UWA $130,000*  *GA*  *$165,000*  *Vessel charter (Agency independent) $100,000* |  |
| *Total NESP Funding* | *$50,000* | *$525,000* | *$575,000* |
| *Cash co-con* |  |  |  |
| *In-kind co-con* | *UTas $20,000*  *UWA $20,000*  *GA*  *$10,000* | *UTas $130,000*  *UWA $130,000*  *GA*  *$165,000* |  |
| *TOTAL* | *$100,000* | *$950,000* | *$1050,000* |

### Project Summary:

This project will undertake a field survey to build baseline information for benthic habitats in shelf waters of the South West Corner (SWC) CMR. It will apply a standard operating protocol (SOP)-based approach to inventory and monitoring as a model example of how such surveys should be undertaken more widely throughout the CMR network in shelf waters. The prioritisation of this CMR, and methods used, is based on (1) the need for additional baseline/monitoring within the south west CMR network as part of the current 10 year management plan; (2) known significant pressures, including recreational fishing (line) on discrete shelf reefs, (3) need for baseline biological data (except for limited BRUV drops there is virtually no quantitative knowledge of their presence/distribution of biota within the SWC CMR (see Figures 1-4) (4) potential for SOE reporting based on condition of targeted fish stocks (including recreational species) and habitats, and climate-related shifts in benthic species distributions; (5) significant alignment with state interest, including adjacent (conjoining) State Marine Park monitoring programs in Western Australia (Ngari Capes Marine Park); (7) potential for alignment with existing BRUV and Reef Life Survey monitoring programs with the State MP; (8) adjacent to existing survey in the Geographe Bay CMR that provides a template for the survey methods to be used; (9) potential for engagement with the indigenous communities in the region based on improved understanding of historical management of terrestrial areas, that are now below sea level, and marine resources.

The intent of the survey is to apply the core benthic SOPs being developed by the Hub for inventory and monitoring programs (e.g. multibeam sonar, autonomous underwater vehicle, baited remote underwater video, towed video).

There has been some limited previous multibeam seabed mapping of the area as part of Australian Hydrographic Office and Southern Surveyor/Investigator surveys, that indicate that the continental shelf area may be primarily dominated by soft sediments with some high-profile reef in the 30-150 m bathome within the CSW CMR (Figure 5). The reefs are recognised as a Key Ecological Feature (KEF) but their true extent is unknown and they remain undescribed from a biodiversity and ecological perspective.

While the majority of the continental shelf within the SWC CMR are proposed to be zoned either IUCN category IV and VI there are two distinct IUCN category II which means no fishing methods are not allowed (Figure 6). Hence, new surveys in this region will not only provide a biological baseline, but also establish a basis for a longer-term monitoring program, while undertaking a first assessment of the effectiveness of category IV and VI zoning for benthic habitat protection.

The proposed survey will produce a full coverage, high-resolution maps of representative habitats within the CMR, including areas of the rocky reef KEF, allowing these to be subsequently surveyed quantitatively using the SOP-based biological sampling activities, as developed in Project D2. Currently, proposed SOPs include MBES, AUV, BRUVs and TV to provide broad scale to fine scale quantitative descriptions of the habitats, assemblages and fish species that represent the CMR. Biological surveys will follow best-practice spatially balanced designs developed during the NERP Hub and refined under project D2 in the NESP Hub. Data processing and analysis will also adopt standard procedures (e.g. CATAMI for image scoring of AUV and TV derived imagery, SOPs for multibeam processing and BRUV processing).

### Proposed outcomes:

A successful demonstration of the utility of a nationally consistent approach to survey and inventory of shelf habitats in CMRs, with a focus on shelf reefs, leading to longer-term uptake by Parks Australia in a well-structured monitoring program.

Successful uptake of SOPs and incorporation of outputs into national databases, demonstrating a data acquisition and management pathway to be adopted by long-term CMR monitoring programs, as well as by all agencies involved in inventory and monitoring by SOPs in state and commonwealth waters (including oil and gas industries).

An improved understanding of the habitats and biota in a CMR region subject to significant human pressures (fishing), leaving to an improved capacity to adaptively manage these pressures to meet planned conservation outcomes.

Improved integration of CMR inventory and monitoring programs with state programs based around standard methods such as AUV and BRUV (e.g. as used in adjacent Marine Parks).

Improved ability to report into the SOE, via enhanced regional coverage, analysis of decadal-scale trends (AUV), and a focus on key reporting metrics such as biomass of target finfish species and lobsters (BRUVs and potentially limited lobster potting).

### Planned Outputs

The outputs for this project will include:

* Post survey report describing data acquired on the survey and preliminary interpretations, in a format to be used as an example reporting template for subsequent CMR surveys (similar to existing Tasman Fracture survey report)
* Acquired data contributed to national databases (e.g. AUV-Squidle+, BRUV- Global Archive, MBES –GA/AHO)
* High resolution bathymetry and acoustic backscatter data and maps for representative areas of shelf waters (including rocky reef KEF) within the Southwest Corner CMR
* Underwater images (video, still) of benthic invertebrate and fish communities
* Species inventory for observed and sampled biological specimens (epibenthic and infaunal)
* Habitat map(s) and coverage estimates representing the submerged reefs KEF and soft sediment habitats within representative waters of the Southwest Corner CMR, including sponge dominated low-profile reefs and higher profile reef ridges
* Qualitative model for the rocky reef KEF and associated soft sediment habitats within the Southwest Corner CMR
* Publications in peer reviewed literature
* Communication products (images, bathymetry flythrough) highlighting submerged reefs and associated biota. Published in the proposed MPA/CMR atlas and MBH website.

### Overall justification against requested additional criteria

1. Likely uptake of results by Parks Australia: High. As there is currently limited knowledge of the distribution of habitats and species within this CMR, the acquired knowledge will be essential to informing ongoing management planning and responses. More generally, by applying a broad set of SOPs specifically tailored to CMR monitoring, in a typical shelf setting representing the SW CMR network, the demonstration of the efficacy of such approaches will be of significant interest to PA in evaluating the merit of such approaches for use in the longer-term.
2. Contribution to a 10 year monitoring strategy. High. Benthic shelf habitats have been assessed as those most under anthropogenic pressure, most likely to benefit from CMR protection, and underrepresented in higher levels of protection with respect to other environments (slope, abyssal plains, seamounts). This survey will evaluate the effectiveness of SOPs specifically developed for benthic shelf habitats and their associated biodiversity in a regional context (SW CMR network), and form a component of a planned program intended to provide representative national coverage over a ten-year period. By also focussing on providing baselines in proposed category II protection zones in this CMR, and contrasting with adjacent areas open to fishing, it will allow future evaluating human impacts on these habitats and of the efficacy of current management strategies (e.g. Cat. II zoning) in time for future reviews of management plans. Finally, part of the 10 year strategy is to assist PA in meeting inventory and monitoring goals, and this survey does so, including inventory and baselines in a previously unsurveyed CMR, and providing an example survey design for similar shelf regions of the SW CMR network.
3. Opportunity for collaboration with industry partners. High. The Western Rock Lobster Council and the Department of Primary Industries and Regional Development are being consulted to develop an experimental design for sampling rock lobster using commercial pots, that will involve the deployment of POTBot’s to collect imagery of benthos and fish assemblages.
4. Science excellence. High. In addition to a commitment to science excellence through undertaking surveys based on Hub-developed SOPs and statistically-based sampling designs, and subsequent publication of these approaches and results in the primary literature, the survey will have a core focus on assessing human impacts on high and low profile reef fauna and flora, and the value of Cat. II protection zones.
5. Capacity of science communication from the survey to achieve high public interest. High. Many of the research activities lead to visually appealing communication products, including detailed bathymetric maps, BUV-based video footage, AUV based still and video imagery, and towed video imagery. In addition to public interest in the biodiversity values of waters near major tourist centres such as Ngari Capes Marine Park.

### Indigenous engagement

During survey planning, the project leaders will engage with local representatives from the West Australian indigenous communities - details to be confirmed once likelihood of survey funding is sufficient for engagement process to begin in earnest.

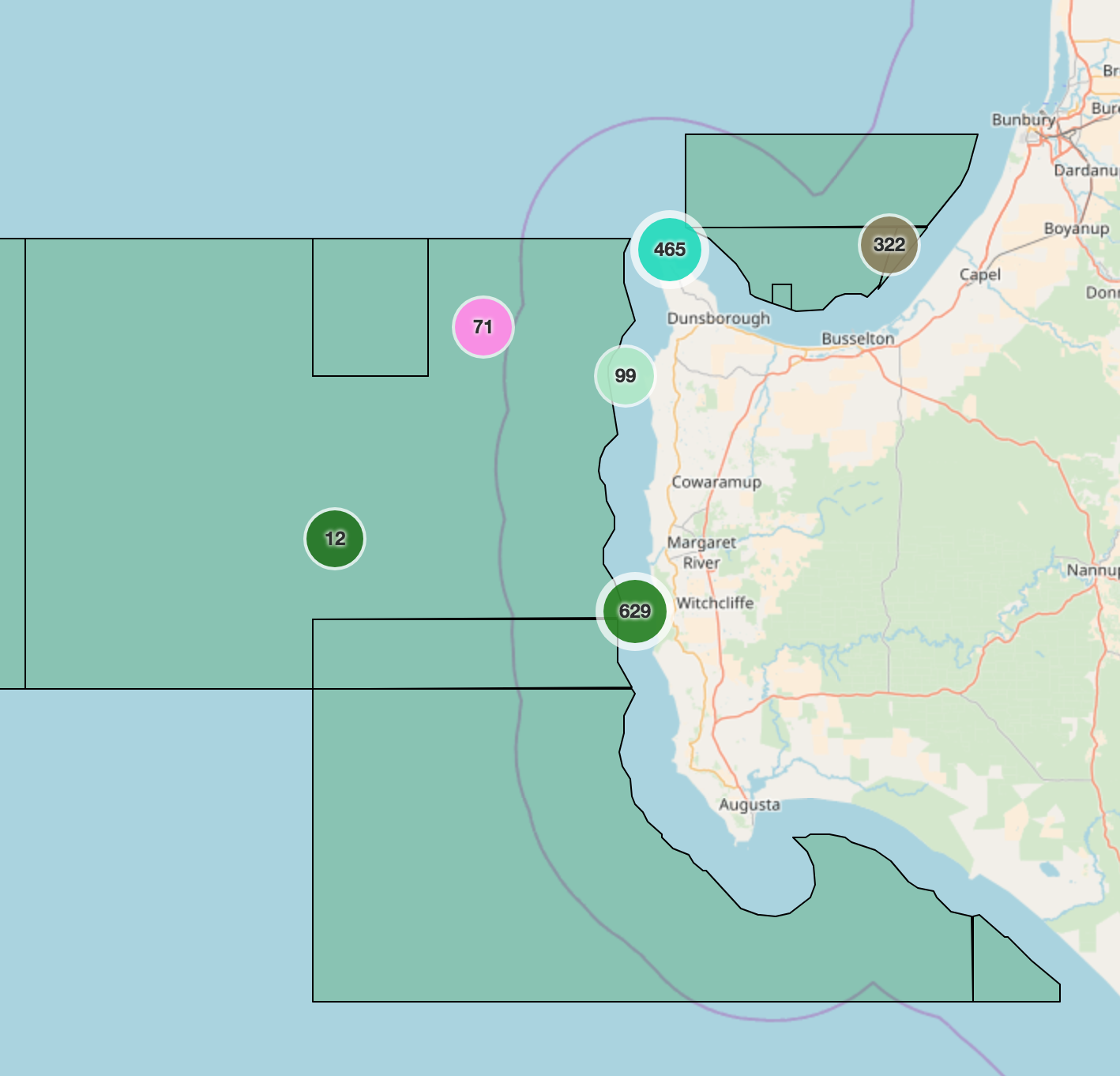
### Researchers and Staff

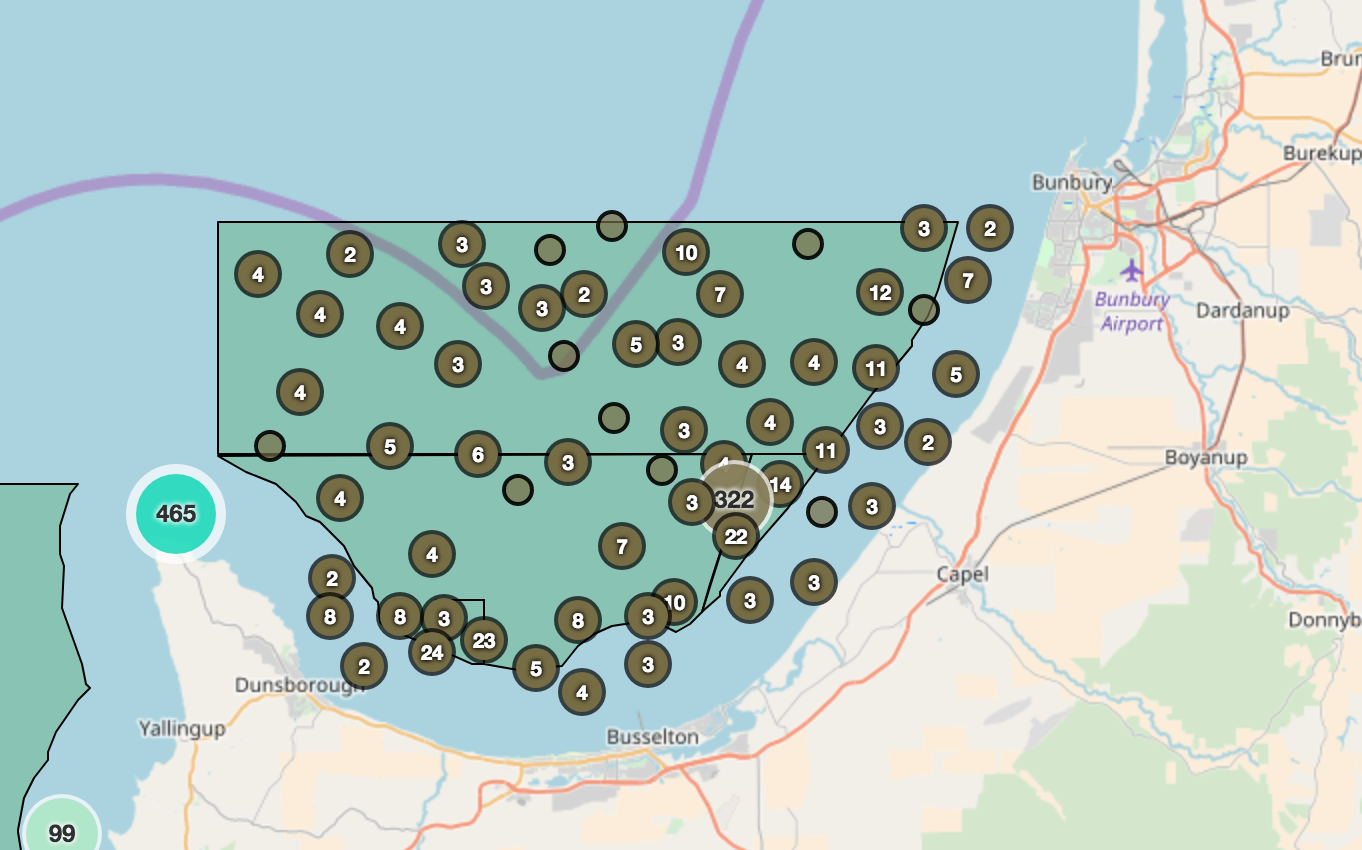
\* - denotes on survey

| Name | 2019 FTE | 2020 FTE | Organisation | Project Role |
| --- | --- | --- | --- | --- |
| Scott Nichol |  | 0.1 | GA | Project co-ordination, geoscience\* |
| Ian Atkinson |  | 0.15 | GA | Acoustics engineer/multibeam operations\* |
| Andrew Carroll |  | 0.05 | GA | Benthic ecology / SOPs |
| Zhi Huang |  | 0.05 | GA | Spatial analyst |
| Rachel Nanson |  | 0.1 | GA | Geomorphology interpretation |
| Kim Picard |  | 0.15 | GA | Seabed acoustics/geomorphology\* |
| Rachel Przeslawski |  | 0.05 | GA | Benthic ecology / SOPs |
| Justy Siwabessy |  | 0.15 | GA | Seabed acoustics/mapping\* |
| Neville Barrett |  | 0.3 | UTas | Project leadership, benthic ecology |
| Jacquomo Monk | 0.25 | 0.5 | UTas | Benthic ecology – AUV and BRUV |
| Gary Kendrick | 0.1 | 0.2 | UWA | Project leadership, benthic ecology |
| Tim Langlois | 0.25 | 0.5 | UWA | Benthic ecology – AUV and BRUV |
| Mike Taylor | 0.5 | 1.0 | UWA | Technical support |
| Justin Hulls |  | 0.5 | UTas | Technical support AUV and potentially ROV |
| Scott Foster |  |  | CSIRO | Statistical support (from D2) |

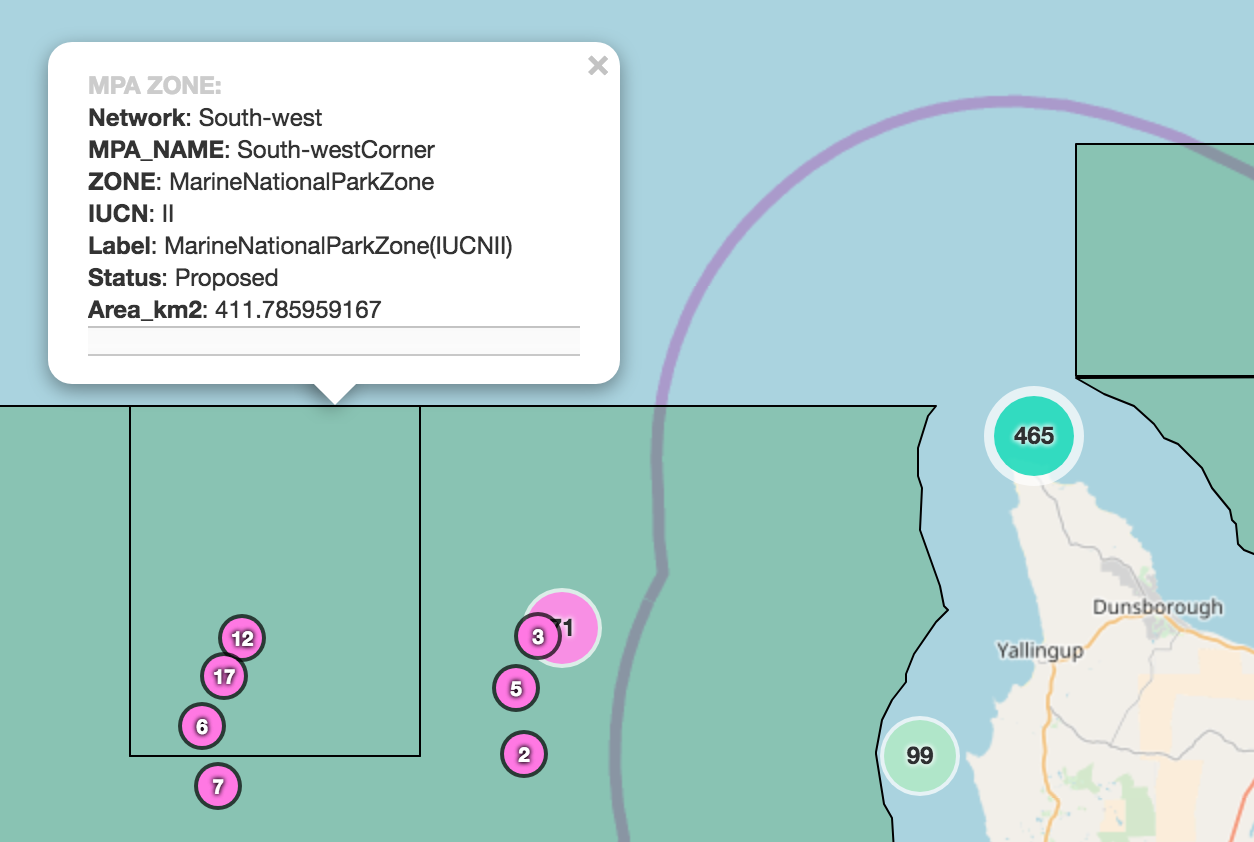
### Co-contributors

|  |  |  |
| --- | --- | --- |
| Name | Organisation/ | Contribution |
| Stefan Williams | USyd/IMOS | AUV facility support-IMOS |

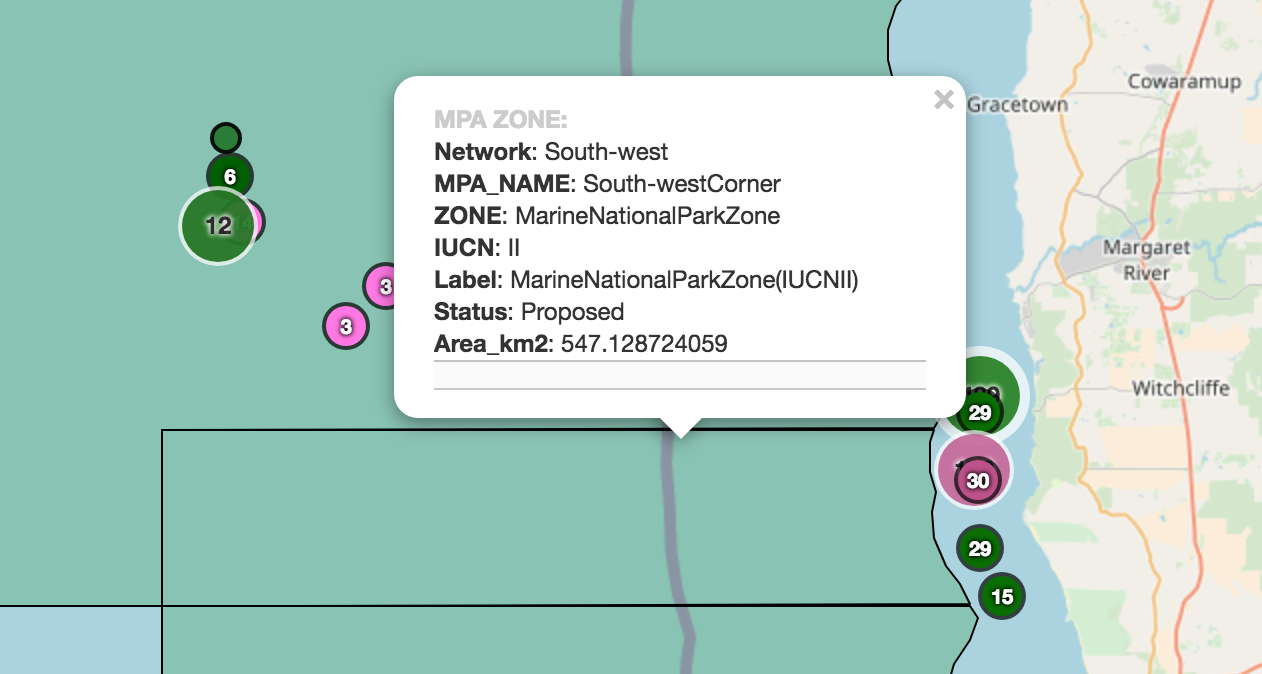
**Figure 1: Overview of BRUV sampling in and around the SWC CMR.**



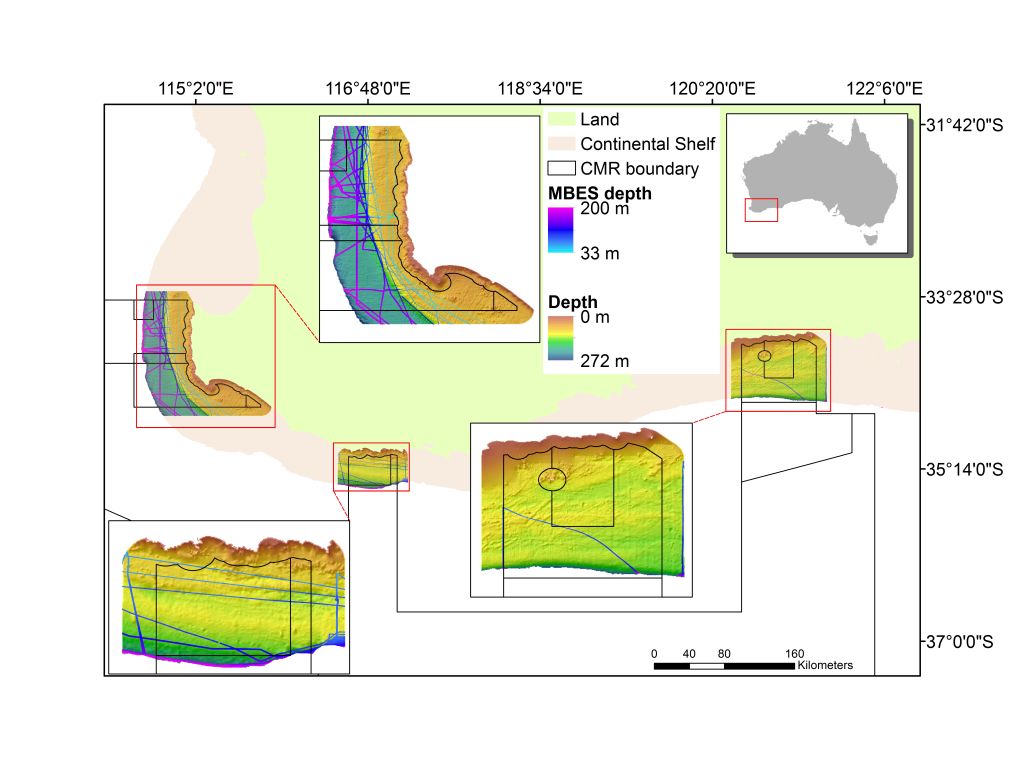
**Figure 2: Existing adjacent BRUV surveys in Geographe Bay CMR.**



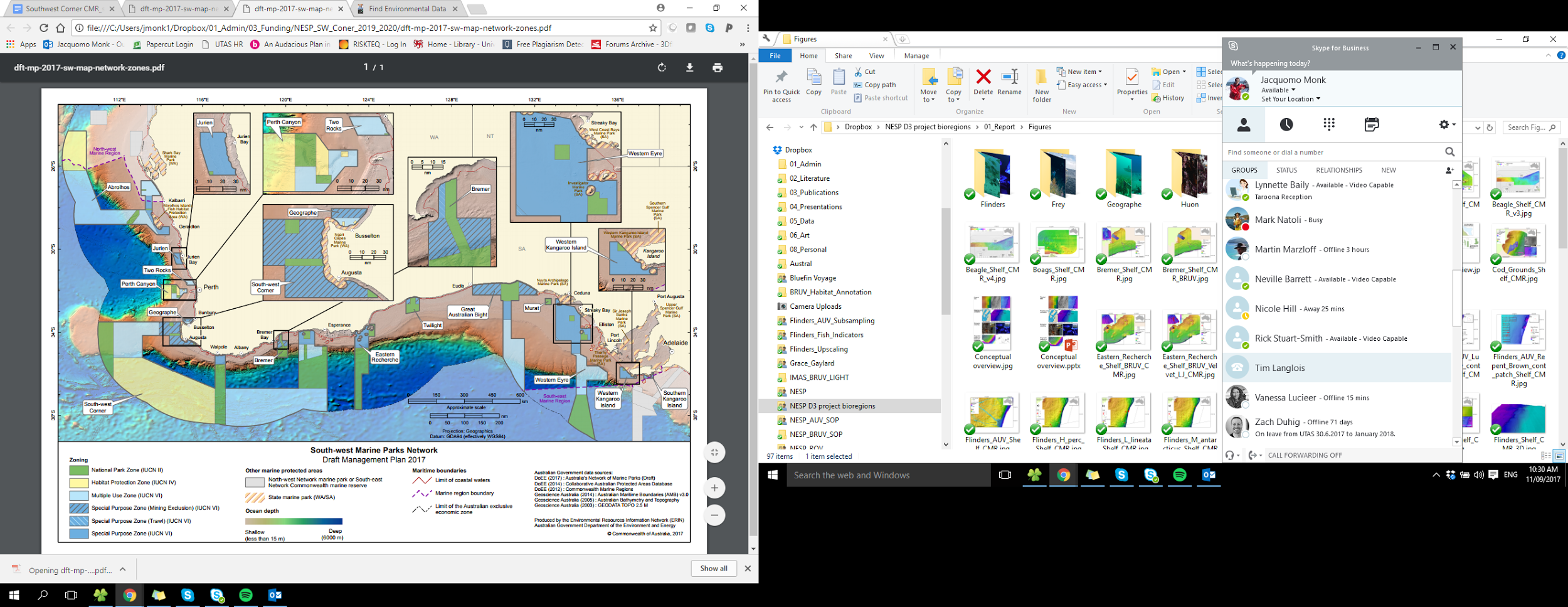
**Figure 3: Location of existing BRUV data in and around the proposed IUCN zone II offshore of Yallingup.**

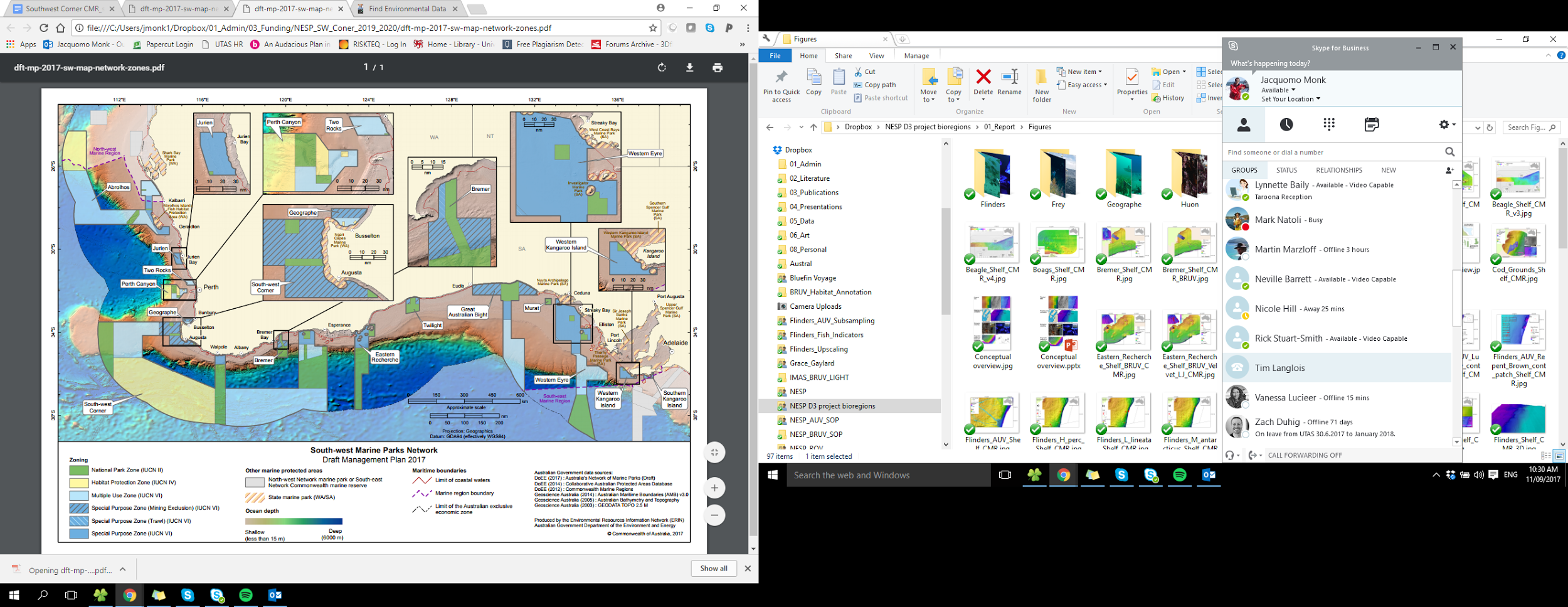


**Figure 4: Existing BRUV data adjacent the SWC CMR IUCN zone II offshore of Margaret River.**



**Figure 5: Map of the limited coverage of multibeam sonar mapping (MBES depth: pink to blue colour ramp) overlaid on coarse bathymetry data based on the 250 m Australian Bathymetry grid (depth: red to blue) within the SWC CMR.**



**Figure 6: Map of draft protection zones within the SWC CMR.**

# Project D3 – Appendix 6 – Survey Proposal: Initial Baseline Survey of Deepwater Fish in the Ningaloo CMR

Project length – 18 months

Project start date – 1/8/2017

Project end date – 31/1/2019

Project approval date - TBC

Project current status - In progress

Project Leaders – Russ Babcock, Mat Vanderklift, Tim Langlois

Lead Research Organisation –CSIRO, UWA

Project leader contact details: - CSIRO Oceans and Atmosphere, EcoSciences Precinct, GPO Box 2583, QLD 4001. [russ.babcock@csiro.au](mailto:russ.babcock@csiro.au)

### Project Funding

***NOTE: This project is now proposed for 2019 to 2020, with overall budget as per the D3 project proposal. The table below has yet to be adjusted to reflect this.***

|  |  | 2019 | 2020 | TOTAL |
| --- | --- | --- | --- | --- |
| NESP funding | CSIRO  UWA | $81,035  $37,961 | $153,297  $75,921 | *$234,332*  *$113,882* |
| Cash co-con |  |  |  |  |
| In-kind co-con | CSIRO  UWA | $81,035  $37,961 | $153,297  $75,921 | *$234,332*  *$113,882* |
| TOTAL |  |  |  | $696,664 |

### Project Summary

The Ningaloo Commonwealth Marine Reserve (NCMR) lies offshore and adjacent to the state-managed Ningaloo Marine Park (Figure 1). The reserve extends for ~300 km along the west coast and the depth ranges from 50 to 500 m. The NCMR is zoned IUCN Category II – Recreational Use Zone and no commercial fishing is permitted. However, an increasing number of recreational fishers are choosing to move offshore from the state managed Ningaloo Marine Park into the deeper waters of the NCMR. This is concerning because very little is known about the composition and abundance of demersal fish the habitats and depths encompassed by the Commonwealth reserve. It is also one of the few Commonwealth Marine Reserves readily accessible to recreational fishers (the distance from the recently enlarged Tantabiddi boat ramp to the NCMR is as little as 10 km).

We propose a non-extractive survey to establish baseline composition and abundances of fish in the NCMR, and align this with standardised surveys of fishing effort. Our team has been strongly engaged in research in the Ningaloo Marine Park (State waters) since 2006, compiling detailed time series of abundance and composition for shallow water habitats of Ningaloo, and we have research programs on the ecology of targeted fish species and megafauna (including whale sharks and turtles). We work closely with WA DPaW and DoF (now DPIRD) to ensure our information is relevant, and we can leverage on existing data and efforts such as re-surveying IMOS AUV sites within the CMR in 2017. We would link the deepwater research with our other research programs on shallow reefs and the ecology of megafauna to maximise the benefits of the research program. We will also leverage on a voyage of the MNF in October 2017, which will transit through the NCMR and will collect high resolution multibeam data for the 125m ancient shoreline isobath during transit. The survey will employ Standard Operating Procedures for all mapping and sampling activities, as developed in Project D2.

The project will execute each of the pre-conditions, as follows:

* *Validate SOPs*: The project will implement and validate existing SOPs, including those for towed video and BRUVs
* *Legacy Data*: Some BRUV and AUV data for deeper areas of Ningaloo were collected in 2013 in the 40-60m depth range (collected by DPaW in collaboration with CSIRO and UWA) and some earlier samples collected in the CMR (UWA WAMSI project). We will be able to re-survey many of these sites to leverage the benefits from the baseline data they provide, as well as deploying BRUVs in deeper water.
* *Leverage off existing initiatives*: We will leverage off existing work being conducted through Ningaloo Outlook (multibeam, tow video and Starbug and IMOS AUVs), and the MNF cruise (multibeam). We will use and extend the data provided by these programs.
* *Science communication*: CSIRO O&A has established a web page for the research conducted at Ningaloo (research[.csiro.au/ningaloo)](http://www.csiro.au/ningaloo)), and through the Ningaloo Outlook project we have established strong links with online, radio and print media.

We will also meet the over-arching-objectives:

* Excellence in science: The project will use best practice science, including new tools in analysis of deepwater habitats and deepwater BRUVs.
* Meet needs of CMR network: We aim to explicitly address a key knowledge gap in the establishment and management of the CMR network, namely the effects of fishing on the deep (i.e. beyond diving depths) fish assemblages. We will do this by establishing a baseline and comparing to existing data and trends. The work will also address knowledge gaps relating to the Ancient Shoreline KEF
* Long-term data collection: CSIRO has been studying the fish assemblages of shallow reefs at Ningaloo since 2006, and it is through the depth of insights gained through this research that we have developed the understanding necessary for this project, including the knowledge that recreational fishers are increasingly moving further offshore.
* Cost-effectiveness: Through leveraging off existing activities we have developed a highly cost effective survey program.
* Multidisciplinary: The research to be conducted will include habitat mapping through multibeam and tow video as well as characterisation of fish assemblages associated with those habitats through BRUVs. The project will also have tight links with research into the patterns of recreational fishing at Ningaloo and the behaviours that influence those patterns.

### Planned Outputs

The outputs for this project will include:

* Post survey report describing data acquired on the survey and preliminary interpretations;
* High resolution bathymetry and acoustic backscatter data and maps for deepwater reefs within Ningaloo CMR;
* Underwater images (video, still) of benthic communities, demersal and pelagic(tbc) fish assemblages;
* BRUV data from 200 sites to provide initial baseline data on fish assemblages of shelf-break habitats in the eastern Ningaloo CMR;
* Publications in peer reviewed literature;
* Communication products (images, bathymetry flythrough) highlighting submerged reefs and deepwater fish communities. Published on the North-west Atlas and MBH website.

Researchers and Staff

| Name | 2019-20 FTE | Organisation | Project Role |
| --- | --- | --- | --- |
| Russ Babcock | .1 | CSIRO | Project Leader, |
| Mat Vanderklift | .1 | CSIRO | Benthic ecology |
| Tim Langlois | .1 | UWA | BRUV and fish ecology |
| Emma Lawrence | .25 | CSIRO | Sampling design and biostatistics |
| Mick Haywood | .25 | CSIRO | BRUV and fish ecology |
| Stuart Edwards | .1 | CSIRO | Acoustics engineer/multibeam operations |
| Karl Forcey | .3 | CSIRO | Benthic video sampling |
| TBC | 1.2 | UWA | Video analysis |
| Mark Tonks | .2 | CSIRO | BRUV sampling |
| Mike Taylor | .2 | UWA | BRUV sampling |
| Simon Collings | .45 | CSIRO | Multibeam analysis and habitat modelling |
| Anthea Donovan | .15 | CSIRO | co-ordination |
| TBC | .4 | CSIRO | Tow video analysis |
| **TOTAL** | 2.3+1.5 |  |  |

Co-contributors

| Name | Organisation/ | Contribution |
| --- | --- | --- |
| Di McLean | UWA | BRUV and fish ecology |

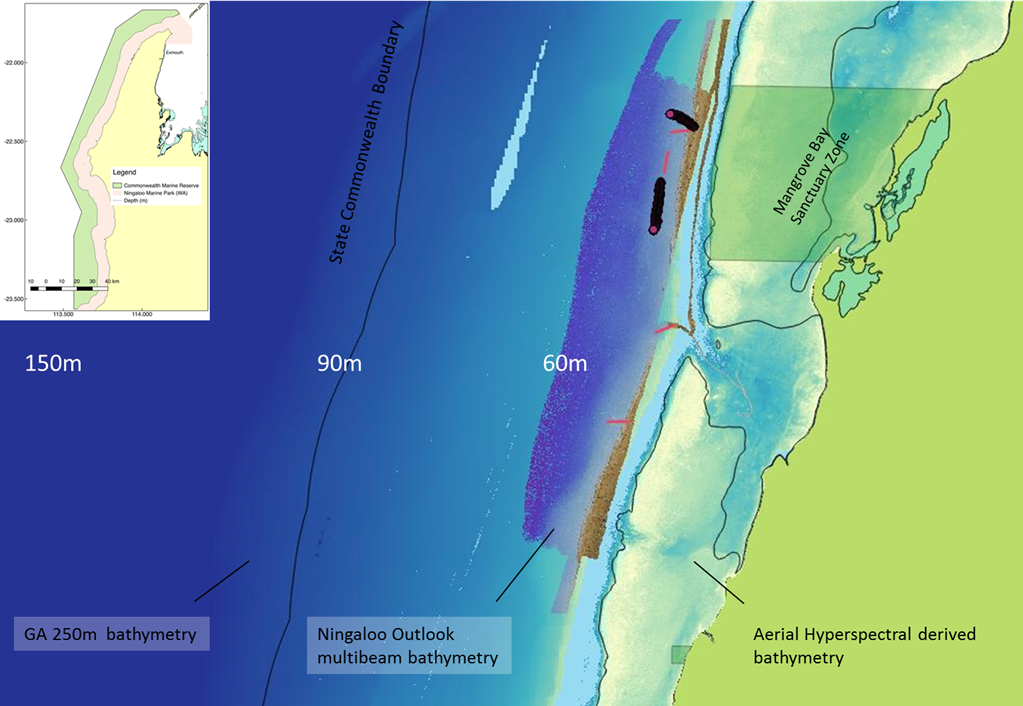
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Figure 1. Map of Mangrove Bay area of Ningaloo demonstrating current bathymetry layers and depth ranges across Commonwealth and State marine parks. Inset: Map of the Cape Range showing the location of the Ningaloo Commonwealth Marine Reserve and the Ningaloo Marine Park.

## Project E1 – Guidelines for analysis of cumulative impacts and risks to the Great Barrier Reef

*Project length*: *1year*

*Project start date*: *1/1/2018*

*Project end date*: *31/12/2018*

*Project current status*: *To be approved under RPV4*

*Co-Project Leaders:* *Piers K. Dunstan and Jeffrey M. Dambacher (FTE – 30% & 30%)*

*Lead research organisation*: *CSIRO*

*Project leader contact details:* [*Jeffrey.Dambacher@csiro.au*](mailto:Jeffrey.Dambacher@csiro.au)*, 03 62325096*

[*Piers.Dunstan@csiro.au*](mailto:Piers.Dunstan@csiro.au)*, 03 6232 5382*

# Project Funding and Expenditure

***Project funding table***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *2018* | *2019* | *2020* | *2021* | ***TOTAL*** |
| *NESP funding* | *350,000* | *x* | *x* | *x* | *350,000* |
| *Cash co-con* | *0* | *x* | *x* | *x* | *0* |
| *In-kind co-con* | *411,000* | *x* | *x* | *x* | *411,000* |
| ***TOTAL*** | ***761,000*** | ***x*** | ***x*** | ***x*** | ***761,000*** |

***Expenditure statement***

Funding will be used for FTE of project staff and operational costs for stakeholder workshops.

Current NESP funding split will be

Project Management, workshops and reporting

CSIRO 50K +50K In-kind

Guidance for analysis of cumulative impacts and risk

NSW DPI $ 60K + 60K In-kind

CSIRO $90K + $90K In-kind

AIMS $10K + $10K In-kind

Total 160k and 160k in-kind

GBR and Coral Sea reefs case study

UTas $140K + $201K In-kind

# Project Description

### Project Summary

The project will develop guidance for the analysis of cumulative impacts and risks to the environmental, social and economic values of the GBR. The project will use existing information to develop guidance for use by GBRMPA, DoEE, the Queensland Government and proponents of future development proposals. The project will build on the work undertaken in the GBR Strategic Assessment and support works undertaken under the Reef 2050 plan. The guidance will provide a practical science-based approach to assessment of cumulative risks to the Reef. Research will focus on providing a general and repeatable approach to be applied at the whole-of-reef scale (to meet planning, assessment and reporting requirements of the GBRMPA) and also at the development-site-scale (to meet the environmental assessment requirements of the GBRMPA and future proponents). The guidance will be developed in close collaboration with the GBRMPA and DoEE to ensure it is practical and compatible with relevant legislation and policy applicable to proposed actions within the GBR. The project will include a case study focused on attributing impacts of pressures and their cumulative impacts on shallow-water coral reefs of eastern Australia (including cumulative impacts for the whole-of-GBR). It will also examine how this could be applied to shallow temperate reefs follow recent risk assessments conducted in NSW. Research is primarily designed to meet the specific needs of GBRMPA and future proponents. NSW DPI, QLD Government and Parks Australia, may also benefit from the case study and insights to assessment of cumulative impacts.

### Project Description

#### Problem Statement

Existing guidance and standards for assessing cumulative impacts to the marine environment are typically high-level allowing for considerable variation in approach, cost and outcomes from assessments. While GBRMPA and DoEE provide guidance to proponents on how to assess potential impacts of proposed activities, and GBRMPA has recently released a draft cumulative impact policy, these are high–level documents will little operational detail about how to approach the assessment of cumulative pressures and impacts to the Reef. These approaches are well intended but fall short of meeting the current needs of managers and proponents, and there is an identified need for guidance on how to properly assess cumulative impacts across a broad range of circumstances and settings. High-level guidance on assessing cumulative impact needs to be supplemented with science-based approaches that are practical and repeatable and can be understood by both regulators and proponents.

#### How Research Addresses Problem

The research aims to complete four tasks within the year.

* To develop guidance for assessing cumulative risks and impacts on the GBR.
* To demonstrate application of the guidance for assessing cumulative risk and impacts on the GBR, including how it accommodates scale issues and provide technical advice on appropriate methodologies.
* To investigate options for how social and economic values can be better integrated into analysis of, and guidance for, ecological impact and risk
* To complete a case study focused on attributing impacts of pressures and their cumulative impacts on shallow-water reefs of eastern Australia (including cumulative impacts for the whole-of-GBR) demonstrating the methodologies outlined in the guidance

#### Description of research

* Guidance development stage

The guidance development stage of the project will be progressed with close collaboration between researchers, the GBRMPA, DoEE ESD and relevant industry and QLD government stakeholders. The guidance will be developed to ensure that it is compatible with the approaches outlined in the Integrated Monitoring Framework as applied by RIMREP.

The guidance will be shaped by the management/regulatory use-cases (e.g. reef planner, reef regulator and proponent), the varying levels of complexity of interactions between values and activities, data availability and levels of certainty, for example providing guidance for how to deal with:

1. Data poor areas where there is high uncertainty (e.g., poorly known populations or habitats and other MNES within the GBR).
2. Areas with intermediate levels of data, or mixtures of different types of data (e.g., where there is existing recreational activity linked to the values of different zones).
3. Areas with high levels of data and good understanding of social and economic values where more quantitative methods can be tested (e.g., shallow reef systems of the GBR).

The guidance will need to need to accommodate assessment at different spatial scales, corresponding with the scales at which GBRMPA manages and make decisions, for example

1. At a Plan of Management (POM) scale - The POM scale will support assessment of broad scale impacts, including frequent low level impacts and seascape scale pressures such as climate change.
2. At a site specific scale for assessment of proposed activities -the site scale will support assessment where specific new developments are occurring (e.g., Public Environment Reports or Environmental Impact Statements).

The guidance will be developed so that a triage-type approach can be taken for the analysis of new impacts to allow rapid screening of low risk activities, moving to detailed analysis for high risk activities. This approach will provide a more practical means to implement EPBC significant impact criteria for matters of MNES. It will also assist GBRMPA to develop cumulative risk-based assessment process to prioritise protection and plans of management actions. The guidance will include options for how social and economic values can be better integrated into analysis of cumulative impacts and risk. It will be tested with key user groups and stakeholders to establish a practical set of procedures that can be implemented across the range of circumstances encountered in the GBR. For example, in state and Territory jurisdictions (e.g., Integrated risk assessments are a key need across marine and terrestrial parks, New South Wales has recently developed and implemented a Marine Estate Threat and Risk Assessment Report) or for management of Australian Marine Parks.

* Guidance development informed by data analysis case study

The guidance development phase will include a study of analytical approaches to test and demonstrate the effectiveness of the approaches. This will be undertaken by collating and combining data on the most important pressures identified across the Coral Sea coral reef systems and the Great Barrier Reef, with detailed quantitative data on shallow reef biodiversity. This case study will use the rich ecological datasets available from the Reef Life Survey and AIMS LTM programs related to spatial footprint and levels of impact associated with identified pressures. Fishing pressure is one of these pressures, and will be investigated through new collation of existing charter fishing vessel AIS data and recently collected recreational fishing effort collected for the Great Barrier Reef. Climate change is another key pressure, to be investigated using ‘before-after’ data from the 2016 bleaching event. Impacts of extreme climate events will be assessed, and risk forecast, using observed spatial patterns in community composition (which provides an indication of local vulnerability to species loss, as identified in project C2), in combination with forecasts of marine heatwaves through the ESCC Hub project on Decadal Forecasting. COTS and water quality are additional key pressures that may be of possible significance in these analyses. The case study will provide a valuable means to assess whether the risk assessment framework can correctly identify cumulative impacts or attributed changes to pressures.

* Links to past and current research

The GBRMPA Draft Cumulative Impacts Policy articulates the need for effective approaches to assessing cumulative risks and impacts to fulfil Reef 2050. More specifically, it calls for operationalising the approach to cumulative impact assessment laid out in the strategic assessment for the GBRWHA. These two documents set the policy context for this research project. The project team is building on considerable experience in this area and is well positioned to carry this research forward. Specific experiences include:

* + Co-project leader JMD provided a general approach and methodological strategy to understand and assess cumulative impacts that was adopted and implemented within the GBRWHA Strategic Assessment (SA).
  + Co-project leader JMD, with AIMS researchers, conducted a supporting research project to the SA, in which they developed a systematic approach to assess cumulative impacts and apply structured decision making across jurisdictions from activities and developments within and adjacent to the GBRWHA.
  + Co-project leader JMD, along with NERP Hub researchers, in another supporting research project to the SA, developed the Integrated Monitoring Framework for the GBRWHA. This Framework laid out the general principles and procedures required for effective monitoring in the GBR, and is foundational for the Reef Integrated Monitoring and Reporting Program (RIMREP). JMD is currently assisting the implementation of this Framework as a RIMREP co-chair.
  + Co-project leader PKD had lead NESP MBH project focused on National Collation of Pressures, Understanding of How Values Inform Risk and Impact Analysis and Options for Assessing Cumulative Impacts (NESP MBH Projects C1). The pressure data collated through this project is being used by MBH researchers to support their work on the status and trends of biodiversity.
  + The project will incorporate understanding developed through project C2 on the impacts of pressures on shallow reef systems to inform the case study.

NESP 2017 Research Priority Alignment

This project aligns with:

* *consider the impact of climate change in the research design, delivery and recommendations, as appropriate*

Climate change remains one of the most significant pressures on the Marine Environment and may be especially pervasive as its impacts are expected to often be cumulative to existing impacts. The project will coordinate with the ESCC Hub project on the development of Decadal Forecasting capability to include outputs from the Decadal project into the analysis of impact and particularly risk of future impacts on MNES. This will include approaches to analyse the direct, indirect and cumulative impacts.

**Maximising the efficacy of managing Australia’s marine environment**

* *Identify key social and economic values of the marine environment to build better stakeholder support and engagement in the management of marine and coastal environments*

The project will work with stakeholders to identify and populate a framework on the social values held within marine reserves and parks and the context of those values

**Improving our understanding of pressures on the marine environment**

* *Identify past and current pressures on the marine environment, and understand their impact to better target policy and management actions*

The project will specifically develop guidelines for the analysis of impacts of pressures, including direct, indirect and cumulative impacts on MNES. Past NESP projects have identified past and future pressures and this project will allow understanding of their impact. Further, this will allow other researchers within the Hub to apply common approaches, facilitating uptake by research end users.

* *Determine the causes of, and relationships between, pressures on the marine and coastal environment to inform government investment.*

Development of standard approaches to the analysis of impact and risk, including indirect and cumulative, on MNES, will allow clear understanding of the causes and relationships between pressures and marine biodiversity.

* Improved prediction of likely future pressures and their potential impacts on marine and coastal biodiversity and economic and social values to enable the mitigation of avoidable impacts.

Linking to the ESCC Hub will allow the integration of outputs from the decadal forecast program that will provide explicit forecasts on the future states of climate over the next 10 years. These forecasts can be added directly to the analytical approaches of this project.

**Meaningful and accessible information on the status and trends of key social and economic values associated with the marine environment**

* Meaningful and accessible information on the status and trends of key social and economic values associated with the marine environment.

The project will expand on a template to describe the social, economic and environmental values relationships that builds on the values that have already been described by DoEE and extends to include other values types.

Pathway to Impact

|  |
| --- |
| **Outcomes** |
| * GBRMPA will have practical science-based guidance for how to approach analysis of cumulative impact and risk for whole of reef scale * GBRMPA and developers will have practical science-based guidance for how to approach analysis of cumulative impact and risk for development site scale * A practical example for other jurisdictions, programs and settings for how to approach assessment of cumulative risk and impact. * Engagement and communication for this project will be planned and implemented consistent with the [Hub’s Knowledge Brokering and Communication Strategy](https://www.nespmarine.edu.au/system/files/Knowledge%20Brokering%20and%20Communictions%20Strategy%20version%201.1%20.pdf). |

| **Research-user** | **Engagement and communication** | **Impact on management action** | **Outputs** |
| --- | --- | --- | --- |
| Great Barrier Reef Marine Park Authority  DoEE- Environmental Standards Division  Queensland Government | Research-users were actively engaged in the development of the project plan in the last quarter of 2017. The plan has been progressively refined to ensure it is aligned to research user policies and needs.  There is strong history of engagement with GBRMPA through projects supporting its Strategic Assessment and rolling out of its Reef2050 plan. The project team will continue to engage research users in the further refinement and delivery of this project through workshops and multilateral meetings. | This project is specifically focused on delivering practical means to operationalise GBRMPAs cumulative impact management policy. | Guidance for assessing cumulative risk and impact assessment.  The guidance will provide a step by step process for each definition (as above) that can be used by regulators and detailed technical information and examples for proponents and scientists. |
| Parks Australia | Parks Australia requested a plain language summary of project to assist their planning, and also a case study report on the impacts in the GBR and Coral Sea. | Lessons and understanding developed can assist Parks Australia in operationalisation of their risk framework, and the case study will assist Park Australia in managing the Coral Sea Marine Park. | Plain English summary communicating the purpose, use and portability of the guidance.  Case study report on assessment of data on shallow coral reefs. |
| NSW Government | NSW Government has engaged in the development of the Project and is on the project team | NSW Government will use the lesson learnt to inform cumulative impact analysis in their marine estate. | Plain English summary communicating the purpose, use and portability of the guidance |
|  |  |  |  |
| **Additional outputs** | | | |

### Indigenous Consultation and Engagement

Indigenous consultation and engagement for this project will be undertaken in a manner that is consistent with the [Hub’s Indigenous and Participation Strategy](https://www.nespmarine.edu.au/document/indigenous-engagement-and-participation-strategy). This project is considered a category three project for Indigenous engagement. This means the knowledge generated in this project will be effectively shared and communicated between relevant Indigenous peoples, communities and organisations. The project leaders will consult with GBRMPA and NESP Tropical Water Quality Hub to determine the most appropriate mechanisms for sharing and communicating knowledge generated by the project.

Indigenous consultation and engagement contact:

Piers Dunstan

Ph: 03 6232 5382

Email: [Piers.Dunstan@csiro.au](mailto:Piers.Dunstan@csiro.au)

### Project Milestones

| **Milestones** | **Due date** | **Milestone Status** |
| --- | --- | --- |
| Project planning workshop with research-users and researchers | Feb 2018 |  |
| Agreed refinements to project plan based on workshop and followup discussions | March 2018 |  |
| Workshop to elicit options for technical guidance from stakeholders and researchers, held in Townsville. | May 2018 |  |
| Draft report - guidance for consultation | September 2018 |  |
| Case Study Report on GBR & Coral Sea reefs pressure analysis | December 2018 |  |
| Final report - guidance for analysis of cumulative impacts and risk | December 2018 |  |
| Plain English summary of guidance | December 2018 |  |

# Data Management and Accessibility

All project outputs (including data) will be made publically available in accordance with the NESP Data Management and Accessibility Guidelines. To facilitate a consistent standards based approach, the Hub has produced a [Data Management Framework](https://www.nespmarine.edu.au/system/files/MBH%20Data%20Management%20Framework%20v1.2%20-%2005Dec16_AO.pdf). The framework provides project leaders with clear directions on publishing metadata, storing data and satisfying requirements for open access to journal articles. Pressure datasets will be stored in a long-term secure storage, metadata will be created to meet the Marine Community Profile for metadata and published on the Australian Ocean Data Network Portal <http://portal.aodn.org.au/aodn/>, which is consistent with Reef 2050 Integrated Monitoring and Reporting Program requirements. An email will be sent to marinemetadata@environment.gov.au each time a data set is published.

Publications, reports, factsheets, maps and images will be made publically and freely accessible and available on the Hubs website http://www.nespmarine.edu.au.

The primary contact point for data and information management contact for this project is the project leader (see details in front page).

| **Project output** | **Data Management and Accessibility** |
| --- | --- |
| *Report outlining the terminology of different definitions of cumulative impact* | *Report will be made available through the Hub website and provided to research end users* |
| *Guidelines for analysis of direct, indirect and cumulative impacts* | *Report will be made available through the Hub website and provided to research end users* |

Location of Research

The GBR, Queensland and NSW state waters.

Project Specific Risks

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Risk to project** | **Potential impact on project** | **Risk rating (low, medium high, severe)** | **How will risk be managed?** | **Residual Risk after mitigation** | **Who is responsible for managing risk?** |
| The guidelines will not have broad support amongst MBH researchers and will not utilise all the expertise of Hub researchers | The guidelines will not be broadly applied to cumulative impact problems without broad support. | High | The development of the guidelines will have broad consultation and will explicitly build on existing work.  Objectives will be communicated early to all hub researchers.  The guidelines will be sent to partner representatives in the draft stage for independent review. | Low | Piers Dunstan |
| Failure to engage with research end users to ensure that needs are met | The guidelines of the project will be poorly aligned to the GBR cumulative impact guidelines | High | Project staff will consult with GBRMPA and DoEE to identify key individuals to provide advice for this project. Project team will maintain effective communication with these individuals. | Low | Jeff Dambacher |
| Loss or lack of coordination amongst partners | The approaches will not be applied across all partners and some partners will act independently. | Medium | Project team will hold monthly meetings to ensure that tasks for all project members are clear. | Low | Piers Dunstan |
| Failure to agree on a guidelines within the project constraints (time and budget) | The project team will not have sufficient time to coordinate inputs with MBH researchers. | Medium | The project team will engage early and often with Hub researchers and end users | Low | Jeff Dambacher |

Project Keywords

Cumulative, indirect, impact, risk

Project contacts

**Researchers and Staff**

| **Name** | **Organisation** | **Project Role** | **FTE** |
| --- | --- | --- | --- |
| Piers Dunstan | CSIRO | Project Lead/ Framework for Impact Assessment | 0.3 |
| Jeffrey Dambacher | CSIRO | Project Lead/Framework for Impact Assessment | 0.3 |
| Nadine Marshall | CSIRO | Social/economic Values | 0.1 |
| Alan Jordan | NSW DPI | Risk Assessment | 0.2 |
| Kate Thornborough | NSW DPI | Risk assessment and cumulative impacts | 0.5 |
| Rick Stuart Smith | UTas | Analysis of impacts | 0.7 |
| UTas Technical officer | UTas | Curation and management of reef and pressure data, mapping assistance | 0.3 |
| Graeme Edgar | UTas | Advisor | 0.3 |
| Ken Anthony | AIMS | Framework for Impact Assessment | 0.05 |

**Data Management**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Organisation** | **Email** | **Phone** |
| Piers Dunstan | CSIRO | [Piers.Dunstan@csiro.au](mailto:Piers.Dunstan@csiro.au) | 03 6232 5382 |

**Co-contributors**

|  |  |  |
| --- | --- | --- |
| **Name** | **Organisation/** | **Contribution** |
|  |  |  |

**Key Partners and Research End Users**

|  |  |  |
| --- | --- | --- |
| **Key Partners (organisation/program)** | **Name/s** | **Email (optional)** |
| CSIRO | Piers Dunstan/Jeff Dambacher |  |
| NSW DPI | Alan Jordan |  |
| UWA | Michael Burton |  |
| UTAS | Rick Stuart-Smith |  |

| **Research Users (program/section/branch/organisation)** | **Name/s** | **Email (optional)** |
| --- | --- | --- |
| **Primary Research Users** |  |  |
| Great Barrier Reef Marine Park Authority | Amanda Brigdale | Amanda.Brigdale@gbrmpa.gov.au |
| DOEE Environmental Standards Division | Karina McLachlan | Karina.Mclachlan@environment.gov.au |
| Queensland Government | Louise Smyth | Louise.Smyth@ehp.qld.gov.au |
| **Secondary Research Users** |  |  |
| Parks Australia | John Lloyd  Amanda Richley  Samantha Fox  Kate Mooney | John.Lloyd@environment.gov.au,  Amanda.Richley@environment.gov.au  Samantha.Fox@environment.gov.au  Kate.Mooney@environment.gov.au |
| NSW Department of Primary Industries | Natalie Gollan | natalie.gollan@dpi.nsw.gov.au |

## Project E2 – Characterising anthropogenic underwater noise to improve understanding and management of acoustic impacts to marine wildlife

*Project length*: 2 Years/0 Months

*Project start date*: 01/01/2018

*Project end date*: 31/12/2019

*Project current status*: To be approved under RPV4

*Project Leader*: David Peel (FTE – 30%)

*Lead research organisation*: CSIRO

Project leader contact details: [david.peel@csiro.au](mailto:david.peel@csiro.au)

03 6232 5179

# Project Funding and Expenditure

Project funding table

|  | *2015* | *2016* | *2017* | *2018* | *2019* | *2020* | *2021* | ***TOTAL*** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *NESP funding* | *x* | *x* | *x* | *$198,903* | *$202,952* | *x* | *x* | *$401,855* |
| *Cash co-con* | *x* | *x* | *x* |  |  | *x* | *x* | *x* |
| *In-kind co-con* | *x* | *x* | *x* | *198,903* | *202,952* | *x* | *x* | *$401,855* |
| ***TOTAL*** | ***x*** | ***x*** | ***x*** | ***$397,806*** | ***$405,904*** | ***x*** | ***x*** | ***$803,710*** |

Expenditure statement

The majority of the funding will be used on staffing. $140,000 is allocated to loggers, array building, fieldwork deployment and data processing. A small amount of funding covers publication expenses and travel (to engage with stakeholders/end-users and meeting between project team members as required).

Breakdown by partner NESP funding

|  |  |  |
| --- | --- | --- |
| **Partner** | **2018** | **2019** |
| AIMS | $37,844 | $37,844 |
| CSIRO  (sub-contracting to Curtin & Murdoch) | $21,059 | $25,109 |
| Curtin University | $90,000 | $90,000 |
| Murdoch University | $50,000 | $50,000 |

# Project Description

Project Summary

Shipping noise is a marine pollutant that contributes significantly to the marine soundscape and is a stressor of marine animals, particularly marine mammals. In Australia, the characterisation and actual impacts of shipping noise on species behaviour are not clearly understood and information is needed. This research will provide quantitative spatial and temporal maps of shipping noise to inform on noise exposure and impacts to MNES within the EEZ and in WHA’s. The outputs will provide key information to marine management agencies such as DoEE, AMSA and GBRMPA to help them meet responsibilities and obligations under international and national law and policy to minimise the impacts of shipping noise on MNES.

Project Description

#### Problem

There have been significant global increases in anthropogenic underwater noise over the past century from a range of sources, such as commercial shipping, oil and gas exploration, recreational and military sound sources. Many marine animals, and especially marine mammals, rely on sound for short and long range communication, mating, foraging, navigation and predator avoidance. Sound exposure may affect the ability of the animal to detect sounds that are biologically meaningful or it may impair hearing mechanisms either temporarily or permanently. An increasing body of research over the past few decades has demonstrated anthropogenic noise can impact marine animals, which can result in a range in response from no adverse impacts, to temporary behavioural responses to significant, longer term hearing loss and physical injury and mortality. Consequently, anthropogenic noise is recognised as a marine pollutant (UN Commission for the Law of the Sea (UNCLOS)) and is acknowledged as a global issue that the international community needs to address.

There is increasing concern that commercial shipping contributes to a significant portion of the underwater noise generated by human activity which has been driven by globalisation and marine transport network expansion, urbanization, and greater demand for natural resources. In 2014, the International Maritime Organisation (IMO) adopted guidelines to reduce underwater noise from commercial ships which recognised that underwater radiated noise from shipping can have short-term and long-term impacts on marine life. Given the increases in man-made underwater noise and the observed effects on marine life around the world (e.g. right whales in the USA and killer whales in Canada), there is an urgent need for a greater understanding of the impacts of noise within Australian waters and for guidance on measures to avoid or mitigate these impacts on marine animals. While there is a national policy addressing the acoustic impacts of seismic surveys on whales, little is known regarding the effects of noise pollution for most marine species in Australia and no specific legislation address governs it.

The noise arising from Australia’s large fleet of recreational vessels are also of concern. In particular in shallow reef habitats such as the Great Barrier Reef World Heritage Area (GBRWHA) where predictions are that by 2040 up to 500,000 recreational boats will be registered in Queensland and potentially - traversing reef waters. Although small, these vessels travel in very close proximity to the reef and even within the reef matrix of individual reefs, so that the impacts of noise occur within the reef community. Recent research has shown sound from outboard motors has negative impacts on predator-prey relationships, physiology and the behaviour of reef fishes, the reproduction and parental behaviour of adult reef fish and the survivorship of their young. Together, this growing body of research shows that small vessels are an important source of pollution, especially in places like the Great Barrier Reef (GBR).

#### How Research Addresses Problem

This project will provide characterisation and quantification of shipping noise within Australia’s Exclusive Economic Zone (EEZ) and provide noise maps to inform management agencies of the spatial and temporal extent of shipping noise within high conservation value areas. Acoustic models will be informed by targeted input data and ground validated to reliably estimate cumulative noise (from ships) over a wide geographic area of the EEZ. The contribution of shipping noise to the marine soundscape will be quantified and sound exposure levels on Matters of National Environmental Significance (MNES) will be estimated to evaluate the potential impact of underwater ship noise. With projected increases in shipping within Australia and particularly within the GBRWHA, the project will allow an assessment of the effects of predicted increases in shipping and how this relates to changes in noise levels.

*Knowledge Brokering*

The later stages of project C5 were used to engage key partners and research-users in the develop of this project. A key step was convening a multi-stakeholder workshop in November 2017 to discuss progress with project C5 and opportunities and stakeholder needs for this project. A summary of the workshop was completed to capture the workshop findings. This project will maintain these connections to provide updates on project progress and communicate results and seek feedback on shaping project outputs to ensure they are fit-for-purpose. Engagement and communication for this project will be planned and implemented consistent with the [Hub’s Knowledge Brokering and Communication Strategy](https://www.nespmarine.edu.au/system/files/Knowledge%20Brokering%20and%20Communictions%20Strategy%20version%201.1%20.pdf).

### Research

This project will quantify ship noise for various vessel class/types within the Australian EEZ and develop a database of ship noise source levels and a national cumulative ship noise map. This approach involves using acoustic loggers/hydrophone arrays and AIS ship data to develop ship noise signatures for different vessel types and their source levels, which along with sound propagation models specific to specific acoustic zones that are defined based on geomorphological seabed composition, will produce a cumulative noise map.

The proposed work will build on the data obtained within Project C5 of the database of ship noise source levels for the various vessel classes/types and will target new data near ports to quantify noise levels when ships are loaded vs unloaded. Proposed work would also focus on critical habitat of marine mammals in a World Heritage Area in close proximity to shipping lanes and ship traffic to characterise sound exposure levels from ship noise and identify any potential impacts on biologically relevant activities. The cumulative ship noise maps will also allow for an assessment of the contribution of ship noise to ambient levels within high value conservation areas. Ultimately, this work is leading towards a cumulative noise framework that integrates various noise sources.

#### Description of research

1. **Quantify ship noise source spectra measurements for the predominant large commercial vessel types from both IMOS data and newly deployed hydrophone arrays**

This will build on preliminary proof of concept noise mapping work undertaken in 2017 as part of NESP Project C5. While there is some published literature regarding source spectra of ships, most report radiated noise levels which are affected by the specific environment in which the measurements were taken and which would lead to large errors without this information taken into consideration. We will quantify monopole source spectra (SPLrms) in a series of frequency bands for the predominant large vessels in Australia (e.g. tankers, cargo, passenger and tugs) using the closest point of approach of vessels past deployed acoustic stations. This will be computed according to the new ISO standard (ISO 17208-1:2016) which specifies the general measurement system, procedure, and methodology used for the measurement of underwater sound from ships under a prescribed operating condition. We will complement existing data gathered in Project C5 that used Integrated Marine Observing System (IMOS) acoustic stations located around Australia with strategic hydrophone array deployments near major ports to increase the sample size for certain vessel types. This will potentially allow measurements of the same ships entering and leaving port that could inform on differences in ship noise levels that are loaded and carrying cargo compared to unloaded ships.

1. **Develop shipping noise maps for Australia**

Compile hydro- and geoacoustic data around Australia, such as sound speed profiles, bathymetry and geomorphology of the seabed. The AIS data of polled ship locations will then be gridded at an appropriate resolution with each grid representing the amount of time a ship has spent in the cell and speed metric will be calculated for each vessel type for modelling. Using the ship noise source spectra (SPLrms), we would develop noise maps in a series of frequencies for each area to be modelled. Maps will be produced for specific regions, tailored to individual stakeholder requirements. Guidance will be given for managers on how to utilise these maps in likely management scenarios. Within the framework of the current budget, we foresee the delivery of fine-scale maps for TWO key habitats/management areas under point 2.

1. **Quantify ship noise exposure on MNES within a World Heritage place**

In addition to the two key habitats to be modelled under 2), we will quantify noise from shipping traffic within the inner shipping route in the GBRWHA that overlaps with the breeding grounds of the E1 humpback whale population and estimate noise exposure on breeding humpback whales.

1. **Quantify the contribution of shipping noise to the natural soundscape in comparison to wind-driven noise**

Model natural ambient noise within key sites that ship noise recordings are undertaken to develop baseline levels of noise in marine soundscapes and identify the contribution of ship noise above ambient noise levels. This requires monthly/seasonal/annual weather tables for the various acoustic zones to model wind noise using natural ambient noise recordings.

1. **Characterise noise from prominent noise sources within high value conservation areas** e.g. GBRWHA, Key Ecological Features (KEF’s), Biologically Important Areas (BIA’s).

From the ship noise maps, evaluate noise levels overlayed with GIS layers of high value conservation areas e.g. BIA’s, Marine Park areas, and compare with low conservation areas. Identify areas of interaction between high/key species diversity and noise exposure from point 3. Overlay noise maps with high density/important underwater tourism/recreational areas. Note that we can run the overlays for the coarse-scale Australia-wide map from project C5 AND for the three fine-scale maps produced in points 2 and 3 above.

1. **Investigate quantifying small boat noise.**

For the GBRWHA bring together various data sources e.g. as remote sensing, GPS loggers, and other indirect proxy data (such as mobile phone data) to build an understanding of small boat behaviour, spatial patterns and develop future projections. Investigate the feasibility of utilising this information to build maps of small vessel noise. Note that because small boats do not log AIS positions, this point will require pooling info on boat distribution from alternate sources. Note that source signatures of small boats need to be compiled too as these were not part of previous project C5.

1. **Investigate the feasibility of adding other anthropogenic noise sources to these maps, e.g., seismic surveying**

Compile data on other noise sources, e.g. marine seismic surveys, and investigate a framework for integrating cumulative noise sources into biologically relevant outputs. Different noise sources have dramatically different acoustic characteristics and are therefore quantified in different parameters and units. They also lead to different bioacoustic impacts that will vary with species. In the past, different noise sources have therefore not been combined. Under this point we will commence work on a framework to integrated different anthropogenic noise sources and explore how species-specific bioacoustic impacts might be modelled. This point is a feasibility study.

#### This proposed project will develop the framework and methodology to produce shipping noise maps. With this framework, future phases of this ship noise project may include determining areas in which noise levels exceed pre-set thresholds, determining the probability that certain thresholds are exceeded (“% time above threshold plots”), determining the amount of time that ship noise is above ambient levels and audible to marine fauna, measurement of noise around moored vessels, modelling past or future scenarios, etc.

#### Related research

NESP project C5 began the initial proof of concept to produce a draft map to put in place the capability, software/code development, and test the process. The later stages of project C5 were used to engage key partners and research-users in the develop of this project. A key step was convening a multi-stakeholder workshop in November 2017 to discuss progress with project C5 and opportunities and stakeholder needs for this project. A summary of the workshop was completed to capture the workshop findings.

Within Australia there is various ongoing and existing work to establish the biological impact of noise on specific species or locations. The proposed project naturally complements this work, providing a framework at the national scale to extend findings of localised studies to better understand national repercussions. In future the combination of national noise maps and knowledge of noise impact response will provide a complete picture to be able to map impact.

#### Links with other projects and hubs

This project will have strong links and integration with NESP project C1 with the final noise maps adding to the overall picture of pressures that Project C1 had collated. The work in the project to work towards a general framework for cumulative maps of a wider range of sound sources will work toward a complete spatial quantification of the noise pressure nationally.

The investigation of small boat patterns and noise may be able to leverage and contribute to the work in project “Valuing recreational fishing in Commonwealth waters: hotspots, fishers’ motivations, their impacts and economics” in particular the remote sensing work.

#### Specific management or policy outcomes

GBRMP 2014 Strategic Assessment – this project will provide a greater understanding of the ecological impacts of noise within the GBR Region and a framework to better assess the potential of underwater noise as being an impact on GBR species.

AMSA North East Shipping Management Plan – Information obtained from research on noise can be used to inform further routeing measures, identify the need for additional Associated Protective Measures and/or develop a long term monitoring system to assess noise levels around ports in real time.

NESP 2017 Research Priority Alignment

The project aligns with the following NESP marine Biodiversity hub priorities, particularly with regard to improving our understanding of pressures on the marine environment:

* **Identify past and current pressures on the marine environment, and understand their impact**, **including cumulative impacts such as climate change,** **to better target policy and management actions** *-* The work will identify past, and present, chronic noise pressures on the marine environment. It also provides one part of the information required to identify impact.
* **Improve prediction of likely future pressures and their potential impacts on marine and coastal biodiversity and economic and social values to enable the mitigation of avoidable impacts** - The project analysis will provide a framework that can produce noise maps based on future shipping scenarios (Changes in the overall amount of shipping, and/or changes in spatial distribution or density) to predict the future implications of shipping on noise and be flexible to respond to revised projections.

Furthermore, this project aligns with the NESP research priorities cross-cutting issues by quantifying ship noise exposure on Matters of National Environmental Significance (MNES) within a World Heritage Area (GBRWHA), a Particularly Sensitive Sea Area (IMO).

Pathway to Impact

| **Outcomes** |
| --- |
| Planned Outputs  1. A suite of maps of chronic shipping noise for key areas and species of concern, identifying key management areas and gross polluters. 2. A database of ship source spectra for predominant large vessels 3. A paper on improved methods or ambient noise estimation 4. Year 1 report 5. Report on the quantification of shipping noise on Matters of National Environmental Significance 6. Final report on the characterisation of shipping noise in Australia  Outcomes **Impact Type 1**  Much greater understanding of ocean shipping noise on a national scale.  **Impact Type 2**  More precise management and decision making due a better understanding of spatial intensity of ocean noise.  **Impact Type 3**  Longer term this research aims to work toward minimising the noise impact on the ocean ecosystem in particular for at-risk species and high-value conservation areas e.g. GBRWHA, KEFS, BIA’s, by allowing more precise management and decision making. Environmental value There is increasing recognition and concern of the environmental effects from anthropogenic underwater noise. The ultimate value to the environment from this project would be the ability to minimise the pressure from anthropogenic noise on at-risk marine life via management decisions informed by this research (i.e. national shipping noise maps).  The measurement of value for the environment and the effectiveness of the management decisions will be specific to the management application. But could include, observed reduction of site noise levels and monitoring of changes in key indicator species, such as habitat displacement, stress levels, behaviour, life history parameters or population recovery/stabilisation. |

| **Research-user** | **Engagement and communication** | **Impact on management action** | **Outputs** |
| --- | --- | --- | --- |
| *DoEE-Migratory Species* | Project briefings of research progress and findings via phone/email  Discussion on uses of noise mapping for migratory species management  Final project report  (see knowledge brokering text under Project Description section) | Shipping noise is identified as a threat in both the southern right whale recovery plan and blue whale recovery plan, as well as the humpback whale conservation advice. This project will provide policy officers with a better understanding about the spatial intensity of shipping noise in the marine environment and can be used to inform decisions to protect migratory species | *A, D, E, & F*  *Finer scale vessel noise maps covering preferred habitat of a species of concern (e.g., Southern Right whale breeding areas).* |
| *GBRMPA* | Project briefings of research progress and findings via phone/email  Final project report  (see knowledge brokering text under Project Description section) | This project will provide managers with a better understanding about the spatial intensity of shipping noise in the marine environment and can be used to:   1. inform the development of a guideline specific to the Great Barrier Reef on assessing and managing impacts of underwater noise on species 2. the GBR Outlook Report 2019 | *A, D, E, & F*  *Finescale noise map for GBR.*  *Recreational boat results for GBR* |
| *AMSA* | Project briefings of research progress and findings via phone/email  Final project report  (see knowledge brokering text under Project Description section) | AMSA North East Shipping Management Plan – Spatial distribution of shipping noise can be used to inform further routeing measures or identify the need for additional Associated Protective Measures.  *AMSA identified emerging issue*  Shipping management in the context of noise, sea floor disturbance, near shore impacts from ship weight and speed in context of rising sea levels, impacts of anchoring in sensitive areas – eg waiting for pilots in the Torres Strait. | *A, D, E, & F*  *Noise map for Australian EZ*  *Extra detailed information on validation and groundtruthing* |
| *Department of Defence* | Project briefings of research progress and findings via phone/email  Final project report  (see knowledge brokering text under Project Description section) | This project will provide the DOD with a better understanding of sources of ambient noise in the marine environment, the contribution of shiiping noise and what other research-users are seeking to understand about noise in the marine environment | *A, B, C, D, E, F* |
| *Parks Australia* | Project briefings of research progress and findings via phone/email  Final project report  Parks Australian to supply polygons of marine reserves and/or any other areas they are interested.  (see knowledge brokering text under Project Description section) | This project will provide managers with a better understanding about the spatial intensity of shipping noise in and adjacent to Australian Marine Parks (AMPs) and can be used to inform decision making to protect values in AMPs. | *A, D, E, & F*  *National Noise maps in and around marine reserves.* |
| *NOPSEMA* | Project briefings of research progress and findings via phone/email  Final project report  (see knowledge brokering text under Project Description section) | *NOPSEMA identified as an emerging issue*  This project will provide regulators with a better understanding about the spatial intensity of shipping noise in the marine environment and can be used to inform decision making on environmental assessments | *A, D, E, & F*  *The investigation of extending noise mapping framework to other noise sources (e.g. seismic surveys) will work towards the NOPSEMA emerging issue.* |
| *Marine Safety Queensland* | Project briefings of research progress and findings via phone/email  Final project report  (see knowledge brokering text under Project Description section) | This project will provide regulators with a better understanding about the spatial intensity of shipping noise in the marine environment and can be used to inform decision making on identifying and managing shipping risks | *A, D, E, & F*  *The results of the investigation into mapping noise from vessels at anchor.*  *Queensland noise map* |
| *State Gov. agencies* | Project briefings of research progress and findings via phone/email  Final project report  (see knowledge brokering text under Project Description section) | This project will provide policy makers and managers with a better understanding about the spatial intensity of shipping noise in and adjacent to State marine jurisdictions and can be used to inform decision making to protect marine environment values. | *A, D, E, & F*  *In particular state maps of vessel noise*  *State noise maps* |
| **Additional outputs**  Guidance for managers on how to utilise the results produced by this project in likely management scenarios. | | | |

### Indigenous Consultation and Engagement

Indigenous consultation and engagement for this project will be undertaken in a manner that is consistent with the [Hub’s Indigenous and Participation Strategy](https://www.nespmarine.edu.au/document/indigenous-engagement-and-participation-strategy). This project is considered a category three project for Indigenous engagement. This means the knowledge generated in this project will be effectively shared and communicated between relevant Indigenous peoples, communities and organisations.

The approach will include communication of generated knowledge to the Hub Steering Committee, the Fisheries Research and Development Corporation Indigenous Reference Group and the DoEE Indigenous Advisory Group. We will seek advice from these groups about other relevant Indigenous communities and organisations and appropriate communication mechanisms.

### Project Milestones

**Year 1**

| **Milestones** | **Due date** | **Milestone Status** |
| --- | --- | --- |
| **Milestone 1**  A database of ship source spectra for predominant large vessels | 1 November 2018 |  |
| **Milestone 2**  A finescale shipping noise map for a smaller area (e.g. GBR) to demonstrate improved methods/data | 1 November 2018 |  |
| **Milestone 3**  A submitted paper on improved methods or ambient noise estimation | 31 Dec 2018 |  |
| **Milestone 4** A short report summarising the results of the initial investigation into incorporating other sound sources and cumulative mapping and a roadmap to accomplish aims in year 2. In particular for Research item 7. | 31 Dec 2018 |  |

**Year 2**

|  |  |  |
| --- | --- | --- |
| **Milestones** | **Due date** | **Milestone Status** |
| **Milestone 5**  Suite of shipping noise maps for Australia’s EEZ | 1 April 2019 |  |
| **Milestone 6**  Report on the quantification of shipping noise on Matters of National Environmental Significance | 31 October 2019 |  |
| **Milestone 7**  Final report on the characterisation of shipping noise in Australia | 15 December 2019 |  |

# Data Management and Accessibility

All project outputs (including data) will be made publically available in accordance with the NESP Data Management and Accessibility Guidelines. To facilitate a consistent standards based approach, the Hub has produced a [Data Management Framework](https://www.nespmarine.edu.au/system/files/MBH%20Data%20Management%20Framework%20v1.2%20-%2005Dec16_AO.pdf). The framework provides project leaders with clear directions on publishing metadata, storing data and satisfying requirements for open access to journal articles.

| **Project output** | **Data Management and Accessibility** |
| --- | --- |
| Milestone 1 - Library of sound spectral for vessels | The data will be described in the final report and possibly a scientific publication. Metadata will be added to NESP data using the IMAS Metadata Tool |
| Milestone 2 - Small area finescale shipping noise maps | The maps will be sent to separately to end-users. Depending on advice from end-users and NESP. The map will be made accessible via inclusion in the year 1 report and/or using the same framework as the suite of maps in Milestone 5. |
| Milestone 3 - A paper on improved methods or ambient noise estimation | This paper will be submitted to a peer-reviewed journal preferably with open-access (in accordance with the NESP Data Management and Accessibility Guidelines) |
| Milestone 4 - Year 1 report | The report will be made available on the NESP website and sent to end-users. |
| Milestone 5 - National map of chronic shipping noise | The project will use the Hubs Data Management Framework to ensure timely and easy access to research datasets, outputs and synthesis and ensure that any publications receive the necessary approvals. The maps will feed into the framework of pressures made available in NESP project C1. Data and end-products will be publically discoverable by publishing metadata records on the Australian Ocean Data Network Portal (<http://portal.aodn.org.au/aodn/>) with were appropriate direct links to the data. |
| Milestone 6 - Report on the quantification of shipping noise on Matters of National Environmental Significance | The report will be made available on the NESP website and sent to end-users. |
| Final report on the characterisation of shipping noise in Australia  (i.e., Milestone 7) | The report will be made available on the NESP website and sent to end-users. |

Location of Research

The research impact will be at the National level (i.e. Australia’s EEZ), with focus on specific on areas of high conservation value e.g. GBRWHA, KEFS, BIA’s.

Project Specific Risks

The following risks were identified:

| **Risk to project** | **Potential impact on project** | **Risk rating (low, medium high, severe)** | **How will risk be managed?** | **Who is responsible for managing risk?** |
| --- | --- | --- | --- | --- |
| 1. that key stakeholders or research-users will not meaningfully engage in the project | High | Medium | Regular engagement via reports, email, discussions and NESP reports.  A final report will be produced for stakeholders/endusers and there will be opportunity for discussion/feedback. | Project Leader |
| 1. that key dependencies (e.g. project leader or scientific expertise) or inputs (e.g. data or knowledge) will be withdrawn or not be provided | High | Medium | Firstly, within the project team we have some capability to cover loss of staff (eg project leader). Secondly, within and outside the respective project organisations there is some capability that could be drawn upon. | Project Leader |
| 1. Risk that proposed scientific method/approach may not produce desired results | Critical | Low | Project C5 has already demonstrated that the scientific methodology can work | Project Leader |
| 1. Logger deployment/recovery issues | Moderate | Low | The logger plan has some inbuilt redundancy so if there is an issue, useful results can still be gained. If there are delays we can proceed with modelling/processing development and incorporate new data at a latter stage in the project. | Murdoch/Curtin |
| 1. Risk that project outputs may not be delivered on time or budget | Moderate | Medium | Regular meetings, timeline plan | Project Leader |
| 1. Risks to staff and contractors associated with field work at sea | Moderate | Low | The field work will be assessed and approved under the existing field work risk management of the collaborating organisations (i.e. Curtin, Murdoch universities and CSIRO) | Field work leader/coordinator |

Project Keywords

shipping; chronic noise, pressure mapping, AIS data, anthropogenic underwater noise

Project contacts

Researchers and Staff

| **Name** | **Organisation** | **Project Role** | **FTE** |
| --- | --- | --- | --- |
| *Christine Erbe* | *Curtin University* | Acoustic Modelling lead/expert | 0.30 |
| *Joshua Smith* | *Murdoch University* | Acoustic data/Processing | 0.40 |
| *David Peel* | *CSIRO* | AIS data processing/Project coordinator/Programmer | 0.30 |
| *TBC PostDoc* | *AIMS* | Small boat acoustics | 0.20 |
| *Judy Upston* | *CSIRO* | Data Collation | 0.05 |

Data Management

| Name | Organisation | Email | Phone |
| --- | --- | --- | --- |
| David Peel | CSIRO | david.peel@csiro.au | 03 6232 5179 |

Co-contributors

| Name | Organisation/ | Contribution |
| --- | --- | --- |
|  |  |  |

Key Partners **and** Research End Users

| **Key Partners (organisation/program)** | **Name/s** | Email (optional) |
| --- | --- | --- |
| *CSIRO* | *David Peel* | david.peel@csiro.au |
| *AIMS* | *Mark Meekan* | M.Meekan@aims.gov.au |

| Research Users (program/section/branch/organisation) | Name/s | Email (optional) |
| --- | --- | --- |
| *DoEE-Migratory Species* | *Fiona Bartlett*  *Peter Benson* | [FionaJ.Bartlett@environment.gov.au](mailto:FionaJ.Bartlett@environment.gov.au)  Peter.Benson@environment.gov.au |
| *AMMC* | *Mike Double* | Mike.Double@aad.gov.au |
| *GBRMPA* | *Chloe Schauble* | Chloe.Schauble@gbrmpa.gov.au |
| *AMSA* | *Matt Johnston* | Matt.Johnston@amsa.gov.au |
| *NOPSEMA* | *Christine Lamont* | Christine.Lamont@nopsema.gov.au |
| *DSTG* | *Chris Gillard* | Chris.Gillard@dst.defence.gov.au |
| *Parks Australia* | *Candace Cooke* | Candace.cooke@environment.gov.au |
| *Geoscience Australia* | *Rachel Przeslawski* | Rachel.Przeslawski@ga.gov.au |
| *NSW Environment* | *Tim Pritchard* | Tim.Pritchard@environment.nsw.gov.au |
| *NSW National Parks & Wildlife* | *Hannah Lloyd* | hannah.lloyd@environment.nsw.gov.au |

## Project E3 - Developing a national standardised methodology to monitor waste inputs to the marine environment, and evaluating existing and potential responses by Industry and Government

***(Placeholder – to be approved at a later date.)***

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## Project E4 – Recreational fishing in Commonwealth waters

*Project length – 1 Years/0 Months*

*Project start date – 01/01/2018*

*Project end date – 31/12/2018*

*Project current status*: To be approved under RPV4

*Project Leader – Tim Lynch (FTE – 40%)*

*Lead Research Organisation – CSIRO*

*Project leader contact details: - Dr Tim P. Lynch, Senior Research Scientist, CSIRO, GPO Box 1538, HOBART TAS 7001, Ph: (03) 6232 5239, Mob: 0416 089 749,* [*tim.lynch@csiro.au*](mailto:tim.lynch@csiro.au)

# Project Funding and Expenditure

Project funding table

|  | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | TOTAL |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| NESP funding | x | x | x | $153,883 |  |  | x | $153,883 |
| Cash co-con | x | x | x | $ |  |  | x |  |
| In-kind co-con | x | x | x | $153,883 |  |  | x | $153,883 |
| TOTAL | x | x | x | $307,766 |  |  | x | $307,766 |

Expenditure statement

Dr Tim Lynch will lead the scoping project and provide: milestone and annual reporting, administration and ethics permitting. With state based colleagues, Dr Lynch will assess state fisheries research and databases, co-supervise a student and also chair workshops with state colleagues to develop methodologies and federal colleagues and funding bodies to scope needs. Operational and travel funds of $15,000 will be provided. This component’s cost to NESP will be $73,883 with CSIRO matching this cost.

The state based case-study data mining work is scoped to cost NESP $70,000 with matching in-kind (contributions from partners. NSW DPI staff and contractors including Dr Alan Jordan ($35,000), will participate in workshops in 2018 and assist in the analysis of state-based fisheries data. WA DPIRD ($15,000) and UWA ($20,000) staff, including Dr Claire Smallwood and Assoc. Prof. Michael Burtons, will participate in workshops in 2018, assist in the analysis of state-based fisheries data and Michael will supervise a student to assess a questionnaire detailing with motivations by fishers for accessing Commonwealth waters. Both state partners will provide links to existing projects such as the Ningaloo Australian Marine Park (AMP) longitudinal study and help with scoping a larger project. Dr Jeremy Lyle ($10,000) from UTAS will provide advice and mentoring to the research team in regards to recreational fisheries design and analysis.

# Project Description

Project Summary

Australia’s recreational fishing sector is moving further offshore in pursuit of fishing opportunities, which places them in areas managed by the Australian Government. As recreational fishers are key stakeholders in marine management a better understanding of their motivations and values are required to effectively inform administration of the EPBC Act - such as effects on Matters of National Environmental Significance - use of Australian Marine Parks and Commonwealth managed commercial fisheries. Most recreational fisheries research is state based and we will both assess and contrast the general utility of existing state datasets from WA and NSW for quantifying recreational fishing in adjacent Commonwealth waters. At two case study sites – the Hunter and Ningaloo AMP – we will also test if state data can be downscaled to example areas of interest.

Project Description

Recreational fishing is a very popular activity, especially in Australia and for many species harvest exceeds the commercial fishery. The last State of the Environment (SoE) report and recent state based assessments suggested that components of the Australian recreational fishing sector are moving further offshore in their pursuit of fishing opportunities. Many if not all of these harvested species are being affected by climate change with range contractions in warmer regions and extension poleward in cooler regions.

One of the big challenges for contemporary Australian society is the management of competing human uses of, and impacts on, natural, transformed and rapidly climate changing ecosystems. In meeting this challenge, governments have encouraged an increasingly prominent role for science to provide information and analytical methods for supporting policy and management decisions. Feedback from multiple end users (ie DoEE/Parks Australia, AFMA, DAFF) has indicated that better knowledge of recreational fisheries, as key stakeholders in marine management and regulation, is required to effectively inform administration of the EPBC Act. (e.g. effects of Matters of National Environmental Significance (MNES) and use of Australian Marine Parks.

Unlike commercial fisheries, all recreational fisheries are managed by the states, however their move offshore places them into Commonwealth’s jurisdiction for Matters of National Environmental Significance (MNES), Australian Marine Parks and Commonwealth managed commercial fisheries. Recreational fishers are an important stakeholder for the management of both fisheries and marine biodiversity but their numbers, harvest and motivations are not well understood. Gaining an understanding of these values has significant challenges:

1. Most research is by state agencies, and while near shore vs offshore data is often collected a fundamental difficulty relates to separation of data between jurisdictions
2. Much of the state fisheries research is for assessment of catch and effort within regions. This differs from AMP and MNES which permits activities within spatial management plans that are generally sub-regional. Hence the level of data resolution may not be fine enough to apply to areas of management interest and fishers are faced with two contrasting approaches to management, which may be confusing
3. All states border a single Commonwealth jurisdiction but there has been no nationally standardised survey for recreational fisheries since 2001 and there are differences in assessment approaches between states
4. There are a diverse range of end users and stakeholders at both state and Commonwealth levels

We propose a scoping project to address these problems using the consolidated data from the last two statewide assessments conducted by WA and NSW:

Data mining and disaggregating of existing state recreational fishing data

* In collaboration with state base fisheries scientists we will develop methodologies as part of workshops that include end-users. These will include explicit objectives and criteria for assessment
* We will data mine the most recent of the multiyear state assessments for two states – WA and NSW -to test their ability to determine recreational fishing harvest and effort (with associated uncertainty) in Commonwealth waters adjacent to these two state boundaries
* We will test the ability to disaggregate the state assessment data in WA and NSW for two regional case study areas: Ningaloo (WA) and Hunter (NSW) MPA. More localised research at these areas of interest may also be considered.
* We will compare and contrast states approaches for data collection in WA and NSW

The Department of Agriculture and Water Resources, ABARES and the FRDC are conducting a national recreational fishing survey in 2018. This study will not collect catch and effort data, however, the final report will provide national-level analysis on recreational fishing: demographics, participation rates, distribution, expenditure and motivations. We will investigate potential linkages between this research and the survey.

Motivation interviews

In partnership with the UWA and in close consultation with Parks Australia at sites on the East Coast of Tasmania (e.g. Bicheno Boat ramp), where AMP zoning plans have been established since 2013, we will trial an interview method to assess motivations. Interviews will include questions about on-shore vs offshore participation and activity (fishing vs not fishing). The motivation work will be based on and be complimentary to existing perception and longitudinal studies developed by UWA for Ningaloo and also the proposed ABARES rec-fish survey for valuing recreational fishing. The interviews will include a trial for a national approach for DoEE consultation in regards to the motivation and harvest of fishers accessing both Commonwealth waters and AMPs and will include:

* Motivations for fishing Commonwealth waters (e.g. large fish, wilderness, culture)
* A gauge of fishers’ understanding of Marine Park existence, location and South-east Commonwealth Marine Reserves Network Management Plan 2013 zoning plans to provide insight into the effectiveness of Parks Australia education program
* Investigate perceived impacts of zoning on fishing opportunities (i.e. based on knowledge of the zoning plan)
* Describe both the targets and actual catch of species harvested offshore
* Describe the technological status and evolution of fishing methods

Scoping with FRDC, AFMA, DAFF, DoEE, States

As part of the project the project leader will scope a larger project in collaboration with a range of key stakeholders. This would include functionality of existing databases, consideration of needs, changing technology, climate effects and the challenges of multiple state jurisdictions both managing and reporting to various components of the Australian government on recreational fishing.

The work is different to other attempts at data mining e.g. Griffiths et al ‘Co-ordinated national data collection for recreational fishing in Australia’.  It is more focused on jurisdictional divisions in effort and harvest between the state and the Commonwealth and if these can be discovered from existing state based data.  If this is not possible, then the next question needs to be what would be required to allow for this type of data collection to be undertaken by the states in a cost effective manner using their existing systems?  It may be possible to make small changes to current state based data collection and allow for better granularity (e.g. state vs commonwealth waters fishing effort) or identification of fishing at smaller scales (e.g. specific AMP) within the larger zones often used for statewide assessments. This pragmatic approach acknowledges the often very different fisheries and challenges for data collection between states, rapid technological and methodological change occurring in the scientific field of recreational fisheries assessment, and the difficulties in negotiation across multiple states to reach agreements for consistent data collection. However any changes to current practises would need to be negotiated and budgeted within the context of additional data collection and reporting.

Engagement has already occurred with both state fisheries departments. In WA a draft of the proposal were sent to and comments received back from Karina Ryan, Steve Taylor and Claire Smallwood. In NSW Alan Jordan has been the main contact and has made comments on earlier drafts. Contact has also been made both via telephone and email with Josh Fielding from FRDC, Beth Gibson from AFMA, Tony Harman from DAFF and various DoEE staff.

We acknowledge the difficulties in the short timeframe given the logistical issues when engaging with the States. To address this the scope of the work is sharply constrained. The work is essential a test of functionality of existing databases in two as well as a trial of a questionnaire.

Link to overarching theme E project: national standard to the analysis of impact and risk

We will characterise the variations between two states (NSW and WA) in their approach to research for recreational fisheries.

Both WA and NSW have extensive recreational fishing assessment programs. The first steps in the project will be to commence close liaison with our state based colleagues to determine the extent of current knowledge and also what ability there is to tease apart data collected by the state on recreational fishers in Commonwealth waters.

There is also a link to project D3 that includes a biophysical benthic survey of the Ningaloo Australian Marine Park considering effects of recreational fishing on biodiversity.

NESP 2017 Research Priority Alignment

***Maximising the efficacy of managing Australia’s marine environment***

* Identify key social and economic values of the marine environment to build better stakeholder support and engagement in the management of marine and coastal environments.

We will actively engage with fishers to collect data through interviews that investigate perception of management and important values of offshore areas. Analysis of fisheries data will also identify areas with high recreational value relative to AMPs and areas outside of the reserve system.

***Improving our understanding of pressures on the marine environment***

* Identify past and current pressures on the marine environment, and understand their impact to better target policy and management actions.

The assessment of state based fishing research for two case study sites will provide context and an understanding of trends.

* Improve prediction of likely future pressures and their potential impacts on marine and coastal biodiversity and economic and social values to enable the mitigation of avoidable impacts

Through a better understanding of the types of gears, target species, distribution and intensity of recreational fishing effort, future pressures and impacts will be assessed.

***Improving our understanding of the marine environment including biophysical, economic and social aspects***.

* Meaningful and accessible information on the status and trends of key social and economic values associated with the marine environment

We will develop and trial direct interviews of fishers on ramps to provide key social values associated with the MNES and AMPs.

* Better understand issues that are common to the fishing industry and the environment including identifying solutions of mutual benefit.

Perceived versus actual interactions by recreational fishers with marine reserve management plans and the environment can differ but a common goal is often the sustainable use of natural resources.

Pathway to Impact

|  |
| --- |
| **Outcomes** |
| Recreational fishing in Commonwealth waters is currently poorly understood. The work will test if the current state-based data collection can discriminate between state or commonwealth fishing effort and harvest (with associated measures of uncertainty). The outcome will be dependent on the results of this test. If this is possible for one or both of the state databases then an outcome could be a report on recreational fishing to the commonwealth as a sub-section of regular state wide assessments. This could be used to assist in the modelling of the recreational component of harvest for setting of ecologically sustainable quotas or input controls such as bag and size limits. If the data is not useful for determining commonwealth fisheries metrics then an outcome would be to see if small and cost effective changes can be made to data collection to allow this to occur. For example adding questions to existing surveys.  A second outcome is the use of a well-developed questionnaire to test if AMP communication is adequately addressing the needs of the park users. This could be used for better targeting education and compliance activities. |

| **Research-user** | **Engagement and communication** | **Impact on management action** | **Outputs** |
| --- | --- | --- | --- |
| DoEE, Parks, WA DPI, NSW DPI, AFMA, DAFF, FRDC | An initial workshop will be held between CSIRO, NSW DPI, WA DPI and UWA in February 2018 to develop methods and exchange information. A further workshop will be held during the AMSA national conferences in July 2018 with researchers and research end users.  These two workshops will allow key stakeholders to be involved in the development of the project, scoping of a larger project and to maintain ongoing communication through face to face meetings.  Detailing of both state and commonwealth data needs – for example the data on specific species such as sharks and rays and tunas    This will include milestone meetings with DoEE (see milestone table) | An increased understanding of impacts of recreational fisheries on MNES and AMPs  Improved understanding about what can be done with collection, collation and analysis of recreational fisheries data to better meet the needs of decision makers. | A **state of knowledge and gap analysis for Commonwealth waters** based on review of state based fisheries research  **Potential for downscale estimates of effort and harvest** from AMP Ningaloo and Hunter based on state data  **Scoping of research needs** to understand recreational fishing in commonwealth waters through workshops |
| DoEE Parks, AFMA, FRDC | The project lead, through his membership of the Fisheries Research and Development Corporation (FRDC) Research Advisory Group (RAG) for recreational fisheries, will brief this committee twice a year to communicate the project to the broader research and management community. | **Trial of on-ground perceptions** **by active fishers accessing AMP** for management, values and their motivations, this will generate better intelligence to target education, outreach and compliance activities when implementing the management plan | Report and presentations to regional managers and the compliance arm within the branch.  Honours thesis (UWA) – State based assessments for Commonwealth waters and the use of questionaries to determine motivations and knowledge of fishers  Questionnaire template for surveying recreational fisher to understiand use of Australian Marine Parks |
| **Additional outputs** | | | |

### Indigenous Consultation and Engagement

Indigenous consultation and engagement for this project will be undertaken in a manner that is consistent with the [Hub’s Indigenous and Participation Strategy](https://www.nespmarine.edu.au/document/indigenous-engagement-and-participation-strategy). This project is considered a category three project for Indigenous engagement. This means the knowledge generated in this project will be effectively shared and communicated between relevant Indigenous peoples, communities and organisations. This research project is primarily desktop based, with the exception of the trial of the motivation questionnaire, and does not have direct collaboration with an Indigenous community, organization, group or individual. Indigenous engagement will be through invitation of the FRDC indigenous reference group to join our workshops. The chair of the reference group Chris Calogeras and the FRDC project officer Jo-Anne Ruscoe have been contacted and asked to provide advice on how the project results might appropriately be conveyed to interested Indigenous people and the results of the case studies (WA and NSW) communicated back to Indigenous groups at a regional level.

### Project Milestones

| **Milestones** | **Due date** | **Milestone Status** |
| --- | --- | --- |
| Milestone 1 – Sydney Workshop with NSW and WA state colleagues. Other end users will be invited as observers | 20th February 2018 |  |
| Milestone 2 – Adelaide Workshop at AMSA with project team and AFMA, FRDC, DAFF, ABARES and DoEE to scope larger project | Due 3rd July 2019 |  |
| Milestone 3 – Finalisation of data mining for state assessments and disaggregating | Due 30 October 2018 |  |
| Milestone 4 – Finalisation of questionnaire trial | Due 30 November 2018 |  |
| Milestone 5 – Presentation to Parks Australia in Hobart | Due 15th December 2018 |  |
| Milestone 6 - Annual report including a plain English summary for managers in Parks and DoEE | Due 20 December 2018 |  |

# Data Management and Accessibility

All data outputs will be stored on NPEI compliant servers and accessible through AODN and specialised web services on the NESP Hub website. We will also circulate reports, publications, thesis, and presentations through our stakeholder contact list.

| **Project output** | **Data Management and Accessibility** |
| --- | --- |
| State of knowledge and gap analysis: recreational fishing in Commonwealth waters assessed from state based data | Datasets will be stored, by the states, in a long-term secure storage, metadata will be created to meet the Marine Community Profile for metadata and published on the Australian Ocean Data Network Portal http://portal.aodn.org.au/aodn/. An email will be sent to marinemetadata@environment.gov.au each time a data set is published. The major sensitivity will be working across jurisdictions.  The state of WA will provide estimates that have been disaggregated at appropriate spatial scales (if possible with associated sample sizes and uncertainty). Raw data can’t be provided at this stage due to research agreements that are in place with Edith Cowan University and current student research projects |
| On ground motivation and targets by active fishers of AMP | *As above* |

All project outputs (including data) will be made publically available in accordance with the NESP Data Management and Accessibility Guidelines. To facilitate a consistent standards based approach, the Hub has produced a [Data Management Framework](https://www.nespmarine.edu.au/system/files/MBH%20Data%20Management%20Framework%20v1.2%20-%2005Dec16_AO.pdf). The framework provides project leaders with clear directions on publishing metadata, storing data and satisfying requirements for open access to journal articles. Datasets will be stored in a long-term secure storage, metadata will be created to meet the standard of the Marine Community Profile and published on the Australian Ocean Data Network Portal http://portal.aodn.org.au/aodn/. An email will be sent to marinemetadata@environment.gov.au each time a data set is published.

Specific knowledge brokering and communication activities will include:

* Close engagement with key partners and research-users to scope project, communicate progress and shape project outputs.
* Upload of any publications, reports, factsheets, maps and images will be made publically and freely accessible and available on the Hubs website http://www.nespmarine.edu.au. Access to journal publications will also be provided via the Hub’s website to the extent permitted by journal licensing conditions.
* Any publications will also be subject to internal review by the relevant partners (UWA, WA DPRID, NSW DPI and CSIRO)
* Two workshops with stakeholders and end users (see milestones)
* Presentation at the 2018 AMSA conference
* Presentation to Parks in Hobart (see milestones)
* Distribution of reports to end users contact list

Location of Research

* WA and Ningaloo Marine Park
* NSW and Hunter Marine Park
* East coast of Tasmania, Bicheno boat ramp, Burns Bay boat ramp, Triabunna boat ramp – Freycinet Marine Park

ProJect Specific Risks

| **Risk to project** | **Potential impact on project** | **Risk rating (low, medium high, severe)** | **How will risk be managed?** | **Who is responsible for managing risk?** |
| --- | --- | --- | --- | --- |
| The state based data is not suitable for either the separation between jurisdictions or downscaling to areas of interest | While this may be perceived as a project risk this is actually the primary research question | Medium | If this does occur, recommendations will be developed with state based partners about how, or whether it is possible, to rectify this situation | Tim Lynch |
| High degree of complexity and number of partners | Confusion about roles and responsibilities leading to milestones being missed | Low | Roles and responsibilities will be closely detailed and scoped accordingly | Tim Lynch |
| Interaction with the public on boat ramps | Assault, reputational risks | Low | The principle investigator will be involved and is highly experienced in dealing with public. Officers will always travel in pairs within workplace field management plans | Tim Lynch |

Project Keywords

Offshore recreational fishing, Commonwealth waters, harvest, climate change, fishing effort

Project contacts

Researchers and Staff (including early career researchers/PhDs – if names not yet known, list position/role)

| Name | Organisation | Project Role | FTE |
| --- | --- | --- | --- |
| Tim Lynch | CSIRO | Principle investigator | 0.4 |
| Carlie Devine | CSIRO | Data office | 0.1 |
| Alan Jordan | NSW DPI | Survey design, implementation and analysis | 0.05 |
| Jeff Murphy | NSW DPI | Data mining and analysis | 0.05 |
| Joel Williams | NSW DPI | Survey data analysis | 0.15 |
| Faith Doyle | NSW DPI | Data mining | 0.05 |
| Student (Honours or Masters) | UWA | Motivation of fishers and analysis of recreational fishing data | 1.0 |
| Claire Smallwood | WA DPI | Data mining and analysis | 0.3 |
| Assis/Prof. Michael Burton | UWA | Supervision of student, analysis | 0.2 |
| Jeremy Lyle | UTAS | Advice and mentoring | 0.05 |

Data Management

| Name | Organisation | Email | Phone |
| --- | --- | --- | --- |
| Carlie Devine | CSIRO | [Carlie.devine@csiro.au](mailto:Carlie.devine@csiro.au) | 6232 5478 |

Co-contributors – only list contributors who are not already identified as Researchers and Staff

| Name | Organisation/ | Contribution |
| --- | --- | --- |
| Karina Ryan | WA DPIRD (Department of Primary Industries and Regional Development)  [Karina.Ryan@dpird.wa.gov.au](mailto:Karina.Ryan@dpird.wa.gov.au) | Claire Smallwood line management [Claire.Smallwood@dpird.wa.gov.au](mailto:Claire.Smallwood@dpird.wa.gov.au)  $15,000 in-kind |

**Key partners and research end-users** **–** Please identify at least one section or programme within DoEE who will be an end user for this project, as well as any end users external to the department and ensure that you have in principal support from them before submitting your application.

| Research End Users (section/programme/organisation) | Name/s | Email (optional) |
| --- | --- | --- |
| Department of Agriculture and Water Resources | Emma Lowe | [Emma.Lowe@agriculture.gov.au](mailto:Emma.Lowe@agriculture.gov.au) |
| DoEE | Amanda Richley | [Amanda.Richley@environment.gov.au](mailto:Amanda.Richley@environment.gov.au)) |
| DoEE | Cath Samson | [Cath.Samson@environment.gov.au](mailto:Cath.Samson@environment.gov.au) |
| DoEE | Candace Cooke | [Candace.Cooke@environment.gov.au](mailto:Candace.Cooke@environment.gov.au) |
| DoEE | Fiona Bartlett | [Fiona.Bartlett@environment.gov.au](mailto:Fiona.Bartlett@environment.gov.au) |
| Parks Australia/DoEE | Bianca Priest | [Bianca.Priest@environment.gov](mailto:Bianca.Priest@environment.gov) .au |
| WA DPI (Fisheries) | Steve Taylor | [Steve.Taylor@dpird.wa.gov.au](mailto:Steve.Taylor@dpird.wa.gov.au) |
| AFMA | Beth Gibson | [Beth.Gibson@afma.gov.au](mailto:Beth.Gibson@afma.gov.au) |
| FRDC | Josh Fielding | [joshua.fielding@frdc.com.au](mailto:joshua.fielding@frdc.com.au) |
| DAFF | Tony Harman | [tony.j.harman@agriculture.gov.au](mailto:tony.j.harman@agriculture.gov.au) |
| ABARES | Andy Moore  Mandy Goodspeed | [Anthony.moore@agriculture.gov.au](mailto:Anthony.moore@agriculture.gov.au) |
| NSW DPI (Fisheries) | Luke Erskine | Luke.Erskine @dpi.nsw.gov.au |
| CSIRO | Russ Babcock | [Russ.babcock@csiro.au](mailto:Russ.babcock@csiro.au) |
| Department of Biodiversity, Conservation and Attractions (WA) | TBA |  |

| Key Stakeholders (organisation/programme) | Name/s | Email (optional) |
| --- | --- | --- |
| NSW Office of Environment and Heritage Coastal and Marine  Waters Wetlands and Coasts Science | Peter Davies | [Peter.Davies@environment.nsw.gov.au](mailto:Peter.Davies@environment.nsw.gov.au) |
| FRDC indigenous RAG | Chris Calogeras | chris@c-aid.com.au |
| FRDC contact indigenous fishing | Jo-Anne Ruscoe | jo-anne.ruscoe@frdc.com.au |
| Break O day Council (East Coast Tas) | John McGiveron | [John.mcgiveron@bodc.tas.gov.au](mailto:John.mcgiveron@bodc.tas.gov.au) |

## Project E5 – The role of restoration in conserving MNES

*Project length*: *1 Year\**

*Project start date*: *01/01/2018*

*Project end date*: *31/12/2018*

*Project current status*: To be approved under RPV4

*Project Leader*: *Ian McLeod (FTE – 40%)*

*Lead research organisation*: *James Cook University*

*Project leader contact details:* *ian.mcleod1@jcu.edu.au, mob. 0449 840 082*

# Project Funding and Expenditure

Project funding table\*

|  | *2015* | *2016* | *2017* | *2018* | *2019* | *2020* | *2021* | ***TOTAL*** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *NESP funding* | *x* | *x* | *x* | *$171,750* | *x* | *x* | *x* | *$171,750* |
| *Cash co-con* | *x* | *x* | *x* | *x* | *x* | *x* | *x* | *x* |
| *In-kind co-con* | *x* | *x* | *x* | *$171,750* | *x* | *x* | *x* | *$171,750* |
| ***TOTAL*** | ***x*** | ***x*** | ***x*** | ***$343,500*** | ***x*** | ***x*** | ***x*** | ***$343,500*** |

\* pending outcomes from 2018, we envisage subsequent work in 2019 and 2020 (~$300k p.a. NESP funding) trialling the more promising restoration techniques and habitats. See project description below.

Expenditure statement

Personnel

McLeod (JCU) ~0.40 FTE $58,500

Kendrick (UWA) ~0.10 FTE $17,500

Johnson (Uni Tas) ~0.10 FTE $17,500

Rogers (UWA) ~0.15 FTE $26,250

Workshop 1 $25,000

Workshop 2 $25,000

Consumables $ 2,000

TOTAL $171,750

# Project Description

Project Summary

Restoration of marine ecosystems offers the prospect of effective conservation in the face of chronic degradation and climate change. But techniques for restoration are generally in their infancy. In 2018 this project will review the capacity for recent advances in restoration of

* giant kelp forests,
* seagrass communities,
* saltmarsh communities, and
* shellfish communities,

to reduce conservation risks associated with matters of national environmental significance (MNES) listed under the Cth EPBC Act. In subsequent years we will trial and extend restoration techniques in critical habitats and develop a restoration decision framework to guide future investments.

Project Description

This research will assess the capacity of habitat restoration to insulate against loss and degradation of MNES, through restoration key habitats and the species they support. In general, restoration techniques in marine ecosystems have been seen as embryonic and cost-prohibitive. But the risk of decline in key habitats and their potential loss through the cumulative impacts of climate change and local pressures makes the imperative for more effective and efficient techniques urgent. In several habitats, recent advances in technology suggest marked improvement in efficacy and cost-effectiveness. This project will review and assess the capacity of active restoration to secure conservation outcomes for MNES across four habitats: giant kelp forests, seagrass communities, saltmarsh communities, and shellfish communities.

The cover of dense **kelp forests** is now <5% of that recorded in the early-mid 1970s as a direct result of ocean warming, leading to listing as a threatened ecological community under the EPBC Act. Despite broadscale losses, individual sporophytes of giant kelp persist in eastern Tasmania, in Bass Strait, and in Victoria, suggesting that warm-tolerant strains are emerging. Restoration of giant kelp forests involves (a) selection of warm-resistant strains, (b) development of techniques that optimise growth of sporophytes on existing reefs, and (c) optimal practice for seeding wild reefs with environmentally tolerant giant kelp.

Five percent of **seagrass** meadows globally are being lost every year. The imperative for seagrass restoration has become more apparent in recent years, with the decline of meadows in the Shark Bay World Heritage Area a notable example. Traditional vegetative sprig approaches to restoration have been largely ineffective. The major breakthrough in seagrass restoration has been in seed-based approaches where thousands of hectares of *Zostera* have been restored in the Virginia coastal bays in the USA, from repeated seeding over 10 years. Australian successes have been in planting vegetative runners, for *Posidonia australis*, a red listed community in central NSW. The challenge now is to learn from these successes and assess the feasibility of deployment at scale.

Many Wetlands of International Importance under the Ramsar Convention (e.g. Moreton Bay, Western Port) and World Heritage properties such as the Great Barrier Reef (GBR) and Wet Tropics contain **saltmarsh** wetlands. Many of these saltmarsh wetlands are degraded and exposed to additional risk in a changing climate. There are considerable opportunities to restore degraded saltmarsh wetlands in Australia. In some locations actions as simple as the installation of a few culverts or pipes would restore large areas of saltmarsh wetlands. Other sites need more intervention, for example some sites in the Sydney Region required excavation and land reshaping to create the right conditions for saltmarsh vegetation to thrive.

Native **shellfish** reefs are considered imperilled marine ecosystems within Australian coastal waters. These reefs are vital to the health of Australia’s bays and estuaries supporting high levels of marine biodiversity. Shellfish reefs are a ‘listed habitat type’ under the Ramsar Convention. Recent work supported by the NESP Marine Biodiversity Hub demonstrates enhanced feasibility and strong social support for restoration of oyster reefs throughout Australia. This project will build on this work through emphasis on prospects for cost-effective deployment beyond demonstration sites.

The project involves two phases:

1. Review of the feasibility of restoration to progress conservation of MNES, and
2. Assessment of the cost-effectiveness of deploying alternative technologies and techniques in different habitats and specific candidate sites via two workshops involving domain experts and marine managers.

The table below summarises a cursory scan of MNES and their association with the four habitat types. The focus of the phase 1 review will be a detailed account of these associations and description of how restoration can benefit specific MNES. It will include a summary of the capacity of conventional techniques to be deployed at scale, along with emerging techniques and technologies.

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| --- | --- | --- | --- | --- |
| MNES | Kelp | Seagrass | Saltmarsh | Shellfish |
| World heritage properties |  | • |  |  |
| Wetlands of international importance |  | • | • | • |
| Listed threatened species | • | • | • |  |
| Listed ecological communities | • |  | • |  |
| Migratory species |  | • | • |  |
| Commonwealth marine areas | • | • |  | • |
| The Great Barrier Reef Marine Park |  | • | • |  |

For each habitat, elements of the review in phase 1 will include

* Alternative approaches and technologies, including recent advances.
* Estimation of the costs of implementation.
* Identification of MNES that could benefit from on-ground restoration investment.
* Ancillary benefits stemming from restoration, with particular emphasis on carbon sequestration and prospects for progressing Indigenous values and engagement.
* Identification of potential indicator(s) for key MNES benefits to be used in phase 2 assessment of cost-effectiveness and subsequent monitoring of outcomes.

Phase 2 will start with Workshop 1 which will be dedicated to problem formulation, including specification of candidate restoration projects at specific sites across the four habitat types. The nomination of candidates will be informed by the phase 1 review. Workshop 2 will combine data and expert judgment to characterise the cost-effectiveness of alternative projects and technologies. **Cost-effectiveness analysis** is an economic decision tool that enables quantitative evaluation of the costs and (non-monetary) benefits for alternative restoration projects. The analysis is capable of including tangible and intangible outcomes of a proposed project, and comparing those outcomes relative to alternative projects or the baseline position of not undertaking any restoration activity. Outcomes will directly inform priorities for field trials in subsequent years.

The primary focus of the work is the benefits and costs of restoration as they pertain to MNES. While this focus provides immediate relevance for national environmental priorities as described under the EPBC Act, we note that many ecosystem services have been invoked as arguments for increased restoration effort. In addressing only conservation benefits as they pertain to MNES this project will provide lower bound estimates on the cost-effectiveness of restoration. A full account of ecosystem service benefits may make the case for future investment more substantial. In making recommendations for future on-ground investment among the pool of candidate projects considered in phase 2, we will provide qualitative assessment of potential benefits for carbon sequestration and Indigenous engagement and consider restoration options at Ramsar-listed wetlands.

The project links with a number of related research initiatives:

* The NESP Tropical Water Quality Hub proposed project, *Best practice assisted recovery for the GBR,* which will explore local scale restoration of coral reefs.
* Established NESP TWQ Hub projects
  + 3.3.2 *– Science evaluation of coastal wetland systems repair projects across GBR catchments.*
  + 2.1.2 – *Scoping option for low-lying, marginal cane land to reduce DIN in priority wet tropics catchments*, which explores conversion of low productivity cane land to coastal wetland.
* The project builds on cost-effectiveness analyses developed under the NESP MB Project B1 *Road testing decision support tools via case study applications*, dealing with decision-making under uncertainty. It will also utilise outcomes from *C1 Improving our understanding of pressures on the marine environment*, via incorporation of the spatial distribution of pressures and their implications for the viability of restoration efforts.
* The project will coordinate with the ESCC Hub project on the development of Decadal Forecasting capability to include outputs from the Decadal project into the analysis of restoration feasibility.
* The project links with the National Marine Science Plan and its identification of restoration ecology and eco-engineering as a ‘leverage point for action.’

NESP 2017 Research Priority Alignment

Priority: *Matters of national environmental significance – areas of particular interest are listed species and communities…*

Priority*: Identify and trial methods to restore degraded habitats such as oyster and mussel beds, seagrass, and intertidal habitats to underpin on-ground management actions.*

Restoration is increasingly seen as a potential management tool in the context of degradation from cumulative impacts including climate change, but there is limited information to support effective management. This project directly addresses this information gap, with particular emphasis on MNES, including the threatened ecological communities, giant kelp forests of south east Australia and subtropical and temperate coastal saltmarsh, and a suite of threatened species associated with the four habitats.

Priority: *Research undertaken under all hub priorities should consider the impact of climate change in the research design, delivery and recommendations, as appropriate.*

A primary motivation for considering restoration is the loss and decline of MNES through climate change. But climate change also poses a threat to the feasibility and long term viability of restoration initiatives. The project will explicitly incorporate decadal climate change scenarios developed by the NESP ESCC Hubs in workshop based assessment of the cost-effectiveness of alternative investments.

Pathway to Impact

This project was developed and refined through advice and consultation with the named co-contributors, key partners and research end users through phone meeting and follow up emails.

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| **Outcomes** | | | |
| The project will develop a shared understanding among policy managers about options for cost-effective investments in habitat restoration to protect targeted Matters of National Environmental Significance prescribed under the EPBC Act. The project will provide the scientific basis for considering future investments in habitat restoration. This project will review and assess the capacity of restoration to improve the status and trend of MNES across four marine habitats. | | | |
| **Research-user** | **Engagement and communication** | **Impact on management action** | **Outputs** |
| *DoEE Wildlife Heritage, Reef & Marine Division, Cth Environmental Water Office, GBRMPA*  *Australian Coastal Restoration Network* | *All researcher users were engaged in the scoping of the project plan to ensure alignment with interests and existing initiatives.*  *Research-users be engaged in the project through: circulation of quarterly update via email; preparation and participation in workshops.*  *An end of project briefing and seminar will be provided to research-users* | *Information of the cost and benefits of restoration activities will allow managers to compare the return on investment between on-land or in-water management options.*  *Clear prioritisation of future investment in restoration on the basis of conservation outcomes as they pertain to MNES.* | *Prospectus for future investment based on cost-effectiveness analysis*  *Presentations and workshops of findings for both research end-users and wider stakeholder groups* |
| **Additional outputs**  The cost-effectiveness analysis will be used by the NESP MB and NESP TWQ Hubs to identify priorities for future trials and restoration related research. The TWQ Hub has particular interests in techniques aimed at saltmarsh restoration. The NESP MB Hub may be well placed to progress promising avenues for restoration of seagrass, kelp forests and/or shellfish habitats.  Other key interests in outcomes and outputs include (a) the NESP Tropical Water Quality Hub, (b) The Nature Conservancy, (c) those within DoEE that administer the Emissions Reduction Fund, and (d) the FRDC Indigenous Reference Group. See *Co-contributors* and *Key Partners and Research End Users* below. These stakeholders and co-managers will be linked via quarterly email updates, invitations to be involved in workshops, and end of project briefings and seminar. Research outputs will be promoted through media releases and highlighted on JCU and NESP MB Hub websites and social media platforms. | | | |

Knowledge Brokering and communication

The approach to interaction with research-users and stakeholders will be consistent with the Marine Biodiversity [Hub’s Knowledge Brokering and Communication Strategy](https://www.nespmarine.edu.au/system/files/Knowledge%20Brokering%20and%20Communictions%20Strategy%20version%201.1%20.pdf). The project leader is a skilled knowledge broker and communicator. The project leader will develop a schedule for product delivery and stakeholder engagement in consultation with the Marine Hub Knowledge Broker, and this will be modified in consultation with research-users on an as-needs basis to maximise impact.

Knowledge brokering and communication contact:

Name: Ian McLeod

Email: ian.mcleod1@jcu.edu.au

Phone: 07 4781 5474

### Indigenous Consultation and Engagement

Contact: Ian McLeod, *ian.mcleod1@jcu.edu.au, tel. 07 478 15474 mob. 0449 840 082*

Indigenous consultation and engagement for this project will be undertaken in a manner that is consistent with the [Hub’s Indigenous and Participation Strategy](https://www.nespmarine.edu.au/document/indigenous-engagement-and-participation-strategy). This project is considered a category three project for Indigenous engagement. This means the knowledge generated in this project will be effectively shared and communicated between relevant Indigenous peoples, communities and organisations. Although 2018 involves no field work or on-ground action, Indigenous groups and Traditional Owners are likely to have a keen interest in some or all of the candidate restoration projects nominated under the phase 2 cost-effectiveness assessment. In preparing candidate site-specific projects, researchers will invite contribution from local indigenous co-managers on (a) cultural values and ecoservices that may be improved via restoration, and (b) prospects for engagement in implementation and monitoring via ranger groups, should candidates be shortlisted for subsequent funding of on-ground works.

### Project Milestones

| **Milestones** | **Due date** | **Milestone Status** |
| --- | --- | --- |
| *Milestone 1 – Signing of contract* | *1 Jan 2018* |  |
| *Milestone 2 – Workshop 1 – multi-stakeholder workshop to address* problem formulation and identify candidate restoration projects | *30 Jun 2018* |  |
| *Milestone 3 – Report: Review – the role of restoration in conserving matters of national environmental significance.* | *30 Jun 2018* |  |
| *Milestone 4 – Workshop 2 – multi-stakeholder workshop to* characterise the cost-effectiveness of alternative projects and technologies | *mid Nov 2018* |  |
| *Milestone 5 – Report: Workshop outcomes - The cost-effectiveness of alternative restoration projects* | *31 Dec 2018* |  |

# Data Management and Accessibility

All project outputs (including data) will be made publically available in accordance with the NESP Data Management and Accessibility Guidelines. To facilitate a consistent standards based approach, the Hub has produced a [Data Management Framework](https://www.nespmarine.edu.au/system/files/MBH%20Data%20Management%20Framework%20v1.2%20-%2005Dec16_AO.pdf). The framework provides project leaders with clear directions on publishing metadata, storing data and satisfying requirements for open access to journal articles.

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| **Project output** | **Data Management and Accessibility** |
| Review | Managed in accordance with the Hub’s Data Management Framework. Report will be made available via the Hub website. |
| Cost effectiveness analysis | Managed in accordance with the Hub’s Data Management Framework. Reports will be made available via the Hub website. All project outputs will be made freely and openly available as per the Data Management and Accessibility Guidelines. |

Location of Research

The review planned for 2018 is a desktop study. Workshops will be held in Canberra.

The location of field trial(s) to be undertaken in 2019 will be informed by 2018 outcomes.

Project Specific Risks

The project is low risk, involving a review task and workshops.

| **Risk to project** | **Potential impact on project** | **Risk rating (low, medium high, severe)** | **How will risk be managed?** | **Who is responsible for managing risk?** |
| --- | --- | --- | --- | --- |
| 1. Late delivery of outputs | Failure | low | Inception meeting to plan review structure and timetable sub-tasks.  Monthly reminders of progress requirements. | Ian McLeod |
| 1. Lack of engagement among end-users | No adoption | low | Quarterly updates and invitation to be directly involved in workshop preparation and delivery | Ian McLeod |

Project Keywords

Restoration, matters of national environmental significance, feasibility, scale, cost-effectiveness.

Project contacts

Researchers and Staff

| **Name** | **Organisation** | **Project Role** | **FTE** |
| --- | --- | --- | --- |
| Ian McLeod | JCU | Lead researcher – restoration of saltmarsh and shellfish communities; Indigenous consultation and engagement | 0.40 |
| Abbie Rogers | UWA | Cost-effectiveness analysis | 0.15 |
| Gary Kendrick | UWA | Partner researcher – restoration of seagrass communities | 0.10 |
| Craig Johnson | Uni Tas | Partner researcher – restoration of giant kelp forests | 0.10 |

Data Management

| Name | Organisation | Email | Phone |
| --- | --- | --- | --- |
| Ian McLeod | JCU | ian.mcleod1@jcu.edu.au | 0449 840 082 |

Co-contributors

| Name | Organisation/ | Contribution |
| --- | --- | --- |
| Damien Burrows | NESP TWQ | Interest in adoption of research outcomes – trial of restoration methods |
| Chris Gillies | The Nature Conservancy | TNC is funding and organising many restoration projects in Australia |

Key Partners **and** Research End Users

| **Key Partners (organisation/program)** | **Name/s** | Email (optional) |
| --- | --- | --- |
| FRDC Indigenous Reference Group | Jo-Anne Ruscoe | jo-anne.ruscoe@frdc.com.au |
| The Nature Conservancy Australia | Dr James Fitzsimons | jfitzsimons@tnc.org |

| Research Users (program/section/branch/organisation) | Name/s | Email (optional) |
| --- | --- | --- |
| Biodiversity Conservation Division, DoEE | Ashley Leedman | ashley.leedman@environment.gov.au |
| Wetlands Section, Cth Environmental Water Office, DoEE | Janine Cullen | janine.cullen@environment.gov.au |
| GBRMPA | Dylan Horne | dylan.horne@gbrmpa.gov.au |
| Emissions Reduction Fund, DoEE | Rachel Burgess | rachel.burgess@environment.gov.au |
| Australian Coastal Restoration Network | Various |  |
| NESP TWQ | Damien Burrows | damien.burrows@jcu.edu.au |

1. Fujiwara M, Caswell H. 2002. Estimating population projection matrices from multi-stage mark-recapture data. Ecology 83: 3257 – 3265. [↑](#footnote-ref-2)