



**National Environmental Science Program
Marine Biodiversity Hub
FINAL REPORT
1 January 2015 – 30 June 2021**

Hub Name (full activity title): NESP Marine Biodiversity Hub

Host organisation: University of Tasmania

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Other consortium partners/subcontractors/research organisations:

Partners

CSIRO

AIMS

Geoscience Australia

University of Western Australia

Charles Darwin University

New South Wales, DPI

New South Wales, OEH

Museums Victoria

Integrated Marine Observing System

Main Subcontractors

Clean Ocean Foundation

James Cook University

WA Museum

University of Melbourne

Curtin University

Murdoch University

Western Australian Department of Primary Industries and Regional Development

North Australian Indigenous Land and Sea Management Alliance (NAILSMA)

Tasmanian Department of Primary Industries, Parks, Water and Environment

Sea Mammal Research Unit, University of St Andrews

Claire Charlton Environmental Consulting

Macquarie University

Hub Leader Certification

As Hub Leader, I certify that I have taken adequate steps to reasonably assure myself that:

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

Signed: 

Hub Leader Name: Alan Jordan

Date: 13 July 2021

Hub Steering Committee Chair Certification:

As steering committee chair, I certify that any issues of concern or matters raised during Steering Committee meetings where the Final Report was discussed have been adequately resolved, amended or incorporated into the Final Report submitted to the Department.

Signed:



Hub Steering Committee Chair Name: Peter Cochrane

Date: 20 May 2021

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Letter from the Hub Leader

Since July 2015, the NESP Marine Biodiversity Hub has provided evidence and tools to help the Australian Government, state governments, Indigenous communities, industry and the community to better understand, manage and conserve Australia's marine environment. The Hub research partners have worked closely with the Department to align their co-investment towards key management and policy priorities, and have established enduring partnerships to deliver fit-for-purpose scientific advice and tailored outputs to meet the needs of research end-users.

The final year of the Hub research program, delivered through Research Plan Version 6 (2020), presented the Hub's researchers challenges that required them to adapt and respond to travel restrictions associated with COVID-19, and manage program level risks associated with delayed milestones. With a total of 29 active research projects in 2020, delayed milestones extending into 2021 were spread across a number of projects, and the Hub executive worked closely with the project leaders and end-users to ensure the needs of decision makers were met.

Highlights during 2020 include leading and supporting Australian Marine Park (AMP) seabed mapping and biodiversity surveys and analysis covering the Hunter, Lord Howe, Ningaloo, Arafura, Wessels, Beagle, Gascoyne and South-west Corner Marine Parks. These surveys extended the Hubs program of inventory and baselines, with large areas of high-resolution multibeam sonar surveys of the seafloor allowing detailed bathymetric mapping. Biotic data on benthic assemblages and fish surveyed using stereo camera systems on Autonomous Underwaters Vehicles, Remotely Operated Vehicles, towed systems and baited cameras has provided a raft of new insights into patterns of marine habitats and biodiversity around the country and across large depth ranges in Australia's extensive marine estate.

These surveys have applied the Hub's *Field Manuals for Marine Sampling to Monitor Australian Waters, version 2*, which are endorsed by experienced researchers, managers and technicians from multiple agencies. The field manuals are a critical requirement for nationally coordinated marine research and monitoring, and are used by Parks Australia as part of approving scientific sampling in marine parks. Much of this work has also contributed to projects supporting the development of the AMP Monitoring, Evaluation, Reporting and Improvement System, which has also incorporated mapping of pressures and evaluation of risks to natural values, and common approaches to evaluate social and economic values associated with AMPs. All of this work has been built on effective collaboration between researchers and marine park managers, and has raised the bar for achievements with co-designed and co-delivered practical research for Australian Marine Parks.

An important focus for much of the work of the Hub has been to support the recovery and conservation of a number of threatened and migratory marine species. Projects have aimed to strengthen Australia's capacity to effectively meet the requirements of regional, national, and international conservation policies. One of the Hub's key products soon to be published is "*The Action Plan for Australian Sharks and Rays 2021*" for Australian cartilaginous fishes, which provides a comprehensive and consistent review of the extinction risk of all Australian sharks, rays, and chimaeras. This publication provides a benchmark from which changes in population and risk can be measured; and to help guide management for their conservation. The Action Plan also serves to raise the profile of their diversity and conservation needs.

Another area of important development over the life of the Hub relates to coastal habitat restoration where research investment is generating national research capacity and a better evidence base to target and accelerate restoration research in Australia. Our work with stakeholders and research users, in particular through the Australian Coastal Restoration Network, is forging nationally coordinated approaches to the repair of shellfish reefs and saltmarshes, and testing methods for

enhancing recovery and survival of temperate seagrasses and giant kelp forests. This includes evaluating restoration practices and economics, working with traditional owners, and supporting platforms for knowledge sharing among policy makers, practitioners and communities.

Cutting across these research areas the Hub has progressively increased Indigenous engagement and partnerships to deliver a broad range of regionally focused projects to identify and advance Indigenous research interests and priorities. This work has contributed to empowering Indigenous people in land and sea research and management, including championing partnerships with Indigenous organisations and the Australian Marine Science Association (AMSA) to convene four annual Indigenous engagement workshops. These were designed to showcase collaborative projects and share information and perspectives on Indigenous Sea Country rights and aspirations, successful research partnerships, and the importance of culturally appropriate engagement based on accepted standards. The first part of a fifth Indigenous workshop was held at the AMSA 2021 annual conference in June, with the second part of the workshop delayed due to re-introduced COVID-19 restrictions prior to the conference. It is to be rescheduled for late 2021.

Other key Hub successes includes a substantial contribution to national environmental reporting within the 2016 and 2021 national State of the Environment (SoE) reports in relation to data quality and standards; providing datasets, case studies, analyses and better use of existing quantitative data. This continues to build confidence in the reporting process and product, and increases its influence and value to end-users, stakeholders and the broader community.

Effective collaboration and capacity development both within the existing Hub and across the broader science community in general, made possible by co-investment in NESP, has been a key factor in the success of the current Hub. This has enhanced the national capacity for marine science (meeting a number of National Marine Science Plan priorities), and also enabled cross-discipline collaborations to enhance regional capability by skill-sharing and postgraduate training opportunities. It has also enabled collaborative data analysis, storage and visualisation tools developed with significant Hub input (e.g. AusSeabed, AMP Science Atlas). Hub members have also had considerable, and growing, multidisciplinary expertise in collaborations with Indigenous communities. All of these aspects are essential to maintain and further develop the capacity, investment and partnerships to ensure management of marine ecosystems and resulting community benefits are based on the best available science. The Marine Biodiversity Hub has made an important contribution to achieving this goal.

The Hub has effectively managed the financial aspects of the program, with research partner matching co-investment consistently meeting program requirements, and appropriate investment made across areas of communications, knowledge brokering and data management. It is anticipated that there will be a small underspend, and specific details of this will be provided in the final financial statement. Overall, research conducted within Marine Biodiversity Hub programs has provided foundational scientific evidence for biodiversity conservation and sustainable use in Australia's marine environment, and partnerships and processes established by the Hub will continue to serve the needs of end-users engaged in emerging initiatives and protecting conservation priorities.

Research

Achievement of hub outcomes

The Marine Biodiversity Hub has successfully delivered an effective national partnership and co-invested collaborations to support evidence-based decision making aimed at addressing the Department's marine management priorities. There has been significant investment across multiple national and regional projects that have focussed on characterising, monitoring, and reporting coastal and marine species and ecosystems. This was delivered across tropical to cold temperate regions, and at scales and resolution ranging from seascapes (e.g. mapping of the temperate east abyssal plain) to locally distributed threatened species (e.g. Spotted Handfish).

Hub researchers developed comprehensive national maps of current and historical pressures (including wastewater inputs, plastic waste, ship strike and shipping noise), enabling assessment of the risks posed to natural values, including the effect of cumulative pressures. Large scale mapping of natural values in Australian Marine Parks (AMP), in combination with pressures mapping, has contributed to projects supporting the development of the AMP Monitoring, Evaluation, Reporting and Improvement System, a key component of ongoing management. The development of a national 'common language' for defining natural values and evaluating of risks to values has led to improved national approaches to marine planning and evidence-based decision. In addition, the Hub's *Field Manuals for Marine Sampling to Monitor Australian Waters* supported applying national approaches to data collection, with related projects facilitating national and international advances for storing, accessing, and sharing marine data.

Hub research achieved important outcomes to inform the recovery and conservation of a number of threatened and migratory sharks, fishes, sea snakes and marine mammals. Projects involved population assessments using standard and innovative genetic techniques, species distribution modelling, mapping of pressures, through to on-ground action. There was a strong focus on both temperate and tropical sharks, particularly those such as White Sharks and Largetooth Sawfish where scientific evidence is needed to support Australian and state government recovery and risk mitigation actions and policies. Projects evaluated a number of threatened species that have coastal and terrestrial extensions, particularly birds and euryhaline sharks distributed across northern Australia that are of relevance to other NESP Hubs.

In order to better understand the distribution and potential impacts of sewerage outfalls on Australia's marine environment, the Hub worked with the Clean Ocean Foundation to develop the National Outfall Database (NOD). This has provided readily accessible, national scale, annually reported data on Australia's domestic wastewater outfalls across 186 coastal outfalls. Such work is providing the basis for developing national standardised data reporting, which is involving stakeholders in decisions on scope, data access and reporting.

Other key achievements relate to increasing investment in generating national research capacity for habitat restoration, and building an improved evidence base to target and accelerate restoration research in Australia. In addition, the Hub has also enabled collaborative data analysis, storage and visualisation tools, all of which are essential components to maximise investment and allow effective knowledge exchange with end-users and stakeholders. Hub members continue to develop expertise in partnering with Indigenous communities, and ensure engagement is culturally appropriate, respectful and inclusive of Indigenous rights and perspectives. Collectively, these projects, and the related end-user engagement, have made a tangible impact on the knowledge base required to support evidence-based decision making on management of Australia's marine resources.

Research projects

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

Performance against milestones

Performance against Funding Agreement Milestones

All milestones for the period and to date have been met as per Funding Agreement Milestones 1-30.

Performance against the Research Plan milestones

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

Measuring success

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

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

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

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

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

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

The intended outcomes of the NESP are:

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

Table A: Quantitative performance measures

Key Performance Indicator	Hub Result for entire activity period (1 Jan 2015 - 30 June 2021) (numerical only)	Explanation (if any)
1. Percent of projects (active or completed in the reporting period) for which there is a research-user actively engaged in the project.	100%	Average across 6 year period
2. Percent of projects approved under RPV1-6 in which research-users were actively involved in project design.	100%	Average across 6 year period
3. Number of research outputs provided to end users on time ¹ and as identified in the Research Plans.	300	Total across 6 year period
4. Proportion of research outputs provided to end users on time and as identified in the Research Plans.	66%	Average across 6 year period
5. Number of instances of where the hub has used NESP-generated information from another NESP hub.	5	Total across 6 year period
6. Number of peer reviewed NESP-funded publications during the reporting period.	234	Total across 6 year period: 90 scientific journal articles; 144 scientific reports
7. Number of NESP research citations in other researchers' publications during the reporting period.	273	Total across 6 year period
8. Number of researchers, including PhD and Post-Doc positions engaged as a result of NESP (total, Full-time equivalent) during the reporting period.	34	Total across 6 year period
9. Number of data sets provided to the Hub, or made publicly available, by third parties for the purposes of informing NESP research.	57	Total across 6 year period
10. Percentage of data sets made publicly available under open licence by the Hub.	99%	Percentage across 6 year period. White shark data has been classified as restricted due to risks of targeting a threatened species listed under the EPBC Act.
11. Percentage of NESP research outputs (including publications, data and metadata) that are discoverable and accessible in accordance with NESP data accessibility requirements and the funding agreement.	98%	All data is currently discoverable and accessible except for: 1. White shark data which has been classified as restricted due to risks of exploitation for a threatened species listed under the EPBC Act. 2. Euryhaline elasmobranchs acoustic telemetry data has been

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

Key Performance Indicator	Hub Result for entire activity period (1 Jan 2015 - 30 June 2021) (numerical only)	Explanation (if any)
		<p>embargoed to the end of 2023 for use on a PhD project. (This data can be accessed on request via the IMOS Animal Tracking facility.)</p> <p>3. Discipline-specific repositories (endorsed by the Australian marine community) exist for multibeam bathymetry, AUV, and BRUVs data (AusSeabed, UMI/Squidle+, and GlobalArchive, respectively). Hub data from project D3 has been contributed to these repositories but in some cases is still in a processing queue, with an estimated public release date by end of 2021.</p> <p>Details of other research outputs still to be published are provided in Attachment A.</p>
12. Number and FTE of Indigenous people employed in a project (separate into full and part time positions).	23 part-time; 1.9 FTE 0 full-time, 0 FTE	Total across 6 year period
13. Number of Indigenous researchers/graduates/post-graduate/PhD/Post Doc Positions in projects.	6	Total across 6 year period
14. Number of Indigenous people trained in the use of environmental management tools and techniques.	49	Total across 6 year period
15. The number of management tools for Indigenous waters and land that benefitted from NESP research and outcomes (including but not limited to Plans of Management for IPAs, Co/Joint managed parks, Marine Park Plans of Management, Conservation Agreements).	5	Total across 6 year period
16. Number and type of communication products that have been used to communicate research with Indigenous people.	41	Total across 6 year period. Types of communication products included fact sheets, short videos (both in English and Kriol), educational signage at boat ramps, on country presentations, reports and art.
17. Number of research, knowledge sharing and communication events held with Indigenous communities.	143	Total across 6 year period
18. Number of public events, conference presentations, jointly authored/published	19	Total across 6 year period

Key Performance Indicator	Hub Result for entire activity period (1 Jan 2015 - 30 June 2021) (numerical only)	Explanation (if any)
papers with Indigenous participants/contributors.		
19. Number of Indigenous communities and organisations engaged to develop, refine or inform NESP research	70	Total across 6 year period

NESP impact stories

NESP impact stories are provided at Attachment B. These stories showcase the contribution of NESP funded research to the environment, the economy, society, culture, public policy, quality of life, beyond contributions to academia.

Financial Information

Financial reporting

Financial information for the Marine Biodiversity Hub is provided at Attachments C and D.

Marine Biodiversity Hub Final Report - Attachment A

Project Number/ID	Project Name/Title	Project Summary	Project Leader	Lead Organisation	Approved Funding Research Plan Versions 1-6			Start Date	Completion Date	Status
					NESP Funding* \$	Total Other Contributions* \$	Total Budget* \$			
A1	Northern Australian hotspots for the recovery of threatened euryhaline species	Euryhaline elasmobranchs represent over half of the EPBC-listed threatened sharks and rays, with northern Australia of national importance for this threatened species community. Critical information gaps remain, limiting the implementation of Recovery Plan objectives. This project will fill many data gaps through the application of acoustic telemetry, traditional and advanced molecular research (population genetics and close-kin mark-recapture), life history studies and Indigenous knowledge and education. The focus is to improve management and facilitate recovery of these threatened species, through three research themes: 1) monitoring and understanding euryhaline species; 2) Indigenous partnerships for management of euryhaline species; and 3) knowledge for the reassessment of river shark status.	Peter Kyne	Charles Darwin University	846,509	890,346	1,736,855	01.07.15	29.07.20	Completed
A2	Quantification of National Ship Strike Risk	See Project C5	David Peel	CSIRO	0	0	0	01.07.15	30.06.18	Completed
A3	A national assessment of population status of white sharks	White sharks are listed as Vulnerable under the EPBC Act and the subject of a national recovery plan, yet there is still no effective way to assess their population status and thus no way of determining the efficacy of conservation actions. Recent debate due to various human-shark interactions has highlighted the need for further information. This project will provide a national assessment of population size and status in order to establish the efficacy of existing recovery actions and provide a scientifically sound and rational basis from which to develop policies that balance conservation objectives and public safety.	Barry Bruce	CSIRO	764,000	807,208	1,571,208	01.07.15	28.02.18	Completed
A4	The Status of Human-Shark Interactions and Initiatives to Mitigate Risk in Australia	Considerable political, public and media attention have recently been focussed on human-shark interactions, specifically surrounding shark attack and ways to mitigate this risk. Finding the most appropriate policy balance between conservation of sharks, maximising public safety and understanding the broader social and economic ramifications/drivers for doing so is a continuing challenge for Government. To deliver this need the project has reviewed the status of human-shark interactions in Australia, provided a synthesis of current initiatives to reduce risk, reviewed recent international efforts to address these issues and identified knowledge gaps to provide an informed base to determine the most appropriate future research and policy support.	Barry Bruce	CSIRO	50,000	42,359	92,359	01.06.2015	15.12.2015	Completed
A5	Defining Connectivity of Australia's hammerhead sharks	Hammerhead sharks are the focus of conservation management through recent listing on CITES and CMS. The clear data gap for DAWE and GBRMPA is connectivity of populations across national and international jurisdictions. This project applies genetic and satellite telemetry to examine the movement and connectivity of hammerhead sharks. This will help refine use of CMRs and the GBRMP, and define BIAs where possible. These data will be assimilated with current research to provide a more comprehensive understanding of the status of hammerhead shark populations to inform species listing and assist management and conservation policies at national and international levels.	Michelle Heupel	Australian Institute of Marine Science (AIMS)	742,852	729,542	1,472,394	01.07.2015	31.12.2019	Completed
A6	Prioritisation of research and management needs for Australian elasmobranch species	NERP successfully demonstrated new ways to get the raw ingredients for evidence-based management of previously intractable species: abundance, survival, connectivity. But there is still a need to explore/demonstrate how management can use these tools (e.g. adaptive control of bycatch, or deciding if more monitoring is needed), and which species are suitable. This project comprised (i) a workshop to re-assess Australian shark and ray species in terms of degree-of-concern, state-of-knowledge-for-management, and feasibility-of-filling-knowledge-gaps; and (ii) a desk study exemplifying one pathway to management use. In 2016, we have worked with DAWE to prioritise species for research and explore more management pathways.	Michelle Heupel	Australian Institute of Marine Science (AIMS)	88,493	94,516	183,009	01.05.2015	31.12.2015	Completed
A7	Monitoring population dynamics of 'Western' right whales off southern Australia	Continuation (since 1993) of annual aerial surveys, to include counts and identification photographs, of Southern Right Whales between Cape Leeuwin (WA) and Ceduna (SA), where wintering animals come close to the coast – adult females to calve, at approximately three-year intervals, other adults and juveniles less regularly. The area is the main wintering ground of a major 'western' subpopulation of 'Australian' right whales, differing in number and extent of recovery (from 19th century hunting) from an 'eastern' subpopulation which so far shows little if any recovery. Counts allow estimation of population trend and current numbers; identification photographs allow estimation of life history parameters.	Diana Jones	The Western Australian Museum	249,000	40,000	289,000	15.08.2015	30.3.2021	Completed
A8	Exploring the status of Western Australia's sea snakes	All sea snakes are listed marine species under the EPBC Act and three Australian endemic species are listed as Critically Endangered or Endangered, and as such are a national conservation priority. This project examines sea snake abundance and diversity from broad-scale and targeted surveys at reef and coastal sites to update Conservation Advices, refine status within CMRs and inform policies of DAWE, DPaW, PA and others. This research will improve our understanding of population status to guide on-ground conservation to reduce population declines.	Michelle Heupel	Australian Institute of Marine Science (AIMS)	453,015	517,986	971,001	01.02.2016	30.06.2020	Completed

Marine Biodiversity Hub Final Report - Attachment A

Project Number/ID	Project Name/Title	Project Summary	Project Leader	Lead Organisation	Approved Funding Research Plan Versions 1-6			Start Date	Completion Date	Status
					NESP Funding* \$	Total Other Contributions* \$	Total Budget* \$			
A9	Grey Nurse Shark Ck-MR Population Estimate - East Coast	A review of the 2002 National Recovery Plan for Grey Nurse Shark (DEWHA 2009) concluded it was not possible to determine if the east coast population had shown any signs of recovery (DoE 2014). Action 1.1 of the new recovery plan (DoE 2014) is to resurvey Grey Nurse Shark populations to assess population trends and dynamics. This project will resample the east coast population and use genetic SNP data to inform close kin-mark recapture analysis to estimate population size and trend, and provide guidance on future monitoring strategies for the east coast population of Grey Nurse Shark.	Russell Bradford	CSIRO	115,000	109,424	224,424	01.01.2016	20.06.2018	Completed
A10	Conservation of spotted handfish and their habitat	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.	Tim Lynch	CSIRO - Oceans & Atmosphere	633,743	1,727,049	2,360,792	01.03.2016	31.12.2020	Completed
A11	Shark action plan	Conservation of elasmobranch species (sharks and rays) is an increasing priority globally, including Australia, as evidence of overexploitation of some species becomes apparent. Common issues and threats among elasmobranch species may improve management if considered holistically. This project will produce a Shark Action Plan assessing requirements for improved management including a summary of current status across the taxa, guidelines for reducing impacts and improving management, and identification of key knowledge gaps impeding conservation and management. This Plan will help guide policy for Australian elasmobranchs developed by DAWE and fishery managers. On-ground conservation will be developed from recommendations in this plan.	Michelle Heupel	Australian Institute of Marine Science (AIMS)	235,092	378,074	613,166	10.01.2017	16.03.2021	Ongoing
A12	Australia's Northern Seascape: assessing status of threatened and migratory marine species	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.	Peter Kyne	Charles Darwin University	1,347,105	1,489,658	2,836,763	1.01.2017	31.3.2021	Ongoing
A13	Estimation of population abundance and mixing of 'Southern' right whales in the Australian and New Zealand regions	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 movement and connectedness of whales that utilise breeding areas on the eastern, southern and western coasts of Australia. Information on the population abundance and movements of southern right whales provided by this project will allow the Australian government to better evaluate progress made against the Conservation Management Plan for the species and ensure conservation efforts for the species are effectively coordinated at the regional level.	Karen Evans	CSIRO	297,374	116,015	413,389	1.04.2018	30.03.2021	Ongoing
A14	Identification of near-shore habitats of juvenile white sharks in Southwestern Australia	There is credible evidence that juvenile white sharks are present in a relatively restricted region between the head of the Great Australia Bight (GAB) and Ceduna, which encompasses the boundaries of State and Commonwealth managed marine parks and reserves, some of which are accessed via Indigenous Protected Areas. This pilot project is to undertake visual surveys (using Unmanned Aerial Vehicle – UAV) for juvenile white sharks during spring and summer. The on-land surveillance approach outlined in this proposed pilot project will inform decision makers on the efficacy of supporting subsequent on-water activity to capture and electronically tag juvenile white sharks to assess habitat use in the Great Australian Bight Marine Park (Commonwealth waters) and Far West Coast Marine Park (State waters).	Russell Bradford	CSIRO	50,000	71,886	121,886	14.01.2019	01.03.2020	Completed
A15	Conservation Status of Tropical Inshore Dolphins	The <i>Conservation Status of Tropical Inshore Dolphins</i> project will entail the compilation and review of the results of numerous research projects completed under the <i>Whale and Dolphin Protection Plan</i> , as well as monitoring and offset programs associated with port developments. The aim is to determine the conservation status and address the listing criteria of the: Australian snubfin dolphin, <i>Orcaella heinsohni</i> ; Australian humpback dolphin, <i>Sousa sahulensis</i> ; and Indo-Pacific bottlenose dolphin, <i>Tursiops aduncus</i> .	Simon Allen	UWA	35,000	35,000	70,000	01.01.2020	31.03.2021	Completed

Marine Biodiversity Hub Final Report - Attachment A

Project Number/ID	Project Name/Title	Project Summary	Project Leader	Lead Organisation	Approved Funding Research Plan Versions 1-6			Start Date	Completion Date	Status
					NESP Funding* \$	Total Other Contributions* \$	Total Budget* \$			
B1	Road testing decision support tools via case study applications	This project will deploy tools from economics and decision science to identify sound investments within constrained budgets for: 1. Ecological monitoring of Commonwealth Marine Reserves 2. Management actions for threatened and migratory species or threatened communities, and 3. Restoration of saltmarsh and shellfish habitats. The three case studies involve coherent integration of ecological understanding, social and organisational value judgements, and economic analysis.	Terry Walshe	Australian Institute of Marine Science (AIMS)	452,099	431,771	883,870	01.07.2015	31.12.2019	Completed
B2	Analysis and elicitation to support State of the Environment reporting for the full spectrum of data availability	The availability and quality of observation data that may be used to support State of the Environment reporting lies on a spectrum from: (i) high quality (e.g. Reef Life Survey, Long term reef monitoring programme, Temperate Reef Monitoring programme, state-based MPA monitoring programmes); (ii) moderate quality (e.g. continuous plankton recorder, occasional by catch surveys); (iii) low quality (anecdotal information) to (iv) expert beliefs but no empirical observations. The project has been completed, and provided direct input to the marine chapter of the 2016 State of the Environment report, by providing expert assessment of environmental status indicators defined for the 2011 State of the Environment report.	Simon Barry	University of Tasmania, CSIRO	61,759	63,640	125,399	01.07.2015	30.06.2017	Completed
B3	Enhancing access to relevant marine information – developing a service for searching, aggregating and filtering collections of linked open marine data	This project aims to improve the searchability and delivery of sources of linked open data, and to provide the ability to forward collections of discovered data to web services for subsequent processing through the development of a linked open data search tool. The work will improve access to existing data collections, and facilitate the development of new applications by acting as an aggregator of links to streams of marine data. The work will benefit managers (i.e. Department of the Environment staff) by providing fast and simple access to a wide range of marine information products, and offering a means of quickly synthesizing and aggregating multiple sources of information.	Johnathan Kool	Geoscience Australia	91,750	47,749	139,499	01.07.2015	31.12.2016	Completed
B4	Underpinning the repair & conservation of Australia's threatened coastal-marine habitats – phase II.	The objective of this research is to support the scaling-up of repair efforts for two threatened nearshore marine ecological communities, shellfish reefs and salt marshes. Both habitats harbour significant marine biodiversity and play a critical role in supporting healthy estuarine and nearshore systems. The research synthesis will be used to guide the development of more effective policy on coastal-marine repair, improve community education on the importance of habitats to estuary health and develop a detailed business case to support investment in marine repair activities for private industry stakeholders.	Colin Creighton Dr Ian McLeod Dr Chris Gillies	James Cook University	520,000	616,569	1,136,569	01.07.2015	30.06.2018	Completed
C1	Improving our understanding of pressures on the marine environment	The marine environment in Australia is impacted by a wide range of different pressures. This project aims to assist DAWE, and other research users, to improve understanding of the potential impacts of anthropogenic disturbance to marine conservation values by providing up-to-date data and analyses on the spatial distribution of pressures and trends. The research is designed to inform decision making under the EPBC Act (acceptability of proposed activities, evaluation of effectiveness of mitigation measures) on NMES (including Key Ecological Features), implementation of multiple strategies in four Marine Bioregional Plans management of Commonwealth Marine Reserves and State of the Environment reporting.	Piers Dunstan	CSIRO	551,278	568,387	1,119,665	01.07.2015	20.12.2020	Completed
C2	Continental-scale tracking of threats to shallow Australian reef ecosystems	The project will integrate Australia's largest, most detailed datasets of shallow-water tropical and temperate marine biodiversity, and assess how pollution, fishing, rising sea temperatures and introduced species are impacting associated natural values. An initial outcome will be the identification of state-of-the-environment indicators for inclusion in the 2016 State of the Environment report, with subsequent activities aimed at contributing additional data products needed for other NESP projects, Parks Australia, and the Essential Environmental Measures initiative. The project will also describe a national shallow-water baseline of biodiversity in Commonwealth Marine Reserves for assessment of change through the long term.	Graham Edgar	University of Tasmania	806,954	1,433,575	2,240,529	01.07.2015	31.12.2017	Completed
C3	Change detection and monitoring of key marine and coastal environments – application of the Australian Geoscience Data Cube	This project aims to leverage the extensive time-series of earth observation image data in the Australian Geoscience Data Cube (AGDC) by developing change detection algorithms to analyse key environmental parameters in the coastal and marine zone. Spatial information produced by this project can inform management decisions, and assist in evaluating management action outcomes, by providing a quantifiable measure of historical change and ongoing monitoring and change detection capabilities. Phase 1 of this project aimed to demonstrate the capability of using the AGDC through the development of an inter-tidal zone change detection algorithm and data set, with a view to developing and implementing an expanded range of stakeholder targeted algorithms to inform decision making processes in Phase 2.	Stephen Sagar	Geoscience Australia	56,500	42,790	99,290	01.05.2015	01.12.2016	Completed

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C4	The National Outfall Database project (Clean Ocean Foundation)	NOD addresses the need of government and community to understand the impacts on health and the ocean environment that occur from sewerage outfalls around Australia. The project will be delivered over a three year time frame and will provide: 1) A publicly accessible national outfall database and reports. 2) A ranking of the outfalls (and sewerage treatment systems) according to health and impact criteria with peer review of the ranking system and resulting ranking outcomes. 3) Comparison of geographical regions in sewerage volume and pollution impact. 4) Mapping of the database. 5) Community engagement in conduct of this research and consumption of the outcomes.	John Gemmill	Clean Ocean Foundation	520,000	605,852	1,125,852	01.07.2015	31.3.2021	Completed
C5	Quantification of risk from shipping to large marine fauna across Australia	Given the substantial and ongoing increases in coastal and port development along the Australian coastline, and an associated increase in recreational and commercial shipping, there is an increasing potential for adverse interactions with marine species. Two risks associated with these activities for large marine fauna are ship collisions (particularly relevant for marine mammals, turtles and whale sharks) and the impact of chronic ocean noise (across a wide range of species). This project aims to provide directed and robust science (species- and area-specific) to inform management and administrative decision-making by the Department of Environment in its application of the EPBC Act.	David Peel	CSIRO	367,000	348,428	715,428	01.07.2015	30.06.2018	Completed
D1	National Data Collation, Synthesis and Visualisation to Support Sustainable Use, Management and Monitoring of Marine Assets	Effective management of marine assets requires an understanding of ecosystems and the processes that influence patterns of biodiversity. Through collaboration and synthesis of existing data this project will improve access to, and usability 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 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.	Karen Miller	Australian Institute of Marine Science (AIMS)	1,595,105	1,401,327	2,996,432	01.07.2015	30.06.2019	Completed
D2	Standard Operating Procedures (SOP) for survey design, condition assessment and trend detection	Understanding of the status and trends of indicators in Australia's marine environment requires standardised monitoring. This project will develop Standard Operating Procedures (SOP) in the planning, collection, analysis, and reporting of monitoring data. In particular, the project will: 1) provide guidance on what kind of monitoring is required (and where and when), 2) provide a simple yet powerful survey design tool, 3) provide two worked SOP examples (one benthic and one pelagic), 4) develop field manuals for some high priority sampling platforms (e.g. underwater video) with prioritisation stemming from a comparative analysis, and 5) assess approaches for monitoring pelagic ecosystems.	Scott Foster	CSIRO	837,712	920,446	1,758,158	01.07.2015	31.03.2021	Ongoing
D3	Implementing monitoring of AMPS and the status of marine biodiversity assets on the continental shelf	New [RPv3] - There is a significant 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. This project will provide the science support for program development, and a prioritisation framework for implementation. 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 a CMR monitoring program, new knowledge to inform CMR management, a national integrated framework for SOE reporting, and collaboration between State-based and Commonwealth-based programs.	Neville Barrett	University of Tasmania	4,829,464	5,025,364	9,854,828	01.01.2017	20.03.2021	Ongoing
D4	Expanding our spatial knowledge of marine biodiversity to support future best-practice reviews	This project will fill data gaps and evaluate methods relevant to the ongoing spatial management of seafloor biota across the Australian marine domain. The objective is to prepare Australian, State and Territory governments for future best-practice reviews of Australia's marine bioregionalisation that can be used to improve marine spatial planning and management initiatives (e.g. marine bioregional plan and marine protected area reviews, environmental impact and natural heritage assessments). The project will incorporate results from field trips to unexplored offshore areas of Australia's marine domain and communicate biodiversity values of the CMR network to the Australian public.	Tim O'Hara	Museum Victoria	770,000	1,694,248	2,464,248	01.07.2017	31.12.2020	Completed
D5	A standardised national assessment of the state of coral and rocky reef biodiversity	This project will involve integration of a national suite of reef biota Underwater Visual Census (UVC) monitoring datasets (Reef Life Survey, UTas, AIMS, Parks Victoria, SA DEWNR) to provide a comprehensive update to the state of Australian Reefs report for the next national State of the Environment Report. Maps and indicator trends will show changes in the health of rocky and coral reefs nationally from 2005 to 2020. The update will include addition of a new index which summarises the population trajectories for 600-1000 reef species nationally. Individual species trajectories will provide the only threat status information for the majority of these species, assisting future listing of previously unassessed species if significant declines are detected.	Rick Stuart-Smith	University of Tasmania	199,233	825,228	1,024,461	01.01.2019	31.03.2021	Ongoing

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D6	Socioeconomic benchmarks	Social and economic values are key drivers for marine science and marine policy but are too rarely integrated with marine biodiversity monitoring programs. In close consultation with PA we will review existing metrics used to survey social and economic values associated with marine parks. This review will include consulting with national and international expertise and actively consulting with State and other Commonwealth agencies, some of whom are currently conducting reviews or have existing frameworks for surveying social and economic values (e.g. GBRMPA, NSW DPI and Vic Parks). In collaboration with national partners and PA we will organise a national methods workshops to discuss and refine metrics and methods to quantify social and economic benchmarks for State and Australian Marine Parks (AMPs) and produce an SOP relevant to AMPs taking into consideration the DAWE's environmental accounting processes and PA's Monitoring, Evaluation, Reporting and Improvement (MERI) framework.	Tim Langlois	University of Western Australia	281,902	248,237	530,139	10.01.2019	31.03.2021	Ongoing
D7	Support for PA MERI Implementation	This application is to facilitate Hub engagement with Parks Australia during development and initiation of their Monitoring, Evaluation, Reporting and Improvement (MERI) System for Australian Marine Parks. A key priority for the Marine Parks Branch in the 2019-20 financial year is finalising the Australian Marine Park MERI system. The Marine Biodiversity Hub will play an important role in development and implementation of this system. Hub partners have had previous experience in developing the integrated monitoring framework for the Great Barrier Reef, developing a process for identifying indicators for monitoring Key Ecological Features, and also have collected much of the ecological data that exists within Australian Marine Parks.	Neville Barrett /Piers Dunstan	UTAS/CSIRO	100,000	142,666	242,666	02.01.2020	20.12.2020	Completed
D8	SOI Gascoyne Marine Park	The approved survey to the Gascoyne canyons aims to map the surrounding marine park using multibeam sonar and to characterise the biodiversity of North-West canyon fauna, using an ROV to undertake a comprehensive taxon inventory and eDNA analyses to provide a methodological comparison. The proposed project will extend the survey's capability and increase its relevance to marine park management, particularly in deep-sea and canyon habitats. The proposed project will yield communication products such as a fly-through, eco-narrative, and image library, as well as products consistent with previous NESP reporting such as a voyage plan and post-survey report.	Rachel Przeslawski	Geoscience Australia	29,528	76,407	105,935	01.01.2020	31.03.2021	Completed
E1	Guidelines for analysis of cumulative impacts and risks to the Great Barrier Reef	Existing guidance and standards for assessing impacts and risk (e.g. ISO 31000) are specified at a high-level allowing for considerable variation in approach, cost and outcomes from assessments and no guidance on direct or cumulative impacts. We will develop a national standard to support analysis of impacts and risks to the environmental, social and economic values required by the EPBC Act. The standard will be compatible with and support the process outlined in the Significant Impact guidelines for MNES and for Australian Marine Parks (AMP), including the means to calculate the impact and risk of upstream, downstream, facilitated and indirect impacts that will be presented in clear tabular and graphic formats, including maps as appropriate.	Piers Dunstan	CSIRO	400,000	682,333	1,082,333	01.01.2018	31.03.2021	Ongoing
E2	Characterising anthropogenic underwater noise to improve understanding and management of acoustic impacts to marine wildlife	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 vessel noise exposure and impacts to MNES. The outputs will provide key information to marine regulators and management agencies such as DAWE, AMSA and GBRMPA, and their counterparts in state and territory governments, to help them meet responsibilities and obligations under international and national law and policy to minimise the impacts of the shipping noise on MNES.	David Peel	CSIRO	401,855	476,990	878,845	01.01.2018	15.03.2021	Ongoing
E3	Marine Plastics	The project will inform national policy and action to reduce the release and impacts of microplastics on our environment and oceans: 1) A literature review will firstly identify key marine microplastics research and policy development internationally, with a focus on research that is contextual to microplastics in the Australian marine environment; 2. From this literature review, an options paper will be developed to explore the most feasible and impactful policy approaches for the Australian context and that can be used to form the basis for discussions at a workshop; 3) A one day workshop will draw together policy-makers, researchers and relevant industry peak bodies to discuss and recommend policy and other options to limit microplastics release into the environment. A workshop report will be drafted to summarise findings, recommendations, and next steps. The report will provide evidence to underpin the development of national policy aimed at reducing microplastic pollution, including by identifying priority actions to deliver Australia's 2018 National Waste Policy.	Marcus Haward	UTAS	49,909	90,159	140,068	01.02.2020	30.11.2020	Completed

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E4	Recreational fishing in Commonwealth waters	Australia's recreational fishing sector is moving further offshore in pursuit of fishing opportunities, which places them in areas managed by the Australian Government. Most recreational fisheries research is state based and at two case study sites - Hunter Australian Marine Park (AMP) and the Ningaloo AMP - this data will be assessed for its usefulness to quantify offshore fishing. New data will also be collected will also be collected using creel, socio-economic and remote sensing techniques to better understand fisher's effort, harvest and motivations. As well, the response by fish communities to harvest and the fishery to climate change will be assessed at larger scales. As recreational fishers are key stakeholders in marine management and regulation, a better understanding of their values is required to effectively inform administration of the EPBC Act (e.g. effects of Matters of National Environmental Significance), use of Australian Marine Parks and Commonwealth managed commercial fisheries.	Tim Lynch	CSIRO	252,904	342,315	595,219	01.01.2018	31.12.2019	Completed
E5	The role of restoration in conserving MNES	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 <ul style="list-style-type: none"> • giant kelp forests, • coral reefs, • 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 the more promising habitats and develop a restoration decision framework to guide future investments.	Ian McLeod	James Cook University (JCU)	221,750	374,726	596,476	01.01.2018	31.12.2020	Completed
E6	Assisting restoration of ecosystem engineers through seed-based and shoot-based programs in the Shark Bay WHS	This project will develop community-based seeding and shoot planting restoration practices in the Shark Bay World Heritage Site (WHS). The goal is to scale up the existing restoration research to practice and assist recovery of the dominant seagrasses, <i>Amphibolis Antarctica</i> and <i>Posidonia australis</i> following the 2011 marine heat wave. The Shark Bay WHS is unique globally for its natural values, including stromatolites, extensive seagrass meadow that have constructed sills and banks over 1,000s of years resulting in restricted exchange with the ocean, unique and abundant marine megafauna including 1/8th of the worlds population of dugongs, large populations of sharks and turtles, and one of the longest studied populations of dolphins in the world. The inshore waters of the WHS provides connectivity to the deeper waters of the adjacent Commonwealth Shark Bay Marine Park. Shark Bay seagrasses have recently been devastated by the marine heatwave of 2010-2011 and these events are predicted to increase in frequency and intensity with global warming. The loss of 23% of seagrass cover in the bay (860 km ²) had a flow on effect to mega herbivores, fish, tourism and the commercial aquaculture and fisheries industries dependent of the ecosystem. There is a critical need to develop management actions to respond to such events and to prepare for predicted future events. Seagrass restoration has been explored at Useless Loop and on both sides of the Peron Peninsula near Denham and Monkey Mia over the past 6-8 years (3 ARC Linkage, 1 ARC Discovery Grant), resulting in an increased understanding of the factors required for successful seagrass restoration along the extreme salinity gradient found in Shark Bay. The Malgana people have responsibilities for sea country in Shark Bay and a strong tie to the land and inshore seas that make up the Shark Bay WHS. This project is a collaboration between scientists and the Mulgana community whereby methods will be jointly developed to assist natural recovery in preparation for future devastating impacts of climate change.	Gary Kendrick	University of Western Australia	200,000	210,290	410,290	30.1.2019	30.03.2021	Ongoing
E7	Assessing the feasibility of restoring giant kelp beds in eastern Tasmania	The proposed research will extend on externally funded work commencing in 2018 to select for thermally tolerant and low-nutrient-tolerant giant kelp (<i>Macrocystis pyrifera</i>) genotypes, and which will examine effects of acclimation of selected genotypes by pre-exposure to warm, nutrient poor conditions. The project will outplant pre-exposed selected genotypes of giant kelp as micro-sporophytes in experiment providing / not providing an added source of nutrient. The work is designed to assess the feasibility of this approach as a means to develop minimum patch sizes for giant kelp that can be self-replacing and self-expanding.	Craig Johnson	University of Tasmania	149,909	356,217	506,126	01.01.2019	31.03.2021	Ongoing

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SS1	Synthesis Project 1: Cross-Hub Integrated Assessment - Northern Australia	This project is a cross-hub research collaboration that draws on the considerable experience, regional knowledge, data and networks in the NESP Hubs to explore the potential application, and benefits, of integrated environmental assessments (IEA), focusing on Northern Australia. The project will develop a process framework to guide IEA, identifying available information and critical knowledge gaps, methods for synthesis and analysis, and participatory approaches and governance settings. The project will review the existing tools and systems to support IEA and identify opportunities and potential location/s to test implementation in Northern Australia. The project will provide decision-makers in the Department (and State and Territory regulatory and planning agencies) with pathways for undertaking IEA approaches in Northern Australia, to underpin sustainable regional development and, avoid environmental harm to internationally important biodiversity assets and cultural heritage values.	Nic Bax	CSIRO	39,593	0	39,593	01.10.2019	30.06.2021	Ongoing
SS2	Synthesis Project 2: F. Interpreting pressure profile	This project has three objectives: (i) to provide a geo-spatial analysis of the relative risks posed to Matters of National Environmental Significance (MNES) by pressures that operate within Australia's Exclusive Economic Zone and state/territory waters (a "hotspots" analysis). This relative risk assessment will provide interval-scale risk estimates – also known as semi-quantitative risk estimates - that are meaningful when compared within a study, e.g. between locations within the study's geographic scope, but are not calibrated to observable outcomes in nature; (ii) provide a proof of concept of an adaptive, probabilistic assessment of the cumulative risks posed to MNES in the North Marine Bioregion in a manner that is consistent with the seascape-scale cumulative assessment described in the "Guidelines for analysis of cumulative impacts and risks to the Great Barrier Reef" (developed and tested with Commonwealth, State and Industry stakeholders). This will provide a proof of concept of a fully quantitative risk assessment, providing risk estimates on a ratio scale that are calibrated with, and hence can be compared to, observed outcomes in nature; and (iii) provide additional support to the Marine Biodiversity Hub's contribution to the NESP cross-hub Northern Integrated Knowledge project.	Keith Hayes	CSIRO	151,777	162,560	314,337	15.01.2020	31.03.2021	Completed
SS3	Synthesis Project 3: N. National trends in coral species following heatwaves	This project will engage coral taxonomic experts to annotate existing Reef Life Survey photoquadrats taken across northern Australia before and after major disturbances, to allow: 1) Quantification of the spatial and species-level responses of Australian corals to the 2016 and 2017 marine heatwave and mass bleaching events (and cyclones that occurred during this period); 2) Identification of the species most threatened by warming and cyclones, and species likely to respond best to restoration efforts; and 3)Contribution to a coral-specific analysis to the next national State of the Environment report, through project D5.	Rick Stuart-Smith	UTAS	51,911	193,277	245,188	01.10.2019	30.11.2020	Ongoing
					19,897,075	24,430,614	44,327,689			

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A1	Northern Australian hotspots for the recovery of threatened euryhaline species	Euryhaline elasmobranchs represent over half of the EPBC-listed threatened sharks and rays, with northern Australia of national importance for this threatened species community. Critical information gaps remain, limiting the implementation of Recovery Plan objectives. This project will fill many data gaps through the application of acoustic telemetry, traditional and advanced molecular research (population genetics and close-kin mark-recapture), life history studies and Indigenous knowledge and education. The focus is to improve management and facilitate recovery of these threatened species, through three research themes: 1) monitoring and understanding euryhaline species; 2) Indigenous partnerships for management of euryhaline species; and 3) knowledge for the reassessment of river shark status.	Life history of the Critically Endangered largetooth sawfish: a compilation of data for population assessment and demographic modelling	https://www.nespmarine.edu.au/document/life-history-critically-endangered-largetooth-sawfish-compilation-data-population	
			Troubled waters: Threats and extinction risk of the sharks, rays and chimaeras of the Arabian Sea and adjacent waters	https://www.nespmarine.edu.au/document/troubled-waters-threats-and-extinction-risk-sharks-rays-and-chimaeras-arabian-sea-and	
			Close-Kin Mark-Recapture population size estimate of Glyphis garricki in the Northern Territory	https://www.nespmarine.edu.au/document/close-kin-mark-recapture-population-size-estimate-glyphis-garricki-northern-territory	
			Northern River Shark project summary fact sheet (2020)	https://www.nespmarine.edu.au/document/northern-river-shark-fact-sheet-2020	
			Northern River Shark project summary poster	https://www.nespmarine.edu.au/document/northern-river-shark-poster	
			Conservation impact scores identify shortfalls in demonstrating benefits of threatened wildlife displays in zoos and aquaria	https://www.nespmarine.edu.au/document/conservation-impact-scores-identify-shortfalls-demonstrating-benefits-threatened-wildlife	
			Categorising use patterns of non-marine environments by elasmobranchs and a review of their extinction risk	https://www.nespmarine.edu.au/document/categorising-use-patterns-non-marine-environments-elasmobranchs-and-review-their-extinction	
			The scientist abroad: maximising research impact and effectiveness when working as a visiting scientist	https://www.nespmarine.edu.au/document/scientist-abroad-maximising-research-impact-and-effectiveness-when-working-visiting	
			Data report to synthesize the available telemetry data from this project	https://animaltracking.aodn.org.au/receivers/dep/loyment	Search for project 'NESP Northern Australian hotspots for the recovery of threatened euryhaline species' at link. Detection data is embargoed until the end of 2023.
			One panel to rule them all: DArTcap genotyping for population structure, historical, demography, and kinship analyses, and its application to a threatened shark		Manuscript has been published in Molecular Ecology Resources, DOI 10.1111/1755-0998.13204. Not yet available for publishing on the Hub website.
			Troubled waters: Threats and extinction risk of the sharks, rays and chimaeras of the Arabian Sea and adjacent waters	https://www.nespmarine.edu.au/document/troubled-waters-threats-and-extinction-risk-sharks-rays-and-chimaeras-arabian-sea-and	
			A rare contemporary record of the Critically Endangered Ganges Shark, <i>Glyphis gangeticus</i>	https://www.nespmarine.edu.au/document/rare-contemporary-record-critically-endangered-ganges-shark-glyphis-gangeticus	
			Species Overview: Largetooth Sawfish <i>Pristis pristis</i> - Report	https://www.nespmarine.edu.au/document/species-overview-largetooth-sawfish-pristis-pristis	
			Recreational fishing impacts on threatened river sharks: A potential conservation issue - Journal Article	https://www.nespmarine.edu.au/document/recreational-fishing-impacts-threatened-river-sharks-potential-conservation-issue	
			Description of the egg cases of Dentiraja polyommata (Rajiformes: Rajidae) and Asymbolus pallidus (Carcharhiniformes: Scyliorhinidae) from Queensland, Australia - Journal Article	https://www.nespmarine.edu.au/document/description-egg-cases-dentiraja-polyommata-rajiiformes-rajidae-and-asymbolus-pallidus	
Sawfishes in Papua New Guinea: a preliminary investigation into their status and level of exploitation - Journal Article	https://www.nespmarine.edu.au/document/sawfishes-papua-new-guinea-preliminary-investigation-their-status-and-level-exploitation				
Inferring contemporary and historical genetic connectivity from juveniles - Journal Article	https://www.nespmarine.edu.au/document/inferring-contemporary-and-historical-genetic-connectivity-juveniles				

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			Reproductive parameters of rhinobatid and urolophid batoids taken as bycatch in the Queensland (Australia) East Coast Otter Trawl Fishery - Journal Article	https://www.nespmarine.edu.au/document/reproductive-parameters-rhinobatid-and-urolophid-batoids-taken-bycatch-queensland-australia	
			Urogymnus acanthobothrium sp. nov., a new euryhaline whipray (Myliobatiformes: Dasyatidae) from Australia and Papua New Guinea - Journal Article	https://www.nespmarine.edu.au/document/urogymnus-acanthobothrium-sp-nov-new-euryhaline-whipray-myliobatiformes-dasyatidae	
			A new species of wedgefish, <i>Rhynchobatus cooki</i> (Rhinopristiformes, Rhinidae), from the Western Pacific - Journal Article	https://www.nespmarine.edu.au/document/new-species-wedgefish-rhynchobatus-cooki-rhinopristiformes-rhinidae-western-pacific	
			Malak Malak Sawfish Patrol and Relocation Protocol	https://www.nespmarine.edu.au/document/malak-malak-sawfish-patrol-relocation-protocol	
			Genetic sequencing of threatened euryhaline species	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=f7d3a11e-bd2b-4d8d-af3d-d2fc3a058339	
			Acoustic telemetry tracking data	http://metadata.imas.utas.edu.au/geonetwork/srv/en/metadata.show?uuid=8e9746ed-20f8-4c1b-9437-1fa0d5e53264	
			Euryhaline elasmobranch fishing database (including images)	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=a0cf8cc5-67cd-49bb-bcaadef21ed3287	
			Euryhaline Elasmobranchs community communications outputs	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=2b1ebdbb-e6c5-4673-b230-d7d2b5eba819	
			Every Sawfish Counts - Sawfish Rescue, Daly River, September 2017	https://www.youtube.com/watch?v=fKkvHRptWww	
			Every Sawfish Counts - Sawfish Rescue, Daly River, September 2017	https://www.youtube.com/watch?v=fKkvHRptWww&t=10s	
			Save a Sawfish (Kriol)	https://www.youtube.com/watch?v=u22S1zVwiLE&t=5s	
			Save a Sawfish (English Angelina Joshua)	https://www.youtube.com/watch?v=dESDV9A7gFs	
			Tyemirerriny: looking after Daly River Sawfish	https://www.youtube.com/watch?v=o5oN7xu1mI0&t=10s	
			Sawfish territory - Malak Malak rangers	https://www.youtube.com/watch?v=QxRgjRqtth0	
A2	Quantification of National Ship Strike Risk	See Project C5	See project C5		
A3	A national assessment of population status of white sharks	White sharks are listed as Vulnerable under the EPBC Act and the subject of a national recovery plan, yet there is still no effective way to assess their population status and thus no way of determining the efficacy of conservation actions. Recent debate due to various human-shark interactions has highlighted the need for further information. This project will provide a national assessment of population size and status in order to establish the efficacy of existing recovery actions and provide a scientifically sound and rational basis from which to develop policies that balance conservation objectives and public safety.	Evidence of diverse movement strategies and habitat use by white sharks, <i>Carcharodon carcharias</i> , off southern Australia	https://www.nespmarine.edu.au/document/evidence-diverse-movement-strategies-and-habitat-use-white-sharks-carcharodon-carcharias	
			First national-scale snapshot of how marine researchers engage with Aboriginal and Torres Strait Islander communities - Fact sheet	https://www.nespmarine.edu.au/document/first-national-scale-snapshot-how-marine-researchers-engage-aboriginal-and-torres-strait	
			Estimating growth in juvenile white sharks using stereo baited remote underwater video systems (stereo-BRUVs) - Final report	https://www.nespmarine.edu.au/document/estimating-growth-juvenile-white-sharks-using-stereo-baited-remote-underwater-video-systems	
			Genetic relatedness reveals total population size of white sharks in eastern Australia and New Zealand	https://www.nespmarine.edu.au/document/genetic-relatedness-reveals-total-population-size-white-sharks-eastern-australia-and-new-zealand	
			Assessing the size of Australia's white shark populations - Fact sheets	https://www.nespmarine.edu.au/document/assessing-size-australias-white-shark-populations	

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Project Number/ID	Project Name/Title	Project Summary	Outputs	Link to Output	Comments on outputs
			A national assessment of the status of white sharks - Report	https://www.nespmarine.edu.au/document/national-assessment-status-white-sharks	
			Broad-scale coastal movements of white sharks off Western Australia described by passive acoustic telemetry data - Journal Article	https://www.nespmarine.edu.au/document/broad-scale-coastal-movements-white-sharks-western-australia-described-passive-acoustic	
			Juvenile white sharks <i>Carcharodon carcharias</i> utilise estuarine environments in south-eastern Australia - Journal Article	https://www.nespmarine.edu.au/document/juvenile-white-sharks-carcharodon-carcharias-utilise-estuarine-environments-south-eastern	
			Use of stereo baited remote underwater video systems to estimate the presence and size of white sharks (<i>Carcharodon carcharias</i>) - Journal Article	https://www.nespmarine.edu.au/document/use-stereo-baited-remote-underwater-video-systems-estimate-presence-and-size-white-sharks	
			Towards a national population assessment for white sharks - Fact sheet	https://www.nespmarine.edu.au/document/towards-national-population-assessment-white-sharks-fact-sheet	
			White shark acoustic tracking movement data 2015, 2016, 2017	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=d4cfbedf-6a0f-44ef-b736-08974c14bbcc	Data has been classified as <u>restricted</u> to minimise the risk that data could be used in ways that may threaten conservation of white shark
			Sequence IDs for archived white shark genetics data	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=de2cb27d-ae90-476d-b609-3fd1a2f52871	
A4	The Status of Human-Shark Interactions and Initiatives to Mitigate Risk in Australia	Considerable political, public and media attention have recently been focused on human-shark interactions, specifically surrounding shark attack and ways to mitigate this risk. Finding the most appropriate policy balance between conservation of sharks, maximising public safety and understanding the broader social and economic ramifications/drivers for doing so is a continuing challenge for Government. To deliver this need the project has reviewed the status of human-shark interactions in Australia, provided a synthesis of current initiatives to reduce risk, reviewed recent international efforts to address these issues and identified knowledge gaps to provide an informed base to determine the most appropriate future research and policy support.	The status of human-shark interactions and initiatives to mitigate risk in Australian waters	https://www.nespmarine.edu.au/document/status-human-shark-interactions-and-initiatives-mitigate-risk-australian-waters	
A5	Defining Connectivity of Australia's hammerhead sharks	Hammerhead sharks are the focus of conservation management through recent listing on CITES and CMS. The clear data gap for DAWE and GBRMPA is connectivity of populations across national and international jurisdictions. This project applies genetic and satellite telemetry to examine the movement and connectivity of hammerhead sharks. This will help refine use of CMRs and the GBRMP, and define BIAs where possible. These data will be assimilated with current research to provide a more comprehensive understanding of the status of hammerhead shark populations to inform species listing and assist management and conservation policies at national and international levels.	Examination of connectivity of hammerhead sharks in northern Australia	https://www.nespmarine.edu.au/document/examination-connectivity-hammerhead-sharks-northern-australia	
			Description and genetic characterisation of <i>Pulchrascaris australis</i> n. sp. in the scalloped hammerhead shark, <i>Sphyrna lewini</i> (Griffin & Smith) in Australian waters		Manuscript has been published in Springer Nature. DOI is 10.1007/s00436-020-06672-w but is not yet available on the Hub's website.
			Northern Australia Hammerhead Shark Tagging Program - Fact Sheet (Update January 2019)	https://www.nespmarine.edu.au/document/northern-australia-hammerhead-shark-tagging-program-fact-sheet-update-january-2020	
			Description of <i>Piscicapillaria bursata</i> sp. nov. (Capillariidae) and Redescription of <i>Parascaraphis sphyrnae</i> Campana-Rouget, 1955 (Cystidicolidae), Two Nematode Parasites of Hammerhead Sharks (<i>Sphyrna</i> spp.)	https://www.nespmarine.edu.au/document/description-piscicapillaria-bursata-sp-nov-capillariidae-and-redescription-parascaraphis	
			Acanthocephalans from Australian elasmobranchs (Chondrichthyes) with a description of a new species in the genus <i>Gorgorhynchus</i> Chandler, 1934 (Rhadinorhynchidae)	https://www.nespmarine.edu.au/document/acanthocephalans-australian-elsmobranchs-chondrichthyes-description-new-species-genus	
			Indigenous knowledge and cultural values of hammerhead sharks in Northern Australia	https://www.nespmarine.edu.au/document/indigenous-knowledge-and-cultural-values-hammerhead-sharks-northern-australia	

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			Crossing lines: a multidisciplinary framework for assessing connectivity of hammerhead sharks across jurisdictional boundaries - Journal Article	https://www.nespmarine.edu.au/document/crossing-lines-multidisciplinary-framework-assessing-connectivity-hammerhead-sharks-across	
			Northern Australia Hammerhead Shark Tagging Program - Fact Sheet	https://www.nespmarine.edu.au/document/northern-australia-hammerhead-shark-tagging-program-fact-sheet	
			Exploring the status of Australia's hammerhead sharks - Report	https://www.nespmarine.edu.au/document/exploring-status-australia%E2%80%99s-hammerhead-sharks	
			Defining the connectivity of Australia's hammerhead sharks - Fact Sheet	https://www.nespmarine.edu.au/document/defining-connectivity-australia%E2%80%99s-hammerhead-sharks-fact-sheet	
			Hammerhead connectivity metadata from tagged sharks	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=0b1796db-6686-4577-95fe-770e1e8ffb46	
			Hammerhead connectivity movement kmz files (for mapping)	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=9a767302-742f-447c-a060-a23d9f12197c	
			Description and characterisation of Terranova pectinolabiata n. sp. (Nematoda: Anisakidae) in great hammerhead shark, Sphyrna mokarran (Rüppell, 1837), in Australia	https://www.nespmarine.edu.au/document/description-and-characterisation-terranova-pectinolabiata-n-sp-nematoda-anisakidae-great	
A6	Prioritisation of research and management needs for Australian elasmobranch species	NERP successfully demonstrated new ways to get the raw ingredients for evidence-based management of previously intractable species: abundance, survival, connectivity. But there is still a need to explore/demonstrate how management can use these tools (e.g. adaptive control of bycatch, or deciding if more monitoring is needed), and which species are suitable. This project comprised (i) a workshop to re-assess Australian shark and ray species in terms of degree-of-concern, state-of-knowledge-for-management, and feasibility-of-filling-knowledge-gaps; and (ii) a desk study exemplifying one pathway to management use. In 2016, we have worked with DAWE to prioritise species for research and explore more management pathways.	Close-Kin Mark-Recapture - Journal Article	https://www.nespmarine.edu.au/document/close-kin-mark-recapture	
			Prioritisation of research and management needs for Australian elasmobranch species - Final Report	https://www.nespmarine.edu.au/system/files/FINAL%20Heupel%20A6%20report%20Prioritisation%20of%20research%20and%20management%20needs%20of%20Aust%20elasmobranch%20species_mh.pdf	
A7	Monitoring population dynamics of 'Western' right whales off southern Australia	Continuation (since 1993) of annual aerial surveys, to include counts and identification photographs, of Southern Right Whales between Cape Leeuwin (WA) and Ceduna (SA), where wintering animals come close to the coast – adult females to calve, at approximately three-year intervals, other adults and juveniles less regularly. The area is the main wintering ground of a major 'western' subpopulation of 'Australian' right whales, differing in number and extent of recovery (from 19th century hunting) from an 'eastern' subpopulation which so far shows little if any recovery. Counts allow estimation of population trend and current numbers; identification photographs allow estimation of life history parameters.	Monitoring Population Dynamics of 'Western' Right Whales off Southern Australia 2018-2021 - Progress Report on activities for 2020	https://www.nespmarine.edu.au/document/monitoring-population-dynamics-%E2%80%98western%E2%80%99-right-whales-southern-australia-2018-2021-final-1	
			Monitoring Population Dynamics of 'Western' Right Whales off Southern Australia 2018-2021 - Final Report on activities for 2019	https://www.nespmarine.edu.au/document/monitoring-population-dynamics-%E2%80%98western%E2%80%99-right-whales-southern-australia-2018-2021-final-0	
			Monitoring Population Dynamics of 'Western' Right Whales off Southern Australia 2018-2021 - Progress Report on activities for 2019	https://www.nespmarine.edu.au/document/monitoring-population-dynamics-%E2%80%98western%E2%80%99-right-whales-southern-australia-2018-2021-progre-0	
			Monitoring Population Dynamics of 'Western' Right Whales off Southern Australia 2018-2021 - Final Report on activities for 2018	https://www.nespmarine.edu.au/document/monitoring-population-dynamics-%E2%80%98western%E2%80%99-right-whales-southern-australia-2018-2021-final	
			Monitoring Population Dynamics of "Western" Right Whales off Southern Australia 2018-2021 - Progress Report on activities for 2018	https://www.nespmarine.edu.au/document/monitoring-population-dynamics-%E2%80%98western%E2%80%99-right-whales-southern-australia-2018-2021-progress	
			Monitoring population dynamics of Western right whales - Final Report on activities for 2017	https://www.nespmarine.edu.au/document/monitoring-population-dynamics-%E2%80%98western%E2%80%99-right-whales-southern-australia-final-report-0	

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			Monitoring population dynamics of Western right whales - Progress Report on activities for 2017	https://www.nespmarine.edu.au/document/monitoring-population-dynamics-western-right-whales-progress-report-activities-2017	
			Monitoring Population Dynamics of "Western" Right Whales off Southern Australia - final report on activities for 2016 - Report	https://www.nespmarine.edu.au/document/monitoring-population-dynamics-%E2%80%98western%E2%80%99-right-whales-southern-australia-final-report	
			Monitoring population dynamics of Western right whales - Progress report on activities for 2016 - Report	https://www.nespmarine.edu.au/document/monitoring-population-dynamics-western-right-whales-progress-report-activities-2016	
			Population trend in right whales off southern Australia 1993-2015 - International Whaling Commission June 2016 - Report	https://www.nespmarine.edu.au/document/population-trend-right-whales-southern-australia-1993-2015-international-whaling-commission	
			Monitoring population dynamics of Western right whales - Final report on activities 30 March 2016 - Report	https://www.nespmarine.edu.au/document/monitoring-population-dynamics-western-right-whales-final-report-activities-30-march-2016	
			Monitoring Population Dynamics of "Western" Right Whales off Southern Australia Milestone Report - Report	https://www.nespmarine.edu.au/document/monitoring-population-dynamics-%E2%80%98western%E2%80%99-right-whales-southern-australia-milestone-report	
			Aerial survey monitors right whales off southern Australia - Fact Sheet	https://www.nespmarine.edu.au/document/aerial-survey-monitors-right-whales-southern-australia-fact-sheet	
			2020 Aerial survey data of southern right whales (Eubalaena australis) off southern Australia	https://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=298ada9a-b326-48f9-8e0a-2dba0b315b53	
			2019 Aerial survey data of southern right whales (Eubalaena australis) off southern Australia	https://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=C1968847810-AU_AADC	
			2018 Aerial survey data of southern right whales (Eubalaena australis) off southern Australia	https://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=C1968847807-AU_AADC	
			2017 Aerial survey data of southern right whales (Eubalaena australis) off southern Australia	https://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=C1968847804-AU_AADC	
			2016 Aerial survey data of southern right whales (Eubalaena australis) off southern Australia	http://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=881d2cde-26af-44e9-b695-6c3b458fafc2	
			2015 Aerial survey data of southern right whales (Eubalaena australis) off southern Australia	http://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=0c8cf643-8111-4872-9ece-7672c2ef460b	
A8	Exploring the status of Western Australia's sea snakes	All sea snakes are listed marine species under the EPBC Act and three Australian endemic species are listed as Critically Endangered or Endangered, and as such are a national conservation priority. This project examines sea snake abundance and diversity from broad-scale and targeted surveys at reef and coastal sites to update Conservation Advices, refine status within CMRs and inform policies of DAWE, DPaW, PA and others. This research will improve our understanding of population status to guide on-ground conservation to reduce population declines.	Distribution, fisheries interactions and assessment of threats to Australia's sea snakes	https://www.nespmarine.edu.au/document/distribution-fisheries-interactions-and-assessment-threats-australia%E2%80%99s-sea-snakes	
			Prioritising search effort to locate previously unknown populations of endangered marine reptiles	https://www.nespmarine.edu.au/document/prioritising-search-effort-locate-previously-unknown-populations-endangered-marine-reptiles	
			Pinpointing drivers of extirpation in Sea Snakes: A synthesis of evidence from Ashmore Reef		Published by Frontiers in Marine Science, DOI https://doi.org/10.3389/fmars.2021.658756 . Not yet available on the Hub's website.
			Future directions in the research and management of marine snakes	https://www.nespmarine.edu.au/document/future-directions-research-and-management-marine-snakes	

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			Spatial and temporal patterns in sea snake populations on the North West Shelf - Progress Report	https://www.nespmarine.edu.au/document/spatial-and-temporal-patterns-sea-snake-populations-north-west-shelf-progress-report	
			Exploring the status of Western Australia's sea snakes - Report	https://www.nespmarine.edu.au/document/exploring-status-western-australia%E2%80%99s-sea-snakes	
			Spatial distribution map of sea snake species occurrence	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=8114ec84-7907-4ad8-8453-e0b255dc2bd7	
A9	Grey Nurse Shark Ck-MR Population Estimate - East Coast	A review of the 2002 National Recovery Plan for Grey Nurse Shark (DEWHA 2009) concluded it was not possible to determine if the east coast population had shown any signs of recovery (DoE 2014). Action 1.1 of the new recovery plan (DoE 2014) is to resurvey Grey Nurse Shark populations to assess population trends and dynamics. This project will resample the east coast population and use genetic SNP data to inform close kin-mark recapture analysis to estimate population size and trend, and provide guidance on future monitoring strategies for the east coast population of Grey Nurse Shark.	Sizing up Australia's eastern Grey Nurse Shark population - Fact sheet	https://www.nespmarine.edu.au/document/sizing-australia%E2%80%99s-eastern-grey-nurse-shark-population	
			A close-kin mark-recapture estimate of the population size and trend of east coast grey nurse shark	https://www.nespmarine.edu.au/document/close-kin-mark-recapture-estimate-population-size-and-trend-east-coast-grey-nurse-shark	
			Grey Nurse Shark Tissue Sample Collection	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=fc5edda0-cd1e-462e-a610-d45106111db4	
A10	Conservation of spotted handfish and their habitat	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.	Conservation of handfishes and their habitats - final report 2020	https://www.nespmarine.edu.au/document/conservation-handfishes-and-their-habitats-%E2%80%93-final-report-2020	
			Genetic diversity and restricted connectivity in an endangered marine fish provides a model for conservation management in related and data deficient species (journal article)		Manuscript submitted to publisher. Publication date not yet known.
			Conservation of handfish and their habitats – annual report (milestone 10, 2019)	https://www.nespmarine.edu.au/document/conservation-handfish-and-their-habitats-%E2%80%93-annual-report-2019	
			Conservation challenges for the most threatened family of marine bony fishes (handfishes: Brachionichthyidae)		Published by Biological Conservation, DOI https://doi.org/10.1016/j.biocon.2020.108831 . Accepted version is embargoed for 24 months.
			Conserving the Critically Endangered Red Handfish - Fact Sheet	https://www.nespmarine.edu.au/document/conserving-critically-endangered-red-handfish-fact-sheet	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=5fef1ed3-d94e-49a2-bc90-e40d8aca5c2f
			Conservation of handfish and their habitats – annual report (milestone 4, 2018)	https://www.nespmarine.edu.au/document/conservation-handfish-and-their-habitats-%E2%80%93-annual-report-0	
			Procedures and methods for establishment of captive breeding populations of spotted handfish	https://www.nespmarine.edu.au/document/procedures-and-methods-establishment-captive-breeding-populations-spotted-handfish	
			Local densities and habitat preference of the critically endangered spotted handfish (<i>Brachionichthys hirsutus</i>): Large scale field trial of GPS parameterised underwater visual census and diver attached camera	https://www.nespmarine.edu.au/document/local-densities-and-habitat-preference-critically-endangered-spotted-handfish	
			Conserving Critically Endangered spotted handfish - Fact Sheet	https://www.nespmarine.edu.au/document/conserving-critically-endangered-spotted-handfish-fact-sheet	
			Monitoring of Spotted Handfish (<i>Brachionichthys hirsutus</i>) populations and on ground conservation actions - Report	https://www.nespmarine.edu.au/document/monitoring-spotted-handfish-brachionichthys-hirsutus-populations-and-ground-conservation	
			Red and spotted handfish morphometrics data	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=2a76fa0e-7cfa-4ae6-9d45-80df490058a8	

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			Density estimates of Spotted Handfish (<i>Brachionichthys hirsutus</i>) - GPS Underwater Visual Census. 2015-2016	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=b0c79329-a480-4762-a943-a902a74fc13e	
			Spotted Handfish (<i>Brachionichthys hirsutus</i>) - GPS Underwater Visual Census - 2017 resurveys of baseline sites	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=51702b57-d4e4-4477-b199-b3485675f66c	
A11	Shark action plan	Conservation of elasmobranch species (sharks and rays) is an increasing priority globally, including Australia, as evidence of overexploitation of some species becomes apparent. Common issues and threats among elasmobranch species may improve management if considered holistically. This project will produce a Shark Action Plan assessing requirements for improved management including a summary of current status across the taxa, guidelines for reducing impacts and improving management, and identification of key knowledge gaps impeding conservation and management. This Plan will help guide policy for Australian elasmobranchs developed by DAWE and fishery managers. On-ground conservation will be developed from recommendations in this plan.	Shark Action Plan Policy Report - milestone 11, Rpv3 2017	https://www.nespmarine.edu.au/document/shark-action-plan-policy-report	
			The extinction risk of New Zealand chondrichthyans	https://www.nespmarine.edu.au/document/extinction-risk-new-zealand-chondrichthyans	
			The Action Plan for Australian Sharks and Rays 2021	https://www.nespmarine.edu.au/node/4406	
			NESP MBH Shark Action Plan 2020 (metadata record)	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=5fef1ed3-d94e-49a2-bc90-e40d8aca5c2f	Pending publication
A12	Australia's Northern Seascape: assessing status of threatened and migratory marine species	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.	Life history of the Critically Endangered largetooth sawfish: a compilation of data for population assessment and demographic modelling	https://www.nespmarine.edu.au/document/life-history-critically-endangered-largetooth-sawfish-compilation-data-population	
			Population structure of <i>Anoxypristis cuspidata</i> across northern Australia		Report is currently with industry for review
			Molecular analysis of newly-discovered geographic range of the threatened river shark <i>Glyphis glyphis</i> reveals distinct populations		Report has been received by the Hub and approved. Now being prepared for submission to Dept
			Garig Gunak Barlu National Park Green Sawfish (<i>Pristis zijsron</i>) aggregations		Report has been received by the Hub for review and approval.
			Qualitative Models of Northern Seascapes	https://www.nespmarine.edu.au/document/qualitative-models-northern-seascapes	
			Distribution and habitat suitability of Threatened and Migratory Marine Species in Northern Australia	https://www.nespmarine.edu.au/node/4593	
			Reducing bycatch of a threatened and protected benthic elasmobranch species in trawl fisheries using electric fields		Manuscript submitted to publisher. Publication date not yet known.
			An annotated checklist of the chondrichthyans of South Africa	https://www.nespmarine.edu.au/submission/annotated-checklist-chondrichthyans-south-africa	
			Social media posts reveal the geographic range of the Critically Endangered Clown Wedgefish <i>Rhynchobatus cooki</i>		Manuscript published by Journal of Fish Biology. DOI 10.1111/jfb.14530. 12-month embargo placed on accepted version.
			Mapping threats to species: Method matters		Manuscript published by Marine Policy. DOI 10.1016/j.marpol.2021.104614. 12-month embargo placed on accepted version.
			Half a century of global decline in oceanic sharks and rays	https://www.nespmarine.edu.au/document/half-century-global-decline-oceanic-sharks-and-rays	
			Lost before found: A new species of whaler shark <i>Carcharhinus obsolerus</i> from the Western Central Pacific known only from historic records	https://www.nespmarine.edu.au/document/lost-found-new-species-whaler-shark-carcharhinus-obsolerus-western-central-pacific-known	
Garig Gunak Barlu Cobourg Marine Park Green Sawfish Project: Scoping Trip Report	https://www.nespmarine.edu.au/document/garig-gunak-barlu-cobourg-marine-park-green-sawfish-project-scoping-trip-report				

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			The phylogenomic position of the Critically Endangered Largemouth Sawfish <i>Pristis pristis</i> (Rhinopristiformes, Pristidae), inferred from the complete mitochondrial genome	https://www.nespmarine.edu.au/document/phylogenomic-position-critically-endangered-largetooth-sawfish-pristis-pristis	
			Scoping a seascape approach to managing and recovering northern Australian threatened and migratory marine species	https://www.nespmarine.edu.au/document/scoping-seascape-approach-managing-and-recovering-northern-australian-threatened-and	
			Desktop review of Indigenous research and management priorities for threatened and migratory species	https://www.nespmarine.edu.au/document/desktop-review-indigenous-research-and-management-priorities-threatened-and-migratory	
			Characterising northern estuaries using the Digital Earth Australia	https://www.nespmarine.edu.au/document/characterising-northern-estuaries-using-digital-earth-australia	
			Northern Australia threatened species	http://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=47042e1d-8940-4186-8644-e6f5402574f4	
			Northern Australia pressures mapping	http://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=ecb15d97-8deb-454e-bca8-0db634d9e29a	
			Northern Australia changes in key coastal habitats	http://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=1ab541b2-01ce-4062-8b1d-8b5d24f7d346	
A13	Estimation of population abundance and mixing of 'Southern' right whales in the Australian and New Zealand regions	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 movement and connectedness of whales that utilise breeding areas on the eastern, southern and western coasts of Australia. Information on the population abundance and movements of southern right whales provided by this project will allow the Australian government to better evaluate progress made against the Conservation Management Plan for the species and ensure conservation efforts for the species are effectively coordinated at the regional level.	Estimation of population abundance and mixing of southern right whales in Australian and New Zealand regions.	https://www.nespmarine.edu.au/node/4636	
			ARWPIC Right Whale resighting data summaries used to estimate abundance and connectivity	https://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=30e156aa-7f85-41ff-8348-a1157bd04b98	
A14	Identification of near-shore habitats of juvenile white sharks in Southwestern Australia	There is credible evidence that juvenile white sharks are present in a relatively restricted region between the head of the Great Australian Bight (GAB) and Ceduna, which encompasses the boundaries of State and Commonwealth managed marine parks and reserves, some of which are accessed via Indigenous Protected Areas. This pilot project is to undertake visual surveys (using Unmanned Aerial Vehicle – UAV) for juvenile white sharks during spring and summer. The on-land surveillance approach outlined in this proposed pilot project will inform decision makers on the efficacy of supporting subsequent on-water activity to capture and electronically tag juvenile white sharks to assess habitat use in the Great Australian Bight Marine Park (Commonwealth waters) and Far West Coast Marine Park (State waters).	Story for Marine Park Science Atlas: On the hunt for prime white shark habitat	https://atlas.parksaustralia.gov.au/hunt-for-prime-white-shark-habitat	
			Final report: A14 Identification of near-shore habitats of juvenile white sharks in south-western Australia	https://www.nespmarine.edu.au/document/final-report-a14-identification-near-shore-habitats-juvenile-white-sharks-south-western-0	
A15	Conservation status of tropical inshore dolphins	The Conservation Status of Tropical Inshore Dolphins project will entail the compilation and review of the results of numerous research projects completed under the Whale and Dolphin Protection Plan, as well as monitoring and offset programs associated with port developments. The aim is to provide a synthesis of scientific information to inform assessments of the conservation status of the: Australian snubfin dolphin, <i>Orcaella heinsohni</i> ; Australian humpback dolphin, <i>Sousa sahalensis</i> ; and Indo-Pacific bottlenose dolphin, <i>Tursiops aduncus</i> .	Conservation status of tropical inshore dolphins	https://www.nespmarine.edu.au/node/4611	

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Project Number/ID	Project Name/Title	Project Summary	Outputs	Link to Output	Comments on outputs
B1	Road testing decision support tools via case study applications	<p>This project will deploy tools from economics and decision science to identify sound investments within constrained budgets for:</p> <ol style="list-style-type: none"> 1. Ecological monitoring of Commonwealth Marine Reserves 2. Management actions for threatened and migratory species or threatened communities, and 3. Restoration of saltmarsh and shellfish habitats. <p>The three case studies involve coherent integration of ecological understanding, social and organisational value judgements, and economic analysis.</p>	Restoration Showcase June 2020 - Webinar Presentation - "How can we target investment for healthier habitats"	https://www.nespmarine.edu.au/document/restoration-showcase-june-2020-webinar-presentation-how-can-we-target-investment-healthier	
			Review of decision support tools and their potential application in the management of Australian Marine Parks	https://www.nespmarine.edu.au/document/review-decision-support-tools-and-their-potential-application-management-australian-marine	
			Benefit-cost analysis of the Windara shellfish reef restoration project	https://www.nespmarine.edu.au/document/benefit-cost-analysis-windara-shellfish-reef-restoration-project	
			Benefit-cost analysis for marine habitat restoration: a framework for estimating the viability of shellfish reef repair projects	https://www.nespmarine.edu.au/document/benefit-cost-analysis-marine-habitat-restoration-framework-estimating-viability-shellfish	
			An assessment of alternative management interventions for treatment of Tropical Fire Ants on Ashmore Reef - Report	https://www.nespmarine.edu.au/document/assessment-alternative-management-interventions-treatment-tropical-fire-ants-ashmore-reef-0	
			Does membership matter? Individual influences in natural resource management decision making	https://www.nespmarine.edu.au/document/does-membership-matter-individual-influences-natural-resource-management-decision-making-0	
B2	Analysis and elicitation to support State of the Environment reporting for the full spectrum of data availability	<p>The availability and quality of observation data that may be used to support State of the Environment reporting lies on a spectrum from: (i) high quality (e.g. Reef Life Survey, Long term reef monitoring programme, Temperate Reef Monitoring programme, state-based MPA monitoring programmes); (ii) moderate quality (e.g. continuous plankton recorder, occasional by catch surveys); (iii) low quality (anecdotal information) to (iv) expert beliefs but no empirical observations.</p> <p>The project has been completed, and provided direct input to the marine chapter of the 2016 State of the Environment report, by providing expert assessment of environmental status indicators defined for the 2011 State of the Environment report.</p>		https://soe.environment.gov.au/sites/default/files/soe2016-marine-launch_v36march17.pdf?v=1517454961	This project produced outputs and advice that shaped the SoE 2016 marine chapter, the first edition of SoE to be based on expert knowledge and quantitative measurements that are linked to datasets made available to the public. The resulting assessments were launched by the Federal Environment Minister and it is anticipated that they will be used broadly by policy makers and managers, as well as being of use to the general public. See NESP Marine Biodiversity Hub Impact Case Study

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Project Number/ID	Project Name/Title	Project Summary	Outputs	Link to Output	Comments on outputs
B3	Enhancing access to relevant marine information – developing a service for searching, aggregating and filtering collections of linked open marine data	This project aims to improve the searchability and delivery of sources of linked open data, and to provide the ability to forward collections of discovered data to web services for subsequent processing through the development of a linked open data search tool. The work will improve access to existing data collections , and facilitate the development of new applications by acting as an aggregator of links to streams of marine data. The work will benefit managers (i.e. Department of the Environment staff) by providing fast and simple access to a wide range of marine information products, and offering a means of quickly synthesizing and aggregating multiple sources of information.	Enhancing access to relevant marine information - developing a service for searching, aggregating and filtering collections of linked open marine data - final report - Report	https://www.nespmarine.edu.au/document/enhancing-access-relevant-marine-information-%E2%80%93-developing-service-searching-aggregating-and-filtering-collections-linked-open-marine-data-final-report-report	
			Enhancing access to relevant marine information: Developing a service for searching, aggregating and filtering collections of linked open marine data - Scoping study - Report	https://www.nespmarine.edu.au/document/enhancing-access-relevant-marine-information-developing-service-searching-aggregating-and-filtering-collections-linked-open-marine-data-scoping-study-report	
B4	Underpinning the repair & conservation of Australia’s threatened coastal-marine habitats – phase II.	The objective of this research is to support the scaling-up of repair efforts for two threatened nearshore marine ecological communities, shellfish reefs and salt marshes. Both habitats harbour significant marine biodiversity and play a critical role in supporting healthy estuarine and nearshore systems. The research synthesis will be used to guide the development of more effective policy on coastal-marine repair, improve community education on the importance of habitats to estuary health and develop a detailed business case to support investment in marine repair activities for private industry stakeholders.	Charting two centuries of transformation in a coastal social-ecological system: implications for modern management		Published by 'Global Environmental Change', DOI. 10.1016/j.gloenvcha.2020.102058. Not yet available on the Hub's website.
			Estimating the value of tropical coastal wetland habitats to fisheries: Caveats and assumptions	https://www.nespmarine.edu.au/document/estimating-value-tropical-coastal-wetland-habitats-fisheries-caveats-and-assumptions	
			Prospects for seascape repair: three case studies from eastern Australia	https://www.nespmarine.edu.au/document/prospects-seascape-repair-three-case-studies-eastern-australia	
			Habitat value of Sydney rock oyster (<i>Saccostrea glomerata</i>) reefs on soft sediments	https://www.nespmarine.edu.au/document/habitat-value-sydney-rock-oyster-saccostrea-glomerata-reefs-soft-sediments	
			Estimating the potential fishery benefits from targeted habitat repair: a case study of School Prawn (<i>Metapenaeus macleayi</i>) in the lower Clarence River Estuary	https://www.nespmarine.edu.au/document/estimating-potential-fishery-benefits-targeted-habitat-repair-case-study-school-prawn	
			Expanding fish productivity in Tasmanian saltmarsh wetlands through tidal reconnection and habitat repair	https://www.nespmarine.edu.au/document/expanding-fish-productivity-tasmanian-saltmarsh-wetlands-through-tidal-reconnection-and-habitat-repair	
			Seven pearls of wisdom: advice from Traditional Owners to improve engagement of local Indigenous people in shellfish ecosystem restoration	https://www.nespmarine.edu.au/document/seven-pearls-wisdom-advice-traditional-owners-improve-engagement-local-indigenous-people	
			Australian shellfish ecosystems: Past distribution, current status and future direction	https://www.nespmarine.edu.au/document/australian-shellfish-ecosystems-past-distribution-current-status-and-future-direction	
			Underpinning the repair and conservation of Australia's threatened coastal-marine habitats: Shellfish restoration research - Mid-project update - Report	https://www.nespmarine.edu.au/document/underpinning-repair-and-conservation-australia%E2%80%99s-threatened-coastal-marine-habitats	
			Repairing and conserving Australia's saltmarshes and seascapes - Report	https://www.nespmarine.edu.au/document/repairing-and-conserving-australia%E2%80%99s-saltmarshes-and-seascapes	
Sustainable management of Australia's coastal seascapes: a case for collecting and communicating quantitative evidence to inform decision-making - Journal Article	https://www.nespmarine.edu.au/document/sustainable-management-australia%E2%80%99s-coastal-seascapes-case-collecting-and-communicating				

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Project Number/ID	Project Name/Title	Project Summary	Outputs	Link to Output	Comments on outputs
			Shellfish reef habitats: a synopsis to underpin the repair and conservation of Australia's environmental, social and economically important bays and estuaries - Report	https://www.nespmarine.edu.au/document/shellfish-reef-habitats-synopsis-underpin-repair-and-conservation-australias-environmental	
			Australia's saltmarshes: a synopsis to underpin the repair and conservation of Australia's environmentally, socially and economically important bays and estuaries - Report	https://www.nespmarine.edu.au/document/australias-saltmarshes-synopsis-underpin-repair-and-conservation-australias-environmentally	
			Fostering the repair of Australia's saltmarshes and shellfish reefs - Fact Sheet	https://www.nespmarine.edu.au/document/fostering-repair-australia%E2%80%99s-saltmarshes-and-shellfish-reefs-fact-sheet	
			Symposium report: Inaugural Australian Coastal Restoration Symposium	https://www.nespmarine.edu.au/document/symposium-report-inaugural-australian-coastal-restoration-symposium	
			Restoring Angasi oyster reefs: What is the endpoint ecosystem we are aiming for and how do we get there?	https://www.nespmarine.edu.au/document/restoring-angasi-oyster-reefs-what-endpoint-ecosystem-we-are-aiming-and-how-do-we-get-there	
			Australian shellfish reef images	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=2ddd5dbc-cc54-4777-aa14-56c461d180f0	
			Shellfish reef locations	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=8677fd3f-c640-460c-b5a9-3417884a076	
			Biodiversity supported by shellfish reefs	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=5acb935b-c8da-4b2e-af38-63ac1da126be	
			Saltmarsh prawn and fish species composition and production data	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=a15a9349-e357-4e0a-a8c0-8e6fcb306279	
			Shellfish water filtration data	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=13682e14-1d4d-46d5-839d-8c40a3713ce6	
			Restoring Shellfish Reefs (Ocean brief)	https://www.youtube.com/watch?v=nl-CzovK5pA	
C1	Improving our understanding of pressures on the marine environment	The marine environment in Australia is impacted by a wide range of different pressures. This project aims to assist DoE, and other research users, to improve understanding of the potential impacts of anthropogenic disturbance to marine conservation values by providing up-to-date data and analyses on the spatial distribution of pressures and trends. The research is designed to inform decision making under the EPBC Act (acceptability of proposed activities, evaluation of effectiveness of mitigation measures) on NMES (including Key Ecological Features), implementation of multiple strategies in four Marine Bioregional Plans management of Commonwealth Marine Reserves and State of the Environment reporting.	Challenges for global ocean observation: the need for increased human capacity	https://www.nespmarine.edu.au/document/challenges-global-ocean-observation-need-increased-human-capacity	
			Globally consistent quantitative observations of planktonic ecosystems	https://www.nespmarine.edu.au/document/globally-consistent-quantitative-observations-planktonic-ecosystems	
			Options for assessing risks to environmental values in Matters of National Environmental Significance and Commonwealth Marine Reserves – report to be uploaded to website	https://www.nespmarine.edu.au/document/options-assessing-cumulative-impact-and-risk-environmental-values-matters-national	
			Reviewing the EBSA process: Improving on success	https://www.nespmarine.edu.au/document/reviewing-ebsa-process-improving-success	

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Project Number/ID	Project Name/Title	Project Summary	Outputs	Link to Output	Comments on outputs
			Essential ocean variables for global sustained observations of biodiversity and ecosystem changes	https://www.nespmarine.edu.au/document/essential-ocean-variables-global-sustained-observations-biodiversity-and-ecosystem-changes	
			Rethinking Approaches to Valuation in Marine Systems – report to be uploaded to website	https://www.nespmarine.edu.au/document/rethinking-approaches-valuation-marine-systems	
			Towards a value based approach to cumulative risk and impact analysis - Fact sheet	https://www.nespmarine.edu.au/document/towards-value-based-approach-cumulative-risk-and-impact-analysis	
			Changes in pressures on the Marine Environment over three decades	https://www.nespmarine.edu.au/document/changes-pressures-marine-environment-over-three-decades	
			Australian Ship Reporting System and Automatic Identification System - Shipping Summaries - 1999-2015	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=b8135966-33c6-4a1c-bcbc-d797c2a1155f	
			Cyclone Summaries 1900-2015	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=9fb32adf-f8e8-4b38-8e23-1c6e847b6a91	
			Maritime Cables	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=b8824a13-8e0b-4172-9678-dabccdedeeb7	
			Petroleum and Gas Production Facilities, Australia 2016	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=2eddb26-0276-4468-a210-0c00ada8bf39	
			Petroleum pipelines	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=19d8f59a-b918-442f-8e2c-d80125600868	
			Petroleum Titles, Australia 2016	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=836b1a1d-19d8-4f66-b12f-88e4ce9ba19c	
			Plastic Pollution in the World's Oceans (2007-2013)	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=DA83B0E3-2B75-48A2-8FDD-874EDD9DBDBF	
			Pollution Events Summary, Australia 1970-2015 (AMSA)	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=2ff40822-a773-4788-aedd232639142cde	
			Population Density, Australia 2011 (ABS)	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=c8b09cef-c645-48aa-8658-22ece782365f	
			Seismic Surveys, Australia (2015)	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=17249677-2be0-43a0-a9b5-da01e0be3fa7	
			Using ecologically or biologically significant marine areas (EBSAs) to implement marine spatial planning	https://www.nespmarine.edu.au/document/using-ecologically-or-biologically-significant-marine-areas-ebas-implement-marine-spatial	
			Summaries of AFMA log book data on effort distribution for Commonwealth fisheries in the Australian Exclusive Economic Zone	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=aa53a4df-7fe6-46d1-93b7-2d3732f4883e	
			Twenty years of high-resolution sea surface temperature imagery around Australia: inter-annual and annual variability	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=b8f48127-495e-42e6-8d53-db3c56ee3a7f	
			Fishing Effort Maps Based on Commercial Fishing Logbook Data - Queensland 2011-2015	https://marlin.csiro.au/geonetwork/srv/eng/catalog.search#/metadata/ac413df7-19ed-475c-b121-9aeec44b6cf0	

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			Fishing Effort Maps Based on Commercial Fishing Logbook Data - New South Wales 2011-2015	https://marlin.csiro.au/geonetwork/srv/eng/catalog.search#/metadata/04afcd60-1eb3-4edb-843d-623050bc7511	
			Fishing Effort Maps Based on Commercial Fishing Logbook Data - Victoria 2011-2015	https://marlin.csiro.au/geonetwork/srv/eng/catalog.search#/metadata/eafc6022-a74f-4fd8-9f74-ebe54436b6fc	
			Fishing Effort Maps Based on Commercial Fishing Logbook Data - Western Australia 2011-2015	https://marlin.csiro.au/geonetwork/srv/eng/catalog.search#/metadata/1be71f33-7478-4f2f-a641-aafafe1e69ce	
			Fishing Effort Maps Based on Commercial Fishing Logbook Data - Northern Territory 2006-2017	https://marlin.csiro.au/geonetwork/srv/eng/catalog.search#/metadata/262fec77-f800-4d69-adf1-a572c829234e	
			Fishing Effort Maps Based on Commercial Fishing Logbook Data - TAS	https://marlin.csiro.au/geonetwork/srv/eng/catalog.search#/metadata/6db22a4c-0176-435d-943a-e568cf007961	
			Fishing Effort Maps Based on Commercial Fishing Logbook Data - SA	https://marlin.csiro.au/geonetwork/srv/eng/catalog.search#/metadata/a0052d38-d663-49ee-8807-223318117b89	
C2	Continental-scale tracking of threats to shallow Australian reef ecosystems	The project will integrate Australia's largest, most detailed datasets of shallow water tropical and temperate marine biodiversity, and assess how pollution, fishing, rising sea temperatures and introduced species are impacting associated natural values. An initial outcome will be the identification of state-of-the-environment indicators for inclusion in the 2016 State of the Environment report, with subsequent activities aimed at contributing additional data products needed for other NESP projects, Parks Australia, and the Essential Environmental Measures initiative. The project will also describe a national shallow-water baseline of biodiversity in Commonwealth Marine Reserves for assessment of change through the long term.	<p>A global assessment of the direct and indirect benefits of marine protected areas for coral reef conservation</p> <p>Moving beyond trophic groups: evaluating fishing-induced changes to temperate reef food webs</p> <p>Continental-scale tracking of threats to shallow Australian reef ecosystems - Indicator report</p> <p>Thermal limits to the geographic distributions of shallow-water marine species - Journal Article</p> <p>Abundance and local-scale processes contribute to multi-phyla gradients in global marine diversity - Journal Article</p> <p>Translating local benthic community structure to national biogenic reef habitat types - Journal Article</p> <p>Ubiquity of microplastics in coastal seafloor sediments - Journal Article</p> <p>Colours of the Coral Sea - Poster</p> <p>Assessing national biodiversity trends for rocky and coral reefs through the Integration of citizen science and scientific monitoring programs - Journal Article</p> <p>Biodiversity enhances reef fish biomass and resistance to climate change - Journal Article</p> <p>Bright spots among the world's coral reefs - Journal Article</p> <p>Thermal biases and vulnerability to warming in the world's marine fauna</p>	<p>https://www.nespmarine.edu.au/document/global-assessment-direct-and-indirect-benefits-marine-protected-areas-coral-reef</p> <p>https://www.nespmarine.edu.au/document/moving-beyond-trophic-groups-evaluating-fishing-induced-changes-temperate-reef-food-webs</p> <p>https://www.nespmarine.edu.au/document/continental-scale-tracking-threats-shallow-australian-reef-ecosystems-indicator-report</p> <p>https://www.nespmarine.edu.au/document/thermal-limits-geographic-distributions-shallow-water-marine-species</p> <p>https://www.nespmarine.edu.au/document/abundance-and-local-scale-processes-contribute-multi-phyla-gradients-global-marine</p> <p>https://www.nespmarine.edu.au/document/translating-local-benthic-community-structure-national-biogenic-reef-habitat-types</p> <p>https://www.nespmarine.edu.au/document/ubiquity-microplastics-coastal-seafloor-sediments</p> <p>https://www.nespmarine.edu.au/document/colours-coral-sea</p> <p>https://www.nespmarine.edu.au/document/assessing-national-biodiversity-trends-rocky-and-coral-reefs-through-integration-citizen</p> <p>https://www.nespmarine.edu.au/document/biodiversity-enhances-reef-fish-biomass-and-resistance-climate-change</p> <p>https://www.nespmarine.edu.au/document/bright-spots-among-world%E2%80%99s-coral-reefs</p> <p>https://www.nespmarine.edu.au/document/thermal-biases-and-vulnerability-warming-worlds-marine-fauna</p>	

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			Pollution markers at ecological monitoring sites	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=11075fdf-e53e-4d8c-8999-0b239a742243	
			Integration of marine biodiversity datasets and derived indicators	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=084e90fe-ef03-4b41-8991-832116db2ffb	
C3	Change detection and monitoring of key marine and coastal environments – application of the Australian Geoscience Data Cube	This project aims to leverage the extensive time-series of earth observation image data in the Australian Geoscience Data Cube (AGDC) by developing change detection algorithms to analyse key environmental parameters in the coastal and marine zone. Spatial information produced by this project can inform management decisions, and assist in evaluating management action outcomes, by providing a quantifiable measure of historical change and ongoing monitoring and change detection capabilities. Phase 1 of this project aimed to demonstrate the capability of using the AGDC through the development of an inter-tidal zone change detection algorithm and data set, with a view to developing and implementing an expanded range of stakeholder targeted algorithms to inform decision making processes in Phase 2.	Coastal change detection tools utilising 28 years of Earth Observation data in the Australian Geoscience Data Cube (AGDC) - Report	https://www.nespmarine.edu.au/document/coastal-change-detection-tools-utilising-28-years-earth-observation-data-australian	
			AGDC Time Series Video - Murray Mouth and Lower Lakes	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=a0bf5d29-0986-443a-a9e2-a9d7523c9a3c	
			AGDC Time Series Video - Southern Moreton Island	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=90f1121e-b973-46d4-9a51-5f750d954319	
			AGDC Time Series Video - Southern Stradbroke Island	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=67fef6b1-1540-445f-a995-71abcefeb99b	
C4	The National Outfall Database project (Clean Ocean Foundation)	NOD addresses the need of government and community to understand the impacts on health and the ocean environment that occur from sewerage outfalls around Australia. The project will be delivered over a three year time frame and will provide: 1) A publicly accessible national outfall database and reports. 2) A ranking of the outfalls (and sewerage treatment systems) according to health and impact criteria with peer review of the ranking system and resulting ranking outcomes. 3) Comparison of geographical regions in sewerage volume and pollution impact. 4) Mapping of the database. 5)Community engagement in conduct of this research and consumption of the outcomes.	Towards a national standard and guidelines for reporting wastewater treatment plant outfall data	https://www.nespmarine.edu.au/node/4553	
			Increased transparency and resource prioritisation for the management of pollutants from wastewater treatment plants: A national perspective from Australia (journal article)	https://www.nespmarine.edu.au/document/increased-transparency-and-resource-prioritization-management-pollutants-wastewater	
			Preliminary river outfalls assessment	https://www.nespmarine.edu.au/document/preliminary-river-outfalls-assessment	
			National Outfall Database Ranking Report 2018-2019	https://www.nespmarine.edu.au/document/national-outfall-database-ranking-report-2018-2019-financial-year	
			National Outfall Database - Prospectus Report 2019	https://www.nespmarine.edu.au/document/national-outfall-database-prospectus-report-2019	
			Australian coastal sewage outfalls and data transparency - Public access to government information	https://www.nespmarine.edu.au/document/australian-coastal-sewage-outfalls-and-data-transparency-public-access-government	
			Perceptions and information disclosure of water quality issues in Australia 2019	https://www.nespmarine.edu.au/document/perceptions-and-information-disclosure-water-quality-issues-australia-2019	
			National Outfall Database - Community Report for August 2018	https://www.nespmarine.edu.au/document/national-outfall-database-community-report-august-2018	
			National Outfall Database Ranking Report 2017-2018	https://www.nespmarine.edu.au/document/national-outfall-database-ranking-report-2017-2018	
			2017 Data Analysis Report	https://www.nespmarine.edu.au/document/national-outfall-database-ranking-report-2017-2018	The data analysis for 2017 is contained within the National Outfall Database Ranking Report 2017-2018 (the output from the previous row)
			Warriewood Monitoring Summary - Report	https://www.nespmarine.edu.au/document/warriewood-monitoring-summary	
National Outfall Database https://www.nod.org.au/	http://catalogue.aodn.org.au/geonetwork/srv/en/g/metadata.show?uuid=21448123-0170-4aff-9b56-2b6aa21c73ed				

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Project Number/ID	Project Name/Title	Project Summary	Outputs	Link to Output	Comments on outputs
C5	Quantification of risk from shipping to large marine fauna across Australia	Given the substantial and ongoing increases in coastal and port development along the Australian coastline, and an associated increase in recreational and commercial shipping, there is an increasing potential for adverse interactions with marine species. Two risks associated with these activities for large marine fauna are ship collisions (particularly relevant for marine mammals, turtles and whale sharks) and the impact of chronic ocean noise (across a wide range of species). This project aims to provide directed and robust science (species- and area-specific) to inform management and administrative decision-making by the Department of Environment in its application of the EPBC Act.	Quantification of risk from shipping to large marine fauna across Australia: Final Report, Milestone 3.5, Rpv3 2017	https://www.nespmarine.edu.au/document/quantification-risk-shipping-large-marine-fauna-across-australia-final-report	
			Avoiding the collision course	https://www.nespmarine.edu.au/document/avoiding-collision-course	
			Report from workshop on characterising underwater shipping noise in Australia - Report	https://www.nespmarine.edu.au/document/report-workshop-characterising-underwater-shipping-noise-australia	
			Historical Data on Australian Whale Vessel Strikes - International Whaling Commission June 2016 - Report	https://www.nespmarine.edu.au/document/historical-data-australian-whale-vessel-strikes-international-whaling-commission-june-2016	
			Scoping of potential species for ship strike risk analysis - Report	https://www.nespmarine.edu.au/document/scoping-potential-species-ship-strike-risk-analysis	
			Historical Australian vessel strike data	http://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=78cfb62c-e8ec-4437-9113-1e1fdc523f95	
			Distribution map for Western Australian Humpback whale Migration	https://www.cmar.csiro.au/geoserver/nerp/ows?service=WFS&version=1.0.0&request=GetFeature&typeName=nerp%3Awahumpbackdistbroadscale&outputFormat=csv	
			Relative vessel strike risk for Southern Right Whales	https://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=40e7e293-e5e2-4d46-9611-c2db22182b24	
			Relative vessel strike risk for Eastern Australian Humpback whales	https://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=40e7e293-e5e2-4d46-9611-c2db22182b24	
			Relative vessel strike risk for Western Australian Humpback whales	https://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=40e7e293-e5e2-4d46-9611-c2db22182b24	
			Relative vessel strike risk for Green Turtles	https://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=40e7e293-e5e2-4d46-9611-c2db22182b24	
			Vessel Traffic Density from AIS Data (2013-2015)	https://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=e11903ab-836c-4b67-aa41-b2fc7f70ed2	
D1	National Data Collation, Synthesis and Visualisation to Support Sustainable Use, Management and Monitoring of Marine Assets	Effective management of marine assets requires an understanding of ecosystems and the processes that influence patterns of biodiversity. Through collaboration and synthesis of existing data this project will improve access to, and usability 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 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.	Eco-narrative of Bonaparte Gulf Marine - Milestone 17, Rpv4 2018	https://www.nespmarine.edu.au/document/eco-narrative-joseph-bonaparte-gulf-marine-park-%E2%80%93-north-marine-region	
			Eco-narrative of Kimberley Marine Park - Milestone 17, Rpv4 2018	https://www.nespmarine.edu.au/document/eco-narrative-kimberley-marine-park-north-west-marine-region	
			An eco-narrative of Huon Marine Park - South-east marine region	https://www.nespmarine.edu.au/document/eco-narrative-huon-marine-park-south-east-marine-region	
			An eco-narrative of Geographe Marine Park - South-west marine region	https://www.nespmarine.edu.au/document/eco-narrative-geographe-marine-park-south-west-marine-region	
			An eco-narrative of Gifford Marine Park - Temperate East marine region	https://www.nespmarine.edu.au/document/eco-narrative-gifford-marine-park-temperate-east-marine-region	
			An eco-narrative of Perth Canyon Marine Park - South-west marine region	https://www.nespmarine.edu.au/document/eco-narrative-perth-canyon-marine-park-south-west-marine-region	

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Project Number/ID	Project Name/Title	Project Summary	Outputs	Link to Output	Comments on outputs
			Origin of high density seabed pockmark fields and their use in inferring bottom currents	https://www.nespmarine.edu.au/document/origin-high-density-seabed-pockmark-fields-and-their-use-inferring-bottom-currents	
			Transferring biodiversity models for conservation: Opportunities and challenges	https://www.nespmarine.edu.au/document/transferring-biodiversity-models-conservation-opportunities-and-challenges	
			Ecosystem Understanding to Support Sustainable Use, Management and Monitoring of Marine Assets in the North and North-West Regions: Final Report 2016 - Report	https://www.nespmarine.edu.au/document/ecosystem-understanding-support-sustainable-use-management-and-monitoring-marine-assets-0	
			Environmental predictors of foraging and transit behaviour in flatback turtles (Natator depressus) - Journal Article	https://www.nespmarine.edu.au/document/environmental-predictors-foraging-and-transit-behaviour-flatback-turtles-natator-depressus	
			Palaeoshorelines on the Australian continental shelf: morphology, sea-level relationship and applications to environmental management and archaeology - Journal Article	https://www.nespmarine.edu.au/document/palaeoshorelines-australian-continental-shelf-morphology-sea-level-relationship-and	
			Ecosystem understanding to support sustainable use, management and monitoring of marine assets in the North and North-west regions - Stakeholder workshop report April 2016 - Report	https://www.nespmarine.edu.au/document/ecosystem-understanding-support-sustainable-use-management-and-monitoring-marine-assets	
			Developing a toolbox of predictive models for the monitoring and management of KEFs and CMRs in the North and North-west regions - Scientific Workshop Report - Report	https://www.nespmarine.edu.au/document/developing-toolbox-predictive-models-monitoring-and-management-kefs-and-cmr-north-and	
			Sea Around Us Project - Relative pelagic fish abundance inferred from commercial catch data, Western Australia (1997-2006)	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=16501b1f-4b29-4b52-82d1-2e5c4d536acc	
			Sea Around Us Project - Relative demersal fish abundance inferred from commercial catch data, northwestern Australia (1997-2006)	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=e90f84bd-a1c8-4943-ac6a-dbf0cc313e	
			Juvenile shark occurrence inferred from baited remote underwater video surveys Northwest Australia (2003-2013)	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=5af57072-c4c2-4a5a-bc72-62486dc6d73e	
			Oceanic Shoals Commonwealth Marine Reserve - Pelagic baited camera surveys (stereo-BRUVS)	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=ef452136-c42c-4f0a-98b3-f38a000a3752	
			Oceanic Shoals Commonwealth Marine Reserve - Opportunistic visual surveys of marine megafauna	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=99208235-d68e-4039-bf77-362549a7aa48	
			Oceanic Shoals Commonwealth Marine Reserve - Predicted pelagic diversity	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=99208235-d68e-4039-bf77-362549a7aa48	
			Chlorophyll-a and ocean productivity	http://northwestatlas.org/node/27500	
			Sea Surface Temperature (SST)	http://northwestatlas.org/node/27499	
			Petroleum leases and offshore titles near the Oceanic Shoals as of 2016	http://northwestatlas.org/node/1651	
			Biologically important areas (BIAs)	http://northwestatlas.org/node/27496	
			Species richness	http://northwestatlas.org/node/27495	
			RAMSAR wetlands	http://northwestatlas.org/node/27494	
			World Heritage Areas	http://northwestatlas.org/node/27492	
			IMCRA provincial bioregions	http://northwestatlas.org/node/27490	
			IMCRA mesoscale bioregions	http://northwestatlas.org/node/27489	
			Key Ecological Features	http://northwestatlas.org/node/27488	

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			Bathomes	http://northwestatlas.org/node/27486	
			Oceanic Shoals/Wessel Islands Sponge species ids	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=32066411-0967-4188-9287-b1f3a33beae6	
			Oceanic Shoals Polychaete species ids	http://www.ga.gov.au/metadata-gateway/metadata/record/102241	
			Interactive map gallery 'What research has been done in the North and NorthWest regions to document megafauna, benthos, demersal and pelagic fish and megafauna?'	http://northwestatlas.org/nwa/map/gallery	
			Petroleum leases and offshore titles near the Oceanic Shoals as of 2016	http://northwestatlas.org/node/1651	published (maps only) 2016
			Interactive map gallery 'Benthic habitat model outputs for the Oceanic Shoals CMR'	http://northwestatlas.org/node/1710	published (maps only) 2017
			Most likely benthic class habitat model for the Oceanic Shoals CMR	http://northwestatlas.org/node/1710	published (maps only) 2017
			Combined benthic class habitat model for the Oceanic Shoals CMR	http://northwestatlas.org/node/5449#indeterminant	published (maps only) 2017
			Hard coral probability habitat model for the Oceanic Shoals CMR	http://northwestatlas.org/node/5449#hard_coral	published (maps only) 2017
			Soft coral probability habitat model for the Oceanic Shoals CMR	http://northwestatlas.org/node/5449#soft_coral	published (maps only) 2017
			Filterer probability habitat model for the Oceanic Shoals CMR	http://northwestatlas.org/node/5449#filterer	published (maps only) 2017
			Gorgonian probability habitat model for the Oceanic Shoals CMR	http://northwestatlas.org/node/5449#gorgonians	published (maps only) 2017
			Alcyon probability habitat model for the Oceanic Shoals CMR	http://northwestatlas.org/node/5449#alcyon	published (maps only) 2017
			Whips probability habitat model for the Oceanic Shoals CMR	http://northwestatlas.org/node/5449#whips	published (maps only) 2017
			Sponge coral probability habitat model for the Oceanic Shoals CMR	http://northwestatlas.org/node/5449#sponge	published (maps only) 2017
			Burrowers probability habitat model for the Oceanic Shoals CMR	http://northwestatlas.org/node/5449#burrowers	published (maps only) 2017
			Macroalgae probability habitat model for the Oceanic Shoals CMR	http://northwestatlas.org/node/5449#macro-algae	published (maps only) 2017
			Seagrass probability habitat model for the Oceanic Shoals CMR	http://northwestatlas.org/node/5449#seagrass	published (maps only) 2017
			Halimeda probability habitat model for the Oceanic Shoals CMR	http://northwestatlas.org/node/5449#halimeda	published (maps only) 2017
			The 25%, 50%, 75% and 95% kernel utilisation distribution of telemetry data from 11 flatback sea turtles from the Lacepede Islands for each of the main turtle phases of turtle life history; inter-nesting, transit to foraging grounds and foraging	http://northwestatlas.org/node/27491	published (maps only) 2018
			Count of research effort across the N and NW regions: high resolution bathymetry; by (1) CMR, and (2) KEF	http://northwestatlas.org/node/1684 http://northwestatlas.org/node/1689	published (maps only) 2018
			Count of research effort across the N and NW regions: all bathymetry; by (1) CMR, and (2) KEF	http://northwestatlas.org/node/1685 http://northwestatlas.org/node/1688	published (maps only) 2018
			Count of research effort across the N and NW regions: oceanic data; by (1) CMR, and (2) KEF	http://northwestatlas.org/node/1686 http://northwestatlas.org/node/1687	published (maps only) 2018
			Count of research effort across the N and NW regions: hard corals; by (1) CMR, and (2) KEF	http://northwestatlas.org/node/1674 http://northwestatlas.org/node/1690	published (maps only) 2018
			Count of research effort across the N and NW regions: soft corals; by (1) CMR, and (2) KEF	http://northwestatlas.org/node/1682 http://northwestatlas.org/node/1691	published (maps only) 2018

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			Count of research effort across the N and NW regions: sponges; by (1) CMR, and (2) KEF	http://northwestatlas.org/node/1683 http://northwestatlas.org/node/1692	published (maps only) 2018
			Count of research effort across the N and NW regions: brittle stars; by (1) CMR, and (2) KEF	http://northwestatlas.org/node/1671 http://northwestatlas.org/node/1693	published (maps only) 2018
			Count of research effort across the N and NW regions: marine mammals; by (1) CMR, and (2) KEF	http://northwestatlas.org/node/1675 http://northwestatlas.org/node/1696	published (maps only) 2018
			Count of research effort across the N and NW regions: polychaetes; by (1) CMR, and (2) KEF	http://northwestatlas.org/node/1679 http://northwestatlas.org/node/1694	published (maps only) 2018
			Count of research effort across the N and NW regions: molluscs; by (1) CMR, and (2) KEF	http://northwestatlas.org/node/1676 http://northwestatlas.org/node/1695	published (maps only) 2018
			Count of research effort across the N and NW regions: seabirds; by (1) CMR, and (2) KEF	http://northwestatlas.org/node/1681 http://northwestatlas.org/node/1698	published (maps only) 2018
			Count of research effort across the N and NW regions: sea turtles; by (1) CMR, and (2) KEF	http://northwestatlas.org/node/1680 http://northwestatlas.org/node/1697	published (maps only) 2018
			Count of research effort across the N and NW regions: demersal sharks and rays; by (1) CMR, and (2) KEF	http://northwestatlas.org/node/1673 http://northwestatlas.org/node/1700	published (maps only) 2018
			Count of research effort across the N and NW regions: pelagic sharks and rays; by (1) CMR, and (2) KEF	http://northwestatlas.org/node/1678 http://northwestatlas.org/node/1701	published (maps only) 2018
			Count of research effort across the N and NW regions: demersal fish; by (1) CMR, and (2) KEF	http://northwestatlas.org/node/1699 http://northwestatlas.org/node/1672	published (maps only) 2018
			Count of research effort across the N and NW regions: pelagic fish; by (1) CMR, and (2) KEF	http://northwestatlas.org/node/1677 http://northwestatlas.org/node/1702	published (maps only) 2018
					Bathymetry of Bremer Commonwealth Marine Reserve
D2	Standard Operating Procedures (SOP) for survey design, condition assessment and trend detection	Understanding of the status and trends of indicators in Australia's marine environment requires standardised monitoring. This project will develop Standard Operating Procedures (SOP) in the planning, collection, analysis, and reporting of monitoring data. In particular, the project will: 1) provide guidance on what kind of monitoring is required (and where and when), 2) provide a simple yet powerful survey design tool, 3) provide two worked SOP examples (one benthic and one pelagic), 4) develop field manuals for some high priority sampling platforms (e.g. underwater video) with prioritisation stemming from a comparative analysis, and 5) assess approaches for monitoring pelagic ecosystems.	A field and video annotation guide for baited remote underwater stereo-video surveys of demersal fish assemblages (manuscript)	https://www.nespmarine.edu.au/document/field-and-video-annotation-guide-baited-remote-underwater-stereo-video-surveys-demersal	
			Quality control and interoperability of spatial data	https://www.nespmarine.edu.au/node/4653	
			Guide for producing science communication videos of surveys of fish and benthic assemblages	https://www.nespmarine.edu.au/node/4673	
			Map-Based Portals for Marine Science Communication and Discovery - Report from July 2019 workshop	https://www.nespmarine.edu.au/node/4658	
			Enhancement, connectivity and interoperability of spatial portals	https://www.nespmarine.edu.au/node/4670	
			MBHdesign: an R-package for efficient spatial survey designs (journal article)		Published by Methods in Ecology and Evolution, DOI 10.1111/2041-210X.13535. Not yet available on the Hub's website.
			Earth Observation for monitoring of Australian Marine Parks and other off-shore Marine Protected Areas	https://www.nespmarine.edu.au/document/earth-observation-monitoring-australian-marine-parks-and-other-shore-marine-protected-areas	
			Designing monitoring programs for marine protected areas within an evidence based decision making paradigm (journal article)	https://www.nespmarine.edu.au/document/designing-monitoring-programs-marine-protected-areas-within-evidence-based-decision-making	
			Scoping of new field manuals for marine sampling in Australian waters - Milestone 29, Rpv4 2020	https://www.nespmarine.edu.au/document/scoping-new-field-manuals-marine-sampling-australian-waters	
			Coral reef monitoring, reef assessment technologies, and ecosystem-based management	https://www.nespmarine.edu.au/document/coral-reef-monitoring-reef-assessment-technologies-and-ecosystem-based-management	

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			A response to scientific and societal needs for marine biological observations	https://www.nespmarine.edu.au/document/resp-onse-scientific-and-societal-needs-marine-biological-observations	
			A suite of field manuals for marine sampling to monitor Australian waters	https://www.nespmarine.edu.au/document/suite-field-manuals-marine-sampling-monitor-australian-waters	
			Digital Platforms for Marine Science Data and Information (infographic)	https://www.nespmarine.edu.au/document/digital-platforms-marine-science-data-and-information-infographic	
			Data Discoverability and Accessibility: Report from July 2019 Workshop on Marine Imagery	https://www.nespmarine.edu.au/document/data-discoverability-and-accessibility-report-july-2019-workshop-marine-imagery	
			Field manuals for marine sampling to monitor Australian waters, version 2 (pdf)	https://www.nespmarine.edu.au/document/field-manuals-marine-sampling-monitor-australian-waters-version-2	
			Field Manuals for Marine Sampling to Monitor Australian Waters (On-line webpage)	https://marine-sampling-field-manual.github.io/	
			Data discoverability and accessibility: report from workshops on marine imagery and biological specimen data	https://www.nespmarine.edu.au/document/data-discoverability-and-accessibility-report-workshops-marine-imagery-and-biological	
			Effects of ignoring survey design information for Data Reuse (journal article)		Published by Ecological Applications, Ecological Society of America. DOI 10.1002/eap.2360. Not yet available on the Hub's website.
			An Introduction to MBHdesign	https://www.nespmarine.edu.au/document/introduction-mbhdesign	
			Advancing marine biological observations and data requirements of the complementary essential ocean variables (EOVs) and essential biodiversity variables (EBVs) frameworks	https://www.nespmarine.edu.au/document/advancing-marine-biological-observations-and-data-requirements-complementary-essential	
			Linking capacity development to GOOS monitoring networks to achieve sustained ocean observation	https://www.nespmarine.edu.au/document/linking-capacity-development-goos-monitoring-networks-achieve-sustained-ocean-observation	
			Comparative assessment of seafloor sampling platforms	https://www.nespmarine.edu.au/document/comparative-assessment-seafloor-sampling-platforms	
			Comparative assessment of pelagic sampling methods used in marine monitoring	https://www.nespmarine.edu.au/document/comparative-assessment-pelagic-sampling-methods-used-marine-monitoring	
			Poster - Gear Up: Field manuals for marine sampling	https://www.nespmarine.edu.au/document/gear-field-manuals-marine-sampling	
			Field manuals for marine sampling to monitor Australian waters - Report	https://www.nespmarine.edu.au/document/field-manuals-marine-sampling-monitor-australian-waters	
			Flyer - Field manuals for marine sampling to monitor Australian waters - Fact sheets	https://www.nespmarine.edu.au/document/flyer-field-manuals-marine-sampling-monitor-australian-waters	
			Spatially balanced designs that incorporate legacy sites - Journal Article	https://www.nespmarine.edu.au/document/spatially-balanced-designs-incorporate-legacy-sites	
			Scoping report: Comparative assessment of benthic sampling platforms - Report	https://www.nespmarine.edu.au/document/scoping-report-comparative-assessment-benthic-sampling-platforms	
			Scoping report: Comparative assessment of pelagic sampling platforms - Report	https://www.nespmarine.edu.au/document/scoping-report-comparative-assessment-pelagic-sampling-platforms	

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D3	Implementing monitoring of AMPS and the status of marine biodiversity assets on the continental shelf	New [RPv3] - There is a significant 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. This project will provide the science support for program development, and a prioritisation framework for implementation. 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 a CMR monitoring program, new knowledge to inform CMR management, a national integrated framework for SOE reporting, and collaboration between State-based and Commonwealth-based programs.	Elizabeth-Middleton Reefs: Post survey report	https://www.nespmarine.edu.au/node/4620	
			Fly-through of the Arafura Marine Park	https://www.nespmarine.edu.au/node/4581	
			An eco-narrative of South-west Corner Marine Park - Capes region	https://www.nespmarine.edu.au/node/4675	
			Arafura Marine park Eco-narrative	https://www.nespmarine.edu.au/document/arafura-marine-park-eco-narrative	
			South-west Corner Marine Park Post Survey Report		Report has been received by the Hub and approved. Now being prepared for submission to Dept
			Initial baseline survey of deepwater fish in the Ningaloo Marine Park (Commonwealth Waters) - Final Report	https://www.nespmarine.edu.au/node/4677	
			Money Shoal, Arafura Marine Park: An eco-narrative	https://www.nespmarine.edu.au/document/money-shoal-arafura-marine-park-eco-narrative	
			Arafura Marine Park: Post survey report	https://www.nespmarine.edu.au/document/arafura-marine-park-post-survey-report	
			Beagle Marine Park Post survey report: Southeast Marine Park Network	https://www.nespmarine.edu.au/document/beagle-marine-park-post-survey-report-southeast-marine-park-network	
			Progress towards a nationally integrated benthic biodiversity monitoring program for Australia's marine realm	https://www.nespmarine.edu.au/node/4570	
			Increased connectivity and depth improve the effectiveness of marine reserves	https://www.nespmarine.edu.au/document/increased-connectivity-and-depth-improve-effectiveness-marine-reserves	
			The fate of deep-sea coral reefs on seamounts in a fishery-seascape: What are the impacts, what remains, and what is protected?		Published by Frontiers in Marine Science. DOI 10.3389/fmars.2020.567002. Not yet available on the Hub's website.
			True size matters for conservation: deep-sea coral reefs are typically small and estimates of their size are remarkably robust to a method used to define them (journal article)		Published by Frontiers in Marine Science. DOI 10.3389/fmars.2020.00187. Not yet available on the Hub's website.
			Mapping and characterising reef habitat and fish assemblages of the Hunter Marine Park	https://www.nespmarine.edu.au/document/mapping-and-characterising-reef-habitat-and-fish-assemblages-hunter-marine-park	
			Monitoring the resilience of a no-take marine reserve to a range extending species using benthic imagery	https://www.nespmarine.edu.au/document/monitoring-resilience-no-take-marine-reserve-range-extending-species-using-benthic-imagery	
			A systematic review of remotely operated vehicle surveys for visually assessing fish assemblages	https://www.nespmarine.edu.au/document/systematic-review-remotely-operated-vehicle-surveys-visually-assessing-fish-assemblages	
			Taking a deeper look: Quantifying the differences in fish assemblages between shallow and mesophotic temperate rocky reefs	https://www.nespmarine.edu.au/document/taking-deeper-look-quantifying-differences-fish-assemblages-between-shallow-and-mesophotic	
Differential vulnerability to climate change yields novel deep-reef communities	https://www.nespmarine.edu.au/document/differential-vulnerability-climate-change-yields-novel-deep-reef-communities				
Fish assemblages on reefs in the Hunter Marine Park and adjacent waters	https://www.nespmarine.edu.au/document/fish-assemblages-reefs-hunter-marine-park-and-adjacent-waters				

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			Spatial properties of sessile benthic organisms and the design of repeat visual survey transects	https://www.nespmarine.edu.au/document/spatial-properties-sessile-benthic-organisms-and-design-repeat-visual-survey-transects	
			Trialling suitable indicator metrics of change for baited remote underwater video station datasets - progress report	https://www.nespmarine.edu.au/document/trialling-suitable-indicator-metrics-change-baited-remote-underwater-video-station-datasets	
			Theme D Project showcase and future research prioritisation workshop report - Report	https://www.nespmarine.edu.au/document/theme-d-project-showcase-and-future-research-prioritisation-workshop-report	
			ARMADA: A marine data aggregator and visualisation tool to support management of Australia's Commonwealth Marine Area - Report	https://www.nespmarine.edu.au/document/armada-marine-data-aggregator-and-visualisation-tool-support-management-australia%E2%80%99s	
			Sensitivity of fine-scale species distribution models to locational uncertainty in occurrence data across multiple sample sizes - Journal Article	https://www.nespmarine.edu.au/document/sensitivity-fine-scale-species-distribution-models-locational-uncertainty-occurrence-data	
			Changes in deep reef benthic community composition across a latitudinal and environmental gradient in temperate Eastern Australia - Journal Article	https://www.nespmarine.edu.au/document/changes-deep-reef-benthic-community-composition-across-latitudinal-and-environmental	
			Collation of existing shelf reef mapping data and gap identification - Phase 1 Final Report Shelf reef key ecological features - Report	https://www.nespmarine.edu.au/document/collation-existing-shelf-reef-mapping-data-and-gap-identification-phase-1-final-report	
			Identification and collation of Australia's shelf mapping datasets and development of a national geomorphological classification scheme for reef systems - Phase 1 Workshop Report - Report	https://www.nespmarine.edu.au/document/identification-and-collation-australia%E2%80%99s-shelf-mapping-datasets-and-development-national	
			Mapping shelf rocky reef habitats in the Hunter Commonwealth Marine Reserve - Report	https://www.nespmarine.edu.au/document/mapping-shelf-rocky-reef-habitats-hunter-commonwealth-marine-reserve	
			Geomorphological classification of reefs: draft framework for an Australian standard - Report	https://www.nespmarine.edu.au/document/geomorphological-classification-reefs-draft-framework-australian-standard	
			Spatial scale and geographic context in benthic habitat mapping: review and future directions - Journal Article	https://www.nespmarine.edu.au/document/spatial-scale-and-geographic-context-benthic-habitat-mapping-review-and-future-directions	
			Biological and habitat feature descriptions for the continental shelves of Australia's temperate-water marine parks- including collation of existing mapping in all AMPs	https://www.nespmarine.edu.au/document/biological-and-habitat-feature-descriptions-continental-shelves-australia%E2%80%99s-temperate-water	
			Workshop report from the inaugural National MPA Science/Management Network meeting	https://www.nespmarine.edu.au/document/workshop-report-inaugural-national-mpa-science-management-network-meeting-0	
			Workshop report from the National BRUV Forum – Perth, 18-19 July 2017	https://www.nespmarine.edu.au/document/workshop-report-national-bruv-forum-%E2%80%93-perth-18-19-july-2017	
			Reefs on the Australian Continental Shelf	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=2ffb37a5-5c58-4ea9-a47d-5d526be31346	
			Hydrographic Survey of the Boags Commonwealth Marine Reserve in Southwestern Bass Strait	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=fd47612a-fb21-4459-9e3a-adf66ed8ca59	
			2019 Hydrographic surveys of Freycinet, Huon and Tasman Fracture Marine Parks for Parks Australia	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=be7daab3-8b0d-4af6-9b49-1fd8af58846f	

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			Beagle Marine Park backscatter data 2018	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=52cf4bee-eeec-4b80-ad31-db2f27f4c9e6	
			Beagle Marine Park bathymetry data 2018	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=5164ad74-4924-411e-a25f-8a25bc2c1dd6	
			Bicheno region urchin barrens from AUV imagery	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=d29fa59e-203f-42a8-b0a7-cf77fde7b88a	
			Hunter Marine Park stereo-BRUV 2016-18	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=ee42c3b2-dd23-4ffe-ac2d-cbfc522f3951	
			AUV imagery - Ningaloo, South West Corner, Beagle, Boags, Freycinet, Huon + Tasman Fracture (seamounts), Hunter, Elizabeth/Middleton Reef (LH), Arafura and Gulf of Carpentaria Marine Parks		Publication pending
			BRUVs benthic fish abundance - Ningaloo, South West Corner, Beagle, Boags, Hunter, Freycinet, Huon + Tasman Fracture (seamounts) and Elizabeth/Middleton Reef (LH) Marine Parks		Publication pending
			Towed video - Beagle, Hunter and South West Corner Marine Parks		Publication pending
			Arafura Marine Park Communications Products	https://northwestatlas.org/nwa/money-shoal	
			Multibeam bathymetry - Ningaloo, South West Corner, Boags, Hunter, Elizabeth/Middleton Reef (LH) and Gulf of Carpentaria Marine Parks		Publication pending
			First look at deep rocky reefs in Beagle Commonwealth Marine Reserve	https://www.youtube.com/watch?v=i2JGGR2SEAc&t=15s	Video on YouTube
			Discovering black corals in Freycinet Commonwealth Marine Reserve	https://www.youtube.com/watch?v=kgKgNgx4UP4&t=83s	Video on YouTube
			Oceans of the Unknown Exhibition - mapping the oceans	https://www.youtube.com/watch?v=vzYATX64LNg	Video on YouTube
			RV Investigator Voyage - Blogging the Seamounts voyage: 23 Nov-19 Dec 2018	https://www.nespmarine.edu.au/seamounts/landing-page	
			RV Investigator Voyage - Videos from the Seamounts voyage (23 Nov - 19 Dec 2018)	https://www.youtube.com/user/NERPMarineHub/feed	Videos on YouTube
D4	Expanding our spatial knowledge of marine biodiversity to support future best-practice reviews	This project will fill data gaps and evaluate methods relevant to the ongoing spatial management of seafloor biota across the Australian marine domain. The objective is to prepare Australian, State and Territory governments for future best-practice reviews of Australia's marine bioregionalisation that can be used to improve marine spatial planning and management initiatives (e.g. marine bioregional plan and marine protected area reviews, environmental impact and natural heritage assessments). The project will incorporate results from field trips to unexplored offshore areas of Australia's marine domain and communicate biodiversity values of the CMR network to the Australian public.	Wessel Marine Park Post-Survey Report for IN2019T02	https://www.nespmarine.edu.au/document/wessel-marine-park-post-survey-report-in2019t02	
			The lower bathyal and abyssal seafloor fauna of eastern Australia (journal article)	https://www.nespmarine.edu.au/document/lowe-r-bathyal-and-abyssal-seafloor-fauna-eastern-australia	
			Post survey report for the Coral Sea Australian Marine Park 2019	https://www.nespmarine.edu.au/document/post-survey-report-coral-sea-australian-marine-park-2019	
			Deep-sea temperate-tropical faunal transition across uniform environmental gradients	https://www.nespmarine.edu.au/document/deep-sea-temperate-tropical-faunal-transition-across-uniform-environmental-gradients-0	
			Contrasting processes drive ophiuroid phylodiversity across shallow and deep seafloors	https://www.nespmarine.edu.au/document/contrasting-processes-drive-ophiuroid-phylodiversity-across-shallow-and-deep-seafloors	
			The eastern Australian Marine Parks: biodiversity, assemblage structure, diversity and origin	https://www.nespmarine.edu.au/document/eastern-australian-marine-parks-biodiversity-assemblage-structure-diversity-and-origin	

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			Regional-scale patterns of deep seafloor biodiversity for conservation assessment	https://www.nespmarine.edu.au/document/regional-scale-patterns-deep-seafloor-biodiversity-conservation-assessment	
			Expanding our spatial knowledge of marine biodiversity to support future best practice reviews	https://www.nespmarine.edu.au/document/expanding-our-spatial-knowledge-marine-biodiversity-support-future-best-practice-reviews	
			Polychaetes from Australia's Eastern Abyss	https://www.nespmarine.edu.au/document/polychaetes-australia%E2%80%99s-eastern-abyss	
			Towards an IMCRA 5	https://www.nespmarine.edu.au/document/towards-imcra-5	
			RV Investigator voyage - Blogging the Abyss (15 May - 16 June 2017)	https://www.nespmarine.edu.au/abyss-landing-page	
			Coral Sea - Calder Seamount - Geomorphology and Surface Classification	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=28047a73-ad75-4035-9188-ac1b3a92bf78	
			Coral Sea - Cassowary Seamount - Geomorphology and Surface Classification	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=242826bd-a159-4836-9103-f19dd37c65ac	
			Coral Sea - Fregetta Seamount - Geomorphology and Surface Classification	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=e91473ad-e6bf-4bef-9c63-40ca1dcf1671	
			Coral Sea - Kenn Seamount - Geomorphology and Surface Classification	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=433e18cd-c908-4553-b116-b604327730b0	
			Coral Sea - Lexington Seamount - Geomorphology and Surface Classification	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=8eca7224-1d85-4412-8ae9-c02092cab07	
			Coral Sea - Mellish Seamount - Geomorphology and Surface Classification	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=fa1d9951-b1a3-449d-8d2a-520161a84a2c	
			Coral Sea - Sula Seamount - Geomorphology and Surface Classification	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=cbe3e3fc-c951-428b-a89a-ee345a352da2	
			Wessell AMP survey - IN2019_T02 - towed imagery	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=c5bc7619-46c3-4773-b64e-cdce82c444e1	
			Wessell AMP survey - IN2019_T02 end of voyage archive (hydrology, CTD profiles, ACDP data, multibeam echosounder, sub-bottom profiler)	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=54158abf-7d02-4e66-8529-48ba6e286d63	
			RV Investigator Voyage - Videos from the Abyss voyage (15 May - 16 June 2017)	https://www.youtube.com/user/NERPMarineHub/feed	Videos on YouTube
D5	A standardised national assessment of the state of coral and rocky reef biodiversity	This project will involve integration of a national suite of reef biota Underwater Visual Census (UVC) monitoring datasets (Reef Life Survey, UTas, AIMS, Parks Victoria, SA DEWNR) to provide a comprehensive update to the state of Australian Reefs report for the next national State of the Environment Report. Maps and indicator trends will show changes in the health of rocky and coral reefs nationally from 2005 to 2020. The update will include addition of a new index which summarises the population trajectories for 600-1000 reef species nationally. Individual species trajectories will provide the only threat status information for the majority of these species, assisting future listing of previously unassessed species if significant declines are detected.	A standardised national assessment of the state of coral and rocky reef biodiversity	https://www.nespmarine.edu.au/node/4679	
			Fish body sizes change with temperature but not all species shrink with warming (journal article)	https://www.nespmarine.edu.au/document/fish-body-sizes-change-temperature-not-all-species-shrink-warming	
			Habitat loss and range shifts contribute to ecological generalisation amongst reef fishes	https://www.nespmarine.edu.au/document/habitat-loss-and-range-shifts-contribute-ecological-generalisation-amongst-reef-fishes	
			Maps and trends in SOE indicators (On-line maps)		Publication pending
			Raw data underlying SoE analyses (CSV files/database excl. AIMS data)		Publication pending

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D6	Socioeconomic benchmarks	Social and economic values are key drivers for marine science and marine policy but are too rarely integrated with marine biodiversity monitoring programs. In close consultation with PA we will review existing metrics used to survey social and economic values associated with marine parks. This review will include consulting with national and international expertise and actively consulting with State and other Commonwealth agencies, some of whom are currently conducting reviews or have existing frameworks for surveying social and economic values (e.g GBRMPA, NSW DPI and Vic Parks). In collaboration with national partners and PA we will organise a national methods workshops to discuss and refine metrics and methods to quantify social and economic benchmarks for State and Australian Marine Parks (AMPs) and produce an SOP relevant to AMPs taking into consideration the DAWE's environmental accounting processes and PA's Monitoring, Evaluation, Reporting and Improvement (MERI) framework.	A continental scale social and economic benchmark of Australia's no-take marine reserves and other protected areas (journal article)		Manuscript submitted to publisher. Publication date not yet known.
			Social and economic benchmarks of the Australian Marine Parks	https://www.nespmarine.edu.au/node/4681	
			Measures for social and economic monitoring of the Australian Marine Parks	https://www.nespmarine.edu.au/document/measures-social-and-economic-monitoring-australian-marine-parks	
			Socio-economic benchmarks - attitudes and perceptions surveys for the Australian Marine Parks	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=fbb1f773-02f9-44bb-92cc-1e821ebda8a0	Pending publication
			Socio-economic benchmark nationally modelled recreational fishing effort	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=2cd22229-a38d-4abf-b57c-0a41aa5b7d50	Pending publication
			Socio-economic benchmark boat-ramp surveys - recreational use patterns	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=9f40ac0c-e0b1-436b-abc7-b19bc7159d86	
D7	NESP Hub support for Parks Australia's Monitoring, Evaluation, Reporting and Improvement System for Australian Marine Parks	This application is to facilitate Hub engagement with Parks Australia during development and initiation of their Monitoring, Evaluation, Reporting and Improvement (MERI) System for Australian Marine Parks. A key priority for the Marine Parks Branch over the next 18 months is finalising the Australian Marine Park MERI System. The Marine Biodiversity Hub will play an important role in development and implementation of this system. Hub partners have had previous experience in developing the integrated monitoring framework for the Great Barrier Reef, developing a process for identifying indicators for monitoring Key Ecological Features, and also have collected much of the ecological data that exists within Australian Marine Parks.	Designing a targeted monitoring program to support evidence-based management of Australian Marine Parks A pilot in the South-east Marine Park Network	https://www.nespmarine.edu.au/node/4618	
D8	Canyon mapping & biodiversity in Gascoyne Marine Park	The approved survey to the Gascoyne canyons aims to map the surrounding marine park using multibeam sonar and to characterise the biodiversity of North-West canyon fauna, using an ROV to undertake a comprehensive taxon inventory and eDNA analyses to provide a methodological comparison. The proposed project will extend the survey's capability and increase its relevance to marine park management, particularly in deep-sea and canyon habitats. The proposed project will yield communication products such as a fly-through, eco-narrative, and image library, as well as products consistent with previous NESP reporting such as a voyage plan and post-survey report.	Fly-through of the Gascoyne Marine Park	https://www.nespmarine.edu.au/document/fly-through-gascoyne-marine-park	
			An eco-narrative of the Gascoyne Marine Park, North-west marine region	https://www.nespmarine.edu.au/document/eco-narrative-gascoyne-marine-park-north-west-marine-region	
			Gascoyne Marine Park Post-survey report, RV Falkor, FK200308	https://www.nespmarine.edu.au/document/gascoyne-marine-park-post-survey-report-rv-falkor-fk200308	
			ROV imagery from the Gascoyne Marine Park	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=2fcaec3b-2828-451f-89a6-215db3db3cf1	
			Illuminating the Biodiversity of the Cape Range and Cloates Canyons [bathymetry]	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=c5533723-0328-4e97-8cac-d7be7c1f6544	Bathymetry data also published to AusSeabed as 'Cape Range Canyon Bathymetry 2020'
			Seafloor bathymetry of the Gascoyne Marine Park [flythrough]	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=03656bf4-5351-4e21-8e51-01ef55028964	
E1	Guidelines for analysis of cumulative impacts and risks to the Great Barrier Reef	Existing guidance and standards for assessing impacts and risk (e.g. ISO 31000) are specified at a high-level allowing for considerable variation in approach, cost and outcomes from assessments and no guidance on direct or cumulative impacts. We will develop a national standard to support analysis of impacts and risks to the environmental, social and economic values required by the EPBC Act. The standard will be compatible with and support the process outlined in the Significant Impact guidelines for MNES and for Australian Marine Parks (AMP), including the means to calculate the impact and risk of upstream, downstream, facilitated and indirect impacts that will be presented in clear tabular and graphic formats, including maps as appropriate.	High level summary of technical report describing guidelines for analysis of cumulative impacts and risks to the Great Barrier Reef for Environmental Standards, DAWE	https://www.nespmarine.edu.au/node/4585	
			High level summary of technical report describing guidelines for analysis of cumulative impacts and risks to the Great Barrier Reef for Environmental Standards, GBRMPA	https://www.nespmarine.edu.au/node/4587	
			Case study for Great Barrier Reef cumulative impact guidance: Whitsundays Plan of Management	https://www.nespmarine.edu.au/node/4683	
			Guidelines for analysis of cumulative impacts and risks to the Great Barrier Reef	https://www.nespmarine.edu.au/document/guidelines-analysis-cumulative-impacts-and-risks-great-barrier-reef	

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			Ecosystem restructuring along the Great Barrier Reef following mass coral bleaching	https://www.nespmarine.edu.au/document/ecosystem-restructuring-along-great-barrier-reef-following-mass-coral-bleaching	
			A new wave of marine evidence-based management: emerging challenges and solutions to transform monitoring, evaluating, and reporting	https://www.nespmarine.edu.au/document/new-wave-marine-evidence-based-management-emerging-challenges-and-solutions-transform	
E2	Characterising anthropogenic underwater noise to improve understanding and management of acoustic impacts to marine wildlife	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 vessel noise exposure and impacts to MNES. The outputs will provide key information to marine regulators and management agencies such as DAWE, AMSA and GBRMPA, and their counterparts in state and territory governments, to help them meet responsibilities and obligations under international and national law and policy to minimise the impacts of the shipping noise on MNES.	Underwater noise signatures of ships in Australian waters (Technical Report)	https://www.nespmarine.edu.au/document/underwater-noise-signatures-ships-australian-waters-technical-report	
			Contributions of shipping noise to Australia's marine soundscape (Australian shipping noise - GBR Case Study)	https://www.nespmarine.edu.au/node/4095	
			It often howls more than it chugs: Wind versus ship noise underwater in Australia's Maritime Regions	https://www.nespmarine.edu.au/submission/it-often-howls-more-it-chugs-wind-versus-ship-noise-underwater-australia%E2%80%99s-maritime	
			Marine acoustic zones of Australia	https://www.nespmarine.edu.au/document/marine-acoustic-zones-australia	
			Characterising anthropogenic underwater noise to improve understanding an management of acoustic impacts to maritime wildlife - Final Report	https://www.nespmarine.edu.au/node/4632	
			Ocean wind noise of Australia	https://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=0d3c7edc-463a-4fa0-8039-4d5a779035c3	
			Acoustic Zones of Australia	https://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=0c1bb667-29b2-4848-ade7-a98417121a66	
			Cumulative sound exposure from shipping in Australian EEZ	https://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=480847b4-b692-4112-89ff-0dcef75e3b84	
			Fine-scale cumulative sound exposure from shipping in the Great Barrier Reef (GBR)	https://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=9e27e495-5bd3-4e9c-a956-b387cbefdd4a	
			Database of ship spectra for large vessels	https://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=fa4f8288-5dbf-450a-bfa1-6a83764a94ad	
E3	Microplastics in the Australian marine environment	The project will inform national policy and action to reduce the release and impacts of microplastics on our environment and oceans: 1. A literature review will firstly identify key marine microplastics research and policy development internationally, with a focus on research that is contextual to microplastics in the Australian marine environment. 2. From this literature review, an options paper will be developed to explore the most feasible and impactful policy approaches for the Australian context and that can be used to form the basis for discussions at a workshop. 3. A one day workshop will draw together policy-makers, researchers and relevant industry peak bodies to discuss and recommend policy and other options to limit microplastics release into the environment. A workshop report will be drafted to summarise findings, recommendations and next steps. a. The report will provide evidence to underpin the development of national policy aimed at reducing microplastic pollution, including by identifying priority actions to deliver Australia's 2018 National Waste Policy.	Microplastics in the Australian marine environment: issues and options	https://www.nespmarine.edu.au/document/microplastics-australian-marine-environment-issues-and-options	
			Primary microplastics in the marine environment: scale of the issue, sources, pathways and current policy	https://www.nespmarine.edu.au/document/primary-microplastics-marine-environment-scale-issue-sources-pathways-and-current-policy	

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E4	Recreational fishing in Commonwealth waters	Australia's recreational fishing sector is moving further offshore in pursuit of fishing opportunities, which places them in areas managed by the Australian Government. Most recreational fisheries research is state based and at two case study sites - Hunter Australian Marine Park (AMP) and the Ningaloo AMP - this data will be assessed for its usefulness to quantify offshore fishing. New data will also be collected will also be collected using creel, socio-economic and remote sensing techniques to better understand fisher's effort, harvest and motivations. As well, the response by fish communities to harvest and the fishery to climate change will be assessed at larger scales. As recreational fishers are key stakeholders in marine management and regulation, a better understanding of their values is required to effectively inform administration of the EPBC Act (e.g. effects of Matters of National Environmental Significance), use of Australian Marine Parks and Commonwealth managed commercial fisheries.	Trail camera video systems: investigating their utility in interpreting patterns of marine, recreational, trailer-boat fishers' access to an offshore Marine Park in differing weather conditions		Published by ICES Journal of Marine Science. DOI 10.1093/icesjms/fsaa209. Accepted version is embargoed for 12 months.
			A cross continental scale comparison of Australian offshore charter boat and tournament recreational fisheries research and its applications to Marine Park and fisheries management	https://www.nespmarine.edu.au/document/cross-continental-scale-comparison-australian-offshore-charter-boat-and-tournament	
			Recreational fishing in Commonwealth waters - Milestone Report, milestone 6 RPv4 2018	https://www.nespmarine.edu.au/document/recreational-fishing-commonwealth-waters	
			A cross continental scale comparison of Australian offshore recreational fisheries research and its applications to Marine Park and fisheries management	https://www.nespmarine.edu.au/document/cross-continental-scale-comparison-australian-offshore-recreational-fisheries-research-and	
			Trail cameras and boat ramp interviews for assessing perceptions and understandings of AMPs and small scale spatial distributions of fishers in relation to an offshore Marine Park	http://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=cdbedeb3-986c-46ac-92d3-141bfd42dcf6	
			Reanalysis of state-based aggregated recreational fishing data (WA and NSW)	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=09df3cc3-6d91-4b87-a3b7-cca7a288ff6f	
E5	The role of restoration in conserving MNES	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 <ul style="list-style-type: none"> • giant kelp forests, • coral reefs, • 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 the more promising habitats and develop a restoration decision framework to guide future investments.	Marine and coastal restoration database	https://www.nespmarine.edu.au/document/marine-and-coastal-restoration-database	
			UN Decade on ecosystem restoration 2021-2030 - What chance for success in restoring coastal ecosystems?	https://www.nespmarine.edu.au/document/un-decade-ecosystem-restoration-2021-2030-what-chance-success-restoring-coastal-ecosystems	
			The value and opportunity of restoring Australia's lost rock oyster reefs		Published by Restoration Ecology. DOI 10.1111/rec.13125. Not yet available on the Hub's website.
			Seagrass restoration is possible: Insights and lessons from Australia and New Zealand	https://www.nespmarine.edu.au/document/seagrass-restoration-possible-insights-and-lessons-australia-and-new-zealand	
			Restoration Showcase June 2020 - Webinar Presentation - "United Nations Decade on Ecosystem Restoration 2021-2030"	https://www.nespmarine.edu.au/document/restoration-showcase-june-2020-webinar-presentation-united-nations-decade-ecosystem	
			Restoration Showcase June 2020 - Webinar Presentation - "Rebuilding Australia's lost shellfish reefs"	https://www.nespmarine.edu.au/document/restoration-showcase-june-2020-webinar-presentation-rebuilding-australias-lost-shellfish	
			Restoration Showcase June 2020 - Webinar Presentation - "Rebuilding coastal wetland ecosystems in Great Barrier Reef catchments"	https://www.nespmarine.edu.au/document/restoration-showcase-june-2020-webinar-presentation-rebuilding-coastal-wetland-ecosystems	
			Benefits and Costs of Alternate Seagrass Restoration Approaches	https://www.nespmarine.edu.au/document/benefits-and-costs-alternate-seagrass-restoration-approaches	
			Successful communication for shellfish reef restoration projects	https://www.nespmarine.edu.au/document/successful-communication-shellfish-reef-restoration-projects	
			Report on cost-effectiveness of alternative restoration projects	https://www.nespmarine.edu.au/document/benefit-cost-analysis-marine-habitat-restoration-framework-estimating-viability-shellfish	
Can bivalve habitat restoration improve degraded estuaries?	https://www.nespmarine.edu.au/document/can-bivalve-habitat-restoration-improve-degraded-estuaries				

Marine Biodiversity Hub Final Report - Attachment A

Project Number/ID	Project Name/Title	Project Summary	Outputs	Link to Output	Comments on outputs
			The role of restoration in conserving matters of national environmental significance in marine and coastal environments	https://www.nespmarine.edu.au/document/role-restoration-conserving-matters-national-environmental-significance-marine-and-coastal	
			Marine and coastal habitat restoration projects database	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=ff059811-8ab9-4458-a76b-2be44c816c49	
E6	Assisting restoration of ecosystem engineers through seed-based and shoot-based programs in the Shark Bay WHS	This project will develop community-based seeding and shoot planting restoration practices in the Shark Bay World Heritage Site (WHS). The goal is to scale up the existing restoration research to practice and assist recovery of the dominant seagrasses, <i>Amphibolis antarctica</i> and <i>Posidonia australis</i> following the 2011 marine heat wave. The Shark Bay WHS is unique globally for its natural values, including stromatolites, extensive seagrass meadow that have constructed sills and banks over 1,000s of years resulting in restricted exchange with the ocean, unique and abundant marine megafauna including 1/8th of the worlds population of dugongs, large populations of sharks and turtles, and one of the longest studied populations of dolphins in the world. The inshore waters of the WHS provides connectivity to the deeper waters of the adjacent Commonwealth Shark Bay Marine Park. Shark Bay seagrasses have recently been devastated by the marine heatwave of 2010-2011 and these events are predicted to increase in frequency and intensity with global warming. The loss of 23% of seagrass cover in the bay (860 km ²) had a flow on effect to mega herbivores, fish, tourism and the commercial aquaculture and fisheries industries dependent of the ecosystem. There is a critical need to develop management actions to respond to such events and to prepare for predicted future events. Seagrass restoration has been explored at Useless Loop and on both sides of the Peron Peninsula near Denham and Monkey Mia over the past 6-8 years (3 ARC Linkage, 1 ARC Discovery Grant), resulting in an increased understanding of the factors required for successful seagrass restoration along the extreme salinity gradient found in Shark Bay. The Malgana people have responsibilities for sea country in Shark Bay and a strong tie to the land and inshore seas that make up the Shark Bay WHS. This project is a collaboration between scientists and the Mulgana community whereby methods will be jointly developed to assist natural recovery in preparation for future devastating impacts of climate change.	Assisting recovery of seagrass in Shark Bay, Gathaagudu - Final Report	https://www.nespmarine.edu.au/node/4627	
			Baseline genomic data collection and assisting natural recovery of seagrass meadows	https://www.nespmarine.edu.au/document/baseline-genomic-data-collection-and-assisting-natural-recovery-seagrass-meadows	
			Restoration Showcase June 2020 - Webinar Presentation - "Assisting restoration of ecosystem engineers through seed-based and shoot-based programs in the Shark Bay World Heritage Site"	https://www.nespmarine.edu.au/document/restoration-showcase-june-2020-webinar-presentation-assisting-restoration-ecosystem	
			Seagrass (wirriya jalyanu): giving life to sea country of Shark Bay (Gathaagudu) - Fact sheet 2021	https://www.nespmarine.edu.au/document/seagrass-wirriya-jalyanu-giving-life-sea-country-shark-bay-gathaagudu-fact-sheet-2021	
			Survival of transplanted <i>Posidonia australis</i> seagrass	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=2df66a54-63fe-41f0-acd3-883b63674d9a	
			Invertebrate biodiversity assessments in plots with transplanted seagrass (<i>Amphibolis antarctica</i> and <i>Posidonia australis</i>)	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=6205351f-cdc0-4bca-a788-9f5e4801454b	
			Growth (shoot counts) of transplanted <i>Amphibolis antarctica</i> and <i>Posidonia australis</i> seagrass	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=2b049116-949f-4f5a-9b5f-bf245936884c	
			Sediment carbon stock in plots of transplanted <i>Posidonia australis</i> seagrass	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=647d1c42-f3b0-4ed6-b300-4416702a7729	
Genomics of <i>Amphibolis antarctica</i> and <i>Posidonia australis</i> seagrass in Shark Bay	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=cbe117a8-c04a-48a2-91b2-dfcd4f109e39				
E7	Assessing the feasibility of restoring giant kelp beds in eastern Tasmania	The proposed research will extend on externally funded work commencing in 2018 to select for thermally tolerant and low-nutrient-tolerant giant kelp (<i>Macrocystis pyrifera</i>) genotypes, and which will examine effects of acclimation of selected genotypes by pre-exposure to warm, nutrient poor conditions. The project will outplant pre-exposed selected genotypes of giant kelp as micro-sporophytes in experiment providing / not providing an added source of nutrient. The work is designed to assess the feasibility of this approach as a means to develop minimum patch sizes for giant kelp that can be self-replacing and self-expanding.	Restoration Showcase June 2020 - Webinar Presentation - "Assessing the feasibility of restoring giant kelp forests in Eastern Tasmania"	https://www.nespmarine.edu.au/document/restoration-showcase-june-2020-webinar-presentation-assessing-feasibility-restoring-giant	
			Assessing the feasibility of restoring giant kelp forests in Tasmania	https://www.nespmarine.edu.au/node/4668	
			Macrocystis thermal tolerance testing	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=0b91d7fd-7d29-452f-954a-78cf75151035	
			Survivorship of outplanted kelp	https://catalogue.aodn.org.au/geonetwork/srv/en/metadata.show?uuid=908afd8c-cc7a-4ea3-a87e-4497ae8da87a	

Marine Biodiversity Hub Final Report - Attachment A

Project Number/ID	Project Name/Title	Project Summary	Outputs	Link to Output	Comments on outputs
SS2	Interpreting pressure profiles	This project has two objectives: (i) to provide a spatial explicit analysis of the relative risks posed to marine conservation values, as defined by the natural values hierarchy of Park Australia's Monitoring, Evaluation, Reporting and Improvement (MERI) framework, by pressures that operate within Australia's Exclusive Economic Zone and state/territory waters (a "hotspots" analysis); and, (ii) provide a proof of concept of an adaptive, probabilistic assessment of the cumulative risks posed to these values, in a region determined to support the Parks Australia MERI project D7, in a manner that is consistent with the seascape-scale cumulative assessment described in the "Guidelines for analysis of cumulative impacts and risks to the Great Barrier Reef" (developed and tested with Commonwealth, State and Industry stakeholders in project E1).	Designing a targeted monitoring program to support evidence-based management of Australian Marine Parks A pilot in the South-east Marine Park Network	https://www.nespmarine.edu.au/node/4618	
			NESP Cumulative Pressures - R Shiny app	https://data.csiro.au/collections/collection/CiCsir o:44323/SQpressures/RP1/RS25/RORELEVANCE/STsearch-by-keyword/RI1/RT154/	
			Maps of cumulative pressures		Publication pending
SS3	National trends in coral species following heatwaves	The project will engage coral taxonomic experts to annotate existing Reef Life Survey photoquadrats taken across northern Australia before and after major disturbances, to allow: - Quantification of the spatial and species-level responses of Australian corals to the 2016 and 2017 marine heatwave and mass bleaching events (and cyclones that occurred during this period). - Identification of the species most threatened by warming and cyclones, and species likely to respond best to restoration efforts. - Contribution to a coral-specific analysis to the next national State of the Environment report, through project D5.	Species-level responses of corals to a 2016 mass bleaching event in Australia	https://catalogue.aodn.org.au/geonetwork/srv/eng/metadata.show?uuid=5263c0bd-aa00-4769-9041-f42390920c3f	
			A standardised national assessment of the state of coral and rocky reef biodiversity	https://www.nespmarine.edu.au/node/4679	

NESP Impact Stories

Getting to know Australian Marine Parks

Mapping the distribution, extent and structure of biodiversity is fundamental to understanding and managing Australia's marine environment. The Marine Biodiversity Hub surveyed habitats and marine life across tropical and cold temperate regions, from the coast to the abyssal plain. High-resolution maps and imagery generated by the surveys provide baseline information to understand and monitor the natural values of Australian Marine Parks (AMPs) and support management planning and evaluation.

This work advanced the use of technologies such as swath acoustics, remotely operated vehicles and stereo underwater cameras, and developed [marine sampling best practices](#). The marine sampling best practices are being adopted by researchers and industry, and have been endorsed by key national and international organisations. Communication activities and materials associated with surveys include [voyage blogs](#), [videos](#) and animated '[flythroughs](#)', which have showcased the new knowledge to help stakeholders and the broader community understand the values being protected to achieve conservation goals and sustainable use.

Detailed mapping and sampling supported by the Hub revealed [evolutionary secrets](#) of Australia's eastern abyss, and studied the [recovery of deep-sea corals](#) on Tasmanian seamounts. We also inventoried the predators and prey that aggregate at Bremer Marine Park, and spectacular corals and fishes in deeper waters of the [Ningaloo](#), Hunter and [Lord Howe](#) AMPs.

Research outputs and attributions

[Field manuals for marine sampling to monitor Australian waters](#)

R. Przeslawski; S.D. Foster; B. Gibbons; T.J. Langlois; J. Monk (2021) [Impacts and Outcomes of Marine Sampling Best Practices](#)

O'Hara et al (2019) [Contrasting processes drive ophiuroid phylodiversity across shallow and deep seafloors](#)

Images and video

[Marine Biodiversity Hub YouTube channel](#)

[Blogging the seamounts: 23 Nov-19 Dec 2018](#)

[Gifford Marine Park animation](#)

[Seamount corals survey 2018 Episode 2: Eyes on the Seafloor](#)

[Surveying fishes in the deeper waters of Ningaloo](#)

[Surveying our southernmost coral reefs](#)

Mapping natural values

Marine Biodiversity Hub researchers worked with Parks Australia to conduct surveys that have vastly extended our knowledge of life in [Australian Marine Parks](#) (AMPs). Best practice approaches developed by the Hub were used to map bathymetry and sample biodiversity in 15 AMPs using high resolution sonar and remote cameras.

Existing datasets were reviewed and combined with results from the targeted surveys, providing baseline knowledge required for Parks Australia to identify key natural values and set monitoring priorities for AMPs. The program also advanced national collaborations in marine data sharing, and visualisation tools to improve user accessibility.

Research outputs and attributions

N. Barrett; J. Monk [Progress towards a nationally integrated benthic biodiversity monitoring program for Australia's marine realm](#)

K.J. Miller; M.L. Puotinen; R. Przeslawski; Z. Huang; P.J. Bouchet; B. Radford; J. Li; J.T. Kool; K. Picard; M. Thums; J.J. Meeuwig; S.L. Nichol (2016) [Ecosystem understanding to support sustainable use, management and monitoring of marine assets in the north and north-west regions: final report](#)

J. Monk; J. Williams; N. Barrett; A.R. Jordan; V.L. Lucieer; F. Althaus; S.L. Nichol [Biological and habitat feature descriptions for the continental shelves of Australia's temperate-water marine parks - including collation of existing mapping in all AMPs](#)

N. Barrett; J. Monk; S.L. Nichol; G. Falster; A. Carroll; J.P.W. Siwabessy; A. Deane; R. Nanson; K. Picard; N. Dando; J. Hulls; H. Evans [Beagle Marine Park Post Survey Report: South-east Marine Parks Network](#)

K. Picard; M. Stowar; N. Roberts; J. Siwabessy; M. Abdul-Wahab; R. Galaiduk; K.J. Miller; S.L. Nichol [Arafura Marine Park: Post Survey Report](#)

J. Williams; T. Ingleton; M. Sutherland; P. Davies; J. Monk; N. Barrett; A.R. Jordan [Mapping and characterising reef habitat and fish assemblages of the Hunter Marine Park](#)

Social and economic baselines and monitoring

Social and economic values are important to marine park management, but are rarely integrated with biodiversity monitoring programs. Marine Biodiversity Hub researchers worked with Parks Australia to develop ways of measuring changes in the way people experience and value the marine environment, in response to the establishment and management of AMPs. The approaches include surveys of AMP users such as fishers and tour operators. The resulting [key measures](#) are designed to be incorporated in the Monitoring, Evaluation, Reporting, and Improvement System being developed for AMPs, and in state-based marine park management.

Research outputs and attributions

Navarro, M., Langlois, T.J., Burton, M., Kragt, M.E., Rogers, A. (2020) [Measures for social and economic monitoring of the Australian Marine Parks](#)

Image

<https://www.nespmarine.edu.au/recreational-fishers-still-image>

Understanding the risks that pressures pose to natural values

Parks Australia managers need to understand pressures on the marine environment in order to protect and enhance the benefits of AMPs. Marine Biodiversity Hub researchers collated pressure datasets for oil and gas extraction and infrastructure,

seismic surveys, shipping movements, aquaculture leases, pollution events, and changes in ocean temperature. They developed new approaches to measuring individual and cumulative pressures, and made the information accessible to guide decision-making about management and monitoring priorities. The pressures datasets were used in a collaborative project between the Hub and Parks Australia that identified monitoring priorities for the South-east Marine Parks Network.

Image

<https://www.nespmarine.edu.au/indo-pacific-bottlenose-dolphin-3-still-image>

Developing a monitoring, evaluation, reporting and improvement system for Australian Marine Parks

Regular monitoring, evaluation, reporting and improvement (MERI) is essential to Australian Marine Park (AMP) management. Marine Biodiversity Hub researchers worked closely with Parks Australia to help the Australian Government develop a MERI system for Australian Marine Parks. They collated baseline environmental and pressure datasets, conducted risk assessments, and developed monitoring evaluation and reporting approaches as part of a consistent, best practice approach to AMP management. The monitoring prioritisation approach will be incorporated in science plans being developed for each of the five AMP networks and the Coral Sea Marine Park.

Research outputs and attributions

NESP Marine Biodiversity Hub: Keith R. Hayes*, Piers Dunstan*, Skipton Woolley*, Neville Barrett*, Scott Foster, Jacquomo Monk, David Peel, Geoffrey R. Hosack

Parks Australia: Steffan A. Howe*, Cath R. Samson*, Renee Bowling*, Mitchell P. Ryan*, Scott O. Francis

[Designing a targeted monitoring program to support evidence-based management of Australian Marine Parks A pilot in the South-east Marine Park Network \(2021\)](#)

Image

BRUVS deployment, Ningaloo Marine Park

<https://www.nespmarine.edu.au/bruvds-deployment-ningaloo-marine-park-still-image>

Benchmark survey of fishes and habitats in the Two Rocks region of South-west Marine Park.

Additional images

Arafura Marine Park

<https://www.nespmarine.edu.au/spectacular-coral-communities-arafura-marine-park-still-image>

<https://www.nespmarine.edu.au/samsonfish-south-west-marine-park-video-0>

Kimberley Marine Park bathymetry

<https://www.nespmarine.edu.au/seafloor-bathymetry-kimberley-marine-park-figure>

Huon Marine Park bathymetry

<https://www.nespmarine.edu.au/cmr-still-image-9>

Perth Canyon Marine Park (video)

<https://www.nespmarine.edu.au/sperm-whales-sharks-dolphins-deepwater-corals-animation>

Theme title

Assessing threatened and migratory species

Theme description

Marine Biodiversity Hub research supports the recovery and conservation of threatened and migratory sharks, marine mammals, fishes and sea snakes. Our projects have built Australia's capacity to meet regional, national and international conservation commitments; from research prioritisation and strategic planning and reporting to on-ground action.

Tropical and temperate sharks have been a major focus. We published the first comprehensive review of the status of Australia's 329 shark, ray and chimaera species, assessed White Shark, [Grey Nurse Shark](#) and Northern River Shark populations, and defined regional stocks of [hammerhead sharks](#). We also worked with Traditional Owners to rescue Largetooth Sawfish in the Daly River.

[Annual surveys](#) of right whales off southern Australia, and development of the Australasian Right Whale Photo-Identification Catalogue provide evidence to monitor their recovery in Australian waters. Mapping the risk posed by [vessel strike](#) to large marine mammals contributed to national and international planning and risk management. Our [catalogue of ship noise signatures](#) and identification of acoustic zones in Australian waters brought us closer to understanding the effects of underwater noise on marine life.

Conservation actions to help recover Tasmania's Red Handfish and Spotted Handfish involved studying spawning behaviour, establishing artificial spawning habitats, captive rearing and reintroduction of Red Handfish, and population monitoring and assessment.

Research outputs and attributions

C. Erbe; A. Duncan; D. Peel; J. Smith (2021) [Underwater noise signatures of ships in Australian waters \(Technical Report\)](#)

Bradford, R. W.; Thomson, R.; Bravington, M.; Foote, D.; Gunasekera, R.; Bruce, B. D.; Harasti, D.; Otway, N.; Feutry, P [A close-kin mark-recapture estimate of the population size and trend of east coast grey nurse shark](#)

Heupel, M., Simpfendorfer, C., Chin, A., Appleyard, S., Barton, D., Green, M., Johnson, G., McAuley, R, White, W. (2020) [Examination of connectivity of hammerhead sharks in northern Australia](#)

J. Smith; D. Jones; K. Travouillon; N. Kelly; M.C. Double; J. Bannister (2020) [Monitoring Population Dynamics of 'Western' Right Whales off Southern Australia 2018-2021; Final Report on activities for 2020](#)

D. Peel; J. Smith; C. Erbe; T.A. Patterson; S. Childerhouse (2019) [Quantification of risk from shipping to large marine fauna across Australia: Final Report](#)

J.F. Stuart-Smith; T. Lynch; F. McEnnulty; M. Green; C. Devine; A. Trotter; T. Bessell; L. Wong; P. Hale; A. Martini; R.D. Stuart-Smith; N. Barrett [Conservation of handfishes and their habitats – Final Report 2020](#)

Images

Grey Nurse shark image: <https://www.nespmarine.edu.au/grey-nurse-shark-still-image-0>

Tagged Great Hammerhead shark image: <https://www.nespmarine.edu.au/great-hammerhead-shark-great-barrier-reef-marine-park-still-image-0>

Impact snap shots

Expanded range and population size for the Northern River Shark

A decade of Marine Biodiversity Hub surveys [discovered several new populations](#) of the threatened Northern River Shark and found nursery grounds in the Kakadu National Park and World Heritage Area. Genetic studies enabled the first population size estimates and identified five distinct populations: four in Australia and one in Papua New Guinea. The new understanding of Northern River Shark populations highlights the need for localised management and provides up-to-date information for assessments conducted under Australia's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in the context of northern Australia's development. This [video](#) shows the research in action.

Research outputs and attributions

M. Bravington; P. Feutry; R.D. Pillans; R. Hillary; G. Johnson; T. Saunders; R.M. Gunasekera; N.J. Bax; P.M. Kyne (2019)

[Close-Kin Mark-Recapture population size estimate of *Glyphis garricki* in the Northern Territory](#)

Images and video

[Brighter prospects for the Northern River Shark](#) (video)

Northern River Shark: <https://www.nespmarine.edu.au/northern-river-shark-still-image-1>

Sizing up Australia's White Shark populations

White Sharks are protected in Australian waters and scientific evidence is needed to support national and regional strategies for management. Marine Biodiversity Hub researchers combined acoustic tagging and genetic and statistical techniques to produce the [first evidence-based population estimates](#) for Australia's White Sharks. Their novel approach to estimating status and trends of White Shark populations reduced uncertainty about conservation listings and provided a means of measuring the effectiveness of risk mitigation and recovery and actions under the *Environment Protection and Biodiversity Conservation Act 1999*, and state legislation.

Research outputs and attributions

R.M. Hillary; M. Bravington; T.A. Patterson; P. Grewe; R. Bradford; P. Feutry; R. Gunasekera; V. Peddemors; J. Werry; M.P. Francis; C.A.J. Duffy; B.D. Bruce (2018)

[Genetic relatedness reveals total population size of white sharks in eastern Australia and New Zealand](#)

Image



A tagged White Shark at The Neptunes, SA. Image: CSIRO

The Action Plan for Australia's Sharks and Rays 2021

Shark conservation is an increasing priority globally as their overexploitation becomes increasingly apparent. *The Action Plan for Australian Sharks and Rays 2021* reviews the extinction risk for Australia's 329 sharks, rays, and chimaeras. It shows that sharks and their relatives are faring better in Australia than in the rest of the world, with relatively few threatened species. Managers and other stakeholders have a shared understanding of the status of Australia's shark species, including those most in need of protection, and a benchmark for measuring future change. The *Environment Protection and Biodiversity Conservation Act 1999* is as up to date as possible in protecting sharks, rays and chimaeras.

Research outputs and attributions

Peter M. Kyne, Michelle R. Heupel, William T. White, Colin A Simpfendorfer (2021)
The Action Plan for Australian Sharks and Rays 2021

<https://www.nespmarine.edu.au/action-plan-australian-sharks-and-rays-2020>

(unpublished and will change to 2021)

Image



The Coastal Stingaree is one of 329 species assessed in *The Action Plan for Australian Sharks and Rays*. Image: David Muirhead

Exploring the status of Australian sea snakes

Northern Australia has been a global hotspot for sea snakes, but reported population declines in many locations raised concerns about their status. Marine Biodiversity Hub researchers compiled existing information and conducted surveys to identify areas of high diversity and endemism, and species vulnerable as bycatch in trawl fisheries. Distribution modelling uncovered new localities for three threatened species. The [new understanding](#) of species distributions and threatening processes reduces uncertainty about the conservation status of sea snake species. It supports species listings and recovery actions under the *Environment Protection and Biodiversity Conservation Act 1999*, research planning, fisheries ecological assessments and bycatch strategies, and State of the Environment reporting. It also contributes to the baseline inventory of natural values available for monitoring Australian Marine Parks.

Research outputs and attributions

V. Udyawer; K. Oxenham; M. Hourston; M.R. Heupel (2020)

[Distribution, fisheries interactions and assessment of threats to Australia's sea snakes](#)

Image

[Sea snake image: https://www.nespmarine.edu.au/reef-shallows-sea-snake-still-image](https://www.nespmarine.edu.au/reef-shallows-sea-snake-still-image)

Theme title

Indigenous engagement, participation and partnerships

Theme description

Traditional Owners, Indigenous organisations and their ranger groups have an increasing interest in driving the marine and coastal research agenda, leading research, and establishing partnerships that benefit Indigenous people. Their research interests often reflect powerful obligations to the custodianship of country.

The [Marine Biodiversity Hub](#) strategically planned and developed its focus on Indigenous partnerships for research and monitoring on Sea Country. Innovative collaborations were fostered with Indigenous organisations and with the [Australian Marine Sciences Association](#) to promote engagement at the national scale, and numerous Hub projects identified and advanced Indigenous research interests, priorities and capabilities.

The Hub provided benefits to many Indigenous people across several communities by offering employment and [training opportunities](#) in field research and environmental management. This increased the capacity of Indigenous communities to provide leadership for managing Sea Country and to partner with research and management agencies. Additionally, Indigenous people were commissioned to organise workshops and prepare research communication materials including artwork, interpretive signs, [educational videos](#) and reports.

Indigenous engagement and participation in Hub research significantly increased understanding and respect for Indigenous rights, interests, responsibilities and cultural values among Hub researchers and their stakeholders and collaborators.

Research outputs and attributions

[Marine Biodiversity Hub](#) website

[Australian Marine Sciences Association Indigenous Engagement in Marine Science web page](#)

[Workshopping seagrass \(Wirriya Jalyanu\) restoration in Shark Bay \(Gathaagudu\)](#)

Images and video

[Save a sawfish](#) (video)

General images for Indigenous engagement

<https://www.nespmarine.edu.au/indigenous-ranger-still-image>



Rock art of a sawfish found on Revolver Creek, a tributary of the Victoria River, near Kalkaringi in the Northern Territory. Image: Peter Kyne

Impact snap shots

Research partnerships to restore coastal habitats

Many Indigenous communities have strong interests in research partnerships to restore coastal habitats. At Shark Bay, Western Australia, the Malgana Aboriginal Corporation and the [Marine Biodiversity Hub](#) co-led a project to [restore seagrasses](#) destroyed by marine heatwaves. Collaborative workshops, training and community events built trust and understanding, leading to successful seagrass restoration and the certification of six Malgana Rangers. In Tasmania, the Weetapoonna Aboriginal Corporation helped Hub researchers shape research to restore giant kelp forests. In both cases Indigenous people identified their interests, contributed to research design, and advised on culturally respectful site access.

Research outputs and attributions

[Marine Biodiversity Hub](#) website

[Seagrass \(wirriya jalyanu\): giving life to sea country of Shark Bay \(Gathaagudu\) - Fact sheet 2021](#)

Images and video

Shark Bay seagrass restoration image

<https://www.nespmarine.edu.au/malgana-rangers-and-uwa-researchers-still-image-0>

Mapping culture and marine life across ancient south-west coastlines

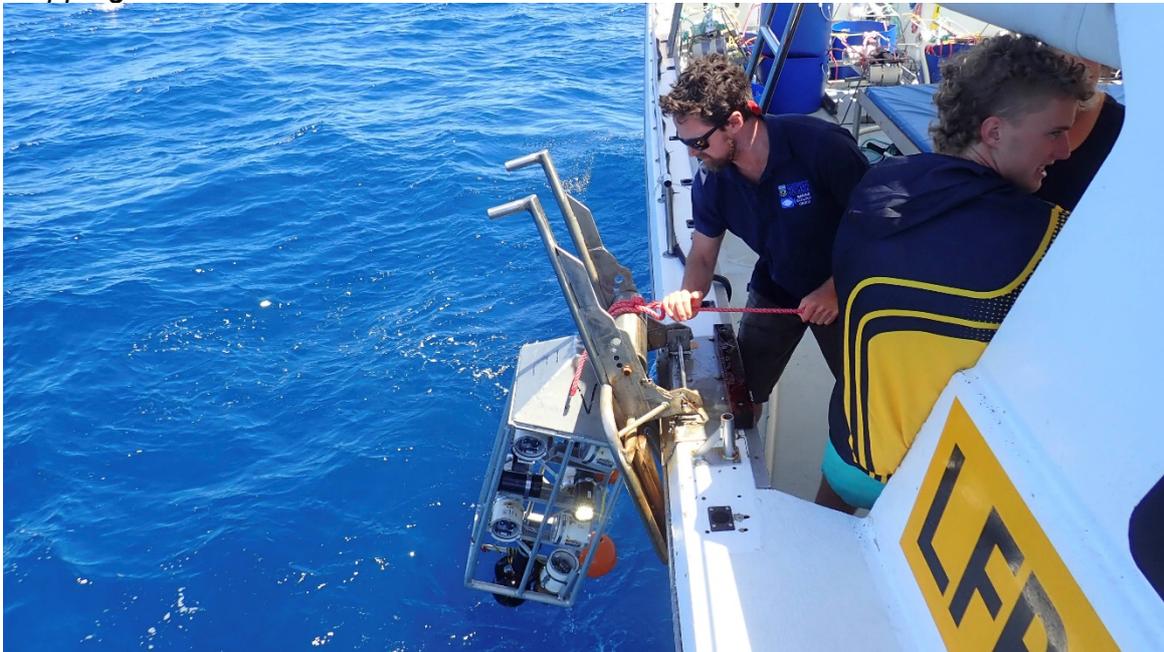
Traditional custodians and [Marine Biodiversity Hub](#) scientists partnered with Parks Australia to design biodiversity surveys for the management and protection of Australian Marine Parks off south-western Western Australia. The collaboration helped scientists understand and map the pathways of ancient rivers in the submerged landscape. It also illustrated the interconnected nature of land and sea, and provided insight essential to developing management strategies for Australian Marine Parks that recognise and appreciate cultural heritage.

Research outputs and attributions

[Marine Biodiversity Hub](#) website

Images and video

Mapping culture and marine life across ancient south-west coastlines



Deploying a drop-camera. Image: Brooke Gibbons

A national baseline for Indigenous engagement in marine science

Australian marine scientists demonstrate positive aspirations to engage Aboriginal and Torres Strait Islander people in their research. Many scientists are unsure about where the responsibility for engagement lies, and what research is of interest to Indigenous communities. These were key findings of the [first national-scale survey](#) of Indigenous engagement in marine science, conducted by the [Marine Biodiversity Hub](#). As well as profiling the motivations, perceptions and practices of researchers, the survey established an empirical baseline for monitoring changes through time.

Research outputs and attributions

[Reflections on the first national-scale snapshot of Indigenous engagement in marine science](#)

Paul Hedge, Elizabeth Ingrid van Putten, Cass Hunter and Mibu Fischer (2020)
[Perceptions, Motivations and Practices for Indigenous Engagement in Marine Science in Australia](#)

Images and video



Cass Hunter of CSIRO, co-leader of the Indigenous engagement in marine science survey. Image: Leigh Harris

Malak Malak Ranger patrol saves Largetooth Sawfish

The [Marine Biodiversity Hub](#) worked with Malak Malak Traditional Owners and rangers on the [recovery of Largetooth Sawfish](#) in northern Australian rivers. The rangers decided to carry out an annual on-country patrol to find sawfish that might need rescuing from drying waterholes. More than 60 Largetooth Sawfish have been relocated by rangers and scientists. Malak Malak Rangers now have the capability to undertake annual on-country sawfish patrols, backed by protocols on safe handling practices, sampling and data collection. This is part of the Malak Malak community's contribution to protecting the sawfish for future generations.

Research outputs and attributions

- [Making art, videos, signs and steps to save sawfish in Australia's northern rivers](#)

Images and video

Malak Malak/Largetooth Sawfish image



Researchers and Malak Malak Rangers on patrol for Largetooth Sawfish. Image: Michael Lawrence-Taylor

Theme title

Intervening to restore coastal habitat

Theme description

In Australia, interest and investment is growing in coastal habitat restoration which offers a 'hands-on' approach in the face of chronic degradation and climate change. Best practice restoration requires scientific understanding of historical habitat decline, and the full range of available methods for reinstating the structure and function of coastal habitats.

[Marine Biodiversity Hub](#) research generated an evidence base and fostered the participation required to accelerate coastal habitat restoration by Australian governments, industries and communities. This included evaluating existing and emerging restoration practices and providing [ecological](#) and [economic](#) analyses to underpin policy development and community investment.

Our work with stakeholders and research users forged nationally coordinated approaches to the repair of shellfish reefs and saltmarshes. We also tested innovative methods for enhancing recovery and survival of temperate seagrasses and giant kelp forests.

The [Australian Coastal Restoration Network](#) supports knowledge-sharing and maintains a database covering numerous coastal and marine restoration projects. The network also connects the [Shellfish Reef Restoration Network](#), the [Seagrass Restoration Network](#) and the [Mangrove and Saltmarsh Network](#).

In 2016 the Hub brought Traditional Owners together with marine scientists at Bribie Island, Queensland to discuss the importance of shellfish reefs, and ways to engage with local Indigenous people in restoration. See this [video](#) and [article](#) about their 'pearls of wisdom'.

Research outputs and attributions

[Marine Biodiversity Hub website](#)

I.M. McLeod, L. Bostrom-Einarsson, C. Creighton, B. D'Anastasi, 3 B. Diggles, P.G. Dwyer, L. Firby, A. Le Port, A. Luongo, F. Martinez-Baena, S. McOrrie, G. 4 Heller-Wagner, C. Gillies

[Habitat value of Sydney rock oyster \(*Saccostrea glomerata*\) reefs on soft sediments](#)

Abbie A. Rogers, Anita Nedosyko, Ian M. McLeod, Chris Gillies and Michael P. Burton

[Benefit-cost analysis of the Windara shellfish reef restoration project](#)

[Australian Coastal Restoration Network Website](#)

[Shellfish Reef Restoration Network website](#)

[Seagrass Restoration Network website](#)

[Mangrove and Saltmarsh Network website](#)

Ian McLeod, Joann Schmider, Colin Creighton and Chris Gillies (2018)

[Seven pearls of wisdom: Advice from Traditional Owners to improve engagement of local Indigenous people in shellfish ecosystem restoration](#)

Images and video

[Traditional Owners shellfish restoration workshop – Bribie Island 2017](#)

Impact snap shots

Laying the groundwork for shellfish reef restoration

Traditional Owners, industry, community groups, non-government organisations and policy-makers worked with the [Marine Biodiversity Hub](#) to review the history, status and ecology of Australia's shellfish reefs, and develop methods to rebuild them. New knowledge presented in report, '[Shellfish reef habitats: a synopsis to underpin the repair and conservation of Australia's environmental, social and economically important bays and estuaries](#)', underpinned policies, investment and participation in restoration projects. Evidence of national shellfish reef status underpins the nomination for native flat oysters and Sydney rock oysters to be listed as a Critically Endangered Ecological Community under the EPBC Act. See our animated introduction to [shellfish reef restoration in Australia](#) and meet an unlikely [ecological hero](#).

Research outputs and attributions

Gillies CL, Creighton C and McLeod IM (eds) (2015) [Shellfish reef habitats: a synopsis to underpin the repair and conservation of Australia's environmental, social and economically important bays and estuaries](#)

Images and video

- [Shellfish reefs image](#)
- [Shellfish reefs \(animation\)](#)
- [How oyster reefs are built on Hercules \(video\)](#)



Australian flat oyster reef at Georges Bay, Tasmania, the last surviving healthy reef of its kind. Image: Chris Gillies, The Nature Conservancy.

Saltmarsh: a powerhouse of productivity

[Marine Biodiversity Hub](#) researchers demonstrated the substantial benefits that can accrue from reinstating ecosystem services such as fisheries productivity. Repair strategies such as reconnecting tidal flows to boost habitat for prawns and fish were studied at Queensland's Burdekin floodplain, the New South Wales Clarence River estuary, and Circular Head in Tasmania. The report, '[Australia's saltmarshes: a synopsis to underpin the repair and conservation of Australia's environmentally, socially and economically important bays and estuaries](#)', summarises their findings. Saltmarshes are now being repaired in several New South Wales estuaries, including the Wooloweyah wetland in the lower Clarence River estuary.

Research outputs and attributions

Creighton C, Gillies CL and McLeod IM(eds) (2015) [Australia's saltmarshes: a synopsis to underpin the repair and conservation of Australia's environmentally, socially and economically important bays and estuaries](#)

Images and video

- [Saltmarsh images](#)

Heat-tolerant giant kelp families show promise for restoration

Ocean warming has reduced the giant kelp forests of south-eastern Australia to isolated patches. [Marine Biodiversity Hub](#) researchers [collected and cultivated](#) giant kelp plants and established a seed bank from remnant Tasmanian forests. Family-lines tolerant of warmer waters were bred in large quantities, and juvenile plants were successfully out-planted at trial restoration sites. The new techniques and understanding provide a platform for future breeding and selection programs and the refinement and upscaling of restoration. A seed-bank of thermally tolerant giant kelp strains has been created for use in future restoration efforts.

Research outputs and attributions

[Assessing the feasibility of restoring giant kelp beds in eastern Tasmania](#)

Images and video

- [Giant kelp image](#)

Seagrass (wirriya jalyanu): giving life to sea country of Shark Bay (Gathaagudu)

In the summer of 2010–2011, a marine heatwave devastated the [seagrass meadows](#) of Western Australia’s Shark Bay World Heritage Area – known as Gathaagudu (two waters) to Malgana Traditional Owners. In four workshops, [Marine Biodiversity Hub](#) researchers and Malgana Rangers [developed and trialled](#) innovative, [cost-effective methods](#) to assist seagrass recovery. The partnership allowed traditional knowledge and skills focused on managing country to be integrated with western science, and developed the capacity of Malgana Rangers to participate in restoration. A strategy for nature-based restoration presents a solution to the effects of climate change on seagrasses in the Shark Bay World Heritage Area.

Research outputs and attributions

[Seagrass \(wirriya jalyanu\): giving life to sea country of Shark Bay \(Gathaagudu\) - Fact sheet 2021](#)

[Workshopping seagrass \(Wirriya Jalyanu\) restoration in Shark Bay \(Gathaagudu\)](#)

Abbie A. Rogers, Michael P. Burton, John Statton, Matthew W. Fraser, Gary Kendrick, Elizabeth Sinclair, Daniel Gorman, Mat Vanderklift, Jennifer Verduin and Ian M. McLeod (2019) [Benefits and costs of alternate seagrass restoration approaches](#)

J. Statton; E.A. Sinclair; A. Kendrick; S. McNear; G.A. Kendrick (2020) [Baseline genomic data collection and assisting natural recovery of seagrass meadows](#)

Images and video

[Seagrass image](#)