

An Economic Analysis of Investment in Assessing Proposed Marine Protected Areas

Introduction

Background

Under international agreements the Australian Government is committed to establishing a network of Marine Protected Areas (MPAs) in Australia by 2012 to ensure long-term ecological viability of existing biodiversity and the marine and estuarine systems. The South East region boasts many species that are not found anywhere else in the world, and hence was a prime target for the establishment of MPAs. Also, there is an agreement between the Australian Government and the States to establish a National Representative System of Marine Protected Areas (NRSMPA) in Australian waters. Further information concerning the development of MPAs is available in Anon (2007).

In 2005, the then existing regulations to ensure fishing was sustainable were already complex with some fisheries in the region being managed by the Australian Government while others were managed by the southern states (NSW, Victoria, South Australia and Tasmania). Some fisheries were managed jointly. Overall there were over 30 Commonwealth, State or jointly managed open ocean fisheries in the region. The regulatory processes were based on managing individual user groups and sectors, but not in a holistic or integrated manner across all biodiversity values in an area. It was considered that to alleviate the risk of environmental degradation under existing regulation that further protection of conservation values was required.

While regulation existed, the Australian Government was attempting to reduce the pressure on many Australian fisheries and an adjustment package of \$220 million (the “Securing Our Fishing Future” program) had been made available for reducing the catch in Commonwealth Fisheries. The South-east fishery was to be included in this restructuring. This meant that considerable financial resources were available for industry adjustments where they were deemed necessary under the MPA development.

Planning by Government for the MPA network for the region had commenced in 2002 with a scientific inventory of relevant mapping and research. There were also a Scientific Reference Panel and a Scientific Peer Review Panel. However, in late 2005 there was some political urgency in developing the MPAs. The selection of the MPAs was undertaken according to a set of criteria established by the Australian Government. The MPAs were selected with boundaries identified to make compliance and management easier. While planning was largely conservation driven, there was a commitment by Government to maintain commercial access and sustainable use of the resource by industry. In this regard, a Fisheries Risk Assessment (FRA) was undertaken on the type of fishing activities that were suitable for multiple use management zones where fishing was proposed to be allowed.

The Australian Government decided to speed up the South-east region MPA development in order to align it temporally with the “Securing Our Fishing Future” package. Hence,

in December 2005 a detailed proposal by the Australian Government was released specifying a network of 14 MPAs for the oceans of South East Australia.

The MPA Proposal

The MPA initiative was aimed at producing a system of marine parks that was comprehensive, adequate and representative. Core data sets for the region were used to define the areas for the parks and their boundaries. The proposed areas were made available to the fishing industry and comment was sought on the proposal by the Australian Government.

The categories assigned to each MPA were:

1. Strict Nature Reserve. All commercial fishing, recreational fishing and charter fishing are disallowed.
2. Habitat Protection Zone. Recreational and charter fishing and commercial tourism are allowed. All commercial fishing operations are disallowed.
3. Managed Resource Protected Zone. Recreational and charter fishing are allowed, but only some specified commercial fishing methods allowed. Those not allowed were to be demersal trawl, Danish Seine, mesh netting, demersal longline and scallop dredge.

Rationale for the Research

As the proposed MPAs and their boundaries were open to negotiation the commercial fishing industry requested a study to determine the socio-economic impact of the proposed MPAs on the industry and to assess alternative approaches to minimise the industry impacts while retaining the biodiversity protection required by the Government., This study was led by Prof Colin Buxton of the Tasmanian Aquaculture and Fisheries Institute (TAFI) at the University of Tasmania. It was funded by the Fishing Industries Research and Development Corporation (FRDC) and the Tasmanian Department of Primary Industries and Water (DPIW).

The Project

Project Objectives

The project had the following objectives:

- (i) To quantify the commercial fisheries catch for the key species within the proposed MPAs for the South-east region.
- (ii) To quantify the commercial fisheries economic value associated with the catch within the proposed MPAs for the South-east region.
- (iii) To quantify the socio-economic impact of the proposed MPAs on the commercial fishing industry.
- (iv) To outline in terms of (i), (ii) and (iii), alternative approaches that minimise the impact on the fishing industry without compromising the biodiversity objectives of the Department of Environment and Heritage (now Department of Environment and Water).

Project Investment

Estimates of the total investment by FRDC and others are provided in Table 1. The TAFI study was completed in a short time period due to the expectation from Government of the timing of a response from industry to the proposed MPA regions.

Table 1: Estimate of Investment in TAFI Study of Marine Protected Areas for the South-east Region (nominal \$)

Year ending June	FRDC	Cash from other investors (a)	BRS (in kind) (b)	Total
2006	37,900	15,000	15,000	67,900
Total	37,900	15,000	15,000	67,900

(a) Contribution of \$15,000 from the Department of Primary Industries and Water (Tasmania)

(b) Contribution on mapping and GVP displacement

In addition, resources were contributed in-kind from:

- Commonwealth and State fishing industry bodies and industry members in the South-east Region
- Industry advocate costs which can be considered an extension component of the study
- State Government Departments in SA, Vic and Tas.

These additional in-kind resources have not been included in the R&D costs *per se*, as it is likely that they would still have been incurred and would have been considerably greater if the FRDC study had not gone ahead. This is explained in more detail in the section called “Benefits” following later in the analysis.

Project Description

The TAFI study maintained a close interaction with industry, particularly with an MPA subcommittee established by the then existing Australian Seafood Industry Council (ASIC). In addition, the study leader interacted with a number of people in government and several fishing authorities.

Assembling Catch Data

Given the protected areas and their boundaries being proposed, the project first set about estimating the fish catch that would be most likely displaced. Historical catch databases were held by the various State and Commonwealth fisheries management authorities. The Commonwealth fisheries authority (Australian Fisheries Management Authority or AFMA) had reported catch and effort by latitude and longitude allowing catch and effort data to be estimated with GIS tools. The final estimates of the displaced catch were based predominantly on data averaged over the 2000-2005 period for each of the proposed MPAs. Comparisons were then made with the total allowable catch (TAC) for each area in 2006 and the future TAC adjusted for the proposed protected areas.

Another source was from the logbook data for the Commonwealth fisheries. This data was compiled also for latitude and longitude and for each shot (trawling/nets/lines). In broad terms data was apportioned according to the length of each shot made in each proposed area.

The study benefited greatly from assistance given by BRS in terms of the estimate of value of the displaced catch from Commonwealth Fisheries using mapping software and applying prices etc.

For the fisheries managed by the States, data had been reported by defined statistical reporting blocks. These varied somewhat between the different states and did not coincide with the boundaries of the proposed MPAs. Conservative estimates were made in aligning these boundaries in accord with the reported overlap for the reporting blocks and the MPA boundaries.

The AFMA database for catch and effort was compared against the log book records. Only a low frequency of errors was detected (mostly associated with dates, quantity of fish caught and some small latitude errors). This validation exercise showed that the catch quantities could be considered highly accurate.

Assessing Economic and Social Impact

A population of key informants was defined. These were operators who were likely to be significantly affected by the MPAs. They included individual operators in the small pelagic fishery or the giant crab fishery, autolongline operators and scallop fishers. A sample of these operators was chosen for analysis of impact.

Estimates were made for the sampled operators of:

- the gross revenue foregone by fishers by gear type for each MPA
- the added costs to fishers of adjusting their areas of operations and/or practices
- the number of jobs lost resulting from cost reducing strategies by fishers and processors in adjusting to the MPAs and due to operators going out of business

Developing Alternative Options

Alternative options to the originally proposed MPAs were developed in conjunction with the Australian Seafood Industry Council (ASIC) and the Australian Government. Industry workshops and meetings with the Australian Government were held for this purpose. The aim was to minimise impact on the commercial fishing sector while maintaining the relative conservation value of the initiative.

Outputs

It should be noted that the study was carried out in a very short time period (mainly January to February 2006) due to submissions having to be made in a tight time frame.

The first outputs from the study were the catch and socioeconomic impacts for each proposed MPA. A summary of these impacts is shown in Table 2.

Table 2: Summary of Estimated Catch Displacements and Impacts

MPA	Area (sq km)	Fisheries Affected	Type of Catch Displaced and Impact	Socio-economic impact
Murray	20,794	Northern Zone Rock Lobster (State) and Commonwealth S and E Scalefish and Shark Fishery	Rock lobster losses of 9.2 tonnes would require a reduction in TAC; also loss of 23.7 t of market fish and sharks	Displaced catch for rock lobster about \$270,000 per annum; \$237,000 per annum of Commonwealth Fisheries catch displaced
Nelson	6,000	Commonwealth S and E Scalefish and Shark Fishery	Very little; 673 kg spread across 37 different species	No significant impact on commercial fishing
Apollo	1,226	Rock lobster (State) and Commonwealth S and E Scalefish and Shark Fishery	1600 kg per year spread among several species	Minimal impact
Zeehan	20,000	Victorian Giant Crab fishery (State) and Commonwealth S and E Scalefish and Shark Fishery	2.3 t per year of giant crab (high proportion of total catch) and 0.5 t of rock lobster. Also 24 t of market fish from Commonwealth fisheries	Crab catch displaced about \$66,000 per annum (2.3 t @ \$28.5 /kg)
Tasman Fracture	40,000	Rock lobster and scalefish and Commonwealth S and E Scalefish and Shark Fishery	1.5 t of rock lobster displaced and 239 t of scalefish across a number of species including the blue-eye trevalla	Catch displaced of about \$450,000 per annum from Commonwealth Fisheries
Huon	13,000	Rock lobster and scalefish (State) and Commonwealth S and E	170 t from Commonwealth fisheries	Catch displaced of about \$145,000 per annum from

		Scalefish and Shark Fishery	including orange roughly and smooth oreo dory	Commonwealth Fisheries
South Tasman Rise	9,000	Minor	Minor	Minor
Banks Strait and Offshore Seamounts	45,000	Tasmanian scallops, rock lobster, Scalefish and Giant Crab and Commonwealth S and E Scalefish and Shark Fishery	Scallops, rock lobster and giant crab catches and 3,078 t of several scalefish Commonwealth fisheries	Very significant with estimate of loss of \$5.2 m per annum for scallops alone and a further \$3.2 m from Commonwealth Fisheries
Off shore Seamounts	6,000	Commonwealth fisheries only	231 t displaced	Significant with displaced catch of about \$1.18 m per annum
Bass Basin	2,931	Bass Strait Central Zone Scallop Fishery (currently closed) and Commonwealth S and E Scalefish and Shark Fishery	45.6 t displaced from shark gillnet fishery	Value displaced of about \$410,000 per annum for Commonwealth Fisheries
East Gippsland	4,213	Commonwealth S and E Scalefish and Shark Fishery including the scalefish hook and travel sectors and the Tuna and Billfish Fisheries	29 t displaced	Minor

The main predicted impacts were on:

1. The Tasmanian scallop fishery
2. State Rock Lobster fisheries (Tasmania and South Australia)
3. State scale fisheries (Tasmania)
4. Orange Roughy fishery (Commonwealth)
5. Small pelagic fishery (Commonwealth)
6. Other miscellaneous species

A summary of the estimated annual displaced catch for the State Fisheries is shown in Table 3 below:

Table 3: Summary of Tonnage Displacement in State Fisheries by Species

Common name	Total (tonnes per annum)
Rock lobster	13.95
Giant Crab	6.90
Commercial Scallop	4,000.00
Striped trumpeter	6.37
Bastard trumpeter	0.41
Jackass morwong	1.02
Ocean perch	0.56
Flathead	0.48
Wrasse	0.38
Total	4,030

A summary of the estimated annual displaced catch for Commonwealth fisheries is shown in Table 4. (adjusted for TAC)

Table 4: Summary of Tonnage Displacement in Commonwealth Fisheries by Species

Common name	Total (tonnes per annum)
Redbait	1,112
Common jack mackerel	631
Orange Roughy	214
Blue-eye trevalla	103
Gummy Shark	56
Other	364
Total	2,480

Economic impacts produced by the study was from a survey of a sample of industry participants regarding the operators assets, fishing and processing activities, expenditures, impact of the proposed MPAs and the operators likely response to the impact. The majority of the 44 valid responses came from operators in Tasmania, followed by South Australia. These operators represented a total of 54 vessels.

In support of the catch displacement and socioeconomic impact estimates, a series of case studies was assembled to demonstrate the impact on individual companies, buyout costs, fishing investment and infrastructure and its utilisation, safety impact, relocation, employment, downstream businesses, and fishing communities.

The magnitude of the economic impacts was discussed in the report in terms of:

- the gross value of the displaced catch due to the MPAs, allowing for adjusted TACs
- the added costs of fishing resulting from operational adjustments to the proposed MPAs
- the number of jobs lost

The estimated economic impacts were to be used as a benchmark against which the impact of alternative MPA boundaries and categories could be measured.

Displaced Catch

The catch data was adjusted for the proposed 2007 reductions in the TAC by species as this reduction would have happened whether the proposed MPAs were adopted or not. A summary of the displaced catch impact is provided in Table 5.

Table 5: Summary of Gross Value of Displaced Catches (\$ million)

Fishery	Value of Displaced Catch after adjustment for 2007 TAC (2004/05 data)
Commonwealth	5.7
State Fisheries - scallops	5.2
State Fisheries – rock lobster	0.4
State Fisheries – other	0.3
Total	11.6

Based on 2004/05 data the displaced catch value would be \$5.7 million for Commonwealth operators, and \$5.9 m for State operators (mainly the scallop industry). The largest impacts were on Tasmanian vessels (about 90% of the total impact).

Additional costs

While some limited data was assembled on the additional costs that may have been experienced by fishers in pursuing quota elsewhere, this area of information was not pursued.

Estimated Job Losses

An estimate of the jobs lost as a result of the proposed MPAs is provided in Table 6.

Table 6: Estimate of Loss of Employment

Sector	Jobs lost	
	Full time	Casual
Fishing	29	35
Secondary	23	117
Total	52	152

Alternative Proposals

Alternative proposals for a set of MPAs were developed to serve as a platform for negotiation between industry and the DEW. These proposals had a lesser impact on the fishing industry but still addressed the essential conservation objectives and outcomes targeted in the original MPA proposal.

The study commented on the method used to develop the initial MPAs; comments included:

- (a) that information about conservation values was important in the Fisheries Risk Assessment and that the DEW specification for biodiversity objectives and values should not be eroded.
- (b) that the one-size-fits-all approach with depth as a major focus excluded some fishing methods e.g. longlining.
- (c) that different sectors had been treated differently (e.g. recreational lobster fishing versus commercial lobster fishing) despite having the same fishing method e.g. there was no reasonable justification for the exclusion of longlining which left a very insignificant footprint with low risk.
- (d) that some of the classifications for the MPAs should be changed.
- (e) that an alternative set of boundaries for the MPAs should be considered.

The study concluded that there should be some re-evaluation of some of the fishing methods excluded from multiple use areas.

A summary of some of the proposed changes proposed to minimise impacts are presented in Table 7.

Table 7: Summary of the Proposed Changes to the MPAs to Minimise Impacts

MPA	Fisheries Affected	Proposed Change to Minimise Impacts
Murray	Northern Zone Rock Lobster (State) and Commonwealth S and E Scalefish and Shark Fishery	Establish multiple use zones on shelf waters so that rock lobster and shark gill net are permissible activities.
Nelson	Commonwealth S and E Scalefish and Shark Fishery	No changes.
Apollo	Rock Lobster (State) and Commonwealth S and E Scalefish and Shark Fishery	Straighten the boundary adjacent to state waters but no change proposed to classification.
Zeehan	Victorian Giant Crab fishery (State) and Commonwealth S and E Scalefish and	Establish a multiple use zone in the area to benefit giant crab potting, midwater trawl and drop line.

	Shark Fishery	
Tasman Fracture	Rock Lobster and Scalefish and Commonwealth S and E Scalefish and Shark Fishery	Significant changes to the configuration and zoning of the MPA removes most of the impact on the fisheries.
Huon	Rock Lobster and Scalefish (State) and Commonwealth S and E Scalefish and Shark Fishery	Join these two MPAs. Change western boundaries so as to avoid the impact on the trawl fisheries. Change zoning to that of the Tasmanian Seamount Reserve. Will allow pelagic fishing, especially tuna fishing.
South Tasman Rise	Minor	
Banks Strait and Offshore Seamounts	Tasmanian scallops, Rock Lobster, Scalefish and Giant Crab and Commonwealth S and E Scalefish and Shark Fishery	Split the proposed MPA into two separate MPAs. The southern MPA to be partly a multiple use area and partly a strict nature zone. The northern MPA also to have multiple use area. This will significantly impact on the Tasmanian Scallop Fishery and Commonwealth fisheries especially longlining, droplining and trawl.
Off shore Seamounts	Commonwealth fisheries only	Offshore Seamounts to be removed from the network
Bass Basin	Bass Strait Central Zone Scallop Fishery (currently closed) and Commonwealth S and E Scalefish and Shark Fishery	Changes to boundaries and zonation to reduce impact on the gill net shark fishery. The boundary changes also capture a larger area of the shelf.
East Gippsland	Commonwealth S and E Scalefish and Shark Fishery including the scalefish hook and travel sectors and the Tuna and Billfish Fisheries	Minor changes only to the western boundary to avoid the existing trawl area.

Outcomes

In finalising the MPAs, the Australian Government held extensive consultations with fishing industries, conservation groups, Indigenous interests, scientists, State Governments and their State Fishing Authorities. Public submissions were invited and the DEW received about ten submissions including those from industry, CSIRO, non-Government Organisations and individuals.

The TAFI report was developed in conjunction with industry and others and it was substantially used as an input to representations made by the fishing industry to the Australian Government on the MPAs and their location, characteristics and categorisation. Of critical significance is that there was only one submission from industry, rather than from the multitude of industry groups with differing interests. The TAFI report acted in a unifying role for the industry to present an agreed industry position.

The industry submission (ASIC, 2006) was based on the TAFI report and differed only to a small extent, mostly in terms of additional changes made to the Murray MPA proposal. These changes were considered as part of the project but only finalised after the TAFI final report had been submitted

The TAFI study and the industry submission were scientifically based, pursued the same objectives that DEW had set regarding protecting biodiversity and conservation objectives, and therefore did not materially compromise any conservation outcomes. However, the TAFI study and industry submission demonstrated that a very substantial reduced impact on the commercial fishing industry could be achieved. Most of this reduced impact was on the Commonwealth fisheries rather than the State fisheries.

For example, the TAFI report examined fishing methods with regards to potential damage they may do to the sea floor. One principle pointed out was that if fishing was carried out only down to 500 m then fishing in this zone had no interaction with the communities living on the sea floor. The use of longlines was more passive and selective than trawling which had been considered similarly in the development of the original MPA categories. Further, fishers do not necessarily favour bottom biodiversity as they can incur more damage to fishing gear.

There was a very high level of support for the content of the report from the State Fisheries Authorities. The recreational fishing industry negotiated an outcome separately to the industry.

The development of the MPAs then entered the political process. The TAFI report and associated industry submission played a significant role in the determination of the final decision by the Australian Government.

The final boundaries and categories were decided in May 2006. The statutory process then had to be followed. This required formal gazetting of the final MPAs (October 2006), formal consultation under the Environmental Protection and Biodiversity Conservation (EPBC) Act under which MPAs are declared, and a regulation impact statement (Anon, 2007).

In July 2007 the Australian Government formally declared the South-east Commonwealth Marine Reserve (CMR) Network which will contribute to the National Representative System of Marine Protected Areas.

The network comprises five different zones (Minister for Environment, Press release July 2007):

- sanctuary zones, where extractive uses are prohibited;
- benthic (sea floor) sanctuary zones, where extractive uses are prohibited in the area 500 metres below sea level to the sea floor;
- multiple use zones, where only low-impact fishing methods and other activities are permitted;
- special purpose zones, where all commercial fishing is prohibited, but oil and gas activities and recreational fishing are permitted; and
- recreational use zones, where recreational and charter fishing are allowed, while other extractive activities are prohibited.

Impact on Commercial Fishing

The most significant changes included a 24% increase in the area protected and a more than 90% reduction in the impact on the commercial fishing sector, compared to that originally proposed (Anon, 2007).

Conservation Impact

Regarding conservation, the biodiversity features included in the protected areas are compared in Table 8 for the original proposal and the final outcome.

Table 8: Comparison of Areas and Biodiversity Features Protected

	Original Proposal	Final Outcome
Area protected (sq km)	171,000	226,458
% area of feature protected		
Seamounts	64	81
Canyons	20	21
Shelf	6	8
Slope	19	27

Starting with the TAFI report the representations by industry were aligned by about 85% of those in the TAFI report. The final boundaries and categories proclaimed were about 80% of those in the TAFI report. It should be noted that the final MPA specifications design needed to take into account oil and gas considerations.

Major losses to the industry in the final MPAs were south of Tasmania in the Huon/Tasman Fracture where the industry may have lost some future commercial opportunities.

Benefits

Economic Benefits

The final MPAs provided a significantly lower economic impact on the fishing industry. The displaced gross value of product (GVP) for the original proposal was estimated to be \$11.6 m per annum for both Commonwealth and State fisheries (Anon, 2007). In

comparison, the final outcome the estimate of GVP displaced was estimated at \$0.9 million per annum. The difference was due in the main to (Anon, 2007):

- The removal of the Cascade reserve which allows ongoing fishing for orange roughy;
- The replacement of the Banks Strait reserve with the Flinders and Freycinet reserves, which reduce the impact on scallop fisheries;
- the altered zoning of the Tasman Fracture reserve to minimise the impact of blue-eyed trevalla catches; and
- The altered design and altered zoning of the Murray reserve to allow harvest of rock lobsters.

The first three of the above factors, but not the rock lobster alterations, can be attributed, at least in part, to the TAFI study (Colin Buxton, pers.comm., 2007).

The reduction in the displaced catch is linked to retention of profits in the industry, reduced unemployment, and a reduction in the flow-on economic impacts to fishing industry servicing businesses.

The revised MPAs are more or less “owned” by industry compared to the original MPAs. Hence, compliance with the boundaries and conditions for the revised MPAs are likely to be high.

The DEW was supportive of the outcome as it has cost the Australian Government less in terms of adjustments costs than the initial plan. There were lowered transaction costs for both industry and government in that industry representation was channelled though one party, making it easier for government to hear and respond to the many industry groups affected and who would have made representation.

The MPA process undertaken for the South-east fisheries region is likely to be used in the development of networks for the next four Australian fisheries regions. Four more Australian fisheries regions are presently being developed with MPAs including the South-west, North-west, Northern and Eastern Marine Regions (Paul Garrett, pers. comm., 2007).

Environmental Benefits

As described earlier, the final MPAs provided a marginally improved set of conservation and biodiversity outcomes to those originally proposed. For example, the MPAs now include more of the shelf areas than in the original proposal and these areas are considered important to biodiversity.

Social Benefits

Communities currently engaged in servicing fishing boats and crews (e.g. processors) will lose less infrastructure and employment. The reduced number of personnel losing jobs in the catching and processing industries, particularly in Tasmania, will mean that total disruption and dislocation costs to them and their families will be less.

A summary of the principal types of benefits and related costs associated with the outcomes of the project is shown in Table 8.

Table 8: Categories of Benefits from the Investment

Benefits
<u>Economic</u> <ul style="list-style-type: none"> • Reduced impact of the displaced catch leading to reduced financial impact of sales foregone and reduced impact on industry profits • Reduced potential un-employment • Reduced impact on those providing inputs to the industry supply chain (e.g. processors, repairs and maintenance suppliers) • Reduced compliance costs due to greater industry ownership of the revised MPAs • More efficient development of MPAs for other Australian fisheries
<u>Environmental</u> <ul style="list-style-type: none"> • Marginally improved set of biodiversity and conservation assets
<u>Social</u> <ul style="list-style-type: none"> • Lowered impact on localised fishing communities and reduced social costs of disruption and dislocation of families, particularly in Tasmania

Public versus Private Benefits

Both private and public benefits will arise from the investment. Private benefits will be captured by fishing industry businesses, many of which will be able to continue in business at near 2006 capacity. Public benefits that accrue will largely be social in nature, for example the retention of income, employment and infrastructure in small fishing towns in Tasmania.

Supporting this study was extremely high priority for FRDC. The study had to be completed in two months so it was not a high cost. If FRDC had received restricted or zero funding from government, the study would still have been funded by FRDC.

Distribution of Benefits Along the Fish Supply Chain

The private benefits will initially be captured by the fishers and their employees. However, as the impacts would have been severe along the industry supply chain with the initial MPAs, it is likely that there will be a significant flow on benefit to other parts of the industry (input suppliers, processors, marketers) and possibly seafood consumers.

Benefits to other Primary Industries

It is likely that most economic benefits will be confined to the fishing industry in the southern states, particularly Tasmania with some benefits captured by fishing interest in South Australia and Victoria. Social benefits will be captured mainly in Tasmania.

Match with National Priorities

The Australian Government’s national and rural R&D priorities are reproduced in Table 9.

Table 9: National and Rural R&D Research Priorities 2007-08

Australian Government	
National Research Priorities	Rural Research Priorities
<ol style="list-style-type: none"> 1. An environmentally sustainable Australia 2. Promoting and maintaining good health 3. Frontier technologies for building and transforming Australian industries 4. Safeguarding Australia 	<ol style="list-style-type: none"> 1. Productivity and adding value 2. Supply chain and markets 3. Natural resource management 4. Climate variability and climate change 5. Biosecurity <p><i>Supporting the priorities:</i></p> <ol style="list-style-type: none"> 1. Innovation skills 2. Technology

The major focus of the MPA initiative has been on the first National Research Priority (environmentally sustainable Australia) and is strongly associated with Rural Research Priority 3 (Natural Resource Management). The study has contributed to this outcome. However, while the environmental value of oceans and biodiversity were protected, there was a strong cost saving benefit that served the productivity and added value focus of Rural Research Priorities 1 and 2.

Quantification of Benefits

Counterfactual

If the TAFI study had not been funded, the most likely scenario is that some attempt may have been made by industry to reduce the industry impact. However, characteristics of the ‘without study’ scenario are likely to have been:

- The industry impact estimates would still have been made;
- ASIC may have still coordinated a study but they were not strong at a national level and did not cover State Fisheries and all industry groups. ASIC disappeared from the industry scene in June 2006;
- Less data would have been produced on alternatives and with less scientific rigour;
- Conflicting submissions would have been received by DEW requiring difficult tradeoffs to be made;
- There would have been a higher level of time and travel required as each industry group would have made some submission; and
- There would have been a higher level of political involvement.

It is estimated that 50% of all the industry benefits achieved from the TAFI study may have been achieved if the TAFI study had not been funded, but at a higher transaction cost.

Economic Benefit: Change in the Value of the Displaced Catch

The displaced GVP for the original proposal was estimated to be \$11.6 m per annum for both Commonwealth and State fisheries (Anon, 2007). In comparison, for the final outcome the estimate of GVP displaced was \$0.9 million per annum. The difference is \$10.7 million.

Of this \$10.7 million, \$5.2 million was contributed by the changes affecting the scallop industry whose sustainable management plans would have been completely compromised by the original MPAs. Another \$0.4 million GVP gained by the rock lobster industry was not influenced by the TAFI study. Hence, it could be argued that of the \$10.7 million the TAFI study influenced:

- the \$5.2 million saving for the scallop industry
- the other \$5.1 million that excluding the rock lobster industry gains

The \$10.3 million could be used as a proxy for the economic gain from the changes made from the initial MPAs to those finally gazetted. However, the gross value of product (the displaced catch) does not equate to the impact on the fishers alone. The GVP is produced from, and equates to, a combination of resources (the return to capital, labour and a set of inputs and services).

The displaced return to capital and some labour may be recaptured if boats are redeployed to catch fish elsewhere. Likewise, if labour displaced can find work and add value elsewhere, loss of employment due to the MPAs is not necessarily a loss to the Australian economy. The set of inputs and services no longer paid for out of the GVP represents lost sales to other businesses in the economy.

Difficult assumptions about redeployment of capital and labour are required. Table 10 demonstrates the approach taken here. It is assumed that the closure would have removed nearly all of the entire scallop industry in that region. However, for the other fisheries influenced by the TAFI study, it is assumed that 40% of boats, and labour would have been redeployed elsewhere. The 40% is an average, for example most resources displaced by the changes to small pelagic fisheries may have been redeployed but those catching blue-eyed trevalla may not have been re-deployed at all, at least in catching the same species.

Table 10: Estimate of Economic Gains from Scallop and other Fisheries from Changes to MPAs

Fishery	Gross value of reduction in displaced catch (\$ million)	Proportion of Resources Redeployed	Economic Gain (\$ million)
Scallop	5.2	0.1	4.7
Other Fisheries	5.1	0.4	3.1
Total			7.8

The attribution of the economic gain in Table 10 due to the TAFI study was estimated to be high at 90%.

Economic Benefit: Other Marine Protected Areas in Australia

There is a significant likelihood that the lessons learned from the MPAs in the South-east region would have been applied to the other MPAs being established in four fisheries regions as identified earlier. This application of the efficiencies gained from the South-east MPA experience probably will result in further saved costs to the respective fishing industries. It is assumed that the likelihood of this occurring is 30%, with a saved cost of \$2 m per annum per fisheries region, and with these savings commencing every 3 years from 2010 onwards.

Social Benefit: Avoided Future Local Community Support

Social costs of disruption and dislocation of communities, families and individuals would have been real due to the increased unemployment and general community disruption where most businesses and communities depended heavily on the fishing fleet and associated servicing. A proportion of the structural adjustment costs paid by government could be viewed as a surrogate for avoiding such costs. This is estimated as a one-off cost of \$10 m avoided and is based on one third of the total structural adjustment costs avoided of around \$30 m that would most likely have been paid by government.

The \$30 m structural adjustment cost has been estimated by applying a factor of 3 to the likely value of the displaced catch of about \$10 m (Confidential pers. comm., DEW, 2007).

Benefits Not Valued

While the final MPAs provided an improved set of conservation and biodiversity outcomes (and hence an environmental benefit), the gain would have been marginal and extremely difficult to value.

Other benefits and costs identified earlier but not valued include:

- Higher advocacy and representation costs to industry without the TAFI study
- Reduced compliance costs

Both of these benefits are considered to have been relatively small in relation to the benefits from the changes to the displaced catch, and also would have been difficult to value.

Summary of Assumptions

A summary of the key assumptions made is shown in Table 11.

Table 11: Summary of Assumptions

Variable	Assumption	Source
<i>All fisheries – displaced catch</i>		
Total gross value displaced catch – original proposal	\$11.6 m per annum	Anon (2007)
Total gross value displaced catch – final outcome	\$0.9 m per annum	Anon (2007)
Reduced value of displaced catch	\$10.7 m (11.6-0.9)	Anon (2007)
<i>Fisheries influenced by the TAFI report</i>		
Reduced value of displaced catch excluding rock lobster	\$10.7 – 0.4 million = \$10.3 million	Buxton et al (2006)
<i>Specific fisheries gains associated with TAFI report</i>		
Contribution of catch gain from scallops	\$5.2 million	Buxton et al (2006)
Contribution of catch gain from other fisheries	\$5.1 million	\$10.3 m less \$5.2 m
Resources engaged elsewhere with scallop industry closure	10%	Consultant estimate
Resource engaged elsewhere due to impact on other fisheries	40%	Consultant estimate
Proportion of actual gains made for scallops and other fisheries due to TAFI report	90%	Consultant estimate after discussions with industry and DEW representatives
Proportion of gains made that would have been made without the TAFI study	50%	Consultant estimate after discussions with industry representatives and others
<i>Benefits to other Marine Protected Area Development in four more Australian fisheries</i>		
Saving	\$2 m per annum for each of four fisheries	Consultant estimate
Probability of saving occurring	30%	Consultant estimate
Years in which each saving commences	Year ending June 2010, 2013, 2016 and 2019	Consultant estimate

<i>Social Costs Avoided</i>		
Proxy for social costs avoided	\$10 m in 2008/09	Consultant estimate

Results

All past costs and benefits were expressed in 2006/07 dollar terms using the CPI. All benefits after 2006/07 were expressed in 2006/07 dollar terms. All costs and benefits were discounted to 2006/07 using a discount rate of 5%. The base run used the best estimates of each variable, notwithstanding a high level of uncertainty for many of the estimates. All analyses ran for the length of the investment period plus 20 years from the last year of investment (2005/06) to the final year of benefits assumed (2025/26).

The present value of benefits (PVB) from each source of benefits was estimated separately and then summed to provide an estimate of the total value of benefits.

Investment criteria were estimated for both total investment and for the FRDC investment alone. Each set of investment criteria were estimated for different periods of benefits. The investment criteria were all highly positive as reported in Tables 12 and 13. The benefit-cost ratio and the internal rate of return are very high due to the very small investment in the project.

Table 12: Investment Criteria for Total Investment
(discount rate 5%)

Criterion	0 years	5 years	10 years	15 years	20 years
PVB - Displaced Catch	0	12.35	24.76	34.48	42.09
PVB – Other MPAs	0	1.56	6.62	12.95	18.20
PVB- Reduced Social Costs	0	9.52	9.52	9.52	9.52
Total Present value of benefits (m\$)	0	23.43	40.90	56.95	69.82
Present value of costs (m\$)	0.07	0.07	0.07	0.07	0.07
Net present value (m\$)	-0.073	23.36	40.83	56.88	69.74
Benefit cost ratio	0	322	562	783	959
Internal rate of return (%)	negative	1310	1311	1311	1311

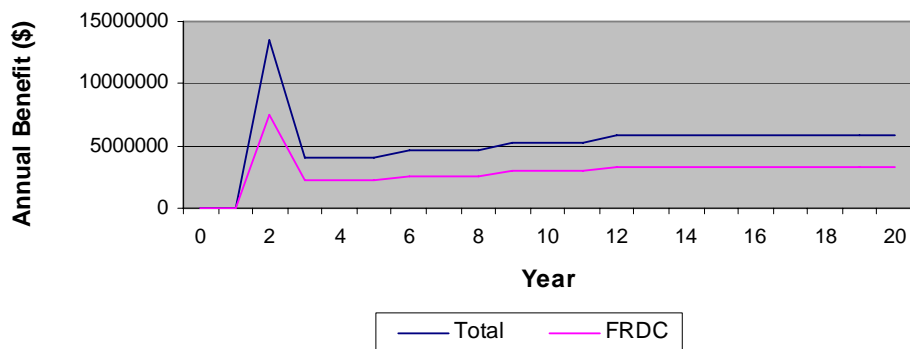
Table 13: Investment Criteria for FRDC Investment
(discount rate 5%)

Criterion	0 years	5 years	10 years	15 years	20 years
PVB - Displaced Catch	0	6.89	13.82	19.24	23.50
PVB – Other MPAs	0	0.87	3.70	7.23	10.16
PVB- Reduced Social Costs	0	5.32	5.32	5.32	5.32
Total Present value of benefits (m\$)	0	13.08	22.83	31.79	38.97
Present value of costs (m\$)	0.04	0.04	0.04	0.04	0.04
Net present value (m\$)	-0.04	13.04	22.79	31.75	38.93
Benefit cost ratio	0	322	562	783	959
Internal rate of return (%)	negative	1310	1311	1311	1311

In terms of the quantified benefits, 60% were sourced from the savings made in the displaced catch, 14% from the social costs avoided and 26% from the expected efficiencies made in the development of MPAs in the four other fisheries. Of the quantified benefits 86% could be attributed to the productivity and adding value component of the rural research priorities with the other 14% (social costs avoided) not fitting with any rural research priority but rather addressing the national research priority of promoting and maintaining good health.

The cash flow of benefits is shown in Figure 1 for both the total investment and for the FRDC investment.

Figure 1: Annual Benefit Cash Flow



Sensitivity Analyses

Sensitivity analyses were carried out on a range of variables and results for the FRDC investment alone are reported in Tables 14 and 15. All sensitivity analyses were performed using a 5% discount rate with benefits taken over the life of the investment plus 20 years from the year of last investment. All other parameters were held at their base values.

Table 14: Sensitivity to Counterfactual Achievement
(FRDC investment, 5% discount rate; 20 years)

Criterion	Level of Benefits Produced without the FRDC Investment		
	90%	(Base) 50%	10%
Present value of benefits (m\$)	4.70	38.97	42.29
Present value of costs (m\$)	0.04	0.04	0.04
Net present value (m\$)	4.66	38.93	42.25
Benefit cost ratio	115.7	959	1041.1
Internal rate of return (%)	271	1311	902

Table 15: Sensitivity to Level of Social Costs Avoided
(FRDC investment, 5% discount rate; 20 years)

Criterion	Level of Attribution to FRDC Investment		
	\$5 m	(Base) \$10 m	\$40 m
Present value of benefits (m\$)	36.31	38.97	54.92
Present value of costs (m\$)	0.04	0.04	0.04
Net present value (m\$)	36.27	38.93	54.88
Benefit cost ratio	894	959	1352
Internal rate of return (%)	1032	1311	2409

Table 16: Sensitivity to Proportion of Resources Redeployed in Other Fisheries
(FRDC investment, 5% discount rate; 20 years)

Criterion	Level of Resources Redeployed		
	80%	(Base) 40%	10%
Present value of benefits (m\$)	32.78	38.97	43.62
Present value of costs (m\$)	0.04	0.04	0.04
Net present value (m\$)	32.74	38.93	43.57
Benefit cost ratio	807	959	1074
Internal rate of return (%)	1260	1311	1347

Conclusions

The result for the final boundaries and zoning of the Marine Protected Areas in the South-east can be described as a win-win outcome for both industry and the environment. The final MPAs provided a marginally improved set of conservation and biodiversity outcomes to those originally proposed as the MPAs now include more of the shelf areas than in the original proposal. The impact on the fishing industry and its infrastructure and associated communities is far less than what may have been the case under the original proposals.

There is substantial agreement that the TAFI study contributed significantly to this win-win outcome. However, it is difficult to quantify and value this contribution without making a series of assumptions that can be the subject to debate, for example what would have happened if the TAFI study had not gone ahead.

Given the assumptions made, the economic analysis suggests that the TAFI study and the small FRDC investment made provided significant benefits to Australia. The net present value for the total investment was estimated at about \$70 million at a 5% discount rate, with a benefit-cost ratio of 959 to 1 and an internal rate of return of 1311%. The estimate of the value of benefits is likely to be an underestimate, given that several identified benefits have not been valued.

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References

Anon (2007) “The South-east Commonwealth Marine Reserve Network: Regulatory Impact Statement”, Marine and Biodiversity Division, Department of Environmental and Water Resources, Canberra.

ASIC (2006) “South –East Region Marine Protected Areas : Fishing Industry Response to the DEH Proposal”, Australian Seafood Industry Council, March 2006

Buxton C.D., Haddon, M. and Bradshw, M. (2006) “Regional Impact Assessment for the Marine Protected Areas proposed for the South-East Region”, Fisheries Research and Development Corporation Final Report Project 2005/083, 198pp.