Marine Biodiversity Hub

National **Environmental Science** Programme

Stakeholder Workshop Report (21 April 2016)

Rachel Przeslawski, Karen Miller, Jessica Meeuwig

NESP Project D1: Ecosystem understanding to support sustainable use, management and monitoring of marine assets in the North and North-west regions

10 June 2016

Australian Government
Geoscience Australia

AUSTRALIAN INSTITUTE OF MARINE SCIENCE

THE UNIVERSITY OF **WESTERN AUSTRALIA**
SEEK WISDOM

Copyright

Acknowledgement

Important Disclaimer

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

National **Environmental Science** Programme

Marine Biodiversity Hub

Contents

EXECUTIVE SUMMARY

A stakeholder workshop for NESP Project D1 'Ecosystem understanding to support sustainable use, management and monitoring of marine assets in the North and North-west regions' was held at the University of Western Australia, Perth, on 21 April 2016. The objective of the workshop was to identify stakeholder information needs in the North and North-west regions and use these to guide research activities in Project D1.

Stakeholders from State and Local Government departments, Industry, Fisheries, Conservation, and Indigenous groups each explained their priorities and issues in the North and North-west region, after which geographic focus, research scope, and data delivery needs were discussed across the group and prioritised through a post-workshop online survey (30% response rate).

From a stakeholder perspective based on the workshop discussion and online survey, the geographic focus of research should be prioritised towards large shelf areas under the highest pressures (e.g. Kimberley and Gascoyne Commonwealth Marine Reserves (CMRs)). In the workshop, stakeholders considered that research in Project D1 should be targeted towards using predictive models to characterise and map benthic habitats and demersal fish species, while the online survey revealed more research effort should be applied to benthic areas compared to pelagic. Common themes were the importance of whole ecosystem processes, pressures, threatened species, CMRs (and associated KEFs and BIAs), and accessibility and communication of information particularly related to industry. There was positive feedback from Stakeholders regarding the Northwest Atlas as a platform for the communication of research outcomes and as a repository for information relevant to management of the regions, with a number of suggestions made for making information more readily searchable within that framework and expanding it to include the North region.

Combined outcomes from the D1 Stakeholder Workshop and the earlier D1 Science Workshop will provide direction for future research within Project D1 and contribute to the National Prioritisation workshop with Project D3.

1. WORKSHOP OBJECTIVES & STRUCTURE

The primary objectives of the workshop were to identify stakeholder priorities in the North and North-west regions and to use these to guide research activities in Project D1. Stakeholders included representatives from State and Federal Government departments, Industry, Fisheries, Conservation, and Indigenous groups with activities or interests in the North and North-west regions (Appendix A). WAMSI recently concluded an intensive assessment of stakeholder research priorities to develop an end-user driven framework for marine science across all of Western Australia, which was released as the *Blueprint for Marine Science 2050* report. The D1 Stakeholder Workshop took lessons from the *Blueprint* but with a refined focus on the research to be undertaken through the NESP Marine Biodiversity Hub Project D1 in the North and Northwest Bioregions, and with the incorporation of the Hub's specific strengths and resources, as well as the needs of the Department of Environment. Additionally, a scientific workshop with NESP researchers from AIMS, CSIRO, GA and UWA was held in September 2015 (Przeslawski et al. 2015a) to identify researcher capabilities and science priorities, and the current workshop aims to identify such priorities from a stakeholder and end-user perspective. In combination, the outcomes from the Science and Stakeholder Workshops will lay the foundation for future research within Project D1.

The morning sessions of the Stakeholder Workshop included an overview of the NESP Marine Biodiversity Hub and Project D1 (Section 2), followed by a series of presentations by stakeholders to provide overviews of their activities and information needs for North and North-west regions (Section 3). Afternoon sessions included group discussions around the geographic focus, research scope, and data delivery platforms (Section 4), with a concluding summary about opportunities and future directions (Section 5). A post-workshop online survey was conducted to assist with the prioritisation of Stakeholder research needs for the North and North-west regions, as well as an external meeting with a stakeholder unable to attend the workshop (Marine Policy section of DoE, Appendix A).

2. OVERVIEW OF PROJECT

2.1 NESP Marine Biodiversity Hub

The NESP Marine Biodiversity Hub (MBH) is the third iteration of a consortium of research organisations funded by the Department of Environment. The NESP MBH continues previous efforts to understand and manage Australia's marine environments, with increased focus on listed species and indigenous engagement. Ten organisations are currently partners within the Hub: CSIRO, University of Tasmania, Australian Institute of Marine Science (AIMS), Geoscience Australia (GA), Museum of Victoria, University of Western Australia (UWA), Charles Darwin University, Integrated Marine Observing System (IMOS), NSW Environment and Heritage Portfolio and NSW Department of Primary Industries. The Hub has four main research themes, each of which includes multiple projects:

A. Improving the management of threatened and migratory species

B. Supporting management decision making

C. Understanding pressures on the marine environment

D. Understanding biophysical, economic, and social aspects of the marine environment

2.2 NESP Project D1

Project D1 is collaboration between AIMS, GA and UWA and leverages previous research undertaken through the CERF and NERP programmes along with stakeholder knowledge to improve ecosystem understanding for management in the North and North-west Regions. These areas support important cultural and economic activities and are ecologically important, encompassing 29 Key Ecological Features (KEFs), 21 Commonwealth Marine Reserves (CMRs) and 250 listed species. Australia's North and North-west marine estate is vast (~1.7million km^2), and data is limited. Consequently, Project D1 is collating existing data for the region to apply and improve models to predict the extent and nature of biological communities in unstudied areas.

The project has the capacity to focus on four key ecological components and models: the Benthic Habitat Model, the 4-D connectivity model, the Megafauna Habitat Use model, and the Pelagic Model, each briefly described below.

Using the AIMS Benthic Habitat Model, we can correlate physical parameters derived from geophysical data with observations of major biotic and abiotic substrate groups to produce probability of occurrence models for major benthic groups (i.e. corals, sponges/filter feeders) and demersal fish abundance and biodiversity. From these we can produce habitat maps based on combined benthic probability models, for example those produced in collaboration with Woodside Petroleum Ltd for the Glomar Shoals KEF (Figure 1).
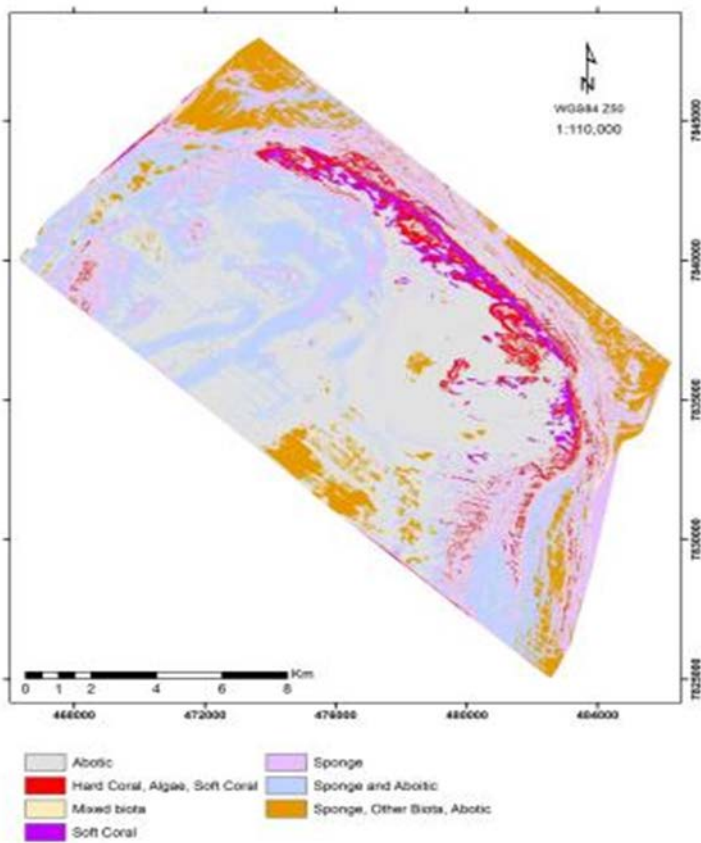
Figure 1 Combined benthic habitat model for Glomar Shoal KEF

The GA 4-D connectivity model simulates dispersal of marine larvae in four dimensions (3D + time) and is generated from ocean currents and larval behaviour. From the model we can evaluate connectivity among target areas e.g. among CMRs or between geomorphic features (Figure 2).
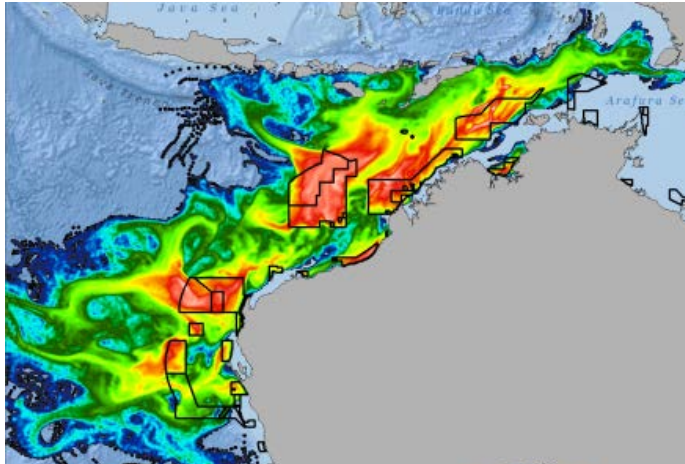
Figure 2 Predicted larval dispersal among CMRs in the North and North-west based on the GA connectivity model (Kool & Nichol, 2015)

Megafauna Habitat Use Models are based on satellite telemetry data, and animal behaviour is inferred from the autocorrelation in speed and direction. From the AIMS megafauna modelling we can determine areas of high residency (e.g. nesting/foraging) and areas of transit for species such as turtles (Figure 3), sharks, whales and dugongs.
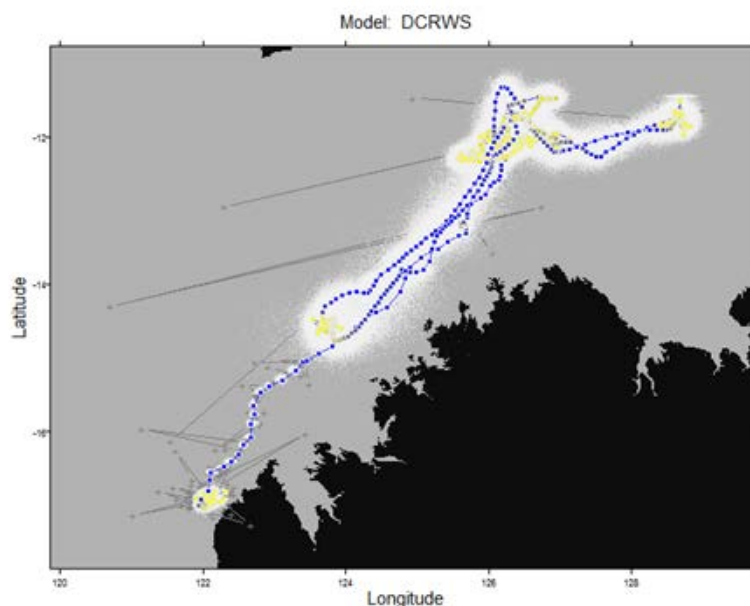
Figure 3 Habitat use by flatback turtles in the North-west region. Blue denotes transiting animals, yellow denotes areas of residency (feeding).

The UWA/GA Pelagic model predicts hotspots of large-bodied open-water predators such as tunas, marlins and mackerels in relation to marine topography and seabed features such as canyons provided by Geoscience Australia (Huang et al. 2014). The model is currently based on the Sea Around Us Project's database of fish landings and effort (www.seaaroundus.org). From the model we can identify hotspots for pelagic fish abundance and persistence, for example, in the North-west region the hotspot stretching from Barrow Island across part of the Exmouth Plateau, along the Rowley Terrace and Wombat Plateau and bounded by the Scott Plateau (Figure 4). Notable in the analysis is a lack of correspondence between hotspots and boundaries of the CMRs (Figure 4).
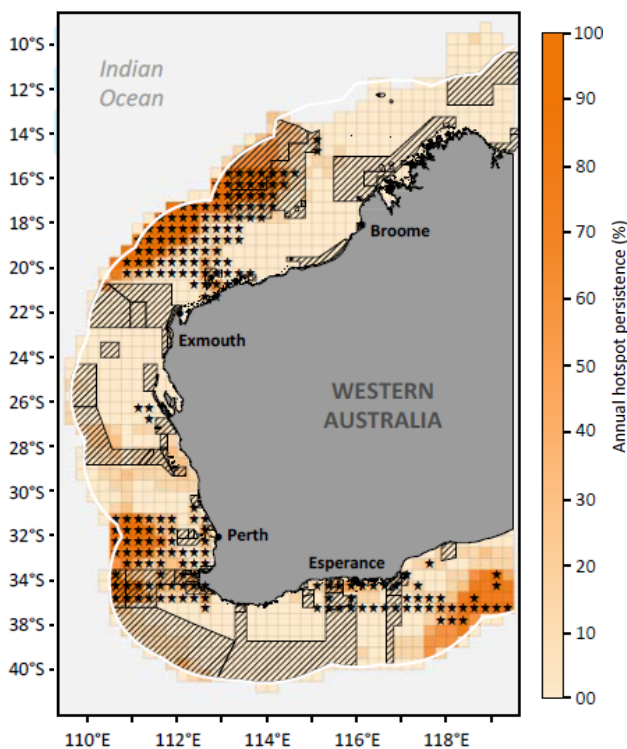
Figure 4 Abundance hotspots (black stars) and hotspot persistence (coloured surface) relative to Commonwealth Marine Reserves (striped fill) (adapted from Bouchet, submitted).

One of the primary goals of Project D1 is to refine and apply these existing models to predict ecosystem attributes at key locations in the North and North-west. Importantly, the areas targeted for research within Project D1 need to identified and prioritised in consultation with stakeholders to ensure the results are relevant for management. The project is proceeding in five stages;

1) Identifying and collating existing data to assess its relevance to models, identify key data gaps and target areas for application of models based on scientific knowledge (see Science Workshop Report, Przeslawski et al. 2015a);

2) engage with stakeholders to determine their needs and priorities (this workshop);

3) prioritise the geographic scope for future research based on results from 1 & 2;

4) apply models to address priority questions, and

5) communicate the results.

3. STAKEHOLDER REGIONAL INTERESTS

3.1.1 WAMSI

The Western Australian Marine Science Institution (WAMSI) is a collaboration between state, federal, industry and academic entities to develop benchmark research with a focus on applied science for user benefit. WAMSI has recently developed the *Blueprint for Marine Science 2050* report of which a core component is stakeholder engagement focussed on high-level representatives from key agencies. Therefore, the priorities as listed in the *Blueprint* may be at a higher level than needed for NESP Project D1. Stakeholder priorities that may be applicable to NESP Project D1 include the following:

- A systematic framework for environmental baselines and indicators
- A reusable and focussed framework for environmental modelling
- Single web interface or data portal for marine information defined by end-user needs, and
- Shared decadal community engagement strategy

WAMSI has an interest in the Pilbara region and areas of active shipping routes. They recognise the potential to collaborate with NESP, particularly in relation to environmental baselines and modelling frameworks and the identification of priority areas for industry data release.

3.1.2 Parks Australia

Parks Australia is keen to discover, identify and refine our understanding of natural assets and pressures on those assets in our Commonwealth Marine Reserves. This will assist in the development of baselines, targeted indicators and standardised monitoring techniques to gather information that contributes to managing those reserves. The D1 project provides a great opportunity to refine our biophysical values in the North-west region, through collation of existing information that may be relevant to the reserves, modelling of predicted biodiversity traits within CMRs and adjacent areas and in field testing of the models through collection of bathymetry and biological data. Recognising the importance of the oil and gas industry in the region and many other interests such as Indigenous, fisheries and State reserves, the project is a good opportunity to show how multiple use CMRs in the region work. Based on discussions, key areas of interest are the Kimberley CMR and Ningaloo CMR.

Key outputs of most interest to Parks Australia are increasingly the amount of relatively detailed bathymetry of CMRs; compilation of knowledge and understanding about reserves; benthic habitat maps and habitat-forming species distributions verified with some within-reserve data; and demersal fish assemblage distributions verified with some within-reserve data. Depending on the scale and scope of the project, information on pelagic fish assemblages, bentho-pelagic coupling, threatened species including BIAs within or adjacent to CMRs are also of interest. Managers are also interested in stories, photos and tools such as the interactive website that convey what is in our reserves and why it is important to a wide range of people.

3.1.3   NOPSEMA

NOPSEMA and the oil and gas industry rely on published scientific research and management planning documents to support environmental impact assessment during environment plan preparation and for regulatory decision making. There are many locations in the North and North-west of Western Australia where oil and gas activities operate, or are proposed, in close proximity to CMRs and other biologically sensitive features. In many cases there is a paucity of knowledge about those places and it is a priority that research be focussed in areas where industry pressures exist including the continental shelf, canyons, and ancient coastline. The data required to support impact assessment includes baseline information but also needs to extend to information on the connectivity, representativeness and resilience of those species and communities to industry pressures at appropriate spatial and temporal scales. Where there are gaps in information about a location or species (e.g. BIA use, temporal importance of KEFs), or where information cannot be accessed publically (e.g. industry data), it can lead to overly conservative management controls and precautionary decision making. This highlights the importance of developing standards for data collection, accessing existing data sources and quantifying data gaps.

3.1.4   Oil and Gas Industry

Oil and Gas activities are an ongoing presence in Australian waters of the North-West region of Western Australia and neighbouring New Territories (refer to titles map at www.dmp.wa.gov.au/Documents/Petroleum/PD-SBD-GEO-102D.pdf). Against a backdrop of oil price uncertainty, there has been a reduction in exploration and greenfield development activities. Ongoing activities include brownfield development, maintaining production and planning for decommissioning. With reference to the NESP Project D1, industry is supportive of synthesising new and existing datasets and leveraging such datasets into existing models to address knowledge gaps to understand and document the values of CMRs, KEFs and BIAs.

As such, priorities for the acquisition and collation of further information to be able to describe and understand the values within and of CMRs, KEFs and BIAs and the application of such knowledge to evaluating environmental impacts are supported. Industry is supportive of such knowledge being available on a publically accessible web portal. The industry and regulators would also benefit from the provision of resources based on scientific research presented in formats that assist with informed decision making and increasing certainty with regards to the evaluation of environmental risk and impacts.

3.1.5   Department of Parks and Wildlife WA

The Department of Parks and Wildlife Marine Science program (MSP) undertake research and monitoring projects within state coastal waters. A main priority of the MSP is to determine biological and ecological patterns of marine assets relative to human use in marine ecosystems, with a focus on marine reserves and threatened marine fauna. Research priorities have been identified for marine reserves based on a prioritisation framework (Simpson et al. 2015) and discussions with regional marine staff (Kendrick et al. in press). A priority common among reserves is more detailed habitat maps and improved understanding of how climate driven changes in oceanic currents may alter dispersion, connectivity, species distributions and productivity. How this information can be used to better design reserves, including the

configuration of management zones and the incorporation of local knowledge, is also required. This is especially true of areas around the Kimberley coastline where there is little baseline information on benthic habitats. Among threatened marine fauna there is a need for better population estimates of some marine mammals (dugong, snubfin dolphin, Indo-Pacific humpback dolphin, Dwarf Minke whale) and turtles (especially hawksbill) combined with improved understanding of how human pressures, including climate change, contribute to variation in demographics and population estimates. More information is also required on the movement patterns of threatened marine fauna, as well as identifying critical habitats such as key foraging grounds, stock boundaries, and migration pathways.

3.1.6   Department of Fisheries WA

The Department of Fisheries WA has shown that 97% of WA fish stocks are in a good state, but this is not reflected in public opinion. Due to this poor regard towards the fisheries industry, a pre-assessment of fisheries has been undertaken in Gascoyne, North, South, and West regions. Based on discussions held at the current NESP workshop, it is obvious that some information has not been included in these pre-assessments, likely due to poor accessibility or visibility. There is thus a need for data consolidation and accessibility. Fishermen are also concerned about seismic noise in the area, particularly with potential seismic surveys in shallow waters near commercial oyster beds. The main priorities for future research are wildlife interactions including marine noise impacts.

3.1.7   Indigenous Perspectives

There are two main aims regarding marine research from North-west Indigenous perspectives: 1) Integrate traditional knowledge into marine science planning, and 2) Develop standard practices with researchers regarding engagement prior to fieldwork.

The integration of traditional knowledge into marine science planning will involve linking specific research projects to the entire region and specifically describing how these projects can contribute to Indigenous groups and other stakeholder interests (and vice-versa). For example, many Indigenous groups are interested in behaviour and movement of key migratory species (e.g. dugongs and sea turtles), but these groups can also contribute relevant historical and anecdotal knowledge to such research to facilitate a more holistic management framework. The effects of climate change, particularly on nesting turtles, are also of great interest, as are the biodiversity of traditional islands, oceanographic influences on coastal populations, and increased recreational fishing pressure.

In order to appropriately integrate traditional knowledge and to ensure marine research in the region is relevant to Indigenous groups, standard practices must be developed and implemented prior to research being undertaken. This will meet the need for standardised data collection to facilitate comparability across regions and groups, as well as foster engagement with particular indigenous groups in the area of study.

National **Environmental Science** Programme

Marine Biodiversity Hub

4.   STAKEHOLDER RESEARCH PRIORITIES

4.1   Geographic focus

There are many characteristics to consider when identifying geographic focus: CMRs, KEFs, BIAs, pressures, values, inshore vs offshore, benthic vs pelagic, and spatial scales. In addition, areas for which we have existing information (e.g. Oceanic Shoals CMR, Glomar Shoals KEF) may be an efficient use of resources and yield timely outcomes within the current funding year of Project D1.

The Department of Environment was most interested in research that could be applied to existing CMRs, meaning a focus within the CMRs or immediate surrounds, or research associated with an overlapping KEF (e.g. ancient coastline) or more general ecosystem processes (e.g. canyon productivity). From the perspective of the petroleum industry and associated regulators, certain CMRs are a priority due to their proximity to oil and gas production and exploration (e.g. Ningaloo/Gascoyne, Montebello, Oceanic Shoals), with Gascoyne identified as particularly important due to high pressure levels, connectivity, habitat and depth range, adjacent marine parks and existing knowledge. Similarly the Pilbara was of interest as it was considered to be an area of highest pressure from oil and gas industry, fishing, and tourism, although there was some concern about data accessibility issues (addressed in following paragraph). The Kimberley CMR was considered an area of interest due to its alignment with ongoing WAMSI projects in state waters. From fisheries and indigenous perspectives, most areas in the North and North-west are relevant due to the provision of data and information about connectivity and ecosystem processes applicable to nearshore areas. Stakeholders agreed that deeper waters were lower priority than shelf and nearshore waters due to lower immediate pressures.

Data availability and accessibility may determine geographic areas of focus, and the challenges associated with obtaining industry data were raised. Approval for data release can often take several months, and there is thus potential for Project D1 to test this in an exercise whereby industry data is sought in 2016 for use in 2017 NESP funded projects. Such data can also be incorporated into visualisations from the North-west Atlas.

4.2   Research scope

NESP and previous Hub iterations have produced a large body of peer-reviewed publications and associated datasets, but the utility and accessibility of these to stakeholders is uncertain. Department of Environment stakeholders emphasised the need for a clear story that could be used to increase public awareness and interest in marine management. As such, it was recommended that researchers directly link results in publications to management or stakeholder interests when possible.

Predictive models are the core of Project D1, and it is therefore crucial to determine what users want a predictive model to measure and do. In general stakeholders agreed that it was most important to know what was present in a given area (e.g. Przeslawski et al. 2015b), although the taxa and metric of interest varied among stakeholders. Once this knowledge exists, verification and monitoring can then occur. Uncertainty increases over larger areas with less data, but spatial predictors (SSTs, ocean currents) may be useful for large-scale predictions

such as the entire North-west region (e.g. Kool and Nichol 2015). Thus there was recognition of the value of using models both at fine and large scales to address management requirements.

Management decisions and environmental compliance requirements are often linked to boundaries of important features or zones (e.g. CMRs, KEFs, BIAs). The need for defined boundaries of BIAs was discussed but no consensus was reached, indicating that future research on spatial and temporal patterns within BIAs is warranted. This ideally would also incorporate an understanding of what proportion of BIAs are represented inside and outside of reserves. The potential for reviewing KEF boundaries and values was raised, particularly regarding the ancient coastline (revision of boundaries) and Glomar Shoals (inclusion of Rankin Bank). A KEF review has been flagged by the Department of Environment, but there is no timeframe for this as other priorities have taken precedence. Fuzzy boundaries are another option to traditional hard boundaries, and it was agreed that this would allow more flexibility but may reduce clarity and user friendliness. Linked to these management needs is an understanding of the location and extent of key physical and biological features in the North and North-west regions.

Unsurprisingly, interest in taxa varied among stakeholders. Most stakeholders agreed that listed species including sea snakes, turtles, and cetaceans were a priority, with demersal fish also considered important. Stakeholders want to know where they are, what they are, and what habitats they use in relation to pressures. In addition, ecosystem engineers such as sponges and corals are a priority focus due to their correlation with biodiversity of other taxa. These habitat-forming taxa are often included in models as a type of habitat, rather than more traditional biological metrics of taxonomic abundance, richness, or assemblages.

The connectivity model developed in the NERP Hub (Kool and Nichol 2015) may afford an opportunity to test resilience in CMRs and other areas of interest. Genetic analyses and connectivity models developed by WAMSI and DPaW could be used to test this connectivity model at various locations and times in the North-west region.

The importance of understanding links between benthic and pelagic communities (bentho-pelagic coupling) was also discussed by the group. There was recognition that, while valuable, such research was lower priority in the short term, and it would also need to be underpinned by basic knowledge about the spatial and temporal distribution of species and communities to be useful.

4.3   Data delivery platform needs

Most information is now delivered and used via the web, and the North-west Atlas (www.northwestatlas.org) is the delivery platform used by NESP Project D1. The Atlas provides data and meta-data for the region and has the flexibility for the user to employ various GIS software. Web-based platforms are ideal for users unable to easily install specialised software on their workstations (e.g. many Commonwealth government agencies). Use is tracked via automated bots and periodic user surveys. In general, users fall into two groups: 1) those who want quick information or summary reports, and 2) analysts who want to use the data themselves. There is thus not much need for spatial analyst tools.

The main requirements for a marine data delivery platform were as follows:

- Long-term accessibility
- Web map services
- Systems that inform users of new information
- Ability to focus on species geographic areas or taxa
- Summary data and ability to drill down to specifics
- User-friendly
- Search term functionality as related to management
- Incorporates indigenous values
- Consistency with boundaries (e.g. World Heritage Areas).
- Report generation at a broad level

Some of the main concerns regarding data delivery platforms are promotion, integration, and longevity. Regarding promotion, one of the stakeholders was not aware of the Northwest Atlas until only recently. It was noted that face-to-face meetings remained the best way of encouraging uptake of such marine data portals. Regarding integration, the possibility of merging Ningaloo, North-west and other Atlases into one was recommended to provide a one-stop-shop. These Atlases can all be accessed from the e-Atlas portal (www.eatlas.org.au) and are all run from the same back-end; separation is from the user side only. Regarding longevity, security will be maintained via regular updates coordinated by the development team, mostly permanent AIMS staff.

With a recent focus on Indigenous engagement, marine researchers and managers are seeking input from traditional owners on areas of cultural significance. As part of collaboration with ANU, a new indigenous cultural layer is being developed for GIS products. Such information would be valuable to include in the Atlas to provide a more integrated perspective of values in the North-west and Northern marine regions.

There was also some concern about whether the Atlas included all relevant data. This is challenging due to the need for the data provider to provide appropriate meta-data and upload data themselves; uptake was very low when data providers were encouraged to directly upload. Incentives to encourage uploading and data sharing may increase data provision from a range of sources (e.g. no new licence granted for industry until previous data released, final grant payments associated with data release). It was noted that the NW Atlas draws directly on other web data portals for content e.g. AODN.

4.4   Prioritisation of stakeholder research needs

Following on from the workshop, an online survey (Appendix C) was conducted to assist in prioritising the various stakeholder needs highlighted through the workshop process, and allowing for attendants to contemplate the discussions of the workshop to consolidate their perspectives. The survey was open to all stakeholders that were part of the workshop and was available online until the 8th May. Although the response rate was low (~30%), there were some clear priorities from the results. From a stakeholder perspective, research needs to be

focussed on CMRs (particularly the Kimberley and Gascoyne areas) and areas under pressure and targeted towards using predictive models to characterise and map benthic habitats and demersal fish species (Tables Q1-Q3).

Q1. What are the most important types of areas that you think we should focus research on in NESP Project D1?	
	RANKING
Areas under highest pressure	2
Commonwealth Marine Reserves	3
Large, Whole of Shelf scales	5
Iconic Areas	5
Key Ecological Features	6
Offshore	6
Small, well defined areas	7
Inshore	7
Areas with existing information	8
Biologically Important Areas	8
Other	8

Q2. Where in the North & Northwest should we focus our research within NESP Project D1	
	RANKING
Kimberley CMR & surrounds	2
Gascoyne CMR	3
Oceanic Shoals & surrounds	4
Montebello CMR	4
Ningaloo area	5
Pilbara area	5
Other	6

Q3. What research do we prioritise in NESP Project D1 to best align with your needs?	
	RANKING
characterising benthic communities using predictive habitat models	1
characterising demersal fish communities using predictive models	3
Determining locations of features	5
determining how much of important areas (e.g. BIAs) are represented inside and outside reserves	5
megafauna/listed species (sea snakes, turtles, whales) (where they are and what habitats they use)	5
bentho pelagic coupling	5
connectivity	6
other	7
pelagic fish and sharks	8

National **Environmental Science** Programme

Marine Biodiversity Hub

5.   OUTCOMES & OPPORTUNITIES

The Stakeholder workshop has been valuable in highlighting end-user information needs in the North and North-west regions and will ensure that future research undertaken within the NESP MBH Project D1 is highly relevant for management. Industry has consistently identified its need for a regional context in which its activities are evaluated and monitored. The regional (EEZ) scale of some of the available models (e.g. pelagic, connectivity) allows site-specific infrastructure development such as pipeline infrastructure, offshore drilling platforms, and the activities associated with them, to be considered against broader scales of diversity. Future research opportunities may include model validation and application of existing models to other taxa or habitats at finer spatial scales and in targeted locations. The outcome of these opportunities is to provide both industry and government with a regional and local context in which ocean use can be considered, answering questions such as 'What is the regional implication for marine biodiversity of placing development X in location Y?' and 'What is the likely trajectory for wildlife in CMRs given their spatial relation to regional patterns of marine wildlife?' The application of modelling tools also enables the prediction of biodiversity, assets and values across an extensive part of Australia's marine estate against which there is little empirical knowledge and for which new data collection is not possible in a reasonable time frame for management. Knowledge derived from these modelling exercises can provide an understanding of the abundance and distribution of marine biodiversity which will underpin future activities, including monitoring to assess natural change, impacts of activities as well as the effectiveness of management actions.

The next phase of Project D1 will occur in July 2016 when the combined outcomes from the science and stakeholder workshops will be used to provide direction for future research. This will then feed into the National Prioritisation workshop with Project D3 (planned for September 2016) that will also guide the future activities of NESP research in the North-west marine region.

REFERENCES

Huang, Z., S.L. Nichol, P.T. Harris and M.J. Caley. 2014. Classification of submarine canyons of the Australian continental margin. Marine Geology **357**: 362-383.

Kendrick, A., S. K. Wilson, K. Friedman, K. Waples, S. Whiting, T. H. H. Holmes, M. J. Rule, A. Halford, T. Quartermaine, A. Bobojcov, A. McCarthy, D. Stevens, R. Marshall, P. Barnes, D. Holley, P. Jennings, M. Evans, M. Dasey, S. Ossinger, and J. Holmes. in press. Strategic marine ecological research priorities for CALM Act marine parks and reserves 2016-2021. Conservation Science Western Australia.

Kool, J. T. and S. L. Nichol. 2015. Four-dimensional connectivity modelling with application to Australia's north and northwest marine environments. Environmental Modelling & Software **65**:67-78.

Przeslawski, R., K. Miller, S. Nichol, P. Bouchet, Z. Huang, J. Kool, B. Radford, and M. Thums. 2015a. 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. NERP Marine Biodiversity Hub.

Przeslawski, R., B. Alvarez, J. Kool, T. Bridge, M. J. Caley, and S. Nichol. 2015b. Implications of sponge biodiversity patterns for the management of a marine reserve in northern Australia. PLoS ONE.

Simpson, C. J., M. Beger, J. G. Colman, K. J. Friedman, A. K. Hill, A. J. Kendrick, K. A. Waples, S. D. Whiting, and S. K. Wilson. 2015. Prioritisation of conservation research and monitoring for Western Australian protected areas and threatened species. Conservation Science Western Australia **9**:227-237.

APPENDIX A – LIST OF WORKSHOP PARTICIPANTS

Name	Organisation
Nic Bax	CSIRO, NESP Marine Hub Director
Julian Caley	AIMS
Stuart Field	Department of Parks and Wildlife WA
Dan Gaughan	Department of Fisheries WA
Jillian Grayson[1]	Marine Policy (DoE)
Jennifer Hoy	Parks Australia (DoE)
Christine Lamont	NOPSEMA
Guy Leyland	WA Fishing Industry Council
Dean Mathews	Yawuru, WAMSI
Denise McCorry	Woodside
Jessica Meeuwig*	University of Western Australia
Karen Miller*	AIMS
Amanda Parr	Parks Australia (DoE)
Rachel Przeslawski*	Geoscience Australia
Ben Radford	AIMS
Patrick Seares	WAMSI
Di Walker	Shark Bay World Heritage Advisory Committee
Shaun Wilson	Department of Parks and Wildlife WA

* Workshop organisers

[1] Did not attend workshop but stakeholder engagement occurred in a subsequent meeting with GA in Canberra

APPENDIX B – WORKSHOP AGENDA

D1 Northern Project - Stakeholder Workshop, April 21st 2016

University of Western Australia Boatshed, Carpark 23, Hackett Drive, Crawley (see attached map)

AGENDA

9:00 Introductions
    Overview of NESP MBH (Nic Bax)
    Goals of Workshop (Rachel Przeslawski)
9:30 Overview of NESP Northern Project D1
    Project goals and predictive models (Karen Miller)
    Outcomes of July Science Workshop for D1 (Karen Miller)
10:15 Morning Tea
10:45 Stakeholder input on priorities for the North and Northwest Regions
    1. WAMSI (Patrick Seares)
    2. Parks Australia (Amanda Parr)
    3. NOPSEMA(Christine Lamont)
    4. Oil and Gas Industry (Denise McCorry)
    5. WA Department of Parks and Wildlife (TBA)
    6. WA Department of Fisheries (TBA)
    7. Indigenous perspectives (Dean Mathews)
12:15 Lunch
1:00 Summary and Scene-setting for Working Groups
1:15 Working Groups (*led by Ben Radford, Julian Caley & Nic Bax*) -30 minutes each on:
    Where do we focus our research activities geographically?
    What research do we prioritise within NESP D1?
    What do we need in a delivery platform?
2:45 Afternoon Tea
3:00 Report back from workshop discussions *(Ben Radford, Julian Caley & Nic Bax)*
3:30 Way forward *(Rachel Przeslawski)*
4:15 Wrap up *(Karen Miller)*
4:30 Sundowner
5:30 Workshop close

National **Environmental Science** Programme

Marine Biodiversity Hub

APPENDIX C – RESEARCH PRIORITISATION SURVEY

NESP Project D1 Stakeholder Survey

Prioritising research within NESP Project D1

This survey follows on from the Stakeholder Workshop held in Perth on the 21st April 2016. There are three questions below which are based on your input to the workshop on the day, in the context of the general research areas and directions that you highlighted. To assist us now in focussing the project direction, and now that you have had a little time to reflect on the workshop discussions, we ask for you to rank each of these in order of priority for your management needs. Thanks very much for your input!

* 1. What are the most important *types* of areas that you think we should focus research on in NESP Project D1?

- Inshore
- Biologically Important Areas (BIAs)
- Offshore
- Areas under highest pressure
- Large whole-of shelf scales
- Key Ecological Features (KEFs)
- Small, well defined iconic areas
- Areas with existing information
- Iconic Areas
- Commonwealth Marine Reserves (CMRs)
- Other (provide details at the end of the survey)

* 2. Where in the North & Northwest should we focus our research within NESP Project D1

- Montebello CMR
- Ningaloo Area
- Gascoyne CMR
- Pilbara Area
- Oceanic Shoals CMR & surrounds
- Kimberly CMR & surrounds
- Other (provide details at the end of the survey)

National Environmental Science Programme

Marine Biodiversity Hub

* 3. What research do we prioritise in NESP Project D1 to best align with your needs?

⠿	⬍	Megafauna/listed species (sea snakes, turtles, whales) (where are they and what habitats do they use)
⠿	⬍	Determining locations of features (e.g. carbonate banks and shoals)
⠿	⬍	Pelagic fish and sharks
⠿	⬍	Bentho-pelagic coupling
⠿	⬍	Characterising demersal fish communities using predictive models (i.e. where are they, what are they, and what habitats do they use)
⠿	⬍	Determining how much of important areas (e.g. habitats or BIAs) are represented inside and outside reserves
⠿	⬍	Connectivity
⠿	⬍	Characterising benthic communities using predictive habitat models
⠿	⬍	Other (provide details at the end of the survey)

4. If there are any other aspects of the three elements above that you think we missed on the day, please note them below.

> Done

Powered by

SurveyMonkey

National **Environmental Science** Programme

Marine Biodiversity Hub

www.nespmarine.edu.au