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**Towards an assessment of the natural and  
human use impacts on the marine environment  
of the Abrolhos Islands**

VOLUME 2  
Strategic research and development plan

Proceedings of a workshop held at the Western Australian Museum,  
Geraldton, July 11-13th, 2001

C.F. Chubb, F.J. Webster, C.J. Dibden, and K.E. Weir



Department of Fisheries  
Government of Western Australia

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## **Fisheries research in Western Australia**

The Fisheries Research Division of the Department of Fisheries is based at the Western Australian Marine Research Laboratories, P.O. Box 20, North Beach (Perth), Western Australia, 6020. The Marine Research Laboratories serve as the centre for fisheries research in the State of Western Australia.

Research programs conducted by the Fisheries Research Division and laboratories investigate basic fish biology, stock identity and levels, population dynamics, environmental factors, and other factors related to commercial fisheries, recreational fisheries and aquaculture. The Fisheries Research Division also maintains the State data base of catch and effort fisheries statistics.

The primary function of the Fisheries Research Division is to provide scientific advice to government in the formulation of management policies for developing and sustaining Western Australian fisheries.

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## **Executive summary**

These proceedings form the second of two public documents resulting from the project "Towards an assessment of the natural and human use impacts on the marine environment" funded by the Fisheries Research and Development Corporation (project no. 2000/166). Volume 1, a summary of existing information and assessment of current levels of human use, was presented at a Public Forum in Geraldton on July 11, 2001.

A two-day workshop was held immediately after the forum and was attended by invited representatives from professional fishing and recreational groups together with research and management experts. The issues identified in Volume 1, and those additional issues raised during the Public Forum, were addressed. The purpose of this report is twofold; firstly to document the proceedings to the workshop and, secondly, to present a strategic research and development plan to ensure a sound basis for the management of sustainable multiple use of the Abrolhos Islands resources.

A summary of the relevant legislation influencing the management of the Abrolhos Islands was presented to provide a context for the ensuing discussion. This was followed by a consideration of the natural impacts affecting the Abrolhos system. The third session dealt with human use impacts on the Abrolhos habitats. Strengths and weaknesses of the data contained in Volume 1 of this report were identified and the major issues, as they related to individual anthropogenic uses, were prioritised. The final session allowed for a summary of previous deliberations and the formulation of the strategic research and development plan.

The strategic plan lists research projects focussing on three main areas: Ecosystem Structure, Ecosystem Processes and Measurement and Monitoring of Impacts and Uses. A fourth area, Environmental Impact Assessments, was listed, but it was noted that projects under this heading were to be developed on an "as required" basis. Participants at the workshop indicated a need for the various projects to be undertaken based upon the issues raised. The time frame

for these needs was agreed as immediate (within 1-2 years), intermediate (from 2-4 years) or distant (greater than 4 years).

The key priority identified during the workshop was the need to gain a greater understanding of the natural variability of the Abrolhos system, so that anthropogenic impacts can be understood properly. Baseline monitoring information from areas listed as sites for tourism development also was considered important.

The strategic research and development plan will be presented to the Abrolhos Islands Management Advisory Committee (AIMAC) which will set its own research priorities based upon the requirements for its management advisory role.

It is envisaged that the research at the Abrolhos will be undertaken by a variety of research institutions (Australian and perhaps international) with assistance from community user groups where possible. It is vital that this research be coordinated by a single entity. It is suggested that all research proposals be coordinated through the AIMAC, or a sub-committee of AIMAC, to ensure the research needs of management are met, and the necessary, but not directly management oriented, research on ecosystem variability and processes is promoted and supported.

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## **Preface**

Under the *Fish Resources Management Act 1994*, the Department of Fisheries in Western Australia is responsible for managing the Abrolhos Island Reserve (A20253) and Abrolhos Islands Fish Habitat Protection Area and its fisheries. In December 1998, the Minister for Fisheries released the management plan entitled “Management of the Houtman Abrolhos System”<sup>1</sup>, providing a “blue print” for the future management of the area. This was followed by the release, in May 2000, of the “Aquaculture Plan for the Houtman Abrolhos Islands”<sup>2</sup>. This plan detailed a process to ensure that aquaculture is undertaken sensibly at the Abrolhos whilst retaining the area’s unique features and maintaining its conservation and tourist values. In April 2001, the Minister for Fisheries released the “Sustainable Tourism Plan for the Houtman Abrolhos Islands”<sup>3</sup> identifying a tenet of encouraging environmentally-sensitive, or nature-based tourism compatible with maintaining the Abrolhos system in an ecologically sound condition.

These plans and other national and international obligations to examine the effect of extractive and non-extractive anthropogenic activities on marine habitats (eg. Marine Stewardship Council certification of the western rock lobster fishery) led to a one year project entitled “Towards an Assessment of the Natural and Human Use Impacts on the Marine Environment of the Abrolhos Islands”. The project was funded by the Fisheries Research and Development Corporation (project no. 2000/166) to be undertaken from October 2000 to September 2001. The objectives of the project were:

1. To collate existing research information, relating to human use impacts and natural perturbations in Abrolhos marine habitats, to provide a detailed overview of the status of current knowledge about the marine ecosystem of the Abrolhos Islands.
2. To conduct limited field work to determine the spatial and temporal distribution of commercial fishing and recreational activities and provide general descriptions (ground truthing) of habitat/community types at the Abrolhos as baseline data for presentation at the workshop.

3. To conduct a scientific workshop including community representatives and technical experts to determine the objectives for and formulate a dedicated research programme to provide quantitative monitoring data for use in the sustainable management of the Abrolhos Islands Fish Habitat Protection Area.

Two reports were to be produced for the project. The reports form two volumes of a single report. A draft of Volume 1 entitled “Summary of existing information and current levels of human use” was distributed to the invited workshop participants for their information, review and comment. It contained a summary of existing published and unpublished data and a limited assessment of the state of the Abrolhos marine habitats. Volume 1 consisted of not only previously existing data, but also the results of field work conducted during the study, including the “ground truthing” of habitat and sensitivity classifications, aerial survey of lobster pot numbers and interviews with individuals of the many groups using the Abrolhos Islands.

The information contained in Volume 1 was presented at a Public Forum in the Queens Park Theatre, Geraldton on July 11, 2001. A representative cross section of all stakeholders and the general public were present and given an opportunity to comment on the research findings and raise issues for consideration at the workshop conducted on July 12 and 13, 2001.

The workshop was attended by invited representatives of all user groups and was assisted by the research and management expertise of the Australian Institute of Marine Science (AIMS); the Marine Conservation Branch of the Department of Conservation Land Management (CALM) and the Great Barrier Reef Marine Park Authority (GBRMPA) (see Appendix 1 for invitees). The objective was to prepare a strategic research and development plan to ensure ecologically sustainable multi-use management of the Abrolhos Islands well into the future.

The workshop addressed all issues raised by the research team and at the Public Forum. The workshop comprised four sessions (see Appendix 2). The first session was an introduction outlining the various legislative responsibilities of the managers, followed by the workshop objectives, the planned outcomes of the workshop and consideration of the agenda. The second session considered the natural and biological events impacting on the Abrolhos and the research needed to fully understand those events. Session three explored the human-use impacts on the Abrolhos from the viewpoint of commercial fishing, current marine-based recreational activities and likely future tourist impacts, conservation uses and other uses such as oil and mineral exploration. The final session drew together the issues and needs and led to a strategic view of the research required for the management of the Abrolhos Islands.

The workshop proceedings form Volume 2 of the research report “Strategic Research and Development Plan”, presented here. It details the issues raised, summarises discussions conducted during the workshop and outlines the strategic plan for the many areas of research considered important in the future management of the Abrolhos Islands system.

<sup>1</sup> *Fisheries Management Paper No. 117, Fisheries Western Australia, Dec 1998*

<sup>2</sup> *Fisheries Management Paper No. 137, Fisheries Western Australia, May 2000*

<sup>3</sup> *Fisheries Management Paper No. 146, Fisheries Western Australia, Feb 2001*

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## **Considered issues**

A number of issues were identified in the draft research report and were presented at the Public Forum. They included:

### ***Rock lobster fishing***

1. Rock lobster fishing in sensitive areas: the extent of damage, response (growth and regeneration) of corals and the contribution of lobsters in these areas to catches.
2. The frequency of groundings by rock lobster vessels and extent of damage caused.

### ***Scallop trawling***

3. Extension of underwater video survey of benthic habitats to determine areas at risk from trawl damage and to define trawl exclusion areas.
4. The importance of sponge gardens in relation to biochemical properties for pharmaceutical products.

### ***Wetlining***

5. Identification of exact locations where fishing and anchoring occur was problematic.
6. Commercial wetline activities should be prohibited in the shallows of the main island groups of the Abrolhos (Fisheries Management Paper 117).

### ***Aquaculture***

7. Placement and stability of the “anchor” system for longlines and potential impacts to reef systems.
8. Effects of pollutants.
9. Cage culture, anchoring, shading and nutrient loading effects.

### ***Recreational activities***

10. Popular areas which receive a high concentration of divers and anchoring need to be monitored.
11. The requirement for additional moorings needs to be addressed.
12. The number of private boat owners, family and friends of rock lobster fishers needs to be determined.
13. Quantitative data on the level of physical disturbance caused by divers needs to be assessed at popular dive sites.
14. An education program for divers and visitors is required.

### ***Tourism***

15. Impacts on marine habitats of infrastructure associated with land based developments on uninhabited islands.

## **Conservation**

16. General research on biota to improve basic biological and ecological understanding to ensure balanced decision making.

## **Additional issues**

Other issues were raised by participants in the Public Forum. These were:

17. Disposal of rubbish.
18. Research is required in relation to terrestrial activities.
19. The combined impacts from all user groups, both recreational and commercial on marine habitats needs to be considered.
20. More geological research will reveal information in relation to marine stability, long term changes in the system and climate.
21. Impact of the extraction of the rock lobster on the trophic levels.
22. Water circulation at the islands.
23. Summary data for the impact of rock lobster potting effort in the habitats of moderate biological sensitivity.
24. Habitat complexity needs to be further understood. For example, in areas classified as highly sensitive not all of the habitat will be fragile corals and vice versa for areas of moderate sensitivity where most of the habitat is less sensitive but some fragile corals are present.
25. Rate of coral damage verses rate of coral recovery and recruitment.
26. Frequency of winter low pressure systems.
27. Grounding of large ships. Can exclusion zones be established?
28. What are the actual impacts of anchoring from boats?
29. Cultural heritage needs to be protected.
30. The ropes on lost pots can be entangled over the reef and kill corals.
31. An index of coral health and the marine system at the Abrolhos, how does it rate?

# Workshop Sessions

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## **Session 1 Introduction** Chaired by Dr Chris Chubb

The opening session dealt with the conduct of the workshop and its expected outcomes. The participants were informed that the first day of the workshop should be used to investigate and understand fully all data presented in the draft research report and at the Public Forum and the issues raised therein. This would ensure that deliberation on day 2 would focus on the research requirements necessary for sustainable multi-use management of the Abrolhos Islands.

The workshop was charged with the task of developing a strategic research plan that not only identified the gaps in the knowledge about the Abrolhos system, but also suggested the likely groups that would undertake the research and indicate the desired timing for the commencement of the proposed research. The workshop was directed to consider all research without reference to the level of resources that might be required, since it was anticipated that, over time, a wide variety of research institutions and community groups would assist in the conduct of that research.

The agenda was tabled and accepted without modification.

To ensure that participants understood the requirements of legislation governing the Abrolhos Islands, Mr Colin Chalmers was invited to present a prepared paper on the subject, a summary of which follows.

### **Legislation influencing the management of the Abrolhos system**

There are a number of pieces of State and Federal legislation which affect the management of the Abrolhos Islands and surrounding waters. Each is described separately.

#### ***Land Administration Act 1997***

- DEFINITION OF LAND

All land in Western Australia and all of the State Waters are defined as land pursuant to the *Land Administration Act*. Therefore the Act's provisions apply to all of the Abrolhos Islands and the Fish Habitat Protection Area.

- MINISTER MAY RESERVE LAND

Under the Act, the Minister for Lands may reserve land for a number of purposes. The Abrolhos Islands comprise Reserve A 20253 which has been established for the purposes of the Conservation of flora and fauna, tourism and purposes associated with the fishing industry.

- MAY ORDER THE VESTING OF LAND

The Minister for Lands may vest a reserve in a person or corporate body for a particular purpose. Vesting is a form of tenure that gives a measure of control to the vestee. The Abrolhos Islands are vested in the Minister for Fisheries.

- CLASS A RESERVES

Reserves are described as A, B or C Class reserves. Parliament must approve any

amendment to the purpose or boundaries of A Class reserves, with the exception of minor modifications for administrative purposes. It is important to note that A Class reservation in itself does not confer any special protection beyond that outlined above. Protection is provided by the objects of the Act and associated regulations.

### ***Fish Resources Management Act 1994 (FRMA 1994)***

- OBJECTS OF THE *FISH RESOURCES MANAGEMENT ACT 1994*

The first object of the *FRMA 1994* is to conserve fish and protect their environment. This object requires the Minister and the Department of Fisheries to protect the aquatic environment. Another object enables the management of ecotourism.

- DEFINITION OF FISH

With the exception of mammals, birds, reptiles and amphibians, all aquatic life is defined as fish under the Act. This includes algae, coral, seagrass, mangroves and shells.

- PART 11 ABROLHOS ISLANDS

Part 11 of the Act empowers the Minister for Fisheries and the Department of Fisheries to manage and make any regulations required for the protection of the Abrolhos Islands.

- SECTION 115 FISH HABITAT PROTECTION AREAS

Section 115 of the *FRMA 1994* enables the Minister to set aside State Waters as Fish Habitat Protection Areas. FHPAs may be set aside for the following purposes:

- The conservation of fish, fish breeding areas, fish fossils, or the aquatic ecosystem;
- The culture or propagation of fish; or
- The management of fish or activities associated with the appreciation of fish.

Before a FHPA can be established, the Minister must oversee the planning and consultation process defined in the Act. A FHPA cannot be established where there is a marine reserve and is abolished if a marine reserve is established where a FHPA exists. The State Waters of the Abrolhos are a FHPA.

### ***Abrolhos Islands Regulations 1995***

The existing Abrolhos Regulations were established under the now rescinded *Fisheries Act 1905* and are still in effect.

- SECTION 42 ABROLHOS ISLANDS MANAGEMENT ADVISORY COMMITTEE

The Minister established the Abrolhos Islands Management Advisory Committee (AIMAC) in 1996 pursuant to Section 42 of the *FRMA 1994* to advise him about the management of the Abrolhos System.

### ***Environmental Protection Act 1996 (EPA 1996)***

- IMPACTS OF PROPOSALS

Under the *EPA 1996* all proposals that may have an adverse impact upon the environment must be referred to the Environmental Protection Authority for assessment. Therefore, any proposal that may have a major impact on the Abrolhos will require assessment.

- POLLUTION CONTROL

Under the *EPA 1996*, the Department of Environmental Protection (DEP) is responsible for pollution control throughout Western Australia. AIMAC and the Department of Fisheries are working with the DEP to develop appropriate waste management arrangements at the Abrolhos.

### ***Wildlife Conservation Act and Regulations 1950***

- PROTECTION OF WILDLIFE

The *Wildlife Protection Act* applies throughout Western Australia and at the Abrolhos Islands. The Department of Conservation and Land Management (CALM) administers the Act. Where practical, Department of Fisheries assists CALM in the execution of these duties at the Abrolhos.

### ***Museum Act 1965***

- DOCUMENT THE FAUNA OF WA

The Western Australian Museum is responsible for the documentation and description of all flora and fauna in WA. Already it has undertaken an extensive study of the waters of the Abrolhos.

### ***Marine Archaeology Act 1973 & Commonwealth Historic Shipwrecks Act 1976***

The WA Museum is responsible for the administration of both of these pieces of legislation which are in place to preserve the integrity of historic shipwrecks and associated sites. Department of Fisheries officers are trained and designated as wardens under this legislation.

### ***Australian Heritage Commission Act 1975***

This legislation creates the Register of the National Estate and the Abrolhos Islands are on the Register. At present this mainly limits the actions of Commonwealth Agencies but it is anticipated that amendments to the Environment Protection and Biodiversity Act will significantly increase the powers of the Commonwealth in these areas.

### ***Marine Act 1982***

This legislation is administered by the Department of Transport and provides for the safety of all vessels in territorial waters including the Abrolhos.

### ***Commonwealth Environment Protection and Biodiversity Conservation Act 1999***

This new piece of Commonwealth legislation enables the Commonwealth to become involved in the management of the environment in a detailed manner. The Commonwealth has advised that it proposes to amend the Act to include areas on the Register of the National Estate as Commonwealth Areas pursuant to the Act. If this occurs all developments at the Abrolhos will be assessable under the Act.

## ***International Conventions Relevant to the Management of the Abrolhos System***

The following international conventions apply at the Abrolhos.

- International Convention on the Trade in Endangered Species of Wild Fauna (CITES)
- Convention on Wetlands of International Importance (Ramsar Convention)
- Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environments (JAMBA)
- Convention for the Conservation of Migratory Animals (Bonn Convention)
- Australian Netherlands Committee on old Dutch Shipwrecks (ANCODS)
- Convention on Biological Diversity (Rio Convention)
- International Charter in the Protection and Management of Underwater Cultural Heritage (ICOMOS)

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## **Session 2      Natural impacts      Chaired by Dr Chris Chubb**

Issues: 14, 16, 20, 22, 24, 25, 26, and 31.

The draft research report provided a comprehensive summary of all published and unpublished marine research conducted at the Abrolhos. However, quantitative information about the natural variability of the marine system, the levels of natural disturbance and the rates of recovery of reef communities after disturbance is lacking. Long term monitoring of the marine system was identified by the workshop as a priority and factors requiring investigation were:

- sea temperature profiles including an investigation of upwelling;
- salinity variations, particularly in view of significant rainfall run off from the islands;
- currents;
- sediment transport processes and the relationship to reef building;
- swell and whether the Jurien wave rider buoy adequately reflects the swell patterns encountered at the Abrolhos. Consideration of the west-east refraction of swell energy also should be considered; and
- photosynthetic radiation and its availability at depth.

An understanding of these factors and the roles they play in the formation and maintenance of reefs and biodiversity was considered essential background in understanding the system.

The physical parameters could be monitored by remote sensing techniques, but *in situ* devices and experiments would be fundamental not only to “ground truthing” but also to a detailed understanding of how the processes shape the Abrolhos system.

A number of biological considerations were raised, and the research priorities were identified as:

- further habitat mapping and survey to refine habitat composition and sensitivity of biological communities to disturbance;
- understanding the natural biological variability in Abrolhos marine communities;
- assessing rates of recovery and recruitment for damaged coral communities;
- understanding the competitive interaction between coral and macroalgae at the Abrolhos;
- primary productivity;
- nutrient budgets; and
- larval sources of corals and fish.

The workshop noted that the above biological research could occupy many research institutions for many years and that it was not expected that this work would be undertaken immediately. Rather the workshop felt that progress towards understanding each of the seven research areas should be made gradually but on a continuous basis so the knowledge base could be built up over time. Nevertheless, the workshop realised that an understanding of the natural variability is crucial to assessing anthropogenic impacts on the marine environment of the Abrolhos.

People resources to undertake the research on natural variability, in all probability, would be limited and it was suggested that local communities residing at the Abrolhos and charter boat crews and customers could be a useful and enthusiastic source of labour given an appropriate level of training and supervision. This would confer a degree of ownership to the user groups.

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## **Session 3      Island uses: explore data and prioritise physical impact issues**      Chaired by Mr. Russel Dyson

### ***Rock lobster Fishery***

Issues 1, 2, 17, 19, 21, 23 and 30.

The workshop identified that the two main issues in relation to the effects of rock lobster fishing were the physical effect of fishing gear on marine habitats; and the effect of the removal of rock lobsters and its consequent impacts on the general ecosystem, *eg.* food chain (trophic) effects.

The workshop first considered the effects of rock lobster pots only in waters less than 20m depth based on the detail provided in the summary report and comments at the Public Forum. A number of questions were raised as topics for further study:

- In habitats where lobster pots may cause damage, how large is the area affected by a single pot deployment? This was raised in response to the assumption in the summary report that a lobster pot would affect an area of 4 square meters on deployment. Many thought this area was too large but recognised the use of this assumption was to display the “worst case scenario”. The average area affected is unknown and should be measured to ensure that the estimate of potential area impacted is accurate.
- What is the percentage of pots deployed on coral versus non-coral habitats in areas classified as having a high biological sensitivity? The highly variable nature of life form within a biologically sensitive habitat was recognised by the workshop. So when considering pot damage in these fragile areas, it is important to understand the distribution of pots with respect to a finer scale habitat classification. For example, pots would be set close to table corals but virtually never in stands of branching *Acropora* since lobsters are found in the former but not in the latter.
- What are the actual ecosystem effects of pot deployments and retrievals in shallow water communities? The effects of potting with respect to damage, coral regeneration, coral recruitment and the hypothesis that the balance in competition between macroalgae and corals is shifted towards the algae require investigation. Long term monitoring and biological studies are required in areas having differing sensitivity to physical damage.
- What proportion of the catch comes from biologically sensitive areas? The issue here was that if very small proportions of the catch come from very fragile biological communities, then protection from pot fishing might be afforded with little impact on the catch.
- What is the interaction between biological communities and the western rock lobster; ie what is the distribution and relative abundance (density) of lobsters by habitat type? This is a fundamental consideration.

Questions also were raised by the workshop in relation to the potential impacts from lobster potting on benthic communities at depths greater than 20m. It was commented that deeper water studies are expensive by definition since equipment such as Remotely Operated Vehicles (ROVs) and large vessels to service them are necessary. The deeper waters in the channels between and outside of the island groups are thought to have more robust habitats. This was, in part, confirmed by Assoc. Prof. Lindsay Collins who has conducted surveys in deeper waters around the Abrolhos and identified that the areas in his surveys were mainly sponge gardens. This issue was considered to have a low priority for future dedicated research. Nevertheless, existing equipment and data recording processes could be used to provide potential information in the immediate to intermediate term. These data could be obtained from:

- requests to participants in the voluntary rock lobster research log book programme to detail the sessile organisms (eg. sponges, corals, etc) brought to the surface in pots;
- research and compliance staff observations of sessile organisms in pots when conducting departmental activities on commercial rock lobster vessels;
- using underwater camera and video equipment affixed to pots to observe habitat type and potential impacts; and

- using Roxann-like equipment (acoustic sea-bed classification and mapping systems) to survey bottom type and hardness with the above observations adding to the understanding.

The ecosystem effects of the extraction of rock lobsters were raised by the workshop participants. The workshop heard that an examination of those impacts for the coastal assemblages of rock lobsters had been made through a formal ESD risk assessment process and the subsequent collation of published information and recent population modelling results. The effects were considered to be minimal given a large proportion of the biomass comprises sub-legal size and breeding female rock lobsters which are left on the fishing grounds. The rock lobster also is an opportunistic omnivore feeding upon a wide variety of prey items many of which are very abundant but are short-lived and have high turnover rates. There appeared to be no significant interaction between the western rock lobster and other organisms such as is found in other parts of the world, where the heavy fishing of lobsters has led to “plagues” of sea urchins and fundamental ecological shifts.

The workshop noted that the coastal and Abrolhos systems were different but that a very similar situation to that described above for the coast probably applied to the Abrolhos. There has been anecdotal accounts from rock lobster fishers that rock lobster catches have declined in Reef Observation Areas, which could be the result of recreational fishing bans in these areas and an increase in baldchin gropers, a rock lobster predator. It was noted that ecosystem and food chain studies would require an element of temporary closure of some areas to fishing in order to study the effects and interactions. Once studies were complete, decisions about the need for the permanent closure of any areas could be made. The ROA at Leo’s Island in the Easter Group was suggested as an area where closure could be accommodated for study. Moreover, as the Reef Observation Areas (ROAs) had been closed for some time and larger fish were inhabiting the ROAs, a study of predation upon rock lobsters and the resulting size composition of lobsters also could be facilitated. The workshop suggested these studies were likely to be a lower priority.

### ***Scallop Fishery***

Issues: 3, 4, 17, 19 and 28.

Discussions of the effects of scallop fishing related to concerns about impacts from trawl nets in sensitive areas such as sponge gardens and reef. The workshop recognised that trawling occurred mainly in sand but occasionally impacted the sensitive habitats that also were rock lobster habitat from time to time. Exploration by the trawl fleet does occur, so incidental damage is likely. The West Coast Trawl Association advised that most exploratory fishing involved a small try net (5m head rope) which does not cause extensive damage because the net covers a relatively small surface area. Moreover, the Association representative commented that potential damage could be further reduced if the pre-season survey conducted by the Department of Fisheries was expanded both in terms of the number of surveys conducted and area covered. This would more accurately estimate scallop densities, identify fertile fishing grounds and reduce the need for scallop fishers to conduct their own exploratory shots.

The workshop suggested that further detailed surveys of the benthic habitat using a towed video by Department of Fisheries research vessels would identify non sensitive and biologically sensitive areas within the boundaries of the trawl ground to delineate access to

trawl and non trawl areas. The video surveys conducted in 1997 will need to be repeated as habitats may have been modified in the interim due to trawl fishing.

Another approach was for commercial rock lobster fishers to accurately identify (from GPS co-ordinates) rock lobster fishing grounds in sensitive areas and designate these areas as non trawl areas. It was thought that most rock lobster fishers would be willing to co-operate providing the information about fishing grounds be kept confidential. This method for identifying non trawl areas may be more efficient and less expensive than extensive video surveys.

There have been numerous accounts of structural and faunal composition modification from trawling impacts, both at the Abrolhos and throughout the state. The recovery rates of sensitive habitats after trawling was raised as an area requiring research.

### **Wetline Fishery**

Issues: 5, 6, 17 and 19.

Most of the wetlining discussion related to the management of fish stocks rather than impacts to the benthic habitat and this was the main priority for concern. The identified issues are described:

- Reduction of the block size for the recording of catch and effort data collected by the Department of Fisheries, to allow a more accurate understanding of fishing effort;
- To gain knowledge about the effects of fishing on different species, catch and effort data records should include details about the quantities of different fish caught;
- More accurate data are required about the number of commercial wetline fishers and recreational fishers and their catch;
- The effects of fish extraction on the ecosystem e.g. trophic effects;
- Recreational fishers should only be allowed to take their catch back to the mainland as whole fish and not fillets (it was suggested that a letter be written to the Minister in relation to this issue); and
- The Abrolhos Islands should have unique fishing regulations similar to Shark Bay and the Ningaloo Marine Park.

The important issue for wetlining habitat interaction was damage, or potential damage, caused by anchoring. However, the workshop considered this impact to be minimal given the small number of commercial fishers and the sporadic fishing patterns of this group. Anchoring is common to many activities and research needed to be focused on the combined effects of anchoring by all user groups.

### **Aquaculture**

Issues: 7, 8, 9, 17, 19 and 22.

Aquaculture activities at the Abrolhos are confined to pearling at this time and activities involving other species are unlikely in the foreseeable future. There are minimal, if any, impacts from pollution associated with the *Pinctada margaritifera* industry. *Pinctada margaritifera* is very sensitive to changes in water quality and the industry does not use

chemicals. The animals are filter feeders and produce little waste. The impacts of pearl aquaculture on habitat, then, were related to systems of anchoring the pearl longlines.

The workshop was cognizant of the need for Fisheries staff to assess the suitability of each licensed site for use of the pin-system of anchoring longlines. It also recognised that strong storm events conceivably could cause longlines to break, resulting in considerable damage to fragile coral habitats where longlines overlaid fragile corals. Another issue that was raised dealt with the ability to reduce the minimum distance between aquaculture site boundaries from 5km to 2km, and its theoretical implication of allowing more sites (not only pearling) to be allocated in the Abrolhos with the consequent impact considerations.

Research considerations related to the following aspects:

- With each application or licence variation, a specific marine habitat study should be undertaken by someone other than the proponent to assess the suitability of the site for aquaculture with respect to anchoring and other possible impacts such as shading;
- Further detailed habitat mapping of the Abrolhos needs to be undertaken by the Department of Fisheries to identify areas of biologically sensitive habitat from which aquaculture activities should be excluded as a guide to future applicants;
- Studies on nutrient cycling in relation to aquaculture projects are required, especially if fish cages are introduced.

As a general comment, the workshop agreed that each aquaculture proposal should include a formal risk assessment to assess the viability of the operation, as an integral part of any application for a licence in this important and unique area.

### ***Recreational visitors***

Issues: 10, 11, 12, 13, 14, 19 and 28

The two main impacts of recreational users of the Abrolhos were identified as anchoring by dinghies, yachts and larger pleasure craft and damage to habitats by SCUBA divers. A significant problem in the estimation of these impacts was the difficulty in gathering accurate data on the numbers of all recreational users of the Abrolhos. Suggestions for obtaining quantitative data included:

- Log books for charter boat operators providing data on visitor numbers, activities and quantities of fish caught;
- Aerial survey to count recreational vessels and their locations within the Abrolhos. These flights could provide a “snapshot” at the times they are conducted and the information extrapolated to estimate total annual visitor numbers; and
- The introduction of a visitor’s fee to allow for more accurate estimates of visitor numbers and the development of a statistically sound survey technique to provide information about those visitors and their activities.

The issue of anchoring sites and permanent moorings was discussed at length. The impact from the anchoring of dinghies for recreational pursuits was not considered significant enough to warrant a dedicated research programme, the emphasis being on the determination of the numbers of recreational users. For larger pleasure craft, the suitability of some popular

anchoring sites was questioned due to the water depth, length of anchor rope needed and safety issues, due to wind directional changes. The placement of permanent moorings also was questioned. Whilst the workshop understood that Environment Australia funded the moorings and, therefore, the moorings were sited by their strict environmental criteria, the workshop also heard that often the new moorings were too far away from dive sites and thus charter boats favoured anchoring closer to the sites. The workshop suggested greater collaboration in establishing the sites for new permanent moorings. The impact of placing permanent moorings in sensitive areas should be investigated.

It was suggested that a monitoring programme be established at popular dive sites to examine the level of SCUBA diver damage. This would allow the impacts to be quantified and possibly enable the determination of the “carrying capacity” for each site. Video transects were suggested. However, the experience of the Great Barrier Marine Park Authority was that standard video surveys were not appropriate for this type of research and it was better to look at trends in damage to corals rather than changes in percentage coral cover. It was pointed out to the workshop that much had already been published on this subject and that rather than repeat similar work, the establishment of an education programme for divers was a higher priority. The most appropriate tool to achieve this would be an educational video.

It was suggested that an accreditation system for tour operators would be useful. This would require tour operators to have been trained in educating tourists about the sensitive habitats of the Abrolhos to promote responsible diving by their customers. The locations to which operators take divers may be reliant upon the level of diver awareness and understanding about the fragility of the spectacular ecosystems in the Abrolhos as well as the diver’s level of experience. This suggested habitat awareness extension work was considered a high priority by the workshop.

### ***Proposed Tourism***

Issues: 15, 17, 18, 19, 28 and 29.

The workshop considered that the effects of proposed tourism operations were difficult to define, given that no proposals existed, but were likely to be restricted to impacts around structures and activities associated with land based facilities and those associated with moored structures, such as pontoons.

Workshop participants identified a priority need for independent monitoring of the marine habitats around such areas of activity. The level of monitoring would depend upon the activity and the degree to which habitat change could be detected statistically. In such experiments, control areas are required for comparative purposes. However, caution in selecting control sites was needed to ensure that control sites did not become impact sites in the future.

Pontoon facilities are proposed in the tourism plan, however, the workshop agreed that these facilities should not be sited where they could impact on coral habitats. Issues of anchoring these structures and the extent to which they shade benthic habitats with respect to the sun’s positional shifts during a year, required assessment but were not considered a high priority.

Whilst not strictly part of the deliberations, the impact of tourist activities on the terrestrial environment was identified as an area of considerable concern and the workshop agreed that

equivalent levels of research funding should be sought for the terrestrial research. Projects could determine the carrying capacity of tourists, *eg*, the number of tourists that could visit an island for bird watching which did not result in environmental degradation and the need for establishing closures to certain islands during bird breeding seasons. A summary of issues relating to the interaction of land-based recreation and bird populations is provided in Appendix 3. In a similar context, it is important that heritage values also are maintained.

### **Conservation**

Issues: 16, 17, 18, 19, 21, 24, 25, 28, 30 and 31.

The discussion surrounding the use of the Abrolhos for conservation purposes involved two principal components; the maintenance of biodiversity and study of ecological processes and the setting aside of areas for tourist use. The second aspect has been partially implemented, with the establishment of Reef Observation Areas (ROAs) in each of the island groups. These were set aside as “look don’t touch” areas and include some of the more popular dive sites in the Abrolhos. Tourist use of the ROAs invites a physical impact in the form of large vessel anchoring and damage associated with SCUBA diving. These issues were dealt with earlier in the workshop (see Recreational Visitors p.14).

To ensure extractive and non-extractive anthropogenic use of the Abrolhos Islands FHPA is balanced, it is necessary (both a legal and moral requirement) to understand the ecological and geological processes that shape the islands and the biota, and to set aside areas for the maintenance of biodiversity. In this context, the workshop recognised that ongoing reef fish studies by the Department of Fisheries (underwater visual survey, tagging, etc) had generated valuable information on changes in fish sizes and abundance within the ROAs and fully supported the continuation of this research.

Discussion concerning conservation use was wide ranging with many topics relating to the previous discussion about Natural Impacts. Topics included:

- more detailed survey work to delineate clearly the fragile and less fragile areas of the ROAs;
- the issue of surveying the areas of sponge garden, classified as fragile habitat, and closing them to trawling was again raised (see Scallop Fishery p. 12);
- the need to understand the “flow-on” effects to assemblages of other organisms resulting from changes seen in fish size and abundance in the ROAs;
- the mobility of fish between fished and unfished areas and the need to model overall fish populations;
- patterns of recruitment of corals, algae and fish across all geomorphological units;
- growth of damaged and undamaged coral colonies, susceptibility to damage and disease and recovery rates of corals in shallow and deeper waters. This was thought to be essential given that research results from the Great Barrier Reef and other areas are probably not directly applicable to the Abrolhos, due to differences in the environment in which the corals grow;
- survey work to establish areas of importance for the maintenance of biodiversity, noting that areas of high coral cover may not be areas of high diversity *eg*. dense stands of branching *Acropora*; and

- establishing programmes to monitor natural changes in biodiversity in Reef Observation Areas.

The workshop recognised the differing views held by user groups with respect to the “need” for closures to areas of marine habitat. The question of how large these areas needed to be was debated with participants agreeing that any closures should have a sound biological basis and not simply be based on guesswork. It is important to note that the purpose of closures dictates how long they should be set aside. For example, for purpose of biodiversity maintenance, closures would be permanent; for long term monitoring and comparative research at least 10 years is required to establish trends; and for short term experiments closures of a few years may be sufficient. The workshop also noted the importance to all user groups of being fully informed and consulted where closures were proposed.

Data from other areas of the state are, or will be available, for comparison with the Abrolhos. For example, survey data from the proposed Jurien Marine Park are available and an application for FRDC to fund a comparative reef fish study between Ningaloo and the Abrolhos reefs is being submitted this year. Such comparative data will be extremely useful.

The workshop was informed of a computer programme called Land Use Planning Information System (LUPIS), a decision support system that allows “what if?” questions and shows the outcome of different potential area use allocations. In this system once all the mapping units within the Geographic Information System (GIS) are attributed with their values for different uses, LUPIS produces an area use plan for all competing candidate uses. The values can be adjusted until stakeholder requirements are satisfied or consensus is reached (see [www.complexia.com.au/Documents/DSS/M&D.html#lup](http://www.complexia.com.au/Documents/DSS/M&D.html#lup)). This tool was developed by John Ives, CSIRO Division of Wildlife and Ecology, ACT for land use, but the workshop was told it was applicable to decisions about the Abrolhos. Other similar management tools exist.

Other related issues discussed at the workshop included the passage of a cargo vessel that apparently “lost its bearings” between island groups and the necessity to ensure that a contingency response and research plan for major ship groundings or oil spills at the Abrolhos were in place. The workshop was informed that a state oil spill contingency plan already was in place.

The dumping of rubbish at the islands was considered by the workshop. Participants recognised that the at-sea dumping sites, within the island groups, for large and bulky items that could not be burnt or returned to the mainland, were a necessary evil at this time. Nevertheless, they suggested there was a need to survey those dumps to examine the status of the rubbish in terms of dispersal, disintegration and sedimentation.

### **Other Issues**

Four exploration wells were drilled in waters surrounding the Abrolhos in the late 1960s and 1970s, for petroleum. These wells have been capped and abandoned (Mr S. Doherty, Department of Minerals and Energy DME, pers. comm.). The workshop was informed that in 2001 the DME released further areas in Western Australia (including the Abrolhos) for petroleum exploration. The leases at the Abrolhos are outside of the Fish Habitat Protection Area. Current exploration is likely to be seismic with further development unlikely in the near future. Potential issues associated with petroleum drilling are ecotoxicology and turbidity.

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## **Session 4      Research and development strategic plan**

Chaired by Dr Jim Stoddart

Previous sessions identified the research requirements associated with issues raised by the research team or during the Public Forum. The workshop noted that current research at the Abrolhos, *eg.* ROA fish studies; commercial fisheries monitoring and catch and effort data collection; geological studies; and opportunistic core sampling of corals will continue (Table 1). In addition, an application for funding for a comparative study of fish between the Abrolhos and Ningaloo reef systems was made in late 2001.

Thus, the discussion during Session 4 of the workshop related to gaps in the current research framework and the formulation of a strategic plan of research designed to improve our knowledge in those areas. The workshop agreed to group the research requirements into three core programmes; Ecosystem Structure, Ecosystem Processes and the Measurement and Monitoring of Impacts and Uses. A fourth area, Environmental Impact Assessments, was listed, but it was noted that projects under this heading were to be developed on an “as required” basis. Each core programme contains a list of projects identified by the workshop in its deliberations (Table 2). Each project has been assigned a need, that is, the level of importance that the workshop attributed to the knowledge and understanding resulting from a particular project. The need is measured in terms of the time frame in which the projects should commence:

- Immediate – within 1-2 years.
- Intermediate – within 2-4 years.
- Distant – greater than 4 years.

However, it is important to note that it is expected that each project in the core programmes will be assigned a priority listing by the AIMAC following a formal risk assessment based on AIMAC’s requirement for providing management advice to the Minister for Fisheries.

The strategic plan deals with a considerable amount of research that will be undertaken by a number of institutions in Western Australia, from other Australian states and, perhaps, from overseas. It is vital that this research be coordinated by a single entity. It is suggested that all research proposals be coordinated through the AIMAC, or a sub-committee of AIMAC, to ensure the research needs of management are met, and the necessary, but not directly management oriented, research on ecosystem variability and processes is promoted and supported.

**Table 1.** Current research at the Arolhos Islands.

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**Rock Lobster (*Panulirus cygnus*) – Department of Fisheries Research**

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- Collection of compulsory monthly catch and fishing effort data – all vessels
  - Collection of voluntary daily research log book data for catch, effort, breeding stock, by-catch information etc – all island groups
  - On-board monitoring of commercial rock lobster catches by depth for size, sex and breeding data – Easter Group
  - Lunar collection of settling puerulus numbers on panels of artificial seaweed – Easter Group
  - Continuous recording of water temperature at puerulus collection site in the shallows of the Easter Group
  - Fishery independent breeding stock survey in October to assess levels of egg production - all island groups
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**Scallop (*Amusium balloti*) – Department of Fisheries Research**

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- Collection of compulsory monthly catch and effort data-all vessels
  - Collection of voluntary daily research log book data for catch, effort and location of shots.
  - Pre-season surveys to determine locations of scallop settlement
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**Finfish (various) – Department of Fisheries Research**

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- Collection of compulsory monthly catch and effort data-all commercial vessels with a wetline catch.
  - Examination of the effects of protected areas (Reef Observation Areas) on two commercially important fish species; baldchin groper (*Choerodon rubescens*) and coral trout (*Plectropomus leopardus*). In closed and non closed areas fish density, abundance, distribution, age and size structure are monitored.
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**Other – Various universities and institutions**

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- Examination of coral cores for Strontium/Calcium (Sr/Ca) ratios, oxygen and carbon stable isotope ratios and radiocarbon ratios. This information is used to determine coral growth and age and to develop a historical record of the environment. This type of research is ongoing as funds become available. National Institute of Environmental Studies. Ibaraki. Japan.
  - Research on the coral rubble storm ridges in the leeward Islands of the Easter Group by the School of Applied Geology, Curtin University.
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**Table 2.** Strategic Research and Development Plan.  
(Need refers to the workshop's view of the commencement times for the research projects listed: Immediate 1-2 years; Intermediate 2-4 years; Distant; greater than 4 years.)

<b>ECOSYSTEM STRUCTURE</b>		<b>Need</b> (see text)
<b>Aims</b>	Better document the physical and biological components of the Abrothos Islands marine ecosystems Inventory of organisms to address biodiversity issues.	
<b>Projects</b>	Collect physical data using remote satellite sensing and in situ devices including: Leewain Current	Immediate
Physical	Water temperatures in shallow areas near corals and near the continental shelf to test for upwelling Salinity Currents Primary productivity Sediment transport Swell Tides Photosynthetically available radiation	
Biological	Understand the contribution to total biodiversity of the non-Acroporid component of Abrothos corals Determine the abundance and species composition of any deep-water coral communities Compile an inventory on the species present in the deep benthic 'sponge gardens' adjacent to scallop trawl grounds and determine whether they are part of a widespread community type Mapping of sensitive benthic communities in trawl areas Biodiversity inventory of other organisms	Intermediate Distant Intermediate Immediate Intermediate
Geological	Evaluate long-term trends at the islands on rates of accretion and erosion, climate change, sea level changes, wave climate and reef growth. Analysis of island geomorphology and the record of storm ridge chronology in the leeward islands Coastline stability of the islands particularly little Roma and Long Islands	Intermediate Distant Immediate

**Table 2.** Strategic Research and Development Plan. (cont.)

<b>Who</b>	<p>Department of Fisheries: continue collection of water temperature data/collate other data</p> <p>Australian Institute of Marine Science: broadscale monitoring studies for life form or coral/algal abundance: snapshots and over a 5 year time scale.</p> <p>Western Australian Museum: surveys to document and inventory deepwater coral communities, “sponge gardens” and others</p> <p>Community Groups/charter operators - establish community-based monitoring for reef health such as Conservation and Land Management, Great Barrier Reef Marine Park Authority volunteer methods, or Global Reef Check methods.</p> <p>Universities: continuation of work such as that carried out thus far, e.g. Curtin University.</p>
<b>ECOSYSTEM PROCESSES</b>	
<b>Aims</b>	<p>Understand the natural variability of the marine ecosystem</p> <p>Improve understanding of the interaction between corals and macroalgae at the Abrohos as a long-term determinant of reef status</p> <p>Understand the distribution and significance of freshwater runoff or outflow from islands to fringing reefs</p> <p>Better understand the rate of coral recovery (individuals &amp; community) from disturbance (including the frequency of disturbance).</p>
<b>Projects</b>	<p>Mapping areas of freshwater outflow occurring in peak rainfall events - studies of impacts on adjacent reefs, includes groundwater and nutrient plume derived from islands</p> <p>Studies of larval transport of corals, fishes and other organisms will be important to resolving ‘source-sink’ issues in understanding recruitment of tropical species to the area.</p> <p>Continue studies of coral growth (both acroporid and massive/sub-massive corals) around Abrohos waters and progress understanding of recovery natural disturbance and role of disturbance in shaping Abrohos coral communities.</p> <p>Develop measures (eg ‘snapshot surveys’) of the interaction between corals and algae - possibly yielding reef-health indicators.</p>
<b>Who</b>	<p>Department of Fisheries, CSIRO Marine Research, Australian Institute of Marine Science - major advances in fundamental studies</p> <p>Consultants - for specific targeted studies</p> <p>Universities - connectivity of populations and larval support</p>
	<b>Need</b>
	Intermediate
	Immediate
	Immediate
	Immediate

**Table 2.** Strategic Research and Development Plan. (cont.)

<b>MEASUREMENT AND MONITORING OF IMPACTS AND USES</b>		<b>Need</b>
<b>Aims</b>	<p>Provide greater coverage of the range of anthropogenic use of the Abrolhos marine habitats.</p> <p>Provide improved accuracy in measuring the levels of use for non-commercial visits to the Islands.</p> <p>Provide a better understanding of direct impacts associated with rock lobster pot deployment on the marine habitat.</p> <p>Provide a better understanding of the direct impacts of recreational diving on 'high use spots' within the Islands.</p>	
<b>Projects</b>	<p>Establish a survey of recreational users - perhaps by targeting key use periods, such as Easter and extrapolating to the remainder of the year, include use estimates for: charter boats, private boats, fly in/fly out visitors, family and friends of rock lobster fishers. Determine the key activities of these visitors</p> <p>Carry out studies of anchor damage and diver impacts on corals- extrapolation of data from studies elsewhere may not be appropriate</p> <p>Establish a monitoring program at key SCUBA diving sites such as the Anemone Lump</p> <p>Categorise the impact intensity of an 'average' pot drop on corals to provide an improved basis for estimating the total area of impact for potting</p> <p>Establish a monitoring program in selective habitats to detect whether changes are occurring in the marine habitat in relation to rock lobster potting. This includes closed areas.</p> <p>Keep a register of ad-hoc impacts (natural and anthropogenic) reported from the Abrolhos</p> <p>Closure of larger areas such as the ROA's and extension of reef fish studies (such as baldchin groper and coral trout) to other species</p>	<p>Immediate</p> <p>Distant</p> <p>Immediate</p> <p>Immediate</p> <p>Immediate</p> <p>Immediate</p> <p>Distant</p>
<b>Who</b>	<p>Visitor Numbers: principally collected through the Department of Fisheries, Geraldton Office, under the proposed visitor permit system and target surveys. Some assistance possible from charter operators and the community.</p> <p>Impact Studies: Department of Fisheries, other marine science agencies or consultants.</p> <p>Incidents register: Department of Fisheries, Geraldton Office.</p>	
<b>ENVIRONMENTAL IMPACT ASSESSMENTS</b>		<b>Need</b>
<b>Aims</b>	<p>Additional studies may be necessary to prepare the knowledge-base for Department of Fisheries to act as a regulator for the permitting and management of tourist or other developments at the Islands. There is an expectation that monitoring will be required in waters adjacent to land based tourism.</p>	
<b>Project</b>	<p>To be determined.</p>	

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## Concluding remarks

The summary of findings in Volume 1 of this research report, showed that the current impacts of fishing and other human-use activities on the marine habitats were minimal compared to the effects of natural perturbations. This led to the conclusion that the Abrolhos reef system was in “almost pristine” condition, with anthropogenic impacts likely to be extremely localised and not significant. This conclusion was reached on the basis of the recovery time afforded to the system by the closed fishing seasons, and the impact of winter weather on human activities. Consequently, no research requirement was identified as an immediate high priority. Rather the general need to increase the knowledge base in a number of directions was deemed important.

After reviewing the issues raised in Volume 1 of the research report, and in the Public Forum, the workshop concluded that there existed a real need to understand ecological and geological processes and the extent of natural variability within the Abrolhos system. This understanding is crucial to assessing and predicting anthropogenic impacts and placing them in the proper context. The view held by the workshop was that research to understand processes and variability should be supported as priority work since substantial knowledge in these areas can be built up only in the medium to long term.

Other priority issues in the workshop related to the conduct of survey work and the establishment of monitoring programmes. Quantifying numbers of individuals and boats that use the Abrolhos was a key research element. More extensive surveys of habitats were required to address issues related to biodiversity and habitat damage. Long term monitoring projects needed to be implemented to establish baseline data from which the impacts of proposed tourist facilities and SCUBA divers can be assessed. The workshop concurred that more research was required on understanding the specific impacts of rock lobster pots on fragile Abrolhos habitats.

To a large extent, the research strategy presented in these workshop proceedings is consistent with the requirements identified in the Abrolhos Islands Management Plan released in December 1998. Needs indicated in these proceedings are those suggested by the workshop, however, this strategic plan will be forwarded to the Abrolhos Islands Management Advisory Committee (AIMAC) for their consideration and anticipated priority setting following formal risk assessment. While the suggestion is that much of the specialised research is undertaken by the bodies that hold the expertise, such as the Department of Fisheries and the Australian Institute of Marine Science, it is expected that research into other aspects will be conducted by other research institutions such as Universities, TAFEs, Abrolhos user groups, etc with local community involvement wherever possible. A final point identified was that significant offshore funding (Great Barrier Reef Research Foundation) may be available in the future to support an Abrolhos Islands study program.

It was a credit to all participants that sectorial issues largely were set aside to enable full and frank discussion throughout the workshop. Participants remained focussed on the identification of strategic research directions that will ensure the needs of management are met for the sustainable multi-use of the unique marine ecosystem that is the Abrolhos Islands.

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## Appendices

### Appendix 1: List of invited participants.

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## Appendix 2: Agenda.

### **Towards an assessment of natural and human use impacts on the marine environment of the Abrolhos Islands**

#### **Strategic Research Plan Development**

**Thursday July 12**

##### **Session 1 Introduction (Chair Dr C.F. Chubb)**

(0900)

Outline the various legislative responsibilities under the plans (Dr C. Chalmers)  
Workshop objectives  
Planned outcomes  
Agenda

##### **Session 2 Natural impacts**

1. Climate/weather
2. Biological

##### **Session 3 Island uses: Explore data and prioritise physical impact issues (Chair Mr R. Dyson)**

###### **Commercial**

1. Western rock lobster fishery
2. Scallop fishery
3. Wetline fishery
4. Aquaculture

###### **Recreational**

1. Charter boat operations
2. Recreational Fishing
3. Pleasure craft - boating

###### **Proposed Tourism**

1. Likely activities
2. Likely areas

###### **Conservation**

1. Reef observation areas
2. Biodiversity reference areas

###### **Other Issues (including oil and mineral exploration)**

**Friday July 13**

##### **Session 4 R&D Strategic Plan Development (Chair Dr Jim Stoddart)**

(0900)

1. Prioritise issues and needs
2. Research projects to suit (basic approaches and methods)
3. Identify likely research groups and sources of funding
4. R&D strategic plan
5. Community extension

**Appendix 3: Baseline research and monitoring required at seabird colonies to accommodate proposed tourism developments at the Houtman Abrolhos.**

Provided by Mr Nick Dunlop.

**Introduction**

The Sustainable Tourism Plan for the Houtman Abrolhos proposes (in the short-term) the establishment of land-based accommodation infrastructure on Long Island in the Wallaby Group and Little Roma Island in the Easter Group. It also invites proposals for a pontoon accommodation unit on the Leo Platform in the Wallaby Group.

Seabird breeding colonies are, to varying degrees, susceptible to disturbance caused by inappropriate and untimely human activities on, or around, their nesting islands. The presence of permanent tourism nodes, and the projected increase in private vessel, “fly-in” and charter tourism will increase the disturbance pressures in the affected areas.

**Baseline Surveys**

There are two important elements to managing visitation to seabird islands, these are

- a) preventing direct impacts to nests or habitats, and
- b) controlling approach distances and maximizing seabird habituation to visitors.

a. Direct Impacts on Nests or Habitats

Most seabirds that nest on the ground have cryptic eggs and young that are difficult to see and easily trodden on. The excavated burrows of shearwaters and storm-petrels are susceptible to collapse if walked over and this may entomb the adults or chicks, or cause a breeding attempt to be abandoned. These impacts are normally managed by directing access away from colonies or by using hardened paths or raised wooden walkways.

b. Approach distances and habituation

Seabird species respond to intruders in different ways, showing varying degrees of site-tenacity, displacement and anti-predator behaviour. The distance at which a visible intruder (visitor) produces a change in behaviour in a nesting seabird is referred to as the “critical approach distance” (CAD). This will vary between species and between stages in the nesting cycle.

The CADs also may vary between populations of the same species breeding on different islands. This variation is often attributable to patterns of historical disturbance. Benign patterns of exposure to visitors will lead to habituation ( ie. the dampening of escape, flight or defensive responses) and to a shortening of CADs (Nisbet 2000). Destructive patterns of intrusion may lead to heightened escape responses and the spatial displacement of nests or colonies.

The consequences of inappropriate patterns of visitation are likely to be increased physiological stress, reduced reproductive performance and increased adult mortality. The habituation of seabirds to visitors increases the thresholds at which defensive and flight responses are induced in the breeding birds. This in turn prevents the exposure of eggs and young to the weather and predators and mitigates the energetic cost that might be incurred through frequent disturbance. It also may reduce physiological stress, although there is some

evidence that the heart rates in nesting seabirds may still be elevated before there is any observable change in behaviour.

A number of factors assist in encouraging habituation by seabirds to visitors. The most critical are

- a) that visitor behaviour is benign,
- b) that visitor access patterns and activities are predictable, and
- c) visitor groups are small and frequent rather than large and infrequent.

The considerations that might be taken into account in managing passive or self-guided visitor access to seabird islands are presented in a decision tree (Figure 1).

It is difficult to develop habituation on very small islands where there is always insufficient distance between nesting birds and any intruders. Therefore, it is suggested that, in the Abrolhos context, breeding islands of less than 3ha should not be accessible to tourists.

Some larger islands will be a magnet for visitors because of their beaches, anchorages or wildlife populations. Others will be less attractive and may not require as much management attention. Nature-based tourism, intensive visitor management and interpretation should all be focused on the larger islands that are attractive to visitors. In the Wallaby Group (given the proposed nodes at Long Island and Leo Platform) these should include West Wallaby, Long and Beacon Is) and in the Easter Group (with the node at Little Roma Is) the work should focus on Leo, Wooded and Morley Islands.

The distribution of the seabird colonies / breeding areas needs to be mapped on these islands and the current “critical approach distances (CADs)” need to be measured for surface-nesting species. Some seabirds return to the same nest site each season (eg. shearwaters, white-faced storm petrels, pacific gulls, bridled and sooty terns, brown and lesser noddies) whilst others use traditional areas on an intermittent or rotational basis (eg. pied cormorant, caspian, crested, roseate and fairy terns). It may take several seasons to establish the preferred habitat areas for the latter group. There are also spring/summer and autumn/winter breeding populations of some species (eg. crested, roseate and bridled terns) necessitating seasonal surveys.

These data should be used to determine the low impact access ways to beaches, anchorages and vantage points. Formal, hardened access in the form of constructed walkways may be necessary in some situations. Interpretation for passive and self-guided visitors needs to be deployed along the access ways.

Some supervised eco-tourism products may include hands-on scientific research or monitoring activities that would need to be licensed under the *Wildlife Conservation Act (1950)*. These activities may well have to occur off the designated public-access ways and should be directed at meeting the monitoring needs of the management plan. People operating under research permits need to be clearly identified in the field.

### **Monitoring**

Seabird populations and levels of breeding activity are influenced by a number of factors that are not related to human disturbance on the breeding islands. Any monitoring system designed to detect changes induced by visitor disturbance must be capable of accounting for

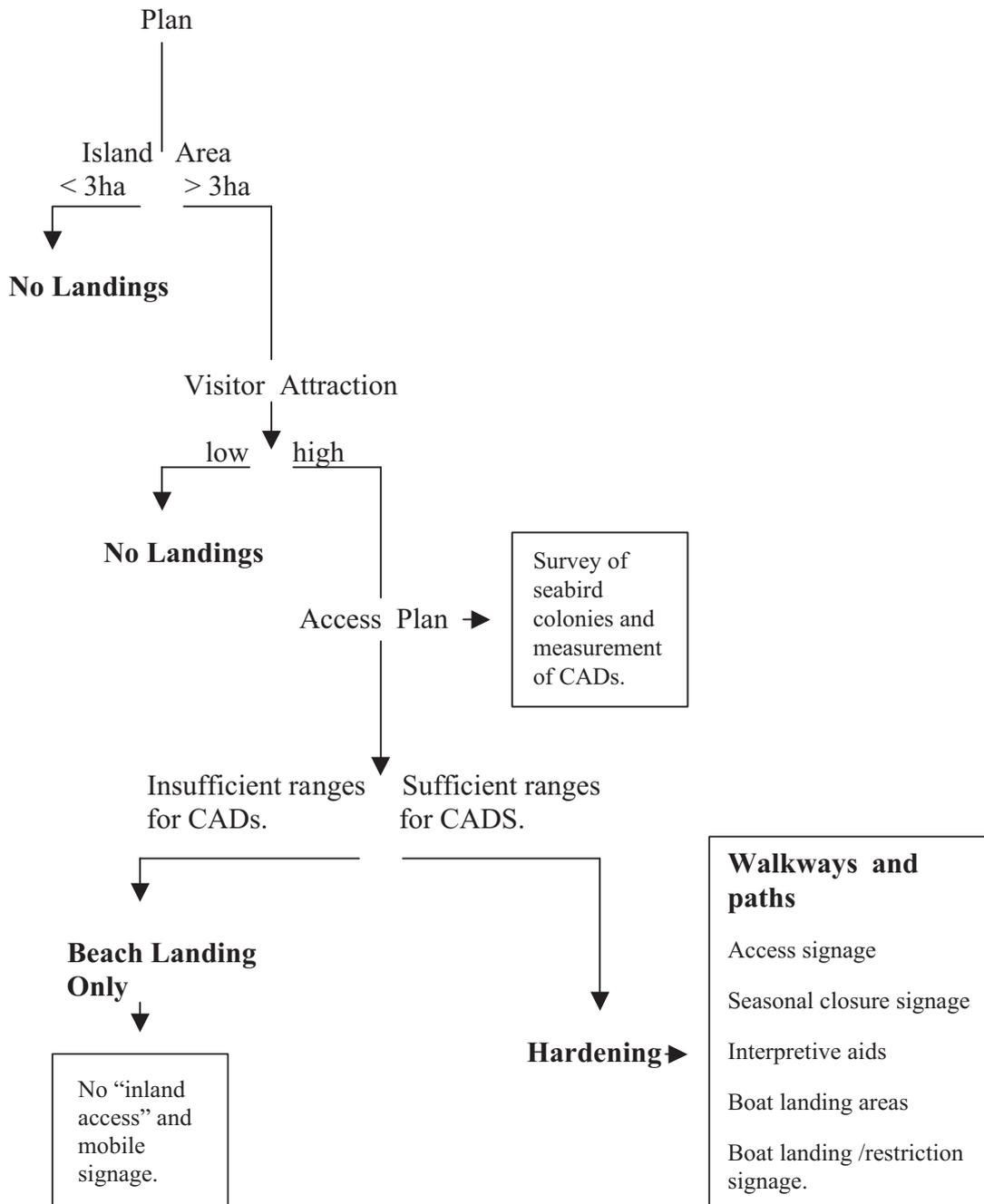
large-scale inter-annual variations in seabird participation and performance. These variations generally are caused by shifts in prey availability, which in turn may be related to ocean climate and/or fishing pressures. At the Abrolhos, changes in the Leeuwin Current are known to produce marked inter-annual variations in prey availability and breeding participation/performance in a number of seabird species.

The following relatively cost efficient parameters may be useful measures of the various pressures on Abrolhos seabirds. (The seabird species are denoted as WTS-Wedge-tailed Shearwater, WFSP-White-faced Storm Petrel, PC-Pied Cormorant, CaT-Caspian Tern, CT-Crested Tern, Roseate Tern-RT, Fairy Tern-FT, Bridled Tern-BT, Sooty Tern-ST, BN-Brown Noddy, LN-Lesser Noddy)

<b>Pressure</b>	<b>Parameter (state variable)</b>
Prey availability	Number of nests with eggs in fixed plots on a critical date (WTS, BT, ST, LN, BN compared to Pelsaert Is. control). Number of pairs breeding on monitored islands at a critical date compared to Pelsaert Is. control (PC, CT, RT, FT). Fish carried to clubs or crèches per unit time (CT, RT, FT)
Visitor disturbance	Hatching success at plots (marked nests/burrows), close to and away from access ways/focal points (WRS, BT, ST, LN, BN). Critical approach distances (BT, ST, LN, BN) Distance of colonies from access ways/focal points (CaT, CT, RT, FT).
Lights at facilities	Number of collisions/strandings at facility per month (WTS, LS, WFSP, BT, LN).
Habitat change	Woody vegetation cover-abundance (fixed plots) Occurrence of woody weeds (particularly box thorn)

## Reference

Nisbet, I.C.T (2000). Disturbance, habituation and management of water-bird colonies. *Waterbirds* **23**: 312-332.



**Figure 1.** Visitor management to seabird islands decision tree.