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EXECUTIVE SUMMARY

A one-day forum was held in Hobart in October 2017 to establish a MPA Science/Management network, and undertake the first formal meeting of the network. The forum was attended by representatives of MPA science and management agencies from most Australian States and the Commonwealth, in response to a long-recognised need for sharing of information and experience across agencies, and to facilitate cooperation, collaboration, standardisation and integration, particularly with respect to monitoring/inventory programs. In addition to sharing information about MPA management on a State-by-State basis, a range of discussions centred around how various agencies matched monitoring programs with management needs, and the extent to which these were driven by formal analysis of risks, values and pressures. Currently these range from the detailed state-wide risk assessment recently undertaken by NSW, and a similar program in the GBR (RIMREP) by the GBRMPA, through to Tasmania, where there are no formal MPA management and monitoring policies in place. The value of building socio-economic studies into the management information framework (and including socio-economic researchers in the network/forum) was discussed, and some examples from South Australian studies highlighted the value of well-targeted socio-economic information for network management.

A range of updates on nationally important programs applicable to MPA management and research were presented and discussed. These included: development of nationally consistent standard operating protocols for typical monitoring methods (to aid in national integration); development of a range of national working groups (e.g. AUV, BRUV and MBES) to facilitate uptake of SOPs and aid collaboration and integration of programs; the Essential Environmental Measures Program (and how it aids integration of information for SOE reporting); development of national shared databases (Squidle + and Global Archive), and the need to improve this area where it is currently failing (e.g. MBES data management and sharing). The new Seamap Australia website was also showcased, where all available habitat maps (digitised polygons in habitat classes) from coastal and shelf waters can be viewed.

Finally, the formation of an ongoing network and forum was discussed. The aim is to address the recognised need by developing a similar structure to the National Estuaries Network and associated annual forum. After much discussion around the broad or narrow focus of the forum it was decided to start as the narrower MPA Science Management Network (and forum) and assess options for broadening the focus through time. The initial intent is for the network itself to consist of a core of representatives from State and national MPA management agencies and associated major science providers. The network would hold biannual meetings, one by phone/online and one at an annual, one day, face-to-face meeting. As per the National Estuaries Network, the annual one day meeting would be followed by a one day open forum, with a specific topic each year, and open to the wider community to attend. The annual meeting/forum, would be hosted by a different State each year, and organisation/leadership each year would be led by the host State organisation. Next year's first formal network meeting and forum is proposed for Hobart, with support from the Marine Biodiversity Hub to initiate the process.

1. TECHNICAL ABBREVIATIONS USED BY PARTICIPANTS

AUV	Autonomous underwater vehicle
BRUV video	Baited remote underwater
CATAMI	Collaborative and Annotation Tools for Analysis of Marine Imagery and Video
CBiCS	Combined Biotope Classification Scheme
CPCe	Coral Point Count with Excel extensions
MBS/MBES	Multibeam Echosounder
MER	Management, evaluation and reporting
MERI	Management, evaluation, reporting and improvement
RIMREP	Reef 2050 Integrated Monitoring and Reporting Program
RLS	Reef Life Survey
SOE	State of the Environment
SOP	Standard operating procedures
TEPS	Threatened and protected species
UVC	underwater visual census

2. ATTENDEES

Neville Barrett	Institute for Marine and Antarctic Studies/ Marine Biodiversity Hub
Rick Stuart Smith	Institute for Marine and Antarctic Studies/ Marine Biodiversity Hub/Reef Life Survey
Graham Edgar	Institute for Marine and Antarctic Studies/ Marine Biodiversity Hub/Reef Life Survey
Scott Foster	CSIRO/ Marine Biodiversity Hub
Keith Hayes	CSIRO/ Marine Biodiversity Hub
Tom Holmes	WA, Marine Science Program
Simon Bryars	SA, Department of Environment, Water and Natural Resources
Stefan Howe	Parks Victoria
Alan Jordan	NSW Department of Primary Industries
Nathan Knott	NSW Department of Primary Industries
Amanda Richley	Parks Australia, Department of the Environment and Energy
Cath Samson	Parks Australia, Department of the Environment and Energy
Jarrod Green	Essential Environmental Measures Program, Department of the Environment and Energy
Ana-Lara-Lopez	Integrated Marine Observing System
Tim Moltmann	Integrated Marine Observing System, National Marine Science Council
Nicola Udy	Qld Department of National Parks, Sport and Racing (now Environment and Science)
Rachel Przeslawski	Geoscience Australia/ Marine Biodiversity Hub
Vanessa Lucieer	IMAS/Marine Biodiversity Hub/Seamap Australia
Nic Bax	NESP Marine Biodiversity Hub/CSIRO/NMSC
Paul Hedge	NESP Marine Biodiversity Hub

3. CORE AGENDA

9 am	Welcome and introduction.
9.15	Overview of State and Commonwealth MPA management agencies and science programs
9.15	NSW. Alan Jordan.
9.30	SA. Danny Brock.
9.45	Vic. Stefan Howe
10.00	Tas. Nev Barrett
10.15	WA. Tom Holmes
10.30	CMR network. Amanda Richley.
10.45	Qld. Nicola Udy.
11-11.20	Morning tea
11.20-1300	Discussion on establishment of a network. Inclusions, scope, frequency of forums, length of forums (opportunity for break out discussions etc).
1300-13.45	Lunch
13.45	Integration of management with monitoring.
1345-1415	NSW marine risk assessment and implications for integration with MPA monitoring programs.
1415-1445	Vic risk vs response evaluation of management mechanisms vs information needs.
1445-1500	Discussion on MER adoption across agencies, typical terms of reference and programs.
1500-1530	Current developments in approached to developing Standard operating protocols (e.g. Biodiversity Hub program with state engagement-Rachel Przeslawski/Scott Foster), national working groups (e.g. AUV and BRUV groups- Nev Barrett), reporting metrics/indicators for SOE and MPAs (e.g. evaluation of UVC datasets Rick Stuart-Smith), Essential Environmental measures (EEM team) and databases (e.g. Squidle, Global Archive- Nev Barrett).
15.30-15.45	Afternoon Tea
15.45-1700	Integration. What it means, monitoring with management, biological with physical, state with state, state with commonwealth, conservation with fisheries and other agencies. How to progress?
1700-1800	Opportunity of informal discussion with representatives from states/commonwealth agencies.
1900-2200	Dinner, and opportunity to continue discussions on collaboration.

4. INTRODUCTION/BACKGROUND

Despite Marine Protected Areas (MPAs) now forming a significant component of the spatial management of Australian waters (State and Commonwealth), there is currently no regular forum for managers and leading science providers to meet to discuss approaches, experiences, exchange ideas, develop collaborations, standardise practices or integrate datasets. With MPAs and MPA management agencies now in most States and Territories, the GBR and new Australian Marine Parks, there is a significant need to improve communication and collaboration. This is increasingly being recognised as a range of projects and initiatives attempt to improve national approaches to monitoring and reporting (e.g. development of national standard operating protocols, essential Environmental Measures).

The Natural Resource Management Ministerial Council's Marine and Coastal Committee agreed to constitute a National Marine Protected Areas Working Group consisting of representatives from the Australian, State and Northern Territory Governments to oversee implementation of the National Representative System of MPAs. The Working Group also coordinated a report to the Marine and Coastal Committee on progress made to implement the National Representative System every two years. The second and final report was presented in 2010 and provided an overview of outcomes, experiences, challenges and progress in developing the National Representative System. The Working Group was disbanded soon after as MACC and all of its working groups were dissolved.

Many of the agencies involved in this space met in South Australia in 2014 in a workshop convened by DEWNR and The Marine Biodiversity Hub to help inform future management and monitoring approaches for the new SA MPA network, and all recognised the significant value of that meeting to all parties and the need for such meetings to continue regularly.

Many of these discussions have continued in other ways, particularly in the monitoring space. For example, much of the groundwork that such a forum may help facilitate, has been facilitated via the NESP Marine Biodiversity Hub (e.g. development of nationally applicable SOPs and associated discussions around integration of monitoring programs). However, not all agencies are part of the NESP Hub or associated working groups, and while many of the SOPs developed recently by the Hub have generally included many external agencies, and been tailored to meet a variety of needs, there are still some gaps that can be addressed through ongoing discussions in a forum.

These gaps clearly include discussions on management frameworks such as MERI, MER, RIMREP, as well as the importance and opportunities arising from socio-economic studies. Such studies have generally been overlooked but are being increasingly recognised as having significant contributions to make.

The need for such an ongoing forum, and its general scope, has therefore been widely recognised over the past few years, and has resulted in a number of suggestions to establish a network and associated annual forum along similar lines to the highly successful National Estuaries Network, that has continued to be highly relevant to estuarine management over the 15 years since its inception. To initiate this process, the NESP Marine Biodiversity Hub has organised this first meeting of likely participants in such a network.

4.1 Main Objectives

1. Establish a MPA Science/Management forum/network via an initial face to face meeting of MPA managers and science providers (initially as State and Commonwealth department levels) to facilitate exchange of ideas, experiences, lessons, advances etc, and to work towards cooperation, coordination, collaboration and integration of monitoring programs as envisaged under the National Marine Science Plan (NMSP) 2015-2025.

   A central focus of the meeting was to formally establish this network, define its scope (i.e. potentially confined to the outline above), mechanisms to continue through time (e.g. phone meetings vs annual face to face forum), and establish an organisational structure to maintain communications and momentum.

2. Initiate discussions on monitoring programs and levels of integration.

5. OVERVIEW OF STATE AND COMMONWEALTH MPA MANAGEMENT AGENCIES AND SCIENCE PROGRAMS

5.1 New South Wales

Alan Jordan
In NSW there is a mix of biological and socio-economic programs that run in parallel to inform the MPA management. They have found that with all of the environmental health information and biology, there is still a strong drive from the ministerial level for how these affect the broader community, hence the socio-economic information need.

NSW has just completed a broad framework of threats and risks in the marine environment to help inform decision making and monitoring. The risk matrix incorporates over 800 "things", including metrics like shipping, commercial fishing, mining, climate change, dredging, anchoring, point discharges, land-based activities etc. From that assessment they have derived the key pressures, which are the usual list. These pressures have been applied in assessments of environmental assets such as reef, seagrass, so this provides a huge matrix, with a confidence index and trend estimated for each asset. Thus, the reporting is underpinned by evidence, and a clear process by which assessments are made. This is then used to identify high-risk activities. What stresses do these create? What assets are impacted? How can these be managed?

Behind this is a MBS program which is large and getting larger. Currently this has resulted in mapping of 42% of State waters, including mapping in all the MPAs. The mapping is overlain by towed video surveys of benthic habitats in depths from 8-80 m, BRUV surveys in depths from 20-80m, UVC surveys at 5 and 10 m, and seabed imagery acquired by the IMOS AUV program. Statewide, there are also aerial surveys to underpin photo-based monitoring.
In addition there are also TEPS focussed studies, including acoustic tracking of Grey Nurse Sharks, Great White Sharks, and Black Cod.

Broad habitat assessments on reef systems include Ecklonia cover, coral cover and fish assemblages. Overall, the programs that underpin these are undertaken state-wide using the same methods across MPAs to allow state-wide comparisons, with the UVC, BRUVs methods being key components, alongside the IMOS AUV-based surveys at targeted sites. All this information feeds into the NSW marine estate management strategy, to assess metrics such as sustainable use, water quality, TEPS etc, via risk assessments coupled with monitoring. Overall, the Marine Integrated Monitoring Program is based on monitoring issues that have been identified at some risk level from the risk assessment.

5.2 South Australia

Simon Bryars
South Australia now has 19 MPAs, covering 44% of State waters, with initial zones within the MPAs declared in 2012 and implemented in October 2014. The MPAs are multiple use, with approximately 5% in sanctuary zones. The MPAs have broad habitat and ecosystem coverage. Under the State MPA act there are management plans for each park, and each has a monitoring evaluation and reporting (MER) program that feeds into a ten year review of the MPAs and the MER program itself.

There are a number of management sub-programs, including performance, protection, compliance and stewardship programs. The performance area includes the monitoring component, and this MER-based approach will be important in the first ten-year evaluation of the network, with the MER plan now being ready, and underpinned by completed baseline reports for each park, and a MER workshop process. The baseline reports include conceptual diagrams of each park, ranging from ecological interactions to socio-economic ones and values. There are also conceptual diagrams of monitoring structures for each park and its assets, and the partnerships with other agencies that underpin this program.

Monitoring/inventory itself currently is primarily around habitat mapping (some swathe mapping), UVC surveys and BRUV surveys. These surveys focus on a mix of discovery (currently little knowledge of biota in some sanctuary zones) and established monitoring (e.g. UVC surveys in Encounter Bay).

There is also some complimentary work in specific locations to meet local needs, including lobster potting surveys in some MPAs where there is a specific interest in more detailed knowledge about particular species. Currently, the lobster work is showing high recovery rates in sanctuary zones since fishing has stopped. There has also been a range of socio-economic studies, including phone surveys to look at public perception of MPAs, including before and after establishment, with recent surveys indicating 90% support for the MPA network. Similar work has focussed on economic consequences of MPA establishment. One study tested the prediction that retail fish prices would increase in areas where sanctuary zones were established. That study found no increase in price in the time following protection.

Citizen science has also been playing a role in building MPA knowledge. This includes studies of Pipi's and UVC-based surveys using RLS divers at a range of locations, including Encounter Bay and Kangaroo Island.

Outputs since the MPAs were established include baseline reports, and summary brochures. A 5-year assessment of the initial implementation will be undertaken at the end of 2017, and help inform discussion around MPAs in the ongoing political process.

5.3 Victoria

Stefan Howe
Victoria has 24 marine parks, the majority are no-take and represent 5% of coastal waters.

Early work when the parks were established focussed on filling key knowledge gaps via mapping and some UVC surveys, and that has increased over time, with extensive mapping in most MPAs and a substantial UVC-based monitoring program. Victoria has an environment strategy, and the research undertaken in the MPAs aligns with this. There are many collaborative projects, including visitor research projects and strategies. Currently there is an increasing interest in seagrass monitoring.

More broadly, Victoria has developed an adaptive management framework for the MPA network that the monitoring program feeds into, and currently has a focus on shallow subtidal reefs in 13 of the 24 parks. Each park has its own Conservation Action Plan, to identify attributes and threats and monitoring that suits the information needs for managing these. As

part of this, there is now a focus on indicators relative to key assets, and management responses to the ones that relate to manageable threats.

A monitoring plan has been developed for the network, however, as the network and needs are very large, this plan has been co-developed with a priority plan for implementing that in two passes. Essentially identifying priority parks, priority assets, priority threats and priority approaches. They are currently using a subset of these using a range of methods. These methods include UVC, lobster potting, towed video and BRUVs in subtidal habitats, complimented by multibeam mapping and coastal LIDAR (external program to Parks) for knowledge on habitat distribution and bathymetry.

In intertidal areas, they are using a mix of unmanned aerial vehicles (imagery based) and visual surveys.

5.4 Tasmania

Neville Barrett
Tasmania has seven marine reserves (including the coastal waters of the sub-Antarctic Macquarie Island), and a series of marine conservation areas restricted to the Bruny Bioregion. The latter were part of a failed political process, where new reserves were to be established on a bioregional basis, but in an initial trial in one bioregion, the number of areas recommended by the planning body exceeded expectations, and the process was stopped, with the areas becoming paper parks, with no overall protection. Overall, of the six coastal MPAs around Tasmania, four are no-take, while two have a zoning arrangement with multiple use and no-take zones.

Currently these are managed by the Tasmanian Parks and Wildlife Service, but there is no one actively assigned to manage these areas, and instead they fall under the district management of all Tasmanian parks and reserves. Policing is primarily undertaken by the Tasmanian marine police.

Despite the lack of park management, there has been a range of studies in these, and all MPAs with sanctuary zones have long-term monitoring programs in place, as well as a range of targeted and opportunistic studies that are typically facilitated by core staff at IMAS. Long-term UVC-studies continue in the six coastal MPAs, most of these have been mapped using single-beam sonar and towed video (producing bathymetric and habitat maps as part of Bruny Bioregion studies and the Seamap Tasmania program), BRUVs have been deployed in two as case studies, the IMOS AUV is utilised for deep reef areas in one MPA, and we have recently, and very successfully, deployed an ROV to survey fish assemblages in one deep reef MPA.

In addition to monitoring the core MPAs, work has continued to build understanding in the marine conservation areas, particularly those initially intended to be flagship bioregional reserves, such as the Waterfall-Fortescue marine conservation area. This latter area now has extensive multibeam mapping coverage, IMOS-AUV surveys, Towed Video surveys, BRUV surveys, and a comprehensive ROV survey planned for this summer.

Unlike many of the other States and the GBR, the Tasmanian network lacks adaptive management frameworks, policies or plans. However, the current mix of science, particularly

the long-term data, does provide a significant knowledge base from which to identify issues, threats and potential management actions (and has done so on multiple occasions).

5.5 Western Australia

Tom Holmes
There have been significant changes in WA MPA management and operations over the past eight years or so in response to a range of factors including ongoing parks establishment, widely varying funding, and restructuring of the operations. Currently the MPA science area sits between fisheries and parks management. In addition, the WA marine parks are split across multiple agencies, including Rottnest Island with the Rottnest Authority, and the Abrolhos Islands areas managed by Fisheries.

The science is managed through the Science and Conservation Division, Marine Science Program, a collaborative program with other agencies. Overall, the science is values-based, e.g. on identified values such as fish, corals and seagrass and these values are identified and monitored at state-wide scales. Many of the projects are collaborative, involving multiple institutions. Currently there are eight core-funded projects and 12 externally funded projects, undertaken across 16 parks with a staff of five. Hence, monitoring is significantly limited by staffing, although assisted by field support from individual park operational budgets with respect to access to vessels and staff locally.

5.6 Australian Marine Parks

(formerly Commonwealth Marine Reserves)

Amanda Richley
Management of the Australian Marine Parks network spans nine programs, of which the science program is one. In this structure, MERI is undertaken separately by a different team, which has interactions across multiple programs. The MERI framework identifies what the management needs are from the science. With the recent establishment of the new park network, and imminent establishment of management plans and effective zoning, Parks Australia has now received a budget to implement the management plans over the next few years. The management plans, under the legislation, are the enabling component. Therefore, without the plans in place (current situation), it is difficult to do anything significant. Despite this, there are opportunities for inventory studies, including bathymetry information.

Currently, and naturally given that apart from the SE Network the parks are relatively new, there are few long-term datasets available, other than UVC in some places, mostly in areas with shallow reef. These typically focus on coral, and coral bleaching, but in places also utilise BRUVs, pelagic BRUVs and AUVs to acquire information. Coral bleaching has been a clear pressure that programs respond to, in addition to invasive species on islands (e.g. Ashmore reef fire ants), seabird studies, and sea snakes and turtles on a sporadic basis.

Parks Australia has recently completed a literature review to discover research undertaken in the AMPs other than known work commissioned by the department. There is the hope that this process will also trigger others to come forward with data if their work has not been identified as part of the review, ultimately ensuring the knowledge base is comprehensive.

Parks is currently looking at establishing a MERI –style framework to underpin management and monitoring, but this is in the early stages, and they plan to fund external expertise to undertake this process.

With respect to socio-economic factors, these are included with biological and physical components in the management plans, but are still at very early stages, including finding the expertise to look at this (a common problem across jurisdictions). There is some work proposed for the future, including recreational fisher surveys as part of NERP Marine Hub research. However, Parks are still looking at a national scale and how to approach this.

5.7 Queensland

Nicola Udy
Queensland marine parks, for much of the coast, essentially complement management of the Commonwealth GBR Marine Park. Within the geographical range of the GBR, where jurisdictional boundaries overlap and are hard to define, joint management occurs between the State and the Commonwealth. GBRMPA manages all waters from the low-tide mark. However, above the low-tide mark, and extending up some estuaries, the State has a complementary large MPA. To the south, below the GBR, there are two other marine parks, the Great Sandy MP and the Moreton Bay MP, however, there are currently no marine parks to the west of the GBR in the Gulf of Carpentaria.

Much of the MPA management is currently focussed on policy and planning (zoning policy), development/activity assessment and compliance. There is no strategic state-wide framework for monitoring. Planning is underpinned by some studies, e.g. in Moreton Bay, where there has been broad-scale habitat mapping, based on some MBES mapping, and use of aerial photographs. Currently 16% of the Moreton Bay Marine Park is in sanctuary zone. Some monitoring had commenced, but this was timed with the large floods that flooded Brisbane which had a major impact on the park. This monitoring wasn't based on a risk-based approach. More information is needed to underpin a re-zoning review to be undertaken in two years' time.

In the Great Sandy park, the department has recently collated scientific / expert knowledge to classify habitat types based on the Intertidal and Subtidal Habitat Classification Scheme (also being developed by the department). The initial classification had 36 habitat classes, that were subsequently amalgamated to a more manageable set and the re-zoning planning will be based upon this. There is currently a future directions discussion paper being developed for this park. An overarching strategy for MPA management throughout Queensland would be beneficial.

5.8 Northern Territory and Great Barrier Reef

These were apologies at the meeting due to other pressing demands at NT DPI, GBRMPA and AIMS.

6. RISK ASSESSMENTS AND INTEGRATED MONITORING/MANAGEMENT FRAMEWORKS.

The initial program intended to review some of the risk –based management, evaluation, reporting and improvement (MERI) frameworks in use by participating agencies, with a detailed overview from NSW and Vic in particular given the advanced nature of those States in this space. However, much of the detail of their approaches was given in the earlier State-based presentations. It was clear however, that many agencies had adopted, or were in the process of developing, such frameworks, including the RIMREP program recently developed by GBRMPA and AIMS for management of the GBR. In NSW in particular, the overarching framework was broader than MPAs, adopting a state-wide threat and risk assessment as the starting point to inform ongoing monitoring and reporting, via a marine integrated monitoring program that feeds into a marine environmental management strategy.

It was clear though, that not all States and agencies were at similar levels of development in this space, and that by sharing experiences, the less advanced agencies could learn from the progress made elsewhere. One important message was that such frameworks cannot emerge in the absence of knowledge on which to identify threats and risks, and that States like NSW were particularly advanced, in significant part, because they had undertaken extensive inventory and monitoring programs over a decade or more that could reliably inform such assessments.

7. CURRENT DEVELOPMENTS

Current developments in approaches to developing Standard operating protocols, national working groups, reporting metrics/indicators for SOE and MPAs, Essential Environmental measures, and databases

A range of recent developments or relevance to MPA research and management were reviewed and discussed at the meeting.

7.1 Standard Operating Protocols

Over the past two years the Marine Biodiversity Hub has been working across a number of projects to develop a range of standard operating protocols that are suitable to guide future inventory and monitoring in CMRs, but are also suitable for broader studies in Commonwealth waters (e.g. oil and gas environmental studies, fishery ecosystem studies), and State waters. Ideally, these SOPs underpin integration of studies across jurisdictions and major research providers. Rachel Przeslawski and Scott Foster outlined some of the SOPs developed to date with respect to both survey gear and statistical designs. Currently SOPs have focussed on the range of gears typically used in AMP/MPA studies, including multibeam echo sounders or similar swath mapping technology, baited underwater video (benthic and pelagic), autonomous underwater vehicles (for image-based sampling), towed video, and grab sampling. Many of the agencies represented at the workshop have been actively engaged in the SOP development project as part of advisory groups, and it is anticipated that uptake of these will be significant, given that in most cases, this will require little change from current operations. The SOP manuals are expected to be completed by the end of 2017, with a focus on additional methods in subsequent years.

7.2 National working groups

To facilitate integration of research activities across agencies, a number of national working groups have been established over the past two years. These form part of the overall network shown in the diagram in Appendix 1, and essentially provide a mechanism for national level coordination and integration of activities, as well as enabling discussions around SOPs that have significantly aided the task of refining these for AMPs by the Hub.

AUV

An AUV-based benthic ecology working group was formally established in 2016 at a Marine biodiversity Hub facilitated workshop to build upon an existing informal network of ecological users of the IMOS facility. This working group, chaired by Neville Barrett, has refined basic operating protocols following review of nearly a decade of AUV operations, and identified gaps and opportunities to be filled/explored to ensure the overall program is meeting IMOS “observing” requirements, and is actively contribution to long-term understanding at national scales that is appropriate for SOE reporting at regional to national levels. A core part of the design in many regions involved incorporation of MPAs/AMPs where possible, to understand potential human impacts, and their interaction with other drivers, including climate change. One of the opportunities that the group was keen to move on in 2017, was refinement of “Squidle +, a software tool supporting image analysis, data storage and sharing.

BRUVs

A BRUV working group, chaired by Euan Harvey, was established at a Marine Biodiversity Hub and WA Fisheries facilitated workshop in 2017 to undertake a very similar role to that described for the AUV program above. While the aims are the same (moving towards SOPs and integration/collaboration), a key difference was that the adoption of BRUV approaches hasn't been facilitated by a national program like IMOS, but rather has developed independently across a range of locations and agencies across Australia, and has also evolved technologically from mono to stereo systems along the way. This working group will allow discussions to continue to developed shared SOPs where possible, identify gaps, and mechanisms to more significantly contribute towards SOE reporting as regional to national scales. Importantly, as per the AUV group, it requires support for developing shared tools for data analysis, safe long-term repository and data sharing. A tool "Global Archive" has been developed over the past year to undertake that task, and a role of the working group is to facilitate adoption of that tool and advocate for support for its ongoing development and maintenance via national facilities such as IMOS/AODN/EMII.

MBES/Bathymetry

A MBES bathymetry working group has been established by Geoscience Australia (GA), and is coordinated by Kim Pickard. While not a formal working group, GA has followed on from a Marine Biodiversity Hub-led national mapping workshop in 2015 to pick up on a range of clear gaps in Australia's approach to bathymetric and habitat mapping. These include coordination, cooperation, spatial coverage, future planning, dada standards and SOPs, data repository, data access and formats of mapping products. In this space GA has led several workshops in 2016 and 2017 to identify gaps and priorities for future surveys (including key partners such as the AHO), and facilitating understanding across jurisdictions of the key drivers/needs for data acquisition and access. The most recent workshops have focussed on developing SOPs for MBES data acquisition and storage.

7.3 Reporting metrics/indicators for SOE and MPAs

A central part of adaptive management and monitoring programs is the identification and use of reporting metrics. Over the past year, the Marine Biodiversity Hub has been evaluating one of the best long-term datasets to identify useful metrics for reporting into SOE and understanding the effectiveness of MPAs. This analysis, led by Rick Stuart Smith, focussed on a combination of the AIMS long-term monitoring in the GBR, the ReefLifeSurvey citizen science dataset, and the long-term temperate reef monitoring program dataset from IMAS. This work, examining reef-associated fishes, found that rather than narrowing the focus of studies onto a particular indicator species, a better approach is to examine the abundance of the full set of species present, and include size estimation for all individuals. From that approach, virtually any other metric can be derived, including the most sensitive one for MPAs (biomass of fish over 20 cm), or for climate change (community thermal index). Most other approaches, while potentially being useful locally (such as the abundance of target species x), don't allow for integration and synthesis at the national level.

7.4 Essential Environmental measures

Jarrod Green from the EEM team gave a brief overview of the marine essential measures project and how it was progressing. As a component of the SOE program, the measures aim to

provide guidance on broad metrics for reporting at national scales (similar to the essential ocean variables of GOOS), and focus on a range of important environmental features such as saltmarshes, seagrass, water quality, coral cover, kelp cover etc. The project is at an early phase in the marine realm, and has initially focussed on a small set of case studies. The case studies are guided by a steering group with broad representation across State and Commonwealth agencies and research providers, and are developed at the feature level by an expert working group. Examples of this are reef fish communities, shorebirds, and water quality. The reef fish working group has developed an initial set of metrics, based on the advanced work of the Hub (by Rick Stuart-Smith) for SOE reporting. As an example of typical essential measures, these include fish abundance, species composition and size structure. As per the reporting metrics section above, there are broadly based variables (i.e. essential variables) from which all other metrics may subsequently be generated. The draft proposals for essential variables will be assessed by an expert EEM committee, before they are released for public comment, and subsequent adoption.

7.5 Development of shared databases

For effective integration of research at the national level, we not only need SOPs, but also a way of storing and sharing datasets. In many cases this has been very difficult due to the lack of readily accessible data platforms, and a range of differing approaches to data acquisition and storage. As an example, image-analysis for benthic fauna has been undertaken using a range of platforms from CPCe, to Transect Measure, to in-house software developed by AIMS and other organisations. And image-scoring had been based on a range of taxonomic approaches and levels. More recently, this community has developed the CATAMI classification scheme to aid this, to be able to speak the same language, allowing comparison of differing datasets. In parallel, Ariel Freidman has been working with a range of research partners with IMOS support, to develop a program called Squidle+, which is an online tool, initially developed for scoring of AUV-derived imagery. This tool can both allow scoring of imagery in a wide range of ways (e.g. 50 random points), with a range of different classification schemes (e.g. CATAMI, morphospecies, CBiCS), as well as act as a repository for the data in the long-term. Refinement of Squidle+ is continuing with support from IMOS/AODN and its use and uptake is encouraged across the wider scientific community. By being part of the AODN infrastructure, the ongoing maintenance of this platform should aid in long-term preservation of data nationally. Ultimately, a central aim of this database is to develop automated image recognition systems using machine learning, such that the cover and abundance of readily identifiable species/habitats can be readily generated automatically.

Likewise, a closely related program, Global Archive, has also been developed by Ariel Freidman and Tim Langlois, with significant input from many others. This software allows all baited underwater video data to be stored and shared across users, readily sourcing data from the common image scoring platforms such as Event Measure. The program allows all standard metrics to be incorporated (MaxN, Time of first arrival, estimated sizes etc), as well as a range of other attributes such as soak time, bait type, location, BRUV type (stereo, mono, horizontal, vertical, benthic, pelagic), and habitat metrics (based on an agreed classification scheme). At this stage many of the BRUV datasets from Hub partners have been uploaded to Global archive, and it is estimated that 95% of the national BRUV data will be on there by the end of the year. Access will be controlled depending on the access levels agreed by each organisation.

For MBES data, this space is still emerging. At a Marine Biodiversity Hub-facilitated mapping workshop in Hobart in 2015 it was clear that there was an urgent need for improved data collation, storage and access, but we have gone backwards rather than forwards since then with the loss of CSIRO's bathymetry website, that has no plans for being replaced. Ultimately, the national bathymetry working group facilitated by GA may lead to a resolution of this. However, in the interim, Seamap Australia, led by Vanessa Lucieer from IMAS, with support from AODN, has collated all the national habitat mapping layers available from State and Commonwealth programs. Vanessa Lucieer gave an overview and initial look at the Seamap Australia website, demonstrating its utility to display habitat data at the finest scale polygons available from relevant agencies, including saltmarsh, seagrass, coastal and shelf reef systems. Ultimately, there is great potential to build on this website by linking in spatially related videos, imagery, and data summaries.

8. INTEGRATION

Integration - What it means: monitoring with management; biological with physical; state with state; state with commonwealth; conservation with fisheries and other agencies. How to progress?

This final session began with an overview of the National Marine Science Council by its current chair, Tim Moltmann, and an indication of what is meant by the term “integrated monitoring” in relation to the key objectives of the National Marine Science Plan. Essentially the aims of this are outlined in the plan itself, and a working group established by the NMSC is specifically focussed on developing the national approach to integrated monitoring. This group, with representation across State and Commonwealth agencies, will be working to facilitate a national approach to integration of monitoring with management needs, better informing SOE assessments, and cross jurisdictional needs. It is likely that the various working groups described above will play a key role in supporting the working group, and this will require some coordination between the various entities, as outlined in figure in Appendix 1.

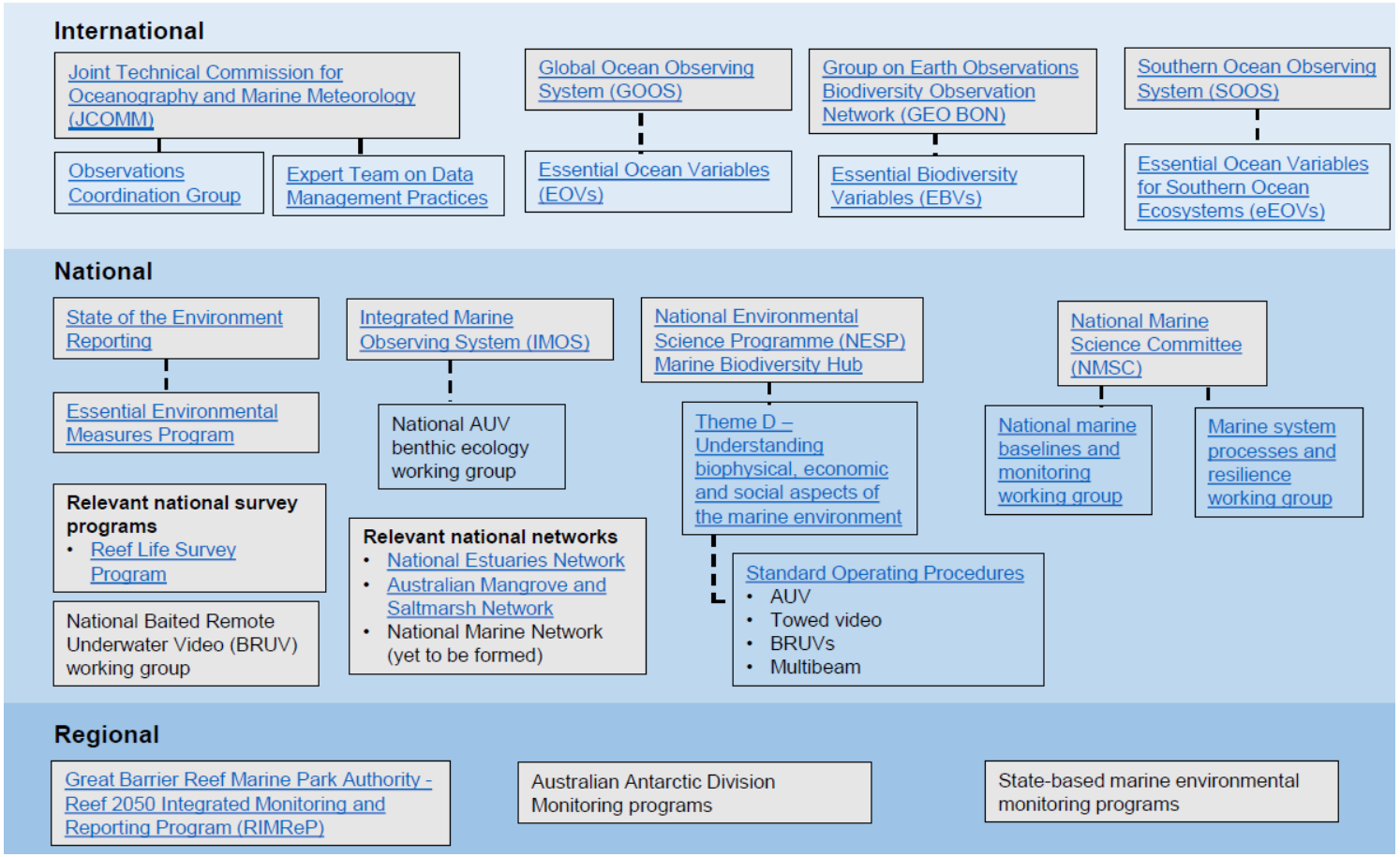
It was clear that the nation’s MPA/AMP programs play a central role in this from the biological perspective, and through processes such as adoption of SOPs, and engagement with the various working groups (including this new network/forum), are well placed to make a meaningful contribution to the larger discussions around integration. Members of the network on the NMSC monitoring group are invited to keep the broader network up to date on deliberations at upcoming network meetings.

9. APPENDIX 1

Map of marine and estuarine groups relevant to the Marine Essential Environmental Measures Working Group

(Adapted from a draft prepared by Alan Jordan)

*Data portals are not included on this map



10. APPENDIX 2

NATIONAL MARINE NETWORK
Draft Terms of Reference

Background

The National Marine Network (NMN) is a new forum that is proposed to comprise relevant marine and coastal managers, researchers and policy makers from Australian state and Commonwealth government agencies and universities. While there are other communication/connectivity networks (linking agency representatives to exchange information) there is currently no national co-ordination network that links agency scientists and managers and other key science stakeholders to create and share ideas, goals and strategies to assist with marine management. It is envisaged that the NMN would, where possible, function as a reference and advisory group, foster collective action by members to recommend innovative practices, promote standardised procedures and provide advice on important aspects of marine science and management.

Aim

The overall aim of the NMN is to exchange science, management and policy information on Australia's marine environments across States and with Commonwealth agencies and universities to better inform marine management.

Scope

- Provide a forum for discussions to exchange knowledge and facilitate problem solving on issues relating to marine research and management
- Facilitate the development of collaborations between relevant research and management agencies
- When requested, provide advice to government at all levels on effective science to underpin marine management
- Where appropriate, to foster standardised methods and procedures to facilitate data sharing and comparison

Deliverables

1. Biannual marine knowledge and information exchange forums (meetings), consisting of one tele-conference and one face-to-face meeting, usually including a science symposium with a locally relevant theme.
2. Biannual reports from State and Commonwealth agencies comprising updates on marine management, policy and research (including management and science gaps)
    a. Brief reports to communicate knowledge from focussed discussions and mini-conferences for web delivery
    b. Abstracts from workshop symposia
    c. Occasional articles produced by members of the outcomes of marine management, policy and science workshops
3. Advice to government on request

Stakeholders

- State and Commonwealth government marine science and management agencies
- Universities with marine management and research groups
- Relevant NGOs
-

Roles and Responsibilities

NMN Members
NMN members comprise the people who represent the various stakeholder organisations. These people can vary from meeting to meeting, and they occupy various roles including Chair, Coordinator and State and National Representatives (as discussed below). The membership should expect to contribute to out of session discussions and working groups on an ad hoc basis, whether directly or via a chosen delegate.

Chair
The chair for each meeting is nominated by the state that hosts each meeting and is one the local NMN representatives. The Chair sets the direction for and administers the annual workshop and 'chairs' the meeting. It is the responsibility of the chair to ensure that written outputs from the meeting are completed and made available for web distribution. This position changes for each meeting.

Coordinator
The coordinator helps to organise the meetings in collaboration with the Chair and State organising committee, and is the main source of communication to NMN members about upcoming meetings and intervening matters that arise. The coordinator is also responsible for compiling the biannual reports, contributing to meeting outputs, record keeping and finding hosts for future meetings.

State and National Representatives

The role of state and national representatives is to gather the state-based reports and participate in meetings by providing roundtable updates, giving presentations and participating in discussions.

Audience
The NMN audience comprises non-members who attend occasional meetings (or components of meetings), are on the mailing list.

Schedule
Twice yearly meetings in April/May/June (tele-conference) and Oct/Nov/Dec (face-to-face)
Success factors

- Integration of marine management at a national scale into policy and decision making at all levels of government.
- Achievement of meeting outputs within 3 months of meetings
- Provision of advice on marine applied science and management issues and the application of this advice beyond the location where it originated.

- Well attended annual science workshop that deliver relevant information to a broad range of researchers, managers and key stakeholders

Risks/constraints

- Inadequate funding/agency support for co-ordination role, meeting costs and meeting attendance.

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