

Project Plan SP 2012-008

Marine monitoring program

BCS Marine Science

Project Core Team

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X X Update requested

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X X

Project Team granted

Program Leader granted

Directorate granted

Biometrician required

Herbarium Curator not required

Animal Ethics Committee not required

Marine monitoring program

Program

BCS Marine Science

Departmental Service

Service 6: Conserving Habitats, Species and Communities

Project Staff

X X X **Role Person Time allocation (FTE)**

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Related Science Projects

Proposed period of the project

None – None

Relevance and Outcomes

Background

The Western Australian Department of Environment and Conservation (DEC) is responsible for conservation of the State's biodiversity. Under Australia's obligation as a signatory to the Convention on Biological Diversity (29th December 1993), a National Representative System of Marine Protected Areas is being progressively established throughout Australia's marine jurisdiction by Commonwealth, State and the Northern Territory governments (ANZECC TFMPA 1999). As part of this process DEC, on behalf of the State Government, is establishing a comprehensive, adequate and representative (CAR) system of marine protected areas (MPAs) throughout the coastal waters of Western Australia. These MPA's are vested (legally entrusted) in the independent Marine Parks and Reserves Authority (MPRA) on behalf of all Western Australians under the provisions of the Conservation and Land Management Act 1984. DEC also has the legislative responsibility for conservation of marine fauna and flora across all State's lands and waters. The importance of implementing a standard approach to monitoring, evaluation and reporting (MER) for assets of State and National significance is receiving greater recognition on the road to National biodiversity reporting (e.g. State of the Environment reports and

National environmental accounting). Long-term monitoring of condition, pressure and management response in relation to ecological and related social assets (see Appendix A), along with evaluation and reporting is a key element of determining whether management and conservation objectives are being met and if the State is getting 'value for money' from their marine management and conservation programs. In response to this need, DEC has established the Western Australian Marine Monitoring Program (WAMMP) which is a statewide long-term, institutional marine MER program currently being developed and implemented primarily to assess the efficiency and effectiveness of MPA and threatened marine fauna biodiversity management and conservation programs. To facilitate and promote management effectiveness WAMMP delivers information on the extent and cause of change in the marine environment using systematic and standardised approaches to data collection, evaluation and reporting over extended periods. Trends in the condition [1] (C) of biodiversity assets is a result of the interplay between natural and anthropogenic [2] pressures (P) and the effectiveness of the management response/s (R) to mitigate these pressures. The primary purpose of MER programs is to provide the asset-based CPR data and trends that are needed to inform adaptive management. MER programs must therefore be designed to ensure that, when changes in asset condition trends are detected, an assessment can be made of whether these changes are caused primarily by natural, anthropogenic or climate change pressures. The WAMMP provides quantitative evidence of condition, pressure and management response changes to support the MPRA's statutory audit function of MPA's. WAMMP will also inform Marine Policy and Planning in DEC's specialist branches and will collaborate with other State and Commonwealth agencies, NGO's, local communities and industry that have responsibilities or a special interest in marine management and conservation. The WAMMP is primarily a partnership between the Marine Science Program (MSP) and the marine staff of the Regional Services Division. The WAMMP is coordinated from the Marine Science Program in DEC's Science Division by a coordinator who helps to oversee the planning and delivery of program activity, and facilitates input and collaboration from other government agencies and statutory bodies, industry and community groups. The WAMMP has permanent staffing positions allocated to support this strategic focus, with a central science capability in Perth (i.e. MSP) and operational support (i.e. marine staff in Regional Services Division) located in regional centers throughout WA (Appendix B). As management agencies cannot comprehensively and effectively manage on their own and the marine environment is owned by all West Australians, DEC benefits greatly from the help of the broader community. * * * [1] Expressed as asset structure and function [2] Climate change is an emerging anthropogenic pressure on natural systems worldwide. Because of the potential significance and large temporal and spatial scales involved, CC pressures are treated separately from local scale anthropogenic pressures within the current context.

Aims

This SPP outlines the structure and operational framework of the WAMMP, which is a statewide, long-term, institutional marine monitoring, evaluation and reporting program currently being developed and implemented to assess the effectiveness and efficiency of MPA and threatened marine fauna biodiversity management and conservation programs.

The main aim of WAMMP is: "To facilitate and promote effective and efficient adaptive management in the protection and conservation of marine biodiversity and related social values in Western Australia".

Expected outcome

As part of annual review of WAMMP outputs there is both an internal DEC MPA asset review process and published MPRA performance assessment reports. Outputs from these documents inform the MPRA annual report to Parliament. WAMMP outputs incorporate:

- Refined historical CPR records for Marine Park assets and threatened fauna;
- On-going quantitative evidence on the status and trends in selected indicators of condition of assets, the pressure/s on these assets and DEC management responses;
- Data to meet legislated audit requirements, and allow measurement of progress towards asset condition, management performance and visitor enjoyment goals;
- Information and understanding of the dynamic nature of undisturbed marine ecosystems;

In recent years managers and civil society are increasingly becoming aware of the value of long time-series datasets as MER provides a better means of learning from past experience, improving service delivery, planning and allocating resources, and demonstrating results as part of accountability to key stakeholders. This performance assessment and adaptive management framework allows conservation managers to respond appropriately to changes as they become apparent and through measurement, adaptation and delivery cycles, refine our approach to managing ecological and social assets.

The WAMMP provides a formalized assessment to determine warning signals of critical condition change to WA marine assets before these change occur. This improved understanding of the effect of key natural (e.g. temperature, coral predators, disease etc) and human pressures (e.g. fishing, dredging, coastal development) allows time for the development of effective mitigation measures to restore, maintain and manage marine biodiversity.

Data from protected environments also offers complementary understanding to information from the resource extraction (e.g. commercial fishing) and industrial (e.g. offshore drilling, port dredging) sectors. WAMMP data can act as a reference point for comparisons with altered environments, and assist State agencies, regulators and developers in better determining and understanding anthropogenic impacts.

Multi-decadal programs like WAMMP require consistent delivery of data that conforms to agreed standards and has defined quality assurance and quality control processes in place. WAMMP needs systems to facilitate regular i) capture of data, with a place to ii) upload, iii) store, iv) discover and access data. Lastly WAMMP needs to be able to design and produce reports from automated work flows that deliver standardised reporting products from defined raw data sets. Provision by WAMMP of time-series of asset condition, pressure and management response information captures the corporate history of what DEC has learnt about changes in asset condition, pressures and the effectiveness of management. This helps DEC managers and the community learn through time, and not suffer the 'shifting baselines' phenomenon as DEC staff and community change. Information management frameworks that manage the collection, entry, quality control and archival of data-sets, and makes them available to contribute to adaptive conservation management for the full lifecycle of WAMMP will be a major benefit to DEC. The development of these systems and processes to service the needs of WAMMP will also have significant flow on benefits to daily operation and the strategic capacity of DEC.

Recognising the 'value for money' imperative, DEC has moved towards an outcome orientated business model that re-affirms the link between management activity and conservation outcomes described in DEC strategic plans and government legislation. WAMMP will play an important part in assisting the re-alignment of work practice and culture, by helping adapt and better integrate DEC business architecture (financial and operational work planning and work-flow designs) and re-focusing effort across work programs to jointly achieve strategic conservation and management objectives.

Knowledge transfer

The information gained from WAMMP will be used by DEC staff for marine reserve management and the recovery and management of threatened marine fauna Statewide. The information gained from marine MER will also be used to inform planning for future DEC monitoring and research, and the EIA process for the design and assessment (surveillance monitoring) of industrial 'developments' and resource use related to our coastal and marine systems. Lastly, the information on the status of assets and our management effectiveness is of general interest to the community (from school children to environmentally aligned community groups both within WA and elsewhere), who wish to be informed on current information on WA marine assets and how they can play an assisting role in ensuring the sustainability of our natural and social values.

A comprehensive variety of communications related to the program will be produced in order to transfer WAMMP findings to DEC managers, other marine science providers and the wider public (Appendix C). Science/Management related outputs include an intra annual progress update of MER activity, through the periodic delivery of the WAMMP monitoring matrix (Bancroft et al 2011) and annual performance reviews of MER data and analysis to reflect outcomes against DEC objectives. The annual reporting cycle is staged, starting internally so that science providers and Marine Park Coordinators share and discuss results before reports are made to the community through the MPRA.

The MPRA's audit function is a statutory requirement under the Conservation and Land Management Act 1984 (also known as the CALM Act). For each marine park, comprehensive ecological and social value report cards are presented annually by Marine Park Coordinators to the MPRA within a formal audit process (both verbal and written). The responsibility for, and timing of the delivery of asset information within the management effectiveness process is described in Bancroft, Friedman, and Kendrick (2011), and Friedman et al. (in prep)

Through the repetition of DEC's monitoring, assessment and reporting cycles and related changes to management, DEC will adaptively evolve and refine its approach to managing assets. Revisions of management activity will be both operational (e.g. changes in annual workplans) and more strategic (e.g. changes in MPA zoning and refinement of management targets in MPA management plans) to ensure tactical and strategic conservation outcomes are attained.

Science related outputs (Appendix C) include the publication of summary asset technical reports and a five yearly outlook report which gives an overview of performance of the reserve system. In addition, peer reviewed journal articles will be produced where applicable.

Communication outputs will also include more 'general reading' publications, e.g. DEC Landscape, local newspapers and DEC's Conservation News. Additional specialised communication outputs for marine park related community interest groups will also be explored. By communicating information about and findings of WAMMP and related changes in asset condition and management, we will foster co-operation and collaboration in the development and implementation of this strategic program, and increase Western Australians' appreciation of the need to conserve their marine environment.

Tasks and Milestones

Year	Milestones / Major activities[1]
Timing (date)	Proportion of total annual project resources
Status (Completion %)	Person/ days
Operational budget (\$)	
1	
June 2011 – July 2012	
1. Annual project planning complete	
WAMMP (Science Regions) MER Workplans	
1/1	
Workplan discussions for following FY held between WAMMP Coordinator and Marine Park Coordinators (MPC's)	
End Feb	
1/2	
WAMMP Coordinator sends draft workplan for following FY to MPC's	
Mid March	
1/3	
Draft agreed workplan for following FY completed by MPCs and WAMMP Coordinator	
End April	
1/4	
WAMMP Workplan for following FY signed off by Science and Regional managers	
End May	
1/5	
Work loaded into Monitoring Matrix	
August new FY[2]	
SCP and SPP development and lodgments	
1/6	
Facilitate the development of SCP's and SPP's for WAMMP related activity that is coordinated in the regions	
On-going	
2. Annual field program complete	
Asset related WAMMP MER Activity	
2/1	
See WAMMP Annual Field Planning held by the WAMMP Coordinator and individual Asset Leaders[3]	
On-going	
2/1	
Facilitate cooperation with fieldwork of external agencies and the community where there is value for WAMMP	
On-going	
3. Annual data analysis complete	
Asset related WAMMP data analysis	
3/1	
See WAMMP Annual Data Analysis Planning held by the WAMMP Coordinator and individual Asset Leaders	
On-going	
3/2	
See WAMMP Historical Time-Series Development program planning held by the WAMMP Coordinator and individual Asset Leaders	

On-going

1

June 2011 – July 2012

4. Annual data management complete

Information Management Systems Development

4/1

Develop and implement knowledge management system for WAMMP documentation (e.g. project or method documentation as well as general information such as reference and image libraries) that is well-structured and searchable, and has online accessibility where necessary.

On-going

4/2

Develop and implement a data collection system that allows for local and remote input of standard conform electronic data

On-going

4/3

Develop and implement a data warehouse, i.e. data storage and automated reporting platform

On-going

4/4

Develop and implement project management support software

On-going

Data Management

4/5

Ensure all WAMMP data has metadata attached and, in the interim, stored appropriately pending transfer to MSP Information Management Officer

On-going

4/6

Lodge all data in a standards compliant MSP Marine Information Management System

On-going

5. Annual reporting (i.e. outputs) complete [1]

5.1 Science

Administration

Complete an ARAR progress report

June 2011

Foundational Documentation for WAMMP[2]

5.1/1

WAMMP Strategic Plan

2012

5.1/2

WAMMP overview manuscript

2012

5.1/3

Asset Knowledge Review Guidelines

2012

5.1/4

Asset Knowledge Reviews series

2012

5.1/5

Historical Time-Series Guideline

2012

5.1/6

Historical Time-Series for individual assets

On-going

5.1/7

Fit to Park Guideline

2012

5.1/8

Asset Fit to Park series

2012

5.1/9

MSP Information Management Strategic Plan

2012

5.1/10

WAMMP Information Management overview manuscript

2012

5.1/11

WAMMP Data sharing guidelines

2014

5.1/12

Standard operating procedure

On-going

5.1/13

Field operations plans

On-going

5.1/14

Complete metadata reports for all fieldtrips and major data acquisition

On-going

5.1/15

Technical Reports

Every 5 years

5.1/16

MPA Reports

Mid August

5.1/17

MPRA Reports

Late September



[1]See SD Scientist Productivity Review Framework (SD Guideline M

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- Underwood, A.J. (1992). Beyond BACI: the detection of environmental impacts on populations in the real, but variable world. *J. Exp. Mar. Biol. Ecol.* 161: 145-178.

Study design

Methodology

In order for DEC to implement a long-term monitoring program for ecological assets and social values, related pressures and management response, a significant investment in planning and design for the WAMMP is required.

On the scale of assets within marine parks (ecological and social values, see Appendix A), the question of identifying, defining and prioritising assets for management is broadly completed in individual MPA management plans and threatened marine fauna recovery plans (see <http://www.dec.wa.gov.au/> for MPA management plans, see Appendix A for a summary of assets). In addition to defining assets for management, articulated within these management plans are asset specific management objectives, performance measures and management targets (see management framework section, DEC 2005). Such measures and targets are as specific as the current level of knowledge allows, but are definitive enough to allow measurement of MER information against the defined performance measures[1].

In addition to these requirements, a number of steps are still needed for long-term MER to be conducted, and these tasks are defined within four sub-programs that are being worked on by a range of WAMMP participants (see Table 2 and 3).

Table 2. Key steps to establish and implement WAMMP with related requirements and documentation.

KEY STEPS
Requirement
Documentation
Strategic Planning and Coordination
1
DEFINE CLEAR GOALS AND OBJECTIVES:
Identify assets and define targets and outcomes
o MPA management plans and threatened marine fauna recovery plans
o WAMMP Strategic Plan[2]
o WAMMP Annual work plan
2
HISTORICAL UNDERSTANDING
Review existing information
o Guidelines for selecting and using historical data
3
REVIEW KNOWLEDGE ON ASSETS
Refine conceptual understanding of asset-pressure relationships and develop MER strategies around selected CPR indicators (what to measure), and methods of monitoring (how to measure)
o Guideline for writing asset knowledge reviews
o Individual asset knowledge reviews completed and externally reviewed, initially for KPI's and then other ecological and social assets.
o Individual asset reviews will periodically require changes themselves, but changes to the monitoring focus should not occur outside the recommendations found in the review process without a full review process being re-conducted (incl. external scrutiny of suggested changes and alignment of old protocols with new ones).
Asset CPR MER
4
FIT to PARK
Establish sampling locations (where) and determine sampling time (when), and sampling frequency (how often) followed by on-going data collection
o Guideline for determining location, sampling time and frequency of sampling / post processing
o Individual fit to park documents for single assets, that document default decisions behind the placement of sites, the selection of sampling time (within a day, season or year), and the frequency of sampling
o Individual fit to park documents for each MPA, that outlines default monitoring plans; sites and the frequency of sampling of all assets within a single park[3]
o Standard operating procedures for sampling tasks (SOP's).
o Fine scale annual asset work plans
5
INTERNAL AND EXTERNAL REPORTING/AUDIT FUNCTION
Develop analysis and reporting procedures. Implement standard performance assessment reporting
o See Table 2 and Appendix C
Information Management
6
INFORMATION MANAGEMENT
Develop information management and data work-flow frameworks
o Information management strategic plan
o System design and protocol documents for working data, corporate data and archived data management
o Data 'warehousing'
o Current version control and work flow specifications for the handling of incoming and outgoing datasets, including listing of historical datasets
o Project time expenditure, reference and photo library management system
Table 2. Continued
KEY STEPS
Requirement
Documentation
Stakeholder Participation & Communication
7

SCIENCE AND GENERAL COMMUNITY LIAISON

Develop and sustain community links

o Community Monitoring Plan

o Local, National and Regional community outreach reporting and collaboration

WAMMP Coordination

The first priority for the WAMMP Coordinator is to publish a Strategic Plan (termed 'the Plan') for WAMMP. The Plan should outline the MER programs aims and objectives and describe the process by which the WAMMP will be designed, established and implemented (Key Step 1, see Table 2). Beyond describing the aims and objectives, the Plan will define the scope of the program and the delivery framework (with guidance on prioritisation), to advise DEC, other government agencies, professional and community collaborators of the range of activity and proposed outputs and outcomes. The Plan should have due regard for capacity and budgetary constraints of DEC, to ensure undertakings are likely to be long-lived.

Historical Time-series and Asset Knowledge Reviews (Key Steps 2 and 3)

Wherever possible, monitoring should make use of, or build upon existing datasets in order that relevant historical data can inform on-going data streams. Historical Time-series development looks for long term value in past "snap-shot" studies implemented in an ad hoc process; opportunistically or in response to either political concerns or obvious loss/damage. Available data collected by DEC and other agencies and institutions has typically been collected through disparate studies over varying spatial and temporal scales in studies measured in terms of half decades or less. Additionally, the information from such studies is not always easily accessible, as most of the data from these studies are only found in grey literature (e.g. government reports), proprietary databases, or are difficult to trace.

Whereas past historical studies have largely been developed opportunistically or in response to particular concerns, the current emphasis of DEC's Western Australian Marine Monitoring Program (WAMMP) is to develop and implement a more strategic integrated program. For this strategic program to respect past work and benefit from historical datasets, those datasets need to be identified and assessed for viable measures of condition and pressure metrics that can provide a historical understanding and long term context for determining the status and variability of assets.

A practical guideline for assessing and utilising historical information from disparate studies has been developed that outlines how to assess for historical spatial and temporal trends in asset condition and related pressures to assist the development of MER programs (Bancroft and Friedman in prep). This guideline will standardise the approach that WAMMP takes in developing time-series data-sets for assets of interest.

A further foundation priority for the implementation of MER activity is to research, develop and publish Asset Knowledge Reviews (AKR) that ensure the program is informed by available information and well targeted. As there is no 'off- the-shelf' guidance to complete these tasks, guidelines will be published on how these processes should be conducted, to ensure there is a standardised and comprehensive approach to these foundational MER issues.

Global and local knowledge of ecosystem function assists in developing conceptual models of how systems work and how a monitoring process might inform management on critical changes. The AKR process, described in a generic guideline by Simpson and Friedman (in prep) outlines a standard process to undertake marine biodiversity asset knowledge reviews that systematically identify and select biodiversity asset condition-pressure-response indicators and methods relevant to the WAMMP. The AKR's relies on the identification of recognised pressures (natural and anthropogenic incl. climate change) and their relationships to ecological assets for MPA's across WA, which is the critical link for building a shared understanding of "what" condition, pressure and response indicators to measure, "how" to measure these indicators (i.e. generic methods) and "why" (i.e. the rationale for "what" and "how").

In AKR's prepared for individual assets, all the suggested pressures are listed, but only the important pressures are discussed in the context of structural and process monitoring related to asset condition. Pressures are only defined as 'significant' if evidence indicates they are known to have occurred, are occurring or are likely to occur in the Western Australian context and are documented to have a 'high impact' on asset condition. Pressures are assessed to be 'potentially significant' if evidence suggests they may be occurring or may occur in the future and are documented to have a 'high impact' on asset condition, while pressures are assessed to be 'not significant' if evidence suggests they have not occurred in the past, do not currently occur and are unlikely to occur in the future or if they are localised, transient and documented to have a 'low impact' on asset condition.

Following the development of conceptual models and publication of asset knowledge reviews in peer reviewed literature, standard operating procedures (SOP's) will be published to specify protocols for use in the field or laboratory. These operational step by step instructions ensure that specific monitoring functions are carried out

in a standardised way. SOP's should be clear and concise but with enough detail so that users with a basic understanding, and limited experience, can reproduce methods of the procedures described.

'Fit to Park', the process of establishing locations, times and frequencies for sampling (Key Step 4)

Once conservation management objectives are defined (see MPA management plans and Threatened fauna recovery plans) and decisions on what metrics to monitor have been developed (Friedman and Simpson, in prep, Simpson and Friedman in prep), the real challenge to a long term systematic monitoring program like WAMMP is to operationalise monitoring within available budgets to create long-term data sets to inform management.

Questions of 'fitting' the monitoring to a marine Park (i.e. 'where', 'when' and 'how often' to monitor) are a challenge for the establishment phase of a MER program and require iterative reflection as information is collected through the life of a MER program. This is especially true for MER that operates within the complexity of ecological and social systems in contrast to those associated with complicated but predictable mechanistic processes.

The 'fit-to-park' process builds on the AKR process (Simpson and Friedman, in prep), by providing the information needed to implement sampling for each of the indicators selected. In the fit-to-park process we consider the environment for monitoring, the inherent nature of the asset and spatial and temporal scales at which natural, anthropogenic and climate change pressures are acting when planning sampling regimes (Underwood 1992; Morrissey et al. 1992). This builds on the foundations of well defined objectives, and an agreement between managers and scientists over what departures from stable baselines, or comparisons between different management zones (effect sizes) are required to be determined through monitoring. Ideally CPR monitoring programs should be capable of detecting significant condition change attributable to a specific pressure[4], with a departure from acceptable limits that allows sufficient time for management to intervene and mitigate damaging impacts. This requires a number of considerations to be dealt with to ensure the MER program can be effective:

- 1) a sound sampling regime that considers how broadly to sample;
- 2) a process to guide where to locate sampling sites;
- 3) a process to guide when to sample (within a day, month year), and
- 4) a process to guide how frequently sampling sites need to be surveyed through time.

When considering these questions, decisions made to guide the monitoring process must be made with consideration of cost and practicality within the context of local staffing and budgetary constraints (Field 2005). The 'fit-to-park' process identifies answers to questions 1-4 for individual assets both at an asset level across the State, and at an asset level within individual management area. This guides the establishment of MER sites and in out-going years, re-sampling of sites to ensure the MER program is responsive to changes in CPR signal. Once a decision is made that re-sampling of condition or pressures is warranted, this can proceed a number of ways depending on the perceived level of need/risk: i) temporal options; when to re-initiate sampling?, ii) spatial options; whether to re-sample all or just a subsample of sites?, and lastly iii) to what degree should re-sampling be conducted (See Appendix D). If re-sampling is initialized at a tactical level and results indicate there may be issues of concern, the sampling level can be escalated to ensure sufficient condition or pressure understanding is acquired to inform management. In order for WAMMP to build the long-term time series data sets of condition, pressure and response needed to guide management over strategic time-scales, the content and level of sophistication of WAMMP inquiry should focus on delivering "sufficient" information for management decision-making (Field et al. 2004, 2005, 2007), and where more information is needed, to increase the intensity of data collection through more investigative monitoring, and/or the use of specific research projects (See Appendix D).

A generic 'fit to park' paper has been prepared to provide practical guidelines in the form of a list of factors to consider when making decisions about "where" and "when" and "how often" to monitor whilst developing sampling designs for MER programs (Friedman and Wilson, in prep). These principles should ensure that the initial data sets address the majority of MER objectives, whilst providing baseline information that supports on-going sampling decisions.

Agency Reporting and MPRA Audit Function (Key Step 5)

The annual work-flow of MER for WAMMP comprises four main steps:

- 1) planning of monitoring for each financial year;
- 2) interim reporting of progress through the year with the use of a 'monitoring matrix';
- 3) reviewing of results in MPA annual reporting meetings, primarily between asset leaders and Marine Park managers[5]; and
- 4) formal performance assessment review reporting that is completed by each Marine Park manager, and presented in a summarising all-parks report for the MPRA.

The results of an annual monitoring cycle are evaluated by science staff and MPA managers who discuss the status of assets in face to face meetings once a year. External parties with information to input into the process are also encouraged to make written submissions to individual asset leaders or to attend these meetings in person. The purpose of these meetings is to capture information from MPA managers and asset leaders who have local and state-wide insights respectively, and to share understanding across the range of assets listed at each MPA. Annual asset CPR report sheets are prepared following MPA meetings by asset leaders and these are collated into Annual MPA CPR reports which are supplied to the relevant MPA managers. This scientific advice is used by MPA managers in designing and delivering on-going management and management effectiveness reporting to community representatives (annual performance review documents for Marine Parks and Reserves Authority).

A fundamental part of the Marine Parks and Reserves Authority's (MPRA) statutory function as outlined in s26B of the Conservation and Land Management Act 1984 is to set performance criteria for evaluating the carrying out of the management plans; and conduct periodic assessments of the implementation of the management plans. The MPRA implement the audit process at three levels:

1. an Annual Performance Assessment Review of each marine park management plan;
2. a Periodic Audit (nominally 3 to 5-yearly) of each marine park management plan based on preceding Annual Audits; and
3. a 10-yearly Audit of each marine park management plan based on preceding Annual and Periodic Audits.

A performance assessment report of DEC's overall effectiveness in relation to conserving key ecological and social values is presented annually by Marine Park managers to the MPRA within a formal process (both verbal and written). The written all park summary provides the MPRA with an update on the status of asset key performance indicators (KPI's) with a focus on providing evidence through time series data where feasible. In addition to reporting on KPI's there is also reporting by exception for other non-KPI assets for any non-desirable asset condition, significant change in pressure, or where there are concerns about the management response. Individual written MPA performance assessment reviews have also a summary and detailed report card section which provides an assessment of the condition, pressures, and management responses for ecological and selected social values (both quantitative and qualitative assessments). The face to face meetings between DEC and the MPRA held in October of each year provide the MPRA to opportunity to discuss questions of implementation of priority strategies or actions of the management plans, any concerning trends in ecological asset condition-pressure-response or the effectiveness/efficiency of DEC management of assets, and allow Marine Park Coordinators to highlight adaptive management responses.

The responsibility for, and timing of the delivery of asset information within the management effectiveness process is further described in Bancroft, Friedman, and Kendrick (2011), while a description of the MPRA performance assessment framework by Lloyd et al (2005) and Friedman et al. (in prep) gives further insight into how C/P/R information is delivered to DEC and the community.

Information Management (Key Step 6)

As the primary purpose of WAMMP is to supply managers with information that allow their conservation programs to operate more effectively and efficiently, WAMMP needs systems and processes for the orderly handing of the full lifecycle of WAMMP data and related documents. Information management and data governance at a strategic timescale will be critical to the success of this long term monitoring program.

Information management (IM) requirements for WAMMP centre on having:

- A 'fit for purpose' data warehouse to store information (including raw data, Pdf library references, digital images and digital video) in formats that are compliant with current standards;
- Defined rules and guidelines to ensure consistent information handling processes (upload, store, discover and access data), and that access to data, imagery and documents is orderly and controlled;
- 'Version control' that allows documents to be changed, but ensures only one 'working' version (points of truth) for corporate documentation (e.g. project documents, method descriptions, experimental designs, standard operating procedures, data-sets and reports) is discoverable; and
- Automated work-flows that deliver standardised reporting products from raw data.

Long-term monitoring is by nature multi-decadal, and therefore careful consideration of the rules (e.g. for access and changes) and standards (e.g. formats, software, languages) that are adopted for data management need to deliver consistent information management and archiving so that information is discoverable through time. A more in-depth review of this requirement is available in a separate IM plan (Mayer and Friedman 2011, in press), and manuscript (Mayer, in prep).

Stakeholder Participation & Communication (Key Step 7)

Timely briefs, trend analysis, synthesis and outlook reports need to highlight variation in the condition of assets, the pressures they face and DEC's management response. In order to communicate results effectively and efficiently, audiences need to be targeted with key messages in appropriate language and formats to ensure conservation outcomes reach the community and DEC fosters community support for conservation activity. As part of the periodic reporting of results WAMMP should also synthesise achievements and learning more broadly in an outlook synthesis report. This communication is principally about communicating scientific knowledge to positively influence community attitudes and behaviour towards conservation and sustainable use of the marine environment. It is also about influencing the attitudes of politicians, media and industry groups with the aim of building confidence about governance, regulation and the use of science and technology. It promotes a better public understanding of the natural and social environments and their interaction, and positively influences both attitudes and the behaviour of users and interest groups in regard to conservation management initiatives.

Australia's marine jurisdiction is a community asset 'owned' by all Australians, and much of the ocean is a common asset available to the National and International community. Management agencies cannot comprehensively and effectively manage on their own and will benefit greatly from the help of the broader community. WAMMP recognises that the general community (and community groups) has broad ranging access to coastal waters and can bring local knowledge, expertise, energy and commitment and resources to the MER process. The WAMMP will engage with community groups to foster improved stewardship and appreciation in marine and coastal management and facilitate engagement and information exchange between the community and asset managers.

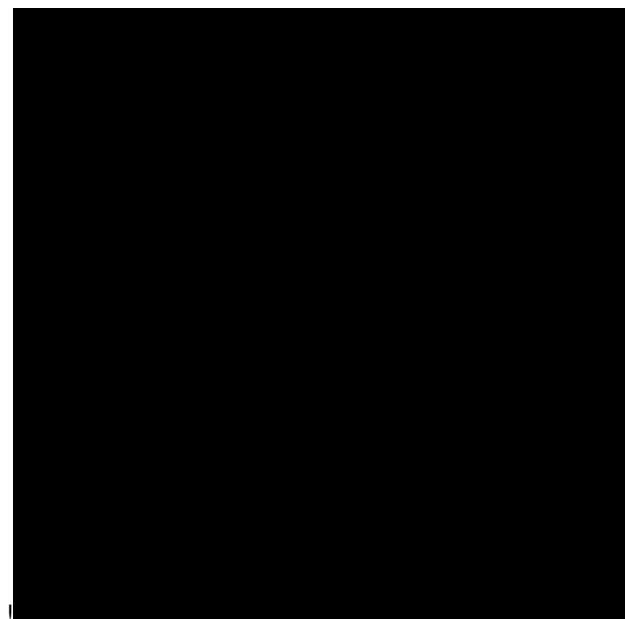
A Marine Community Monitoring (MCM) 'tool box' of simple but effective marine monitoring methods including resources for making identification of marine assets has been developed by DEC to assist local interest (dive groups etc), commercial and school groups to participate in monitoring. These initiatives can support institutional scientific monitoring programs where they are designed correctly, implemented under supervision and have structured data management and reporting processes that comply with standard protocols. MCM is especially useful as an 'early warning tool' for identification of harmful processes (coral bleaching, predator outbreaks, localised pollution events etc) and offers the opportunity for DEC managers to get a information on assets over a large area for 'Tactical MER' (see Appendix D).

With the wide-scale ownership of digital cameras, GPS technology, smartphones etc. and the ability to distribute and receive data through the internet, community sourced information will play a larger part in monitoring of assets across the State in the future.

Within WA, Nationally and Regionally the WAMMP can pass and receive information to the benefit of ourselves and other MER programs. Sharing of MER data collected with standardised approaches by industry, State Governments and regional networks for sharing of marine area management information is already underway across Australia, in Asia and countries bordering the Indian Ocean. However, despite WAMMP having structured monitoring approaches (and related outputs), there are few formal links or networks operating to share such management information with its neighbours. In the medium term, WAMMP should forge links with neighbouring networks and marine management institutions, to build sharing arrangements that will enhance regional skill bases and better understand results on asset change, part of which reflect chronic pressures and management responses to broad-scale climate change.

Such sharing networks would support three main activities:

- i. Conceptual sharing: Getting MER frameworks aligned for assessing ecological and social values
- ii. Audit "case study" sharing: A framework for sharing of annual and 5 yearly audit assessments and 'report cards' that report on ecological and social asset information in a "condition-pressure-response" format.
- iii. Capacity sharing: This component would encourage WA MPA's to host neighbouring key marine park staff for training and sharing trips. WA WAMMP and marine park staff would also participate by doing placements across Australia and the region.



[1] or a surrogate for that measure [2] Subset of DEC strategic plan, and

required

Data management

No. specimens

Not applicable.

Herbarium Curator's Endorsement

not required

Animal Ethics Committee's Endorsement

not required

Data management

Hard copies of any reports resulting from the project will be held at the following locations: Marine Science Program, Science Division, Department of Environment and Conservation, 17 Dick Perry Avenue, Western Australia, 6152. Ph: (08) 9334 0333. Contact WAMMP IM officer. Woodvale Library, Science Division, Department of Environment and Conservation, Ocean Reef Road, Woodvale, Western Australia, 6026. Ph: (08) 9405 5100 Fax: (08) 9306 1641. Archives, Woodvale Library, Science Division, Department of Environment and Conservation, Ocean Reef Road, Woodvale, Western Australia, 6026. Ph: (08) 9405 5100 Fax: (08) 9306 1641 (CD also attached). Serials Section, State Library of Western Australia. Alexander Library Building, Perth Cultural Centre, Perth, Western Australia, 6000. Digital copies of any reports resulting from the project will be held at the following: The Science Division Server: T:\529-CALMscience\Shared Data\Marine Science Program\MSP_REPORTS\ Confluence : <https://confluence.dec.wa.gov.au/display/sd/Marine+Science> CD-ROM, DVD and Hard drives held the Marine Science Program, Science Division, Department of Environment and Conservation, 17 Dick Perry Avenue, Kensington, Western Australia. Ph: (08) 9334 0299 Fax: (08) 9334 0327. Contact WAMMP IM officer. The benthic habitat data collected during the survey will be entered into the Habitats Database, which is located on the Science Division Server: T:\529-CALMscience\Shared Data\Marine ScienceProgram\MSP_DATABASES\Habitatdatabase\MSP Habitats.mdb All digital video footage collected will be held at two locations: MDV masters will be archived in Video Archive files held at the Information Management Branch, Department of Environment and Conservation, 17 Dick Perry Avenue, Kensington, Western Australia. Ph: (08) 9334 0392. Digital copies on DVDs and portable hard drives will be stored at the Marine Science Program, Science Division, Department of Environment and Conservation, 17 Dick Perry Avenue, Kensington, Western Australia. Ph: (08) 9334 0299 Fax: (08) 9334 0327. Contact WAMMP IM officer. All digital still photographs taken during the survey will be archived on the Science Division Server:

T:\529-ALMscience\SharedData\MarineScienceProgram\MSP_COMMUNICATION\imagelibrary\ images
Contact WAMMP IM officer.

Budget

Consolidated Funds

	to X X X X			
Source	Year 1	Year 2	Year 3	
FTE Scientist				
FTE Technical				
Equipment				
Vehicle				
Travel				
Other				
Total				

External Funds

	to X X X X			
Source	Year 1	Year 2	Year 3	
Salaries, Wages, Overtime				
Overheads				
Equipment				
Vehicle				
Travel				
Other				
Total				