MARINE SCIENCE PROGRAM

What did we learn?
Who did we tell?
What difference did it make?

SUMMARY OF ACTIVITIES, OUTPUTS AND EXPENDITURE FOR 2008/09

REPORT TO THE MARINE PARKS AND RESERVES AUTHORITY

REPORT No. 3

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September 2009

Cover photo: Clerke Lagoon reef community, Rowley Shoals Marine Park
Photo courtesy of Marine Science Program, Science Division, DEC

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SUMMARY

This report outlines the performance of the Marine Science Program (MSP) for the 2008/09 financial year and is part of the Department of Environment and Conservation's (DEC) reporting and accountability obligations, under the CALM Act, to the Marine Parks and Reserves Authority. The report is based around the MSP Marine Science Business Plan: 1 July 2008 – 30 June 2009.

Funding for marine science in DEC occurs in the MSP, regional and specialist branch cost centres. This report focuses primarily on expenditure and outputs for 2008/09 by the MSP and does not include expenditure and outputs on marine science by regions and specialist branches or 'in kind' contributions from collaborating external agencies. However, this report has attempted to report on all DEC-supported marine science for the 2008/09 financial year.

The report format consists of individual project progress summaries using the Science Division Annual Research Activity Report proformas for both MSP and Regional marine science projects. The Science Division Scientist Productivity Framework proformas are used to summarise the major science, communication and knowledge transfer outputs of each scientist in the MSP for the 2008/09 financial year. Financial information for MSP projects and activities is also provided.

The MSP has had a significant increase in staff capacity with six new permanent research scientist positions being established during the 2008/09 financial year and the majority of the new staff taking up their positions in October 2008. Following a 'settling in' period, the new staff are now making major progress in their respective areas. A strategy to provide a blueprint to guide the development and implementation of a statewide marine monitoring program has been finalised and is being implemented. Similarly, draft strategies to guide the development of integrated tropical and temperate marine research plans in Western Australia have been formulated and are being progressively implemented. The initial focus of the monitoring and research plans is on WA's system of marine parks and reserves and on threatened marine fauna. The progress of each project is outlined in this document.

The administration of the WAMSI Node 3 Ningaloo Research Program is continuing with most projects due for completion in 2010. A major focus for 2008/09 has been the development of an operational knowledge transfer framework to assist the process of transferring the scientific knowledge gained through the research activities into practice (i.e. into policy, planning and operational management).

1. Introduction

This report outlines the performance of the Marine Science Program (MSP) for the 2008/09 financial year and is part of the Department of Environment and Conservation's (DEC) reporting and accountability obligations, under the CALM Act, to the Marine Parks and Reserves Authority. Copies of this report will also be provided to the Director General, Directors and all Regional, District and Specialist Branch Managers of DEC.

Funding for marine science in DEC occurs in the MSP, regional and specialist branch cost centres. This report focuses primarily on expenditure and outputs for 2008/09 by the MSP and does not include expenditure and outputs on marine science by regions and specialist branches or 'in kind' contributions from collaborating external agencies. However, this report has attempted to report on all DEC-supported marine science for the 2008/09 financial year.

The report format consists of individual project progress summaries using the Science Division Annual Research Activity Report proformas for both MSP and Regional marine science projects. The Science Division Scientist Productivity Framework proformas are used to summarise the major science, communication and knowledge transfer outputs of each scientist in the MSP for the 2008/09 financial year. Financial information is also provided.

2. Report on Activities and Outputs for 2008/09

The major marine science projects, activities and outputs are outlined in the section below. The report summaries are largely based on the marine component of the Science Division's Annual Research Activity Report (SDARAR) which is published each year in August and widely distributed.

2.1 Building a marine science capacity in DEC

Core project

Team members

C Simpson (0.2), K Bancroft (0.2); A Kendrick (0.05); S Armstrong (0.05): Total (0.5).

Context

The Marine Science Program (MSP) was established in the Science Division of DEC in May 2006. A Marine Science Strategy (MSS) was developed in 2006/2007 and endorsed by the DEC Corporate Executive in September 2007. The MSS provides a blueprint for building a marine science capacity in DEC and outlines a collaborative approach that will be taken with DEC regions and specialist branches and with external science providers. The objectives, functions outputs and outcomes for the research, monitoring and science communication units within the MSP are outlined as are proposed staff profile, strategic directions and priorities.

Summary of progress and key findings

- The selection process to appoint six permanent research positions was completed in mid-2008 and all staff had commenced work with the MSP by October 2008.
- Purchase and delivery of major field equipment, including a 5m rigid inflatable boat (RIB).
- Construction of MSP storage facilities and workshop on the Kensington site.
- MSP Business Plan 2008/09 (Report to the MPRA, September 2008).
- MSP Expenditure and Outputs for 2007/08 (Report to the MPRA, September 2009).
- Developed MSP guidelines for:

- Project planning and reporting;
- Staff performance management;
- Scientist productivity framework;
- Marine Science Communication Plan;
- Licensing of marine research and monitoring in DEC (draft);
- Publication processes for MSP staff (draft); and
- Science policy discussion paper.

Management implications
Not applicable.

Future directions (next 12-18 months)
- The acquisition of MSP laboratory facilities at the Kensington site
- Continued purchase of scientific and field equipment
- Developing operational criteria for staff performance management
- Developing operational criteria for research scientist level reclassification

DEC Region
All.

IMCRA Region
All.

NRM Region
All.

2.2 DEC marine science current projects database (WA Marine Science Inventory)

Core Project

Team members
S Armstrong (0.05): Total (0.05).

Context
The DEC Marine Science Program (MSP) keeps an updated inventory of State-wide marine science projects - the MSP 'WA Marine Science Inventory' stored on the MSP server. This information helps to keep track of what research is currently being undertaken relevant to marine conservation management in Western Australia. The database helps to identify gaps in knowledge and provide a rational basis for the prioritization of future marine science project planning. It will also assist scientific and academic organizations to work together towards a strategic and collaborative approach to marine research and monitoring in Western Australia.

Aligns with Corporate Strategies 2007-2009: 1.2, 1.5, 2.3, 7.1, 7.6, 8.1, 8.3, 8.4, 8.5, 8.8; KRAs: KRA1 KRA2.

Summary of progress and main findings
- Ongoing maintenance of the Database.

Management implications

The database will assist a strategic and collaborative approach toward marine science project planning in Western Australia.

Future directions (next 12-18 months)

- Ongoing database maintenance.
- Database to be uploaded onto the DEC Intranet.

DEC Region

All (coastal).

IMCRA Region

All (Western Australia).

NRM Region

All (coastal).

2.3 North West Marine Research Inventory

Core Project

Team members

C Simpson (0.05), K Waples (0.05); Total (0.1)

Context

The Commonwealth initiated its northwest marine bioregional planning exercises and, in conjunction with WAMSI generated support for the development of a metadata database of all completed, current and planned research in the marine and coastal environment from Kalbarri to the Northern Territory and extending out to the Economic Exclusion Zone (EEZ). This project was undertaken through Node 3 of WAMSI and, as such, was coordinated by DEC. A project team from CSIRO constructed and populated the database. The complete metadata database was transferred to iVEC so that it could be made available in a searchable format to all users on-line.

Aligns with Corporate Strategies 2007-2009: 8.3, 1.2

Aims

To develop a database of information on completed, current and planned marine and coastal research in the north-west marine region (Kalbarri to the Northern Territory) maintained in a format that will make this information available to those that need it with the aim of facilitating a strategic and collaborative approach toward future marine research, planning and management in Northern WA.

Summary of progress and main findings

- Project completed in July 2008 including the transfer of the metadata database to an on-line searchable facility through iVEC. The database is under the custodianship of the WAMSI data management officer/iVEC data management officer.
- A final report on the creation of the database and the extent of information that is contained within it was provided to and approved by the steering committee. While the database is not exhaustive, it was able to capture most of the published and much of the grey literature. The project team identified several issues that would need to be addressed for the database to be something other than just a snapshot in time of marine research.
- Staff with marine responsibilities in DEC (i.e. regions, specialist branches) were informed by email of the finalization of the inventory and how it could be accessed on-line.
- A paper was presented to the Inter-Departmental Committee to seek their support for further work

on implementing and promoting the database until it becomes routinely used and updated by users. Support for this further activity has yet to be approved.

Management implications

The completed database will provide a valuable resource for government agencies to identify what research has been undertaken in the marine environment and who holds the relevant information. This will help direct future research programs to fill gaps rather than repeat existing work.

Future directions (next 12-18 months)

Continue to consider and seek means to further promote and maintain the database so that it does not become obsolete, but rather a functional and working database with up to date information.

DEC Region

Kimberley, Pilbara, Midwest.

IMCRA Region

North West, Central West.

NRM Region

Rangelands.

2.4 Comparative marine biodiversity survey of the Rowley Shoals marine protected areas

SPP to be allocated.

Team members

S Wilson (0.05), S Armstrong (0.05), T Holmes (0.05); Total (0.15).

Context

Due to their isolation and protection from most human impacts, the Rowley Shoals are likely to be amongst the most pristine coral reef environments remaining in the world. As coral reefs continue to degrade worldwide, careful management of the Rowley Shoals will be required to establish and maintain them as regional and potentially global benchmarks for coral reef biodiversity conservation.

Successful management requires informed decision-making. Information trends in marine biodiversity over time is essential for assessment of effectiveness of the different management regimes in effect (or shortly to be in effect) across the three shoals. Monitoring of human impacts as manifested in changes in marine biodiversity over time will facilitate best possible management of the Rowley Shoals.

DEC was one of the two major collaborative partners in a major marine biodiversity survey that ran from 1-17 December 2007. The results and outputs produced by DEC and collaborators will be of direct relevance to management of sharks and benthic assemblages (including commercially important invertebrates), not only at the Rowley Shoals but elsewhere in tropical Western Australia.

Aligns with Corporate Priorities 2006-2007: 3, 5, 11, 12. KRAs NC 2B, 2E, 2F, 2G, 2I, 2J;

Aims

To collect data on the distribution and abundance of key components of marine biodiversity that can be used as indicators of the level of human impact on the reefs of the Rowley Shoals. These data will:

- enable local spatial comparisons between the three Rowley Shoals, which although biologically and geologically similar have differing histories of pressures and management;
- serve as a temporal baseline for longer-term monitoring of trends over time; and

- in combination with comparable datasets from other oceanic shoals off northwestern Australia, enable a timely overview of the regional and global conservation status of these coral reef communities to be undertaken.

Summary of progress and main findings

- Metadata report completed,
- Data report completed.
- Keyword-searchable database of WA Museum collections from WA's oceanic shoals completed.
- Photo ID field guides for algae and soft corals completed.

Management implications

- Provides initial datasets for monitoring programs eing developed for the Rowley Shoals marine protected areas.
- Increased public awareness of conservation significance of the Rowley Shoals marine protected areas.
- Increased awareness in federal agencies (DEWHA, Coastwatch) of need for vigilance against poaching.

Future directions (next 12-18 months)

- Data collected during December 2007 field trip to be included as part of the statewide long-term monitoring program currently being developed.
- Complete analysis of data collected by DEC during December 2007 field trip.
- Encourage AIMS to complete analysis of data collected during December 2007 field trip.
- Carry out baseline surveys of fish with respect to different management zones.
- Further assessment of investigations into causes of apparent coral pathology at the Rowley Shoals.

DEC Region
Kimberley

IMCRA Region
Offshore Oceanic Shoals

NRM Region
Rangelands

2.5 Distributions and patterns of major benthic communities of the Montebello/Barrow islands marine protected areas

SPP# to be allocated

Team members
K Bancroft (0.10); Total (0.10).

Context
The Montebello/Barrow islands marine protected areas (MBIMPA) were gazetted in April 2007. Coral reef communities, mangroves, and macroalgal and seagrass communities are identified as key performance indicators in the management plan. However, the current understanding of marine ecological communities in the Montebello/Barrow islands marine protected areas (MBIMPA) is limited. The existing marine benthic habitat map was developed for the reserve planning process, at a resolution that is too broad to determine patterns in distributions and diversity.

This project will further develop a better understanding of marine biodiversity patterns within the MBIMPA. New data, in the form of field surveys, high resolution bathymetry, ortho-aerials and modelled benthic habitat will be used in conjunction with existing remote sensing and ground truth habitat data, to determine the distribution and diversity of major marine benthic communities in the MBIMPA. The data gathered and compiled through this project will form an essential information layer, to assess the appropriateness of existing management zoning and for the ongoing management of the MBIMPA.

This project aligns with Corporate Priorities 2007-2009: 1.2, 2.3 and KRAs 1, 2, NC priorities 3, 4 and PVS priorities 2A

Aims

To improve the understanding of the distribution and diversity of the major marine benthic communities in the Montebello/ Barrow Islands marine protected areas.

Summary of progress and main findings

A data report was published in January 2009.

Further univariate and multivariate statistical analyses have been undertaken.

The introduction and methods sections of a draft technical report have been completed and the results and discussion sections partially completed.

Related activities include:

- Ongoing liaison with Apache Energy Ltd and Chevron Australia Pty Ltd regarding long-term monitoring data exchange and access to the spatial data such as habitat ground-truthing: and
- Advice provided to the Environmental Management Branch on benthic habitat mapping and classification and on the dredging monitoring program for the proposed Gorgon Gas development.

Key preliminary findings include:

- The presence of significant coral reefs along the eastern side of the Montebello/Barrow islands (~100 km);
- Large *Porites* colonies are a conspicuous component of these reefs and support high abundance and diversity of finfish;
- Preliminary analyses suggest that the abundance and species composition of hermatypic coral communities are significantly influenced by exposure to long-period swell and cyclonic waves; and
- The abundance of the common coral predators, *Acanthaster planci* and *Drupella* spp., is low and currently do not appear to be causing extensive damage to live corals on these reefs.

Management implications

- The provision of information that assist in addressing Montebello/Barrow Islands Marine Conservation Reserves Management Plan 2007-2017 strategies: 7.6 (2); 7.6 (4); 9.1.3 (5); 9.1.4 (3); 9.1.5 (4); 9.1.6 (3); 9.1.6 (6); 9.1.7 (3); 9.1.7 (5); 9.1.8 (5); 9.1.9 (4); and 9.1.9 (5).
- Increase understanding on the condition of the coral reef, reef fish and corallivorous invertebrates communities of the Montebello/ Barrow Islands marine protected areas.
- Increase understanding on the distributions of marine benthic communities of the Montebello/ Barrow Islands marine protected areas.
- The identification of Porites coral colonies suitable for effects of climate change research to be undertaken by AIMS.

Future directions (next 12-18 months)

- Finalise and publish the technical report.
- Resurvey the coral communities at established sites within the zone of influence and prior to, during and after the proposed Gorgon dredging operations.
- Quantitatively survey finfish communities at established sites within the zone of influence and prior

to, during and after the proposed Gorgon dredging operations.

DEC Region
Pilbara.

IMCRA Region
Pilbara Offshore.

NRM Region
Rangelands.

2.6 Establishing a long-term monitoring program for the proposed Dampier Archipelago Marine Park

SPP# 2008/002.

Team members
S Armstrong (0.05) ; Total (0.05)

Context
The proposed Dampier Archipelago Marine Park (DAMP) is located off the north-west coast of Western Australia approximately 1,650 km north of Perth. The area comprises of a wide range of marine habitats that support diverse marine biota, including more than 736 fish species and 230 scleractinian coral species, making the Dampier Archipelago the second most diverse site in Western Australia for hard corals. The marine environment of the area has considerable regional ecological and social conservation significance and is subject to increasing human use, including major offshore oil and gas production and associated port development. The region is also subject to a range of commercial and recreational fishing activities and the Dampier area has the highest per capita boat ownership in Western Australia.

Trends in resource condition over time are essential for assessment of the effectiveness of the proposed management regime for the DAMP. This project has established long-term monitoring sites, using a BACI design, to obtain data on the abundance of selected finfish species and the cover of benthic reef communities 'before' the zoning scheme is implemented. These data will provide estimates of the current condition of the reef and reef finfish populations at selected sites to compare with future data following the establishment of the DAMP and the implementation of the zoning scheme (i.e. comparisons between sanctuary and non-sanctuary zones). The data will also be compared to historical data to provide a longer-term temporal perspective.

Aligns with Corporate Strategies 2007-2009: 1.2, 2.3, 2.4, 7.1, 7.6, 8.1, 8.4, 8.5; KRAs: KRA1 KRA2

Aims
To monitor targeted fin fish abundance and length and rock lobster density such that any differences over time between protected and non-protected zones of the DAMPA can be detected.

Summary of progress and main findings
- Preliminary comparisons with an historical AIMS dataset suggests that some target finfish populations have declined significantly between 1993 AIMS survey and the 2006 DEC survey.
- A data report was published in early 2009.
- The introduction, methods, results and discussion sections of a preliminary draft technical report have been completed.

Management implications

- The project will provide information trends in resource condition over time for assessment of the effectiveness of the proposed management regime.
- Increase understanding on the condition of Dampier Archipelago coral reef communities.
- Increase understanding on the condition of Dampier Archipelago reef fish communities.
- Increased public awareness of conservation value of the Dampier Archipelago.

Future directions (next 12-18 months)

- Complete the technical report.

DEC Region
Pilbara.

IMCRA Region
Pilbara Nearshore.

NRM Region
Rangelands.

2.7 Monitoring the coral predator, *Drupella cornus,* in Ningaloo Marine Park

SPP# 2008/002.

Team members
S Armstrong (0.2), Total (0.2)

Context
Between the mid 1980s and early 1990s, the feeding activity of unusually high densities of the corallivorous gastropod *Drupella cornus* resulted in massive coral damage along at least 100 km of Ningaloo Marine Park (NMP), with coral mortality approaching 100% at some areas. The density of *D. cornus,* the area and severity of associated coral damage and longevity of the outbreak itself that occurred at NMP during this event was on a greater scale than recorded on other reefs elsewhere in the world to date.

As the health of coral communities is a key performance indicator of management of NMP and the Muiron Islands Marine Management Area (MIMMA), it is essential to keep a watching brief on spatial and temporal changes to *D. cornus* densities and cover of associated corals in these conservation reserves. Adhering to this management need, the aim of the Ningaloo Marine Park *Drupella* Long-term Monitoring Program (NMPDMP) is to monitor long-term changes in the density of *D. cornus* and cover of associated coral communities at the NMP and the MIMMA. Monitoring of *D. cornus* at NMP has produced a long-term data set with information describing the status of *D. cornus* populations and coral communities dating back to 1987.

A strategy in the Ningaloo Marine Park Management Plan 2005-2015 requires that *D. cornus* abundance and the health of coral communities be surveyed at least every three years with the last major survey undertaken in April 2008.

Aligns with Corporate Strategies 2007-2009: e.g. 1.2, 2.3, 2.4, 7.1, 8.1, 8.4, 8.5; KRAs: KRA1 KRA2.

Aims
To identify trends in *D. cornus* density and cover of associated benthic communities at NMP and MIMMA, by monitoring these variables on a long-term basis.

Summary of progress and main findings

- The results of the surveys indicate that between 1987 and 2008 the changes in D. *cornus* density and percent cover of live hard coral has varied considerably between locations. Overall, however, relative to the outbreak densities recorded during the late 1980s and early 1990s, D. *cornus* densities have been low to moderate since 1994 and have not greatly affected coral cover within the NMP and MIMMA.
- The findings of the 2008 survey support this trend and suggest that current D. *cornus* densities represent no immediate threat to NMP and MIMMA coral communities.
- A data report on the 2008 field survey was completed and published in early 2009.
- A draft technical report was completed in March 2009.
- A paper outlining the study results was published in the Ningaloo Research Program Progress Report 2008 in September 2008.
- A DEC Science Information Sheet 2009 on the study was produced and printed in early 2009.

Management implications

- D. *cornus* populations pose no immediate threat to coral communities at NMP or MIMMA.
- Mechanical damage to corals (e.g. during boating and diving activities) may attract D. *cornus*.
- It is recommended that a simple education pamphlet be developed and distributed by Exmouth District as soon as possible to encourage more sustainable diving and boating practices to address this issue.

Future directions (next 12-18 months)

- Finalise and publish the technical report
- Complete scheduled 2010 Drupella survey
- Detailed analysis of Drupella coral community data to assess the level of change over the past 20 years.

DEC Region
Pilbara

IMCRA Region
Ningaloo

NRM Region
Rangelands

2.8 Bills Bay reef recovery study and coral spawning observations in Ningaloo Marine Park

SPP# to be allocated

Team members
S Armstrong (0.1),, Total (0.1).

Context
In 1989, a novel form of disturbance *was recorded at Bills Bay* in *WA*: unusually calm wind and sea conditions coincident with mass coral spawning caused a dystrophic crisis as the respiratory demand of the spawn slick followed by its decomposition depleted available oxygen in the water column and sediments. Up to 100% of corals, fishes and reef invertebrates died at some sites during this event, including colonies up to 50 years old, indicating that a mass mortality of this magnitude had not occurred for at least four to five decades. Anecdotal reports of less severe anoxic events at Bill's Bay

coincident with coral spawning on several occasions since 1989 indicate that such events may not be uncommon in this location. Since 1989, the recovery of coral reef communities at Bill's Bay has been monitored. Findings from a survey in 2006 indicated that recovery of pre-disturbance levels of coral cover occurred within 10 years, and recovery of pre-disturbance type acroporid-dominated coral communities was achieved at one site within 17 years. Most recovering near-shore sites had not yet reached this successional stage by 2006.

In March 2008, another anoxic event was recorded at Bills Bay. Hundreds of dead fish were washed up along the south eastern shoreline of Bills Bay and coral bleaching was observed along the eastern side of Bills Bay.

Aligns with Corporate Strategies 2007-2009: 1.2, 2.3, 8.4, 8.5; KRAs: KRA1 KRA2

Aims
To monitor the recovery of corals at Bills Bay from the 1989, and any subsequent, dystrophic crisis events.

Summary of progress and main findings

- A field survey was undertaken several months after the event in mid 2008 to determine the extent of coral mortality. Significant coral mortality was only recorded at the inner (nearshore) sites where average live hard coral cover at these sites was reduced from 55% to 40%. The coral mortality was mainly confined to branching and foliose species such as Acropora and Montipora spp. while the massive (i.e. 'brain) corals (e.g. favids and poritids) appeared to have been largely unaffected by this event. Similar patterns of coral mortality have been recorded in past surveys of these events.
- A data report (1) documenting the spawning-induced anoxic event in March 2008 was published in early 2009.
- A draft data report (2) documenting the results of the July 2008 survey of the coral communities has been completed.
- A draft technical series has been completed.
- A paper was published in the Ningaloo Research Program Progress Report 2008 in September 2008.
- A DEC Science Information Sheet 2009 was produced and printed in early 2009.
- A Western Australian newspaper article on the study was published in late 2008.
- A Northern Guardian newspaper article on the study was published in late 2008.

Management implications
Surveys of the recovery of the coral reef communities at Bills Bay has been on-going for 20 years and provides valuable insights into the nature and timescales of coral reef recovery in Ningaloo Marine Park. This study is also providing information on the potential response of coral communities in Ningaloo Marine Park to potential climate change impacts.

Future directions (next 12-18 months)

- Finalise and publish data report (2).
- Finalise and publish the technical series.
- Undertake and publish a synthesis of all data collected since 1989.

DEC Region
Pilbara

IMCRA Region
Ningaloo

NRM Region
Rangelands

2.9 Mapping the coral reef communities of the Shark Bay Marine Park

SPP# to be allocated

Team members
K Bancroft (0.05).

Context
While the Shark Bay Marine Reserves Management Plan 1996-2006 (Department of Conservation and Land Management 1996) is anticipated to be reviewed within the next year, The Shark Bay Terrestrial Reserves Management Plan 2000-2010 (Department of Conservation and Land Management 2000) and the Shark Bay World Heritage Property Strategic Plan (Department of Environment and Conservation 2006) are currently being reviewed. This planning activity provides a window of opportunity for increased technical understanding to immediately inform management, for example, by identifying areas of high conservation value as well as potential human interactions with these values.

The distributions of perennial seagrass meadows in the Shark Bay marine protected areas (SBMPA) are reasonably well understood, there are very few data on ephemeral seagrasses and mangals, and no data on other important benthic communities such as coral reefs, filter-feeders, stromatolites, subtidal reef platforms, beaches, rocky shore or intertidal shoreline reef. Although marine ecological communities are of high conservation value in the SBMPA and the proposed extensions, our understanding of their distributions is limited. The spatial scale of the existing marine benthic habitat map is not at an adequate scale in some areas of the SBMPA for MPA management.

New data obtained by this project, in conjunction with existing aerial photogrammetry and satellite imagery, will increase the current understanding of the distribution and diversity of coral reef communities in the SBMPA. The data gathered and compiled through this project will be presented as GIS information layer for use in the planning phases and the ongoing management of the SBMPA and the proposed extensions to the marine protected areas.

Aligns with Corporate Priorities 2007-2009: 1.2, 2.3. KRAs 1; 2. NC priorities 3; PVA 1A; 2A

Aims
To improve the understanding of the distribution and diversity of coral reef communities in the Shark Bay marine protected areas.

Summary of progress and main findings
- A data report was published and distributed in January 2009.
- A Landscope article was published in Spring 2008.

Management implications
- This project directly addresses Shark Bay Marine Reserves Management Plan 1996-2006 (Department of Conservation and Land Management 1996) management strategies: 5.3 (1); 5.3 (3); 5.5.1 (2) and 11.0 (6).
- Increase understanding on the distribution patterns of the coral reef communities of the Shark Bay marine protected areas.

Future directions (next 12-18 months)
Project is completed.

DEC Region
Mid West

IMCRA Region
Shark Bay

NRM Region
Rangelands

2.10 Summary of historical marine research and monitoring relevant to the Jurien Bay Marine Park

Core project

Team members
K Bancroft (0.15), M Rule (0.05), A Kendrick (0.05).; Total (0.25)

Context
A significant amount of research and monitoring has occurred in the Jurien Bay Marine Park (JBMP) since the beginning of the reservation planning process in 1996 and the gazettal of the park in 2005.
At the launch of the park in 2005, the State Government made commitments to:

- Undertake research to examine the impacts of the rock lobster fishing on the biodiversity of the marine park; and
- Undertake research that would contribute to an understanding of the effectiveness of management zoning.

Since gazettal, there have been numerous research and monitoring projects that have been undertaken by scientists based in State and Commonwealth departments or agencies and several universities, such as WA Museum, Department of Fisheries and the Department of Environment and Conservation, University of Tasmania, University of Western Australia, Edith Cowen University, Murdoch University and CSIRO. A $10 million joint State Government and CSIRO initiative "*Strategic Research for the Marine Environment*" (SRFME) involved research that investigated fauna and flora distributions, coastal processes, physical and biological oceanography, nearshore water quality, benthic communities, commercial and recreation fishing impacts/trends, passive human usage patterns and effectiveness of management zoning.

Activities of this project will include the collation of specific literature relevant to JBMP, recent and current research, and the collation and analysis of appropriate data. This project will provide monitoring information suitable to feed into the marine park management reporting framework for delivery to the Marine Parks and Reserves Authority (MPRA) audit process and the opportunity to assess the gaps in knowledge and to target research and monitoring in priority areas.

Aligns with Corporate Priorities 2007-2009: 1.2, 2.3, KRAs 1, 2, NC priorities 3, 4; and PVS priorities 2A.

Aims

- To identify all ecological and social research that has been undertaken in the reserve in recent years.
- To analyse these data and provide monitoring data to inform marine park management performance reporting related to the Marine Parks and Reserves Authority (MPRA) audit process.

Summary of progress and main findings

- The meta database has been completed.
- The analysis of historical research and monitoring projects has been finalized and a data report has

been published and distributed.

Management implications

- Addresses the JBMP Management Plan 2005-2015 (Department of Conservation and Land management 2005) management strategies: 8.4 (1); 8.4 (3); and 8.5 (1).
- Will assist the development of an integrated marine monitoring program in JBMP.
- Will assist in the identification of research gaps.
- Will assist the provision of resource condition data into the MPRA audit process.

Future directions (next 12-18 months)

- Project is completed.

DEC Region
Mid West

IMCRA Region
Central West Coast

NRM Region
Northern Agricultural Catchment

2.11 Using marine habitats as surrogates to map biodiversity

Core project

Team members
K Bancroft (0.2), C Simpson (0.025).

Context
Marine habitats are commonly used as surrogates for marine biodiversity to overcome the difficulties and costs of surveying and mapping marine biodiversity directly. Marine benthic habitat mapping exercises have been undertaken in many coastal areas of Western Australia using different methodologies and a range of habitat classification schemes. This approach has produced an array of habitat data of varying quality and utility to DEC. This project aims to develop a framework that guides the progressive collection and interpretation of marine habitat data by regional DEC staff. This approach will facilitate the collection of essential biological information, in a targeted, cost-effective and standardised way, to plan and manage the marine environment of Western Australia, with an initial focus on WA's marine protected areas.

The outputs of this project will service a wider, longer-term Marine Science Program objective of developing a standardised approach to the collection of marine habitat data throughout Western Australia.

Aligns with Corporate Priorities 2007-2009: 1.2, 2.3, KRAs 1, 2, NC priorities 3, 4; and PVS priorities 2A.

Aims

- To develop an operational framework for the standardised collection of marine habitat data by DEC staff,
- To develop and include a standardised marine habitat classification scheme within the framework;

Summary of progress and main findings

- A draft technical report, including a preliminary marine habitat classification scheme, has been completed

.

Management implications

Will assist the progressive collection and interpretation of marine habitat data by regional DEC staff in a targeted, cost-effective and standardised way to facilitate the provision of the essential biological information needed to plan and manage marine protected areas in Western Australia.

Future directions (next 12-18 months)

- Finalise and publish the technical report.

DEC Region

All

IMCRA Region

All

NRM Region

All

2.12 WAMSI Node 3: Science administration, coordination and integration

Core project.

Team members

K Waples (0.3); C Simpson (0.05); Total (0.35).

Context

In 2005 the State Government allocated $5million to undertake research at Ningaloo Marine Park that would underpin its management. A Ningaloo Research Program (NRP) was developed in consultation with marine resource managers and scientists to address key strategies in the Ningaloo Marine Park Management Plan. In 2007 a joint research body, the Western Australian Marine Science Institution (WAMSI) was formed and provided with substantial government funding. Research within WAMSI was divided into several themes, each with a lead agency. The DEC is the leader of Node 3 of WAMSI which addresses research in marine biodiversity and conservation. The NRP was accepted as the initial science plan for Node 3 of WAMSI and the $5million allocated to this research was made included as part of the government funding to WAMSI.

At the same time as the development of WAMSI, CSIRO *Wealth from Oceans* National Research Flagship program established a marine research program within Ningaloo Marine Park called the Ningaloo Collaboration Cluster. This research program is designed to complement the NRP. In addition, AIMS has a number of research projects underway at Ningaloo as part of their core research.

DEC is working together with representatives from the Ningaloo Collaboration Cluster and AIMS to ensure that the planned research takes place so that it meets management needs and to ensure the research is properly integrated and communicated. The WAMSI projects described below are an integrated set of projects to achieve these objectives

The science plan for Node 3 of WAMSI consists of 6 main projects which include up to 20 subprojects. Each project area is led by a different institution/University. Thus the coordination and administration role entails ensuring that all project plans are in place and are running smoothly according to the agreed outputs and timeframes. This is managed through the provision of management questions for

each project to the project leader, the review of milestone reports and through direct meetings with the Project leaders.

Integration of research within Node 3, across WAMSI and between WAMSI and the Ningaloo Collaboration Cluster is managed through the formation of the Ningaloo Research Coordinating Committee (NRCC) and through the following activities which serve to provide forums for sharing information, increasing collaboration between scientist groups and engaging managers and stakeholders:

- Annual Ningaloo Research Symposium
- WAMSI Operations Group
- WAMSI cross nodal symposia and meetings
- Directed workshops for specific projects(e.g. Management Strategy Evaluation)

Aligns with Corporate Priorities: 7.1, 7.6, 8.4, 8.5 and KRA2 NC2E

Aims

- To ensure the coordination and administration of the research program conducted under Node 3 of WAMSI.
- To ensure the integration of this research program with other research within WAMSI and with external programs relevant to the Ningaloo Marine Park.

Summary of progress and main findings

- Milestone reports received from the projects underway demonstrate that research is on track and is producing relevant findings on sanctuary zones, biodiversity, oceanographic processes and habitats.
- WAMSI science review of all Node 3 research projects undertaken in February 09. All projects were deemed to be producing quality science and to generally be progressing well.
- A progress report of the NRP was produced and published in October 2008. This report included extended abstracts on all of the Node 3 projects as well as a range of other research underway at Ningaloo and had a specific focus on implications for management from the research. The report was widely distributed and has been made available on both the WAMSI and NRP websites.
- Regular meetings of the NRCC to ensure ongoing integration of research and to plan for the 3rd Annual Ningaloo Research Symposium
- Third Annual Ningaloo Research Symposium- Ningaloo Into the Future: Integrating Science into Management held on 26 and 27 May in Exmouth. The symposium was attended by 100 scientists, managers and interested members of the Exmouth Community. It served a valuable role in promoting the quality science being produced by the NRP.
- Ningaloo Student Research Day held on 30 March in Perth. This event was well attended, with 9 presentations made and 17 abstracts included in the proceedings.

Management implications

A key role of this project is to ensure that outcomes of the research both within the NRP and from external research programs is reviewed and used in refining and updating management of the Ningaloo Marine Park through changes to policy, management activities and planning exercises where relevant.

Future directions (next 12-18 months)

- Continue to monitor progress of the various research projects and communicate findings and information as it becomes available.
- Continue to interact with the NRCC and develop joint communication activities to further integrate the research programs.

DEC Region
Pilbara

IMCRA Region
Ningaloo

NRM Region
Rangelands

2.13 WAMSI Node 3: Communication

Core project

Team members
K Waples (0.1); C Simpson (0.05); Total (0.15).

Context
See context for *WAMSI Node 3: Science administration, coordination and integration* project.

Communication is a key factor for the NRP as it is essential to ensure:

- full integration of research projects from various disciplines;
- knowledge transfer occurs between scientists and resource managers/decision makers;
- the development of linkages between projects and scientists; and,
- the community are aware of research findings and their value to management.

To address the need for good communication and the involvement of a number of organizations and institutions, a joint Ningaloo Research Communication Plan was drafted and implemented. Elements of the Communication Plan also fit in with activities under WAMSI Node 3 Science administration, coordination and integration.

Aligns with Corporate Strategies: 7.1, 7.6, 8.5 and KRA2 NC2E

Aims

- To ensure the research undertaken through the NRP is fully integrated and that the outputs reach the target audiences.
- To ensure the knowledge transfer occurs between scientists and resource managers/policy makers.
- To demonstrate to government that investment in marine science in WA is worthwhile.

Summary of progress and main findings

- Communication Plan and information sheet for scientists provided to scientists within the NRP and made available on the NRP website
- NRP website improved and information provided on all WAMSI Node 3 research projects
- Presentations and meetings to discuss Node 3 research made to relevant audiences as detailed in the Communication Plan (MPRA, Pilbara Region, WAMSI Board, Ningaloo Sustainable Development Office)
- Media releases prepared prior to Ningaloo Research Symposia and production of the NRP progress report.
- Interviews with the media undertaken in relation to the Ningaloo Student Research Day and the third Annual Ningaloo Research Symposium held in 2009

Management implications

Good communication will enhance knowledge transfer which is critical for the uptake of the knowledge generated into management practices.

Future directions (next 12-18 months)

- Ongoing communication activities as outlined in the plan.

DEC Region

Pilbara

IMCRA Region

Ningaloo

NRM Region

Rangelands

2.14 WAMSI Node 3: Data management

Core project.

Team members

K Waples (0.1); C Simpson (0.05) Total (0.15).

Context

See context for *WAMSI Node 3: Science administration, coordination and integration* project.

A critical element to the success of WAMSI is effective management of the data and outputs produced through the research. To that end, a data management protocol was included in the project agreement for each project. This protocol addresses the submission of metadata, data and data products and their long term storage and custodianship. Currently data is being housed through the iVEC data storage facilities, with metadata available on-line. Data and data products will be made available to scientists, managers and those requiring them at the conclusion of each individual project.

Aligns with Corporate Strategies: 7.1, 8.1. 8.5.

Aims

To ensure the long term storage and custodianship of data from research undertaken through Node 3 of WAMSI.

Summary of progress and main findings

- Data management protocol agreed by all project leaders
- Metadata for each project provided to the WAMSI data management officer
- Data provided as it becomes available through milestone reports

Management implications

The program of research within the NRP will produce more data than can or will be analysed before the conclusion of the program. However, with careful provision of metadata and storage, untapped data will be available for future management needs. Additionally, data products derived from the research will available and easily accessible by field managers and planners in ongoing management activities (e.g. GIS referenced maps of biodiversity, human use patterns, etc)

Future directions (next 12-18 months)

- Continue to liaise with the WAMSI data management officer to ensure Node 3 research project leaders are updating and submitting data.

DEC Region
Pilbara

IMCRA Region
Ningaloo

NRM Region
Rangelands

2.15 WAMSI Node 3: Knowledge transfer

Core project.

Team members
K Waples (0.2); C Simpson (0.05); Total (0.25).

Context
See context for *WAMSI Node 3: Science administration, coordination and integration* project.

The success of this program of research depends upon the transfer and uptake of knowledge generated through the research into management policies, practices and actions. Enhancing this knowledge transfer is one key role of the Marine Science Program.

To achieve this, a framework has been developed that will assist in opening and maintaining a dialogue between scientists and managers/decision-makers. In addition, we are furthering the additional elements that are critical to knowledge transfer and uptake (e.g. data management, communication and presence of an intermediary). The MSP sees its role as an intermediary at the interface between science and policy, in particular when dealing with scientists and agencies outside of the DEC. We intend to fulfil this role through:

- Developing strategic research plans and clearly defined management questions for all marine research undertaken or supported by the MSP;
- Maintaining clear and open communication with internal and external scientists through direct contact and collaboration;
- Actively working with both scientists and marine resource managers to clearly identify immediate and potential applications of research outputs; and

Ultimately it is hoped that through this process we will develop joint documents with both scientists and decision-makers/managers (e.g. guidelines or policy statements) that can be used at an operational level.

Aligns with Corporate Strategies: 7.1, 7.6, 8.4, 8.5.

Aims
To ensure that knowledge transfer and uptake occurs between scientists, resource managers and decision-makers.

Summary of progress and main findings

- Management questions have been outlined and provided to the project leaders of all Node 3 WAMSI research projects. Discussions have been held with project leaders to ensure that, as

research projects progress, they will be able to deliver on these management questions.

- A paper was published in the Ningaloo Research Program Progress Report (Oct 2008) on the knowledge transfer issue.
- Framework developed that will enhance knowledge transfer through the completion of a matrix by both scientists and users of the information. The framework addresses the management application of specific research through the seven generic management strategies applied to marine protected area management and includes detail on the users of the information and the most suitable format to ensure it is noted and used at an operational level.
- Framework presented at the 3rd Annual Ningaloo Research Symposium (May 2009) to an audience including both managers and marine scientists in the NRP. A paper was also published in the proceedings of the Symposium.

Management implications

The NRP is producing a vast amount of knowledge on the Ningaloo Marine Park including a new understanding of the significance of biodiversity in deep water areas as well as highlighting the impacts of fishing pressures over time. This information is vital to the long term management of the marine park resources and this project will help ensure that the information reaches the correct departments/individuals and in an appropriate format so that it is acknowledged and acted upon as necessary.

Future directions (next 12-18 months)

The knowledge transfer framework will be further developed and a paper submitted for publication in a peer reviewed journal. The framework will also be implemented through direct contact with scientists in the NRP and with the relevant managers who will use their research findings.

DEC Region

Pilbara

IMCRA Region

Ningaloo

NRM Region

Rangelands

2.16 SRFME Carry-over Projects for Jurien Bay Marine Park

Core project.

Team members

K Waples (0.01); Total (0.01).

Context

At the conclusion of the Strategic Research Fund for Marine Environment (SRFME), there were six projects that remained unfinished. The majority of these addressed biodiversity issues at Jurien Bay Marine Park and included studies on ecological interactions in the marine park, primary production and fish communities as well as final documentation and archiving of the data. These projects were handed over to the DEC to manage to completion under the coordination of the Marine Science Program. The outstanding projects have experienced delays for various reasons, including changes to methodology and analysis, movement of staff and delays in filling positions, however, all projects are due to be completed by December 2009.

Aligns with Corporate Priorities: 8.4, 8.5.

Aims

To ensure the research undertaken through the Strategic Research Fund for Marine Environment is completed and all contractual obligations are met.

Summary of progress and main findings

- Final reports for one project received.
- Final reports for the remaining three projects expected by Dec 09.

Management implications

The milestone and final reports for each project will be reviewed for their implications to management and changes recommended to management practices, policies and planning activities where relevant.

Future directions (next 12-18 months)

Continue to monitor progress of the outstanding research projects and communicate findings and information as it becomes available.

DEC Region

Mid West

IMCRA Region

Central West Coast

NRM Region

Northern Agricultural Catchment

2.17 Conservation of marine turtles in Western Australia

SPP# 1993/040.

Team members

B Prince (0.75); Total (0.75).

Context

All marine turtles found in WA waters are listed as threatened species by the Commonwealth of Australia and the State of Western Australia. This long-standing statewide research project aims to provide the critical scientific information for the conservation of marine turtles in Western Australia and the management of human pressures on these animals. Currently turtle research and monitoring in Western Australia is undertaken by DEC Science Division and regional staff, academics and industry consultants with limited standardisation of methods or integration of data. There has also been a significant increase in turtle research in Western Australia by external (to DEC) scientists over the past decade as a result of the potential impacts on these species from industrial development. A comprehensive review of all (internal and external) historical and current turtle research and monitoring is needed to undepin the development of an integrated statewide approach to turtle research and monitoring in Western Australia, as outlined in the recently completed Western Australian turtle recovery plan. This review will be undertaken in 2009/10.

This project aligns with Nature Conservation Output KRA 4, recovery of threatened species, particularly NC 4E, complete and implement the proposed State sea turtle management plan.

Aims

- To gain an adequate understanding of the distribution and abundance of marine turtle populations utilizing WA rookeries and marine habitats, the nature of inter-relationships within species at the regional level between groups using different rookeries, and the linkages between nesting and

living areas of importance for the maintenance of these adult turtle populations.

- To develop an understanding of the processes affecting maintenance and abundance of these marine turtle populations as an aid to addressing management needs.
- To develop appropriate management measures and interpretation packages.

Summary of progress and main findings

- Integrated turtle tagging database developed and provided to regional staff.
- Ongoing liaison with State and Commonwealth agencies regarding management of threats to marine turtles.
- Continued input into Departmental response to the Gorgon EIS/ERMP in relation to flatback turtles on the east coast of Barrow Island.
- Ongoing study into monitoring of nesting beach temperature profiles.
- Varanus Island turtle population modelling exercise is well advanced. Draft publication in progress.

Management implications
Provision of knowledge to allow adequate management of marine turtle stocks.

Future directions (next 12-18 months)

- Project to be reviewed in 2009/10 as part of a broader review of turtle research and monitoring (see context above)

DEC Regions
Midwest, Pilbara, Kimberley

IBRA Regions
Geraldton Sandplains, Carnarvon, Pilbara, Dampierland, North Kimberley

NRM Regions
Rangelands, Northern Agricultural, Swan, South West

2.18 Strategy for the development and implementation of an integrated, tropical marine research plan: 2010-2015

Core Project

Team members
S Wilson (0.30), T Holmes (0.30), C Simpson (0.025), K Friedman (0.025); Total (0.65).

Context
The research plan will ensure that DEC-funded marine research will be implemented in a strategic and integrated manner, and that appropriate scientific information is available to support DEC's tropical marine protected areas and marine fauna management programs. The document will outline a systematic framework to prioritise marine research, and ensure that research is not needlessly duplicated across biogeographically similar marine reserves or IMCRA bioregions. The local relevance of national and international research will also be assessed. The plan will identify research priorities based on relative conservation significance of the assets, the adequacy of existing knowledge and the relative level of human pressures. Science delivery will be undertaken internally by DEC, through collaborations with external science institutions (e.g. AIMS, CSIRO, universities) and via external contracts.

This project aligns with Corporate Priorities (Key Strategic Aspirational Goals and Actions): 1.1, 1.21, 2.2, 2.9, 2.26, 2.33, 3.1, 4.2
Key Result Areas KRAs 1, 2, 3; Key Supporting Strategies S1, S3.

Aims
To develop and progressively implement a strategic and integrated research plan to support WA's tropical marine protected areas and marine fauna management programs.

Summary of progress and main findings

- Draft Strategic Plan for the Development and Implementation of Marine Research in the Department of Environment and Conservation, Western Australia 2008-2018 completed for internal review.
- Tropical research equipment capacity developed.
- Concept plan for research project The interaction between climate change and fishing has been approved and a draft of the scientific project plan has been written and in MSP and external review.
- Concept plan for Assessing coral disease in WA has been written and in MSP review.
- Collaboration with ECU to purchase and jointly own VRAP system.

Management implications
Development and implementation of the strategic temperate research strategy will enhance DEC's capacity to plan for and manage WA's marine protected areas and threatened marine fauna.

Future directions (next 12-18 months)

- Completion and distribution of the tropical marine research strategy.
- Development and progressive implementation of the research plan.

DEC Region
Pilbara and Kimberly

IMCRA Region
Ningaloo, Pilbara Inshore and Offshore, Offshore Oceanic atols

NRM Region
Rangelands

2.19 Strategy for the development and implementation of an integrated, temperate marine research plan: 2010-2015

Core project

Team members
A. Kendrick (0.55 FTE), M. Rule (0.30 FTE), K. Friedman (0.025 FTE), C. Simpson (0.025 FTE)

Context
See context for the tropical research strategy outlined above

This project aligns with:

- Key Strategic Goals: 1.1, 1.21, 2.10, 3.1, 4.2;
- Key Result Areas: KRA1, KRA2, KRA3; and
- Key Supporting Strategies S1, S3.

Aims
To develop and progressively implement an integrated research plan to support WA's temperate marine protected areas and marine fauna management programs.

Summary of progress and main findings

- Draft Strategic Plan for the Development and Implementation of Marine Research in the Department of Environment and Conservation, Western Australia 2010-2015 completed for internal review.
- Temperate research equipment capacity building program is well advanced.
- Concept Plan for research project The biogeography of mangrove communities in the Shark Bay Marine Park completed and approved. A Science Project Plan has been drafted and is in MSP review.
- Concept Plan for research project Spatial and temporal patterns in the structure of inter-tidal rocky platform communities of the Shoalwater Islands and Marmion Marine Parks completed and approved. A Science Project Plan has been drafted and is in MSP review.
- A Concept Plan for marine research at the Walpole and Nornalup Inlets Marine Park is in preparation.
- Collaboration with Edith Cowan University's Centre for Marine Ecosystem Research to conduct temperate marine biology course field work and lecturing.
- Collaboration with ECU to purchase and jointly own a VRAP acoustic tracking system.

Management implications

Development and implementation of the strategic temperate research strategy will enhance DEC's capacity to plan for and manage WA's temperate marine protected areas and marine fauna management programs.

Future directions (next 12-18 months)

- Completion and distribution of the tropical marine research strategy.
- Development and progressive implementation of the temperate research plan.

DEC Regions

Midwest, Swan and Warren

IMCRA Regions

Shark Bay, Central West Coast, WA South Coast

NRM Region

NACC, PRNRM, SWCC

2.20 Strategic plan for the development and implementation of a long-term marine monitoring program in Western Australia: 2009-2019

Core project

Team members

K. Friedman (0.2 FTE), C. Simpson (0.05 FTE)

Context

The successful establishment of a long-term, broadscale, institutional marine monitoring program requires a strategic approach to be taken. The strategic plan for the Western Australian Marine Monitoring Program (WAMMP) will outline the rationale, major tasks, timelines and delivery models that are required in the development and implementation of an integrated long-term, statewide marine protected area and threatened marine fauna monitoring program in the WA's coastal waters.

This project aligns with:

- Key Strategic Goals: 1.1, 3.1, 3.7, 3.8, 3.9, 4.2, 4.8, 4.10;
- Key Result Areas: KRA1, KRA2, KRA3; and
- Key Supporting Strategies S1, S3.

Aims
To develop a strategic plan to guide the development and implementation of an integrated long-term, statewide marine protected area and threatened marine fauna monitoring program in Western Australia.

Summary of progress and main findings

- Principal Research Scientist (Monitoring) position in place in October 2008.
- Draft Strategic Plan for the Development and Implementation of The Western Australian Marine Monitoring Program (WAMMP) in the Department of Environment and Conservation, Western Australia 2009-2018 completed for internal review.
- Presentations on the Strategy to Nature Conservation Leaders Meeting and District and Regional Leaders meeting.
- Preliminary discussions with Department of Fisheries (DoF) to integrate departmental marine monitoring programs where appropriate.
- Preliminary discussions with with local universities (i.e. UWA, Curtin, ECU, Murdoch.), Commonwealth agencies (e.g. AIMS, CSIRO) and the Australian Marine Science Association about potential future collaborations within the WAMMP.

Management implications
The development and implementation of the strategic plan for marine monitoring within DEC's marine conservation programs in an adaptive management context will improve the efficiency and effectiveness of DEC's marine operational management**.**

Future directions (next 12-18 months)

- Publish Strategic Plan
- Implement actions identified in the strategic plan.

DEC Regions
All

IMCRA Regions
All.

NRM Region
All.

2.21 Implementation of the Western Australian Marine Monitoring Program

Core Project

Team members
K. Friedman (0.35 FTE), C. Simpson (0.05 FTE), A. Kendrick (0.25), S. Wilson (0.2), K. Bancroft (0.15), S. Armstrong (0.2), T. Holmes (0.3), M. Rule (0.3),

Context
The Western Australian Marine Monitoring Program in DEC will adopt a Condition-Pressure-Response (CPR) approach within an adaptive management context and will be delivered primarily through a partnership approach between the Marine Science Program and the Regional Services Division of DEC. Collaborations will also be sought with specialist branches within DEC, other agencies such as

the Department of Fisheries, CSIRO and AIMS, local universities, industry and NRM and community groups. The implementation of an integrated and coordinated marine monitoring program will ensure that clear trends on the condition of assets outlined in marine protected area and threatened marine fauna management plans will be available to DEC managers, local and wider community groups and industry. In addition, trends of the human pressures and the effectiveness of management responses will also be made available.

This project aligns with:

- Key Strategic Goals: 1.1, 3.1, 3.7, 3.8, 3.9, 4.2, 4.8, 4.10;
- Key Result Areas: KRA1, KRA2, KRA3; and
- Key Supporting Strategies S1, S3.

Aims

To develop, progressively implement and document strategic and integrated monitoring within WA's marine protected areas and for threatened marine fauna statewide.

Summary of progress and main findings

- Eighteen marine ecological asset knowledge reviews are underway and due for completion in late 2009. These asset reviews summarise historical research and monitoring data on the condition of the assets, and information on the trends of human pressures and management responses in relation to each asset.
- Preliminary guidelines have been developed, in collaboration with District Managers and Marine Park Coordinators, to guide the development of a partnership approach to implementing the WAMMP.
- Site visits to the Walpole, Metropolitan, Jurien Bay, Shark Bay and Ningaloo marine parks have been completed.
- Equipment purchasing and ordering of an integrated data system for drop camera image acquisition has been undertaken.
- Data management processes and needs have been reviewed.
- Developed a collaboration with DoF on NRM mangrove monitoring project.
- Fieldwork planning for finfish, mangroves and seagrass has been completed and partially implemented.
- Finfish surveys initiated for the Shoalwater Marine Park.
- Mangrove surveys initiated in Montebello and Shark Bay marine parks.
- Seagrass surveys completed in Marmion Marine Park.

Management implications

Development and implementation of the long-term monitoring programs will enhance DEC's capacity to plan for and manage WA's marine protected areas and threatened marine fauna more efficiently and effectively.

Future directions (next 12-18 months)

- Finalisation of asset knowledge reviews.
- Initiation of asset knowledge reviews for turtles, dugong, sharks and rays, invertebrate communities and microbial communities (i.e. stromatolites),
- Further qualitative modelling to identify key pathways for monitoring,
- Field implementation of monitoring programs.
- Liaison within the state and national NRM agencies.

DEC Regions

All

IMCRA Regions
All

NRM Region
All

3. Regional marine science projects, activities and outputs

3.1 Kimberley

No current projects

3.2 Pilbara

3.2.1 Monitoring of the Ningaloo Marine Park whale shark industry and whale sharks (Rhincodon typus) through industry data

SPP #: (to be allocated)
Core project

Team members
K Dixon, E Wilson, M Hughes, T Chapman

Context
The whale shark (*Rhincodon typus*) is listed as a threatened species under WA State legislation and protected under Australian Commonwealth legislation. Internationally, the conservation status of the whale shark is recognised as "vulnerable" in the World Conservation Union Red List of Threatened Species.

The Department of Environment and Conservation (DEC) is the statutory body in Western Australia responsible for the management of whale shark tourism interactions in the Ningaloo Marine Park under the *Wildlife Conservation Act 1950*. Whale sharks are seasonally present in this marine reserve and these animals have become the focal point for a tourism industry that provides in-water experiences with whale sharks. DEC has developed a whale shark management program to monitor and manage human interaction with whale sharks and the industry that provides these experiences. It is a primary imperative in the management of the whale shark interaction program that any impacts on the health of individuals and the overall population are identified so that an adaptive management regime can be applied.

Every whale shark interaction conducted throughout the season should be recorded in vessel logbooks by each licensed operator as per licence conditions. This data has been recorded since 1995 however modifications to the datasheet have been undertaken several times up to the present to improve the quality of data collected. In 2008 the logbook data was finally reviewed to coincide with the development and implementation of an electronic monitoring system (EMS) to replace logbooks in 2009. Spotter pilot data has been collected from 2002 onwards.

Aligns with
Corporate Plan strategy/s: 1.2, 1.3, 2.3, 7.4, 8.4, 8.5;

Management Plan for the Ningaloo Marine Park and Muiron Islands Marine Management Area 2005-2015, strategy: 7.1.15

Whaleshark Interaction Management Program No 27

Aims

This project aims to review the existing whale shark industry logbook data to evaluate the utility of the data to determine industry trends and ecological parameters relating to whale sharks while in Ningaloo Marine Park. The objectives of the project are:

- to ensure ecological data collected through the whale shark interaction industry has scientific applications; and
- to determine sources of error within the existing vessel logbook data set so that data accuracy and interpretation may be improved in the future.

Summary of progress and main findings

Paying passenger numbers increased by 280% from 1996 to 2008 with nearly 8000 participants in the 2008 season joining one of the record 487 tours conducted. The increase in participants has led to an increase in passenger numbers per tour from 10.6 to 16.1. The statutory interaction Code of Conduct restricts swimmers per sharks at anyone time to a maximum of 10. The average number of swimmers per contact has not changed significantly from 7.5 to 8 but as more time is required to ensure everyone gets a good swim, the average tour time has increased by about 1 hour 30 minutes. Based on paying season logbook data (April and May only), the relative number of whale shark interactions has fluctuated between 400 and 570 (with the exceptions of two years, 1996 and 1999), until 2008 when a record 918 interactions were recorded. This number is expected to be exceeded again in 2009 due to a marked increase in whale shark sightings.

An overall decrease in mean whale shark size has been observed from 1996-2008 at Ningaloo. Updated estimated length data showed that mean size has decreased from about 7 to 5 metres from 1996 to 2008, with no significant change in mean length since 2002.

Major activities and outputs

- An annual progress report: Whale Shark Interaction Management Program No 27
- Season updates
- A paper was published in the Journal for Ecotourism in 2005
- A paper was published in the First International Whale Shark Conference: Promoting International Collaboration in Whale Shark Conservation, Science and Management: Conference Overview, Abstracts and Supplementary Proceedings in 2007
- An article in Landscope in 2008
- A paper was published in the Ningaloo Research Program: Progress Report 2008 in 2008

Management Implications

Monitoring industry trends within the whale shark industry at Ningaloo Marine Park has been on-going since 1995. In regards to ecological parameters, the data can now provide an indication of intra- and interseasonal variation in relative abundance. Passenger levels will give an indication of when the carrying capacity of the industry has been reached and what, if any, impacts this will have on whale shark interactions. Estimated whale shark size and gender data has been collected in vessel logbooks and some uncertainty in regards to error sources requires further analysis and research for accurate interpretation of this dataset.

DEC cautions any researcher wishing to derive statistically valid results from the log book/EMS data set to familiarise themselves first with the sources of data errors. The log books were not intended to provide stand alone scientifically rigorous population modelling but rather were developed to reflect industry trends. Little effort has been spent in the past to either train recorders or verify that data recording is occurring with accuracy and consistency. Further reviews of the EMS data and collection method are in progress to ensure that information gathered is accurate and useful to scientists and decision-makers involved in the conservation management of the whale shark of Ningaloo.

Future directions

- Review transition to EMS and analysis of 2009 data
- Finalise 2009 annual report

- Amend EMS to improve data collection and quality by simplifying design prior to 2010 season
- Continue to collect and analyse data during 2010 season
- Further analysis of aerial data to provide better search effort data that can be correlated with other factors that may have an influence on inter-seasonal variability of relative whale shark abundance.
- More detailed size data analysis and accurate length measurements of whale sharks to assist with management actions to address the indicative trend of reduced average size.

DEC Region
Pilbara

IMCRA Region
Ningaloo

NRM Region
Rangelands

3.2.2 Satellite tracking of loggerhead turtles (*Caretta caretta*) at Ningaloo Marine Park

SPP #: (to be allocated)
Core project

Team members
R Mau, N Balcazar, B Halkyard, T Howard
External Collaborators: Volunteer(s): Cape Conservation Group, Ningaloo Turtle Program, DEC staff

Context
Loggerhead turtles are internationally recognised as an endangered species, with Western Australia being home to the third largest remaining population in the world.

Nine female loggerhead turtles were tagged with Platform Terminal Transmitters (or PTTs) at Ningaloo Marine Park early in 2008. The satellite tracking devices will provide valuable information about the turtles' migratory paths, behaviour and destination foraging grounds.

The satellite transmitters, which cost $2500, were attached to the turtles' shells with non-toxic glue. The transmitters allow DEC to determine the location of each turtle with accuracies to within 150m.

This knowledge will contribute to the conservation of turtles because it will allow management agencies to identify threats in areas in which they are migrating to (e.g. trawling). Strategies can then be put in place to protect turtle populations.

DEC engaged volunteers from DEC, the Ningaloo Turtle Program and the local Cape Conservation Group to assist with attaching the devices.

Aligns with
Corporate Plan strategy/s: 1.2, 1.3, 2.3, 7.4, 8.4, 8.5
Science Division Strategic Plan strategy/s:
Business Plan project no.:

Management Plan for the Ningaloo Marine Park and Muiron Islands Marine Management Area 2005-2015 - 7.1.18 Turtles (KPI):

- Determine the location and relative significance of turtle aggregation sites and rookeries within the reserves (H-KMS).

Nature Conservation Service Pilbara Region Plan 2009-2014

- T11: Increase the population size of four nesting marine turtle species (*Chelonia mydas, Eretmochelys imbricata, Caretta caretta, Natator depressus*).

The Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2003)

- Identify and protect habitats that are critical for the survival of marine turtles.

Summary of progress and main findings
To date, the nine tagged turtles have been tracked migrating to feeding grounds in Shark Bay, the Timor Sea and as far away as the Torres Strait. Five of the turtles headed north after being tagged and they all followed the same route to Barrow Island, while the others are migrating to unknown destinations. The tracking devices are revealing a pattern to the turtles' migratory routes which is a major breakthrough; while it is known that turtles come to nest on beaches at Ningaloo in large numbers every summer it's been a mystery where they go once that part of their lifecycle is complete.

The near-real time tracking data can be viewed at www.ningalooturtles.org.au.

Major activities and outputs
- Satellite tracking information made publicly available on www.seaturtle.org and www.ningalooturtles.org
- Details of the project were presented at the International Turtle Symposium in Brisbane (Feb 2009)
- Publicity was generated through two separate press releases, one at the local level and a second through Perth. The media releases resulted in feature on WIN News, two radio interviews (ABC Regional and ABC Perth), an article in the West Australian, the regional paper, and two local papers.
- A paper was published in the *Ningaloo Research Program: Progress Report 2008*.
- The information gained has been relayed to relevant researchers and managers at a workshop for remote area scientists and managers attended by the Principal Investigator. The follow up led to contacts with Geoscience Australia and CSIRO in regards to Commonwealth Regional Planning for the North-West shelf.

Management Implications
Little is known about the offshore habitats off the North-west shelf that appear to make up foraging grounds of the female loggerheads. Spatial information about the foraging grounds will provide researchers with areas to target for future habitat assessments.

When comparing this dataset with other tagging projects, some marine turtle foraging area hotspots may be identified. For instance, there are now three different species of marine turtles (*Natator depressor, Chelonia mydas* and *Caretta caretta*) that appear to favour an area off Roebuck Bay and to the north-east of 80 Mile beach.

The Commonwealth Department of Environment, Heritage, Water and the Arts is currently in Regional Marine Planning process and are seeking data indicating critical habitats that may require some form of management control.

There are numerous offshore gas and oil projects under investigation on the North-West shelf, Timor Sea and Gulf of Bonaparte. An understanding of habitat and migratory routes of *Caretta caretta* will allow decision-makers to consider their needs in relation to an expanding resource industry.

Future directions
As the PTTs are still transmitting, the analysis of the data will commence once the last transmission has ceased and no further signals are recorded for a period of two months.
- Finalise and publish data report
- Distribute project report to funding providers

DEC Region
Pilbara Region, Exmouth District

IMCRA Region
Ningaloo

NRM Region
Rangelands

3.3 Midwest

3.3.1 Monkey Mia Dolphin Monitoring Program

SPP #: (to be allocated)
Core project

Team members
L. Bjeder (0.3) D.Holley (0.1) Total (0.4)

Context
The reduction in the number of commercially licensed operators in the Red Cliff Bay area off Monkey Mia was undertaken in response to research findings evaluating long term impacts of vessel activity on Dolphins. This management action was based mainly on 2 findings: 1) a statistically significant decline of 15% (equivalent to 1 in 7 individuals) in the use of Red Cliff Bay by individual dolphins during a time period when vessel activity doubled; and 2) female dolphins with high exposure to vessels are less successful at reproducing compared to the lower exposed females.

Follow up research is required to evaluate the effectiveness of management actions taken by DEC to restore dolphin abundance and reproductive success in Red Cliff Bay.

Specifically the objectives of this research are;

- To estimate the relative abundance of bottlenose dolphins in both 'control' and 'tourism' areas off Monkey Mia subsequent to management actions.
- Compare relative dolphin abundance estimates in both 'control' and 'tourism' areas before and after implementation of management actions.
- To evaluate whether management implementations reverse the documented negative impacts on female reproductive success of cumulative tour and research vessel exposure.

Aligns with
Corporate Plan strategy/s: 1.2, 2.3, 8.4, 8.5; KRA1, KRA2.
Science Division Strategic Plan strategy/s:
Business Plan project no.:
Management Plan strategy/s: SBMR MP s5.5.7

Summary of progress and main findings
This project is 1 year completed of a 5 year program. Year one was to have provided compiled datasets from the first year as well as cleaned and analysed data collected by others through the Dolphin Research Foundation. Difficulties have been encountered by the project leader in accessing datasets, resulting in a delay of the first annual report. It is anticipated that this report will be produced by the end of the calendar year.

Major activities and outputs
Currently no reports have been produced. Some initial data analysis has been undertaken on dolphin abundance and distribution.

Management Implications
This project will provide the appropriate post analysis of the reduction of tour operators in the Monkey Mia exclusion zone. The desired response would be a return to or increase in abundance levels to those before the introduction of a second tour vessel within the Red Cliff Bay Area.

Future directions

The 1st, 3rd and 5th annual reports will outline summaries of the cleaned up and compliled datasets from each year- based on data provided by the Shark Bay Dolphin Research Group. This data will include the number opf dolphin groups encountered within the defined 'tourism' and 'control' areas.

The 2nd and 4th annual reports will include relative dolphin abundance estimates within defined 'tourism' and 'control' areas and comparisons of relative dolphin abundances within both areas between two-year time blocks.

The annual report from the 4th and 5th year will include a complete analysis that will allow comparison of relative dolphin abundance within the defined areas.

The annual report from the 3rd and 5th years will include the female reproductive success analyses.

DEC Region
Midwest

IMCRA Region
Shark Bay

NRM Region
Rangelands

3.3.2 Dugong Population Trends Across Two Decades in Shark Bay, Ningaloo Reef and Exmouth Gulf.

SPP #: (to be allocated)
Core project

Team members
A.Hodgson (0.3) D.Holley (0.1) Total (0.4)

Context
Shark Bay is believed to be home to more than 10% of the world's dugongs, (*Dugong dugon*), and the importance of Shark Bay as a significant habitat for dugongs was one of the reasons for its World Heritage listing. Ningaloo Reef and Exmouth Gulf also support significant dugong populations that are thought to be interconnected with Shark Bay. Four aerial surveys have been conducted throughout the Shark Bay / Exmouth Gulf / Ningaloo Reef region between 1989 and 2007. A summer survey of Shark Bay only was surveyed in 2002. These surveys have shown fluctuations in dugong numbers throughout the region indicating possible movement of dugongs between Shark Bay and Exmouth Gulf / Ningaloo Reef (Gales *et al*., 2004; Holley *et al*., 2006; Hodgson, 2007). The data from the 2007 survey was analysed using an improved method for determining correction factors for calculating population estimates. Re-analysis of the data from surveys conducted in 1999 and 2002 would allow more direct and accurate comparisons with the most recent estimates. We can then determine whether the apparent changes in dugongs numbers throughout the region are significant.

The objectives of the project are directly related to the recommendations from the report on the aerial surveys conducted in Shark Bay / Exmouth Gulf / Ningaloo Reef in 2007:

1. To reanalyse the 1999 and 2002 aerial survey data using the improved Pollock *et al*. (2006) method for calculating correction factors to allow more accurate comparisons with the most recent 2007 survey, and
2. To compare the dugong population estimates obtained from all surveys in the Shark Bay / Ningaloo / Exmouth region statistically to determine if the apparent fluctuations in numbers are real.

Aligns with
Corporate Plan strategy/s: 1.2, 2.3, 8.4, 8.5; KRA1, KRA2.

Science Division Strategic Plan strategy/s:
Business Plan project no.:
Management Plan strategy/s: SBMR MP s5.5.6

Summary of progress and main findings
The new estimate calculated for the 2002 aerial survey was 9153 ± 1925 se. This estimate is lower than that presented in Holley *et al*. (2006) of 11021 ± 1537 se calculated using the Marsh and Sinclair (1989) method. However, it is similar to that calculated from the 2007 survey using the Pollock *et al*. (2006) method (9347 ± 1204 se). These new estimates are the most robust estimates that we can currently produce and should be the estimates upon which management decisions be based and to which all future surveys be compared.

For Shark Bay, there were no significant differences in: (1) the index of relative dugong density (according to the Marsh and Sinclair method) among all survey years averaged within blocks or over all blocks in Shark Bay, (2) the index of relative dugong density (according to the Pollock *et al*. method) in 2002 and 2007 either averaged within blocks or over all blocks in Shark Bay, (3) the index of relative dugong density (according to the Pollock et al. method) in 2002 and 2007 among blocks averaged across years. However, the relative density index (according to the Marsh and Sinclair method) varied significantly among blocks in Shark Bay.

Major activities and outputs
A detailed report with revised estimates for the Shark Bay, Ningaloo and Exmouth dugong populations was produced.

Management Implications
The results achieved from this study contribute to a greater understanding of the ecology of the dugong within the Shark Bay World Heritage Area. This population of dugongs, as shown from aerial surveys in this and previous work, is large and stable, with consistently high abundance estimates. These surveys have also shown a population density higher in Shark Bay than any other location where similar surveys have been conducted. Maintenance of these estimates is partially attributed to the low level of threatening activity to which dugongs and dugong habitat are exposed within Shark Bay. The significance of this population for global dugong conservation, therefore, cannot be underestimated, not only because of this species' high biodiversity value but also as a reference population for remaining populations elsewhere

Future directions
This report listed a number of recommendations, these are:

1. That the biologically and logistically feasible spatial scale upon which to manage dugongs be investigated through population genetic techniques.
2. That satellite tagging programs be continued and expanded along the WA coastline to determine important habitat areas and movement between them.
3. That the program of aerial surveys in Shark Bay, Ningaloo Reef and Exmouth Gulf be continued, but extended to include dugong habitat northward of the Ningaloo-Exmouth region, to provide the basis for a spatial risk assessment of dugongs in WA.
3. That a spatially explicit dugong density model be developed for Shark Bay and the Exmouth/Ningaloo region from which, the conservation value of various habitats within the regions can be identified and spatial risk assessments can be conducted.
5. That future dugong research in northern Western Australia incorporates the early involvement of stakeholder groups to facilitate knowledge exchange with traditional Indigenous owners, co-payment by industry, and risk assessment of future developments.

DEC Region
Midwest

IMCRA Region
Shark Bay

NRM Region
Rangelands

3.3.3 Literature Review of Marine Ecological and Social Values Relevant to the Shark Bay World Heritage Property and Marine Reserves

SPP #: (to be allocated)
Core project

Team members
P.van Schoebroeck (0.3), D.Holley (0.1);Total (0.4)

Context
In September 2007, the World Heritage Scientific Advisory Committee of the Shark Bay World Heritage Property conducted a workshop to determine an appropriate framework for the prioritization of the research requirements in the Shark Bay World Heritage Property. The committee agreed to utilise an existing risk-based prioritisation framework "A Strategic Framework for Marine Research and Monitoring in the Shark Bay World Heritage Property" (Simpson et. al 2002) to develop a priority list.

In addition to the risk based prioritisation there is also a requirement to have an adequate understanding of historic and current research and monitoring in order to identify knowledge gaps. This requires a literature review of current published and unpublished literature to be completed. The literature review will form the basis for identifying gaps in the information requirements for marine planning, adaptive management and performance assessment reporting for the Shark Bay World Heritage Property and marine reserves. The outputs of the risk-based prioritisation and literature review can then be used to develop a list of priority research and monitoring requirements (i.e. research and monitoring plan).

This project undertook a literature review of ecological and social research and monitoring relevant to the Shark Bay marine and coastal environments. The review built on previous literature reviews conducted for Shark Bay.

Aligns with
Corporate Plan strategy/s: 1.2, 2.3, 8.4, 8.5; KRA1, KRA2.
Science Division Strategic Plan strategy/s:
Business Plan project no.:
Management Plan strategy/s: SBMR MP s12.3.6

Summary of progress and main findings
The methodologies used and outputs produced by the project were consistent with similar projects that have previously been undertaken in Shark Bay, Ningaloo and elsewhere in the State. The outputs generated from this project will provide the Shark Bay Marine Reserves management review process with up to date and relevant information on the ecological and social values of the Property.

Major activities and outputs

- Report: Literature review of marine ecological and social values relevant to the Shark Bay World Heritage Property and Marine Reserves;
- The compilation of a searchable electronic bibliography database (Endnote) of marine reference materials;
- Acquisition of relevant electronic references stored on the Shark Bay District shared drive and the shared drive of Marine Policy and Planning Branch.
- An inventory of current and proposed monitoring and research relevant to marine ecological and social values of the Shark Bay World Heritage Property and Marine Reserves.

Management Implications
This literature review including the databases and information generated from the process will feed into the Resources Assessment Framework for the Shark Bay Marine Reserves as the Shark Bay Marine Reserves management plan 1996-2006 is due for review. The information generated will help identify information gaps and facilitate management approaches to conserve the marine social and ecological values of the SBWHPMR. Furthermore the databases will serve as point of reference for generating a comprehensive understanding of the marine values of Shark Bay, facilitating strategic approaches to scientific monitoring and research and ensuring information requirements are met for conservation management outcomes.

Future directions
When the process for the revision of the SBMR Management Plan commences this literature review will provide the necessary reference material to ensure that the new management plan has available the latest and most relevant information to ensure continued effective and appropriate conservation and management of the Shark Bay Marine Reserves. Until the planning process for the new Plan commences it is proposed that this document remain open with recent literature and publications added as appropriate.

DEC Region
Midwest

IMCRA Region
Shark Bay

NRM Region
Rangelands

3.3.4 Shark Bay Loggerhead Turtle Tagging Program

SPP #: (to be allocated)
Core project

Team members
D.Holley (0.1) SB District Staff

Context
In 1994, the Department of Environment and Conservation (DEC) initiated as part of the Western Australian Marine Turtle Program (WAMTP) a tagging program of nesting female loggerhead turtles at Turtle Bay, Dirk Hartog Island. The tagging program utilises a mark and re-capture methodology to estimate the population size based on the ratio of tagged and non-tagged turtles surveyed annually. During each survey female turtles are intercepted as they come up on the beach to nest. Turtles are marked using small uniquely numbered titanium turtle tags attached to the trailing edge of the fore-flipper(s) allowing turtles to be individually identified and monitored over time. The tag number/s, carapace length and condition of each turtle surveyed are entered into the WAMTP database each year. The timing of the program corresponds with a peak in the annual December to April loggerhead turtle nesting season. The WAMTP database currently holds 13 years of tagging data (approximately 6,000 records for turtles tagged at Turtle Bay since 1994) which can be used to monitor the size and health of the loggerhead turtle population nesting at Turtle Bay. The development of a long term data set is essential for undertaking effective management and determining management effectiveness, given that change in turtle population abundance/health is only detectable over long periods, given their reproductive biology and longevity.

Aligns with
Corporate Plan strategy/s: 1.2, 2.3, 8.4, 8.5; KRA1, KRA2.
Science Division Strategic Plan strategy/s:
Business Plan project no.:

Management Plan strategy/s: SBMR MP s5.5.4

Summary of progress and main findings
Since 1994, with the exception of 1995 and 2006, the program has been conducted annually over a two week period in January. The WAMTP dataset has not been analyzed and as such there is not a current reliable estimate of the status of the Turtle Bay loggerhead turtle nesting population. The future analysis of this long-term dataset will need to address issues relating to a change in methodologies between 2004 and 2007 which reduced sampling effort from five beaches to two.

Major activities and outputs
Annual mark recapture program continued during the 2009 nesting season, with all five nesting beaches surveyed and 1240 migrant and remigrant turtles surveyed.

Management Implications
The Turtle Bay nesting population of the endangered Loggerhead turtle represents the largest rookery of this species in WA. Monitoring of this population is vital for long term maintenance of the species.

Future directions

- Define peak period for breeding season through use of remote camera monitoring.
- Continue with the 2009/10 nesting season program
- Assess validity of current mark recapture program for long term monitoring against budget expenditure and personnel requirements. Assessment to be made as part of statewide turtle monitoring and research program.

DEC Region
Midwest

IMCRA Region
Shark Bay

NRM Region
Rangelands

3.3.5 Jurien Bay MP Sealion Pup Counts.

SPP #: Unknown

Team members
I Hatch, L Butcher, G Ingliss, K Crane, E Richardson, S Glac, M Dasey, and other DEC Moora district staff.

Context
Through anthropogenic pressures the west coast distribution of Sea Lions (*Neophoca cinerea*) has contracted to a few breeding colonies. Two of these colonies are within Jurien Bay Marine Park (Buller Island and North Fishermans Island) and a third (Beagle Island) is close to the park. The species is known to have a low fecundity and show extreme reproductive site-fidelity. This site fidelity is such that where a localized extinction has occurred recolonisation of that site from other colonies is not thought to be possible. Any decline in reproductive output from an individual colony therefore represents a significant threat to the species as a whole and needs to be identified. The following monitoring has been conducted by JBMP:

- Three breeding colonies are visited at least twice through the pupping season and counts are made of: Live newborn and moulted pups; dead pups.

Aligns with:

Management Plan Number 49 (JBMP) strategy/s:

- 7.1.9/3 (KPI, H-KMS: Monitor trends in sealion pup production each breeding season.)
- 8.5/1 (KPI, H-KMS: Develop and implement a prioritized monitoring program of key values and processes.)

Summary of progress and main findings
- Annual pup production is stable at approximately 140 to 180 pups per season at the three islands in/near JBMP.
- Data has been provided to external researchers for value-adding.

Major activities and outputs
- Strategy 7.1.9/3 has been achieved by this program (Monitor trends in sealion pup production each breeding season.).

Management Implications
The main pressures on Sealion populations are thought to be from fishing. Commercial and recreational Western Rock Lobster (WRL) fishing places pressure on Australian Sealions in two ways: Pups may drown in cray traps; and there may be competition for food - crayfish are thought to be a key component of Sealion diet. Exclusion devices on craypots in the area are now widely accepted by the community and this would've prevented deaths of some sub-adults each season.
However, pressure on WRL stocks by over fishing could lead to declines in Sealion fecundity, which would require a management response.

Future directions
This is an ongoing program intended to run every breeding season. The next season is in mid 2010.

DEC Region
Midwest

IMCRA Region
CWC / GS2

NRM Region
Northern Agricultural

3.3.6 Jurien Bay Human Use Monitoring Program (HUMP)

SPP #:: Unknown

Team members
I Hatch, L Butcher, G Ingliss, K Crane, E Richardson, S Glac, M Dasey

Context
Quantifying the spatial and temporal intensity of usage in and adjacent to Jurien Bay Marine Park has been conducted since 2003/04 using five main methods:

1. Aerial surveys / counts of park visitors, including vehicles, camps, and vessels. There have been 42 flights April 2004 to June 2009 and records are in GIS system. Each aerial survey covers approximately 500 km^2 and records the location activity in the marine park or on adjacent lands.
2. The continuous recording of trailer traffic at Jurien Bay Marina (*MetroCount* data). There is almost continuous data recording from 12th September 2005 to July 2009, with two gaps of 6 weeks in total - in all 1330 days of data.
3. Land-based patrols and recording of visitors. Sporadic records mainly from 2004;
4. Gathering and collation of park visitor records from sea rescue and nearby camp grounds. Annual stats from Jurien Coastal Patrol and Sandy Cape camping 2004-2006.
5. Face-to-face interviews of park users. One series of interviews Easter 2003.

The data generated from this monitoring program is used to benchmark park visitation and identify areas of high use. Aerial flight records also contain information on illegal/informal camps, cray pot locations, watercraft, vehicles and boat trailers so a variety of management issues can be addressed with the data.

Aligns with:
Management Plan Number 49 (JBMP) strategy/s:
- 8.5/2 (H-KMS: Develop and maintain a database of human usage);
- Activity Code EC1 – Human Use Impacts

Summary of progress and main findings

- All data for the surveys has been loaded onto databases and several GIS layers for each aerial survey have been created. Analysis has been performed on some of the data and correlations between data recorded in different methods have been used to extrapolate where data gaps exist.
- The surveys have quantified the number of number of visitors to different parts of the marine park in each month of the year. Clear annual patterns of park visitation have been identified and it is possible to extrapolate the date to estimate the total annual number of visitors to the park.
- The number of records of trailer movements are highly correlated (R^2 >0.75) with counts taken on simultaneous aerial surveys of vessels, vehicles, and general visitor numbers.
- Strategy 8.5/2 (H-KMS: Develop and maintain a database of human usage) has been achieved.

Major activities and outputs
No major published outputs have arisen from this work other than in-house analysis for annual reporting. Key periods in the year have been identified as highest use. No significant changes is total annual park visitation are apparent from the existing data for 2006-09.

Management Implications
This data gathering provides a means to plan compliance and educational activities and provides evidence of stable park visitation rates through time. It has identified areas and periods of high/low use, poor compliance and has allowed quantification of the number of park visitors in each area.

Future directions
For 2009-10 :
- The MetroCount data gathering is to be continued at the same location near Jurien Marina,
- Seven aerial surveys are planned for the year with recording of data as has been done previously,
- Data is to be consolidated and passed on to DEC GIS unit for wider distribution.

DEC Region
Midwest

IMCRA Region
CWC / GS2

NRM Region
Northern Agricultural

3.3.7 Jurien Bay MP Seagrass Monitoring Program.

SPP #: Unknown

Team members
I Hatch, L Butcher, G Ingliss, K Crane, E Richardson, S Glac, M Dasey;
and researchers from Edith Cowan University under the direction of Kathryn McMahon.

Context

The dominant primary producer in Jurien Bay Marine Park are the extensive beds of macrophytes which encompass several species with a variety of growth forms. These seagrass beds are range in depth from intertidal to over 10 metres in depth and are found throughout the park on sandy substratum. The health of the seagrass is a KPI in the management plan, so monitoring the health of these beds is of high importance. The monitoring program consists of:

- In Posidonia sinuosa beds at two locations (near Boullanger Island and near Fishermans Island) four permanent transects have been establish at three separate depths (12 transects at each location). Along each of the permanent transects six permanent steel quadrats (0.2m x 0.2m) have been placed and the seagrass shoots in each quadrat have been measured on a number of occasions.
- Within each quadrat the following measures are made: The number of shoots in the quadrat; the length of the longest seagrass leaf in the quadrat; an estimate of the percent cover in the quadrat.
- The field sampling has been conducted in 2003, 04, 05, 07, 08.

Aligns with:
Management Plan Number 49 (JBMP) strategy/s:

- 7.1.4/4, (KPI, H-KMS: Monitor Seagrass meadows in areas at most risk from mooring and anchor damage.)
- 7.1.4/2, (KPI, KMS: Educate users of the important ecological role of seagrass communities…)
- 8.5/1 (KPI, H-KMS: Develop and implement a prioritized monitoring program of key values and processes.)

Summary of progress and main findings
- Prior studies independent to this program have been published internally by How and Lavery (2003 and 2004).
- Data compilation and analysis of JBMP data has been performed in 2007 by ECU and is presented in an internal data report.
- There are no clear overall temporal trends apparent from the data between 2003 and 2008 although there are some statistically significant differences between years at some depths.
- Benchmarking of some seagrass meadow parameters has been achieved by this program.

Major activities and outputs
- Strategy 7.1.4/4 has been achieved (Monitor Seagrass meadows in areas at most risk from mooring and anchor damage).
- Strategy 7.1.4/2 has been partially achieved (Educate users of the important ecological role of seagrass communities…) in that relevant information is available for publication, and some has been published.
- Strategy 8.5/1 is being addressed (Develop and implement a prioritized monitoring program of key values and processes.)

Management Implications
Values for some basic parameters of seagrass meadows have been benchmarked so that change in this might be detected.

Future directions
Monitoring for this program was scheduled for 2008/09 but was not conducted due to vessel and logistical problems. It is anticipated to continue this program in 2009/10, and then reassess the effectiveness of the design to meet the management targets.

DEC Region
Midwest

IMCRA Region
CWC / GS2

NRM Region
Northern Agricultural

3.3.8 Jurien Bay MP Biodiversity Monitoring Program (UTAS)

Project status
SPP #:: Unknown

Team members
I Hatch, L Butcher, G Ingliss, K Crane, E Richardson, S Glac, M Dasey, K Bancroft (MSP), external researchers from The University of Tasmania – N Barrett, G Edgar *et al*.

Context
The goals of this program were/are to both identify areas of high biodiversity and representation that are worthy of being protected and to monitor change in those places through time, through a BACI-style design. The program has had two main phases and there have been approximately 25 sites monitored annually from 1999 to 2009, and an additional 20 sites that have been monitored slightly less frequently. In summary the program consists of:

- Diver fish surveys. These consist of swum transects of 200m long whereby the diver records the species of each fish seen and the approximate size of each fish.
- Diver macroinvertebrate surveys. Within randomly cast quadrats along 200m transects counts of species sea urchins, gastropods, corals, sponges and other classes of invertebrate were made.
- Diver macroalgae surveys. Percent algal cover for several classes are estimated along transects at a number of points.

The data generated from this program has been analysed in a variety of univariate and multivariate ways to yield a wide range of diversity and temporal change data. At the start of the program it was envisioned to run the project 5 year pre zoning and 5 years post zoning and this will be achieved in 2010.

Aligns with:
Management Plan Number 49 (JBMP) strategy/s:

- 7.1.5/2, (Initiate research programs to quantify the floral and faunal diversity in macroalgal habitats…in relation to developing management targets.)
- 7.1.7/2, (H-KMS: Undertake research programs to characterize invertebrate diversity…in the marine park)
- 7.1.8/2, (KPI H-KMS: Undertake research programs to characterize finfish diversity…in the marine park
- 8.4/3, (KPI H-KMS: Identify and communicate high priority scientific and social research projects…to appropriate research organisations.)

Summary of progress and main findings
All data management is undertaken by UTAS and no significant analysis or reporting has been performed by DEC staff. However, data reports have been provided and some published work has been released with the consent of DEC.

A trend of increasing mean size for Breaksea Cod and Silver Trevally through time in protected areas are reported and the lack of representative deeper areas in sanctuary zone are key findings.

- Strategy 7.1.5/2, (H-KMS: Initiate research programs in macroalgal habitats...) has been achieved.
- Strategy 7.1.7/2, (H-KMS: Characterize invertebrate diversity…in the marine park) has been achieved.
- Strategy 7.1.8/2, (KPI H-KMS: Characterize finfish diversity…in the marine park) has been achieved.
- Strategy 8.4/3, (KPI H-KMS: Identify and communicate research projects…) has been achieved.

Major activities and outputs
Several internal data reports have been compiled and provided to JBMP.

Management Implications
Future rezoning of JBMP could be based on this program.

Future directions
The program is reaching its planned end in 2010.

DEC Region
Midwest

IMCRA Region
CWC / GS2

NRM Region
Northern Agricultural

3.3.9 Jurien Bay MP Water Quality Benchmarking Program

SPP #: Unknown

Team members
I Hatch, L Butcher, G Ingliss, K Crane, E Richardson, S Glac, M Dasey; K Bancroft (MSP), R Masini (MEB).

Context
The biota of the bioregion in which Jurien Bay Marine Park is situated has evolved in an environment with very little nutrient input having few riverine sources of terrestrial nutrients. The resultant clear water and low water nutrient concentrations have favoured the growth of extensive macrophyte beds in areas that might otherwise be dominated by macroalgae or bare substratum. Changes to water clarity and nutrient concentrations are known threats to macrophyte beds. Two water quality benchmarking programs have been conducted on different spatial and temporal scales:

- 2004/05 Monthly sampling was conducted over a 12 month period at 19 sites with analysis for toxicants, nutrients and physico-chemical WQ. Data includes: TSS, PAR, OC, NH_3, NOx, OP, Chl-a, Conductivity, Temperature, DO for most sites in monthly sampling.
- 2006, 08, 09. Four sites have been sampled over a 2 month period which included sites that had been sampled in the 2004-05 program. Data includes: TSS, PAR, OC, NH_3, NOx, OP, Chl-a, Conductivity, Temperature, DO for most sites in weekly sampling spread over 2 months.

Aligns with:
Management Plan Number 49 (JBMP) strategy/s:
- 7.1.2/3. (KPI, H-KMS: Establish baseline water quality monitoring program in relation to nutrient enrichment.)
- 8.5/1 (KPI, H-KMS: Develop and implement a prioritized monitoring program of key values and processes.)

Summary of progress and main findings
- Data compilation and analysis has been performed in some depth for the 2004-05 data and this showed that the overall the water quality of the area was good. The Jurien Marina was identified as have eutrophication and algae problems. Presented in Data Report: MMS/CWC/JBMP-83/2005
- Analysis of the 2006-09 data found that there were no clear temporal or spatial trends in the study period and that for many nutrient analytes the concentration of nutrients was close to or below analytical detection limits. In particular N as NOx and NH_3 were not present in measurable concentrations in most samples for 2009. Chl-a was low and variable but above detectable limits in

the study period. The concentration of Chlorophyll - a was greatest at the site closest to Jurien Bay town (PI3) and this could constitute an impact of nutrient enrichment from the community, though the concentration was below acceptable limits (mean of 0.56 µg/L).

Major activities and outputs

- Strategy 7.1.2/3 has been achieved (Establish baseline water quality monitoring program in relation to nutrient enrichment) and a possible location of nutrient enrichment to the nearshore waters has been identified.
- Future changes in water quality parameters can be identified from established baseline data.

Management Implications

The suspected low ambient nutrient status of the area has been verified and benchmarked for many sites in the marine park. The low rate of nutrient inputs to the system because of low runoff is a characteristic of the ecology is identified as a key process in maintaining the macrophyte beds in these locations.

Future directions

There is no plan to continue with the existing water quality monitoring program until 2011 as it is thought that sufficient data has been gathered for benchmarking.

DEC Region
Midwest

IMCRA Region
CWC / GS2

NRM Region
Northern Agricultural

3.4 Swan

No current projects

3.5 Southwest

No current projects

3.6 South

No current projects

4. CURRENT COLLABORATION WITH ACADEMIA

DEC Officer	Student	Project Title	Degree / level	Duration (yr - yr)	University Academic	University
Simpson, Chris	D Holley	Northwest dugong population and habitat use	PhD	2007-9	Dr P Lavery	Edith Cowan University
Simpson, Chris	A. Hill	Factors influencing the establishment of marine protected areas in Western Australia	PhD	2007-2009	Dr S Shea	Notre Dame University
Simpson, Chris, Kendrick, Alan, Wilson, Shaun, Waples, Kelly	various	Science Connections: Marine Science Mentoring Program	U/grad.	2009	Dr Mike van Keulen	Murdoch

5. EXTERNAL PARTNERSHIPS

Partnership Name	Project	Cash funding and source ($)	DEC Involvement (in kind)
Aust. Institute of Marine Science	Comparative marine biodiversity survey of the Rowley Shoals marine protected areas		T Holmes (0.05)
Aust. Institute of Marine Science	Coral reef fish recruitment study		S Wilson (0.1) T Holmes (0.1)
Aust Marine Science Assoc. (WA)	Rottnest Young Scientist Workshop	$500 sponsorship (MSP)	S Armstrong (0.01)
CERF project: Tasmanian Aquaculture and Fisheries Institute, Uni. of Tasmania,	Volunteer monitoring of the state of Australian rocky reef communities	nil	K Bancroft (0.03)
Department of Fisheries, WA	Resource Condition Monitoring of Mangroves in northwest Australia	$28K (MSP)	K Friedman (0.02)
Edith Cowan University	Monitoring movement pattens of marine fauna using Vemco VRAP Accoustic tracking system	$40K (MSP)	A Kendrick (0.01) S Wilson (0.01)
Edith Cowan University	Spatial and temporal patterns in the structure of inter-tidal rocky platforms communities of the SIMP and MMP	$2.5K in 08/09; ECU staff and students made preliminary surveys and collected a voucher specimen collection	A Kendrick (0.05), M Rule (0.05)
Murdoch University/DoF: Indo-Pacific Fish Conference 2009	Organising Committee for the IPFC 2009.	Nil	S Wilson (0.05)
Murdoch University	Monitoring management effectiveness: Monkey Mia dolphins	$15K-$25K pa for 6 years (2006/07-2012/13) (from Shark Bay Marine Park budget)	C. Simpson
Murdoch University	An ecosystem approach to estimating the viability of dolphin populations exposed to industrial/port activities	$10K pa over 3 years (2007-2009)	C Simpson
Murdoch University	Little Penguin Study: Development of a monitoring protocol	$27.5K over three years (2006-2008)	C Simpson
Secretariat of the Pacific Community	Reef Fisheries Observatory Pacific Regional Oceanic and Coastal Fisheries (PROCFish) project	Travel funds from external source (European Union)	K Friedman 0.02
University of Western Australia	Benchmark study on marine communities of the south-west for long-term monitoring	$5k in 2006-2007; (MSP)	K Bancroft (0.01)
University of Western Australia	Assessing fish communities in Shoal water Islands Marine Park.	$12K (MSP)	K Friedman (.01) A Kendrick (.01) S Wilson (0.01) M Rule (.05) K Brancroft (0.01) T Holmes (0.05)
Western Australian Marine Science Institution	North West Marine Research Inventory Project	$15K in 2007/08	K Waples (0.05)

Partnership Name	Project	Cash funding and source ($)	DEC Involvement (in kind)
Western Australian Museum	Inventory and databasing of marine faunal records from the NW atolls	$60K in 2007/08	T Holmes (0.05)

6. SUMMARY OF RESEARCH PROJECTS BY DEC AND NRM REGIONS

DEC Region	NRM Region	Project Title
All	All	Building a marine science capacity in DEC
All	All	DEC marine science current projects database
Pilbara, Kimberley, Mid- west	Rangelands	North West Marine Research Inventory
Kimberley	Rangelands	Comparative marine biodiversity survey of the Rowley Shoals marine protected areas
Pilbara	Rangelands	Distributions and patterns of major benthic communities of the Montebello/Barrow Islands marine protected areas
Pilbara	Rangelands	Establishing a long- term monitoring program for the proposed Dampier Archipelago Marine Park
Pilbara	Rangelands	Monitoring the coral predator, Drupella cornus, in Ningaloo Marine Park
Pilbara	Rangelands	Bills Bay reef recovery study and coral spawning observations in Ningaloo Marine Park
Mid-west	Rangelands	Mapping the coral reef communities of the Shark Bay Marine Park
Mid-west	Northern Agricultural	Summary of historical marine research and monitoring relevant to the Jurien Bay Marine Park
All	All	Using marine habitats as surrogates to map marine biodiversity
Pilbara	Rangelands	WAMSI Node 3: Administration, coordination and integration
Pilbara	Rangelands	WAMSI Node 3: Communication
Pilbara	Rangelands	WAMSI Node 3: Data management
Pilbara	Rangelands	WAMSI Node 3: Knowledge transfer
Mid-west	Northern Agricultural	SRFME carry-over projects: Jurien Bay Marine Park
Mid-west, Pilbara, Kimberley,	Rangelands,	Conservation of marine turtles in Western Australia
Pilbara, Kimberley,	Rangelands	Strategy for the development and implementation of an integrated tropical marine research plan:2010-2015
Midwest, Swan, South west, Warren, South Coast	Swan, South west	Strategy for the development and implementation of an integrated temperate marine research plan:2010-2015
All	All	Strategic plan for the development and implementation of a long-term marine monitoring program in Western Australia: 2009-2019
All	All	Implementation of the Western Australian Marine Monitoring Program

7. STUDENT PROJECTS – PROGRESS REPORT

Scientist: C Simpson
Student: D Holley

Project title
Development of dugong (*Dugong dugon*) research capacity through use of innovative tracking technology

Progress report
This project progressed through 2008/09 with further development of the collaboration with indigenous groups in the Kimberley, namely the Bardi-Jawi Sea Rangers and DAmbi Mangari Traditional Owners. Dave Holley took up a position as Marine Park Coordinator, Shark Bay Marine Park in 2008 and has suspended his studies. However, the research will continue with his ongoing support and involvement of a new project manager.

Scientist: C Simpson
Student: A Hill

Project title
Factors influencing the establishment of marine protected areas in Western Australia

Progress report
This project is now well advanced and due for completion in late 2009.

8. SUMMARY OF SIGNIFICANT ACHIEVEMENTS ANTICIPATED FOR 2009/10

Anticipated achievements
Increased output of publications of results of research
Progressive implementation of integrated tropical and temperate marine research plans
Progressive implementation of an integrated marine monitoring plan for WA MPAs and threatened marine fauna
Completion of major research projects in WAMSI Node 3: Ningaloo Research Program
Implementation of a framework to facilitate better transfer of science into policy, planning and management

9. PRIORITIES AND ANTICIPATED KEY OUTCOMES OR ACHIEVEMENTS OVER THE NEXT TWO TO THREE YEARS

Anticipated outcomes or achievements
Continue to build capacity in the Marine Science Program
Progressive implementation of integrated tropical and temperate marine research plans across WA
Progressive implementation of a statewide marine monitoring program in WA MPAs
Implementation of the knowledge transfer framework
Coordination and finalisation of the Ningaloo Research Program
Initiate a major program of marine research in the Kimberley region.
Building strategic alliances with outside research providers
Increase community involvement in DEC marine science programs through community monitoring and NRM groups

10. MARINE SCIENCE PROGRAM 2008/09 BUDGET EXPENDITURE

Activity/Project Title	DEC Region	PI	Expenditure[1] ($)
MSP Administration	All	CSI	380,084[2]
Building a marine science capacity in DEC	All	CSI	63,817
DEC marine science current projects database	All	SAR	3,925
Comparative marine biodiversity survey of the Rowley Shoals marine protected areas	Kimberley	THO	9,892
Distributions and patterns of major benthic communities of the Montebello/Barrow Islands marine protected areas	Pilbara	KBA	9,417
Establishing a long- term monitoring program for the proposed Dampier Archipelago Marine Park	Pilbara	SAR	14,079
Monitoring the coral predator, Drupella cornus, in Ningaloo Marine Park	Pilbara	SAR	6,024
Bills Bay reef recovery study and coral spawning observations in Ningaloo Marine Park	Pilbara	SAR	17,264
Mapping the coral reef communities of the Shark Bay Marine Park	Mid-west	KBA	4,690
Summary of historical marine research and monitoring relevant to the Jurien Bay Marine Park	Mid-west	KBA	5,751
Using marine habitats as surrogates to map marine biodiversity	All	KBA	11,920
WAMSI Node 3: Administration, coordination, integration	Pilbara	KWA	6,000[3]
WAMSI Node 3: Communication	Pilbara	KWA	6,000[2]
WAMSI Node 3: Data management	Pilbara	KWA	6,000[2]
WAMSI Node 3: Knowledge transfer	Pilbara	KWA	10,000[2]
SRFME carry-over projects: Jurien Bay Marine Park	Mid-west	KWA	0[2]
Conservation of marine turtles in Western Australia	Mid-west, Pilbara, Kimberley,	BPR	5,780
Strategy for the development and implementation of an integrated tropical marine research plan:2010-2015	Pilbara, Kimberley,	SWI	160,395
Strategy for the development and implementation of an integrated temperate marine research plan:2010-2015	Midwest, Swan, South west, Warren, South Coast	AKE	204,147
Strategic plan for the development and implementation of a long-term marine monitoring program in Western Australia: 2009-2019	All	KFR	51,156
Implementation of the Western Australian Marine Monitoring Program	All	KFR	343,977
TOTAL			**1,320,318**

[1] Includes all salary, equipment purchase and operational costs

[2] Includes salary on costs and purchase of equipment

[3] The total expenditure for WAMSI and SRFME related research for 2008/09 was $158,000, however most of the funding is recouped from WAMSI. Expenditure detailed in this table covers the salary component for CS.

11. MARINE SCIENCE PROGRAM: SUMMARY OF BUDGET ALLOCATION AND EXPENDITURE FOR 2008/09

Budget expenditure largely met or exceeded individual reserve CF allocations in all cases (see below). The unevenness in expenditure at a reserve level is a reflection of year to year variations in the geographic emphasis of MSP activities (out of necessity) and the small budgets and very high costs of doing marine science in some reserves (e.g. Montebello and Rowley Shoals marine parks). These reserves will require temporary cross subsidies from time to time to achieve appropriate outcomes. Over time these variations will be evened out to comply with Government allocations for each reserve.

MPA	**Allocation** ($'000s)	**Adjusted Expenditure**[4] ($'000s)
Rowley Shoals Marine Park	0	85
Montebello/Barrow Is MPAs[5]	160	210
Ningaloo MPAs	350	350[6]
Shark Bay MPAs	80	240
Jurien Bay Marine Park	0	70
Metro MPAs	80	290
Walpole	30	75
Statewide	620	NA
Total	**1,320**	**1,320**

[4] Statewide component distributed across Regions evenly.

[5] Includes expenditure in proposed Dampier Archipelago MPAs

[6] This total does not include the $130K allocated through WAMSI to the Ningaloo Research Program.

12 MARINE SCIENCE PROGRAM STAFF PRODUCTIVITY FOR 2008/09

MARINE SCIENCE PROGRAM: SCIENTIST PRODUCTIVITY REVIEW FRAMEWORK - Chris Simpson, Program Leader

OUTPUTS FOR THE PERIOD - 1 July 2008 to 30 June 2009

Science		*Communication*		*Knowledge Transfer*	
Type	**Achievements (list)**	**Type**	**Achievements (list)**	**Type**	**Achievements (list)**
SPP		*Media interviews*	Interview with GWN: Ningaloo Research Program Symposium. 22 May. Interview with ABC Karratha: Ningaloo Research Program Symposium. 25 May Interview with ABC Perth: Ningaloo Research Program Symposium. 27 May	*Advice (e.g. EIA, NRM etc) - (verbal)*	Pilbara Eighty Mile Beach MPA process: Marine Policy and Planning Branch. Kimberley MPA process: Marine Policy and Planning Branch. Gorgon Marine Environmental Offsets process: Environmental Management Branch. Pluto Marine Environmental Offsets process: Environmental Management Branch. Indo-Pacific Fish Conference Biodiversity Monitoring Workshop: Department of Fisheries.
Data Report		*Pamphlets/information sheets/newsletters etc*	Marine Science Program: Science Division Pamphlett. *Conservation News* article: New Staff for Marine Science Program.	*Advice (e.g. EIA, NRM etc) - (written))*	Ecosystem Based Fisheries Management process: Department of Fisheries. WA Biodiversity Conservation Appraisal System strategy: Nature Conservation Service
Technical Report	McKenzie N L, Burbidge A A, Burrows N D, Kenneally K F, Masini R J, Sim C B, **Simpson C J**, Start A N (2009). A synthesis of scientific knowledge to support conservation management in the Kimberley region of Western Australia. Department of Environment and Conservation. WA. 46 pp. Armstrong S, Friedman K, Rule M, Page C, **Simpson C J** (2008). Coral Communities: Review of information relevant to the development of a monitoring program for coral communities in Western Australia. Draft technical report.	*Briefings/formal discussion etc*	MOU with UWA. MOU with AIMS.	*Planning/Management guideline - (contributing author)*	
Conference paper	**Simpson C J**, Waples K, Kendrick A J (2008). *Science and Management: a framework to enhance knowledge transfer.* Pp 88-90. In: Waples K (2008). Ningaloo Research Progress Report: Discovering Ningaloo - latest findings and their implications for management. Ningaloo Research Coordinating Committee. Department of Environment and Conservation, WA. 114 pp. Long S, Wocheslaender R, **Simpson C J** (2008). Comparability within long-term datasets of coral condition when methodology has changed. Pp 106-109. In: Waples K (2008). Ningaloo Research Progress Report: Discovering Ningaloo - latest findings and their implications for management. Ningaloo Research Coordinating Committee. Department of Environment and Conservation, WA. 114 pp. Armstrong S, Long S, Smith L, **Simpson C J** (2008). Coral Bay reef recovery study. Pp 28-30. In: Waples K (2008). Ningaloo Research Progress Report: Discovering Ningaloo - latest findings and their implications for management. Ningaloo Research Coordinating Committee. Department of Environment and Conservation, WA. 114 pp. Waples K and **Simpson, C J** (2009). Integrating science into management to support marine conservation:a management perspective. Pp 9-16. In: Waples K (ed) (2009). Abstracts of the Third Annual Ningaloo Symposium, May 2009. Department of Environment and Conservation, WA. 88 pp.	*Web-based communications*		*Planning/Management guideline - (primary author)*	**Simpson C J** (2008). Science productivity review framework. **Simpson C J,** Waples K (2008). Framework for science communication in DEC. **Simpson C J** (2008). Business Planning and Performance Management. MSP Guideline No. 2. Unpublished Report, Department of Conservation and Environment. 11 pp. **Simpson C J** (2008). Process for planning, approval and reporting on marine science projects supported by DEC. MSP Guideline No. 1. Unpublished Report, Department of Conservation and Environment. 10 pp.
Journal paper		*Popular article*		*Species /Protected Area management plans - (contributing author)*	
Book chapter		*Milestone reports*	**Simpson C J** (2008). Marine Science Program: Summary of outputs and expenditure for 2007/08. Report to the Marine Parks and Reserves Authority. Unpublished Report, Department of Environment and Conservation. 33 pp. **Simpson C J** (2008). Marine Science Business Plan: 1 July 2008-30 June 2009. Unpublished Report, Department of Environment and Conservation. 11 pp. **Simpson et al.** (2009). Marine Science Program: Science Division Annual Research Activities Report 2008/09 contribution. **Simpson et al.** (2009). Marine Science Program: DEC Annual Report contribution.	*Species /Protected Area management plans - (primary author)*	
Major review		*Conference abstracts, presentations; seminar/lecture presentations; Poster/formal field day presentations*	*Presentations:* WAMSI Node 3 Science Review 2008. August 2008. MPRA Review of 2007/08. September 2008. WAMSI 'Show and Tell' 2008. October 2008. WAMSI Node 3 Science Review 2009. February 2009. Southwest Catchment Council: Future MSP Research and Monitoring in WA's southwest. 17 March, 2009. Climate Change presentation to WA Rotary. 3 April, 2009. WAMSI Node 3 Update: Presentation to WAMSI Board. 4 June 2009. Marine Science Program update: Presentation to the MPRA. June 2009.	*Policy/Strategy statement (contributing author)*	Kendrick A, **Simpson C J**, Wilson S (2009). Strategy for the Development of Integrated Marine Research Plans. (Draft). Department of Environment and Conservation, WA. 11 pp. Friedman K, **Simpson C J** (2008). Strategy for the development and implementation of a long-term monitoring program in Western Australia, with particular focus on marine protected areas. (Draft). Department of Environment and Conservation, WA. 11 pp.
Book chapter				*Policy/Strategy statement (primary author)*	**Simpson C J** and Burrows N (2009). Science Policy Discussion Paper. Draft Report, Department of Environment and Conservation. WA. 15 pp. Waples K, **Simpson C J**, McKenna S (2008). Marine Science Program Communication Strategy. Unpublished Report, Department of Conservation and Environment. 12 pp.

MARINE SCIENCE PROGRAM: SCIENTIST PRODUCTIVITY REVIEW FRAMEWORK - Kim Friedman - Principal Research Scientist - Monitoring

OUTPUTS FOR THE PERIOD - 1 July 2008 to 30 June 2009

Science		*Communication*		*Knowledge Transfer*	
Type	**Achievements (list)**	**Type**	**Achievements (list)**	**Type**	**Achievements (list)**
SPP		*Media interviews*		*Advice (e.g. EIA, NRM etc) - (verbal)*	Marine Indicators Workshop: Perth Region NRM. Nature Based Recreation and Tourism Research Reference Group. Gorgon Marine Environmental Offsets process: Environmental Management Branch.
Data Report		*Pamphlets/information sheets/newsletters etc*	**Friedman, K.** 2009 Marine Monitoring Newsletter. Western Australian Marine Monitoring Project. 4p.	*Advice (e.g. EIA, NRM etc) - (written))*	
Technical Report	**Friedman, K.** and Kinch, J. (in press) Samoa. In: FAO. Global Review of the Use of Marine Protected Areas as a Fisheries Management Tool: governance and institutional issues in multi-objective space-based management. FAO Fisheries and Aquaculture Technical Paper. Rome, FAO. **Friedman, K.** and Golbuu, Y. (in press) Palau. In: FAO. Global Review of the Use of Marine Protected Areas as a Fisheries Management Tool: governance and institutional issues in multi-objective space-based management. FAO Fisheries and Aquaculture Technical Paper. Rome, FAO. Kinch, J.; Purcell, S.; Uthicke, S. and **Friedman, K.** 2008. Population Status, Fisheries and Trade of Sea Cucumbers in the Western Pacific. In: Toral-Granda, V.; Lovatelli, A. and Vasconcellos, M. (eds.). Sea Cucumbers: A Global Review of Fisheries and Trade. FAO Fisheries Technical Paper, No.: 516. pp: 7-55. Rome: FAO. Kinch, J.; Purcell, S.; Uthicke, S. and **Friedman, K.** 2008. Papua New Guinea: A Hot spot of Sea cucumber Fisheries in the Western Pacific. In: Toral-Granda, V.; Lovatelli, A. and Vasconcellos, M. (eds.). Sea Cucumbers: A Global Review of Fisheries and Trade. FAO Fisheries Technical Paper, No.: 516. pp: 57-77. Rome: FAO.	*Briefings/formal discussion etc*	MOU with UWA.	*Planning/Management guideline - (contributing author)*	
Conference paper		*Web-based communications*		*Planning/Management guideline - (primary author)*	
Journal paper	Andréfouët, S., **Friedman, K.**, Gilbert, A., and Remoissenet, G. 2009. A comparison of two surveys of invertebrates at Pacific Ocean islands: the giant clam at Raivavae Island, Australes Archipelago, French Polynesia. – ICES Journal of Marine Science	*Popular article*	**Friedman, K.J.** and L. Gisawa. 2008 Sea Cucumbers: Early retirement or renewal? Island Business Magazine. Pg48-49.	*Species /Protected Area management plans - (contributing author)*	
Book chapter	**Friedman K.,** Purcell S., Bell J. and Hair C. 2008. Sea cucumber fisheries: a manager's toolbox. ACIAR Monograph No. 135, 32 pp. **Friedman, K.**and Teitelbaum, A. 2008. Giant Clams in the Indo Pacific. p4-10. In Soorae, P. S. (ed.) Global re-introduction perspectives: re-introduction case-studies from around the globe. IUCN/SSC Re-introduction Specialist Group, Abu Dhabi, UAE. viii + 284 pp.	*Milestone reports*		*Species /Protected Area management plans - (primary author)*	
Major review	Armstrong, S., **Friedman, K.,** Rule, M., Page, C. and Simpson, C. (in prep) Coral communities: Review of information relevant to the development of a monitoring program for coral communities in Western Australia. **Friedman, K.** (in prep) Seagrass communities: Review of information relevant to the development of a monitoring program for coral communities in Western Australia. **Friedman K.J.,** Pakoa K., Kronen M., Chapman L.B., Sauni S., Vigliola L., Boblin P., Magron F. 2008. Vanuatu country report : profiles and results from survey work at Paunangisu village, Moso Island, Uri and Uripiv Islands and the Maskelyne archipelago. Pacific Regional Oceanic and Coastal Fisheries Development Programme (PROCFish/C/CoFish). Noumea, New Caledonia: Secretariat of the Pacific Community. 391 p.	*Conference abstracts, presentations; seminar/lecture presentations; Poster/formal field day presentations*	Presentations: **Friedman, K.** Dec 2008 MSP Monitoring Strategy Presentation. District and Regional Leaders **Friedman, K.** Dec 2008 MSP Monitoring Strategy Presentation. Nat Cons Leaders Meeting Purcell S.W., Tardy E., Desurmont A., **Friedman K.J.** 2008. Commercial Holothurians of the tropical Pacific [Poster]. Noumea, New Caledonia: Secretariat of the Pacific Community. **Friedman, K.** (2009). Establishing a long-term marine monitoring program for ecological and social assets in Western Australia. Pg 62. In: Waples K (ed) (2009). Abstracts of the Third Annual Ningaloo Symposium, May 2009. Department of Environment and Conservation, WA. 88 pp. **Friedman, K.** June 2009. WAMMP presentation. Ningaloo Symposium **Friedman, K.** June 2009. MSP WAMMP update: Presentation to the MPRA.	*Policy/Strategy statement (contributing author)*	
				Policy/Strategy statement (primary author)	**Friedman K**, Simpson C J (2009). Strategy for the development and implementation of a long-term monitoring program in Western Australia, with particular focus on marine protected areas. (Draft). Department of Environment and Conservation, WA. 11 pp.

MARINE SCIENCE PROGRAM: SCIENTIST PRODUCTIVITY REVIEW FRAMEWORK - Shaun Wilson, Senior Tropical Research Scientist

OUTPUTS FOR THE PERIOD - 1 July 2008 to 30 June 2009

Science		*Communication*		*Knowledge Transfer*	
Type	**Achievements (list)**	**Type**	**Achievements (list)**	**Type**	**Achievements (list)**
SPP	**Wilson S K** and Holmes T H (draft). Interactive effects of fishing and climate change on reef fish populations. **Wilson S K** (in prep). Preliminary assessment of diseases affecting Western Australian corals.	*Media interviews*	Media release (via JCU) GCB paper on the effects of climate change and fishing. Nov 2008. Media release (via JCU) J Applied Ecology paper gear regulations to reduce bleaching impacts. June 2009.	*Advice (e.g. EIA, NRM etc) - (verbal)*	Use of Clove oil to collect fish: environmental impacts. Email conversation with Dr. Ross Roberston (STRI)
Data Report		*Pamphlets/information sheets/newsletters etc*	Munday P L, Cheal A J, Graham N A J, Meekan M, Pratchett M S, Sheaves M, Sweatman H, **Wilson S K** (draft). Marine Climate Change Impacts and Adaptation Report Card (MaRC) for Australia: Tropical Coastal and Demersal Fishes. Graham N A J, Pratchett M S, **Wilson S K**, Munday P L (2009). Climate change and reef fish community structure: response, adaptation and resilience. GBR Foundation Discussion paper. Pratchett M S, Graham N A J, **Wilson S K**, Munday P L (2009). Climate change and habitat complexity of coral reef environments. GBR Foundation Discussion paper.	*Advice (e.g. EIA, NRM etc) - (written))*	10 x Review for Peer Reviewed Journal (1x Mar Biol, 1x ICRS, 3x J Fish Biol, 3x Coral Reefs, 1x MEPS, 1x J Anim Ecol) 3 x Project Proposals/Assessing Licence Applications (Coral monitoring at Rottnest-Stoddard, Fish growth and climate change-Meekan, Genetics of giant clams-Penny)
Technical Report		*Briefings/formal discussion etc*	Oral presentation to visiting Ministerial Delegation on the Marine Science Program, Department of Environment and Conservation. (April 09).	*Planning/Management guideline - (contributing author)*	
Conference paper	**Wilson S K** (2009). Climate change and coral reef habitat: implications for fish. In: *A Changing Climate, Western Australia in Focus*. Presenters abstract papers for the CSIRO-AMOS-WAMSI Climate Change Research Symposium.	*Web-based communications*		*Planning/Management guideline - (primary author)*	
Journal paper	**Wilson S K**, Fisher R, Pratchett M S, Graham N A J, Dulvy N K, Turner R A, Cakacaka A, Polunin N V C (in press). Habitat degradation compounds effects of fishing on the size structure of coral reef fish communities. *Ecological Applications.* McClanahan T R, Graham N A J, **Wilson S K**, Letourneur Y (In review). Fisheries closure size, age, and history of compliance effects on coral reef fish communities in the western Indian Ocean. *Marine Ecology Progress Series.*	*Popular article*		*Species /Protected Area management plans - (contributing author)*	
Book chapter		*Milestone reports*		*Species /Protected Area management plans - (primary author)*	
Major review	**Wilson S K** (draft). Tropical finfish communities: Review of information relevant to the development of a monitoring program for tropical finfish communities in Western Australia. **Wilson S K** et al. (in prep). Coral reef fish and climate change questions we need to know. To be submitted to J Exp Biology	*Conference abstracts, presentations; seminar/lecture presentations; Poster/formal field day presentations*	*Conference presentations* CSIRO-AMOS-WAMSI climate change research symposium March 2009. IndoPacifc Fish Conference, June 09.	*Policy/Strategy statement (contributing author)*	
				Policy/Strategy statement (primary author)	Kendrick A, Simpson C J, **Wilson S K** (draft). Strategy for the Development of Integrated Marine Research Plans. Department of Environment and Conservation, WA. 11 pp.

MARINE SCIENCE PROGRAM: SCIENTIST PRODUCTIVITY REVIEW FRAMEWORK - Alan Kendrick, Senior Temperate Research Scientist

OUTPUTS FOR THE PERIOD - 1 July 2008 to 30 June 2009

Science		*Communication*		*Knowledge Transfer*	
Type	**Achievements (list)**	**Type**	**Achievements (list)**	**Type**	**Achievements (list)**
SPP	Spatial and temporal patterns in the structure of intertidal rocky platform communities in the MMP and SIMP (Draft) The biogeography of SBMP mangrove communities (Draft)	*Media interviews*		*Advice (e.g. EIA, NRM etc) - (verbal)*	Pilbara Eighty Mile Beach MPA planning process: Marine Policy and Planning Branch. Walpole and Nornalup Inlets Marine Park planning process: Marine Policy and Planning Branch. Marine Indicators Workshop: Perth Region NRM. Marine Reference Group: Perth Region NRM. 2009 State Coastal Conference Steering Committee: Perth Region NRM
Data Report		*Pamphlets/information sheets/newsletters etc*		*Advice (e.g. EIA, NRM etc) - (written))*	Written advice to MPRA on the Ten yearly audit of the Shark Bay Marine Reserves Management Plan. Written advice to PRNRM on the development of Marine Monitoring Indicators Manuscript review for *Helgoland Marine Research* (August 2008) Written advice to NPB/SCB (DEC) on marine research permit applications
Technical Report	**Kendrick AJ** (2009) Temperate Fish communities: Review of information relevant to the development of a monitoring program for temperate fish communities in Western Australia (Draft). Department of Environment and Conservation. 22pp John A, **Kendrick A** (2009) Microbial communities: Review of information relevant to the development of a monitoring program for microbial communities communities in Western Australia (Draft). Department of Environment and Conservation. 11pp	*Briefings/formal discussion etc*	**Kendrick AJ** (September 2008) *MSP update*. MPRA meeting, 18/09/08. **Kendrick AJ** (March 2009) *MSP Structure and role*. Briefing to South West Region management team. **Kendrick AJ** (June 2009) *Proposed midwest Region marine research.* Briefing to Manager, Midwest Region.	*Planning/Management guideline - (contributing author)*	
Conference paper	Simpson C J, Waples K, **Kendrick AJ** (2008). Science and Management: a framework to enhance knowledge transfer. Pp 88-90. In: Waples K (2008). Ningaloo Research Progress Report: Discovering Ningaloo - latest findings and their implications for management. Ningaloo Research Coordinating Committee. Department of Environment and Conservation, WA. 114 pp. Chapman TF, **Kendrick AJ**, Morris K, Stanley F, Speirs M (2009) Draft marine turtle recovery plan for Western Australia. Presentation at the 29th Symposium on Sea Turtle Biology and Conservation, Brisbane, 17-19 Feb 2009.	*Web-based communications*		*Planning/Management guideline - (primary author)*	
Journal paper	Rule M, **Kendrick A,** Bancroft K. *Benchmarking nutrient values for relatively un-impacted warm temperate coastal waters.* (Draft ms).	*Popular article*		*Species /Protected Area management plans - (contributing author)*	DEC (2009) *Walpole and Nornalup Inlets Marine Park Management Plan 2009-2019*. Department of Environment and Conservation.
Book chapter		*Milestone reports*		*Species /Protected Area management plans - (primary author)*	
Major review		*Conference abstracts, presentations; seminar/lecture presentations; Poster/formal field day presentations*	Rule M, **Kendrick AJ** (March 2009) Marine Conservation Reserves in WA. Lecture to ECU Marine Science Students. Chapman TF, **Kendrick AJ**, Morris K, Stanley F, Speirs M (2009) Draft marine turtle recovery plan for Western Australia. Presentation at the 29th Symposium on Sea Turtle Biology and Conservation, Brisbane, 17-19 Feb 2009.	*Policy/Strategy statement (contributing author)*	**Kendrick AJ,** Simpson C J, Wilson S **(**2009). *Strategy for the Development of Integrated Marine Research Plans*. (Draft). Department of Environment and Conservation, WA. 11 pp.
Book chapter				*Policy/Strategy statement (primary author)*	**Kendrick AJ** (2008) *Marine research permits and the DEC process for reviewing research permit applications.* MSP Guideline No. 4, Marine Science Program. Unpublished Report. Department of Environment and Conservation.

MARINE SCIENCE PROGRAM: SCIENTIST PRODUCTIVITY REVIEW FRAMEWORK - Kelly Waples –Science Coordinator, WAMSI Node 3

OUTPUTS FOR THE PERIOD - 1 July 2008 to 30 June 2009

Science		***Communication***		***Knowledge Transfer***	
Type	**Achievements (list)**	**Type**	**Achievements (list)**	**Type**	**Achievements (list)**
SPP		*Media interviews*	Interview with ABCNorthwest:Ningaloo Student Research Day, 30 March 09 Media release: Ningaloo Student Research Day, March 09 Media release: 3rd Annual Ningaloo Research Symposium, May 09	*Advice (e.g. EIA, NRM etc) - (verbal)*	National Marine Mammal Advisory Committee - grant application review for marine mammal research Ningaloo Research Coordinating Committee - integration of the Ningaloo Research Program CSIRO WfO Cluster Management Committee - integration of the Ningaloo Research Program
Data Report		*Pamphlets/information sheets/newsletters etc*	WAMSI Node 3 information pamphlet (coordinated by WAMSI Communication Officer)	*Advice (e.g. EIA, NRM etc) - (written))*	
Technical Report		*Briefings/formal discussion etc*		*Planning/Management guideline - (contributing author)*	
Conference paper	Simpson C J, **Waples K A**, Kendrick A J (2008). Science and Management: a framework for knowledge transfer. Pp 88-90. In: Waples K and Hollander E (2008). Ningaloo Research Progress Report: Discovering Ningaloo - latest findings and their implications for management. Ningaloo Research Coordinating Committee. Department of Environment and Conservation, WA. 114 pp. **Waples K A** and Simpson, C J (2009). Integrating science into management to support marine conservation:a management perspective. Pp 9-16. In: Waples K (ed) (2009). Abstracts of the Third Annual Ningaloo Symposium, May 2009. Department of Environment and Conservation, WA. 88 pp.	*Web-based communications*	Input to the WAMSI website for Node 3 research. Input and maintenance along with CSIRO of the Ningaloo Research Program website (www.ningaloo.org.au).	*Planning/Management guideline - (primary author)*	
Journal paper		*Popular article*		*Species /Protected Area management plans - (contributing author)*	
Book chapter		*Milestone reports*	**Waples K** and Hollander E (2008)**.** Ningaloo Research Progress Report: Discovering Ningaloo - latest findings and their implications for management. Ningaloo Research Coordinating Committee. Department of Environment and Conservation, WA. 114 pp. **Waples K** (2008). WAMSI Project 3.6: Science cooridination: administration, communiciaton and data management. Milestone report submitted to WAMSI, July 2008.	*Species /Protected Area management plans - (primary author)*	
Major review		*Conference abstracts, presentations; seminar/lecture presentations; Poster/formal field day presentations*	*Presentations:* MPRA Review of 2007/08, MPRA meeting, September 2008. Ningaloo Research Program Update, Pilbara Regional meeting, October 08. WAMSI Science Reviews projects 3.6 and 3.8, WAMSI Science Review Panel, April 2009. Integrating science into management to support marine conservation management; presented at the 3rd Annual Ningaloo Research Symposium, May 2009. Update on Ningaloo research and the knowledge transfer framework, MPRA meeting, June 2009	*Policy/Strategy statement (contributing author)*	
Book chapter				*Policy/Strategy statement (primary author)*	**Waples K,** Simpson C J, McKenna S (2008). Marine Science Program Communication Strategy. Unpublished Report, Department of Conservation and Environment. 12 pp.

MARINE SCIENCE PROGRAM: SCIENTIST PRODUCTIVITY REVIEW FRAMEWORK - Kevin Bancroft					
OUTPUTS FOR THE PERIOD - 1 July 2008 to 30 June 2009					
Science		***Communication***		***Knowledge Transfer***	
Type	**Achievements (list)**	**Type**	**Achievements (list)**	**Type**	**Achievements (list)**
SPP		*Media interviews*		*Advice (e.g. EIA, NRM etc) - (verbal)*	Verbal advice to EMB, MEB & Woodside re fulfilling conditions for the Woodside Pluto trunkline in Dampier Archipelago; Verbal advice to EMB, MEB on the habitat mapping classification, definitions & methods for Gorgon monitoring;
Data Report	**Bancroft KP** (2009) Mapping of the coral reef communities of Shark Bay marine protected areas: Data collected during the February 2008 field survey. Department of Environment and Conservation, Perth, Western Australia, Marine Science Program Data Report MSPDR3. 46 p. **Bancroft KP** (2009) Establishing long-term monitoring sites in the Montebello/Barrow marine protected areas: Data collected in December 2006. Department of Environment and Conservation, Perth, Western Australia, Marine Science Program Data Report MSPDR4. 69 p. **Bancroft KP** (2009) Summary of marine research and monitoring applicable to the management of Jurien Bay Marine Park: 2000 to June 2008. Department of Environment and Conservation, Perth, Western Australia, Marine Science Program Data Report MSPDR8. 69 p.	*Pamphlets/ information sheets/ newsletters etc*		*Advice (e.g. EIA, NRM etc) - (written))*	Written advice to EMB, MEB on the habitat mapping classification & methods for Gorgon monitoring
Technical Report	Edgar G, Barrett BJ, Lenel D, Crane K, **Bancroft KP** (2009) Ecosystem monitoring of subtidal reefs in different management zones in the Jurien Bay Marine Park 1999–2007. Tasmanian Aquaculture and Fisheries Institute , University of Tasmania, Hobart, Tasmania. **Bancroft KP** (in prep) Long-term coral community monitoring in the Montebello/Barrow islands marine protected areas: Site descriptions and preliminary analysis of baseline data collected in December 2006. Marine Science Program, Department of Environment and Conservation, Perth, Western Australia, Marine Science Technical Report Series. **Bancroft KP** (DRAFT) Benthic habitat mapping for the management of marine protected areas: An approach and rationale. Marine Science Program Technical Report Series MSPTRX. Marine Science Program, Department of Environment and Conservation, Perth, Western Australia.	*Briefings/ formal discussion etc*		*Planning/Management guideline - (contributing author)*	Davidson JA, Lawrie R, **Bancroft KP** (2008) Biological classification of marine benthic habitats in waters of proposed marine parks and reserves in the Pilbara region (including Great Sandy Island Nature Reserve, Cowrie Beach and Spit Point to Cape Keraudren including Bedout, North Turtle and Little Turtle islands). Marine Policy and Planning Branch, Department of Environment and Conservation, Perth, Western Australia, Field Program Report. 46 p.
Conference paper		*Web-based communications*		*Planning/Management guideline - (primary author)*	
Journal paper	Rule M J, Kendrick A **Bancroft KP** (DRAFT) Benchmarking nutrient values for relatively un-impacted warm temperate coastal waters- near draft	*Popular article*	**Bancroft KP** (2008) Discovering the coral life in Shark Bay Marine Park. Landscope. 24(1), 50-55.	*Species /Protected Area management plans - (contributing author)*	
Book chapter	Chin A, Sweatman H, Forbes S, Perks H, Walker R, Jones G, Williamson D, Evans R, Hartley F, Armstrong S, Malcolm H, Edgar G, **Bancroft K,** Valentine J, Halstead B (2009). Status of the Coral Reefs in Australia and Papua New Guinea. *In Status of coral reefs of the world: 2008.* (ed. Wilkinson, C). pp. 159-176. Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre, Townsville, Australia.	*Milestone reports*		*Species /Protected Area management plans - (primary author)*	
Major review	**Bancroft KP** (DRAFT) Water quality and sediment quality: Review of information relevant to the development of a monitoring program for water quality and sediment quality in Western Australia	*Conference abstracts, presentations; seminar/lecture presentations; Poster/formal field day presentations*	**Bancroft KP**, Long S (2008) Modelling suggests connectivity between the Ningaloo Reef and coral reefs of the Pilbara. In Discovering Ningaloo: Latest findings and their implications for management. Ningaloo Research Program Progress Report. (ed. K Waples). pp. 61-64. Western Australian Marine Science Institute, Perth, Western Australia.	*Policy/Strategy statement (contributing author)*	
Book				*Policy/Strategy statement (primary author)*	

MARINE SCIENCE PROGRAM: SCIENTIST PRODUCTIVITY REVIEW FRAMEWORK - Shannon Armstrong

OUTPUTS FOR THE PERIOD - 1 July 2008 to 30 June 2009

Science		***Communication***		***Knowledge Transfer***	
Type	**Achievements (list)**	**Type**	**Achievements (list)**	**Type**	**Achievements (list)**
SPP		*Media interviews*	Northern Guardian Newspaper article: "Department's scientists monitor Ningaloo snails". 16/4/08. pg 2. Northern Guardian newspaper article: "Science and the Ningaloo snails". 2/4/08. pg 3. The West Australian newspaper article: "Freak weather inflicts devastating damage on Ningaloo's coral". 23/9/08. pg 3. Northern Guardian newspaper article: "Coral Bay's reef badly bleached". 17/9/08. pg 4. Radio broadcasts: ABC - North West, Midwest and Wheatbelt, WA. Regarding the upcoming field operations and latest findings of the Ningaloo Marine Park Drupella long-term monitoring program. 6.30 am and 7.30 am news. 1/4/2008.	*Advice (e.g. EIA, NRM etc) - (verbal)*	
Data Report	**Armstrong SJ**, Syme R (2009) Anoxic impacts at Bill's Bay, Ningaloo Marine Park associated with the 2008 coral spawning event. Marine Science Program Data Report Series: MSPDR2. January 2009. Marine Science Program, Department of Environment and Conservation, Perth, Western Australia. 19p. **Armstrong SJ** (2009) Ningaloo Marine Park Drupella long-term monitoring program: Data collected during the 2008 survey. Marine Science Program Data Report Series: MSPDR5. January 2009. Marine Science Program, Department of Environment and Conservation, Perth, Western Australia. 17p. **Armstrong SJ** (2009) Assessing the effectiveness of sanctuary zones in the proposed Dampier Archipelago Marine Park: Data collected during the 2007 survey. Marine Science Program Data Report Series: MSPDR6. January 2009. Marine Science Program, Department of Environment and Conservation, Perth, Western Australia. 17p. **Armstrong SJ** (2008) Preliminary assessment of coral communities at selected sites in the proposed Dampier Archipelago Marine Park. Marine Science Program Data Report Series: MSPDR1. November 2008. Marine Science Program, Department of Environment and Conservation, Perth, Western Australia. 29p**.** **Armstrong SJ** (in prep) Disturbance and recovery of coral communities at Coral Bay, Ningaloo Reef Western Australia: 2008 survey data. Marine Science Program Data Report Series: MSPDRXX. May 2009. Marine Science Program, Department of Environment and Conservation, Perth, Western Australia. **Status: Draft completed**	*Pamphlets/information sheets/newsletters etc*	**Armstrong SJ** (2009) The status of the coral predator *Drupella cornus* at Ningaloo Marine Park. Science Information Sheet. Marine Science Program, Department of Environment and Conservation, Perth, Western Australia. 2p. **Armstrong SJ** (2009) Coral Bay coral recovery. Science Information Sheet. Marine Science Program, Department of Environment and Conservation, Perth, Western Australia. 2p.	*Advice (e.g. EIA, NRM etc) - (written))*	
Technical Report	**Armstrong SJ** (in prep) Ningaloo Marine Park *Drupella* long-term monitoring program: Results of the 2008 survey. Marine Science Program Technical Report Series: MSPTR xx. January 2009. Marine Science Program, Department of Environment and Conservation, Perth, Western Australia. 33p. **Status: Final edit stage** **Armstrong SJ** (in prep) Establishing a long-term monitoring program for the proposed Dampier Archipelago Marine Park: 2007 Survey. Marine Science Technical Report: MSPTR? Marine Science Program, Department of Environment and Conservation, Perth, Western Australia. **Status: Started, not fully completed**	*Briefings/formal discussion etc*		*Planning/Management guideline - (contributing author)*	Wasn't sure where to place this - **Armstrong SJ** (draft) Definition, format and process to publish Marine Science Data and Technical Reports. Marine Science Program, Department of Environment and Conservation, Perth, Western Australia. 13p. **Status: final draft stage**
Conference paper	**Armstrong SJ** (2008) Long-term monitoring of Drupella. In Discovering Ningaloo: Latest findings and their implications for management. Ningaloo Research Program Progress Report. (ed. Waples, K): pp. 26-27. Western Australian Marine Science Institution, Perth, Western Australia. **Armstrong SJ** (2008) Coral reef recovery and resilience in Coral Bay, WA. In Discovering Ningaloo: Latest findings and their implications for management. Ningaloo Research Program Progress Report. (ed. Waples, K): pp. 28-30. Western Australian Marine Science Institution, Perth, Western Australia. **Armstrong SJ** (2008) Summary of the 2006 winter bleaching event at Ningaloo Marine Park. In Discovering Ningaloo: Latest findings and their implications for management. Ningaloo Research Program Progress Report. (ed. Waples, K): pp. 26-27. Western Australian Marine Science Institution, Perth, Western Australia.	*Web-based communications*		*Planning/Management guideline - (primary author)*	
Journal paper		*Popular article*		*Species /Protected Area management plans - (contributing author)*	
Book chapter	Chin A, Sweatman H, Forbes S, Perks H, Walker R, Jones G, Williamson D, Evans R, Hartley F, **Armstrong S**, Malcolm H, Edgar G, Bancroft K, Valentine J, Halstead B (2009). Status of the Coral Reefs in Australia and Papua New Guinea. In Status of coral reefs of the world: 2008. (ed. Wilkinson, C). pp. 159-176. Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre, Townsville, Australia.	*Milestone reports*		*Species /Protected Area management plans - (primary author)*	
Major review	**Armstrong, S**., Friedman, K., Rule, M., Page, C. and Simpson, C. (in prep) Coral communities: Review of information relevant to the development of a monitoring program for coral communities in Western Australia.	*Conference abstracts, presentations; seminar/lecture presentations; Poster/formal field day presentations*		*Policy/Strategy statement (contributing author)*	
Book				*Policy/Strategy statement (primary author)*	

MARINE SCIENCE PROGRAM: SCIENTIST PRODUCTIVITY REVIEW FRAMEWORK - Thomas Holmes

OUTPUTS FOR THE PERIOD - 1 July 2008 to 30 June 2009

Science		***Communication***		***Knowledge Transfer***	
Type	**Achievements (list)**	**Type**	**Achievements (list)**	**Type**	**Achievements (list)**
SPP	Wilson S K and **Holmes T H** (draft). Interactive effects of fishing and climate change on reef fish populations.	*Media interviews*		*Advice (e.g. EIA, NRM etc) - (verbal)*	
Data Report	Long S C and **Holmes T H** (2008). Comparative marine biodiversity of the Rowley Shoals 2007: benthic assemblages. Marine Science Program Technical Report Series: MSPDR7. January 2009. Marine Science Program, Department of Environment and Conservation, Perth, Western Australia. 38p.	*Pamphlets/information sheets/newsletters etc*		*Advice (e.g. EIA, NRM etc) - (written))*	1 x Review for Peer Reviewed Journal (Behavioural Ecology and Sociobiology) 1 x Review (Human BA (in prep). A knowledge gap analysis of the coastal and marine environments for the Pilbara and Kimberley regions. Department of Fisheries. *5th WA State Coastal Conference*) 1 x Project Proposals/Assessing Licence Application (Ocean Acidification at the Rowley Shoals)
Technical Report		*Briefings/formal discussion etc*		*Planning/Management guideline - (contributing author)*	
Conference paper		*Web-based communications*		*Planning/Management guideline - (primary author)*	
Journal paper	**Holmes T H** and McCormick M I (in review). Gourmand or Gourmet? How selective are predators for prey size? *Marine Ecology Progress Series*. **Holmes T H** and McCormick M I (in review). Behaviour as a mechanism underlying size-based differences in vulnerability to predation. *Journal of Fish Biology.* **Holmes T H** and McCormick M I (in review). Smell, learn and live: the role of chemical alarm cues in predator learning during early life history in a marine fish. *Behavioural Processes*.	*Popular article*		*Species /Protected Area management plans - (contributing author)*	
Book chapter		*Milestone reports*		*Species /Protected Area management plans - (primary author)*	
Major review *Book*	**Holmes T H** and Friedman K (draft). Mangrove communities: Review of information relevant to the development of a monitoring program for mangrove communities in Western Australia. **Holmes T H** and Friedman K (draft). Supratidal sandy beach communities: Review of information relevant to the development of a monitoring program for supratidal sandy beach communities in Western Australia. Rule M J, **Holmes T H**, Friedman K (in prep). Intertidal rocky shore communities: Review of information relevant to the development of a monitoring program for intertidal rocky shore communities in Western Australia.	*Conference abstracts, presentations; seminar/lecture presentations; Poster/formal field day presentations*	**Holmes T H** and McCormick M I (2009). Response across a gradient: behavioural reactions of newly settled reef fish to predation cues. 2009 Indo-Pacific Fish Conference, Fremantle, WA.	*Policy/Strategy statement (contributing author)* *Policy/Strategy statement (primary author)*	

MARINE SCIENCE PROGRAM: SCIENTIST PRODUCTIVITY REVIEW FRAMEWORK - Michael Rule

OUTPUTS FOR THE PERIOD -2008/09

Science		*Communication*		*Knowledge Transfer*	
Type	**Achievements (list)**	**Type**	**Achievements (list)**	**Type**	**Achievements (list)**
SPP	Kendrick, A and **Rule, M J** (2009) Spatial and temporal patterns in the structure of intertidal rocky platform communities of the Shoalwater Islands and Marmion Marine Parks - in progress Kendrick A and **Rule M J** (2009) The biogeography of Shark Bay Marine Park mangrove communities - in progress	*Media interviews*		*Advice (e.g. EIA, NRM etc) - (verbal)*	
Data Report		*Pamphlets/information sheets/newsletters etc*		*Advice (e.g. EIA, NRM etc) - (written))*	Review of paper for Journal of Experimental Marine Biology and Ecology Review of paper for Marine Biology
Technical Report	McIlgorm, A, Campbell H F and **Rule M J** (2008). Understanding the economic benefits and costs of controlling marine debris in the APEC region (MRC 02/2007). A report to the Asia-Pacific Economic Cooperation Marine Resource Conservation Working Group by the National Marine Science Centre. 88 pp	*Briefings/formal discussion etc*		*Planning/Management guideline - (contributing author)*	
Conference paper		*Web-based communications*		*Planning/Management guideline - (primary author)*	
Journal paper	**Rule M J**, Kendrick and Bancroft-Benchmarking nutrient values for relatively un-impacted warm temperate coastal waters- near draft Mohring, Smith and **Rule M J** (in review) Morphological variation of *Turbo militaris*within the Solitary Islands Marine Park - submitted to Journal of Molluscan Studies	*Popular article*		*Species /Protected Area management plans - (contributing author)*	
Book chapter		*Milestone reports*		*Species /Protected Area management plans - (primary author)*	
Major review	**Rule M J**, Holmes T H, Friedman K (2009). Intertidal Communities Review of information relevant to the development of a monitoring program for intertidal communities in Western Australia. Draft technical report. Armstrong S, Friedman K, **Rule M J**, Page C, Simpson C J (2009). Coral Communities: Review of information relevant to the development of a monitoring program for coral communities in Western Australia. Draft technical report. **Rule M J**, Friedman K (2009) Subtidal reef communities: Review of information relevant to the development of a monitoring program for subtidal reef communities in Western Australia. In progress	*Conference abstracts, presentations; seminar/lecture presentations; Poster/formal field day presentations*	**Rule M J** & Kendrick A. Marine Conservation Reserves in WA. Lecture to ECU Marine Science Students Field assistance for ECU 1st year students Field assistance for ECU 3rd year students	*Policy/Strategy statement (contributing author)*	
Book chapter				*Policy/Strategy statement (primary author)*	