



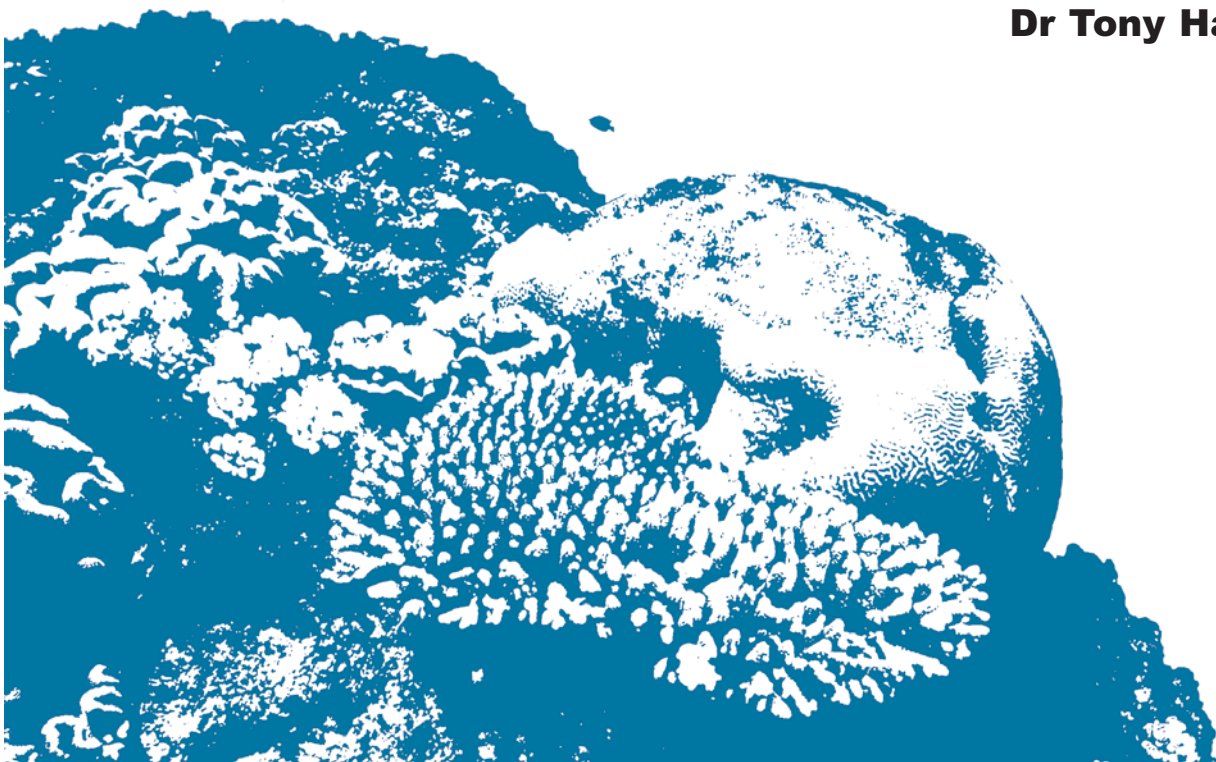
Australian Government

Great Barrier Reef
Marine Park Authority

RESEARCH PUBLICATION NO. 102

Economic research priorities – GBR fisheries

Dr Tony Hand



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A report prepared for the
Fisheries Reef Advisory Committee
of the Great Barrier Reef Marine Park Authority

27 August 2009

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Published by the Great Barrier Reef Marine Park Authority

ISBN 978 1 921682 04 9 (pdf)

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The National Library of Australia Cataloguing-in-Publication entry :

Economic research priorities GBR fisheries [electronic resource] : a report prepared for the Fisheries Advisory Committee of the Great Barrier Reef Marine Park Authority / Marsden Jacob Associates.

ISBN: 978 1 921682 04 9 (pdf)

Research publication (Great Barrier Reef Marine Park Authority : Online) ; 102.

Fisheries--Research--Queensland--Great Barrier Reef.

Marsden Jacob Associates.

Great Barrier Reef Marine Park Authority. Fisheries Advisory Committee.

639.20720943

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Executive Summary

OBJECTIVES

This Report sets out the key economic research priorities for Great Barrier Reef (GBR) fisheries, taking account of the current management issues, research gaps and future identified trends in fishery performance.

The Great Barrier Reef Marine Park Authority (GBRMPA) has a direct interest in the management of GBR fisheries due to the strong linkage between the economic health of fisheries and incentives for fishers to engage in better stewardship of the resource.

This Report focuses on two broad categories of research – cross-fishery issues and fishery-specific research.

THE IMPORTANCE OF ECONOMIC RESEARCH

Economic research is central to the development of ‘best practice’ policies for management of fish resources. To effectively examine the potential impacts of alternative policy options on fisheries, it is necessary to invest in economic research programs that compare and contrast the key policy options from the perspective of:

- economic returns of the fishery; and
- net public benefits from management of the fishery.

Moreover, development and implementation of a comprehensive economic research program sends a strong signal to stakeholders that Government is actively seeking to improve the performance of fisheries, thus providing the community with greater returns from sustainable harvest of the resource and generating greater economic resilience for commercial fishing operators.

CROSS-FISHERY ISSUES

A main finding of this study is that there is a broad spectrum of cross-fishery issues that have not been examined in detail, and which would require economic research to assess.

One of the main reasons for this is that economic research is arguably not a key input into management decisions when an incremental approach to refinement of management settings is adopted (as has historically been the case for most GBR fisheries).

Economic research is, however, particularly relevant to the more challenging issue of examining, or supporting, major reforms of management settings – reforms that require more resources to examine and implement, but which potentially increase fishery performance by an ‘order of magnitude’ relative to current performance.

We propose a ‘quantum shift’ in the overall level of economic research effort to underpin assessment of major fishery reforms, thereby promoting greater economic sustainability in GBR fisheries; improved social and economic contribution of the fisheries; and greater understanding of the resource sharing settings and how these can be restructured to enable an increased contribution by fisheries to the economy.

While eleven (11) research programs within the cross-fishery category have been identified (Table 1 below), the highest priority research areas in the category comprise:

- **Valuation of recreational, Indigenous and charter fisheries** (Program 1) – without this information it is not possible to determine the importance of these fisheries, or

evaluate the flow of social and economic benefits from the recreational and charter fisheries sub-sectors. This information is central to future assessments of management issues that impact the sector, such as control of recreational fishing effort, and allocation of resources between recreational, charter, Indigenous and commercial fisheries.

- **Strategies for removal of fishing effort** (Program 6) – future attempts to improve economic performance of fisheries will be undermined, or thwarted, by excess effort, including excessive latent effort. There needs to be a far greater degree of urgency in addressing this deep rooted problem in GBR fisheries, as it will potentially compromise efforts to reform fisheries management.
- **Assessment frameworks** (Program 7) – fisheries managers with responsibility for GBR fisheries have not been able to present a coherent framework for taking account of economic criteria or ecologically based management objectives. A comprehensive “*Management Assessment Framework for GBR fisheries*” is required to ensure that managers have a better appreciation of the approach for assessing management options.
- **Resource allocation** (Program 10) – surprisingly, there has been a paucity of research on the key issue of resource allocation – i.e. resource allocation between sectors, between vessel classes, and between extractive and non-extractive uses. A major review of resource allocation would be a flagship study for GBR fisheries, and would provide specific focus on the critical issue relating to the efficient management of the resource from the broader community’s perspective.
- **Climate change** (Program 9) – climate change risk assessment and adaptation plans are being prepared by a wide range of government agencies and industry sectors to provide a proactive approach to managing the impacts of climate change. In the case of fisheries, there will need to be a sound understanding of the potential impacts on yields, geographic relocation of fish stocks, impacts on fishing conditions (e.g., more days lost due to rough seas could be attributed to climate change) and impacts on cost structure for processing and freight due to rising energy prices.

FISHERY-SPECIFIC RESEARCH PROGRAMS

The two broad areas where fishery-specific research is required are: (a) bio-economic model development; and (b) large-scale review of management settings / potential for large-scale reforms of individual fisheries.

Bio-economic model development – bio-economics brings together population dynamics and economic models into a single decision support tool. This is a very powerful tool that is capable of examining fishery performance (profitability) for a wide range of management settings. It is the most significant mechanism for assessing management options and for developing long-term strategic targets for fishery settings. Marsden Jacob considers that there should be a bio-economic model for each of the major fisheries to enable fishing effort targets and total allowable catch (TAC) to be set (even if they are long-term targets). Bio-economic models are also an essential tool for considering:

- different fleet structures;
- zonal management;
- quota systems; and
- changes to output controls or revisions to input controls.

Assessment of management settings for all major fisheries needs to be undertaken using economic assessment frameworks, including cost benefit analysis (of alternative policy

options), economic impact assessment (this highlights regional economic flow-on effects) and social impact assessment.

There has only been incremental, or iterative, reform of GBR fisheries as opposed to real focus on the broader perspective of the best future direction for each fishery. Economic research provides the best avenue to examine the net benefits and costs of major reforms.

In fact, economic research needs to be at the core of the assessment process for management options, and the current lack of it limits scope to move to a higher level of fishery performance. For example, some of the ‘big ticket’ fishery management issues are yet to be comprehensively examined, such as:

- the benefits and costs of zonal management;
- resource allocation between sectors (recreational, charter, commercial and ‘the environment’);
- the overall level of catch and effort to deliver maximum economic yield; and
- the benefits and costs of introducing output controls and concomitant reductions in input controls.

A key question is whether a paradigm shift in management settings is justified and, given the presence of significant adjustment costs, it will be necessary to consider all relevant costs and benefits in making such an assessment. Detailed economic research is clearly required, and indeed necessary, to support this type of analysis.

SUMMARY & NEXT STEPS

In Tables 1 and 2 below, and in the body of the Report, we provide more detail of the types of cross-fishery and fishery-specific research that are required. It is recommended that most of the prioritised research flagged in this Report be conducted within a 24-30 month period.

We also provide further commentary on the rationale for the recommended research and the establishment of an Economic Research Committee consisting of stakeholders from GBRMPA, the Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA), the Queensland Government Department of Primary Industries & Fisheries (DPI&F), Sunfish, the Queensland Seafood Industry Association, CSIRO and universities (particularly James Cook University and the University of Queensland).

Management of the research program can be contracted out to an independent research entity or economics consultancy, reporting directly to the Economic Research Committee.

The research entity / consultant engaged will need to develop project briefs, and advise on the appropriate scale of projects, and assist, as appropriate, with the commissioning process, and the process for review of economic research projects.

The advantage of this structure is that as the research entity is effectively at “arms length” from government agencies, it provides greater scope for securing funding from multiple sources and it ensures research remains ‘proactive’ and is not constrained by political or day-to-day management pressures.

Contracting out the coordination of the economic research program, and project management, has significant benefits.

However, given that the research programs are, in essence, tools for the relevant management agencies to apply (sometimes on a regular, or real time, basis to manage fisheries), there will clearly need to be a close working relationship between the entity

managing the research process and key management agencies. The objectives of this process should be to (i) maximise collaboration between researchers and management agencies, and (ii) achievement timely updates of the research.

Table 1: Research priorities for cross-fishery issues

Program	Title	Comments	Priority	Timeframe
1	Valuation of recreational & charter fisheries	<p>Very little work has been done in the GBR to understand the economic value of the recreational and charter fisheries (apart from regional economic impact and/or expenditure studies) and to understand how these values are impacted by changes in resource allocations.</p> <p>From a management perspective, it is extremely important to understand these values, especially given there are some 750,000 recreational fishers active in East Coast Queensland fisheries.</p>	V. high	2009-10
2	Data collection & verification	<p>A holistic review of data collection and verification is required to understand the key gaps, as well as areas where verification processes can be introduced. This project would need to be a joint effort between a range of government agencies such as GBRMPA, DPI&F and DEWHA.</p> <p>Data quality is fundamental to improving understanding and monitoring of fishery performance. Hence, there needs to be significant resources attached to this program.</p>	V. high	2009
3	Monitoring & enforcement	<p>There needs to be a detailed review of all monitoring, surveillance and enforcement (MS&E) to enable critical assessment of the level of resources, and the mechanisms used, for these essential activities.</p> <p>Future research in this area would need to document all MS&E activities, and provide an estimate of the overall expenditure on MS&E, as well as the roles and obligations of different organisations involved in the MS&E task. Options for reform of the MS&E approach would need to be identified, and a framework established and applied to identify the preferred MS&E model.</p> <p>The system of penalties and reliance on common law fines (as opposed to a schedule of</p>	Moderate	2010

		predetermined fines) should also be examined.		
4	Performance indicators	<p>The economic health of GBR fisheries is a key concern, particularly given the cost-price squeeze (i.e., increasing fuel costs and lower fish prices due to increased competition from other countries) and ongoing effects of economic overfishing. To monitor the success of management reforms and the effects of external factors (i.e. fuel costs, price competition from other countries etc.), it is important to improve the monitoring of fisheries through development and application of key performance indicators (KPIs).</p> <p>A performance measurement framework has been established for Queensland fisheries by DPI&F and is currently being rolled out (although it is not GBR-specific). Any program should build upon this to maximise the efficiency from use of resources, and to avoid duplication.</p> <p>The forthcoming DPI&F survey of commercial fishers could provide a critical reference point for future assessments of the trend in economic performance of fishing fleets in the GBR.</p> <p>However, there needs to be further development of KPIs which are assessed annually (at least for a sample of 'representative' vessels) to enable better monitoring of the economic health of fisheries.</p>	Moderate	2009-10
5	Commercial fishery values	To facilitate an understanding of the benefits of the commercial fishery, it is important that the Queensland Government commission a valuation study, to assimilate data on the benefits of fisheries, and to quantify the direct and indirect economic contribution of the various Queensland fisheries . This type of research is essential in understanding the trade-offs between extractive and non-extractive uses of our natural capital.	Moderate	2009-10
6	Strategies for removal of fishing effort	The removal of latent fishing effort is seen as a key step for reform of GBR fisheries. To encourage successful outcomes it will be necessary to consider the economic cost effectiveness of different strategies for removing fishing effort. A major review of options	High	2009-10

		and strategies for removal of latent effort, including a diagnostic of potential risks of activation of dormant licences if there are favourable fishing conditions (e.g., improved prices and profitability) will need to be assessed.		
7	Assessment frameworks	<p>A key area of research is to set out the economic and social assessment frameworks required to assess fishery policies. The nexus between management objectives and management settings can only be addressed by developing, and applying, a robust framework for assessment of fisheries.</p> <p>As an initial step, a technical paper should be prepared for this purpose, outlining the linkage between management objectives, research, and development of management policies. Preparation of this paper, which should be widely distributed to stakeholders, should be underpinned by a comprehensive process of workshops and peer review from stakeholder agencies.</p> <p>The technical paper should build on existing initiatives and processes. In particular, DPI&F is developing a 5-year Fisheries Strategy and DPI&F has noted that Queensland broadly applies the National Fisheries Ecologically Sustainable Development (ESD) assessment and reporting framework.</p>	High	2009-10
8	Cost recovery for managing fisheries	Full review of cost recovery arrangements will be required. This has been achieved in other States and will be consistent with the Council of Australian Government's reforms, as well as national competition policy. Cost recovery increases the level of accountability by fishers, could help resolve issues with latent effort, and provides a greater level of resourcing for improved management outcomes.	Moderate	2010
9	Climate change	<p>All significant natural resource extraction industries exposed to climate change risks should be subject to a major risk assessment and develop a climate change adaptation plan. Factors to take into account include:</p> <ul style="list-style-type: none"> • the potential range of impacts on stocks and catch rates; 	V. high	2009

		<ul style="list-style-type: none"> • the changed impacts of fishing on the broader ecosystem; • issues relating to biological and economic overfishing; and • risk strategies to reduce the severity of impacts and safeguard the fishing industry. 		
10	Resource allocation	<p>This would be a flagship study to comprehensively review fisheries values, and assess the costs and benefits of incremental and major adjustments to the allocation regimes.</p> <p>Evaluation of the optimal allocation of fisheries resources between commercial, recreational, charter, and Indigenous fisheries in inshore and reef fisheries should be undertaken.</p> <p>Queensland’s recreational and charter fisheries are amongst the most valuable fisheries in Australia, yet little is known about the impacts of alternative regimes for resource allocation. Hence, we would attach a high priority to this study.</p>	High	2009
11	Aquaculture	Public benefit tests of aquaculture will be required to assess the overall triple bottom line impacts of proposals. This will require an assessment of the ecological footprint.	Moderate	2010

Table 2: Research priorities for fishery-specific issues

Program	Title	Comments	Priority	Timeframe
12	Development of bio-economic models	<p>Bio-economic models have not been developed for GBR fisheries in the past, with the exception of the beam trawl bio-economic model developed by the University of Queensland (see Section 2.3). However, bio-economic models represent an essential decision support tool for assessing fleet structure, allocation decisions, input controls and output controls.</p> <p>A scoping study to examine potential for development of bio-economic models should be commissioned, followed by development of detailed models for each of the principal fisheries. The development will be facilitated by the availability of population dynamics models and economic data from DPI&F's current survey of commercial fishers.</p> <p>Potential applications: (i) trawl fishery, (ii) reef line fishery and (iii) inshore fishery.</p>	High	2009-2012
13	Major reviews of management settings	<p>It will be necessary to conduct a major review of a suite of management reforms for each of the principal GBR fisheries. The key issues to explore in a major review comprise: relaxation of input controls, streamlining of the system of symbols (which relate to fishing apparatus licences and species licences/quota), effort reduction targets, improving the efficiency of the quota trading system, the introduction of output controls, resource allocation, TAC and zonal management.</p> <p>If major reviews are not feasible in the short to medium term, then smaller studies focusing on the key management issues for each fishery could be commissioned. Alternatively, themed studies focusing on common issues such as relaxing input controls could be commissioned.</p>	V. high	2009-2011
14	Value chain assessments	<p>This study provides further insights into potential ways in which the market could become more efficient.</p> <p>It is very important that this research is couched in terms of a) identifying regulatory impediments to more efficient operation of the value chain, and b) identifying the appropriate</p>	Moderate	2009-2010

		<p>role of government in helping improve the efficiency of the value chain. Trade-offs between efficiencies of vertical integration and gains from specialisation are best addressed through market forces.</p> <p>Potential applications: (i) trawl fishery and (ii) reef line fishery.</p>		
15	Reviews of labour market / labour programs	<p>This type of study would complement other research related to improving the economic efficiency of fishing operations.</p> <p>The study addresses a key impediment to improved profitability that has been identified in stakeholder interviews – availability of skilled labour – and could identify new programs to address the current sectoral weakness, which is the difficulty of retaining crew, and therefore the lack of incentive to invest in crew training.</p> <p>Potential applications: (i) trawl fishery, (ii) reef line fishery and (iii) inshore fishery.</p>	Moderate	2009-10

1. Introduction

1.1. Background

Marsden Jacob Associates (Marsden Jacob) has been commissioned by the Great Barrier Reef Marine Park Authority's (GBRMPA's) Fisheries Reef Advisory Committee (FRAC) to conduct an assessment of economic research priorities for Great Barrier Reef (GBR) fisheries. Factors taken into account in this review include: trends in GBR fisheries, current and emerging management issues, and data availability and gaps.

This review assesses a range of 'cross-fishery' issues relating broadly to GBR fisheries, including potential research into monitoring and enforcement, strategies for removal of fishing effort, the impacts of climate change, and resource allocation issues. We also specifically examine GBR trawl, reef line and inshore fisheries.

1.2. Project purpose

This project represents a key initial step in examining how to develop the future research agenda to promote better outcomes in respect of the areas of fisheries management identified above where GBRMPA has a direct, and ongoing, interest. This is a relatively broad terms of reference, but is an essential step in stimulating constructive dialogue between agencies on these issues.

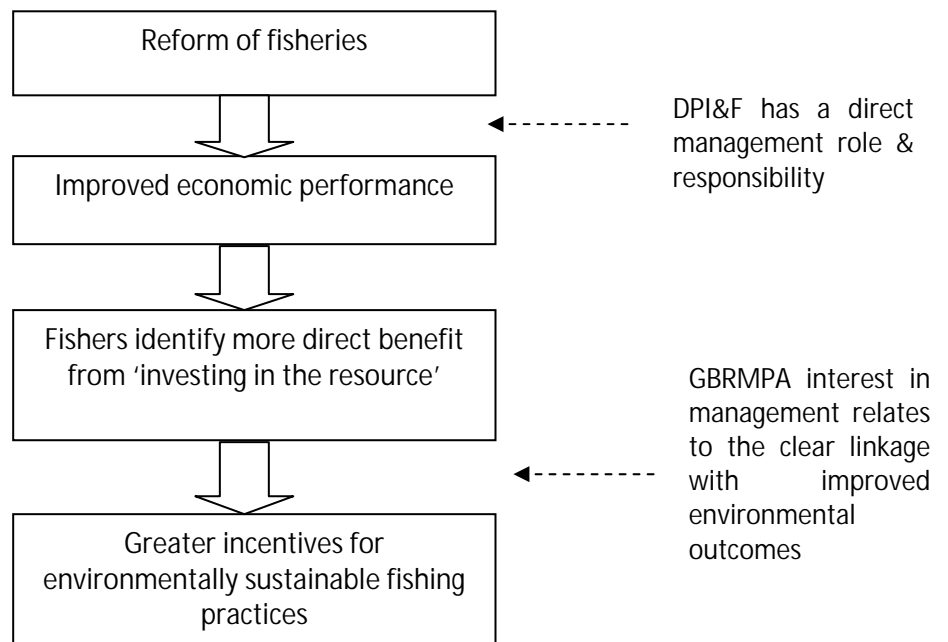
1.3. GBRMPA's interest in fisheries management issues

GBRMPA, and the FRAC, have a direct interest in economic research for fisheries, as this helps generate improved economic performance of fisheries and also provides scope for economic profiling to better understand the value to the community of fishing in the GBR.

1.3.1. Linkage between economic performance and environmental outcomes

Improved economic performance of fisheries promotes greater investment in, and focus on, environmentally sustainable fishing practices. At a broader scale, it provides an incentive structure whereby fishers are more likely to take a direct interest in stewardship (Figure 1.1).

Figure 1.1: Linkage between economic performance and enhanced stewardship



Source: Marsden Jacob Associates 2009.

Thus, GBRMPA has correctly identified, and acknowledged, the strong potential linkage between economic performance and environmental outcomes. Further, GBRMPA has a direct interest in monitoring, and engaging in dialogue with fishery managers, in relation to the process of fishery reform (i.e., reforms designed to engender better economic performance and improved economic sustainability). Realistically, however, such reforms have been slow to gain momentum in some GBR fisheries due to historic problems with over capacity and latent effort in fisheries.

1.3.2. Resource allocation

GBRMPA also has a responsibility to maximise community returns from the GBR Marine Park through appropriate management and resource allocation decisions. Implicit in the multiple-use nature of the GBR Marine Park is the concept that extractive use should be accompanied by 'returns' to the community that at least exceed any attributable loss in environmental values. Economic and social research is essential for examining the overall contribution to the community, particularly sector profiling, which shows the profitability, employment and economic flow-on benefits of the sector; this enables key potential trade-offs to be directly evaluated.

The allocation of fishery catch between sectors, i.e., commercial, recreational and charter sectors, should also be consistent with the overarching objective of maximising community returns from the GBR Marine Park. Again, economic research is central to the assessment of resource allocation and, to examine such issues rigorously, it will be necessary to conduct more formal economic testing of allocation scenarios.

2. Research currently underway or proposed

2.1. Introduction

In this Section, we outline some of the key research that has recently been commissioned, or is scheduled to commence in the near future. Most economic research for GBR fisheries previously undertaken, or currently underway, has been commissioned by the Queensland Government Department of Primary Industries and Fisheries (DPI&F). In addition the Fisheries Research and Development Corporation (FRDC) has been funding some of the larger scale projects undertaken in respect of GBR fisheries.

2.2. DPI&F survey of commercial fishing operators

DPI&F is currently finalising the design of a survey of all commercial fishers scheduled to take place in 2009. The survey will collect data on:

- annual catch;
- fishery returns;
- fishing costs;
- number of fishing trips; and
- time spent fishing.

The survey will also generate information and data (including income data) on shore-based employment (i.e. non-fishing employment).

Thus the survey will provide valuable economic and social data relating to individual operators and each of the major fisheries in the GBR. (Moreover, it is likely that data collected from the survey will be required when undertaking many of the economic research projects proposed in Sections 3 and 4 below.)

However, it is noted that there is a general need for more consistent cost and earnings data. DPI&F's last commercial fishing survey was conducted over a decade ago, and it will be necessary to increase the frequency of the surveys.

2.3. Trawl fishery

Economic research projects that DPI&F has flagged it will be looking to undertake, or has commissioned, for the trawl fishery comprise:

- More detailed **research on the value chain** to examine the potential for vertical integration to reduce costs, which could potentially result in payment of higher prices for landed prawns. This research would build on the FRDC-funded scoping study on the efficiency of the value chain for the trawl fishery currently being undertaken by Nick Ruello, a Cairns-based fisheries consultant.
- **Bio-economic modelling of** the Eastern King Prawn fishery. This model is being developed by DPI&F. The model does not consider interactions with the other fisheries, which could be a significant issue as the vessels operate in several fisheries and switch between them.

In 1999, Reid and Campbell¹ undertook a bio-economic analysis of the Queensland beam trawl fishery, which includes significant catches of banana prawns. The value of the recreational fishery and the value of marginal increases in catches of target species were estimated under the scenario of closing the beam trawl fishery. This study concluded that any marginal benefits from closing the fishery would not justify the costs. This result largely reflected the small catch interaction between trawlers and the recreational sector.

It is anticipated that the inshore finfish and reef line fisheries would have much stronger interactions with recreational and charter fishery catch, and hence the bio-economic modelling of the allocation between commercial and recreational / charter fishing in these sectors would be important to assess (see Section 3).

2.4. Inshore fisheries

An area of research that is currently underway is the assessment of social and regional economic benefits attributable to the inshore fishery. This research is being undertaken by the Fishing and Fisheries Research Centre at James Cook University (JCU) and is being funded by the FRDC. The two-year study includes the following components:

- An examination of the impact of changes in fisheries regulations on recreational, commercial and charter fisheries, as well as on consumers.
- The collection (using a phone survey) of essential baseline socio-economic information in order to get a good measure of any positive and negative impacts of upcoming fisheries management changes for Queensland's East Coast Inshore Finfish Fishery (ECIFFF).
- The design of a long-term socio-economic indicators monitoring system for Queensland's inshore fishery, which can be adopted by Queensland fishery managers.

The results, and data, from the Fishing and Fisheries Research Centre studies could be used to support a wide range of future research projects, and provide a sound foundation for further progressing social and economic research of the inshore fishery.

2.5. Reef line fishery

DPI&F does not have any formal economic research proposed for the reef line fishery. DPI&F has flagged the need for review of input controls and other management settings. As outlined in Section 4, economic tools can be used to support this type of policy assessment.

The JCU “Effects of Line Fishing” (ELF) project, which commenced in the late 1980s, has carried over to the current FRDC project, which is further developing the ELFSim model, a population dynamics model of the reef line fishery. There has also been some work undertaken recently at JCU by Geoffrey Muldoon on “Innovation and capacity in fisheries: value-adding and the emergence of the live reef trade as part of the GBR reef line fishery” (PhD thesis completed in 2008).

¹ Reid, C. R. M., and H. F. Campbell, 1999, 'Bio-economic analysis of the Queensland Beam Trawl Fishery. Fisheries Research and Development Corporation (FRDC) Final Project Report #94/035.' The University of Queensland, Brisbane.

2.6. Cross-fishery issues

2.6.1. Climate change risk and adaptation

GBRMPA has initiated some research on the impact of climate change on GBR resources, including fish resources in the 2007 report titled ‘*Climate Change and the Great Barrier Reef: A Vulnerability Assessment*’². In the report GBRMPA noted that:

“Climate change is recognised as the greatest long-term threat to the Great Barrier Reef. Projections show sea and air temperatures will continue to increase, sea level is rising, the ocean is becoming more acidic, intense storms and rainfall will become more frequent and ocean currents will change.”

These impacts have potential to significantly reduce yields from GBR fisheries – although at this stage it is not possible to predict the quantum of any impacts on yields.

In respect of risk management and adaptation, GBRMPA noted that it will be necessary to:

*“Maximise resilience of the GBR ecosystem to climate change, including:
... assess[ing] sustainability of fishing practices to ensure protection of habitat and key functional groups of plants and animals (for example herbivores) as a strategy for building resilience.”*

The Marine and Tropical Sciences Research Facility (MTSRF) is conducting a major research program on ‘Climate Change: Great Barrier Reef’.

The program addresses specific information gaps of direct relevance and importance to users of the GBR and those charged with its sustainable management. The program will address high priority issues for climate change impacts, including:

- an evaluation of possible futures for the GBR ecosystem on the basis of our present knowledge and forecasted climate variations;
- an early warning and assessment system for thermal stress on the GBR;
- an evaluation of the resilience of coral reef ecosystems to climate change; and
- tools to support resilience-based management in the face of climate change.

Understanding the potential impacts of climate change on the GBR, and the management options for minimising its impacts, is critical to the long-term sustainable use of this valuable natural asset. The MTSRF research will incorporate a large-scale, integrated approach to understanding how environmental conditions will change in the near future, how these changes will impact the species that make up the Reef, how resilient these species are likely to be to such impacts, and what are the best management options for minimising the risks of climate change to these Reef communities.

MTSRF’s program involves four (4) projects:

- regional climate scenarios (research providers: CSIRO, the Australian Institute of Marine Science (AIMS));

² Climate Change and the Great Barrier Reef: A Vulnerability Assessment, 2007, GBRMPA (in collaboration with over 80 climate change and tropical reef experts); Part II: Species and species groups. Chapter 12 Vulnerability of fishes of the Great Barrier Reef to climate change, Philip L Munday, Geoffrey P Jones, Marcus Sheaves, Ashley J Williams and Gillian Goby.

- early warning and assessment system for thermal stress on the GBR (research providers: AIMS, University of Queensland);
- resilience to climate change (research providers: JCU, AIMS); and
- tools to support resilience-based management in the face of climate change (research providers: AIMS, CSIRO, Central Queensland University).

There may need to be further liaison with researchers to ensure that findings of their research are effectively disseminated to GBRMPA and fishery managers, so that the implications for fishery management can be taken into account by DPI&F and other relevant agencies.

2.6.2. Monitoring & enforcement

In 2007, GBRMPA commissioned a review of monitoring and enforcement for the GBR Marine Park. The key findings of the review included a shift to more outcomes-focused benchmarking of monitoring and enforcement activities.

As outlined in Section 3 below, economic research can be used to compare the efficiency and effectiveness of alternative methods for achieving monitoring and enforcement outcomes. Economic research can also be beneficial in assessing the potential benefits from increasing resources allocated to the monitoring and enforcement effort.

2.6.3. Cost recovery

While there are very low levels of cost recovery in respect of GBR fisheries, DPI&F has recently developed a proposal for introduction of cost recovery in the tropical rock lobster (TRL) fishery. This required some estimation of the overall management costs and development of a cost allocation system. Cost recovery arrangements however, are not in place for most of the GBR fisheries. While this is a broader issue for Queensland fisheries, it is important that cost recovery issues be addressed in respect of GBR fisheries, as it impacts on the level of fiscal resources available for management and/or research.

2.6.4. Catch and effort data

Catch and effort data is systematically collected by DPI&F under the logbook data system.

Data validation is undertaken by DPI&F to some extent using landings data and a number of other sources (this is not published, but is completed to meet commitments of fishery approvals under the *Environment Protection and Biodiversity Conservation (EPBC) Act*). However, as landing data is only available for quota managed fisheries, the validation procedures are likely to need strengthening.

Moreover, there are well established statistical processes for calibration of data which are applied in a number of international fisheries where managers acknowledge the inaccuracies in the original data submitted by some fishers³.

³ Some operators in international fisheries have incentives to under-report to avoid access fee payments, while others have been known to 'over report' catch taken to gain greater access rights (i.e., if historic catch is a principal variable in the system used for allocating quota). International research agencies such as the Secretariat of the Pacific Community employ statisticians on a full time basis to maintain logbook databases. One of the principal tasks of the statisticians is to adjust logbook data of various fishing fleets to counter the effects of under- or over-reporting of their catch and/or levels of fishing effort.

Verification of catch and effort data is clearly a broader fisheries management issue for DPI&F but it is important to recognise that it has implications for any research study (and monitoring) relating to the GBR.

2.6.5. Recreational fishing

MTSRF Survey on recreational fishers' perceptions about the costs and benefits of the 2004 Zoning Plan

Steve Sutton from MTSRF recently completed a survey of recreational fisher responses to the 2004 zoning plan⁴. This generally showed positive feedback from recreational fishers on the outcomes of the zoning plan, although respondents were critical of the consultation process undertaken prior to the plan's implementation.

One of Steve Sutton's key recommendations was for continued monitoring of recreational fishers, together with assessment of economic impacts and changes in the geographic location of fishing effort:

“Continued monitoring of attitude and perception variables measured in this study, as well as investigation of additional impacts (e.g. fishing participation rates, economic impact and spatial changes in fishing effort) will be necessary to fully understand the long-term costs and benefits of the 2004 Zoning Plan to the recreational fishing community.”

Report commissioned by the Commonwealth Department of the Environment and Heritage on the impacts of the 2004 GBR Marine Park zoning reforms on recreational fishing

In 2005, Hunt estimated the impact of rezoning on recreational fishing-dependent businesses of GBR Marine Park, in a report prepared for the Department of the Environment and Heritage⁵. The report attempted to isolate the regional impacts of the 2004 rezoning of the GBR Marine Park by comparing the trends in recreational fishing participation and number of fishing trips in regions that do not directly access the GBR Marine Park – and are therefore unaffected by rezoning – with those that do, i.e. Cairns, Townsville, Mackay and Rockhampton.

General surveys of recreational fishers

The National Recreational and Indigenous Fishing Survey was conducted in 1998, and the report on the survey was released in 2003⁶. This study was relatively comprehensive but the survey instrument itself was applied some 10 years ago, and hence the data is starting to become less relevant in reporting on the current recreational and Indigenous sectors.

A recreational fishing survey was undertaken by DPI&F in 2004, but the report documenting the survey results was not completed until 2008 and results are yet to be made available on DPI&F's website. Hence, there has been a significant delay in disseminating results of the research (although it is noted that recreational fishing data has been reported on at a fishery

⁴ Sutton, S. 2008, Recreational fishers' perceptions about the costs and benefits of the 2004 Great Barrier Reef, Marine Park Zoning Plan. Report to the Marine and Tropical Sciences Research Facility. Reef and Rainforest, Research Centre Limited, Cairns.

⁵ Hunt, C. 2005, *Estimating the Impact on Recreational Fishing-dependent Businesses of Great Barrier Reef Marine Park Rezoning*. A report for the Department of the Environment and Heritage, Canberra.

⁶ Henry, G. W. And J. M. Lyle 2003, *The National Recreational and Indigenous Fishing Survey*. Cronulla, NSW: NSW Fisheries, Final Report Series No. 48 for FRDC Project No. 99/158.

level in Queensland's annual fishery status reports since 2007). Such lags in reporting greatly reduce the benefits from research. Reports on the data and results from future Queensland surveys should be published and made available within 12 months. (National surveys may take longer due to the larger scale.)

Expenditure data can provide a useful indicator of the importance of fishing to the community, but the expenditure approach is limited in terms of its ability to measure the true economic value of recreational fishing. The principal issue, or limitation, is that it does not measure the consumer surpluses (value over and above the next best consumption alternative). Conceptually, the consumer surplus is the 'economic value' that would be lost if the recreational fishing opportunity was no longer available.

While a demand curve can be estimated using the 'travel cost' method to enable estimation of consumer surplus, this relies on data from a more specific form of 'travel cost' survey. Moreover, more direct survey instruments (e.g., stated preference methods such as choice modelling and contingent valuation) are generally considered robust alternatives for estimating recreational fishing values (see Section 3.2).

Charter fishing

In 2002, Mark Fenton conducted research on the social and economic impacts of proposed fisheries spawning closures on the GBR charter fishing industry. In addition, the charter fishing industry systematically collects logbook data which can be used for future economic valuation studies relating to the charter fishing industry.

More recently, ABARE⁷ conducted an economic valuation study focusing on charter and recreational fishing in the Eastern Tuna and Billfish fishery. While this study relates to the broader east coast region where the fishery is located, it did include charter and recreational fishing in the GBR.

Revenue instruments

RecFish Australia recently commissioned Marsden Jacob to conduct a "Scoping Study of Options for Strategic Revenue Sources for the Recreational Fishing Sector in Australia".

This study has not been publicly released but examines alternative revenue options at both the State and national level, as well as focusing on revenue options for peak bodies.

Currently, the level of cost recovery in recreational fisheries in Queensland is around \$2.75 million, or 24% of the total expenditure on recreational fisheries management. Revenue is raised through the private pleasure vessel (PPV) levy and through stocked impoundment permits (i.e., for fishing in specified freshwater dams).

2.7. Comments

Economic research has not been a major priority for GBR fisheries. More work is required if DPI&F are to move to the next phase of fishery reform, which is to promote enhanced fishery profitability. Moreover, the recent cost-price squeeze has clearly demonstrated that the financial viability and economic sustainability of operators can be at risk if fisheries are not managed in a way that promotes greater economic efficiency. This points to the need to introduce, and apply, more rigorous economic assessment frameworks.

⁷ Galeano, D., Langenkamp, D., Levantis, C., Shafron, W. and Redmond, I. 2004, *Economic Value of Charter and Recreational Fishing in Australia's Eastern Tuna and Billfish Fishery*, ABARE Report 04.10 Prepared for the Fisheries Resources Research Fund, Canberra, July

3. Cross-fishery research

3.1. Introduction

The purpose of this Section is to consider research requirements for a range of broad issues that are applicable to all GBR fisheries. The research requirements have been developed taking into account the suite of current management issues outlined in interviews conducted by Marsden Jacob with fishery managers and key stakeholders (see Attachment 1).

3.2. Recreational / charter fishing

The recreational and charter fishing sectors represent an extremely high value component of GBR fisheries, with some 750,000 recreational fishers active in Queensland's fisheries (many of whom fish in the GBR region) and over 60% of the annual catch of reef fin fish attributable to the recreational and charter fisheries.

An area where substantial work is required is the understanding of recreational and charter fishing values and potential assessment of the allocation of fish resources between commercial, recreational, charter and Indigenous fishers.

This information would have multiple benefits, including:

- helping to articulate to governments the importance of providing funding for management of the sector; and
- underpinning future assessment of resource allocation issues. That is, information on fishery values could be used to underpin long-term targets for the allocation of resources between commercial, charter, recreational and Indigenous fishers.

DPI&F has articulated its policy for resource allocation in the following way⁸:

“Allocation arrangements should be explicitly stated in terms of the sectors involved, the percentages of the total catch allocated to each and the allocation methods. Such arrangements should reflect sectoral values and the management objectives for the fisheries resources concerned.”

DPI&F acknowledge, however, the inherent complexities in ascribing monetary values to primarily non-market goods and services such as recreational fishing⁹:

“Comparison of different fishing activities, that is comparing a commercial industry with nonmarket based leisure activities, presents a complex and controversial problem. For this reason, when considering the relative economic values of different fishing activities, decision-makers should seek to obtain independent and expert advice. Similar advice should be sought in regard to the social value of fisheries resource use.”

While recreational fishing survey methods have been reasonably well developed, they have wide error estimates, and provide very little information about non-landed catch and Indigenous-specific fishing. Thus techniques for enhancement of recreational fishing surveys need to be further investigated and implemented if found to be more effective than the existing approaches.

⁸ Department of Primary Industries and Fisheries. 2005. Fisheries Resource Allocation Policy. (available at: <http://www2.dpi.qld.gov.au/fishweb/13325.html>)

⁹ Ibid.

Moreover, some stakeholders interviewed for this study have indicated that a high priority should be attached to the attainment of better catch data for the recreational fishing sector. This information would represent a key input into recreational / charter valuation studies, and hence would help provide a true picture of the economic value of the recreational and charter fishing sectors.

The quantification of the recreational and Indigenous sectoral catch is still considered to require strengthening (despite periodic boat surveys undertaken by DP&F) and in fact improving the catch data should be a priority.

Economic valuations of recreational fishing have been undertaken recently as part of resource allocation research applied in other jurisdictions. For example:

- In 2003, the value of alternative uses of several finfish species in the West Coast Wetline Fishery was examined¹⁰.
- In 2006, the value of alternative uses of various finfish species in Victoria's Bay and Inlet fisheries was examined in a major economic assessment commissioned by the Victorian Department of Primary Industries¹¹. A parallel study on the social impacts of alternative resource allocation regimes was also commissioned by the Department.

In summary, as outlined in Program 1 below, we consider that there are significant potential benefits from studies examining non-market values (recreational, charter fishing and Indigenous fishery values). This would enhance knowledge of these important sectors and underpin future evaluations of resource allocation in the major GBR fisheries.

Program 1: Valuation of Recreational / Indigenous / Charter Fishing

Very little work has been done in the GBR to understand the economic value of the recreational and charter fisheries (apart from regional economic impact and/or expenditure studies) and to understand how these values are impacted by changes in resource allocations.

A research program focusing on these key areas is required. There is potential for use of non-market valuation studies (choice modelling, travel cost method) to better understand recreational / charter fishing values.

Given the importance of the recreational / charter fishing sectors, this work is considered to be extremely important, and is one of the key priority areas.

3.3. Data collection & verification

As part of the "Great Barrier Reef Outlook Report", GBRMPA's Ecosystem Conservation and Sustainable Use Group is currently reviewing a wide range of data and monitoring issues. We consider that the Outlook Report is the appropriate forum for examining data issues in a detailed fashion. However, in the course of interviewing stakeholders for this study, a number of potential issues regarding data collection and verification were flagged, including:

¹⁰ McLeod, P and Nicholls, J. 2005, 'A Socio-Economic Valuation of Resource Allocation Options between Commercial and Recreational Use: Fast Four, The West Coast Wetline Fishery Case Study', FRDC Project 2001/2005.

¹¹ Hundloe, T., et al, 2006, 'Victoria's Bay and Inlet Fisheries Resource Allocation Valuation Study, Report Prepared for the Victorian Department of Primary Industries, March.

- More extensive use of landings data / fish purchase docket for verification of logbook entries. While landings data are used only in quota managed fisheries, some stakeholders have indicated that there is a need for a more routine and rigorous approach to data validation through a standardised landings scheme.
- The rigour of diarist programs and boat ramp surveys for recreational fishing sectors; and the viability of using independent regional data collected by non-governmental organisation community groups (e.g. CapReef and fishing clubs) to validate State recreational fishing data.
- The effectiveness of the observer program in promoting accurate logbook entries.
- The level of resources allocated to the observer program.
- Independent stock assessment work to provide a means that is independent of catch per unit effort (CPUE) from logbook data (these data can be biased due to incentives for over-reporting).
- Spatial resolution of data.
- Timeframes for updating of data sets.
- The need for more testing of population dynamics models.
- The impact of incentives for over-reporting – when investment warnings are announced, there is concern that this increases propensity for catch to be over-reported by some fishers in the hope that this will increase their allocation of fishing rights. This inflates CPUE and in turn, has inflated stock assessments and sustainable yields. There is concern that the fishers' inability to take all of the quota in the Spanish mackerel and red throat emperor and 'other' species quota managed fisheries could be partly due to overestimation of stocks. It has been suggested that data received from operators who are likely to be systematically mis-reporting their logbook entries should be adjusted by using trends from known 'accurate logbook recorders'. (This approach is used by logbook data specialists at the South Pacific Community in New Caledonia to adjust logbook data for the Central and Western Pacific Tuna Fishery.)
- There is anecdotal evidence that localised depletions happen (e.g. scallops, prawns, grey mackerel, Spanish mackerel, garfish and beche-de-mer) and, arguably, no active methods are used to avoid them. The lack of effective monitoring at small scales could mean that local depletion effects are not well understood or evaluated. In some cases, effort migrates away from depleted areas and some stocks recover. However, other stocks such as beche-de-mer do not show recoveries in depleted areas, or take long periods of time to recover.

Program 2: Data collection & verification

A holistic review of data collection and verification is required to understand the key gaps, as well as areas where verification processes can be introduced. This project would need to be a joint effort between a range of government agencies such as GBRMP, DPI&F and DEWHA.

Data quality is fundamental to improving understanding and monitoring fishery performance. Hence, there needs to be significant resources attached to this program.

3.4. Monitoring & enforcement

There needs to be a detailed review of all monitoring, surveillance and enforcement (MS&E) activities to enable critical assessment of the level of resources, and the mechanisms used for these essential activities.

There are a number of economic issues relating to MS&E, including:

- optimal overall investment in MS&E, given the economic costs and economic / environmental benefits from increasing investment in MS&E – this can be examined using an economic cost benefit framework. Articulating to government the level of economic / environmental benefits from investing in MS&E can help secure increased funding.
- the impact on economic benefits of changing the MS&E management approach or introducing new MS&E methods. Economic models integrated with models of detection of breaches of zoning controls / fishing management controls can be used to illustrate the effect of changes in MS&E strategy.

3.4.1. Current research on the economics of monitoring & enforcement

There is currently a large-scale economic study on fisheries enforcement being undertaken by the European Community on the Costs and Benefits of Control Strategies (COBECOS).

The primary objective of COBECOS is to conduct a cost benefit analysis of control schemes for management strategies relevant to the Common Fisheries Policy and, based on this analysis, infer the potential economic benefits that might accrue from proper enforcement of the management measures. The study proponents propose to achieve this objective on the basis of:

- an appropriate theory of fisheries enforcement,
- empirical research involving intensive case studies and estimation of theoretical relationships, and
- computer modelling of fisheries enforcement (based on the theory and empirical estimations).

On this basis, the study proponents expect to be able to contribute significantly to answering questions such as:

- What are the costs and benefits of increased enforcement effort in particular fisheries?
- If compliance alters (exogenously) in certain fisheries, what are the costs and benefits?
- What are the impacts of increased penalties for violations of fisheries rules?
- How do different control schemes compare when the cost of enforcement is taken into account?

3.4.2. Potential research on monitoring, surveillance & enforcement for the GBR

Future research in this area would need to document all MS&E activities, and provide an estimate of the overall expenditure on MS&E, and the roles and obligations of different organisations involved in the MS&E task. Options for reform of the MS&E approach would need to be identified, and a framework established and applied to identify the preferred MS&E model.

The system of penalties and reliance on common law fines (as opposed to a schedule of predetermined fines) should also be examined.

A risk framework would need to be applied to ensure that there is a high rate of detection, together with substantial penalties, in those areas where there is most likely to be an infringement of either direct fishery regulations or the GBR Marine Park zoning plan.

One concern is that the Government's level of funding for monitoring and enforcement is set in accordance with the benefits to the commercial fishing sector. It may be beneficial, however, to present a case for increased funding that is couched in terms of the much broader benefits from monitoring and enforcement. Existence values (value of protecting marine species and ecosystems), recreational values, Indigenous values, charter fishing values and tourism values are all protected and enhanced through monitoring efforts. Thus, understanding fishery values could be part of a submission put to Government for increased resources for monitoring and data collection. (This type of submission would draw on valuation studies recommended above under Program 1.)

Program 3: Monitoring, surveillance & enforcement (MS&E)

Detailed review of monitoring and enforcement is required to examine the potential for redesign of the types of vessels, aircraft and technology used for surveillance. In addition, this research program would examine the effectiveness of the systems for scheduling MS&E activities and missions. The overall budget for MS&E could be reviewed by considering the benefits and costs of allocating more resources to MS&E.

3.5. Performance indicators

Fisheries must be granted a Wildlife Trade Operation (WTO) approval under Part 13 of the EPBC Act in order to retain the right to export fish¹². Declaration as a WTO demonstrates that the management arrangements for the fisheries meet, on-balance, the requirements of the Australian Government guidelines for the ecologically sustainable management of fisheries. The WTO can be conditional or make a number of recommendations for management of the fishery. The response to these conditions and recommendations must be of a sufficiently high standard for renewal of WTO approvals.

DPI&F signed off on the reporting requirements in late July 2008 for the new EPBC Act performance measures. Annual fishery status reports are now prepared for DEWHA as part of the requirements for export licences under the EPBC Act.

DPI&F has developed a Performance Measurement System (PMS) framework which is based on the 'National Ecologically Sustainable Development (ESD) Reporting Framework for Australian Fisheries: the 'How To' Guide for Wild-Capture Fisheries' (Fletcher et al., 2002).

PMS systems have been implemented for a number of Queensland fisheries and contain a range of biological, ecological and economic (and to a lesser degree, social) indicators (see website: http://www.dpi.qld.gov.au/cps/rde/dpi/hs.xsl/28_11060_ENA_HTML.htm). However, the PMS indicators are not specific to the GBR. Moreover, DPI&F has noted that indicators developed as part of the JCU research project on "*Social and Regional Economic Benefits Attributable to the Inshore Fishery*" (See Section 2.4) will need to be incorporated

¹² DPI&F noted that monitoring requirements were recently removed from the Coral Reef Fin Fish Fishery Management Plan as they are now a requirement under the EPBC Act reporting process.

into PMSs in the future. The PMS developed by DPI&F, in consultation with DEWHA, for the ECIFFF includes:

- local stock depletion;
- economic indicators;
- social indicators;
- species impacts; and
- quota groups.

DPI&F has noted that:

“During 2007, a draft performance measurement system (PMS) for the ECIFFF was developed with stakeholder consultation to track fishery [performance]. The purpose of the ECIFFF PMS is to establish a set of reference levels in key fishery indicators (e.g. catch and catch rate) to provide a consistent basis for annual review of the fishery.”

The PMS identifies several sub-fisheries in the ECIFFF defined by the target species, fishing method or region of fishing operations, or a combination of these. The PMS includes preliminary performance measures to monitor the sustainability of interactions with retained and non-retained species (by-catch), protected species and ecological diversity within the fishery area.

It is proposed to finalise the draft ecosystem PMS in mid-2008 after the ECIFFF Regulatory Impact Statement (RIS) public consultation process is completed. Further development of robust socio-economic indicators and reference limits was initiated in JCU-led collaborative research project in mid-2007.

CPUE and percentage of quota taken are being used as the main economic indicators. However, DPI&F recognises that this is just the start of the monitoring program and that it will be looking to develop more economic indicators. Data from the forthcoming survey of commercial fishers could be used for this purpose, and then (using a smaller sample), annual or bi-annual updates could be used to monitor trends.

Additional indicators could include:

- annual profits;
- days fished¹³;
- return on investment;
- asset values (written down book value, debt levels (debt–equity ratio));
- levels of new investment / refurbishment;
- expenditure on inputs;
- payments to crew; and
- employment trends (crew resignations and hiring).

¹³ While changes in ‘days fished’ can be interpreted in a number of ways, it is a valid indicator of the level of activity, and can be used in conjunction with a suite of other indicators to provide a profile of the economic health of a fishery.

Tracking the above information could be very useful in assessing the economic health of fisheries, and would provide significant insights into the trends in performance of the fisheries. It is important to recognise, however, that it can be more efficient to build upon existing frameworks than develop completely new, or separate, processes.

Program 4: Performance indicators

The economic health of GBR fisheries is a key concern, particularly given the cost-price squeeze (i.e., increasing fuel costs and lower fish prices due to increased competition from other countries) and ongoing effects of economic overfishing. To monitor the success of management reforms and the effects of external factors (i.e. fuel costs, price competition from other countries etc.), it is important to improve the monitoring of fisheries through the development and application of key performance indicators (KPIs).

The forthcoming DPI&F survey of commercial fishers could provide an initial reference point for future assessments of the trend in economic performance of fishing fleets in the GBR.

However, KPIs that are assessed annually (at least for a sample of ‘representative’ vessels) need to be developed, to enable better monitoring of the economic health of fisheries.

3.6. Commercial fishery values

From GBRMPA’s perspective, given its concerns about resource allocation and management issues, a study quantifying GBR fisheries returns would also be invaluable. Included in this type of analysis would be the broad ‘net community benefits’ from fishing regionally or by fishery.

This work could build on the forthcoming DPI&F survey and utilise some of the KPIs collected as part of Program 4 (see above). This would be a separate study and would include direct economic and social benefits (regional economic flow-on effects, employment etc.).

The output should provide a better understanding of whether the Queensland community is deriving economic or broader benefits from the fishing uses of its natural capital. This sort of benchmark would enable future strategic changes to be made with measurable outcomes.

Program 5: Commercial fishery values

To facilitate an understanding of the benefits of the commercial fishery, it is important that the Queensland government commission a valuation study, to assimilate data on the benefits of fisheries, and to quantify the direct and indirect economic contribution of the various Queensland fisheries. This type of research is essential in understanding the trade-offs between extractive and non-extractive uses of our natural capital.

3.7. Strategies for removal of fishing effort

A key issue for all GBR fisheries examined in this Report is the presence of real and potential excess fishing effort¹⁴. Problems experienced in removing fishing effort include:

- The impact of investment warnings – this warns operators that effort may only be recognised if there is a threshold catch history and can create an incentive to increase fishing effort and/or to over-report catch by some fishers.
- Latent fishing effort – licences held by part-time fishers that are not utilised, or under-utilised, could be sold to full-time fishers when economic conditions for fisheries improve.
- Latent effort due to low levels of utilisation of active licences – this can be attributed to relative economic returns from a) fishing different species (which can fluctuate considerably) or b) operating in different fisheries (many GBR operators operate in multiple fisheries and target multiple species).
- Identifying the appropriate target level of fishing effort. Bio-economic studies recommended in Sections 2–4 would indicate whether fishing effort should be removed in the longer term. The next step would be to develop a strategy for removing fishing effort, including details of timing, staging, and policy instruments to achieve the desired reduction in effort.

A process of removing latent effort recently undertaken by DPI&F has brought the number of licences in the inshore fishery from 800 down to 450. This was achieved by reviewing catch history and only allocating licences to operators with 500 kg catch each year (for each species symbol). Further work is planned however, in the area of latent effort reduction. A latent effort policy is being developed internally by DPI&F, but an assessment of fishing operator responses to economic incentives should be used to underpin development of this policy. Whilst recognising the focus and effort that DPI&F is applying in this area, there is a need to examine a wide range of issues that relate to the reduction of fishing effort in fisheries.

Program 6: Strategies for removal of latent effort

The removal of latent fishing effort is seen as a key step for reform of GBR fisheries. To encourage successful outcomes, it will be necessary to consider the economic cost effectiveness of different strategies for removing fishing effort. A major review of options and strategies for removal of latent effort, including a diagnostic of the potential risks of activation of dormant licences if there are favourable fishing conditions (e.g., improved prices and profitability) will need to be assessed.

3.8. Assessment frameworks

During discussions with DPI&F, it was apparent that there are counteracting factors influencing their role in managing fisheries. On the one hand, they have a charter for sustainable industry growth (including on-shore input suppliers and processors) and on the other hand, their charter is to improve economic performance of fisheries. In essence, one of the core challenges of fisheries management is to balance these two different objectives in a

¹⁴ According to DPI&F, the policy of removing latent fishing licences is currently being implemented in respect of line (south of GBR), crab, beam and eel fisheries

manner which is consistent with achieving the ‘maximum public benefit’ from fisheries management.

DPI&F currently has a statement of objective, which is to:

“...maximise the economic potential of Queensland’s primary industries on a sustainable basis.”

However, it is clear that due to excess capacity, fisheries are not managed in a fashion which is consistent with this overarching objective.

Greater clarity of objective is required, so that fishery managers understand the relevant criteria to use in assessing policy options, and in establishing an economic research program to underpin assessment of policies. The framework should comprise:

- clear separation of criteria related to fleet economic performance and regional economic impacts;
- social benefits from employment and economic flow-on effects; and
- an understanding of the key components of a public benefit test. One of the requirements of a public benefit test (under national competition policy guidelines for regulatory review) is to identify the role of government and test if there is a more efficient way of meeting the objectives of management. However, this is not currently occurring in the public benefit tests being undertaken by DPI&F.

DPI&F’s focus is predominantly on sustainability issues. This is primarily due to historic problems with excessive levels of effort in most fisheries. However, it is also partly due to a lack of resources in the area of economic research.

In this respect, it is important to be mindful that the key rationale for government regulation (apart from sustainability) is the market failure caused by catch interactions. Maximising economic yield directly addresses this market failure, and therefore a high weighting priority needs to be attached to understanding how to promote the economic efficiency of fishing fleets.

3.8.1. Ecologically sustainable development (ESD)

Management of holistic systems in a sustainable fashion is now accepted as the appropriate goal for fishery managers, as well as managers of other natural resources. This means that priority will need to be placed on introduction of management approaches that focus on ecologically sustainable development (ESD). While there is legislative support for an ESD approach, it does present new challenges for managers, a point made in a 2005 article by Scandol et al.¹⁵:

“Given that ecologically sustainable development is already embedded within the policies, statutes and regulations of all Australian jurisdictions, it is likely that existing legal and policy instruments such as environmental assessment will become the key drivers towards the implementation of ecosystem-based fisheries management in Australia.

As the procedural requirements of environmental assessment become finalised in all Australian jurisdictions, it is helpful to reflect upon the challenges met and difficulties that lie ahead for ecosystem-based fisheries management.”

¹⁵ Scandol, J. P., Holloway, M. G., Gibbs, P. J., and K. L. Astles, 2005, ‘Ecosystem based fisheries management – an Australian perspective’, *Aquat. Living Resour.*, 18, 261-273.

Marsden Jacob recommends that further work be undertaken to assess the extent to which current management aligns with the principles of ESD. Where management is inconsistent with these principles, there will need to be consideration of how the broader ecosystem impacts are to be taken into account in designing management settings for individual fisheries.

3.8.2. Resource allocation

The framework development should include consideration of the methods for conducting resource allocation assessments. Resource allocation is expected to become a major policy issue within the next 3-5 years, and at this stage the relevant agencies are not equipped with the necessary tools to consider, or evaluate, major resource allocation issues. The WA model for 'Integrated Fisheries Management' (see Box 3.1 below) could be used in developing an assessment framework for resource allocation decisions for GBR fisheries.

Box 3.1: Innovative frameworks for resource allocation developed in WA

Integrated Fisheries Management (IFM) is an innovative framework being used in Western Australia that addresses the growing competition for fish resources between commercial, recreational and Indigenous fishers.

The Integrated Fisheries Allocation Advisory Committee (IFAAC) is a Ministerial Advisory Committee established under section 42 of the Fish Resources Management Act 1994. It is not independent of the Minister; rather it provides the Minister with advice so that he/she can make decisions based on the best possible information.

The Minister for Agriculture, Fisheries and Forestry appointed IFAAC on 1 October 2004 to investigate fisheries resource allocations issues and provide advice and recommendations to the Minister on matters related to optimal resource use, and in particular provide advice on:

- allocations between groups (sectors) within the harvest limits determined for each fishery;
- strategies to overcome allocation and access issues arising from temporal and spatial competition for fish at a local / regional level;
- allocation issues within a fisheries sector, as referred by the Minister for Fisheries;
- more specific principles (than detailed above) to provide further guidance around allocation decisions for individual fisheries; and
- other matters concerning the integrated management of fisheries, as referred by the Minister for Fisheries.

In the first instance, IFAAC is to provide advice and recommendations on allocations for the Western Rock Lobster resource, the Abalone Managed resource (with emphasis on the Perth metropolitan resource), and the West Coast Demersal Finfish resource (with emphasis on dhufish, baldchin groper and snapper). (Reports are available on the WA Fisheries website)

Source: <http://www.fish.wa.gov.au/sec/man/index.php>

There is also a clear need to develop approaches for intra-sectoral allocation options for the recreational sector. This will become a real issue as the population and numbers of recreational fishers grows. Ultimately the bag limit could be less than one, which is clearly an untenable outcome. Under this scenario, new innovations would need to be developed to allocate the resource. One option that applies in Canada is fish tags sold in tackle shops. This is being discussed as an option for the GBR but, due to the administrative cost, is usually only viable for high value species. Hence, there will need to be consideration of the alternatives.

Program 7: Development of robust assessment frameworks

A key area of research is to set out the economic and social assessment frameworks required to assess fishery policies. The nexus between management objectives and management settings can only be addressed by developing, and applying, a robust framework for assessment of fisheries management.

As an initial step, a technical paper should be prepared for this purpose outlining the linkage between management objectives, research, and development of management policies. Preparation of this paper, which should be widely distributed to stakeholders, should be underpinned by a comprehensive process of workshops and peer review from stakeholder agencies.

3.9. Cost recovery for managing fisheries

There are currently low levels of cost recovery for managing GBR fisheries (consistent with the generally low level of cost recovery for fisheries across the State).

Cost recovery is a broader issue for Queensland fisheries as a whole, but in the context of GBR fisheries it is a relevant area of economic research as:

- economic modelling is required to estimate appropriate levels of cost recovery and to examine impacts of introducing cost recovery on GBR fisheries; and
- economic research can also be used to evaluate transitional arrangements for the introduction of cost recovery for GBR fisheries.

Furthermore, as mentioned in Section 2, cost recovery is seen as an important area for further work, as improved levels of cost recovery could help generate additional resources for management and/or research.

The benefit of increasing cost recovery (if there is no cost shifting) is that it provides resources to fund the management of fisheries, potentially enhancing fisheries management. Moreover, cost recovery often leads to greater transparency and accountability in terms of expenditure on management. User-pays also instils understanding of ownership of property rights to common property resources and drives a better stewardship culture.

DPI&F is proposing to introduce an access fee that would have the effect of partial cost recovery in the TRL fishery, which is one of the better performing fisheries in terms of economic profits:

“It is proposed that licence holders pay a fee for each TRL quota unit held, representing a resource rent to the fisher for access to the lobster resource. The fee proposed will be phased in over three years at 20 cents per unit in the 2008–09 financial year, 25 cents per unit in the 2009–10 financial year and 30 cents

per unit in subsequent years. Initially one unit would be set at one kilogram of whole product. The fee structure is consistent with other high value quota species in Queensland and recognises the high production costs of operating in remote areas and collecting by hand.

... The proposed fishery access fees will not recover the full cost of managing the ECTRLF [East Coast Tropical Rock Lobster fishery].”

It should be noted that if the charge does not recover more than management costs, then it should not be described as a resource rent charge. A resource rent charge is a share of overall fishery resource rent which can be defined as the excess profit over and above, the level of profit required for entities to earn a ‘normal’ risk adjusted return on capital invested in their fishing operations.

Given the significant management reforms, cost recovery would be difficult to implement within, say, the next two to three years. However, cost recovery could be included as part of a longer term 5 or 10 year strategy for GBR fisheries.

Stakeholders interviewed for the current study also flagged the need to examine the scope to introduce a licence system for recreational fishers. This would have both management benefits and ensure consistency with user, or beneficiary, pays principles. A cost benefit analysis of different forms of licence systems could be undertaken. Moreover, the NSW and Victorian models where “all waters” recreational fishing licences have been successfully introduced (with annual revenue of \$10 M. and \$6 M. respectively) could be examined to see if these systems are appropriate for the GBR fisheries.

Box 3.2 outlines the system of cost recovery adopted in Victoria. It comprises phased introduction of fisheries management services levies, and a fisheries activity costing system¹⁶. Key learnings from implementation of cost recovery in Victoria could be beneficial in relation to assessment of the potential for introducing cost recovery for GBR fisheries.

Program 8: Cost recovery

Full review of cost recovery arrangements will be required. This has been achieved in other States and will be consistent with Council of Australian Governments’ reforms, and national competition policy. Cost recovery increases the level of accountability by fishers, could help resolve issues with latent effort, and provides a greater level of resourcing for improved management outcomes.

¹⁶ Information on the Victorian system is presented in Victorian Department of Primary Industries, 2005, ‘The Regulatory Impact Statement (RIS) - Fisheries, Fees & Miscellaneous, Regulations, 2006’. December.

Box 3.2: Introduction of user pays in Victoria

The total fisheries management services (FMS) levies payable in 2008 by the commercial wild catch industry will be in the order of \$2.2 million (compared to \$2.4 million paid in 2007, an 8% decrease). The amount recovered represents 29% of total recoverable recurrent expenditure on FMS (\$7.7 million) delivered to the wild catch industry by the Department of Primary Industries (DPI), or 19.5% of total expenditure of \$11.3 million (excluding research attributable to the recreational sector).¹

An Inquiry into Fisheries Management was undertaken by the Parliamentary Committee of Environment and Natural Resources in 2002. The recommendations of the Inquiry were that fisheries management costs should be recovered from the various sectors that gain direct benefit from such management. The review titled "Review of Fisheries Levy Administration: Review of section 151 of the *Fisheries Act 1995* (2003)", stated:

"The cost of fisheries management services should be borne by those who directly benefit from them or who drive the need for a provision of services..."

One of the principal drivers for efficient resource allocation is that all attributed recoverable costs associated with the management (including compliance and research) of the regulated fishing and aquaculture industries are met by those who directly benefit from the services provided by DPI.

The implementation of full cost recovery (FCR) of attributable costs was phased in over three years. The phase-in began in 2004-05, with the second and third phases being implemented in 2005-06 and 2006-07.

Source: Victorian Department of Primary Industries.

3.10. Climate change

Climate change is a major risk factor for Australian fisheries, and work is required to ensure that management settings for GBR fisheries secure the future viability of the fisheries under a range of climate change scenarios.

Habitat degradation, acidification, increasing sea temperature and changes to sea circulation represent key climate change risks for fisheries. The consequences could include reduced larval dispersal and life cycle changes, reduced abundance and reduced diversity. Distributional shifts in stock abundance could also occur.

A climate change risk assessment and adaptation strategy is required to examine the nature of risks associated with climate change impacts and to develop a suitable adaptation strategy.

It is important to stress that other management reforms, such as removing latent effort and restructuring fisheries, will have significant 'resilience' effects for future pressures from climate change. Hence, there are strong links between climate change research and other types of research into management settings outlined in Section 4. (Management assessment

frameworks should clearly now take account of potential climate change impacts.) Fisheries arrangements that do not produce ‘resource rent’ provide very little buffer against a downturn in yields, or increase in costs, due to direct climate change factors or indirect climate change factors such as rising fuel costs.

It is also instructive to note that the FRDC is now taking a direct role in examining climate change adaptation at a strategic or national level. Fishery-specific assessment of climate change adaptation strategies will need to ‘dovetail’ or interconnect with the key conceptual developments made through FRDC’s national work.

Program 9: Climate change risk assessment and adaptation

All significant natural resource extraction industries exposed to climate change risks should be subject to a major risk assessment and develop a climate change adaptation plan. Factors to take into account include:

- potential range of impacts on stocks and catch rates;
- changed impacts of fishing on the broader ecosystem;
- issues relating to biological and economic overfishing; and
- risk strategies to reduce the severity of impacts and safeguard the fishing industry.

3.11. Resource allocation

A key gap in the existing research and policy assessment work is in relation to resource allocation. A study on resource allocation would represent a flagship study, and would include comprehensive reviews of fisheries values, as well as assessments of the costs and benefits of incremental and major adjustments to the allocation regimes. The focus would clearly be on the optimal allocation of fisheries resources between commercial, recreational, charter, and Indigenous fisheries in inshore and reef fisheries. In addition, the studies would examine the higher level issue of the allocation between extractive and non-extractive uses.

Queensland’s recreational and charter fisheries are amongst the most valuable fisheries in Australia, yet little is known about the impacts of alternative regimes for resource allocation. Hence, we would attach a very high priority to this study.

3.11.1. Consideration of impacts on environmental values

In many cases, bio-economic modelling could be used to examine resource allocation issues. However, the split between extractive and non-extractive (i.e., enhancement of the natural environment) uses can be undertaken at a high level, by valuing fisheries contribution to society and making broad assessments relative to any anticipated loss in value of the natural assets (this can occur, even if fisheries are managed sustainably).

There is scope, for example, to conduct relatively detailed research on the change in habitat values from fishing activity (which will vary according to the level of fishing effort and the types of vessels and fishing methods / gear types used).

To conduct this type of research, and ultimately use it to inform resource allocation decision, there needs to be research on the way in which different fisheries affect these values (e.g., through impacting on the habitats). This could be important when looking at allocation issues (for example, line fishing could have a lower habitat impact than other fishing

methods). These impacts can be documented (and in some cases) valued. This is a potentially important issue to examine as habitat impacts are directly related to fishing (and fishing is one of the main impacting industries in the GBR).

Program 10: Resource allocation

No major studies have been undertaken in relation to resource allocation between sectors. This program of research should be a high priority, given the potential increase in fishery benefits associated with reallocation of resources. The research could be undertaken for all GBR fisheries, or individually for the:

- reef line fishery;
- inshore finfish fishery; and
- trawl fishery.

In addition, it may be beneficial to examine scope for assessing the allocation of resources within the recreational fishing sector. That is, the allocation between different fishers and groups of fishers. Market based instruments (e.g., sale of quota for high value species) represent an option for allocating resources amongst recreational fishers that could be examined.

A higher level study may also be required to examine the resource allocation between extractive (commercial fisheries) and non-extractive (natural capital enhancement) uses.

3.12. New aquaculture developments

Aquaculture currently occurs in some confined sections of the GBR Marine Park, however with economic pressures on the wild fisheries, industry is actively pursuing opportunities to invest in new aquaculture enterprise. This trend is expected to continue, with fisheries most suitable for aquaculture including barramundi and prawns.

Aquaculture policy will need to keep pace with anticipated development of the sector. Moreover, with the economic drivers for expansion of aquaculture potentially placing pressure on the approvals processes, the frameworks for rigorous and systematic consideration of the triple bottom line impacts will be critical from an environmental / resource management perspective.

More specifically, the environmental footprint of aquaculture will need to be assessed to examine the overall net benefit / costs associated with development approvals.

Potential for legislative / regulatory approvals processes will need to be in place to ensure applications for aquaculture developments take full account of the recommendations of any research into the overall triple bottom line impact of proposed developments.

Program 11: Aquaculture

Public benefit tests of aquaculture will be required to assess the overall triple bottom line impacts of proposals. This will require an assessment of the ecological footprint of proposed developments. Research is required to develop the appropriate assessment framework, and to ensure the legislative and regulatory settings are capable of mandating rigorous assessment and approval processes for proposed aquaculture developments.

4. Fishery-specific research

4.1. Introduction

The purpose of this Section is to examine research priorities for specific GBR fisheries, with a focus on the research required for the trawl fishery, reef line fishery, and inshore finfish fisheries.

4.2. Development of bio-economic models

One of the principal tools used to examine the economic performance of fisheries is bio-economic modelling. The biological component (or “population dynamics” model) of the bio-economic model estimates the annual catch, taking account of the impact of the level of fishing effort on stocks and recruitment. The economic model includes the cost model and revenue function to convert information in the population dynamics model into catch revenue and fishing costs. Outputs from the bio-economic model typically comprise:

- total catch and fishery revenue;
- fishery costs; and
- fishery profits.

Bio-economic models can be used to test a number of different management settings, such as:

- changes in the overall level of fishing effort in a fishery;
- changing TAC;
- changes to the type of input controls or removal / relaxation of input controls;
- the impact of introducing trading;
- changes in allocation between different fleet / vessel categories;
- changes in allocation between sectors (charter, commercial and recreational);
- changes in zoning (if the population dynamics model is spatially disaggregated, it is possible to examine the benefits of reduced local depletion of stocks); and
- impacts of changing costs on fishery costs and profitability.

The theoretical Gordon–Schaefer model is often used in an educational context, for illustrating the level of fishing effort that delivers the maximum fishery profits.

The Gordon–Schaefer model is built on a simplified population dynamics model (i.e., the logistic growth model) and has a standard result that the fishing effort required to deliver maximum economic performance is around 50% of the open access fishing effort¹⁷.

Bertignac et al. (2000) provide a real world example of the types of results that bio-economic modelling can produce. Bertignac et al. developed a detailed bio-economic model of the \$US1.5 billion Western and Central Pacific Tuna Fishery¹⁸; the largest tuna fishery in the

¹⁷ This is generally only an indicative result, as the actual relationship between optimal effort and open access effort depends on fishery-specific parameters (i.e., population dynamics, prices, fishing costs, extent to which fish stocks school, etc.).

¹⁸ Bertignac, M., Campbell, H.F., Hampton J. and A.J. Hand, ‘Maximizing Resource Rent in the Western and Central Pacific Tuna Fisheries’, *Marine Resource Economics* Vol. 15, No. 3, 2000, pp. 151-177.

world. Bertignac et al. estimated that fishery profits would rise by around \$US215 million per annum if the fishing fleet was reduced by 50%. While this did not have an immediate impact on fishery management policies, it has been instrumental in driving long-term strategic efforts to reduce fishing effort in the fishery.

Moreover, understanding fishery profitability in the context of GBR fisheries is particularly important given the dual effects of rising fuel prices and increased competition from other countries. These cost-price pressures increase the importance of improving fishery efficiency.

The only alternative to bio-economic modelling is to develop models of 'representative vessels' and apply sensitivity analysis for catch rate scenarios. This approach is very limited compared to bio-economics because there is no direct linkage in the model to the population dynamics function, which determines catch and catch rates for different fleet sizes, vessel sizes / types, gear types etc.

There has been very little use of bio-economic modelling by DPI&F; DPI&F report this is largely because they have historically been managing to support sustainability. Now that DPI&F is at the stage where it considers sustainability objectives are being met, it may seek to increasingly use bio-economics as a tool to help set the longer-term strategic direction for fisheries reform. (The principal current bio-economic modelling project is in relation to the Eastern King Prawn fishery, which is being undertaken directly by DPI&F economists.)

Cost data will be gathered as part of the forthcoming commercial fishery survey being conducted by DPI&F (see Section 2). Hence, data on the cost of fishing will not be an impediment to development of bio-economic models. The main potential impediment to the development of bio-economic models is the availability of suitable population dynamics models for the fisheries concerned; however there are existing population dynamics models for most GBR fisheries.

An advantage of bio-economic modelling is that the key parameters – prices, costs and yields – can be continually updated and revised to enable revised fishery targets for effort and TAC to be estimated. In addition, a range of estimates of prices and costs can be used to examine the potential impacts on operators' financial viability from continuation of the cost-price squeeze.

A core requirement of sound fisheries management is an understanding of the longer-term targets for fishing effort and TAC. This is the foundation for future management reforms. More specifically, a key input into management decisions should be the results of studies assessing the appropriate targets for the fishery in terms of overall level of fishing effort that promotes maximisation of profits.

There is currently no real information regarding the "ideal" or target level of fishing effort expected to give the best outcomes for the GBR fishery in terms of economic profits. Even if maximising economic efficiency is not the sole management objective, it is very important to understand what level of fishing effort is consistent with maximum economic yield (MEY). This information is extremely important if managers and industry are to be able to develop a long-term strategy for the fishery.

Thus, if a key management issue is identification of the appropriate targets for the fishery, then development of bio-economic models of GBR fisheries needs to become a much higher priority.

4.2.1. Trawl fishery

As noted in Section 2, DPI&F is commissioning the development of a bio-economic model for one of the zones in the Trawl fishery. Given there is already a suitable population dynamics model for the fishery, the main impediment to development of a fishery-wide model with multiple zones is research funding. It may be appropriate to make a submission to FRDC for tactical funding to increase the scope of the existing research to encompass all four zones of the fishery.

As DPI&F already has population dynamics models and is scheduled to collect commercial fishery survey data in 2008-09, there is no real basis for considering that development of a bio-economic model is not feasible.

4.2.2. Reef line fishery

Using the existing population dynamics model – the ELFSIM model (see Section 2.5) – it is a relatively straightforward task to develop a bio-economic model for the reef line fishery. A bio-economic model would be useful for exploring issues related to low annual catch relative to available quota, low profit for some fishers due to the cost–price squeeze, and impacts of relaxing some input controls and reforming the system of symbols.

However, a key purpose of the model would be to examine fleet structure and longer-term targets for the overall level of fishing effort and TAC, thus enabling managers to establish longer-term strategic targets for the fishery.

Our expectation is that it would be necessary to jointly model the “live” fishery and the “dead” (i.e., whole / filleted fish) fishery, given that they target the same stocks. The model could either have proportional allocations of each sector as a predetermined parameter, or could be used to evaluate the optimal split between the live fishery and whole / filleted fishery.

4.2.3. Inshore fishery

Due to its diverse nature, there are concerns over the feasibility and cost effectiveness of developing a bio-economic model for the inshore fishery. However, these issues can be explored in a short scoping paper. The objective of the scoping paper would be to determine: a) if development of a bio-economic model for the fishery is feasible; and b) whether there is likely to be a positive return to the community from development of such a model.

If feasible, a bio-economic model of the inshore fishery would be an extremely useful tool for management, as it would enable critical issues facing the fishery to be examined. These issues include effort reduction, restricting of fleets and the effectiveness of buybacks.

Economic models of each major vessel class would need to be added to the biological models to construct a fishery-wide bio-economic model. Assumed species-targeting practices could be built into the model using catch ratios based on catch history and/or relative prices. Where components of the fishery are physically separate – e.g., the barramundi fishery – it may be possible to separate these out. Moreover, focus would be primarily on the eight main species (mullet, shark, whiting, bream, tailor, small mackerel, threadfins and barramundi).

4.2.4. Multi-fishery bio-economic model

A further option that has been flagged is development of a bio-economic model that includes all fisheries, including recreational fishing. Ideally, the model would be linked to (or form part of) an ecosystems model (or at least capture some of the environmental impacts associated with fishing). The model should be developed for the specific purpose of examining the key management issues, and should:

- allow resource allocation issues (program 10) to be assessed;
- provide a framework for assessing fisheries based on economic as well as ecological criteria (program 7);
- provide a means for assessing the benefits (and potential effects) of different effort reduction programs (program 6); and
- potentially be used to evaluate the effects of climate change (program 9) (i.e., depending on the capacity of the underlying population dynamics models to model climate change impacts).

To develop a regional / multi fishery bio-economic model would require appropriate recreational values to be developed and used (program 1).

It is acknowledged that the development of a regional / multi fishery model would be difficult, but it is nevertheless technically feasible. Ecosystem models with detailed fleet components and a management strategy evaluation component have been built for the Australian south east fishery (ATLANTIS). A fisheries bio-economic model, effects of fishing model and ecosystem (ECOPATH) model have been integrated for the Gulf of Carpentaria. Development of a fully integrated ecosystem (ATLANTIS) model (i.e. all parts within the same model rather than just talking to each other) is underway for the area. Furthermore, an ecosystem (ECOPATH) model has already been developed for the GBR.

Hence, while development of a multi-fishery ecosystem model would be resource intensive, if there is sufficient funding, it would represent the most flexible and robust option for examining a wide range of management issues.

4.2.5. Including environmental values in bio-economic modelling

One of the objectives in bio-economic modelling is to ensure that returns to the community exceed any “attributable loss in environmental values”.

An ecosystem model with links to a habitat damage function (and habitat values) could potentially be included in a bio-economic model. However, this could be technically difficult to achieve given that environmental impacts are related to threshold effects (e.g., there may be a range over which management outcomes can change without a critical impact) and high degrees of spatial and temporal variability. Developing a non-market valuation system which reflects all of these dimensions of fishery impacts on the environment could be extremely difficult.

One option would be to evaluate environmental outcomes under each management option being considered in the bio-economic modelling, and document these outcomes, along with the results of the bio-economic model, as part of a broader public benefit test of management options.

4.2.6. Management settings for fisheries

There is a general view that management settings for most GBR fisheries have been developed incrementally over time, and that major reviews of management settings could be beneficial to take a fresh look at the options for reform of fleet structure, less restrictive input controls (where quotas are in place) and the potential for introduction of output controls in some fisheries (or for additional species to be subject to quotas).

Complex layers of input controls are now becoming increasingly costly to manage, as there is a need for continual review and revision of input controls to keep a check on effort levels. The system of symbols for gear types, fishery and species is cumbersome and needs to be reviewed.

Output controls, while increasing monitoring and enforcement costs, enable fisheries to achieve higher levels of performance and reap the benefit of improved profits from increased productivity and technological improvements.

The fishery review(s) could also examine resource allocation issues. A broader review may also examine the extent to which an ecosystem-based fisheries management approach is being applied, and identify ways of moving towards ecosystem based management.

In examining fleet structure and levels of fishing effort and TAC, it would be instructive to consider not only the economic performance, but also the broader ecosystem impacts. This would enable the review to be couched in terms of a public benefit test incorporating a triple bottom line framework (see Program 7 – Assessment Frameworks).

Overall, most of the management changes made in recent years involve relatively minor modifications to the existing management regimes. However, a real and tangible benefit of economic research is that it can examine the net public benefit of pursuing opportunities that represent a complete “re-think” of the existing management paradigms. Large changes are hard to achieve but the rewards in economic performance could be great – ideally an active and rigorous economic research program would illustrate where, and how, these types of rewards can be achieved.

Due to the common property problem, fisheries will have a tendency to dissipate all resource rents if not managed effectively, or if operators can circumvent input controls by increasing the uncontrolled aspects of fishing effort (see Box 4.1 below).

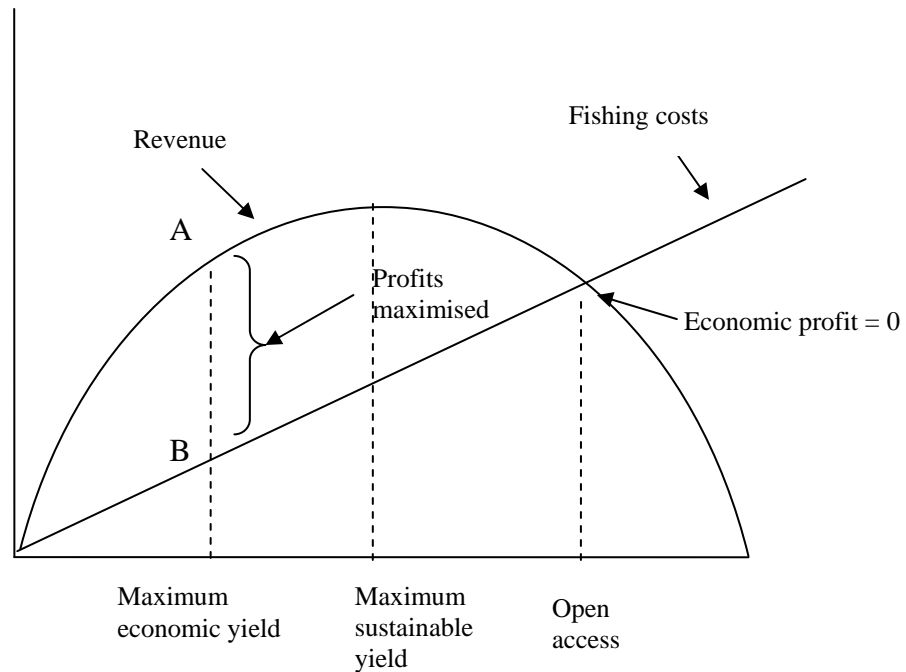
The purpose of bio-economic modelling is to examine the overall fishery performance under different management settings. Figure 4.1 shows the types of outcomes that can be expected under three generic management scenarios – open access, maximum sustainable yield (MSY) and MEY.

MEY reflects the maximum resource rent, and bio-economic model runs can be used to estimate the level of fishing effort and TAC required to achieve the objective of MEY.

MEY provides benefits from restricting fishing effort in the form of increased catch rates (and therefore lower costs per unit of catch)¹⁹ and this results in profits being considerably higher than under open access. Open access enables entry of vessels until all ‘resource rents’ are dissipated. As discussed in Box 4.1 below, input controls can also lead to resource rent being dissipated.

¹⁹ As profit increases under MEY, any reduction in revenue is more than offset by the reduction in fishing costs.

Figure 4.1: Focus of bio-economic analysis and modelling



The overall assessment of fisheries management settings (Program 12 below) must be structured to enable assessment of fishery performance relative to the spectrum between open access and MEY. If management is not focused on MEY, the opportunity cost (difference between MEY profits and actual fishery profits) should be estimated and justified on the basis of social / regional economic impacts.

Generally, however, governments do not promote specific sectors to pursue regional economic impact objectives. Instead, governments support training and infrastructure development to facilitate the development of industries that enjoy a natural comparative advantage in the particular region. Hence, it may be difficult to use “regional economic growth” objectives as a rationale for not targeting MEY through use of appropriate management settings.

A concern is that outcomes too close to open access provide no buffer, or protection, against the potential negative impacts of climate change or the recent unfavourable movements in the terms of trade and/or cost structure for GBR fisheries. The recent exit of fishing effort following the cost–price squeeze is evidence of low ‘resource rent’ (or economic profit) in some GBR fisheries²⁰, indicating the existence of management outcomes that, in terms of economic performance, are too close to the open access outcome.

²⁰ Resource rent can be defined as the excess profit over and above the level of profit required for entities to earn a ‘normal’ risk adjusted return on the capital invested in their fishing operations.

Program 12: Development of bio-economic models

Bio-economic models have not been developed for GBR fisheries in the past, with the exception of the beam trawl bio-economic model developed by the University of Queensland. However, bio-economic models represent an essential decision support tool for assessing fleet structure, allocation decisions, input controls and output controls.

A scoping study to examine potential for development of bio-economic models should be commissioned, followed by development of detailed models for each of the principal fisheries. The development will be facilitated by the availability of population dynamics models and economic data from DPI&F's current survey of commercial fishers.

Potential application: (i) trawl fishery, (ii) reef line fishery and (iii) inshore fishery.

4.2.7. Trawl fishery

The main priorities for the trawl fishery are to:

- Examine **potential for introduction of output controls** – this may relate to the longer term strategic direction of the fishery.
- **Review the input controls** to determine if there is scope for relaxation of these controls. It may be beneficial to examine this issue in conjunction with the assessment of output controls, as introduction of output controls could enable input controls to be relaxed (hence the two issues are closely related).
- Assess **zonal management**, which would help avoid localised stock depletion and potentially support higher catch rates, thus promoting higher fishery profitability.
- Examine **flexible annual input or output controls**. Prawn fisheries have very high annual fluctuations in stock abundance, due primarily to strong relationships between stock recruitment and environmental parameters. Under output (or input) controls there could be some “reserve” allocation that is made available in relatively high yielding seasons but not in low yielding seasons. This option could be explored in a research study, but would require utilisation of a bio-economic model²¹.

Importantly, research on the trawl fishery should inform as to:

- what catch rates need to be achieved to provide positive returns and what size grades and species;
- tonnages needed to be achieved to obtain ‘optimum’ returns, given competition from imports and aquaculture; and
- how the fishery should be run to achieve these optimal approaches.

A major review of the management settings, utilising a bio-economic model, should evaluate these critical issues.

²¹ The structural basis for this is already present in the fishery, but is not used. That is, effort units are already issued in the fishery reflecting trawl capacity nights. What would be required to implement this is better stock abundance knowledge and annual ‘quota’ setting where the number of fishery units is adjusted up and down. The impediment to this at present is that less than 50% of the units are currently used – hence the need to remove effort from the fishery before introducing reforms of this nature.

4.2.8. Reef line fishery

The main priorities for the reef line fishery are to:

- **Review quota systems.** It would be instructive to conduct a review of the overall benefits and costs of the quota systems. Research may also identify ways of improving the efficiency of the quota systems. A concern is that, apart from coral trout, catch for other quota species is less than the total available quota²².
- **Review of options for relaxing input controls.** DPI&F plans to conduct a review, commencing in late 2008, or early 2009, on the scope to relax input controls in the fishery. It will be important to ensure an economic cost benefit approach is adopted, rather than broadly assessing whether CPUE will increase.
- **Assessment of the system of symbols.** This would facilitate assessment of fishery performance under a range of scenarios relating to: (i) change in input controls; (ii) change in quota; (iii) change in fleet size; (iv) change in fleet structure; (v) change in level of fishing effort; and (vi) changes in trading rules.
- **Impediments to quota trading.** There are multiple tradeable units that carry value e.g. vessel licence, fishery endorsements (L symbol, RQ symbol), quota units and tenders. This is a real impediment to trading and makes the quota system inefficient. Essentially the quota system is not acting as the output control mechanism due to the inefficiencies created by the multiple layers of input controls on top, which are preventing the quota market from working effectively. Unscrambling this overly complex system should be given a high priority.
- **Assessment of resource allocation.** It will be necessary to consider the allocation between commercial, recreational and charter fishing sectors. There has been no formal review of this key issue, and it will be necessary in order to ensure that the maximum benefit from the resource is achieved.
- **Evaluate impacts of expansion of the live fishery.** This is likely to enhance overall fishery profits, but there may be impacts on some of the existing operators that need to be assessed.
- **Assessment of economic risks and responses for the reef line fishery.** The reef line fishery is highly exposed economically. This is due to a single-species focus, limited export market, significant threat from competition (including potential large-scale aquaculture of coral trout), price volatility, exchange rate variance and rising input costs. A study that looked at this exposure to economic risk including some scenario modelling to understand the breakeven points would be useful. It could be beneficial to add some comparative market analysis for domestic markets.

Moreover, looking at the fishery holistically, it is apparent that current management of the reef line fishery is a hybrid of input and output controls. This means that all of the potential inefficiencies of input controls are added to the cost base of an additional output control system. Given this situation, there may be merit in assessing the relative benefits of moving to a more pure input or output controlled management system. In summary, the fishery management settings represent a 'bandaid' management structure developed incrementally over time with no real attempt at major holistic reform. Cost benefit analysis is therefore

²² This research could link into issues relating to fishery performance. That is, it may be that inefficiencies in respect of some of the input controls or quota trading rules are creating impediments to full utilisation of available quota.

required to evaluate those reform options which, on a *prima facie* basis, are most likely to deliver significant efficiency gains.

4.2.9. Inshore fishery

Indicatively, the fleet structure comprises: 20 larger gillnet boats (the largest vessels in the fleet, which account for approximately 50% of the total catch); 60 “ocean beach” fishers who operate within 400 metres of shore; 30 tunnel net fishers (not in the GBR); and 150 barramundi fishers. An industry analyst interviewed for this study indicated that the 20 larger gillnet boats are generally more cost efficient (in respect of fishing costs per unit of catch) but are not suited to taking species close to shore.

The question of the **efficient overall level of effort and efficient fleet structure** has not been addressed. These issues need to be examined in detail to:

- identify the target level of fishing effort that managers and industry should seek to work towards over time; and
- determine if increasing the share of catch taken by larger, more efficient, vessels would increase fishery performance.

This type of research would need to include a strong social component, given the importance of smaller vessels to the regional economy and the level of employment generated by the fishery. It would also need to include ecological assessments (e.g., consideration of by-catch impacts).

Box 4.1: Inherent problems with input controls

The inevitability of effort creep and input distortion with input controls means that each management strategy must eventually be replaced. Experience from the Northern Prawn Fishery (NPF) shows that this is a failed management regime. The costs of this failure are potentially enormous, not only as a result of effort creep and losses in efficiency, but as a result of the policy framework itself. Each policy change involves costs that are additional to those caused by the ongoing input distortion. There are at least three types of costs of such management change. Firstly, there are direct and indirect management costs. The costs to managers of developing policy, consulting with industry and implementing a new policy and the costs of research underlying that policy development are often substantial. Secondly, there are costs to the industry through individual operator and industry involvement in the policy development process. Thirdly, there are costs of obsolescence of boats, gear and knowledge. With each policy change comes the need for investment in new equipment and ideas, and premature scrapping of existing equipment and ideas.

The lesson here is clear: the problem with input controls is their inability (except in rare cases) to control effort in the first place. The moment that control of a particular input becomes the policy instrument, operators have an incentive to substitute other inputs in a way that will change the relationship between effort and catch. As well, technological advance and improvements in knowledge provide other background reasons for the relationship to change constantly. A manager relying on input controls is in constant competition with the imagination, energy and inventiveness of each operator in the fishery and the full technological backup of a modern economy. More important to the general lack of success of input control management regimes are two characteristics of the incentives that they provide for operators in the fisheries. Firstly, controls on one or more inputs provide an immediate incentive for operators to substitute uncontrolled inputs. Secondly, input control regimes provide no sense of ownership or stewardship of the fisheries resource. There are no guarantees in any input control management regime except the right of access to the fishery under certain guidelines. Operators are encouraged by these rules to compete for catch within those guidelines and if one operator refuses to expand effort, while others do, that operator will be worse off. Unfortunately, if all operators increase effort, all are made worse off through a fall in profits and the fishery remains overexploited – the proverbial ‘tragedy of the commons’. The management response in this environment is to continuously and repeatedly find ways to cut effort (e.g. gear reductions, area and seasonal closures, vessel buyback schemes, etc.), ‘winding the fishery down’ over time to a small number of boats or days fished, all making zero (or near zero) profits.

In practice, one clear advantage of individual output controls over input controls is the absence of an ongoing competition between managers and individual operators. Under individual harvest controls, potentially cost-reducing improvements in technology lead directly to reductions in the unit cost of fishing and thus to higher net returns to the fishery as a whole. Technological improvement thus has a positive impact on economic performance.

Source: Kompas and Gooday, 2007, The failure of command and control approaches to fisheries management: lessons from Australia, *Int. J. Global Environmental Issues*, Vol. 7, Nos. 2/3.

This project would ideally be undertaken using a bio-economic model. However, if this is not possible, then technical workshops could be used to develop scenarios, which would then be included in the economic model.

Assessing the effects of **relaxing input controls** is seen as a priority for the fishery, as a serious concern is the adverse impact on operator profits in the inshore fishery of the current cost–price squeeze.

DPI&F has indicated it will be conducting an evaluation of options for relaxing input controls to improve operators' efficiency. **Marsden Jacob considers that an economic cost benefit framework should be used for this evaluation**, although other factors such as social outcomes may also be relevant. DPI&F has indicated it will be looking at ways of modifying input controls. A small scoping study may be required to identify the key areas where input controls could be relaxed and identify the nature of efficiency gains from this relaxation. Key risks in terms of increases in fishing power or impacts on the resource / by-catch / ecosystems also need to be flagged.

Resource allocation is a central issue in the inshore fishery that has not been addressed through any detailed research. It is going to be increasingly important to commission this type of research, given the large number of recreational / charter fishers and quantum of economic and health benefits attributable to recreational / charter fishing. As this is a cross-fishery issue, we provide more information on the design of a fisheries allocation study in Section 5.

Program 13: Reviews of management settings

It will be necessary to conduct a major review of a suite of management reforms for each of the principal GBR fisheries. The key issues to explore in a major review comprise: relaxation of input controls, streamlining of the system of symbols, effort reduction targets, improving the efficiency of the quota trading system, resource allocation, TAC and zonal management.

If major reviews are not feasible in the short to medium term, then smaller studies focusing on the key management issues for each fishery could be commissioned. Alternatively, themed studies focusing on common issues such as relaxing input controls could be commissioned.

4.3. Value chain assessments

Further work on value chain assessment would build on the scoping work undertaken by Nick Ruello (see Section 2). There is a view that vertical integration will enhance the efficiency of operations, providing scope to pay a higher price for landed fish.

An issue that will need to be examined is the proportion of the savings associated with enhanced value chain efficiency that is likely to be passed onto operators through higher prawn prices or retained by operators in the processing / marketing / wholesaling sectors.

Program 14: Value chain assessments

This research provides further insights into potential ways in which the market could become more efficient.

It is very important that this research is couched in terms of a) identifying regulatory impediments to more efficient operation of the value chain, and b) identifying the appropriate role of government in helping to improve the efficiency of the value chain. Trade-offs between efficiencies of vertical integration and gains from specialisation are best addressed through market forces.

Potential application: (i) trawl fishery and (ii) reef line fishery.

If the marketing / wholesale sector has a bargaining power advantage (i.e., it is deemed to hold ‘market power’), which depends entirely on the industry structure²³, then the benefits may not accrue to operators as the vertically integrated buyer of fish would be able to purchase fish from the harvesting sector at prices below those that would apply if there was a competitive wholesale market. Thus, we would recommend that this work include consideration of the market structure to determine whether, in principle, the market is competitive enough for the benefits to be passed through to fishing vessel operators.

4.4. Review of labour market / labour programs to enhance capacity to employ and retain crew

Stakeholders have identified that the poor availability of crew is currently an impediment to fishery development. A study reviewing the impediments to employing, and retaining, crew would enable options for labour market programs focused on the key GBR fisheries to be examined.

This type of research would need to encompass an evaluation of the regional labour market, including the current unemployment rate and average wages, and a series of interviews with crew would be required. The study would need to:

- define the structure of an employment / training program specifically related to the sector;
- identify scope for industry and government to co-fund industry training / employment programs;
- evaluate options for improving retention rates; and
- consider innovative remuneration schemes that provide greater incentives for crew to remain in the industry.

²³ Relevant aspects of industry structure are features that create barriers to entry into the market, such as (i) specialised skills; (ii) unique industry networks that are difficult to replicate; (iii) sunk-cost investments in plant and equipment; and (iv) vertical integration, which may make it difficult for new entrants to secure sales contracts.

Program 15: Review of labour market / labour programs

This type of study would complement other research related to improving the economic efficiency of fishing operations.

The study addresses a key impediment to improved profitability that has been identified in stakeholder interviews – availability of skilled labour – and could identify new programs that could be used to address the current sectoral weakness, which is the difficulty of retaining crew, and therefore the lack of incentive to invest in crew training.

Potential application: (i) trawl fishery, (ii) reef line fishery and (iii) inshore fishery.

4.5. Comments on ex-post review of policies using cost benefit analysis

In some cases, it may be technically feasible to conduct an ex-post evaluation of the economic performance of policy reforms that have already been implemented by examining:

- the economic costs incurred from the date of policy implementation to the current date; and
- the benefits derived in terms of the extent to which the policy has met the stated objectives.

However, there is a range of technical issues that limit the validity and effectiveness of this type of research in terms of promoting enhanced policy outcomes.

Key concerns over use of ‘ex post’ cost benefit analysis relate to:

- the fact that sunk costs (or irreversible costs) are not relevant to assessments of future policies;
- the long-lags between policy implementation and realisation of some of the key benefits; and
- the appropriate sequencing of cost benefit analysis in the planning process.

A core axiom of economics is that **sunk costs** (irreversible costs incurred in the past) cannot be mitigated and therefore they should have no bearing on future decisions. While key insights may be gained about how a policy performs from its historic performance, the historic costs and benefits must not be included in the cost benefit model. The model should only include expected future benefit and costs attributed to the policy options being assessed.

In many cases, if there is a **significant lag before benefits are realised** it will not be valid to comment on the economic performance of a policy if it has only been in place for a relatively short timeframe (say 5-10 years). For example, if a policy is designed to enhance the health of fish stocks and / or ecosystems, then the benefit stream attributed to the policy needs to be assessed over a relatively long period. In this case, narrow focus on the historic benefits and costs (i.e., benefits and costs realised between the date of policy implementation and the current date) would not be valid as it would ignore the environmental benefits expected in future periods.

In respect of the role of cost benefit analysis in the **planning process**, there is usually a sequence of events that lead to the commissioning of cost benefit studies of specific policies and/or policy options.

Initially, there is typically a broad rationale presented as to why existing policies need to be reviewed (i.e., an indicator of economic, social or environmental performance (or impacts) of the sector shows that the existing policy regime may not represent ‘best practice’). Then, a scoping study may be undertaken to assess whether there is sufficient *prima facie* evidence to support the need for a detailed policy review. If this is the case, then it will be appropriate to move to the next phase in the assessment process and design alternative new policy options. It is at this stage in the policy review process that detailed cost benefit studies are commissioned (along with detailed environmental and social assessments). These studies should compare and contrast the economic performance of the new options against each other, and against the status quo policy regime.

Given the cost of conducting economic research, this above sequencing of cost benefit studies within the planning process should generally be adhered to, as it ensures that the focus is on using decision support tools such as cost benefit analysis to help design new policies. Use of performance indicators, and smaller scale program reviews are frequently used to continually monitor the effectiveness of programs and policies. However, large scale cost benefit analysis needs to be applied more selectively and with a clear specification of the causally related future costs and benefits attributed to each policy option under consideration.

5. Conclusions

While this study is, in essence, forward looking in terms of research requirements, it is important to recognise that there has been a very small volume of economic research commissioned to support management of GBR fisheries to date.

Marsden Jacob supports the current trend within State and Commonwealth agencies to develop the economic research program to underpin natural resource management – this is occurring in respect of water resources, environmental management and climate change. However, there is clearly a lot of work required to support future management decisions in relation to GBR fisheries.

In this Report, we have identified a large number of projects, and we are not proposing that all projects be commissioned. We have intentionally developed a large suite of potential projects to enable managers to review the types of projects that could potentially enhance the development of fisheries policies.

An Economic Research Steering Committee should be established to:

- help set economic research priorities;
- ensure there is a direct connection between research and the development of management options for fisheries; and
- ensure that there is a comprehensive process of critiquing and reviewing the results of all economic research undertaken in respect of GBR fisheries.

The next stage is to conduct a prioritisation process to identify projects that need to be undertaken within the next 2-3 years (2009-11). Ideally, an economic research program should be developed. This research program should be updated quarterly to ensure that it is flexible and responds to emerging management issues. The program should also strike an appropriate balance between strategic long-term research and research to address short-term policy issues.

We note that long-term strategic planning needs to be underpinned by development of economic tools to facilitate the development of the long-term fishery targets for fishing effort and catch.

Attachment 1: Principal management issues

GBR trawl fishery

The principal management issue for the GBR trawl fishery is low fishery profitability. To help reduce economic pressure on operators, DPI&F anticipates assessing:

- Ways to remove, or relax, some of the input controls. There may be scope to strip the fishery of some of the input controls that are currently curtailing, or impeding, efficiency improvement.
- Mechanisms for improving the efficiency of the value chain, with the intent of passing cost savings on to vessel operators through payment of higher landed prices. (A small scoping study assessing the value chain has been undertaken by Nick Ruello, who is a fish marketing specialist²⁴.)

Additional management issues to examine in the medium to longer term include:

- Assessment of the appropriate targets for the fishery in terms of the overall level of fishing effort that promotes maximisation of profits. There is currently no real information regarding the “ideal” or target level of fishing effort expected to give the best outcomes for the fishery in terms of economic profits. This information is extremely important if managers and industry are to be able to develop a long-term strategy for the fishery.

Thus, a key management issue is identification of the appropriate targets for the fishery (using bio-economic modelling) and development of a strategy to achieve the target in the longer term.

- Implementation of additional output controls (i.e., quota systems). Currently, DPI&F fishery managers assess fisheries on a case-by-case basis to determine whether quota systems are practical. Elements considered in the assessment are the social and economic costs of implementing an efficient quota system versus the value of the fishery. Across-the-board application of TACs for all Queensland fisheries is not considered practical or warranted, considering the diverse multi-species fisheries and the size of the recreational component of each fishery.

Specific concerns include high monitoring costs and the physical difficulty of achieving the level of monitoring and compliance required for effective output control systems. However, we have included output controls as a potential management option because they would enable some of the input controls to be relaxed, with potential efficiency / productivity gains and because technological improvements in monitoring could increase the viability of quota systems.

Economic benefits to industry from introducing quota would need to be clearly demonstrated – the proposed development of bio-economic models would enable this to occur.

- Assessment of zonal management. There are, at various occasions, periods of concentrated fishing effort on any one of the four principal fishing grounds. This reflects differences in catch rates, and differences in the relative price of various species of prawns.

²⁴ Ruello & Associates, 2008, Queensland Seafood Supply Chain Study.

Fishery managers have noted that there is a risk that this could place high pressure on prawn stocks in localised areas.

Zonal management could be used to limit the amount of fishing effort in each zone, providing less risk of biological and economic overfishing.

- Tailoring annual management settings to account for large annual fluctuations in stock abundance and catch rates. It may be beneficial to assess the technical feasibility, and benefits and costs, of adopting innovative management instruments, which adjust fishing effort in accordance with variations in annual yields.

Under this type of seasonal management approach, it would be necessary to conduct fishery independent pre-season surveys or to have models that have high predictive power – the economic benefits of this seasonal management approach (increased profits) would need to outweigh the cost of developing and applying these management tools for the system to add value to the fishery.

This approach is used in irrigation schemes, where the announced allocation (a percentage of nominal water allocation) varies from season to season. In addition, announced allocation is often adjusted a number of times in a water year.

Inshore finfish & crab fisheries

A number of changes have been implemented / are proposed for the management of the fishery, including:

- New and amended bag and size limits – this measure is to control the level of catch taken in the fishery (although the bag limits only apply to the recreational sector).
- New netting arrangements – a key aspect of the proposed management reforms is the requirement for attendance at nets.
- Improvements to the management of shark resources – to protect shark stocks, DPI&F has identified a number of management proposals, in its RIS for the ECIFFF, to enhance sustainable outcomes for shark harvesting.

The other area of focus has been latent effort reduction. DPI&F recently examined catch history to determine which operators would be granted licences and symbols. This process resulted in the removal of a large amount of latent effort from the fishery.

Additional issues to examine include:

- Improved economic performance through reductions in fishing effort / change in fleet structure. One of the drivers of low fishery returns is excessive fishing effort. An option that has been flagged is government and industry buyback of fishing effort (symbols). Thus, a detailed review may be required to determine the appropriate medium- to long-term target reduction in fishing effort. A concurrent assessment of alternative instruments for reducing effort should also be undertaken (e.g., buyback of symbols, buyback of boats, unitisation etc.).

There is a relatively small number of larger gillnet boats (mesh netters) and a large number of smaller boats operating in the GBR. While smaller vessels are better suited to fishing close to shore and in estuaries, they are unlikely to be as efficient for targeting many species of finfish.

Hence, it would also be beneficial to conduct some economic testing to determine the impact of increasing the share of the fishery allocated to the larger gillnet boats.

- Resource allocation between commercial and recreational fishers. With up to 750,000 recreational fishers, it is important to evaluate the appropriate allocation between sectors – however, this assessment has not been undertaken. (As this represents a cross-fishery issue it is discussed in Section 3 – although it is noted that the issue of allocation between commercial and recreation sectors is most significant for the inshore fishery where there is most recreational fishing activity.) It is acknowledged that the Management Advisory Committee (MAC) agreed that the shares should remain approximately equivalent to the current fishery shares. However, without the benefit of targeted fishery valuation and resource allocation studies, it is difficult to make an informed assessment of the expected social and economic outcomes from changing the allocations.
- Address local resource allocation issues. There have been disputes in the past in relation to fishing activity in small local areas within the fishery. Some local fishers adopt ‘unwritten’ agreements regarding sharing of fishing grounds; however, conflict then arises if a fisher from outside the local region starts fishing in the local area but does not abide by these unofficial rules. Proposed measures include a draft code of practice – this is considered to be more efficient than introduction of zonal management.
- More formal regulated allocations of fish resources to sub regions or zones. While current management reforms are tackling the issue of local resource sharing, it may be beneficial to conduct a further review of the resource allocation issue to determine if research is required to assess the key alternative, which is zonal management.

DPI&F considers the problem is largely addressed through informal local protocols or introduction of codes of practice. They also consider that it would be too difficult to introduce zonal catch limits as the cost of monitoring / enforcement would be excessive (relative to the benefits of zonal management). The major issue with zoning is that industry does not universally support it. However, some further investigation on this issue is required to more formally test the hypothesis that the costs outweigh the benefits of zonal management (i.e., reduced conflict over resources and greater scope to avoid excessive localised resource depletion).

Reef line fishery

Principal management issues are as follows:

- Current poor economic performance for some operators in the fishery due to high fuel prices, import competition and (earlier in 2008) the strong Australian dollar. This has resulted in the number of fishing days declining and financial difficulty for some operators. In response, DPI&F has flagged some areas where it is looking to help the fishery improve economic performance. These include:
 - The removal or relaxation of some of the input controls. There may be scope to strip the fishery of some of the input controls which are currently curtailing, or impeding, efficiency improvement.
 - Investigating the impact of relaxing regulations relating to filleting of fish at sea – there needs to be surety that this does not compromise monitoring efforts, but would facilitate longer fishing trips and thus improve returns.
 - Allowing operators to count the number of buckets containing fish in the ‘other’ category instead of the existing requirement to weigh all fish in the ‘other’ category.
 - Reviewing the number of tenders permitted on each vessel.

- Simplifying or streamlining the system of symbols for both equipment type and species.
- Development of zonal management to facilitate closure of zones during spawning periods is an issue that was raised on a number of occasions during meetings held for this study. DPI&F has noted that it has previously examined this option but considered that the monitoring costs would be too high relative to the benefits (although this was not formally tested).
- Following the introduction of quota trading systems from 2004, there were concerns about impediments to trading. DPI&F introduced a suite of reforms in 2006 – as outlined in “A guide to Queensland’s new fisheries licensing and fee system” – including removal of some impediments to trading, such as minimum quota parcel size, etc. Given the under utilisation of quota, the low level of trading may simply reflect low demand (in response to poor economic performance and low catch rates). **There are concerns, however, that inefficient input controls, and reliance on an excessive number of trading instruments, are still creating impediments to trading.**
- Some operators have cited difficulty hiring suitable labour as a potential impediment for the fishery. This may be an issue that can be addressed through assessment of potential labour market programs.