Economic Values of NSW Marine Parks

Models for Identifying Economic Values, and Developing Procedures for On-Going Data Collection and Monitoring

Prepared for the

NSW Marine Parks Authority

Prepared by

Hassall & Associates Pty Lt
GPO Box 4625
SYDNEY
NSW 2000

and

Gillespie Economics

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Contact Information

	Hassall & Associates Pty Ltd John Madden	**Gillespie Economics**
Address	GPO Box 4625 Level 4, 52 Phillip Street Sydney NSW 2001	13 Bigland Avenue Denistone NSW 2114
Telephone Number	02 9241 5655	(02) 9804 8562
Facsimile Number	02 9241 5684	(02) 9804 8563
ABN	95 001 211 007	13 317 461 682

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Abbreviations

CS	Consumer Surplus
CVM	Contingent Valuation Method
GBR	Great Barrier Reef
GBRMP	Great Barrier Reef Marine Park
Ha	Hectares
IO	Input-Output Analysis
km	Kilometres
MPA	NSW Marine Parks Authority
NPWS	National Parks and Wildlife Service
PS	Producer Surplus
REIA	Regional Economic Impact Analysis
TCM	Travel Cost Method
WTP	Willingness to Pay

Executive Summary

The NSW Marine Parks Authority (MPA) engaged Hassall & Associates to conduct a study that can be used to identify the economic values and regional economic impacts associated with the various direct and indirect uses of marine parks in NSW. The study involved:

- A review of economic and other relevant Australian and international literature related to the production, consumption and use of marketable and non-marketable goods and services associated with marine parks;
- Development of models to estimate the economic values of direct and indirect use activities associated with NSW marine parks, including both market and non-market goods and services and identify variables required to estimate and monitor the economic value of these activities; and
- Identification of existing available information and design procedures for collecting additional data to estimate economic values determined by the models.

There are a number of use activities associated with marine parks that can generally be classified as direct market (including commercial fishing and commercial charter operations) and non-market activities (including recreation, amenity, research and education), and indirect uses, or ecosystem function values (such as, fish stock recruitment, habitat and biodiversity protection and waste assimilation). The correct measures for estimating these values include consumer and producer surplus, net costs to government and flow-on effects or multipliers to the regional economy. Further, the true economic value provided by a marine park is measured as the marginal change in the value of these uses resulting from protection.

There has been little empirical work attempting to quantify the direct and indirect uses of marine parks, particularly in Australia. Those studies that have quantified marine park use values tend to be partial estimates focusing on only one, or a few, of all the possible park uses and generally fail to capture the marginal change in resource use and hence the true value from protection.

Concurrent use of a number of valuation techniques is required to fulfil the data requirements necessary to identify the economic values and regional economic impacts associated with the various direct and indirect uses of marine parks in NSW. Additionally, considerable biological data is required to define the “with” and “without” marine park scenarios.

Agency bodies such as MPA, NPWS and NSW Fisheries currently collect some of the data required to develop these models. In addition to this, some value estimates have been made in previous studies, particularly for the Solitary Islands Marine Park. However, the available data tends to be incomplete, in a form that is not suitable for use in economic models or inconsistent across the four marine parks in NSW. Hence specific surveying would need to be undertaken to collect the data required to estimate the direct and indirect use values associated with each park.

Surveys undertaken to ascertain the economic values of their activity should include questions to ascertain the incremental effect that the declaration of the marine park has had on their activity relative to if there was no marine park.

There are no specific guidelines on the desired frequency of monitoring programs. Many factors may have influence including political priorities, funding, the volatility of use patterns, availability of data etc. A 5-year time frame is considered reasonable for distinct surveys such as the travel cost method, financial surveys of fishers and commercial tourism operators. However, where other surveys are to be undertaken on a more frequent basis, such as visitor surveys, piggy backing of additional questions e.g. travel cost questions, would be desirable.

Ultimately the studies undertaken and the frequency of any monitoring are at the discretion of the NSW MPA and will depend on its research priorities and available resources.

1 Introduction

It is the role of the NSW Marine Parks Authority (MPA) to manage marine parks for conservation of marine biodiversity and to maintain ecological processes. There are four marine parks in NSW, Cape Byron, Jervis Bay, Solitary Islands and Lord Howe Island, established under the Marine Parks Act 1997. The various direct and indirect uses of these marine parks generate a range of economic values for the community and associated regional economic impacts for local economies. These uses include recreational and commercial diving, recreational boating and kayaking, swimming, surfing, scientific research, commercial and recreational fishing, and whale and dolphin watching.

The NSW MPA engaged Hassall & Associates to conduct a study that can be used to identify the economic values and regional economic impacts associated with the various direct and indirect uses of marine parks in NSW. Further, the study is to design procedures for collecting data that could be used to identify these values and impacts. The three key objectives of the study are to:

- Examine economic and other relevant Australian and international literature related to the production, consumption and use of marketable and non-marketable goods and services associated with marine parks;
- Develop models to estimate the economic values of direct and indirect use activities associated with NSW marine parks, including both market and non-market goods and services and identify variables required to establish and monitor the economic value of these activities; and
- Identify existing available information and design procedures for collecting additional data to estimate economic values determined by the models.

This work was completed between November 2003 and February 2004.

The major findings from this study are presented in this report. Background information relating to the four marine parks in NSW is provided in Section 2. A review of Australian and international literature on the economic use values of marine protected areas is presented in Section 3. Conceptual models for estimating the economic values of direct and indirect use activities are developed in Section 4 with data availability and gaps, and data collection procedures and alternatives discussed in Sections 5. Conclusions and recommendations from the study are given in Section 7.

2 Marine Parks in NSW

2.1 Introduction

The management objectives of the Marine Park Act (MPA) of 1997 are aimed at protecting conservation values and ecological processes, and sustainable use and public appreciation, understanding and enjoyment.

Under this Act, coastal, estuary and marine environments can be declared a Marine Protected Area in order to preserve their biodiversity. The aim of marine protected areas in NSW is to:

> *"…establish a comprehensive, adequate and representative system of marine protected areas that includes a full range of marine biodiversity at ecosystem levels (e.g. estuaries, coastal lakes, islands, rocky reefs), habitat levels (e.g. sponge gardens, mudflats and coral communities), and species levels (e.g. seabirds, fish, corals and turtles)"*[1].

These parks offer a range of benefits, including preservation of marine environment intrinsic values, protection of endangered species, areas of scientific, educational and eco-tourism significance and a means of aiding fisheries' sustainability.

An overview of the formation and management of marine parks in NSW is given in this section along with further detail of each of the four marine parks in NSW.

2.2 The Formation of Marine Parks in NSW

The NSW MPA is charged with (a) identifying areas that have the potential to become a marine park based on biological and biophysical information, (b) declaring those areas that satisfy the selection criteria and process and (c) instituting appropriate management arrangements (i.e. zoning and operational plans).

The process of identifying a potential marine protected area includes collating data on biodiversity and biophysical features, identifying conservation values, mapping marine environment information and also, importantly, any areas of unique marine environment representation.

Once identified, the selection process includes consultation with individuals and communities to identify social and economic information so as to maximise benefits and minimise adverse impacts on coastal communities and stakeholders.

[1] www.mpa.nsw.gov.au

2.3 Management of Marine Parks in NSW

There is a range of tools used to manage marine parks in NSW including zoning and operational plans, permits and licences to regulate activities, temporary closures and other legislation that operates in conjunction with marine protected areas legislation.

2.3.1 Zoning

There are four types of zones that may be used within a marine park, these are detailed in the *Marine Parks Regulation 1999* and include:

Sanctuary zones	These areas of the marine parks prohibit the removal of any plant or animal from the area and therefore result in a range of biological benefits such as increases in size and number of species and protect breeding areas to re-stock fishable areas, habitat refuges for endangered species.
Habitat Protection zones	Allow low impact activities including limited removal of flora and fauna whilst providing protection to habitat. This allows for a number of recreation activities to be carried out and some commercial fishing.
General Use zones	Allows most recreational and commercial activities to the extent that they remain ecologically sustainable.
Special Purpose zones	These areas require more restrictive management controls, relative to the nature of the unique activities undertaken in that location. An example could be culturally significant areas or port facilities.

The zones in the park are finalised after extensive periods of community, commercial, visitor and stakeholder consultation. Reviews are scheduled every five years to ensure adequate updating of the park zones with any changes. Marine parks may also be closed pending an emergency that may threaten either wildlife or humans.

2.3.2 Operational Plans

The MPA prepares an operational plan after declaration of a marine park. These plans state the aims and goals of the marine park and also play a role in increasing community understanding about management objectives.

The operational management of the park generally incorporates a range of functions including the regulation of charters for commercial fishing, whale watching and diving. There are also controls on pollution, camping, invasive pests and use of personal vehicles and boats within the park.

Specific characteristics and zoning regulations relating to each of the four marine parks in NSW are outlined below.

2.4 Solitary Islands Marine Park

Solitary Island Marine Park is located near Coffs Harbour on the mid-north coast of NSW in the Tweed-Moreton Marine Bioregion. It covers an area of 71,000 ha between Mutton Bird Island in the south and Plover Island in the north. It extends three nautical miles out to sea and is declared to the mean high-water mark

2.4.1 Zoning and Operation Plans

A zoning plan for the Solitary Islands Marine Park commenced on 1 August 2002. A break down of the zoning for the Solitary Islands Marine Park is as follows:

- Sanctuary zones comprise 12% (8,659 ha).
- Habitat zones of 54% (38,860 ha).
- Special purpose zones at 0.1% of the park (57 ha). The area includes oyster leases and areas of aboriginal significance.
- The general use zones cover all other areas of the park at 34% (23,920 ha).

2.4.2 Special Characteristics and Uses

The Solitary Islands Marine Park includes a diverse mix of tropical and temperate marine communities and is dominated by a complex system of reefs and islands. The Park is home to a number of migratory bird species, which have protection agreements arranged with Japan and China. The Park is also home to the endangered grey nurse shark. There are a number of sites in the park significant for aboriginal heritage.

The Park is used for a range of ecotourism activities including fishing, dolphin and whale watching and scuba diving. The park is also regularly used for scientific research, which is accounted for in the 'sanctuary' zoning.

The area's marine park status has had a number of effects on its use, namely to limit commercial fishing, which has no access to the estuaries and is limited in other Park zones.

2.5 Lord Howe Island Marine Park

Lord Howe Island Marine Park is situated 630 km east of the north coast of NSW in the Lord Howe Island Marine Province and covers all NSW waters around the Lord Howe Island Group. It covers an area of 48,000 ha, stretching north around the Admiralty Islands and southeast around Ball's Pyramid and Southeast Rock. It extends three nautical miles out to sea and is declared to the mean high-water mark.

2.5.1 Zoning and Operation Plans

Lord Howe Island Marine Park was declared on 26 February 1999. Operational and zoning plans for the Park have been drafted and were released for public comment on 27 December 2003. Details of the draft plan can be obtained from the MPA website (www.mpa.nsw.gov.au).

2.5.2 Special Characteristics and Uses

The marine environment of Lord Howe Island has international significance being the world's southern most coral reef. The island and surrounding waters were declared a world heritage site in 1982. The Park is home to a mixture of temperate and tropical marine species and as recognised by its world heritage status, is a fundamentally different marine environment to those in the rest of NSW.

The diversity of habitats in Lord Howe Island Marine Park supports a wide range of recreational and commercial activities and uses. Recreational activities undertaken within the marine park include fishing, sight seeing, reef walking, scuba diving, snorkeling, boating, swimming, sea kayaking, surfing and beach activities. Commercial uses of the marine park are dominated by tourism-based activities such as dive charters, charter boat fishing, sightseeing cruises, and eco-tours. These activities provide an important source of income to the local community.

Implementation of the draft zoning plan will have the greatest impact on fishing activities within the park particularly within the sanctuary and habitat protection zones. Activities that do not involve the harming or taking of marine species will experience little effect.

2.6 Cape Byron Marine Park

The Cape Byron Marine Park is in the Tweed-Moreton Marine Bioregion. It stretches from Lennox Head in the south to Brunswick Heads in the north covering an area of 22,700 ha on the eastern most tip of mainland Australia.

2.6.1 Zoning and Operation Plans

Cape Byron Marine Park was declared on 1 November 2002. Operational and zoning plans for the Park are currently being drafted.

2.6.2 Special Characteristics and Uses

The Cape Byron Marine Park has a diverse marine life including dolphins, seabirds, turtles, fish, seaweeds and invertebrates. The park is home to threatened species such as little terns, grey nurse sharks and leather back turtles. The park is also an important site for the long-term monitoring of humpback whales.

Popular activities within the park include fishing, diving, snorkelling, boating, kayaking, windsurfing, swimming and surfing being among the most common recreational uses. Cape Byron Marine Park is also important for many small businesses, such as charter boat operators, commercial fishers, dive shops, bait and tackle shops, as well as boat and aerial whale watching.

Zoning mainly affects the area's fishing industry. Following implementation of the zoning plan it is likely that a proportion of the park will not allow commercial fishing of any kind. At this stage fishing rules in the Cape Byron Marine Park have not been changed as a consequence of the declaration of the park, however, they will change once a zoning plan is prepared in consultation with the local community.

2.7 Jervis Bay Marine Park

The Jervis Bay Marine Park covers an area of 22,000 ha and 100 km of coastline in the Batemans Shelf Marine Bioregion, from Kinghorn Point in the north to Sussex Inlet in the south. The park is approximately 180 km south of Sydney and 20 km south east of Nowra.

2.7.1 Zoning and Operation Plans

A zoning plan for the Jervis Bay Marine Park commenced on 1 October 2002. A break down of the zoning for the Jervis Bay Marine Park is as follows:

- The sanctuary zone covers 20% (4,253 ha) of the park's area protecting riverine and mudflat ecosystems and seagrass to beaches and sub-tidal reefs.
- Habitat protection zones cover the majority of the park at 72% (15,600 ha). This is designed to provide a high level of environmental protection and does not allow trawling although some small areas are available for purse seine and lift netting of baitfish by licensed fishers.
- General purpose areas account for 8% (1,618 ha).
- Special purpose zones adjacent to the HMAS Creswell and at Huskisson Wharf contribute 0.2% (48 ha) to the park's area.

2.7.2 Special Characteristics and Uses

The Jervis Bay Marine Park environment is biologically diverse containing a mix of tropical and temperate species. These species are found in a variety of habitats within the Park including estuaries, rocky shores, sub-tidal rocky reefs, sandy beaches, sub tidal soft substrates and the open ocean. Species of particular importance in the Park include whales, dolphins, seals, grey nurse shark, eastern blue devil fish, weedy sea dragon, elegant wrasse, penguins, seabirds and migratory wading birds.

The Jervis Bay Marine Park is the focus of a wide range of recreational and commercial activities. Popular activities undertaken within the Park include commercial and recreational fishing, scuba diving, whale and dolphin watching, research, boating, surfing and other beach activities. Indigenous people have had strong ties to the land and sea in and around Jervis Bay for thousands of years and many significant cultural and spiritual sites are located within or adjacent to the marine park.

The major effect of marine park zoning is limits to commercial fishing and trawling. Other recreational and commercial activities that are deemed to harm or take from the marine resource are also restricted, particularly in sanctuary and habitat protection zones. Most recreational and commercial tour activities however, will experience little effect.

3 A Review of Literature Relating to the Economic Values of Marine Protected Areas

3.1 Introduction

A key component of this study is to review economic and other relevant Australian and international literature relating to the production, consumption and use of marketable and non-marketable goods and services associated with marine parks. The purpose of this review is to:

- Contribute information toward the development of conceptual models to estimate the economic values of direct and indirect use activities associated with NSW marine parks; and
- Assist in identifying data requirements for these models.

The development of conceptual models and identification of data requirements is the subject of subsequent sections of this report.

The major findings from this review are presented in this section. Consideration of *non-use* values associated with marine parks is outside the scope of this study and has not been included in this review.

3.2 Identification of the Types of Use Values Provided by Protected Areas

There are a number of use values arising from marine protected areas. Economists tend to classify these use values into *direct* use values and *indirect* use values. Indirect use values are also referred to as ecosystem function values.

Direct use values are those that arise from the direct physical use of environmental resources (DEST *et al* 1995) and may include:

- Commercial or market activities. Most common commercial activities in marine parks or of marine resources include:
  - Fishing charter operators;
  - Commercial fishing;
  - Commercial dive tours;
  - Whale and dolphin watching charters;
  - Other sight-seeing tours;
  - Surf schools; and
  - Boat and jetski hire, and parasailing.

- Non-commercial or non-market activities such as:
  - Recreational fishing;
  - Private boating;

- Research and education;
- Beach, rocky shore and headland walks;
- Surfing;
- Camping; and
- Subsistence and indigenous fishing.

Indirect use values or *ecosystem function values* are the value of the ecosystem services and functions provided by an environmental resource. The concept attempts to capture indirect ecosystem values due to the interconnectedness of ecosystems through a variety of food chain and nutrient cycles (Young 1992). Ecosystem function values of marine parks may include:

- Fish stock recruitment and protection;
- Habitat and biodiversity maintenance; and
- Waste treatment and assimilation.

The underlying principles associated with economic valuations of marketable and non-marketable uses associated with marine parks are well documented in both the Australian and international literature. In particular, Hart (1997) and Davis (2001) provide detailed discussions of the economics of marine protected areas. The economic values of market and non-market use activities associated with marine protected areas are measured by:

- Producer surplus, and where relevant consumer surplus, associated with each market based activity;
- Consumer surplus associated with each non-market use activity;
- Producer surplus and consumer surplus (both market and non-market use values) associated with any ecosystem function values; and
- Net costs to government or other community groups (e.g. voluntary associations, clubs or other stakeholders that participate in management of the marine resource).

In addition, market and non-market use activities (including government expenditure) may provide an economic stimulus to the regional economy that are measured in terms of direct and indirect output, value added, income and employment.

Further, a true economic valuation of the formation of a marine protected area should reflect the marginal change in management costs and use values resulting from declaration of the area to a marine park. That is, it is necessary to identify and measure how each component of total economic value would change between the "with" and "without" marine park scenario. Pendleton (1995) suggested that the economic value of a marine park should be measured as potential losses that are avoided because of marine protection, net any costs associated with protection. This needs to be considered in an inter-temporal context to ensure that valuations support the objective of sustainability (refer Figure 3.1).

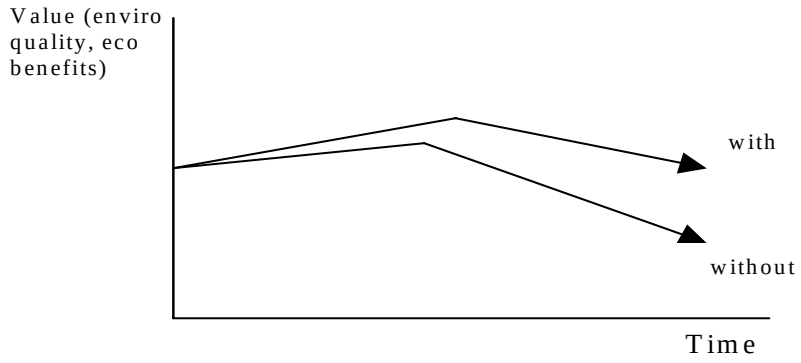

Figure 3.1 Environmental or Economic Benefits With and Without Protection
Source: Davis 2001

In Figure 3.1 the two hypothetical paths, as presented by Davis (2001), represent the value of a marine resource over time "with" and "without" protection. To ascertain the true economic value of protection over time, the area between the with and without paths should be measured. This measurement, along with a range of other hypothetical time paths relating to use activities in marine parks, is further considered in Section 4.6 of this report.

Further issues relating to the economic framework for estimating the economic values of direct and indirect use activities associated with NSW marine parks are discussed in Section 4 of this report where a number of conceptual models are developed. This section provides a review of empirical work relating to market/commercial, non-market/non-commercial and ecosystem function values.

Carter (2003) completed a comprehensive review of research to date relating to the economics of marine protected areas and found that limited empirical research has been conducted. Furthermore, there appears to be a general consensus amongst those who have reviewed literature relating to the economics of marine protected areas that the economic benefits and costs of protection have generally been inaccurately valued (Davis 2001; Hart 1997; Carter 2003; Pendleton 1995).

Empirical studies often focus on one, or a limited number, of all the uses within a marine park. In doing so the studies are partial valuations that do not account for all use benefits and opportunity costs. Additionally, many attempts to value marine protected areas have focused on the *total* contribution of the area to the economy rather than the *additional* contribution resulting from marine protection. As noted by Carter (2003) and Pendleton (1995), many of the studies attempting to value non-market uses of marine parks have inadvertently measured the total impacts or value of the resource and not the marginal change in impacts or value provided through protection of the resource. Hence, these studies have implicitly assumed that these values would not exist in the absence of the marine park. In the hypothetical case illustrated in Figure 3.1, without marine protection use values in marine areas would have experienced a more rapid declined over time. Hence the measurement should reflect the benefits over time of changes induced by the marine protection, i.e. the shift in the time path of values.

3.3 Commercial or Market Activities

As mentioned above, market activities in marine parks include commercial fishing and commercial tour and charter operations. The impact on commercial fishing activities is the subject of many studies relating to protection of marine resources. Less often dealt with are the impacts of marine protected areas on other commercial or market operations.

3.3.1 Commercial Fishing

Major empirical studies conducted in Australia that have attempted to quantify the value of commercial fishing in marine parks include Driml's (1994; 1997; and including the KPMG update in 2000) valuation of commercial fishing in the Great Barrier Reef Marine Park and Hart (1997) and Davis (2001) valuations of commercial fishing in the Solitary Islands Marine Park. Driml estimated the gross value of commercial fishing based on the value of product landed as $128 million per annum with a multiplier for regional flow-ons of two. A measure of producer surplus, being the correct measure for economic value of commercial fisheries (Driml 1994; Davis 2001), estimated a much lower value of $31 million. Hart (1997) and Davis (2001) valued commercial fishing in the Solitary Islands Marine Park as $2.2 million using producer surplus as the economic measure.

The studies by Driml, Hart and Davis, although using producer surplus to estimate the economic value of commercial fishing activities within marine parks, did not measure the marginal value from creation of the protected area. That is, they did not consider the *change* in producer surplus to commercial fishers from the "without" to "with" marine park scenario.

Davis (2001) recognised the opportunity cost of reduced fishing income and hence changed producer surplus, however noted that this was negligible because the 1998 declaration of the Solitary Islands Marine Park little affected commercial fishing activities. The total value was then reported as $2.2 million rather than zero – where the latter is the true value of protection if there is no change in commercial fishing activity. Assuming commercial fishing activities were conducted in these waters prior to declaration of the marine park, the value from these activities would exist regardless of whether the area was protected.

Further work to estimate the total economic value of the GBRMP has recently been completed (BRS 2003; BTR 2003; PDP Australia 2003). The estimated value of commercial fishing in the GBRMP was expressed as gross value product per annum (estimated at $130 million) and on a value-added basis[2] (estimated at approximately $25 million per annum). Impacts on the regional economy were also reported. PDP Australia (2003) attempted to estimate the change in commercial fishing value as a result of implementing a new zoning plan in the Park.

[2] Where value-added is defined as the value of outputs produced by an industry less the value of its inputs. I.e. the surplus is approximately equal to the sum of incomes earned directly from an industry's production process, including returns to capital and labour (GBRMPA 2003).

Closures to fishing grounds were estimated to be valued at approximately $2.59 million per annum value-added and between $10.3 million and $13.6 million per annum gross value of production (BRS 2003; PDP Australia 2003). The impact to commercial fishers was identified as the principle economic cost of the new zoning plan.

Designation of a marine park can impose direct costs on fishers by closing or limiting access to fishing grounds. These costs can be offset if displaced fishers are able to "relocate to another productive area at little or no costs or if there are compensating spill over effects from the protected area to the remaining fishing grounds" (Carter 2003). In measuring the impact on commercial fishers, it is therefore necessary to consider how declaration of a marine park changes fishing conditions (in terms of effort and catch) within the park boundaries and secondly what happens to those fishers who are displaced (i.e. forced out of the marine park).

To answer the first part of this question – how does declaration of a marine park affect effort and catch within the boundaries of the park – it would be necessary to consider the management and zoning plans of the marine park in question. Implementation of zoning, including "no-take" zones (i.e. sanctuary zones) in NSW marine parks was discussed in Section 2. Zoning rules have been established for the Solitary Islands and Jervis Bay Marine Parks and are currently being drafted for the Cape Byron and Lord Howe Island Marine Parks. These plans will dictate how commercial fishing activities change upon declaration of a marine park.

Where commercial fishing is limited or "no-take" areas are enforced (as would be expected within a protected zone) there will be a resultant decline in fishing effort and catch within that area. The resulting ecological benefits from restricted harvesting within these areas are indirect use values and are discussed in Section 4.4. The impacts on commercial fishers form the second part of the above question (that is, what happens to those fishers who are displaced?) are considered below.

Unless there is policy intervention[3] controlling the displaced fishing vessels or the costs of relocation prove too high[4], the effort previously operating in the closed area will adjust to creation of a "no-take" area by relocating to unprotected areas. Any resultant increased effort in unprotected areas could result in stock levels declining to lower levels in these areas. Measurement of the economic effect of creation of a "no-take" area would therefore require monitoring of stock and harvest levels over time both inside and outside the boundaries of the marine park and across different zones.

[3] Policy intervention may include the buy-out of licences. This policy measure has been implemented for some NSW marine parks and is being considered in the formation and regulation of others to avoid adverse displacement effects. The impact of a buy-out on commercial fishers will depend on the payment made by government. That is, if the payment is greater than the net income commercial fishers would have received from being let continue fishing in the area then there will be an increase in producer surplus. Conversely, if the payment were less than foregone income there would be a decline in producer surplus. Again this issue should be considered in the context of time to measure actual sustainability of the fishery and hence actual catch foregone. Regional flow-on effects of any government payments made to commercial fishers would also need to be considered.

[4] In which case displaced fishers are likely to exit the industry on their own accounts.

Publications listings on the relevant NSW Marine Parks and other Australian marine park websites indicate that there have been a number of scientific studies considering the changes in stock and habitat of certain marine species in park waters. However, these findings tend to be in support of the existence of ecosystem function values (which are considered in Section 4.4) as opposed to measuring benefits to commercial fishers and have not been incorporated in the economic literature.

The impact of changed commercial fishing conditions has been recognised in much of the international literature examined relating to the economic effects from formation of marine protected areas. In recent years there has been a number of bioeconomic models developed aimed at examining the expected net economic effects of marine park spill overs on fishing operations, most of which relate to overseas marine resources (refer Sumaila and Charles 2002*a* and Sumaila and Charles 2002*b*). These economic models generally tend to model the biomass flow into and out of the protected and surrounding areas using a net growth function that represents intrinsic growth or recruitment rates less natural mortality rates (Carter 2003). This type of modelling has consistently reiterated the importance of policy relating to the management of fishing effort not just within the marine park but surrounding areas. Carter (2003) noted that if harvest is not managed additional benefits generated by a marine protected area are likely to attract additional effort and hence be dissipated over time. Therefore, if there is a lack of "incentives for fishers to control effort, creation of a marine protected area is likely to…leav(e) the welfare of fishers unchanged at best" (Carter 2003).

Sanchirico (1998) and Walters (1999) discussed the implications of marine protected areas and behavioural patterns of the fishing industry and predicted that harvesting pressure outside (particularly along the boundaries of) the protected area, would increase upon formation of a marine protected area. This phenomenon is often referred to in the literature as "fishing the line". There is evidence of this effect in the NSW abalone fishing industry where it was found that in one fishery studied, the majority of catch was taken along the zone border (TACC 2003). The general conclusion made by those observing this mode of behaviour is that fishers experience benefits from spill over effects along the boundaries of designated marine protected areas.

Several studies have shown that highly protected marine areas allow population densities to significantly increase over two to four years which may allow fishers to enjoy medium-term benefits from increased stock levels (Clark, Causey and Bohnsack 1989; Polunin and Roberts 1994; Sluka, Chiappone, Sullivan and Wright 1997; Williamson 2000). Concern is raised however, that in some instances the sustainability of any increased harvest outside the protected area may diminish the value of any spill over effects. On the other hand, Carter (2003) argued that if effort can be controlled internally by the structure of the fishing industry or by regulatory agencies, it might be possible to sustain the economic benefits from biological spill overs in the long-term. Several studies have indicated that marine protected areas may also be able to reduce the variability in stock levels and hence variations in harvest levels over time (Sumaila 1998; Conrad 1999; Hannesson 2000).

The general conclusion is that spill over benefits to commercial fishers will depend on the linkages between the marine environment, the size of the marine protected area, the presence of predators for protected biomass and the availability of substitutes for foregone fishing grounds (Farrow and Sumaila 2002; Carter 2003). Additionally, it was concluded that unless displaced harvest effort is carefully managed any benefits are unlikely to be sustained. Therefore economic modelling of the value of protection to commercial fishers requires input from marine biologists and scientists to determine if and to what extent these spill over benefits and linkages occur and the resulting impact of stock levels and commercial fishing effort and catch.

Sanchirico (2000) highlighted a number of other costs less commonly covered in the literature that should be considered when assessing the overall impact to commercial fishers. For example, reducing the amount of area open to fishing could result in higher levels of congestion on remaining fishing grounds, which might in turn lead to increased fuel usage, crew employment and higher capital costs thus increasing the cost per unit of catch (Sancharico 2000). Other identified costs included increased variable costs associated with the choice of fishing location, for example, transportation and search costs. If these increased costs exceed the revenue to fishers from relocation it may be that displaced fishers will instead exit the industry. On the other hand if biological spill over effects are such that stock levels increase throughout the fishery, search costs may in fact decrease.

3.3.2 Other Commercial Activities

Other commercial activities in marine parks can generally be classified as commercial tour and charter operations. Commercial tourism operations include whale and dolphin watching, recreational fishing charters and recreational scuba diving charters. The value to commercial tour operators is estimated as direct producer surplus and can be obtained through a financial survey.

Driml (1994) measured the annual financial value of tourism in the Great Barrier Reef Marine Park as $682 million by estimating tourist expenditure and used input-output analysis to estimate indirect flow-on effects as a multiplier of 1.7. Hart (1997) measured the gross revenue to commercial tour operators in the Solitary Islands Marine Park as $477,063 based on annual passenger figures collected by NSW Fisheries. Hart (1997) used average market prices to estimate revenue and noted the difficulty in obtaining accurate breakdowns of passenger numbers and operating costs from tour operators.

These studies however, only measured the value of producer surplus of commercial tour activities in a given year. The analysis therefore does not measure the marginal change in commercial tourism value from pre to post marine park declaration. Davis (2001) concluded that in the case of the Solitary Islands the impact on commercial tourism as a result of the change in status from marine reserve to marine park was negligible.

The static nature of these studies also fails to capture the issue of sustainability of conducting commercial tour operations within marine protected areas. This would also involve measurement of the long term benefits (or indeed costs) that may arise if improvements in biodiversity lead to an increase in the number of passengers utilising commercial tours. This would need to be considered in line with whether these operations would have continued in the long run without a marine park.

Few other studies have attempted to measure the financial value to commercial tour operators. Most empirical studies are concerned with the value to consumers and are applications of non-market valuation techniques such as contingent valuation and travel cost surveys. These studies are reviewed in Section 3.4.

3.4 Non-Commercial or Non-Market Activities

Non-commercial or non-market activities taking place within marine parks may include recreational activities such as fishing (including indigenous and subsistence fishing), boating and diving, education and research activities.

The correct measure of gross economic value for non-market use is consumer surplus, that is, the benefits enjoyed by consumers or recreational users in excess of what was sacrificed to undertake the activity (McLeod and Nicholls 2002). Consumer surplus for non-market activities can only be estimated indirectly using non-market valuation techniques such as the travel cost method, contingent valuation or choice modelling each requiring specific survey approaches.

There has recently been a considerable amount of work undertaken in Western Australia to apply non-market valuation techniques to case study fisheries in an attempt to measure the value of recreational fishing (McLeod and Nicholls 2002 and 2003). There are also several examples of the application of survey techniques to specifically measure consumer surplus relating to recreational use of marine parks in both the domestic and international literature. There has been very little empirical work however, on the extent to which declaration of a marine protected area could directly affect non-market values (Carter 2003). That is, most studies tend to estimate a total value of the marine resource rather than the marginal change in non-market activities resulting from protection, which is the true value of the marine park.

Coleman and Plowman (1996) completed a visitor survey of the Solitary Islands Marine Reserve in 1995. The study indicated that in most cases visitors did not even know they were in or adjacent to a marine protected area. Based on this evidence it is unlikely that, at least in the short term, these visitors experienced any additional benefit (measured by a shift in consumer demand) from declaration of the marine resource to a marine park. However, if there were no marine reserve, and the area had degraded biophysically, these people may not have visited the area as they may have obtained lower consumer surplus. Hence, awareness per se is not necessarily a complete indicator of use.

Methodologies used by Driml (1994; 1999) and KPMG (2000) to measure the economic value of the Great Barrier Reef, and Hart (1997) for the Solitary Islands although correctly aimed at estimating consumer surplus, have not valued the marginal change or taken time into consideration. Davis (2001) recognised the importance of these two issues in his report on the economic valuation of the Solitary Islands, however did not factor these considerations into his results.

Carter (2003) suggested that an alternative approach, capturing the marginal change, is to examine preferences for marine life attributes (for example, species abundance, size, etc.) that might be enhanced or protected through declaration of a marine park (Carter 2003). Consumer (and producer) benefits may be realised if improvements in biodiversity results in increases in the abundance of a particular species to which visitors are attracted. For example, a protected area may lead to an increase in the abundance of whale and dolphin populations, or a particular species of interest to recreational anglers. This effect could be investigated through consumer preference surveys and scientific monitoring of species abundance. It should be noted however, that increases in some species such as sharks might in fact deter recreational activities leading to a decrease in consumer surplus.

Other attempts to investigate the before and after value of marine parks include a benefit transfer study conducted by Leeworthy and Wiley (1999) applied to the proposed Dry Tortugas Ecological Reserves in the Florida Keys of the United States. Despite indicating an increase in consumer surplus from the reserve, the results were speculative and unquantified.

It should not however, be assumed that an increase in recreational activity will necessarily result in an increase in the economic value of the marine park. Increased recreational activity may lead to congestion and further contribute to the degradation of the marine resource. Carter (2003) noted that declaration of a marine park could actually attract attention to an area increasing the potential for congestion and reducing the value derived from the resource by the consumer. This will only result in a net decrease in the recreational value of the resource if over time the sum of the decline in individual consumer surplus is not offset by the increased consumer surplus from additional visitors. More likely to be of concern is if increased recreational use leads to degradation of the marine environment. Davis and Tisdell (1996) supported this view in reference to diving activities in Australian marine parks noting that careful management[5] of these areas is necessary to ensure that increased recreational use does not lead to degradation of the marine resource. There have also been several overseas studies concerned with the impacts of recreational diving and fishing on marine resources.

[5] Davis and Tisdell (1996) concluded that a mixture of regulation and economic instruments would provide for the best management outcome along with education aimed at raising environmental awareness and reducing the damaging impacts of use on popular sites.

In conclusion, valuing the impacts of marine parks on non-commercial use activities must first involve determining what changes declaration of a marine park will have on recreational activities in the area. Benefits from declaration of a marine park are unlikely to be experienced by either visitors or locals in the short term, particularly if users are unaware of the changed status of the area. The benefit to consumers from the park may be experienced in the long-term if protection can ensure long-run sustainability of recreational activities. To measure this effect information would need to be obtained on damage effects and recovery to the resource from different recreational activities at different levels of use. This information would then need to be modelled with projections of recreational use both with and without marine park status.

Some scientific modelling of damage functions and carrying capacities is being undertaken both in Australia and overseas particularly in relation to scuba diving activities[6]. This type of modelling would assist in determining the sustainability of different recreational activities however to determine the true effect of protection, this information would need to be considered in line with projections in use trends over time under the with and without park scenarios. These types of projections could be made by monitoring recreational activity before and after declaration of the marine park and comparing data to non-protected areas with similar recreational attractions. There was no evidence of attempts to quantify the effect of potential increases in sustainability from marine protection in the Australian or international literature examined.

3.5 Ecosystem Function Values

Ecosystem function values are the value of the ecosystem services and functions provided by an environmental resource and may include fish stock recruitment and protection, habitat and biodiversity maintenance, and waste treatment and assimilation.

Ecosystem function values in terms of improved fish stock recruitment and protection, habitat and biodiversity maintenance may affect the direct use values of marine resources (refer Figure 4.1), for example by increasing the consumer surplus of non-market users who value improved biodiversity (refer Section 3.4) or increasing the producer surplus of market users by any spill-over benefits for commercial fishers (refer Section 3.3). Ecosystem function values are measured as the effect they have on the associated direct use value and care should be taken to avoid double counting. The purpose of this section is to review literature relating to the empirical evidence of the existence of ecosystem function values.

The literature indicates that there is little doubt that there are ecosystem benefits realised within the boundaries of marine protected areas (Roberts, Bohnsack, Gell, Hawkins and Goodridge 2001). Sanchirico (2000) reported that biological payoffs include increased abundance, spawning stock, recruitment and biodiversity.

[6] Some of this work is listed on the following website: http://www.opwall.com/2001%20diver%20damage.htm

Uncertainty exists however as to whether these benefits will spill over and will be sustained in remaining marine take areas.

Because fisheries are subject to risk of serious decline or collapse, preserving spawning and nursery grounds through creation of protected areas could serve to reduce this risk. Given the severity of this risk many economists including Dixit and Pindyck (1994), Hayakawa and Farrow (2000) and Farrow and Sumaila (2002) noted that application of the precautionary principle might be relevant. Farrow and Sumaila (2002) noted the growing number of subscribers to this school of thought. This theory states that where uncertainty and irreversibility exist, the standard economic decision rule, i.e. that benefits should be equal to or greater than the costs, is incorrect. In the case of marine resources many believe that a marine park should not be established unless the costs are *significantly* higher than the expected benefits.

3.6 Regional Economic Impacts

As noted in Section 3.2, activities involving expenditure in a region provide some stimulus to economic activity in that region. Given the market-based activities, non-market use activities and government costs associated with marine parks result in regional expenditure, the flow-on effects to the regional economy need to be measured. These impacts will be both positive (for activities increased by marine parks) and negative (where activities are restricted by the marine park). A method used to estimate direct and indirect economic stimulus to a region is input-output analysis.

Input-output analysis involves the calculation of multipliers used to measure the impact a change in final demand has on key economic aggregates. Many of the empirical studies have made use of input-output analysis when measuring the economic value of marine parks. In particular, studies in Australia measuring the financial and economic values of the Great Barrier Reef (Driml 1994; Driml 1999; KPMG 2000; PDP 2003) and the Solitary Islands Marine Parks (Hart 1997; Davis 2001) relied on the use of multipliers to measure the indirect output effects added by market and non-market activities within marine parks.

Jensen and West (1986) noted the following factors to be taken into consideration when using multipliers in a regional context:

- Data requirements mean the process is often cumbersome and expensive;
- Data available (often ABS regional statistics) are often dated;
- The level of accuracy cannot be tested;
- Results may no longer be representative if there is a substantial change in a region's economy; and
- Assumes marginal changes can be calculated from average values.

Further discussion on the use of input-output analysis to estimate regional economic impacts is presented in Section 4.3.

3.7 Conclusions

Australian and international literature relating to the economics of marine protected areas indicates that there are a number of use activities associated with these areas that can generally be classified as direct market and non-market activities, and indirect uses, or ecosystem function values. The correct measures for estimating these values include consumer and producer surplus, net costs to government and flow-on effects or multipliers to the regional economy. Further, the true economic value provided by a marine park is measured as the marginal change in the value of these uses resulting from protection.

There has been little empirical work that has attempted to quantify the indirect and direct uses of marine parks, particularly in Australia. Those studies that have quantified marine park use values tend to be partial estimates focusing on only one, or a few, of all the possible park uses and generally fail to capture the marginal change in resource use and hence the true value from protection. Davis (2001) and others have noted the extensive effort and resources required to provide a comprehensive valuation of marine protected areas. Concurrent use of a number of valuation techniques is required to fulfil the data requirements necessary to assess changes to both producer and consumer surplus. Also of considerable importance is the biological data required to measure the economic values of marine parks. The emergence of a number of studies in recent years attempting to develop bioeconomic marine models illustrates this point. The data needed to develop these models however, is often unavailable and is difficult and expensive to collect.

The following section of this report gives further consideration to the economic principles underlying valuations of marine park market and non-market use activities. Conceptual models are developed for determining the baseline values of uses associated with marine resources and for considering changes resulting from protection. A review of existing data availability and identification of data gaps for estimating the economic use values and regional economic impacts of NSW marine parks is provided in Section 5. Where data gaps exist it will be necessary to develop procedures and alternatives for collecting this data, these procedures are also considered in Section 5.

4 Conceptual Models to Estimate Economic Values

4.1 Introduction

This section provides the technical conceptual framework for the economic values and regional economic impacts of marine parks referred to in Section 3. Using this framework, data requirements and methods for measuring the direct and indirect use values and regional economic impacts of marine parks are identified.

The chapter then examines the technical conceptual framework for distinguishing the economic values associated with existing marine parks from those that would have prevailed in the absence of the marine park i.e. identifying the incremental economic values of existing marine parks. The difficulty of monitoring economic values of existing and prospective marine parks "with" and "without" their declaration is also discussed.

4.2 Economic Values

4.2.1 Total Economic Value Framework

As identified in Sections 2 and 3 of this report, marine resources, such as those contained within marine parks, have many economic values that can contribute to society. These economic values are anthropocentric in nature and so relate to anything from which individuals gain satisfaction (DEST *et al* 1995)[7].

Baseline economic values of marine parks may be associated with goods and services that are traded in markets, as well as goods and services that are outside the market system, provided these contribute satisfaction to individuals in society.

Combined, all the economic values that can be obtained from a resource are often referred to as total economic value. The mechanisms that link resources to individual and community well being are direct use of the resources (for example, commercial and non commercial recreation), indirect use of a resource (i.e. ecosystem function values such as protection of biodiversity) and non-use (such as the preservation of natural ecosystems, species or special areas) (James and Gillespie 2002).

[7] This is an assumption of neoclassical economics. There is some argument that there may also be values to the community that go beyond individual satisfaction and encompass the provision of communal goods and services. However, this study focuses on the total economic value framework only. Refer to Morrison and Hatfield-Dodds (2003) for a discussion of valuation based on re-allocation of existing government expenditures.

TOTAL ECONOMIC VALUE = DIRECT USE VALUES + INDIRECT USE VALUES (OR ECOSYSTEM FUNCTION VALUES) + NON USE VALUES
Adapted from Brown *et al* (1993), p. 13.

NON USE VALUES = OPTION VALUE + QUASI OPTION VALUE + VICARIOUS VALUE + BEQUEST VALUE + EXISTENCE VALUE

Reference: DEST *et al* (1995), p. 18.

Direct use values are those that arise from the direct physical use of environmental resources (DEST *et al* 1995) and may be further classed as commercial/market or non-commercial/non-market activities (refer Section 3.2).

Indirect use values or ecosystem function value[8] is the value of the ecosystem services and functions provided by an environmental resource. The concept attempts to capture indirect ecosystem values due to the interconnectedness of ecosystems through a variety of food chain and nutrient cycles (Young 1992). Ecosystem function values of marine parks may include fish recruitment and stock protection, assimilation of urban and rural runoff etc.

Non-use values comprise *option values, quasi-option values, vicarious use values, bequest values* and *existence values*.

> *Option values* relate to the benefit of maintaining the right to use resources without necessarily doing so. It may include future use by existing individuals or by future generations.
>
> *Quasi-option values* refer to the welfare obtained from the opportunity to get better information by delaying a decision that may result in irreversible environmental damage.
>
> *Vicarious use values* are gained by people from the knowledge that others may be enjoying use of a natural environment, for instance, for recreational activities, commercial activities and through the indirect consumption of an environmental resource through books and other media.
>
> *Bequest values* refer to the maintenance of environmental attributes for the benefit of future generations.
>
> *Existence value* is the satisfaction that the community derives from simply knowing that certain things exist (including because of ethical concerns), for example, rare species or special ecosystems (James and Gillespie 2002).

These values are presented diagrammatically in Figure 4.1. The focus of this report is on use values, both direct and indirect, including ecosystem function value; although for completeness reference is also made to non-use values.

[8] Some economists consider ecosystem function values as a special category of environmental values, but they can usually be decomposed into the other categories of use and non-use value.

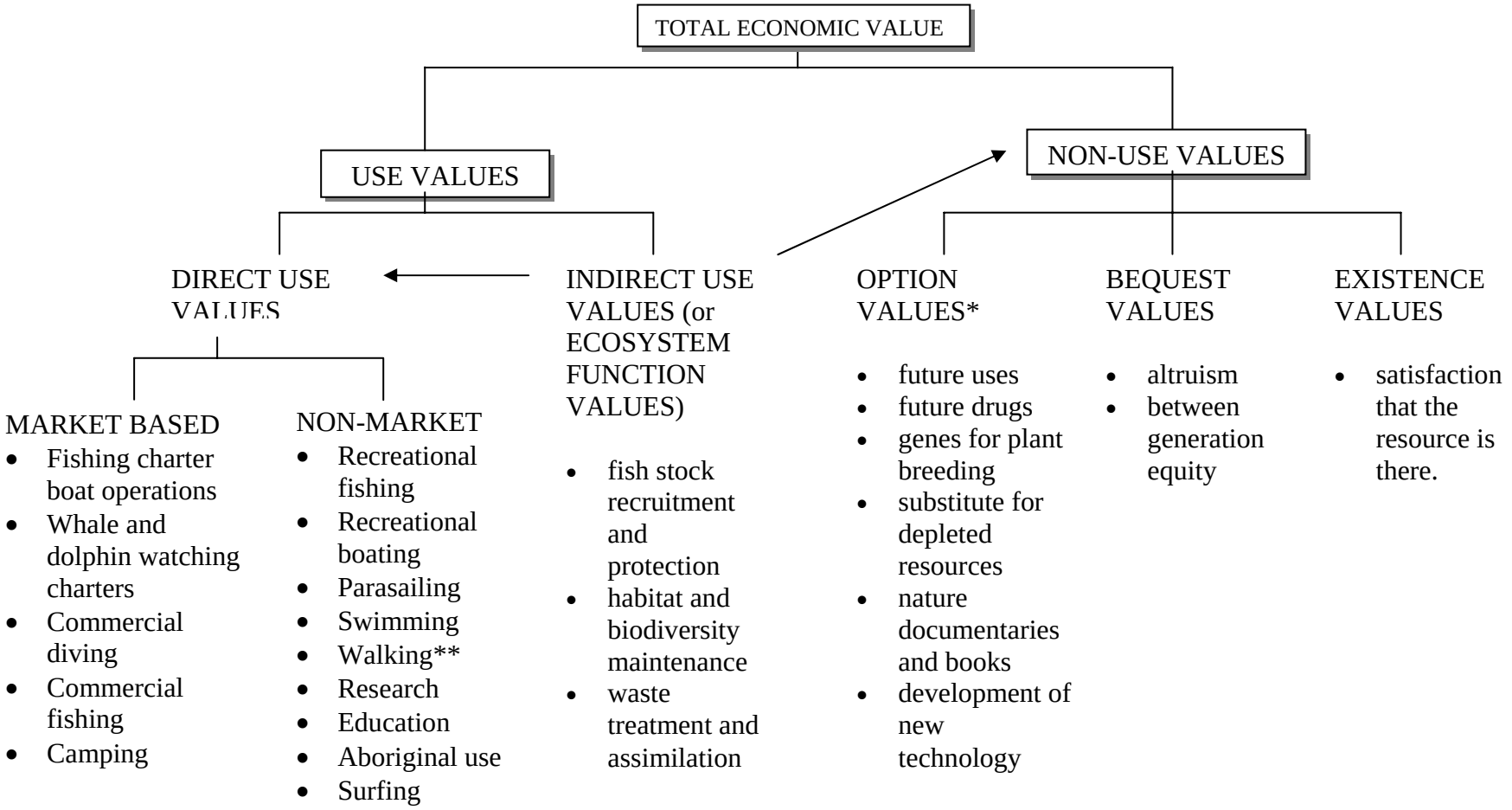

Figure 4.1 Components of Total Economic Value: Use and Non-use Values

* includes option, vicarious and quasi-option values

**walking may occur in the inter-tidal zone

Adapted from Young (1992), p. 23.

4.2.2 Measures of Economic Value

As identified in Section 3.2, the economic values of market goods to the community are measured by consumer and producer surplus. The conceptual framework for providing an understanding of consumer and producer surplus is the supply and demand, or market, model. (Refer to Figure 4.2.)

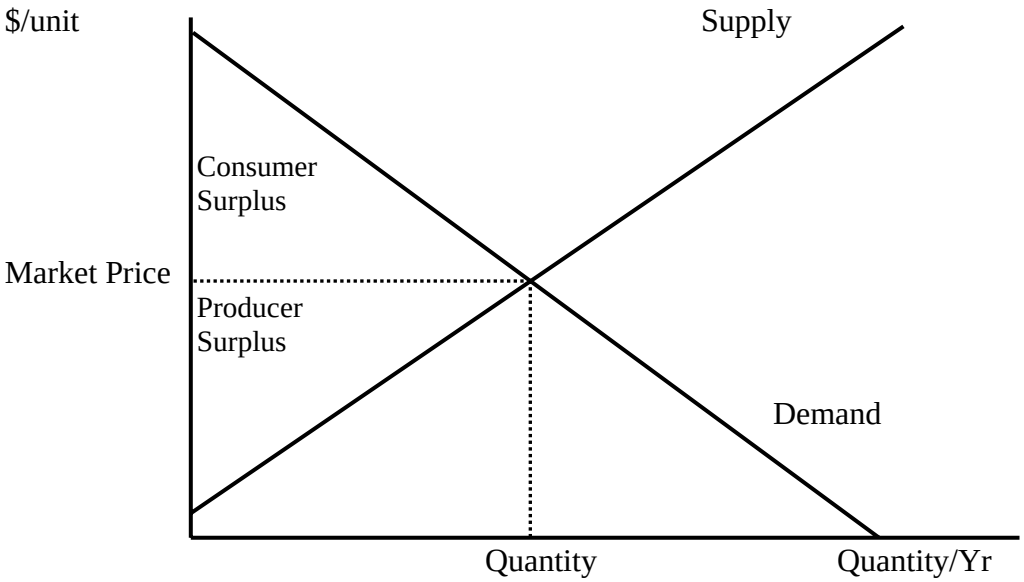

Figure 4.2 Measures of Economic Value

The market supply curve (which comprises the summation of individual firm supply curves) indicates the costs of extra production i.e. the costs to society of producing an extra unit of a good or service. Firms aim to operate on the upward sloping part of their marginal cost curve above the minimum average variable cost, this upward slope reflecting diminishing returns to inputs, and hence it costs more to produce each additional unit of output[9]. The area under the supply curve is the total cost of production.

The market demand curve (which comprises the summation of individual demand curves) indicates the maximum amount that consumers are willing to pay for incremental increases in the quantity of the good or services (Edwards 1990). The demand curve is normally downward sloping because the more someone consumes of a good, the less they are willing to pay. This concept is generally known as diminishing marginal utility. The area under the demand curve is the total willingness to pay for a good.

The interaction of demand and supply determines the market price for a good and the quantity that is produced and consumed in any given time period[10].

[9] Provided the marginal cost of producing an extra unit of output is less than the market price then it is still profitable to produce.
[10] In the most simple economic model where trade and storage are ignored.

This market model provides the basis for identifying and estimating the net economic values to consumers and the net economic values to producers, referred to as consumer surplus and producer surplus, respectively.

Consumer surplus is the difference between what an individual would be willing to pay (demand) for a good or service (the total benefit to the consumer) and what they have to pay (the cost to the consumer i.e. consumer expenditure or price times quantity). In Figure 4.2 it is the area between the demand curve and the price line.

Producer surplus is the difference between the revenue (consumer expenditure) received for a good or service (total benefit to producer) and the costs (supply) of the inputs used in the provision of the good or service (economic cost to producer). In practical terms, it is the net revenue (before tax) that is earned by producer of goods and services (James and Gillespie 2002). In Figure 4.2 it is the area between the price line and the supply curve.

4.2.3 Use Values - Market Goods and Services

The market model presented in Figure 4.2 indicates the potential for the presence of both producer and consumer surpluses for market goods and services.

However, the existence of consumer surplus for market goods will depend on the price elasticity of demand for the good in question. Where demand is perfectly elastic, the demand curve is horizontal and there will be no consumer surplus associated with the good. (Refer to Figure 4.3.) However, where demand is not perfectly elastic i.e. there is some slope to the demand curve, then it will be relevant to measure both producer surplus and consumer surplus.

A key determinant of price elasticity[11] of demand is the presence of close substitutes. Goods and services with close substitutes have higher price elasticity of demand. For example, fish caught by commercial fishers have many close substitutes supplied from other fishers within Australia and from imports. Other meat products also provide substitutes. The existence of export markets may also mean fixed product prices. Demand for fish caught within marine parks is therefore likely to be close to perfectly elastic and hence the conceptual model of supply and demand would be as per Figure 4.3.

Demand for an individual charter boat operator is also likely to be highly elastic since there are very close substitutes e.g. competitors within the marine park, competitors in other marine parks, competitors outside marine parks and alternative recreational experiences. Hence the conceptual model of supply and demand for an *individual* supplier is generally as per Figure 4.3.

However, overall demand for all charter operations within marine parks may be less elastic if collectively charter operations within marine parks provide a somewhat unique experience that cannot be obtained from charter operations outside marine parks or from other recreational experiences.

[11] Price elasticity of demand is a measure of the responsiveness of quantity demanded to a change in price.

If this were the case, demand would be less than elastic and the conceptual model of supply and demand would be as per Figure 4.2.

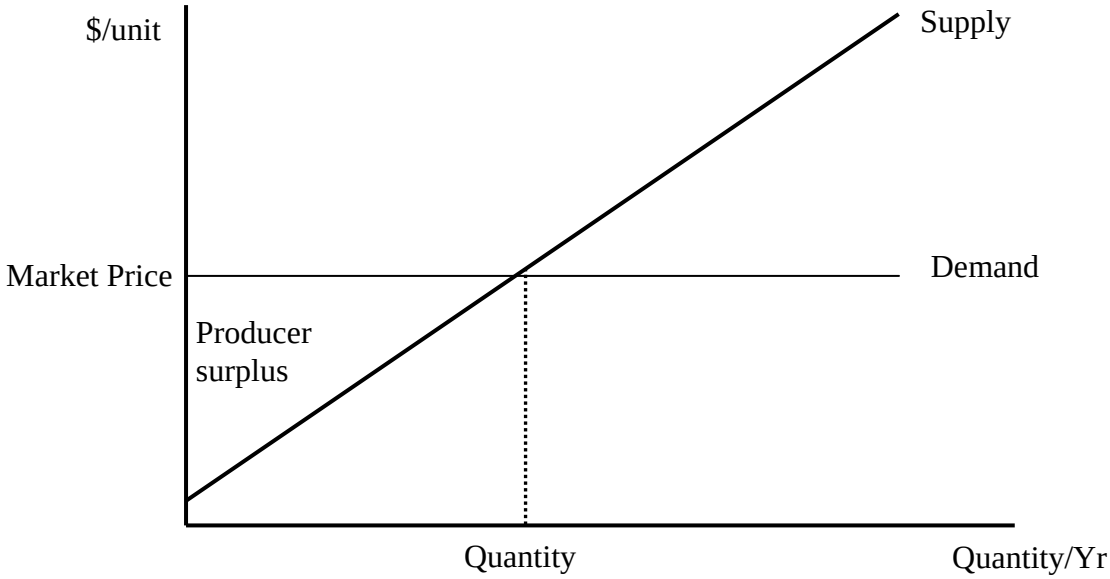

Figure 4.3 Conceptual Model of Supply and Demand when Demand is perfectly Elastic

Calculation of Producer Surplus

For market goods facing infinitely elastic demand the relevant measure of economic value is generally producer surplus, only, and this can be measured directly via market data. The market data required is:

- Total revenue per annum (area under the price line); and
- Total costs per annum (area under the supply curve).

or

- Quantity produced/provided per annum e.g. number of charter boat trips;
- Average price per unit provided e.g. per trip; and
- Average costs per unit provided e.g. per trip.

or

- Total revenue per annum (area under the price line); and
- Percentage of total revenue that is gross profit.

Total revenue (price times quantity) for a given year minus total costs (cost times quantity) for a given year, gives an estimation of producer surplus for that year.

In the short run e.g. for a given year, costs are likely to include those associated with maintenance and operation of boats, employed labour, opportunity costs of self-employed labour and administration costs. In the longer run, costs will also include capital replacement costs.

When producer surplus values over time are being collected it is important to ensure allowance is made for capital replacement costs when in time they occur. Alternatively, capital replacement costs can be annualised and considered in the static model i.e. for a given year.

It is important to realise, however, that in many instances, information on the revenue and costs of individual firms may be considered commercial-in-confidence and hence may not be able to be easily obtained.

A short-cut approach is to estimate total revenue from the collection of quantity and average price information and assume that a certain percentage of this total revenue is producer surplus. The ratio of gross operating surplus to total revenue, for each of the 106 sectors in the national input-output table, is one means of estimating the percentage of total revenue that is producer surplus. Use of an arbitrary percentage such as 20% is another approach.

Calculation of Consumer Surplus

For some commercial activities, such as for regional tourism operators in marine parks, there may be potential for some consumer surplus i.e. the correct conceptual model of supply and demand may be as per Figure 4.2. In this instance, as well as measuring the producer surplus it will be necessary to also estimate consumer surplus.

This requires information on the demand curve for the industry operating in the marine park or reliant on the marine park, in particular the price elasticity of demand[12]. Options for estimation of the consumer surplus associated with market goods include:

- Collecting and collating comprehensive data for economic estimates;
- Undertaking sensitivity testing for various elasticities, with elasticities based on economic principles and/or published data;
- Estimating elasticities from:
  - Visitor surveys asking if visitors would have undertaken the trip if prices were to increase/decrease by various amounts i.e. if price for charters in the marine park increased by $10 per person would you have still have undertaken it?...and so on[13].
  - Producer surveys of how visitation changes with changes in prices - based on past experience or expectations.

[12] Price elasticity of demand is a measure of the responsiveness of quantity demanded to a change in price. This information together with the market price and quantity allows estimation of the demand curve and the associated consumer surplus.

[13] Survey respondents having already expended resources to reach the destination complicate this approach and hence additional prices may now be less significant than if they had known of them when planning their holiday.

Special Cases - Amenity

Another use value associated with marine resources is the amenity provided to adjoining landowners by its presence. This amenity is in the form of views, access, environmental condition etc.

The value of this amenity may be reflected in the price of houses or land.

The price of houses is a function of the environment and other variables:

Ph = P(S, A, E, Y)

where S, A and E are sets of structural, access and environmental attributes (Abelson, 1996) and Y represents economic variables.

The partial derivatives, dPh/dE and so on, show the implicit price for each attribute. In Figure 4.4 it is assumed that dPh/dE is a function of E, i.e. the more of E that is available, the less willing purchasers are to pay for that attribute. The quantity of the environmental attribute (E) is represented on the horizontal axis.

The development of an hedonic price equation, such as that given above, can be undertaken through collection of primary data on house prices, and the structural, access and environmental attributes of the properties. Econometric analysis enables implicit prices for varying levels of an environmental good (implicit price schedule) and other attributes to be identified. Such an approach is resource intensive. Alternatively, property valuation experts can be used to estimate the component of property values that is attributed to varying levels of a specific environmental attribute.

Hence, the total benefit to property values can be ascertained from an estimate of this implicit price and the quantity of properties affected.

The implicit price schedule represented in Figure 4.4 is generally not a demand curve, but a locus of points on the demand curves of many households. Figure 4.4 shows two household demand curves (Da, Db) for an access good such as proximity to the ocean. In equilibrium each household chooses a location where its marginal WTP for the environmental good equals the marginal implicit price of the good. Only if all households have similar demand functions will the implicit price curve be the same as the demand curve (Abelson 1996).

Nevertheless, the implicit price schedule is commonly used as a measure of WTP values and is generally considered a reasonable approximation (Abelson 1996).

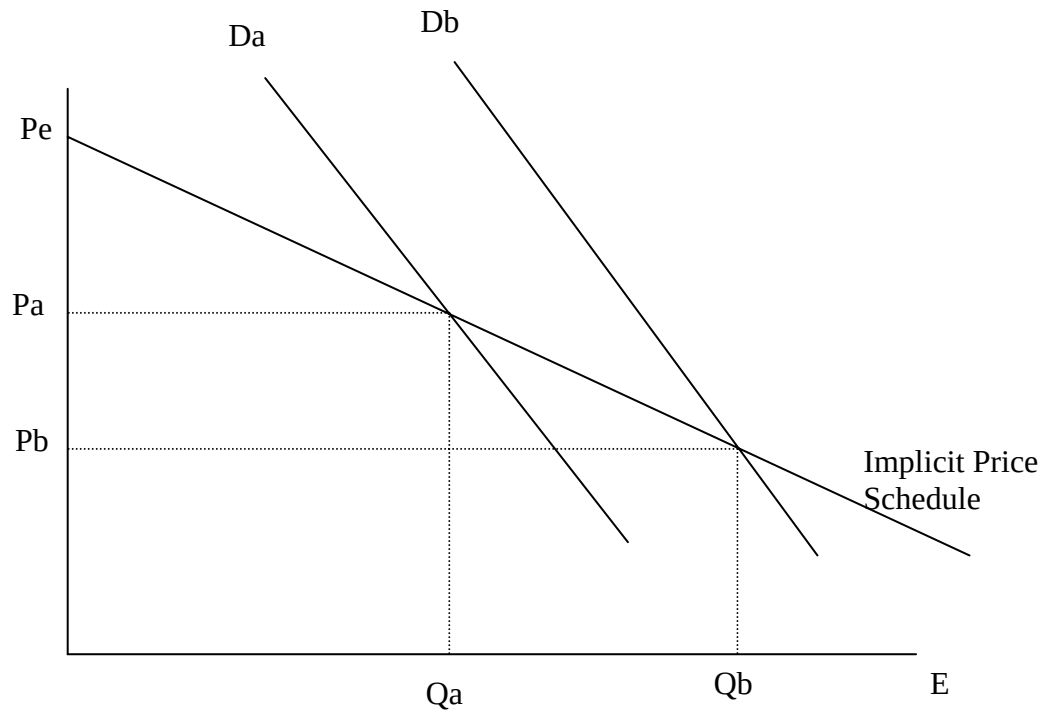

Figure 4.4 Environmental Prices and the Demand for Environmental Quality

4.2.4 Use Values - Non-market Goods and Services

Even where goods and services are provided outside a market, the concepts of demand and supply can still be conceptualised and provide the basis for modelling and estimating economic values.

For non-market use values, such as recreational fishing, swimming, snorkelling etc., the concept of a demand curve exists as if it were a market good (Driml 1994).

For **each** non-market use provided by the marine environment it is therefore possible to conceptualise a downward sloping demand curve.

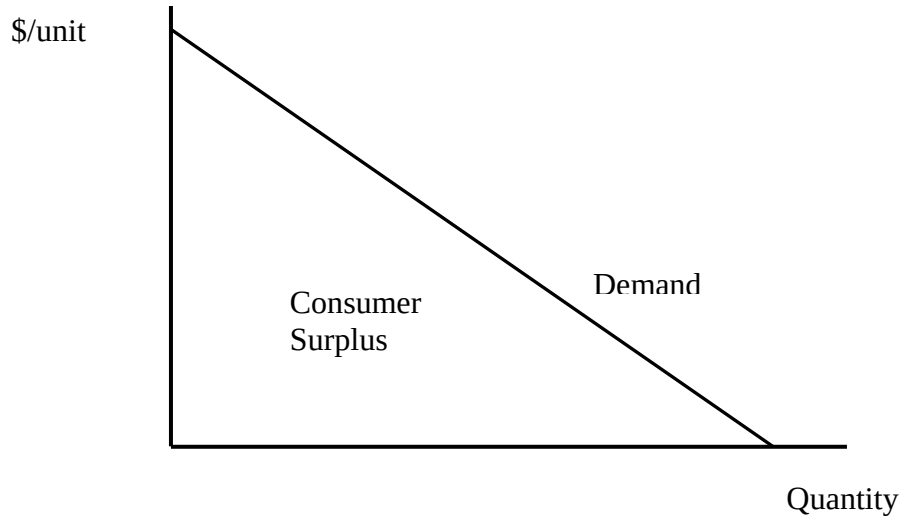

Figure 4.5 Measure of Consumer Surplus for Non-Market Good or Service

The only difference is that the demand curve is not readily identifiable from market transactions and therefore needs to be derived from observing consumer behaviour using revealed preference valuation techniques such as the travel cost method or stated preference techniques such as contingent valuation and choice modelling. The travel cost method was specifically developed for the estimation of non-market use values and is discussed below.

Travel Cost Method

The travel cost method requires the implementation of a specific survey of non-market users and specific data manipulation i.e. two stage regression analysis[14]. It is possible to analyse the relationship between visitation rate and travel costs, as is required by the TCM, on either an individual visitor basis or across a number of distance defined zones. For the individual approach, the number of times each person visits a site in a pre specified time period is considered as a function of the costs incurred by each person. Taking into account a range of other factors that may influence a person's visitation decision can further refine this relationship. These factors could include income, age, life cycle stage, educational background, activities undertaken onsite etc.

The zonal approach requires visitation rate to be defined as the number of visitors per thousand head of population from a specific geographic area per pre specified time period. The travel costs for each zone are taken as an average across all people visiting from each zone. An assumption that people in each zone undertake the same quantity of visits at the same monetary cost is implicit.

[14] A regression equation is derived showing the relationship between visitation rates from different zones (or by different individuals) and the travel costs from these zones (or for these individuals). This equation is then used to simulate the effect of hypothetical entry charges on total visitor numbers. A second regression is undertaken to develop a relationship between varying prices and total visitor numbers i.e. a demand curve. The area under the demand curve and above the actual price line gives an estimation of the consumer surplus.

This approach generalises across the geographically defined zones and so is incapable of incorporating the refined socio-economic factors that can be recognised in the individual approach.

Clearly, the fine detail that is captured by the individual approach is desirable from the perspective of developing an accurate model and specifying the value of individual uses. However, applying the individual approach is limited to cases where there is significant variability in the rate of visitation amongst people undertaking recreation at the site. For many natural areas, especially those located well away from major population centres, visitation rates will be predominantly be at most one visit per twelve months. Without variability in the visitation rate, identifying the relationship between it and travel costs will yield meaningless results.

The choice between the alternative approaches therefore depends on the nature of the visitation pattern. Where visitors frequently return to the site over a year, the individual method is preferable. Otherwise, it is necessary to revert to the broader brush approach of the zonal method.

Key data that requires collection from users for the more commonly applied zonal travel cost model includes:

- Composition of visiting group;
- Postcode of usual place of residence from which the recreation trip commenced;
- The importance of the visit to the marine park for the group's trip.

Refer to Appendix 2 for an example of a simple travel cost method survey.

For the individual travel cost model it is also important to ask:

- How many times in the last year the group has visited the marine park;
- Demographic information on the makeup of the group;
- Activities the group is undertaking in the marine park; and
- Socio-demographic information such as education levels, work status, profession, income etc.

Additional data can also be collected to test various models (refer to Bennett 1995), however, the above information is the minimum required to develop travel cost models and estimate the consumer surplus for non-market uses.

Stated Preference Methods

Stated preference methods such as contingent valuation and choice modelling can also be used to estimate use values and unlike the travel cost method are also able to be used to estimate non-use values.

The contingent valuation method (CVM) establishes a hypothetical market for environmental goods or services and uses a survey questionnaire to elicit people's willingness to pay for some change in the supply or quality of the good or service. The value estimated is obtained using statistical techniques such as probit or logit regression and often relates to a bundle of goods e.g. a wetland with associated flora, fauna and use.

Choice modelling is a stated preference technique in which respondents choose their most preferred resource use option from a number of alternatives. Each alternative exhibits a number of attributes such as land affected, impacts on threatened species, household cost etc. Through statistical means (multinominal, nested or mother logit) choice models produce estimates of the value in changes in individual attributes as well as the value of aggregate changes in environmental quality. Choice modelling can thus be used to produce estimates of the value of multiple resource use alternatives.

4.2.5 Indirect Use values - Ecosystem Function Values

While some economists consider indirect use (ecosystem function) values as a special category of environmental values, they can usually be decomposed into either use values or non-use values and estimated accordingly.

For instance, ecosystem function values associated with marine resources include:

- Fish protection and stock recruitment;
- Protection of biodiversity; and
- Assimilation of urban and non-urban runoff and point source pollution.

To the extent that protection of fish stock leads to:

- Increased commercial catches in adjoining areas, this value would be measured through estimating the increase in producer surplus, and where relevant consumer surplus, of those who benefit. This may involve the use of bioeconomic modelling to model the biomass flow into and out of the protected and surrounding areas (refer Section 3.3.1).
- Increased benefit associated with recreational activities, for example recreational fishing, snorkelling etc, measured by an increase in consumer surplus using non-market valuation techniques.
- Increased utility for the community from knowing that fish stocks and their biodiversity are protected (non-use value) then this value would be measured by estimations of the demand (consumer surplus) of the community for protection through non-market valuation measures such as contingent valuation and choice modelling.

Assimilation of waste from terrestrial runoff and point source pollution can also be decomposed into use and non-use values. If runoff or pollution does not need to be contained on land or treated to a higher level before discharge, this confers a cost saving on society. This cost saving accrues to either individual producers, if they were required to undertake additional treatment, or government if they would otherwise have to undertake action. Measuring a base-line value for this cost saving, however, is problematic in the absence of alternative policy scenarios ("with" and "without" scenarios) as the cost saving involved would depend on what alternative treatment or detention would be required[15]. Baseline determination of physical volumes of run-off, pollutants etc. is therefore preferable to value estimation for this item.

To the extent that runoff and pollution impacts on the biodiversity of the marine park, there will be negative impacts on the use and non-use values of society. However, measurement of baseline use and non-use values already has regard to the existing condition of the environment. Change in use and non-use values associated with alternative policy scenarios for runoff and pollution is relevant to evaluation of alternative policy scenarios (refer to Section 4.6) rather than baseline values.

4.2.6 Non-Use Goods and Services

As identified above, non-use values are measured by directly asking about individuals' preferences using state preference techniques such as choice modelling or contingent valuation. This requires the implementation of a survey instrument that unlike travel cost method surveys needs to be specifically designed on a case-by-case basis. Specific data manipulation is required to elicit consumer surplus estimates e.g. logit or multi-nomial logit regression.

While historically there have been some attempts to separately measure the components of non-use consumer surplus values i.e. option values, existence values, bequest values etc. these are really just different explanations why people may hold non-use values. Non-use values are therefore generally measured in their entirety using stated preference techniques.

4.2.7 Government Costs

Because there is generally a public good element associated with environmental goods, there requires some government intervention in managing the environmental resource. Government costs associated with managing nature resources such as the marine environment essentially represent a supply curve for that good. (Refer to Figure 4.6.) When supply is restricted to Q, in Figure 4.6, which is the amount of management that is provided in any given year. The total cost of Government management is the area under the supply curve, given by area 0CDQ.

[15] There is no alternative waste treatment proposed and hence a cost saving attributable to the marine environment cannot be estimated. With other values discussed in this report there is a more distinct "with" and "without" scenario, the physical effects of which can potentially be estimated.

Often the Government costs may be offset to some extent by revenues such as permit fees etc, given by the area 0PSQ in Figure 4.6. The net cost (or net revenue) of Government activity in managing the environmental resource can be thought of conceptually as a negative producer surplus (or positive producer surplus if this occurs). This net cost[16] should also be included when considering the economic values of an environmental resource. The net cost to Government in Figure 4.6 is given by area PCDS.

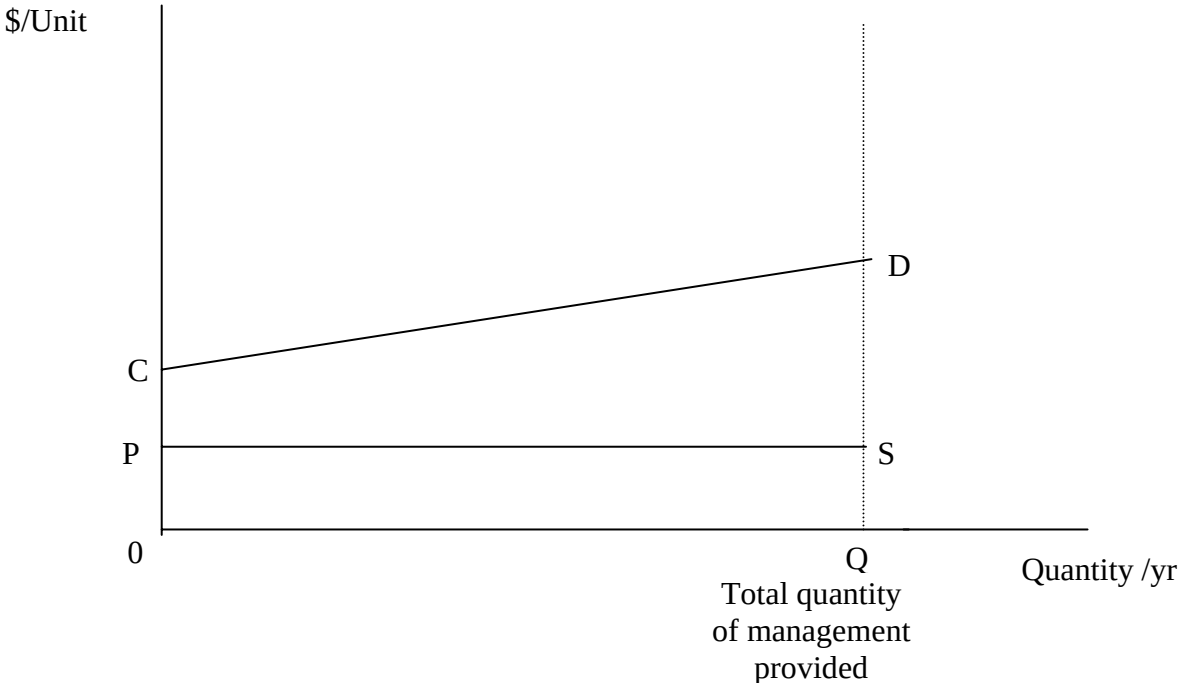

Figure 4.6 Measure of Net Economic Cost to Government

[16] Permit fees paid by producers or consumers to government are simply a means of partially or fully funding government costs. However, provided permit fees paid by producers or consumers are included in the calculation of producer surplus or consumer surplus and revenue received by government is included in the calculation of net government costs. Therefore these values will net out leaving the full net costs of Government management. This approach is often simpler than estimating producer surplus net of permit fees and government revenue net of permit fees.

4.2.8 Conclusion

The total economic value of an existing marine park or marine resources comprises use (direct and indirect) and non-use values. With regard to measurement of these values the important distinction is between market and non-market values.

The correct measures of value for market based use activities e.g. commercial fishing, organised tours etc are:

- Producer surplus, which can be estimated directly from revenue and cost market data; and where relevant
- Consumer surplus, which can be estimated through sensitivity testing of different price elasticities of demand, based on economic theory or published data or through visitor surveys.

The correct measure of value for non-market use values such as recreational fishing, boating, sightseeing etc. and non-use values is consumer surplus. These values can only be estimated indirectly using non-market valuation techniques such as the travel cost method, contingent valuation or choice modelling and require specific survey approaches.

While some economists consider indirect use (ecosystem function) values as a special category of environmental values, they can usually be decomposed into either use values or non-use values and estimated accordingly

Net government costs associated with managing an environmental resource should also be considered and can be estimated directly from Government financial records.

4.3 Regional Economic Impacts

As mentioned in Section 3.6, all activities that involve expenditure in a region provide some stimulus to economic activity in that region.

Hence the following will provide economic stimuli to a region:

- Market based activities;
- Non-market use activities; and
- Government expenditure.

Non-use values do not provide any stimuli to a region since they do not involve any actual consumer expenditure.

Regional economic stimulus is illustrated with reference to the market model for an individual firm, although the same principle applies to expenditure associated with non-market use activity and government expenditure.

Again the demand curve illustrates the revenue received by the firm from the sale of its product. The supply curve indicates the costs of production. These costs of production can be disaggregated into all the inputs into production such as:

- Wages to employees; and
- Other inputs to production such as petrol, machinery repairs and maintenance, clothing, food, transport etc.

Expenditures on any of these inputs to production become revenue to the supplier of the input. So another demand and supply schedule can be envisaged for the supplier of each input to production. The supplier of the input to production also has a range of different expenditures, which in turn become revenues to the supplier of these inputs etc. These first round and industrial support effects are collectively referred to as production-induced effects.

A similar thing happens with wages paid to employees. Employees spend some of their wages on goods and services, which in turn provides revenue for suppliers of these goods and services who have their own expenditure profiles, which provide revenue for suppliers of these inputs etc. These are referred to as consumption-induced effects.

Collectively, production-induced effects and consumption-induced effects are referred to as flow-ons. They measure the backward linkages associated with expenditures.

Because regional economic impact assessment only assesses backward linkages it is essential to identify the point in the production process at which to measure impacts. For instance, a regional economic impact assessment of commercial fishers would estimate the backward linkages associated with the expenditures of commercial fishers but would not capture forward linkages associated with fishing co-ops.

To analyse the regional economic impacts of fishing coops it would be necessary to examine the expenditure patterns of fishing coops. Because regional economic impacts capture backward linkages such an analysis would also encompass the regional impacts associated with commercial fishers. To separate out the regional economic impacts of fishing coops from those of commercial fishers it is necessary to undertake a regional economic impact assessment of coops and commercial fishers and net the latter from the former to avoid double counting.

Because regional economic impact assessment is concerned with a specific region, only direct and indirect expenditure that occurs in the specified region are considered. All other expenditures on goods and services that are provided from outside the region become imports.

A method used to estimate direct and indirect economic stimulus to a region is input-output analysis. This method requires:

- A model of the regional economy to be developed;
- Information on the total revenue and expenditure pattern (including wages to employees) associated with generating this revenue. In particular, expenditure needs to be broken down into different categories as well as by whether it occurs initially within the region or outside the specified region.

The important difference from the information required to estimate producer surplus and net government costs is that not just total revenue and total costs are required but a detailed breakdown of the costs into:

- Expenditure categories; and the
- Location of the expenditure i.e. inside or outside the region.

This generally requires a specific financial questionnaire for all direct expenditure activities e.g. market based activities, non-market activities and government expenditures. An example is provided in Appendix 3.

To estimate regional economic impacts associated with non-market activities, such as recreational fishing, it is necessary to obtain a detailed breakdown of what consumers paid for the recreation experience and which of these expenditures occurred inside the subject region. This expenditure information can be built into a typical travel cost method questionnaire as was done for Dorrigo and Gibraltar Range National Parks and Minnamurra Rainforest Centre (Bennett 1995; Gillespie 1997).

An important distinction between the measurement of economic values (i.e. consumer surplus and producer surplus) and the measurement of regional economic stimuli is that the latter tends to use four measures of economic activity that are not the same as the measures of economic values i.e. producer and consumer surplus.

Regional economic impact analysis measures regional economic activity in terms of direct and indirect:

- Output;
- Value-added;
- Income; and
- Employment.

In terms of the market model, regional economic impact assessment assumes perfectly inelastic demand (i.e. the model assumes a given level of output for each industry) and perfectly elastic supply for products. (Refer to Figure 4.7.) Within this model, direct output is equivalent to total revenue i.e. the area under the price line (OPBQ in

Figure 4.7). Output as a measure of economic activity therefore is not a net measure like producer surplus, as costs of production (supply) are not subtracted.

Direct value-added is the difference between the value of a business' output and the cost of intermediate products, such as raw materials, components or services, used to produce the output (Edwards 1990; Pass and Lowes 1993). However, value-added is not equivalent to producer surplus since the calculation of producer surplus requires all production costs, including labour and capital costs[17], to be subtracted. These costs are not subtracted from value-added calculations because value-added is a measure of returns to factors of product (i.e. capital, labour and land).

In terms of the market model, value-added is the area DPBE in Figure 4.7 and so is greater than producer surplus (CPBA). The degree to which value-added exceeds producer surplus will vary considerably depending on, among other things, the level of labour and capital costs not subtracted and the elasticity of supply.

Income is the wages paid to employees and is a cost of production in the market model i.e. part of the area under the supply curve. Employment is the physical job numbers associated with the wages paid to employees.

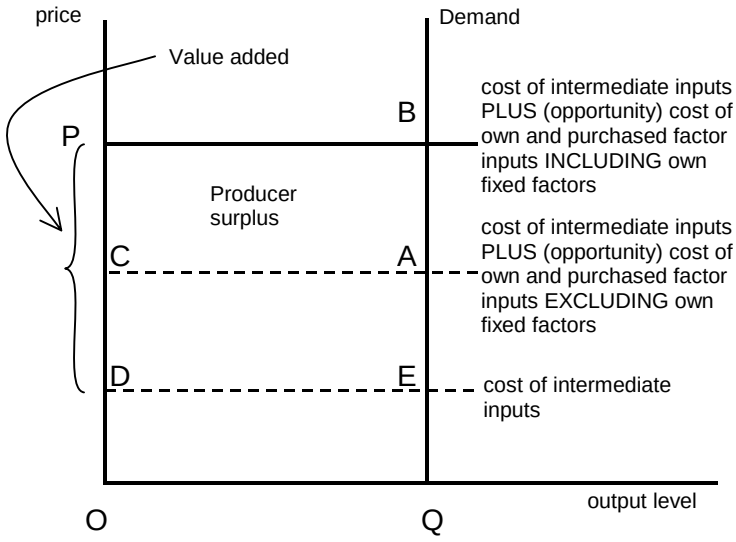

Figure 4.7 Supply and Demand Model in Regional Economic Impact Assessment

A second major difference between the measurement of economic values in accordance with the total economic value framework and the indicators of economic activity used in regional economic impact assessment is that in regional economic impact assessment, direct indicators are measured as well as second and third round affects i.e. flow-ons.

[17] In the short run, calculations of producer surplus may not warrant subtraction of capital costs but in the long run all capital costs must be subtracted.

In the total economic value framework only first round effects on producer and consumer surplus are measured. This is because:

- In a fully competitive economy where there are small changes in output levels there are no real secondary costs and benefits (any secondary costs and benefits displace other benefits and costs);
- Even where the economy is not fully competitive, any spending of resources on alternative projects is assumed to generate comparable secondary costs and benefits;
- The general method of calculating secondary costs and benefits (i.e. regional economic impact analysis) measures income/expenditure rather than surpluses.

4.4 Other Data Requirements

The preceding sections outline the types of economic values and regional economic impacts that may be associated with marine parks, and the economic data required to estimate these values.

However, invariably collection of data may involve specific surveys of all or a sample of relevant businesses, users or the population. It is therefore often necessary to have some other data to facilitate implementation of any survey as well as extrapolation of sample results to the relevant population.

For example, with respect to any financial survey of market operators to estimate producer surplus (consumer surplus, where relevant) or regional economic impacts, it is necessary to know the number of operators and their contact details. This facilitates distribution of any questionnaire.

When only a sample of the operators is questioned, or some operators do not wish to participate, it is necessary to extrapolate the results of the sample to the total number of operators. Extrapolation based on number of operators alone may be inappropriate if operators are of significantly different sizes. Some alternative approach such as total turnover, or total visitors catered for, may be the best method of extrapolation to the population.

Commercial operators, such as commercial fishers and tourism operators, may operate in other areas apart from the marine park. Estimating producer and consumer surplus associated with these activities may therefore overestimate the values associated with the marine park. It will therefore be necessary to obtain some information on the importance of the marine park to their operations. While the commercial fisher or operator is possible the only source of this information, strategic bias may be associated with their response.

With respect to non-market use values and their associated regional economic impacts, surveying of users is generally done onsite. Hence, it is not necessary to know beforehand contact details of those surveyed. Since only a sample of users is likely to be questioned it is, however, necessary to have some estimate of the total number of non-market users. This facilitates extrapolation of the sample results to the total non-market visitor population.

A significant proportion of the population of regional NSW, NSW or Australia may hold non-use values. Hence when surveys attempting to elicit WTP estimates for non-use values are undertaken, a population to sample must be chosen. It is only this population to which extrapolation of the results can be reliably made.

4.5 Summary of the Economic Value of Marine Parks and Data Requirements for their Measurement

The following table provides a summary of the measure, method and data requirements for estimating the baseline economic values of existing marine protected areas (or other marine areas).

Table 4.1 Summary of the measure, method and data requirements for estimating baseline economic use values of marine parks

ECONOMIC VALUE	**MEASURE**	**METHOD**	**DATA REQUIRED**	
Use Value*			**Economic Data**	**Other Data**
Market				
Commercial fishing	Direct PS	Financial survey	Revenue and cost; or Quantity, unit price and unit cost; or Quantity, unit price, % net revenue	No. of operators and contact details; and Total turnover of operators or total catch (to extrapolate sample to); % reliance on marine park
Fishing charter Whale and dolphin watching charter Diving charter	Direct PS and possibly CS	Financial survey and Scenario testing of elasticity of demand (or price sensitivity survey)	Revenue and cost; or Quantity, unit price and unit cost; or Quantity, unit price, % net revenue Sensitivity of visitors to increases in prices	No. of operators and contact details; and Total turnover of operators or total visitors (to extrapolate sample to); % reliance on marine park
Waste Assimilation and other ecosystem services	Cost saving (change in producer surplus)	Market cost data	Not Applicable to Baseline Values	Biological data
Government costs	Direct PS (net costs)	Financial survey	Revenues and costs	N/A

ECONOMIC VALUE	MEASURE	METHOD	DATA REQUIRED	
Use Value*			**Economic Data**	**Other Data**
Non-market				
Recreation fishing	Direct CS	Travel cost method	Group size, postcode of trip origin, importance of marine resource to total trip	Total no. of non-market visitors
Recreational boating	Direct CS			
Swimming	Direct CS			
Parasailing	Direct CS			
Walking	Direct CS			
Education	Direct CS			
Amenity**	Direct CS	Property valuation method	Contribution of amenity to property values	No. of properties benefiting
Research***	Direct CS or PS	Depends on research outcomes		
Non-Use Values*				
Option value	Direct CS	Choice modelling or contingent valuation	Willingness to pay for preservation	Relevant population
Quasi option value	Direct CS			
Vicarious use value	Direct CS			
Bequest value	Direct CS			
Existence value	Direct CS			
REGIONAL ECONOMIC IMPACTS				
Market use activities	Direct and indirect output, value-added, income and employment	Financial expenditure survey	Revenue and expenditure (by item and region)	No. of operators and contact details; and Total turnover of operators or total visitor numbers.
Non-market use activities			Expenditure (by item and region)	Total no. of non-market visitors
Government expenditures			Revenue and expenditure (by item and region)	N/A

*In this table ecosystem function values are not considered separately from use and non-use values.

**Amenity values measured through the property valuation method also capture proximity to the resource reflecting some use values. There is therefore some double counting associated with the values measured through the property valuation method and those measured through the travel cost method.

***The economic values (benefits) associated with research depend on the end potential outcomes associated with the research together with likelihood of adoption. These outcomes may manifest themselves in changes in use values or changes in non-use values depending on the particular nature of the research. There are also costs associated with research and its adoptions. The net economic value of research therefore requires a separate benefit cost analysis to be undertaken incorporating notions of risk and uncertainty e.g. expected net present values.

4.6 Baseline Values and Impacts versus Marginal Change to these Values and Impacts

The total economic value of a marine park relates to the:

- Producer surplus, and where relevant consumer surplus, associated with each market based activity;
- Consumer surplus associated with each non-market use activity;
- Producer surplus and consumer surplus (both market and non-market use values and non-use values) associated with any ecosystem function values;
- Net costs to government; and
- Consumer surplus associated with non-use values.

In addition, market and non-market use activities (including government expenditure) may provide an economic stimulus to the regional economy that are measured in terms of direct and indirect output, value-added, income and employment.

These economic values may be measured at varying points in time. With existing marine parks a program of estimating economic values may involve measuring values in the current year i.e. b in year t in Figure 4.8 and periodically over time i.e. c in year t + 1 in Figure 4.8.

Where a new marine park is proposed a program of estimating economic values may involve measuring economic values before or at the time of declaration i.e. a at time 0 in Figure 4.8 and periodically over time e.g. b at time t and c at time t + 1.

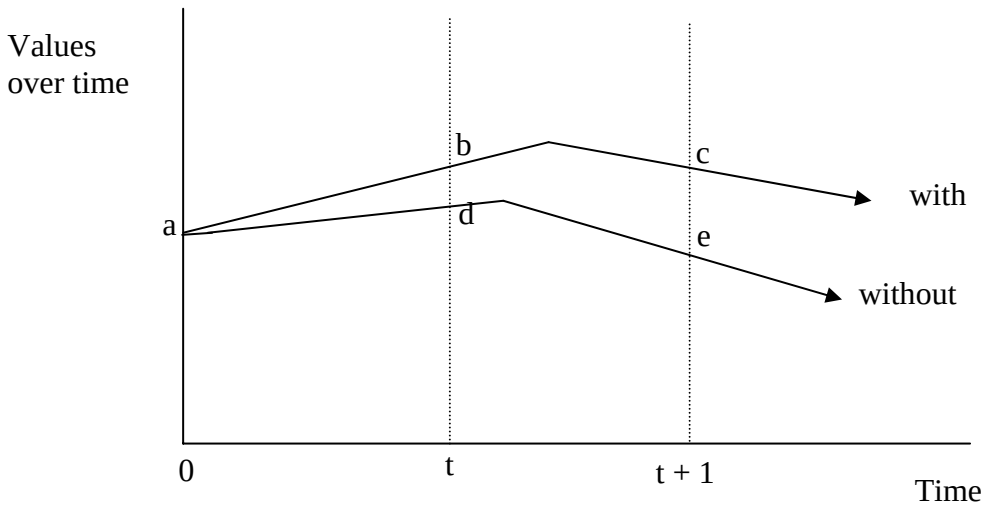

Figure 4.8 Measurement of Economic Values over Time With and Without a Marine Park

The economic values measured by such a program should not, however, be construed as the value of protecting the marine area e.g. by a marine park. Even without gazettal as a protected area much of the visitation and recreational activity may occur in these locations anyway (Davis 2001). A key finding from the review of Australian and international literature relating to the economic values of marine parks (Section 3 of this report) was that although this distinction is recognised in theory, it is often ignored in application.

To examine the economic values generated by protection, or changes in zoning of parts of an existing marine park, requires estimation of the *incremental* change in values. That is, it is relevant to identify and measure how each component of total economic value, and the associated drivers, would change *over time* between the "with" and "without" declaration of a marine park or "with" and "without" zoning changes (cf. Figure 4.8). That is, how producer and consumer surpluses as well as net government costs would change over time.

For existing marine parks, this involves not only measuring existing economic values at time t but also looking backwards from time t in Figure 4.8 and forwards from time t to estimate the economic values of the marine park as well as predicting how these values would have differed in the absence of a marine park.

For prospective marine parks, it involves examining current economic values at time 0 i.e. a in Figure 4.8, and then projecting how these values would change over time e.g. at t, t+1 etc "with" and "without" the marine park.

As previously mentioned, the implementation of zoning plans for marine parks will determine what, if any, changes there will be in use of the marine resource after declaration of the marine park. Some economic values are likely to remain unchanged since there would be no restrictions or changes to uses. Other economic values may vary because the uses permitted may change or the quantity, price and cost of existing uses change. The value of non-market uses may change if environmental attraction changes, visitation numbers change etc.

The important thing is to predict which values are likely to change "with" and "without" a marine park and focus on these for investigation. *Only a subset of total economic values may require investigation.* That is, it may not be necessary to use all of the measures listed in the summary table in Section 4.5. Values affected will require a case by case consideration and will ultimately depend on the detail of management prescriptions proposed for a marine park compared to those under the "without" marine park scenario.

One set of economic values that may potentially change over time "with" and "without" the declaration of a marine park are the producer surpluses associated with commercial fishing.

Declaration of a marine park at time 0 in Figure 4.9 may initially have no impact on commercial fishing. Subsequent zoning (e.g. at time t1) may restrict commercial fishing resulting in some losses of commercial catch. However, stock recovery may ultimately result in greater commercial catches in areas outside restricted zones (e.g. after time t2).

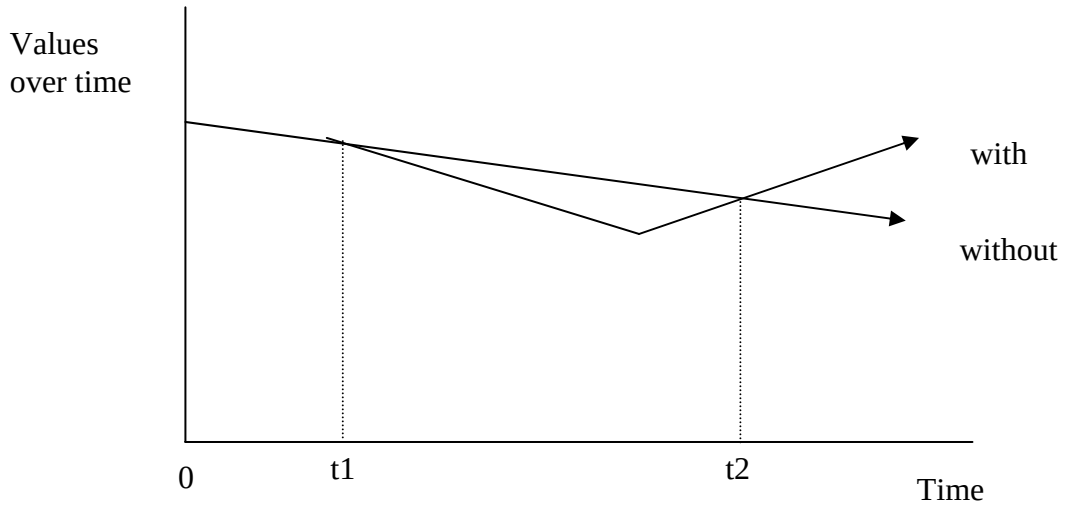

Figure 4.9 Hypothetical Changes in Commercial Fishing Values over Time

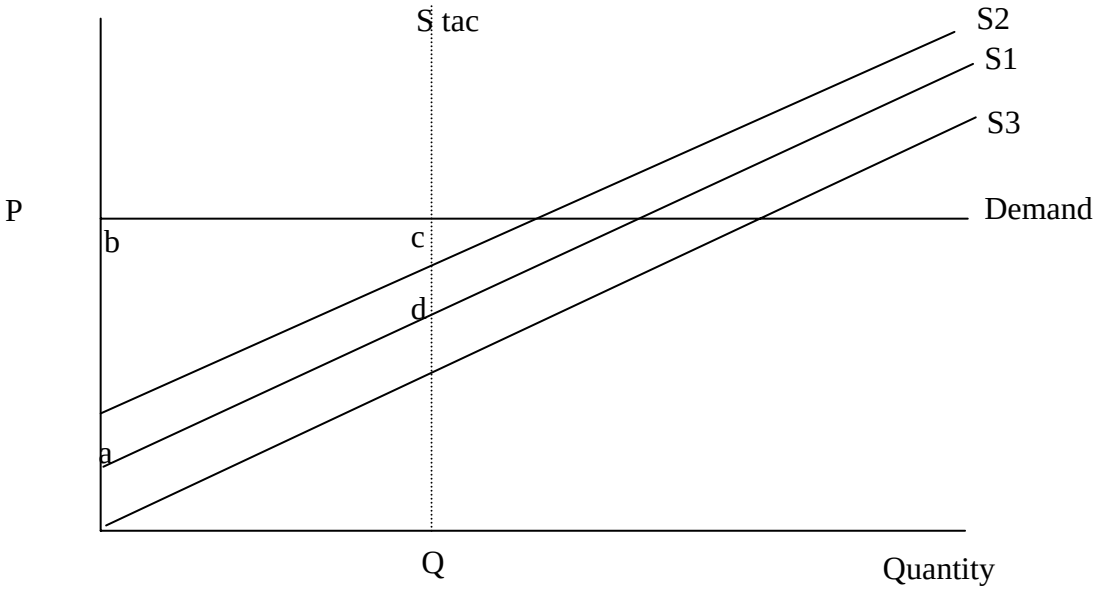

Figure 4.10 Hypothetical Marginal Change over time For |Commercial Fishing Values

These potential changes to commercial fishing can be illustrated with reference to supply and demand models. In Figure 4.10, demand for fish is represented by an elastic demand curve with price P. It is assumed for simplicity that the total allowable fishing catch for commercial fishers is set at Q. The current marginal cost (at time 0) of supplying Q fish is given by S1. The producer surplus that accrues to commercial fishers is given by the area under the demand curve and above S1 as constrained by quantity Q i.e. area abcd.

At point t1 in Figure 4.9, restrictions on the area to which commercial fishers can operate results in increased fishing effort and hence increased costs to achieve the same total allowable catch. This is illustrated in Figure 4.10 as a shift in the supply curve to S2 and a resultant decrease in producer surplus. This increased cost continues each year until after t2 in Figure 4.9 when the increase in availability of fish stocks in surrounding waters results in a reduction in effort, and hence costs, associated with commercial fishers catching Q fish. The result is a shift in supply curve to S3 and an increase in producer surplus.

Another potential scenario relating to incremental commercial fishing values is if there is some increase in willingness to pay for fish caught from a marine park (analogous to dolphin friendly tuna). This can be conceptually thought of as a shift in the demand curve for fish and hence an increase in producer surplus.

Models for changes to recreational fishing can also be developed. Figure 4.11 assumes that initially after the declaration of marine park there is no change in the economic values of recreation fishing. However, after restriction of commercial fishing, t1, fish stocks build and hence more fish are available within the marine park for recreational fishers. After the imposition of any restrictions of access on recreation fishers a decline in the economic values associated with recreational fishing occurs until after time t2 the values are less than they would have been at that point in time without the marine park.

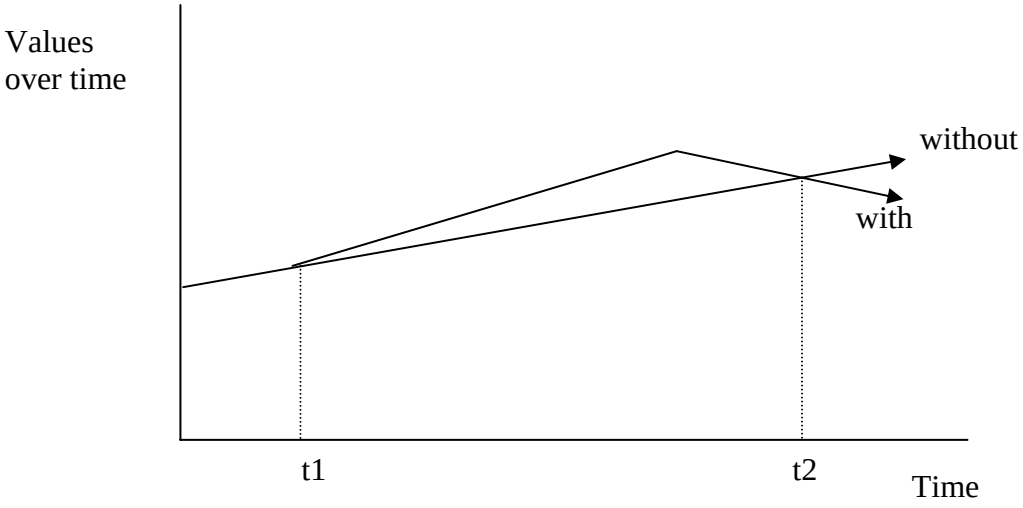

Figure 4.11 Hypothetical Changes in Recreation Fishing Values over Time

These hypothetical changes to recreational fishing can be illustrated with reference to supply and demand models. In Figure 4.12, demand for recreational fishing is represented by a downward sloping demand curve. The area under the demand curve is the total willingness to pay or consumer surplus associated with recreational fishing. At t1 in Figure 4.11, demand shifts to the right relative to the "without" marine park scenario. The increase in consumer surplus, relative to the without marine park scenario, is associated with two effects:

- An increase in consumer surplus for existing users due to increased probabilities of catching fish, Area A in Figure 4.12; and
- An increase in recreational fishers, Area B in Figure 4.12.

Access restrictions on recreational fishers can be modelled as supply constraint, S1, in Figure 4.12, that reduces consumer surplus to recreational fishers.

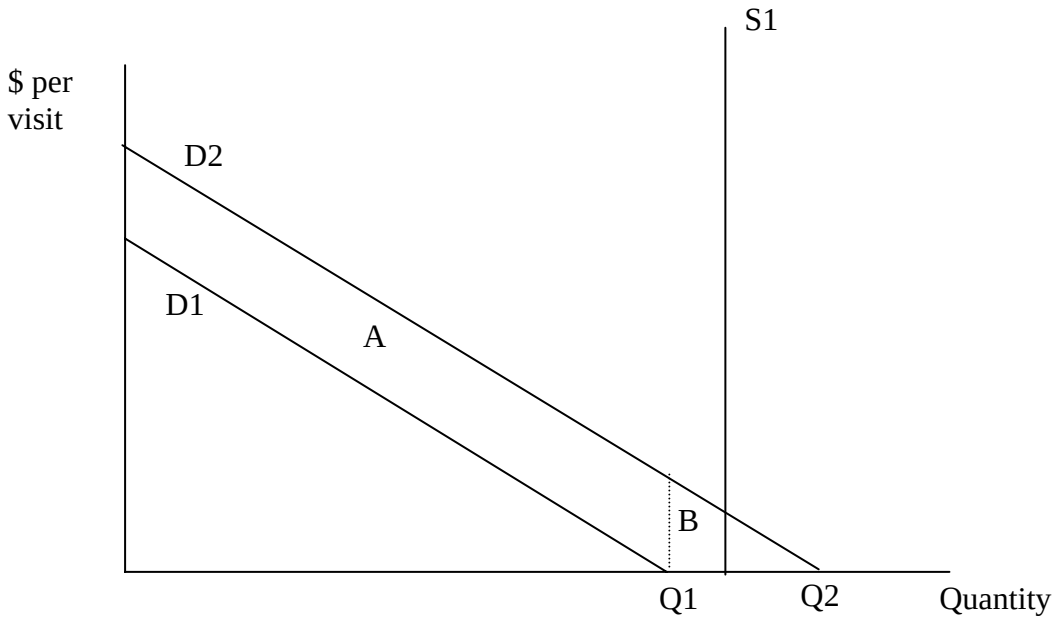

Figure 4.12 Hypothetical Changes in Recreation Fishing Values

Models for changes in producer and consumer surpluses to commercial tourism operators can also be developed. For instance, one scenario may be that after management prescriptions begin to have an effect, t1 in Figure 4.13 the producer and consumer surpluses associated with commercial tourism operators increase over time relative to the "without" marine park scenario due to the improved condition of the environmental resource. This scenario is represented in Figure 4.13.

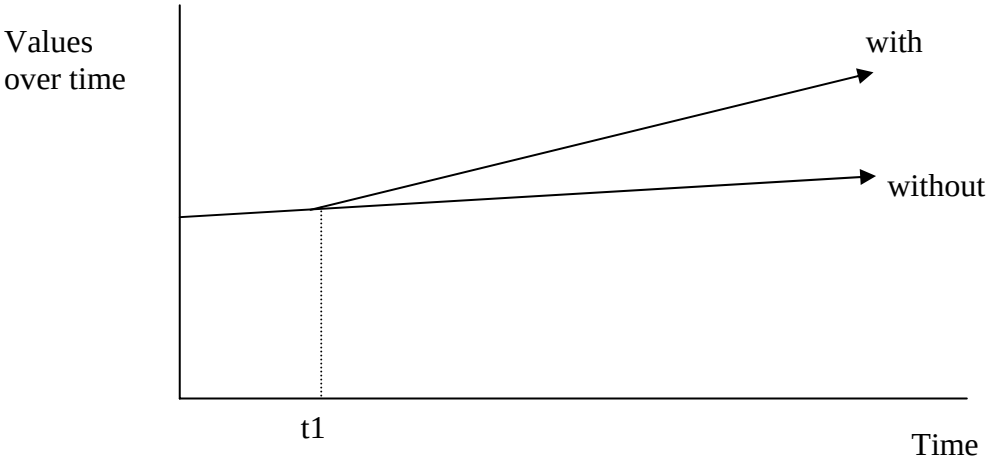

Figure 4.13 Hypothetical Changes in Commercial Tourism Values over Time

Referring to supply and demand models, the change in producer and consumer surplus for any particular year between the "with" and " without" scenario can be represented by an increase in demand.

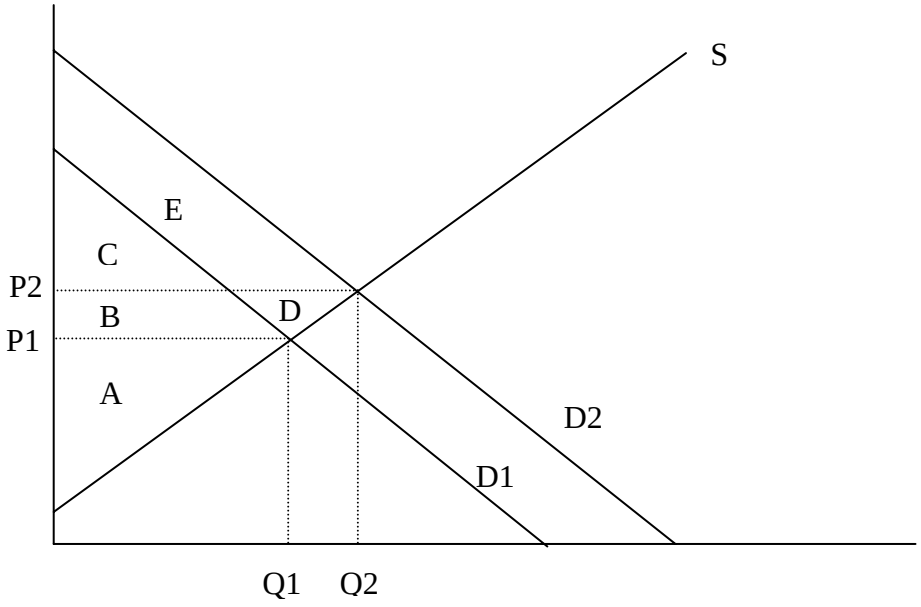

Figure 4.14 Hypothetical Changes in Commercial Tourism Values

In Figure 4.14, demand for commercial tourism services is represented by a downward sloping demand curve, D1, resulting in a price of P1 and quantity produced e.g. number of visits per annum of Q1. The economic values associated with commercial tourism operations is producer surplus, A, and consumer surplus, areas B and C.

At point t1 in Figure 4.13, the improved environmental amenity and/or status of the marine park results in increased demand, D2, relative to the "without" marine park scenario. This shift in demand results in a new market equilibrium of P2Q2. The resulting producer surplus is now the area given by A, B and D while the resulting consumer surplus is given by the area C and E.

The incremental producer surplus is given by area B and D. However, the gain to producers represented by B is a transfer from the benefit originally enjoyed by consumers, it does not therefore represent a net gain to society. The incremental benefit to society is given by the increase in producer surplus (net of transfers), D, and the net increase in consumer surplus, E.

Where demand is perfectly elastic, the incremental benefit of a shift in P1 to P2 would comprise the increase in producer surplus, B and D.

The above are just examples of how demand and supply models can be used to determine the effect on economic values over time of different management prescriptions. The specific models that are applicable for any particular marine park will ultimately depend on the exact management prescriptions that apply "with" a marine park compared to "without" a marine park and the implications of these for market and non-market users.

The key principle, however, is that any producer surpluses and/or consumer surpluses that are predicted to occur over time under the "without" marine park case but are reduced or foregone under the "with" marine park scenario are considered an economic cost, while increased or new producer and consumer surpluses generated from the "with" marine park scenario are considered an economic benefit.

In this benefit cost analysis framework, provided the discounted incremental economic benefits exceed the discounted incremental economic costs then the proposal is considered to provide a net benefit to the community and an improvement in economic efficiency.

Such a benefit cost analysis can be undertaken *ex ante* i.e. before a decision is taken to declare a marine park or *ex post,* after the declaration of a marine park. An *ex ante* benefit cost analysis of a prospective marine park would require examination of current economic values and a projection of the likely incremental change in values over time "with" and "without" the marine park.

An *ex post* benefit cost analysis of an existing marine park would require examination of:

- The current economic values of the marine park;
- Prediction of the likely current economic values "without" the marine park;
- Historical reflection of the incremental difference in economic values "with" and "without" the marine park;
- Prediction of the future incremental difference in economic values "with" and "without" the marine park; and
- Overall assessment of whether projected gains from the MP were actually realised in practice.

Examining how expenditure patterns in the region would change and modelling these using input-output analysis can also be used to estimate the incremental change in regional economic stimulus “with” and “without” a marine park. Because regional economic impact assessment is based on a model of the economy in a particular year, it may be necessary to develop a model of the economy at 5 or 10 year intervals to allow for predicted autonomous changes in a regional economy. Changes in expenditure patterns predicted at these intervals between the "with" and "without" change scenario could then be assessed through manipulation of the economic model. Key information that would be required for each use activity is revenue, employment and expenditure by category, inside and outside the specified region "with" and "without" the policy change.

With respect to this regional economic impact framework, it should be noted that all proposals whether economically efficient or not will provide an economic stimulus to a region. Hence while the method can be used to estimate changes in regional economic activity (value-added, output, income and employment) associated with alternative policy scenarios, unlike the benefit cost analysis framework there are no guidelines for interpretation of whether or not an increase or decrease in economic activity is economically desirable.

Ideally, any monitoring program of the economic values of marine parks should facilitate the measurement of the:

- Total economic value and regional economic impact of marine parks; and
- Incremental economic value and regional economic impact of marine parks.

However, for any existing marine park or prospective marine park it is only possible to **actually** monitor the "with" marine park scenario in the time lines of Figures 4.8, 4.9, 4.11 and 4.13. The "without" scenario cannot be observed. Estimation of the "without" marine park scenario can therefore only be undertaken via predictions and bioeconomic modelling, or the testing of various scenarios based on consultation with:

- Affected producers and consumers; and
- Relevant experts.

The monitoring program developed here is therefore primarily focused on estimating the use components of the total economic value of existing or prospective marine parks, and the regional economic impacts of marine parks, and draws primarily on the methods and data requirements summarised in Section 4.5.

The only alternative to this would be to attempt to establish some "control" area, where no marine park is declared, and monitor usage and economic values over time with some later comparison and analysis of this vis-à-vis a marine park area.

5 Review of Existing Data Availability and Procedures for Ongoing Data Collection and Monitoring

5.1 Introduction

In Section 4 of this report a technical framework was developed for identifying and measuring baseline economic values of direct and indirect use activities associated with marine resources. A summary of economic and other data required to measure the baseline economic values identified was presented in Section 4.5. Issues associated with measuring the value of changes in use activities resulting from marine park declaration were also considered.

The purpose of this section is to further consider the data requirements for the conceptual models developed in Section 4. This section includes a review of existing data availability, identification of data gaps, and discussion of procedures and alternatives for filling data gaps. Data for estimating the values associated with each of the major use categories, as identified in earlier sections, being market or commercial uses, non-market or non-commercial uses, ecosystem function values, and government activity, are considered.

As part of the review of existing data availability, Hassall and Associates undertook consultation with managers from each of the four marine parks in NSW as well as representatives from NPWS, NSW Fisheries, local councils and the EPA. A listing of persons consulted as part of study is provided in Section 6. Information obtained from the review of economic and other relevant literature relating to the economics of marine parks, as presented in Section 3, also contributed to the preparation of this section. A summary table of existing data by use category and Marine Park is included in Appendix 1.

5.2 Commercial or Market Activities

5.2.1 Commercial Fishing

Data required

As was highlighted in Sections 3 and 4 of this report, the correct measure for estimating the value of commercial fishing is producer surplus. The data required to make this estimate together with regional economic impacts was listed in Section 4.5 and includes:

- Economic data
  - Revenue and cost; or
  - Quantity, unit price and unit cost; or
  - Quantity, unit price, % net revenue.

- Other data
  - Number of operators and contact details;
  - Total turnover of operators or total catch (to extrapolate sample to); and
  - Importance of specific marine areas (e.g. current or prospective marine parks) to the commercial catch of each port.

To estimate the flow-on effects of commercial fishing to the regional economy using Input-Output modelling detailed revenue and expenditure data is required by item and by region.

Available Data

Data relating to the total commercial catch in NSW is collected on a monthly basis by NSW Fisheries. This data provides the total weight of the catch by species. Value estimates of the total catch are then made based on average monthly prices achieved for each species through the Sydney Fish Markets.

The NSW Fisheries data is broken down into ocean regions, which may include a number of ports. This data is not relevant for the Lord Howe Island Marine Park as there are no commercial fishing licences issued for this Park. Consultation with the Lord Howe Marine Park however, indicated that commercial fishing charters might sell their catch. Fishing charter operators are required to report the total volume of their catch by species and location on a quarterly basis.

To ascertain the value of the commercial catch in the other three NSW Marine Parks, further surveying of operators would need to be conducted to determine the contribution from within the marine park area to their total catch as this breakdown is not currently available.

Catch values and quantities can be used to estimate revenue to commercial fishers however further information is required to estimate operational costs. Hart's (1997) estimate of producer surplus of commercial fishing operations in the Solitary Islands Marine Park adopted cost estimates from a study by McVerry (1995) on commercial fishing in the Clarence. Reliable estimates of costs applicable to commercial fishing operators in each of the NSW Marine Parks however, would require financial surveys targeted at the relevant operators.

To estimate the flow-on effects of commercial fishing to the regional economy a breakdown of revenue and expenditure of commercial fishers is required by item and by region. This information is not currently available and would need to be included in financial surveying.

As mentioned in Section 4.4, to facilitate implementation of a survey of a population of sample of commercial fishing operators it is necessary to know the number of operators and their contact details. NSW Fisheries holds this information for licensed commercial fishers in NSW. Information provided by licensees includes contact details, where there operation is based, where they work and information relating to their fishing vessels. This information is subject to privacy laws.

Data Gaps
Additional data required to estimated producer surplus values and regional economic impacts includes:

- Importance of specific marine areas (e.g. current or prospective marine parks) to the commercial catch of each port;
- Prices received by the fishers compared to Sydney Fish Market prices; and
- Cost data (including regional expenditure).

5.2.2 Other Commercial Activities – Tour and Charter Operations

Data Required
As identified in Section 4.5, the data required to measure the value of commercial tour and charter operations, in terms of producer surplus, and the regional economic impacts includes:

- Economic data
  - Revenue and cost; or
  - Quantity, unit price and unit cost; or
  - Quantity, unit price, % net revenue.

- Other data
  - Number of operators and contact details;
  - Total turnover of operators or total visitors (to extrapolate sample to); and
  - Importance of specific marine areas (e.g. current or prospective marine parks) to the commercial operation.

Revenue and expenditure of commercial operators by item and by region is also required to measure the flow-on effects of these operations to the regional economy.

Available Data
The requirement for permits to be held by commercial operators in NSW Marine Parks means that the number and contact details of commercial tour and charter operations is held by the MPA. The permitting system in the Cape Byron Marine Park will come into effect this year. Data on the number of charter operators in the Park however, was collected for the *Background Resource Working Paper for the Cape Byron Marine Park* in mid 2003 (MPA 2003).

Commercial tour and charter operators in the Solitary Islands and Lord Howe Island Marine Parks are also required to report information on passenger numbers to the MPA. Further, operators in the Solitary Islands Marine Park provided data on the duration of the trip and where in the Park the operator went.

Historically the Jervis Bay Marine Park has not recorded passenger numbers and trip details from commercial tour and charter operations. The Park however, does have a specific project looking at recording the number of divers in the Park. Data has been collated from dive logs from four of the main dive operators in the park. This information dates back at least 5 years. Over the last year, some information on passenger numbers and activities has been collected from other commercial operators.

Commercial operators are not required to report on their financial details nor activities conducted outside the marine park. Financial surveying would therefore be required to provide estimates of unit revenue and cost data as well as the importance of the marine park to the operators total business. Hart (1997) surveyed commercial tourist operators in the Solitary Islands Marine Park to obtain revenue and cost estimates used to measure producer surplus. No such studies for other marine parks in NSW were identified.

Data Gaps
Based on the review of available data relating to commercial tour and charter operators the following data gaps were identified:

- Actual passenger numbers for those operating within the Jervis Bay and Cape Byron Marine Parks;
- Price/revenue data;
- Cost data (including regional expenditure); and
- Importance of specific marine areas (e.g. current or prospective marine parks) to the commercial operation.

5.3 Non-Commercial or Non-Market Activities

5.3.1 Use for recreational or educational purposes

Data Required
As identified earlier in this report, visitors may use marine parks for a variety of recreational and educational activities. Recreational activities conducted within marine parks include fishing, boating, diving, walking, surfing, parasailing and swimming. The correct measure of value for these non-market uses is consumer surplus, which is estimated indirectly using non-market valuation techniques. A common non-market valuation technique used is the Travel Cost Method. The data required to use this method includes:

- Economic data for the zonal model:
  - Group size;
  - Postcode of trip origin; and
  - Importance of marine resource to total trip.

- Additional economic data for the individual model:
  - How many times in the last year the individual has visited the marine park;
  - Activities the individual is undertaking in the marine park; and
  - Socio-demographic information such as education levels, work status, profession, income etc.

- Other data
  - Total number of non-market visitors.

An important component of recreational use activities in marine parks are the flow-on effects which visitors have on the local economy e.g. recreational fisher expenditure at local bait and tackle shops or expenditure on accommodation from those living outside the region. To estimate these flow on benefits, detailed information on expenditure within the region is required from non-market users. This information can be obtained through a financial expenditure survey.

Available Data

A travel cost survey was conducted by Hart (1997) for the Solitary Islands Marine Park to estimate the demand function and hence measure consumer surplus of recreational visitors to the Park. Hart (1997) estimated the annual recreational value as $445,401 or $2.18/person/visit. In reviewing Hart's work, Davis (2001) noted the major limitations of the study were that the opportunity costs of time of visitors was not included in the analysis and the value of the site to local residents was not accounted for (this value could be measured using Hedonic Pricing Techniques refer Section 4.3.2).

In the review of literature and existing data availability conducted as part of this study, there was no other empirical work identified, other than that by Hart (1997), attempting to quantify the economic value, in terms of consumer surplus, for recreational activities in NSW Marine Parks. Tourism NSW and some of the relevant Shire Councils provide estimates on the overall value of tourism to the local economy however these estimates are purely financial, do not breakdown the importance of the marine park to visitors and do not capture the value of the marine park to local residents. Specific surveying approaches would need to be undertaken to collect this information.

Although not collecting the economic data required for making value estimates of consumer surplus, some general visitor surveys have been conducted at NSW Marine Parks, which may assist in providing information on the number, general demographics and preferred activities of park visitors. The Solitary Islands Marine Park has just completed its second annual visitor survey, which is conducted during the peak summer months. Both locals and visitors to the region are questioned on their use of the park and basic demographic information. Recreational use surveys were also completed for the Cape Byron Marine Park as part of the Background Resource document (MPA 2003) prepared to assist in the management and planning of the newly formed Park. These surveys gathered information on the number of visitors and type and location of recreational use activities in the park. No such surveying has been completed for the Jervis Bay or Lord Howe Island Marine Parks.

There are a number of other studies within NSW Marine Parks looking at recreational fishing, boating and diving. These studies are aimed at obtaining data in terms of effort and distribution but do not gather the other economic data required (refer Section 4.5) to estimate consumer surplus. The Jervis Bay Marine Park has an ongoing study that monitors the number and distribution of recreational vessels across the Park using GPS technology. Similar monitoring is conducted in the Solitary Islands Marine Park.

Data Gaps

A review of existing data relating to recreational uses of marine parks in NSW indicated that although there is some information on the numbers, demographics and preferred activities of visitors to some marine parks in NSW, this information does not provide the necessary economic data to estimate consumer surplus and hence the economic value of recreational use activities. Further surveying of visitors using the Travel Cost Method would therefore need to be conducted for each site to obtain the following information:

- Group size;
- Postcode of trip origin;
- Importance of marine resource to total trip;
- Regional expenditure;
- Annual visitor numbers;
- How many times in the last year the group has visited the marine park;
- Demographic information on the makeup of the group;
- Activities the group is undertaking in the marine park; and
- Socio-demographic information such as education levels, work status, profession, income etc.

5.3.2 Amenity

Data Required

Another non-market use value identified in Section 4 was amenity values. This value represents the amenity provided to adjoining landholders by the marine resource, for example views and access, and is measured by the property valuation method. The economic data required to make this estimate is the contribution of amenity to property values. Other data required is the total number of properties benefiting for which to extrapolate the sample to.

Available Data

There has been no previous work attempting to estimate amenity values of NSW Marine Parks although there is some anecdotal evidence from discussions with Park Managers suggesting that the presence of a marine park has increased surrounding property values.

Data Gaps
Data required to estimate amenity values includes:

- Contribution of amenity to property values; and
- Number of properties benefiting.

5.3.3 Research

Data Required
One of the important uses of marine parks is research activity. By providing areas for protecting and conserving marine biodiversity the marine park system provides a good opportunity to undergo monitoring and research of scientific and ecological aspects of the marine environment. As mentioned in Section 4, the economic values associated with research depend on the end potential outcomes associated with the research together with the likelihood of adoption. To measure these values it would be necessary to undertake separate benefit cost analysis incorporating risk and uncertainty.

A further measure of the value of research in marine parks is expenditure and the flow-on effects to the regional economy. This data is gathered through financial expenditure surveys of those conducting research activities.

Available Data
While Hassall is aware of benefit cost analysis studies being undertaken for research and development activities in a number of other industries we are not aware of any such studies for research activity in marine parks.

Both the MPA and NSW Fisheries issue permits to those conducting research activities within NSW marine parks. Given this the number of research participants and contact details can be obtained. While researchers provide the MPA with information relating to the nature of studies they undertake in the park, they are not required to provide financial information. This information would therefore need to be obtained through a survey of the relevant population.

Data Gaps
Data required to estimate the value of research within marine parks includes:

- Direct revenue and costs to research body (including regional expenditure);
- Expected outcomes of research in terms of potential benefits and adoption rates; and
- Costs associated with research and its adoption.

5.4 Ecosystem Function Values

Data Required

As identified in Sections 3 and 4 there are indirect use values associated with marine parks that are often referred to as ecosystem function values. These values include fish protection and stock recruitment, which may lead to spillover benefits in adjoining areas, protection of biodiversity and assimilation of urban and non-urban run-off and point source pollution.

These factors may influence the market and non-market uses outlined above in terms of consumer and producer surplus. For example, if spillover benefits occur this may lead to an increase in producer surplus or if park visitor's value improved biodiversity this will increase consumer surplus estimates. In order to gauge these effects however it is necessary to monitor to what extent these ecosystem benefits are actually occurring, if at all. This will be achieved through specialised scientific and ecosystem studies.

As mentioned in Section 4.2.5 above, monitoring of baseline volumes of run-off and pollutants can help determine the value of waste assimilation

Available Data

Although the issue of spill over benefits is well covered in the international literature relating to marine resource economics, there have been no specific studies of this nature conducted in relation to NSW Marine Parks. This is largely due to the fact that zoning plans and hence effective no take areas in the parks are still in draft form or have only recently been implemented hence it is too early to measure the spill over effects. Consultation with Park Managers however, indicates that monitoring of spill over benefits is a research issue that is being considered for the future. Studies identified in Section 3 as utilising bioeconomic flow models to estimate spill over effects could be assessed for their relevance to NSW marine parks.

Baseline ecosystem and scientific data is collected for each marine park selected in NSW as part of the bioregional and site assessments performed before the Park is declared. There are a number of other one-off and ongoing monitoring studies conducted within marine parks and surrounding areas that may contribute to data requirements for ecosystem function values. These studies are listed for the relevant Parks on the MPA website and should be considered in the context of the specific economic questions being asked.

Data Gaps

- Biological information linking management prescriptions to commercial fish catches and commercial tourism operations without and outside marine parks; and
- Data on the quantity of run-off and pollutants from both diffuse and points sources that are assimilated by marine parks.

5.5 Government Expenditure

Data Required

Formation of a marine park requires management activities to be undertaken by government, for which there are costs associated. As mentioned in Section 4.2.7, some of these costs will be offset by revenues collected from permitting and fees. Government expenditure and revenue also provide flow-on benefits to the regional economy, which should be included in Input-Output modelling. For this purpose revenue and expenditure would need to broken down by item and region.

Available Data

Under the present setup of the MPA public reporting of financial data is not a requirement. Financial data for NSW Marine Parks has been included in MPA annual reports dating back from 2000; however, in recent years this information has not been reported. Although not currently publicly reported, the data is held by NSW Government and can be broken up by park and by item. Funding for NSW Marine Parks is made available to NSW Fisheries, NSW NPWS and NSW MPA hence data would need to be compiled from these three sources.

Data Gaps

The data exists however needs to be compiled from different data sources.

5.6 Frequency of Monitoring

There are no specific guidelines on the desired frequency of monitoring programs. Many factors may have influence including political priorities, funding, the volatility of use patterns, availability of data etc.

However, in keeping with the general approach taken in program reviews, a 5 year time frame is considered reasonable for distinct surveys such as the travel cost method, financial surveys of fishers and commercial tourism operators etc.

In intervening years, extrapolation of economic values can be undertaken based on estimated changes in visitor or passenger numbers or changes in catch volumes rather than requiring revised cost and revenue estimates.

However, where other surveys are to be undertaken on a more frequent basis, for example, visitor surveys, piggy backing of additional questions such as travel cost questions, would be desirable.

5.7 Assessment of Incremental Effects

As identified in Section 4, for any existing marine park or prospective marine park it is only possible to **actually** monitor the "with" marine park scenario. The "without" scenario cannot be observed.

Estimation of the "without" marine park scenario, and ultimately the incremental impact of the marine park, is therefore best undertaken through the testing of various scenarios based on consultation with effected producers and consumers.

For any, survey undertaken of users to ascertain the economic values of their activity, it would be possible to also include a question regarding their view on the incremental effect that the declaration of the marine park has had on their activity relative to if there was no marine park.

For instance, after asking commercial tourism operators for information on their current revenues and costs, they could be asked how they think their costs and revenues would have been different if there was no marine park. A similar question could be asked of commercial fishers, operating inside and outside of marine parks.

In relation to any expert property valuation study, valuers could be asked for their view on:

- How much views contribute to property values?; as well as
- How much the existence of a marine park contributes to property values?

With respect to non-market use values, visitors could be asked to what extent the existence of the marine park contributed to their use of the area. This information could be used to postulate the level of demand shift that could be attributed to the marine park.

6 Study Findings and Conclusions

There are four marine parks in NSW, Cape Byron, Jervis Bay, Solitary Islands and Lord Howe Island, established under the Marine Parks Act 1997. These parks are managed by the MPA for conservation of marine biodiversity and to maintain ecological processes.

There are a number of direct and indirect uses of marine parks generating a range of economic values for the community and associated regional economic impacts for local economies. The main uses of marine parks as identified in this study include:

- Commercial or market activities. Most common commercial activities in marine parks or of marine resources include:
  - Fishing charter operators;
  - Commercial fishing;
  - Commercial dive tours;
  - Whale and dolphin watching charters;
  - Other sight-seeing tours;
  - Surf schools; and
  - Jetski hire and parasailing.

- Non-commercial or non-market activities such as:
  - Recreational fishing;
  - Private boating;
  - Research and education;
  - Beach, rocky shore and headland walks;
  - Surfing; and
  - Camping.

- Ecosystem function values, which may include:
  - Fish stock recruitment and protection;
  - Habitat and biodiversity maintenance; and
  - Waste treatment and assimilation.

The correct measures for estimating these values include consumer and producer surplus, net costs to government and flow-on effects or multipliers to the regional economy. Further, the true economic value provided by a marine park is measured as the marginal change in the value of these uses resulting from protection.

As part of this study, both Australian and international literature relating to the economic values of marine protected areas was reviewed. The review found that there has been little empirical work attempting to quantify the direct and indirect uses of marine parks, particularly in Australia. Those studies that have quantified marine park use values tend to be partial estimates focusing on only one, or a few, of all the possible park uses and generally fail to capture the marginal change in resource use and hence the true value from protection.

The review of literature therefore indicated that estimating all the values associated with marine park use would require the concurrent use of a number of economic models. These conceptual models were discussed in Section 4 of this report and the associated data requirements identified.

As identified in Section 5, some of this data is available from agency bodies such as the MPA, NPWS and NSW Fisheries. In addition to this, some value estimates have been made in previous studies, particularly for the Solitary Islands Marine Park. A summary of exiting data availability is provided in Appendix 1. The available data however tends to be incomplete, in a form that is not suitable for use in economic models or inconsistent across the four marine parks in NSW. Hence specific surveying would need to be undertaken to collect the data required to estimate the direct and indirect use values associated with each park.

Surveys undertaken to ascertain the economic values of their activity, should include questions to ascertain the incremental effect that the declaration of the marine park has had on their activity relative to if there was no marine park.

There are no specific guidelines on the desired frequency of monitoring programs. Many factors may have influence including political priorities, funding, the volatility of use patterns, availability of data etc. A 5-year timeframe is considered reasonable for distinct surveys such as the travel cost method, financial surveys of fishers and commercial tourism operators. However, where other surveys are to be undertaken on a more frequent basis, such as visitor surveys, piggy backing of additional questions e.g. travel cost questions, would be desirable.

Ultimately the studies undertaken and the frequency of any monitoring are at the discretion of the NSW MPA and will depend on its research priorities and available resources.

7 List of Persons Consulted as Part of the Study

Name
Position
Agency/Organisation

Simon Banks
Marine Parks Coordinator
NSW MPA

Graham Byron
Manager, Jervis Bay Marine Park
NSW MPA

Francis Clements
Acting Manager, Jervis Bay Marine Park
NSW MPA

David Godden
Manager, Conservation Economics Group
NSW National Parks and Wildlife Service

Phyllis Jones
Cape Byron Shire Council

Geoff Kelly
Manager, Lord Howe Island Marine Park
NSW MPA

Mick Lowry
NSW Fisheries

David Makin
Manager, Catch Records
NSW Fisheries

Helen Muldoon
Executive Officer
NSW MPA

Andrew Page
Manager, Cape Byron Marine Park
NSW MPA

Libby Sterling
Manager, Solitary Islands Marine Park
NSW MPA

8 References

Abelson, P. W. (1996) *Project Appraisal and Valuation of the Environment*, Macmillan Press, London.

Bennett, J. (1995) *The Economic Value of Recreation Use of Gibraltar Range and Dorrigo National Parks*, prepared for NSW National Parks and Wildlife Service.

Bennett, J. (1996) *The Economic Efficiency Of RACAC Resource Allocation Options: A Conceptual Framework*, prepared for the Resource and Conservation Assessment Council.

Bureau of Rural Sciences (2003) Implementing the Representative Areas Program in the Great Barrier Reef Marine Park. BRS assessment of potential social impacts on commercial fishing and associated communities – draft report. Bureau of Rural Services, Canberra.

Bureau of Tourism Research (2003) Assessment of tourism activity in the Great Barrier Reef Marine Park Region – Final Report, Bureau of Tourism Research, Canberra.

Carter, D. W. (2003), 'Protected areas in marine resource management: another look at the economics and research issues', Ocean and Coastal Management 46, pp. 439-456.

Clark, J. R., Causey J A, and Bohnsack (1989), Benefits from coral reef protection: Looe Key Reef, Florida. 6th Symposium on Coral and Ocean Management. Charleston, South Carolina, USA.

Coleman, D. and Plowman, B. (1996) *Patterns of Visits to the Solitary Islands Marine Reserve during winter and summer 1995*. Report prepared for ANCA and New South Wales Fisheries by Centre for Leisure Research. School of Leisure Studies, Griffith University.

Conrad, J. M. (1999), 'The bioeconomics of marine sanctuaries', Journal of Bioeconomics 1(2), pp. 205-217.

Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neil, R.V., Paruelo, J., Raskin, R.G., Sutton, and van den Belt, M. (1997) The value of the world's ecosystem services and natural capital *Nature* V387, 15 May 1997, pp.253-260.

Davis, D. (2001) *The Economic Value and Regional Economic Impact of the Solitary Islands Marine Park*, Prepared for the NSW Marine Parks Authority.

Davis, D., and Tisdell, C. (1996), 'Economic Management of Recreational Scuba Diving and the Environment', Journal of Environmental Management 48(3), pp. 229-248.

DEST, Department of Finance, Resource Assessment Commission (1995) *Techniques to Value Environmental Resources*, AGPS, Canberra.

Dixit, A. and Pindyck, R. (1994) *Investment Under Uncertainty*, Princeton University Press, Princeton.

Driml, S., (1994) *Protection for Profit: Economic and Financial Values of the Great Barrier Reef World Heritage Area and Other Protected Areas*. Research Publication No 35, Great Barrier Reef Marine Park Authority, Townsville.

Driml, S. (1999) Dollar Values and Trends of Major Direct Uses of the Great Barrier Reef Marine Park, Research Publication no. 56, Great Barrier Reef Marine Park Authority, Townsville.

Edwards, S. (1990) *An Economic Guide to Allocation of Fish Stock between Commercial and Recreational Fisheries*, NOAA Technical Report NMFS 94, US Department of Commerce, Washington.

Farrow, S., Sumaila, U. R. (2002), 'Conference summary: the 'new' emerging economics of marine protected areas', Fish and Fisheries 3, pp. 356-359.

GBRMPA (2003) Summary report of the social and economic impacts of the rezoning of the Great Barrier Reef Marine Park, Great Barrier Reef Marine Park Authority, Townsville.

Gillespie, R. (1997) *Economic Value and Regional Economic Impact: Minnamurra Rainforest Centre, Budderoo National Park*, NSW National Parks and Wildlife Service.

Hannesson, R. (2000), Economics of Marine Reserves. Economics of Marine Protected Areas, Vancouver, BC.

Hayakawa, H. and Farrow, S. (2000) An Implementable Precautionary Principle: Investing in Safety. Discussion Paper, Center for the Study and Improvement of Regulation, Carnegie Mellon University, Pittsburgh, PA.

James, D. and Gillespie, R. (2002) *Guideline for economic effects and evaluation in EIA*, prepared for Planning NSW.

Jensen, R. and West, G. (1986) Input-Output for Practitioners: theory and applications, AGPS, Canberra.

KPMG Consulting (2000) Economic and Financial Values of the Great Barrier Reef Marine Park, Research Publication no. 63, Great Barrier Reef marine Park Authority, Townsville, March.

Leeworthy, V. R., Wiley, P. C. (1999), Proposed Tortugas 2000 ecological reserve draft socio-economic impact analysis of alternatives, Special Projects Office-NOAA National Ocean Service.

McClanahan, T. R. and Kaunda-Arara, B. (1996), 'Fishery Recovery in a coral-reef marine park and its effect on the adjacent fishery', Conservation Biology 10, pp. 1187-1199.

McLeod, P. and Nicholls, J. (2002*a*) A socio-economic valuation of resource allocation options between recreational and commercial fishing uses, Part 1 – A general theoretical framework, FRDC Project 2001/065, Economic Research Associates, Perth.

McLeod, P. and Nicholls, J. (2002*b*) A socio-economic valuation of resource allocation options between recreational and commercial fishing uses, Part 2 –The Western Australian Cockburn Sound Crab Fishery case study, FRDC Project 2001/065, Economic Research Associates, Perth.

McLeod, P. and Nicholls, J. (2003*a*) A socio-economic valuation of resource allocation options between recreational and commercial fishing uses, Part 3 – The Perth Abalone Fishery case study, FRDC Project 2001/065, Economic Research Associates, Perth.

McLeod, P. and Nicholls, J. (2003*b*) A socio-economic valuation of resource allocation options between recreational and commercial fishing uses, Part 4 – The West Coast Wetline Fishery case study, FRDC Project 2001/065, Economic Research Associates, Perth.

McVerry, S. (1995) *A socio-economic evaluation of the Clarence River commercial fishery*, unpublished Honours Thesis, School of Resource Science and Management, Southern Cross University, Lismore.

Morrison, M. and Hatfield-Dodds, S. (2003) *Valuing Public Goods when Respondents Don't Have to Pay*, Paper presented to the 47th Annual Conference of the Australian Agricultural and Resource Economics Society.

MPA (2003) Marine Parks Authority Status Report 2000-2003. NSW Marine Parks Authority.

MPA (2001) Developing a Representative System of Marine Protected Areas in NSW – an Overview. Prepared by the NSW Marine Parks Authority Marine Protected Area Strategy Working Group. Heartland Publishing, Canberra.

Pass, C. and Lowes, B. (1993), *Collins Dictionary of Economics*, HarperCollins, Glasgow.

PDP Australia (2003) An economic and social evaluation of implementing the Representative Areas Program by rezoning the Great Barrier Reef Marine Park. Report on the revised Zoning Plan. PDP Australia, Sydney.

Pendleton, L. H. (1995), 'Valuing coral reef protection', Ocean and Coastal Management 26(2), pp. 119-131.

Polunin, N. V. C., Roberts, C. M. (1993), 'Greater biomass and value of target coral reef fishes in two small Caribbean marine reserves', Marine Ecology Progress Series 131, pp. 97-113.

Roberts, C. M., Bohnsack, J. A., Gell, F., Hawkins, J.P. and Goodridge, R. (2001) 'Effects of Marine Reserves on Adjacent Fisheries', Science 294, pp. 1920-1923.

Roberts, C. M., Polunin, N. V. C. (1994), 'Hol Chan: demonstration that marine reserves can be remarkably effective', Coral Reefs 13, p. 90.

Sanchirico, J. N. (1998), The Bioeconomics of Spatial and Intertemporal Exploitation: Implications for Management. Ph.D. Thesis: Department of Agricultural and Resource Economics: University of California at Davis.

Sanchirico, J. N. (2000), Marine Protected Areas as Fishery Policy: A Discussion of Potential Costs and Benefits, Resources for the Future, Discussion Paper 00-23.

Sluka R, Chiappone M, Sullivan KM, and Wright R (1997) 'The benefits of a marine fishery reserve for Nassau grouper (Epinephelus striatus) in the central Bahamas'. Proceedings of the 8th International Coral Reef Symposium, Panama. 2: 1961–1964.

Sumaila, U. R. (1998), 'Protected marine reserves as fisheries management tools: a bioeconomic analysis', Fisheries Research 37(1-3), pp. 287-296.

Sumaila, U. S. and Charles, A. T. (eds.) (2002*a*) Special Issue: Economic models of marine protected areas I, *Natural Resource Modelling*, 15(3).

Sumaila, U. S. and Charles, A. T. (eds.) (2002*b*) Special Issue: Economic models of marine protected areas II, *Natural Resource Modelling*, 15(4).

Suman, D. O., Shivlani, M. P., Milon, J. (1999). 'Perceptions and attitudes regarding marine reserves: a comparison of stakeholder groups in the Florida Keys national marine sanctuary', Ocean and Coastal Management 42(12), pp. 1019-1040.

Walters, C. (1999), 'Impacts of dispersal, ecological interactions, and fishing effort dynamics on efficacy of marine protected areas: how large should protected areas be?, University of British Columbia, Vancouver: Fisheries Centre Working Paper.

Williamson, D (2000) An assessment of the effectiveness of management zoning in protecting reef fish stocks of the Palm Islands and the Whitsunday Islands, Central Section, Great Barrier Reef. Unpublished report, Dept of Marine Biology & Aquaculture, James Cook University.

Young, M. D. 1992, *Sustainable Investment and Resource Use: Equity, Environmental Integrity and Economic Efficiency*, Unesco, Paris and the Parthenon Publishing Group.

Appendix 1 - Summary of Data Availability

Data collected for:			Solitary Islands	Jervis Bay	Lord Howe Island	Cape Byron
Commercial Fishing	Previous Value Estimates		Yes – Davis (2001) and Hart (1997)	Not identified	Not identified	Not identified
	Ongoing Data Requirements	Number of operators	Yes - NSW Fisheries	Yes - NSW Fisheries	No licenced commercial fishing within the Park though recreational fishing charters may sell catch. Charter operators require permits and report catch and location.	Yes - NSW Fisheries
		Operator contact details	Yes - NSW Fisheries	Yes - NSW Fisheries	See above	Yes - NSW Fisheries
		Total turnover of operators or total catch	Yes - NSW Fisheries has total catch	Yes - NSW Fisheries has total catch	See above	Yes - NSW Fisheries has total catch
		Unit price data	Yes - NSW Fisheries has catch value	Yes - NSW Fisheries has catch value	Not identified, could use NSW Fisheries value estimates	Yes - NSW Fisheries has catch value
		Unit cost data or % net revenue	Not identified	Not identified	Not identified	Pg 62 Background resource doc
		Importance of MPA to total fishing operation	Not identified	Not identified	Not identified	Not identified

Data collected for:			Solitary Islands	Jervis Bay	Lord Howe Island	Cape Byron
Commercial Tour and Charter Operations	Previous Value Estimates		Yes – Davis (2001) and Hart (1997)	Not identified	Not identified	Not identified
	Ongoing Data Requirements	Number of operators	Yes – MPA permits	Yes – MPA permits	Yes – MPA permits	MPA permits from Nov 03
		Operator contact details	Yes – MPA permits	Yes – MPA permits	Yes – MPA permits	MPA permits from Nov 03
		Total turnover of operators or total passengers	Yes – Operators are required to provide the MPA with passenger numbers	MPA has dive logs for the past 5 or more years and is beginning to collect data on numbers and activities from other commercial operators	Yes – Operators are required to provide the MPA with passenger numbers	Not identified
		Unit price data	Not identified	Not identified	Not identified	Not identified
		Unit cost or % of net revenue	Not identified	Not identified	Not identified	Not identified
		Importance of MPA to total operation	Operators provide MPA with information on passenger numbers, days they went out and where they went	Not identified	Not identified	Not identified
		Sensitivity of visitors to increases in prices	Not identified	Not identified	Not identified	Not identified

Data collected for:			Solitary Islands	Jervis Bay	Lord Howe Island	Cape Byron
Waste Assimilation	Previous Value Estimates		Not identified	Not identified	Not identified	Not identified
	Ongoing Data Requirements	Physical data on runoff and pollutants	MPA has no information, check with local councils and EPA	MPA has no information, check with local councils and EPA	MPA has no information, check with local councils and EPA	MPA has no information, check with local councils and EPA
Government Costs	Previous Value Estimates		Davis (2001) and Hart (1997)	Not identified	Not identified	Not identified
	Ongoing Data Requirements	Revenue data	MPA annual reports	MPA annual reports	MPA annual reports	MPA annual reports
		Cost data	MPA annual reports	MPA annual reports	MPA annual reports	MPA annual reports
Recreational Fishing	Previous Value Estimates		Yes – Davis (2001) and Hart (1997) using TCM	Not identified	Not identified	Not identified
	Ongoing Data Requirements	Total number of visitors	MPA conducts annual visitors survey	MPA conducts GPS monitoring of recreational vessel numbers across the park	Not identified	MPA conducted a recreational use survey 12 months ago recording number of people, activities and location in the Park
		Group size, postcode of trip origin, importance of MPA to total trip	MPA conducts annual visitors survey	Not identified	Not identified	See above

Data collected for:			Solitary Islands	Jervis Bay	Lord Howe Island	Cape Byron
Recreational Boating	Previous Value Estimates		May be included in Hart's (1997) visitor survey	Not identified	Not identified	Not identified
	Ongoing Data Requirements	Total number of visitors	MPA conducts annual visitors survey	MPA conducts GPS monitoring of recreational vessel numbers across the park	Not identified	MPA conducted a recreational use survey 12 months ago recording number of people, activities and location in the Park
		Group size, postcode of trip origin, importance of MPA to total trip	MPA conducts annual visitors survey	Not identified	Not identified	See above
Other Recreational Activities (e.g. walking, surfing etc)	Previous Value Estimates		Davis (2001) and Hart (1997)	Not identified	Not identified	Not identified
	Ongoing Data Requirements	Total number of visitors	MPA conducts annual visitors survey	Not identified	Not identified	MPA conducted a recreational use survey 12 months ago recording number of people, activities and location in the Park
		Group size, postcode of trip origin, importance of MPA to total trip	MPA conducts annual visitors survey	Not identified	Not identified	See above

Data collected for:			**Solitary Islands**	**Jervis Bay**	**Lord Howe Island**	**Cape Byron**
Education	Previous Value Estimates		Not identified	Not identified	Not identified	Not identified
	Ongoing Data Requirements	Total number of visitors	MPA conducts annual visitors survey	Not identified		MPA conducted a recreational use survey 12 months ago recording number of people, activities and location in the Park
		Group size, postcode of trip origin, importance of MPA to total trip	MPA conducts annual visitors survey	Not identified	Not identified	See above
Amenity	Previous Value Estimates		Not identified	Not identified	Not identified	Not identified
	Ongoing Data Requirements	Number of properties benefiting	Not identified	Not identified	Not identified	Not identified
		Contribution of amenity to property values	Not identified	Not identified	Not identified	Not identified
Research	Previous Value Estimates		Davis (2001) and Hart (1997)	Not identified	Not identified	Not identified
	Ongoing Data Requirements	Number of research activities	Yes – MPA permits	Yes – MPA permits	Yes – MPA permits	Yes – MPA permits
		Contact details of research organisations/project managers	Yes – MPA permits	Yes – MPA permits	Yes – MPA permits	Yes – MPA permits
		Expenditure data	Not identified	Not identified	Not identified	Not identified

Appendix 2 - Simple Travel Cost Method Questionnaire

Question 1

Including yourself, how many people are visiting Minnamurra Rainforest Centre in your group?

Adult members of your family ----------
Other adults ----------
Children (17 years and under) ----------

Question 2

In which city or town is your group's usual place of residence? (If you live out of town, please indicate your nearest city or town.)

---------- State---------- Postcode---------

Question 3

Is a visit to Minnamurra Rainforest Centre the sole purpose for your group's trip?

Yes 1
No 2

If a visit to Minnamurra Rainforest Centre is the sole purpose of your group's trip, you have completed this questionnaire. Otherwise, please answer Question 4.

Question 4

How important is your group's visit to Minnamurra Rainforest Centre, relative to the other things your group is doing on this trip?

Very important 1
Somewhat important 2
A little important 3
Not very important 4

Example of Non Commercial Recreation Activity Expenditure Question

Please give your best estimate of the amount your group has spent (or intends to spend) on the following items within the Shire of Kiama (i.e. in the towns of x, y and z) during your trip from your usual place of residence to the Marine Park and return.

Accommodation - motels, camping fees, admission fees etc.....

Prepared meals - in restaurants, cafes etc.....

Shopping - Souvenirs, food, camping gear etc.....

Transport fares, car rentals, tour costs.....

Petrol, oil, car repairs.....

Other (please specify).....

Appendix 3 - Expenditure Surveys

Requested Regional Economic Impact Question

Example of Expenditure Questions to Commercial and Government Activities

Annual Revenue and Expenditure		12 months ended:
INCOME All revenue from sales		Employment No. Full-time (perm) _____ Part-time (casual) _____
TOTAL INCOME		

EXPENDITURE		Value	Expenditure %	Location
Expenditure Item			Inside Region	Elsewhere
Labour:	Full-time			
	Part-time			
	On Costs			
Energy:	Electricity/ Gas			
	Wood			
Materials:	Fuel/ Oil/etc			
	Timber			
	Workshop requirements			
	Tools etc			
	Other Materials			
Repairs & Maintenance:	Building			
	Plans			
	Motor Vehicle			
	Roads/ Tracks			
Admin:	Phone/ Fax/ Postal			
	Accountancy/ Legal			
	Bank Fees			
	Interest			
	Net Insurance			
	Vehicle Rego			
	Rates			
	Rent/Taxes/Levies			

EXPENDITURE continued	Value	Expenditure %	Location
Expenditure Item		Inside Region	Elsewhere
Depreciation			
Advertising			
Donations			
Travel			
Entertainment			
Office Supplies			
Others (please specify)***:***			
TOTAL EXPENDITURE			
CAPITAL EXPENDITURE			

Expenditure categories can be adjusted to suit the type of enterprise being surveyed. Often it is best to just use the accounting categories used by the firm, with them identifying % of expenditure for each category inside the region and outside the region.

Appendix 4 - Commercial Fishers Survey

COMMERCIAL FISHERS ECONOMIC SURVEY 200x

«Sh'Num»
«AuthPersFirstName» «AuthPersInitial» «AuthPersSurname»
«BusinessName»
«PostAddr1» «PostAddr2»
«PostSbrb» «PostCode»

Dear X

<< >> has been retained by NSW Marine Parks to determine the economic values associated with commercial fishing in the << >> Marine Park and the contribution commercial fishing makes to the << >> regional economy.

To do this, << >> requires financial information relating to your commercial fishing activities in the last financial year. Any information that you provide will be confidential and held only by the consultant. Once we have analysed the data your survey forms will be destroyed and results will only be reported in aggregate.

It is important that the information that you provide is accurate and only relates to your fishing activity associated with the in the << >> port. It should not include income or expenses relating to other businesses or other ports.

The annual revenue and cost information should be for the last full financial year. You should be able to copy much of the information directly from your taxation returns. Please provide any additional information that you think will help << >> to understand your fishing expenses.

If you have any questions relating to this survey, please call me during office hours on << >>.

When you have completed the questionnaire, please return it to me using the reply paid envelope provided. Alternatively, you can return your questionnaire by fax
<< >>. We would like to receive the completed forms by << >>.

Yours sincerely
<< >>

Revenue

Please indicate the quantity of the commercial catch from the << >> port in the last financial year?……**kgs.**

What was the total value of this commercial catch at the << >> port? **$**……

What percentage of this catch was from the << >> Marine Park (or marine area)? ……**%**

Capital Costs

In the following tables, please include a list of all capital equipment that you use for fishing in the Abalone fishery, including electronic equipment, sheds, trailers and motor vehicles.

For each item, please provide an estimate:

- of the age of the item
- of the current market value of the item if you were to sell it today?
- of what would it cost you to replace the item if you were to buy it new?
- of the % attributable to commercial fishing from the << >> port, if the equipment is also used for other purposes

Commercial Fisher Capital Equipment

Capital Items	Age (yrs)	Current value	Replacement cost	% for Commercial Fishing from << >> port
Boat engine(s)				
Boat (without engine)				
Electronic Equipment				
Scales				
Winches				
Holding tanks				
Other boat accessories e.g. fuel tanks, radio, life jackets, anchor, all safety equipment etc (specify others)				
Sheds/buildings				
Motor vehicles				
Trailers				
Mobile Phone				
Computer/printer/fax				
Other equipment (specify)				

Direct Fishing and Administration Costs

In the next two tables, please provide estimates of the recurrent expenses associated with fishing from the << >> port for the last financial year. (For all your costs, please include an indication of the % of expenditure that occurred in the << >> region.

Direct Fishing Costs (1997/98)	**Expenses $**	**% in the << >> Region**
Boat Fuel & Lubricants		
Wages to Employees including deckhands, paid family help (inc. super, workers compensation, leave loading payments). ** Data relating to self employed and unpaid labour is collected on page 8 of the survey		
Provisions		
Repairs to Boat and Equipment		
Protective Clothing		
Catch Bags		
Fishing lines and tackle e.g. line, hooks, sinkers (specify other)		
Vehicle Fuel and Lubricant		
Vehicle Repairs and Maintenance		
Other Fishing Costs (provide details)		

Administrative Costs (last financial year)	Expenses $	% in the << >> Region
Boat Registration		
Trailer Registration		
Vehicle Registration and Third Party		
Insurances – vessels		
Insurances – car		
Insurances – other eg. Public liability etc		
Fisheries management charges		
Fishing and Boat Licence Fees (excluding any NSW Fisheries Management Fees)		
Mooring costs		
Legal (excluding litigation) e.g. contracts and other advice		
Legal (litigation)		
Accounting		
Telephone/Fax		
Postage, stationary		
Power		
Rates and Rents		
Interest/borrowing costs for capital equipment		
Interest/Borrowing costs for entry to the fishery		
Bank charges		
Travel, accommodation		
Training		
Memberships, association expenses		
Other administrative expenses (specify)		
Repairs to Buildings/Plant		

Note: Only include expenditure attributable to fishing from the << >> port(s).

Employment

How many people are engaged in your commercial fishing operation from the << >> port(s)? Please include yourself, paid employees and unpaid family helpers involved in running the fishing business, whether they are involved in actual fishing time, maintenance of fishing equipment, or the management (eg bookkeeping, negotiating with processors, attending meetings) of the fishing operation.

Commercial Fishing Employment Numbers

	Full Time	Part Time
You		
Paid Employees including Paid Family		
Family Unpaid		
Unpaid Other Labour		

Commercial fishers and their families can put in a lot of time running the fishing business, whether it is actual fishing time, maintenance of fishing equipment, or the management (eg bookkeeping, negotiating with processors, attending meetings) of the fishing operation. In the next table, please estimate the equivalent number of days i**n the last financial year** that was spent on these activities in your commercial fishing business by **you** and people who were **not paid a wage** (assuming an average of 8 hours per business day).

Commercial fisher and Unpaid Labour Time

	Fishing (boat time) (days)	**Repairs & Maintenance (days)**	**Management & Administration (days)**
You			
Family (unpaid)			
Unpaid other labour			

Additional Comments

Thank you for completing this questionnaire. Occasionally in completing survey forms, there is some difficulty in interpreting what is required. Please provide any additional comments that could help with the information that you have provided.

Please return this questionnaire using the reply paid envelope or by fax.

Please Return by x