RESEARCH PUBLICATION No. 35

Protection for Profit

Economic and financial values of the Great Barrier Reef World Heritage Area and other protected areas

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Great Barrier Reef Marine Park Authority

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Sally Driml
Centre for Resource and Environmental Studies
Australian National University

A REPORT TO THE GREAT BARRIER REEF MARINE PARK AUTHORITY

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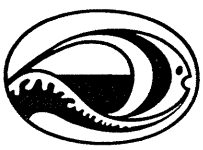

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SUMMARY

The first objective of this report is to present up-to-date information on financial and economic values of the Great Barrier Reef World Heritage Area. This area encompasses the Great Barrier Reef Marine Park, which forms 95 per cent of the World Heritage Area (WHA), and also includes islands and some coastal waters within the boundaries of the Great Barrier Reef Region.

The Great Barrier Reef WHA is a multiple-use area. Its primary 'use' is conservation of outstanding natural environments. Tourism is the direct use which generates the greatest financial value, estimated at $682 million in 1991–92. The financial values of other important uses for the same year were commercial fishing $128 million, private boating and fishing $94 million, and research $19 million. Together, the value of these activities is estimated at close to $1 billion directly spent and earned in the Great Barrier Reef WHA and adjacent mainland regions (see table 1).

Table 1. Gross Financial Values Great Barrier Reef WHA, 1991–92

Direct Use	Description	Financial value $ million
Tourism	2.2 million visitors per year	682
Commercial Fishing	Around 16 000 tonnes catch	128
Recreational fishing and boating	24 300 private boats	94
Research	GBRMPA and AIMS	19
Total		**923**

The second objective of this report is to present financial and economic values of some other Australian protected areas, in order to place the characteristics of the Great Barrier Reef WHA into context. The other protected areas included in this report are the Wet Tropics World Heritage Area, Kakadu National Park, Uluru National Park, the Tasmanian Wilderness World Heritage Area, Kosciusko National Park, Ningaloo Marine Park and the Solitary Islands Marine Reserve.

The primary purposes of all the protected areas included in this report are nature conservation, conservation of cultural features, and for some, the continuation of contemporary Aboriginal use. In most cases, no measures have been made of the economic values of conservation. Governments responsible for reserving these areas have implicitly judged the economic values arising from the protected area status as greater than the values that could be generated by alternative land use patterns.

Direct uses allowed under legislation and Zoning and Management Plans vary from area to area. Tourism and recreation are the most important direct uses, in terms of financial values generated, in all the protected areas. Other uses include, commercial fishing, research, provision of transport and communications facilities and the provision of water catchment services for hydro-electricity generation and consumption.

Findings for all eight protected areas are summarised in table 2. Financial value information is not available for all uses but it is believed that the major financial values have been included in this report (however the financial values of water catchment services have not been measured, and these may be significant). Financial values for tourism and recreation are shown separately. In some cases, these are order-of-magnitude estimates.

Also listed in table 2 are the management budgets and revenue raised from users for each protected area. All data in the table are for 1991–92.

Table 2. Gross Financial Values, Management Budgets and Revenue from Users 1991–92

	Tourism and recreation* $ million	Other uses measured value** $ million	Total measured value*** $ million	Manage-ment Budget $ million	Revenue from users $ million
Great Barrier Reef WHA.	776	147	923	18.1	0.75
Wet Tropics WHA.	377	25	402	12.1	0.30
Kakadu National Park.	122	not available	122	10.8	1.02
Uluru National Park.	38	not available	38	2.9	1.85
Tasmanian WHA.	59	0.2	59	4.8	0.20
Kosciusko National Park.	640	not available	640	11.4	10.85
Ningaloo Marine Park.	not available	not available	not available	0.5	nil
Solitary Islands Marine Reserve	not available	not available	not available	<0.5	nil
Total	**1918**	**262**	**2174**	**61**	**14.97**

* Gross expenditure by tourists and recreational visitors.
**Gross revenue. These include only values able to be measured.
***These include only values able to be measured.

The total measured financial value was over $2.1 billion. This is a significant amount of economic activity, dependant on the natural resources of these protected areas. The Great Barrier Reef WHA contributed 42 per cent of this value, the largest amount for the protected areas studied. This arises from the significant tourism and recreation activity and the fact that the Great Barrier Reef WHA supports a sizeable commercial fishery.

Expenditure on tourism and recreation for the eight protected areas combined was significant. It was of the order of $1.9 billion. This is expenditure made in the protected areas and on accommodation and expenses in adjacent regions associated with visiting the protected areas. It does **not** include the cost of travel from other parts of Australia or overseas.

Government expenditure on management of these protected areas combined was of the order of $61 million in 1991–92, and the study reveals this is three per cent of tourist expenditure. This study did not investigate the adequacy of funding for management.

Revenue raised directly from visitors for park management was of the order of $15 million in 1991–92, and this was less than one per cent of all expenditure by visitors. The relatively

small amount of revenue generated for park management points to a potential to capture more tourist expenditure for park management.

The report draws on published information and available unpublished information. No new data was collected for this report. Financial and economic values have been measured for the major uses of some of the protected areas. In other cases, order-of-magnitude estimates of financial values of major uses have been made for this report.

Financial values are the measurable flows of dollars generated by human use of the resources through industries including tourism and commercial fishing and expenditure on private recreation and research. The financial values reported are gross expenditure by tourists and recreational users, gross expenditure on research and gross revenue to commercial fishing and other extracted products. All activities which generate financial values have 'multiplier effects' or 'flow-on' financial values to other sectors of the economy.

Economic values measure the net benefits to society of resource uses. Economic values include those values of conservation of natural and cultural heritage that do not generate dollar values because they are not traded in markets. There is presently a paucity of economic information on non-market values of protected areas.

It is important to point out that the financial values reported are in almost all cases gross financial values. These really give no idea of the magnitude of any unpriced environmental costs arising as a consequence of producing these values or the sustainability of the level of production. For this reason, resource managers should treat financial values as important indicators of the magnitude of activities, but as less important than economic values as information for resource management decisions.

1. INTRODUCTION

1.1 Objectives and conduct of the study

Objectives of the study

This study was commissioned by the Great Barrier Reef Marine Park Authority. It had two objectives. One was to update and present under one cover, all the available financial and economic information on the Great Barrier Reef World Heritage Area. This area encompasses the Great Barrier Reef Marine Park, which forms 95 per cent of the World Heritage Area (WHA), and also includes islands and some coastal waters within the boundaries of the Great Barrier Reef Region.

The other objective was to put these characteristics of the Great Barrier Reef WHA into perspective by presenting data of a similar kind for a number of other World Heritage Areas, Marine Protected Areas and National Parks in Australia.

The other areas included in this study are the Wet Tropics World Heritage Area, Kakadu National Park, Uluru National Park, the Tasmanian Wilderness World Heritage Area, Kosciusko National Park, Ningaloo Marine Park and the Solitary Islands Marine Reserve.

Each of the eight protected areas considered has unique and valuable natural environment attributes and a number of the areas have significant Aboriginal cultural and contemporary use value. In each case, these special features have prompted designation of these areas as 'protected areas' with the primary aim of maintaining the natural environment and cultural attributes indefinitely. Each area is different in terms of its features and size, management objectives, permitted uses and management needs.

Economic and financial values

This study not only documents available information on the financial and economic values of these protected areas but it also draws attention to the important values not currently measured in dollar terms. This exercise illustrates the economic importance of these protected areas and emphasises the advantages of management to maintain these resource values.

The study explains that 'financial values', (that is measures of flows of dollar values from commercial activities), can differ from 'economic values'. Measures of economic values include, in most cases, the net financial values of commercial activities plus valued attributes of the natural environment which are not normally exchanged in the market place. Many of the range of values of natural environments fall within the latter category. Importantly, economic values recognise the costs of environmental damage often not accounted for in financial values. Both financial and economic data provide very useful information for resource management.

Reasons for being interested in financial and economic values of protected areas are numerous. Such information has been used to support decisions to designate protected status to areas.[1] Information on financial and economic values of existing protected areas can be a guide to decision makers evaluating whether other areas should be similarly protected, or dedicated to other land uses. Another use for such information arises from the fact that most protected areas are, in varying degrees, 'multiple-use' in that activities such as tourism, recreation and other uses are permitted. Managers of protected areas can better understand the costs and benefits of different mixes of these permitted uses with the aid of financial and economic data.

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[1] Economic and financial information played a part in the decisions to protect at least four of the protected areas discussed in this study: the Great Barrier Reef Marine Park, the Tasmanian Wilderness World Heritage Area, the Wet Tropics World Heritage Area and the former Conservation Zone in Kakadu National Park.

Once an area has been deemed worthy of protected status, it has to be managed so that its attributes are not degraded over time. This is the prime function of management. The provision of adequate funds for this task is always a challenge. Management can be thought of as investment in maintaining the value of the resources of the protected areas. Economic analysis can help discover appropriate levels of investment in management.

Economic analysis can be applied at the program level or at the project level. It can be used to evaluate the cost-effectiveness of achieving a particular objective (for example, eradication of feral animals) by different means. There are two obvious sources of funds for management - taxpayers and users of protected areas. Financial and economic analysis can identify how costs and benefits are distributed between users and society as a whole, and the potential for raising funds for management from users may be assessed.

The pursuit of balancing development and conservation of natural resources to achieve Ecologically Sustainable Development (ESD) places emphasis on understanding the ecological and economic dimensions of resource uses. It is likely that financial and economic information will continue to play an important role in resource management in the future, but one that will pay more attention to the total economic values of natural environments over the long term.

Outline of this report

The protected areas studied include some of Australia's most well-known tourist attractions. The influence of these areas in attracting tourism and recreation extends well beyond their boundaries. The relative importance of tourism and recreation in all eight protected areas investigated demands that special attention be paid to these uses. The following section, 1.2, has a discussion about the relationship between tourism and natural environment attractions in Australia. The methodology used in this report to estimate financial values of tourism and recreation is included in appendix 2.

Each protected area is discussed in turn in a separate section. The brief for this report was to identify the financial and economic values of the eight protected areas and to report dollar values where available. For each protected area, indirect and direct uses have been identified, based on published materials and discussions with managers of the areas. These uses are listed in tables with qualitative and quantitative descriptions of the uses and values. See table 2.3 as an example. Where dollar values (financial and/or economic) are available, these are also listed in the tables.

All the World Heritage Areas, Marine Protected Areas and National Parks examined in this report have important values arising from nature conservation and conservation of cultural features. These conservation values have been classified under the heading *primary uses*. Also included as a primary use is contemporary Aboriginal use in a number of the protected areas. With two notable exceptions,[2] no attempt has been made to measure these primary use values in dollar terms.

All of the protected areas examined allow a select range of direct uses which are managed on the basis that they are consistent with the primary objective of conservation. The direct uses include; private recreation, commercial tours and, in the marine areas, commercial fishing. Theses are termed *compatible direct uses* in the study. Measures of financial value are available for many of these direct uses. In fewer cases, economic values have been calculated.

In some of the protected areas, activities which have occurred historically are presently being phased out in order to afford a higher level of conservation. This is most evident in the most recently declared protected areas. In the case of the Wet Tropics WHA, several existing uses are under review at the time of writing.

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[2] These are protecting the Great Barrier Reef from the Crown of Thorns Starfish (Hundloe et al. 1987), and the Kakadu Conservation Zone Contingent Valuation Study (RAC 1991). These studies are discussed in the relevant sections of this report.

The conservation values associated with the primary uses arise in the absence of any direct use of the natural environment. Direct use may add further financial and economic value. The expansion of direct uses and their associated values may only be positive up to the point where they do not reduce, through environmental impacts, the primary use values. Beyond that point, trade-offs occur between the increase in the value of the direct use and decreases in primary use values. It should also be noted that where more than one direct use is allowed, it is possible that trade-offs will be involved in getting the mix of uses that generates the highest value. It would not therefore be proper to extrapolate increasing levels and real values of direct uses into the future as the point at which these uses may begin to reduce primary use conservation values is unknown. It is possible, however, that even where physical limits are placed on direct uses, the dollar values of these uses could continue to increase as people are willing to pay more for these scarce natural environment resources.

It is unknown whether the combination of uses currently allowed in any of the protected areas examined maximises the net benefits in economic terms that could arise from the area. There are no cases where the appropriate economic analysis has been undertaken to try to address this complex question. It is not the task of this study to undertake such an analysis. It can be observed that a thorough economic analysis would need to pay much more attention to valuing the positive and negative impacts of alternative direct uses on primary uses, and on each other, and the trade-offs involved, than has occurred to date.

It is important to point out that the financial values reported are in almost all cases **gross** financial values. These really give no idea of the magnitude of any unpriced environmental costs arising as a consequence of producing these values or the sustainability of the level of production. For this reason, resource managers should treat financial values as important indicators of the magnitude of activities, but as less important than economic values as information for resource management decisions.

Regional output multiplier effects of gross financial values have been presented where the information is available. These should be interpreted carefully as unpriced environmental costs are not taken into account. All direct use activities have multiplier effects, but only those for which multipliers are published have been acknowledged in this report. In most cases, the size of the multiplier is similar across types of activity and regions.

The descriptions of the eight protected areas are followed by a summary of key points in the Conclusions.

More detail on how financial and economic values are defined and measured is presented in appendix 1. This appendix includes a glossary of economic terms. The approach taken in describing the financial and economic values of the eight protected areas included in this report is presented in appendix 2. Appendix 3 includes detail on measurement of economic and financial values of tourism and conservation for the Great Barrier Reef WHA.

Information sources

This report has been compiled from available published information (Annual Reports, Management Plans, research papers, tourism survey reports) as well as unpublished information supplied by the many agencies involved in the management of the protected areas. No new data were collected for this study. The available published and unpublished measures and estimates fall short of measuring the total financial and economic values of these protected areas. This report presents new estimates of financial values of tourism, made in the course of this study.

It is obvious that a significant effort in data collection and analysis would need to be undertaken in order to illuminate in dollar values the full financial and economic values arising from these protected areas. It is also clear that the information that is available has been collected and analysed in a variety of ways. A uniform approach to this task would allow more accurate comparisons of information. Suggestions for a more consistent approach are included in appendix 2 of this report.

As a final introductory comment, it must be said that it remains questionable whether the discipline of economics will ever be able to adequately address measurement of all the important but non-market values of natural and cultural heritage in dollars. In this report, the full range of values from each area is described qualitatively and quantitatively, complemented by dollar values where possible.

1.2 Tourism and the environment

'it is important to recognise that a major motivation for tourism activities in Australia, both domestic and international, is to experience aspects of our natural and cultural environment' (Ecologically Sustainable Development Working Group on Tourism 1991, p. 7).

There is no doubt that Australia's natural environment is a major tourist attraction for visitors from overseas and for Australians travelling within this country. The Ecologically Sustainable Development Working Group on Tourism found that, 'data from the IVS [International Visitor Survey] and from Australian Tourist Commission (ATC) segmentation studies suggest that international tourists rank issues such as beautiful scenery, vastness, cleanliness, natural wonders and wildlife, and good beaches as major attributes influencing their choice of Australia as a travel destination' (1991, p. 8).

The tourist industry is now one of Australia's most significant economic sectors, contributing 5.4 per cent of Gross Domestic Product and 5.8 per cent of employment in 1990–91. Gross expenditure by tourists was $25 billion in 1990–91 (BTR 1992b). Inbound tourism to Australia is particularly important in earning foreign exchange. In 1990–91, this industry contributed 10 per cent to Australia's current account credits, exceeding earnings from coal exports (CDT 1992).

The protected areas included in this report include prime natural environment and Aboriginal culture tourist attractions in Australia. All have experienced significant increases in visitor numbers over the last decade (data for some are shown in table 3.1). This increase is against a background of continuing significant growth in the number of overseas tourists coming to Australia. The number of arrivals doubled between 1985 and 1988 to reach 2.2 million. In 1991 Australia hosted 2.4 million overseas tourists (CDT 1992). The Bureau of Tourism Research has published projections for an eight per cent per annum growth in arrivals which would result in 5.15 million visitors in 2001 (BTR 1992a). These projections are naturally subject to uncertainty and should be interpreted cautiously. Domestic tourism has also been growing, but at a more modest rate and prospects for future growth are strongly related to conditions in the Australian economy. There were 49 million overnight trips within Australia by Australians in 1991 (BTR 1992b).

'Ecotourism' is a term that has been coined to cover tourism that has the natural environment and cultural features as its main focus. All the tourism and recreation in the protected areas covered in this report would come under a broad interpretation of this definition.[3] This segment of the tourist industry has been observed to be growing strongly in the world; Boeger (1992) quotes a study that estimates that internationally tourism is growing at 8 to 10 per cent per annum, the adventure and cultural tourism component of this is growing at 10 to 15 per cent and nature based tourism is growing at 30 per cent per annum. These is as yet no comprehensive database on ecotourism in Australia but many indicators point to the importance of nature based tourism in Australia (Allcock et al. 1994).

The conservation status of an area is often publicised by commercial tour operators in their advertising material, signifying their belief in the drawing power of such status. Management agencies and State and Commonwealth government Tourist Commissions promote protected areas as tourist attractions. The promotion of enjoyment of the protected area is usually amongst the goals of management agencies and there is a

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[3] The National Ecotourism Strategy (Allcock et al. 1994) gives the following definition of ecotourism: 'Ecotourism is nature based tourism that involves education and interpretation of the natural environment and is managed to be ecologically sustainable'. It is possible that not all current tourism in protected areas would qualify as educational and ecologically sustainable.

community expectation that people will be allowed to visit these areas. Management agencies also understand that visitors who appreciate a protected area will be supporters of continued conservation management of the area.

It is clear that natural environment features are important in attracting tourists to Australia and attracting visits to protected areas by tourists and day trippers. The demand for visits to natural environment areas is expected to grow, possibly at a faster rate than tourism generally. However, while well-known protected areas are major attractions with influences beyond their boundaries, it is difficult to say how much overall financial and economic value should be attributed to the attraction of any particular protected area. In this report, only the financial values directly attributable to visits to the protected areas are considered.

Tourism via commercial tour operations and private recreation are permitted activities in all the protected areas covered in this report. In all the areas, tourism and recreation are significant relative to other direct uses in terms of the numbers of people involved and financial impacts.

Table 1.1 Visitor Numbers Protected Areas

	Great Barrier Reef Marine Park	Kakadu National Park	Uluru National Park
1982, 1982–83		45 800	87 871
1984, 1984–85	1 119 000[4]	75 200	110 160
1986		131 000	141 219
1988		220 000	175 536
1990		238 000	218 160
1992	2 291 000	205 000	

Sources: Driml 1987a, unpublished data Great Barrier Reef Marine Park Authority, Australian Nature Conservation Agency, pers. comm.

Definitions

The use in this report of terms used to describe tourism and recreation needs some clarification. The potential for confusion arises because there are two data sets used in this report and each set adopts different terminology and covers different populations. The first data set is the major tourism surveys (the Domestic Tourism Monitor, International Visitor Survey and surveys carried out by state tourism authorities) These surveys define tourists as people on trips involving at least an overnight stay away from home. The majority of data reported in this section is drawn from those surveys.

The other data set is the records kept by management agencies of visitor numbers to the protected areas, which include both tourists and local people travelling on day trips (day trippers). The information that has been recorded for the protected areas included in this study has largely been in terms of the number of 'visits' or 'visitors' and 'visitor-days'. Annual figures on 'visits' and 'visitors' measure the same thing, the number of entries into the protected areas regardless of how long the people stay. Visitor-days record the total number of days spent in the protected areas. Records of visit/visitor numbers and visitor-days are rarely detailed enough to distinguish between tourists and day trippers.

The term 'tourism and recreation' is used at times more broadly to refer to activities by all visitors to protected areas. Later in this report, financial values of tourism are presented for each protected area. These values include expenditure by all visitors - tourists and day trippers.

[4] Passengers on commercial passenger vessels. Recreation in the GBR also includes recreational fishing and boating from private boats and the number of trips (recreational fishing trips only) per year has remained relatively steady at 266 000 trips per year in 1984/85 and 210 000 to 270 000 trips per year in 1990.

2. GREAT BARRIER REEF WORLD HERITAGE AREA

2.1 Description

Location, size
The Great Barrier Reef runs along the east coast of Queensland and into Torres Strait. The Great Barrier Reef Region is defined as the area below low water mark between 10°41' S (Cape York) and 24°30' S (just north of Fraser Island), bounded on the west by low water mark along the coast and on the east approximately by the edge of the continental shelf. The Great Barrier Reef Marine Park has been declared over the majority of the Region but some coastal areas around ports and the like are not included in the Marine Park.

The Great Barrier Reef World Heritage Area includes all waters and islands (areas above low water mark) within the boundaries of the Great Barrier Reef Region. The World Heritage Area is approximately 2000 kilometres long and 348 700 square kilometres in size.

Major natural features
The Great Barrier Reef is the world's largest and most complex expanse of living coral reefs. 'The reef' is not a continuous barrier but is comprised of some 2500 individual reefs. The islands include coral cays and continental island forms. The area supports a great diversity of animal and plant life.

History
The Great Barrier Reef Region was established by legislation in 1975 and the Marine Park was progressively declared over the Region until 1983 when the Marine Park covered 98 per cent of the Region. The majority of islands are Queensland National Parks. The first Queensland Marine Parks (generally covering areas between high and low water marks) were established in 1974.

The Great Barrier Reef World Heritage Area was included on the World Heritage List in 1981.

Management arrangements
The management arrangements for the Great Barrier Reef WHA have to take account of adjacent and overlapping jurisdictions.

Waters below low water mark are under Commonwealth Government jurisdiction and areas above low water mark are under the jurisdiction of Queensland. The Great Barrier Reef Marine Park Authority is the Commonwealth Government agency responsible for planning and management of the Commonwealth areas and the Queensland Department of Environment and Heritage through the Queensland National Parks and Wildlife Service manages the Queensland island National Parks and Marine Parks. Day-to-day management is undertaken by the Queensland National Parks and Wildlife Service and is jointly funded.

Commercial and recreational fisheries of the Region are managed by the Queensland Fish Management Authority (subject to Commonwealth and Queensland Marine Parks zoning plans and regulations). The Queensland Fisheries and Boating Patrol provides a management presence in the Region.

Considerable effort goes into coordination of these major management agencies and the other Commonwealth and State Government Departments and Local Authorities with interests in the Region.

Management objectives
The majority of the World Heritage Area is covered by the Great Barrier Reef Marine Park. This is a multiple-use park, but operations for the recovery of minerals are prohibited. The goal of the Great Barrier Reef Marine Park Authority is 'To provide for the protection, wise use, understanding and enjoyment of the Great Barrier Reef in perpetuity through the care and development of the Great Barrier Reef Marine Park'.

Management funding
In 1991–92, the Great Barrier Reef Marine Park Authority spent $11.393 million on operational expenses for managing the Marine Park and $6.693 million on day-to-day management. Total expenditure was $18.086 million.

The Queensland Government contributed $3.038 million for day-to-day management. The remainder of funding came from Commonwealth Government consolidated revenue and revenue of $2.322 million from other sources. The revenue collected directly from tour operators was $0.75 million for contributions to monitoring programs and permit assessment fees.

A visitor fee of $1 per head for passengers on commercial passenger vessels has been introduced from 1 July 1993, and is expected to raise about $1 million in 1993-94.

Major uses
The primary uses of the Great Barrier Reef WHA are conservation of the natural environment, features of Aboriginal cultural heritage, and shipwrecks and other historical sites. Areas of the Great Barrier Reef WHA continue to be important to Aboriginal and Torres Strait Islander people.

Some research has been undertaken on placing a dollar value on **some** aspects of conservation of the Great Barrier Reef WHA, specifically willingness to pay for management and for research into and control of Crown of thorns starfish. This is discussed in more detail in section 2.2 below.

Major direct uses are tourism, recreation and commercial fishing. These are reported on in more detail in sections 2.3 to 2.5 below. In addition, the region is used by shipping and defence training. The Great Barrier Reef WHA is the focus of a considerable amount of research and educational activities.

The appropriate research and analysis to assess financial and economic values of shipping in the Great Barrier Reef WHA has not been done, but some comments are relevant here. A considerable amount of shipping, over 2000 ships per year, pass through the Great Barrier Reef. As noted in appendix 2, the financial value of shipping is the value added by transporting goods from one place to another. It is conceivable that the proportion of the total trip that is within the Great Barrier Reef WHA could be used to apportion a financial value. However, this value is not really attributable to the resources of the Great Barrier Reef WHA unless they provide some identifiable financial advantage. While the Great Barrier Reef WHA may provide calmer waters than the open sea, this would need to be weighed up against the navigational hazard to shipping caused by the Great Barrier Reef WHA. There are extra costs of shipping in the Great Barrier Reef WHA due to mandatory requirements to carry a pilot and other precautions required to prevent environmental damage. It is not clear whether the resources of the Great Barrier Reef WHA present a positive or negative financial value to shipping. In any economic analysis of shipping in the Great Barrier Reef WHA, any benefits would need to be modified to take into account potential risks of oil spills and other accidents.

The Great Barrier Reef WHA is the focus of a considerable amount of marine research. The GBRMPA funds research by external researchers. Scientists at the Australian Institute of Marine Science (AIMS) located in Townsville undertake much of their research within the area. Researchers from James Cook University undertake work in the Great Barrier Reef WHA as do scientists from other Universities throughout eastern Australia. There are research stations at Lizard Island, Orpheus Island, One Tree Island and Heron Island. It is difficult to identify all research projects and funding levels, while avoiding double counting.

The research and monitoring budget of the GBRMPA was $3.37 million in 1991-92 and the entire budget of AIMS was $16.02 million. Taking the total of these two budgets gives $19.39 million. This may overestimate the proportion of AIMS expenditure that should be attributed to the Great Barrier Reef WHA, but by excluding unidentified funding from other sources gives an underestimate overall.

2.2 Great Barrier Reef conservation values

Economic values for the primary conservation function of the Great Barrier Reef WHA have been calculated in one study (Hundloe et al. 1987). These values were derived using the contingent valuation method (CVM) and should be interpreted as order-of-magnitude only. The value is made up of an annual willingness to pay by the Australian population for management of the Great Barrier Reef, plus an additional annual willingness to pay by the Australian population and by tourists to the Great Barrier Reef WHA for research into and control of crown of thorns starfish. A value of $86 million per year, in 1991–92 dollars, was derived by this study. It is stressed by the authors that this value is for the Australian population and is an underestimate as it does not include values accruing to people in the rest of the world. It would be fair to assume that the existence of the Great Barrier Reef is valued by very many people outside Australia. Details of this research is reported in appendix 3.

2.3 Great Barrier Reef tourism

Tourism is the major direct use of the Great Barrier Reef WHA in financial terms. It has grown significantly in the last decade, on top of a forty fold growth (from very low levels) from 1946 to 1980 (Claringbold et al. 1984). The development of large fast catamarans has enabled many more visitors to enjoy day trips the Great Barrier Reef WHA. An increase in popularity of SCUBA diving has been accompanied by an expansion of day and longer reef trips. The popularity of viewing marine life has eclipsed the popularity of fishing and collecting activities. Island resorts have expanded in capacity and occupancy. In addition, there has been an associated increase in tourism to the adjacent mainland of coastal north and central Queensland.

Great Barrier Reef WHA tourism considered in this section consists of:
(a) tourists who stay on island resorts
(b) tourists who camp on islands
(c) tourists who visit the Great Barrier Reef WHA for day or longer trips via commercial passenger vessels
(d) a component of time spent on the adjacent mainland associated with reef visits
(e) a component of travel to the region associated with reef visits.

The 'tourism' referred to in this section is provided by commercial operators and includes reef trips and transport to islands and accommodation and services on boats, islands and the adjacent mainland. The tourists who use these facilities and services are people from other parts of Australia and overseas who are tourists to the Great Barrier Reef WHA and adjacent mainland plus local residents of the adjacent mainland. Other local residents visit the Great Barrier Reef WHA in their privately owned boats and these people are discussed separately in the following section on recreational fishing and boating.

While the first three components of tourism listed above are self explanatory, the mainland component deserves comment. With the exception of local residents who may make reef trips directly from home, most of the people who make trips to the reef and/or stay on islands must first travel to and stay on the adjacent mainland. A reef trip may feature as a one day trip within a longer stay on the adjacent mainland; or as a one week or longer diving or island resort holiday that is the sole purpose of the visit, or somewhere in between. Surveys have found that the Great Barrier Reef is the major tourist attraction to the mainland regions of north and central Queensland (see appendix 3). It is therefore appropriate to consider a component of tourism and expenditure on the adjacent mainland as a part of Great Barrier Reef WHA tourism. Just what that component should be is discussed in more detail in the appendix 3.

Trends

It is relevant to look at the trends in all tourism to the Great Barrier Reef WHA and adjacent mainland regions in order to place the more limited information on Great Barrier Reef WHA tourism in context. The best indicator of tourism volume is 'visitor-nights'. In 1991–92, there were 22.3 million visitor-nights spent in coastal north and central Queensland and Great Barrier Reef island resorts. Figure 2.1 illustrates the increase in visitor-nights from 1984–85 to 1991–92 (the data are included in appendix 3). The total increase over this period was 70 per cent. In 1991–92, the islands hosted 243 800 visitors for 1.8 million visitor-nights.

Trends in visits to the Great Barrier Reef WHA on commercial passenger vessels show a remarkable increase in this activity over the last 8 years as the number of boats and visitors has doubled. In 1984–85, a census was undertaken of commercial passenger vessels. It was found that there were around 275 vessels operating and they carried 1 119 000 visitors for around 1 274 000 visitor days (Driml 1987). There was no regular information collection in place from then until recently. In early 1993, it was estimated that the number of vessels operating has grown to 542 vessels carrying 2 291 000 visitors (GBRMPA pers. comm. 1993). This increase has been concentrated in the Cairns and Whitsundays areas.

Forecasts for future tourism growth in Australia have been discussed in section 1.2. There is good reason to assume that Great Barrier Reef WHA tourism will experience at least the same growth rate as Australia as a whole.

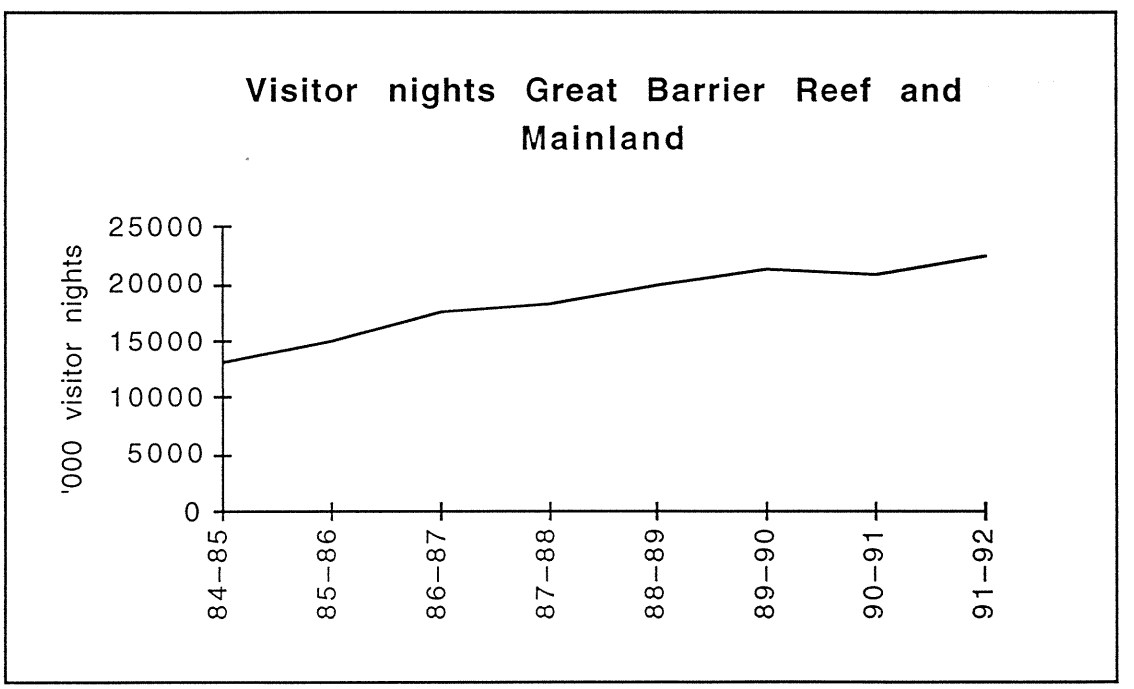

Figure 2.1 Visitor nights Great Barrier Reef WHA and adjacent mainland

Financial values

The relevant measure of the financial value of Great Barrier Reef WHA tourism is expenditure by tourists. This is made up of their expenditure on fares, accommodation and other items actually made within the boundaries of the World Heritage Area, plus a component of their expenditure on travel to the area and accommodation and other costs on the adjacent mainland. Questions arise as to what proportion of travel and costs incurred on the adjacent mainland to attribute to Great Barrier Reef WHA tourism. The Great Barrier Reef WHA is an extremely significant component of the overall attraction of the area for tourists. Tourists who do visit the Great Barrier Reef WHA generally stay on the

adjacent mainland in order to take day or longer trips to the reef[5]. Several means of estimating the relevant amount of expenditure to attribute to Great Barrier Reef WHA tourism are discussed in the appendix 3.

The financial value of tourism to the Great Barrier Reef WHA, including travel to the region, can confidently be valued at over $1 billion per year. This is a conservative estimate. Of this amount, at least $356 million is spent on stays on island resorts and trips on commercial passenger vessels within the Great Barrier Reef WHA. Excluding travel to the region, at least $682 million is spent by tourists to the Great Barrier Reef in the region of the Great Barrier Reef WHA and adjacent mainland.

The multiplier effect of this expenditure can be estimated using multipliers calculated for the Cairns, Townsville, Mackay and Rockhampton regions (Driml 1987a). For island resorts, these ranged from 1.7 to 1.8 and for commercial passenger vessels they were 1.6 to 1.8. Applying a multiplier of 1.7, the direct plus indirect output effect of $1 billion expenditure is approximately $1.7 billion but this includes impacts of expenditure on travel, some of which will occur outside Australia. The impacts within the region of the Great Barrier Reef WHA and adjacent mainland should be calculated on total expenditure excluding travel, that is on a figure of around $682 million. Adopting a multiplier of 1.7, the direct plus indirect output effect of $682 million expenditure is $1 159 million. All figures are in 1991–92 dollars.

Economic values

An explanation of the basis for calculating economic values of Great Barrier Reef WHA tourism and recreation and the values obtained are presented in appendix 3. The relevant measure of the economic value of tourism is the consumer's surplus experienced by tourists to the Great Barrier Reef WHA. The cost to tourists of their visits to the Great Barrier Reef WHA is currently the amount paid to commercial operators for transport, accommodation and other services. The consumer's surplus measures what tourists would be willing to pay above this for access should there be entry fees on access to the Great Barrier Reef WHA itself.

A study by Hundloe et al. (1987) is the only relevant research on this topic for the entire Great Barrier Reef WHA. It presents consumer's surplus measures for three different aspects of Great Barrier Reef WHA tourism. The consumer's surplus is estimated to lie between $23 million and $357 million in 1991–92 dollars. The wide variation in values points to a need for more research to develop a consistent approach to estimating consumer's surplus for the Great Barrier Reef WHA.

2.4 Great Barrier Reef WHA commercial fishing

The commercial fisheries of the Great Barrier Reef WHA are significant in terms of the value of production and the economic activity generated in catching and processing. There are three distinct fisheries within the Great Barrier Reef WHA; the east coast trawl fishery, the commercial line fishery and the commercial net and crab fisheries. Minor fisheries include pearl shell, trochus, marine aquarium fish collecting and mariculture. There are a variety of controls imposed on commercial fishing for environmental and economic reasons.

Financial values

The total gross revenue for Great Barrier Reef commercial fisheries in recent years has been estimated by Bishop (1992), see the Box below. In 1991–92 dollars, this value is $128 million. Data for commercial fishing is summarised in table 2.1. The multiplier effects of commercial fishing, based on a revenue for sales of $128 million, are as follows: the direct plus flow-on effects are $256 million for commercial fishing (including backward

[5] It is possible for visitors to fly directly to Hamilton Island or to make same day connections between airports on the mainland and islands or boat trips. The number of visitors who do not stay on the mainland at least overnight is not known.

linkages); and $384 million for commercial fishing plus local seafood processing industries.

Table 2.1 Commercial; Fishing, Great Barrier Reef WHA, 1991–92.

Fishery	Catch volume tonnes	Catch Value $ million
East coast trawl fishery	8 000 to 10 000	63 to 84
Commercial line fishery	4 000 to 5 000	23 to 27
Net and crab fisheries	950 to 1 100	7.4 to 7.7
Other minor fisheries		4.25
Total		**128**

Source: Bishop 1992 and pers.comm. Queensland Department of Primary Industries.

Calculating financial values

Recent information on the value of commercial fishing is in effect limited to gross revenue from the sale of catch. This is derived from data on the volume of catch and prices paid to commercial fishers for their catch. The latest information available on costs of production is from a survey of the fishery for the years 1985–86.

Data on catch taken by commercial fishing are derived from log books kept by commercial fishers. The log book program is a compulsory program introduced in 1988 by the Queensland Fish Management Authority and administered by the Queensland Department of Primary Industries. There is a separate log book for each of the three major fisheries listed above. In a 1992 report to the Great Barrier Reef Consultative Committee, Bishop has reported information from the log book program for 1988 to 1990.

The east coast trawl fishery is the largest fishery in the Great Barrier Reef WHA in terms of volume and value of catch and fleet size and employment. Ninety per cent of the volume of catch is prawns with most of the remainder being scallops. While the fishery extends along the entire east coast of Queensland and into northern New South Wales, 70 per cent to 80 per cent of the catch is taken within the Great Barrier Reef WHA.

The volume of catch for the entire east coast is reported by Bishop (1992) to be between 8 000 and 10 000 tonnes in the years 1988 to 1990.

The value of the catch for the entire east coast trawl fishery was reported by Bishop (1992) as being between $90 million and $105 million for 1988 to 1990. Applying the 70 per cent to 80 per cent proportion to these figures, values the Great Barrier Reef WHA catch at between $63 million and $84 million in those years.

The commercial line fishery involves the catching of demersal fish species on reefs and pelagic species from the waters between reefs. It is estimated that 90 per cent of the Queensland catch is from Great Barrier Reef WHA waters.

Bishop (1992) has reported catch and value information for the years 1988 to 1990. The volume of the catch ranged between 4000 and 5000 tonnes with a value of $25 million to $30 million. Applying the 90 per cent proportion gives a value of $23 million to $27 million for the Great Barrier Reef WHA.

The net and crab fisheries are concentrated in nearshore and estuarine waters. While many of these areas are not within the Great Barrier Reef Marine Park, they do fall within the Great Barrier Reef WHA. These fisheries include the relatively high value mud crab fishery with sand crabs and spanner crabs being caught in lesser volume. The net fisheries include set gill nets which are used to catch barramundi and many other species of lesser importance. The fishery also includes drift netting and beach seine netting.

The catch recorded from log books for 1988 to 1990 was between 950 and 1 100 tonnes for the Great Barrier Reef WHA and the value is estimated at $7.4 to $7.7 million (Bishop 1992).

Other minor fisheries occurring within the Great Barrier Reef WHA are trochus and Beche-de-mer which together raise around $1.5 million. Aquarium fish collecting for the whole of Queensland generates $3.5 million, and $1.75 million is assumed to come from the Great Barrier Reef WHA. Insufficient information is available on the value of coral collecting, pearl shell and some mariculture. Mariculture of barramundi utilises grow-out cages within the Great Barrier Reef WHA. The value of this was $1 million in 1990 (pers.comm. Queensland Department of Primary Industries).

An important aspect of the value of the fish and seafood product caught in the Great Barrier Reef WHA is the multiplier effect due to the economic activity associated with support for the commercial fishing fleet and the processing industry supported due to the availability of this product. In his 1988 study, Bishop calculated the 'backward linkages' associated with inputs to commercial fishing (vessel supply and repair, fuel, employment, etc.). He also calculated and the 'value added' in the processing sector. Because this value added figure excludes backward linkages in the processing and trade sectors, it is a minimum estimate of flow-on effects. Bishop undertook a detailed analysis for seven Queensland coastal regions, based on Statistical Divisions, of which at least four are adjacent to the Great Barrier Reef WHA. Bishop also calculated average multipliers for the seven regions together and it is these that are used to give estimates the multiplier effects of the Great Barrier Reef WHA catch 1988 to 1990.

The backward linkages are described by a multiplier of around two, so that the value of flow-on effects is around the same as the revenue earned from sales. The value added in processing is also around two so again, the flow-on effect is around the same as the revenue earned from sales. With a revenue for sales of $128 million, the direct plus flow-on effects are $256 million for commercial fishing including backward linkages, and $384 million for commercial fishing and processing.

Economic values

The economic value of an industry such as fishing can be measured as net revenue, that is gross revenue minus costs of production. In economic analysis, costs of production should take account of the full costs of fishing including a component for management of the fishery to avoid environmental damage. Commercial fishing operations in Queensland do make a contribution to management but this study has not evaluated whether this covers the full external costs of fishing.

As the latest cost of production data available is for 1985–86, this does not provide an ideal basis for calculating net revenue for the fishery. The ratio of cost of production to gross revenue for the Queensland commercial fishing fleet in 1985–86 proved to be $222.3 million to $290 million. Costs of production therefore were 76 per cent of the gross revenue to fishermen and net economic benefits were 24 per cent of gross revenue. Applying this proportion to the 1991–92 gross revenue figure gives net economic benefits of $31 million. This exercise must be interpreted as an order-of-magnitude estimate only as there is no way of knowing if the 1985–86 conditions were typical or how they relate to conditions in 1988 to 1990.

2.5 Great Barrier Reef WHA private boat recreational fishing and boating[6]

Private recreational boat trips are undertaken from all settlements along the coast adjacent to the Great Barrier Reef WHA. Trips into the Great Barrier Reef WHA range from trips for a few hours to local nearshore locations to day or longer excursions to distant reefs. For the purpose of this report, all private boat trips made to sea are considered to have been made to the Great Barrier Reef WHA (not all of these are made to reefs or locations within the Great Barrier Reef Marine Park).

A private boat trip may involve sightseeing, fishing, diving, swimming, island visits etc. Recreational fishing is a popular pastime estimated to be undertaken by over two-thirds of boat owners and is the primary reason for the majority of private boat trips. Much of the

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[6] This section was written by Russell Blamey, Centre for Resource and Environmental Studies, Australian National University.

research undertaken on private boat use of the Great Barrier Reef WHA has focussed on recreational fishing as it has been identified as the major recreational activity and also has implications for the resources of the Great Barrier Reef WHA.

Research into financial and economic values has been undertaken for the roughly two-thirds of boat owners who participate in recreational fishing in the Great Barrier Reef WHA, and hence estimates only part (but the major part) of the financial and economic value of Great Barrier Reef WHA fishing and boating. The information on financial values presented here includes all trips made by boat owners who make fishing trips to the Great Barrier Reef WHA, whereas the economic information is for fishing trips only.

Around 24 300 of these private motor boats were used for recreational fishing within the Great Barrier Reef WHA region in 1990. These made between 210 000 and 270 000 such trips per annum (Blamey and Hundloe 1993).

Financial values

The total financial value of recreational fishing and boating for the 24 300 boats that make fishing trips to the Great Barrier Reef WHA was $90 million in 1990. Inflated to 1991–92 dollars, this figure is $94 million.

A multiplier of 1.7 best represents the range of multipliers for recreational fishing for the four economic regions that include the Great Barrier Reef (Driml 1987a). The direct plus indirect effects of expenditure on recreational fishing and boating are therefore estimated at $168 million, in 1991–92 dollars.

Calculating financial values

The most recent information pertaining to the value of recreational fishing and boating from private boats in the Great Barrier Reef WHA is reported by Blamey and Hundloe(1993) and Blamey (1991), the former relating to expenditure figures (financial values) and the latter to consumer's surplus figures (economic values) for recreational fishing.

There are around 39 000 private motor boats registered in the coastal regions adjacent to the Great Barrier Reef WHA[7]. These figures include all boats with motors over 4 hp. and consequently do not include vessels only powered by sail. Yachts and power boats from other ports of origin are not included.

Around 24 300 of these private motor boats were used for recreational fishing within the Great Barrier Reef WHA region in 1990. These made between 210 000 and 270 000 such trips per annum (Blamey and Hundloe 1993).

In order to obtain data on characteristics of recreational fishing and boating in the Great Barrier Reef WHA region, Blamey and Hundloe conducted more than 450 interviews at boat ramps adjacent to the Great Barrier Reef WHA region during the year of 1990. These interviews were supplemented by more than 750 telephone interviews of registered boat owners residing in the regions adjacent to the Great Barrier Reef WHA. The boat ramp questionnaires focussed on obtaining information that could be used to estimate average catches, expenditures etc., whereas the telephone surveys were primarily concerned with ascertaining the relevant populations of Great Barrier Reef WHA recreational boat fishers, for aggregation purposes.

Three types of financial data were obtained from boat owners interviewed at boat ramps:

(i) the total value of 'capital' equipment such as boats, motors, eskies, fishing gear etc., used for fishing in the Great Barrier Reef WHA region;

(ii) the annual or fixed costs associated with fishing in the Great Barrier Reef WHA region, including not only maintenance on boats, motors and trailers but also registrations, radio licence fees and fishing club memberships. Estimates of average annual costs include an annual cost of owning a boat by including boat depreciation and also the money that could have been earned if the boat had been sold at the start of the year and the money invested (opportunity costs of capital);

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[7] Queensland Marine Board data for September 1992.

(iii) the variable or per trip costs of fishing within the Great Barrier Reef WHA region including boat fuel, boat or fishing gear hire fees (where applicable), bait, food, drinks and ice and any accommodation costs incurred.

In order to approximate the proportions of capital and annual costs that may be attributed specifically to recreational boat fishing, boat ramp interviews obtained information relating to the relative importance of fishing (compared with sightseeing, diving, swimming etc.) on boating trips that involve some fishing in the Great Barrier Reef WHA region and telephone interviews obtained information relating to the proportions of boating trips that involve fishing.

The total value of the 24 300 motor boats and other capital equipment is between $200 million and $300 million (based on current market value), of which approximately two-thirds can be attributed specifically to fishing.

The annual costs in 1990 associated with fishing in the Great Barrier Reef WHA sum to almost $3000 per boat on average, of which approximately $2000 can be attributed specifically to fishing. When summed to the population of boat owners fishing in the Great Barrier Reef WHA region, the total annual costs sum to almost $73 million annually. Approximately one-half of this figure involves actual expenditure, the other half taking the form of boat ownership costs as the opportunity costs of capital and depreciation.

The variable, or per trip costs, sum to approximately $80 per trip on average, $700 per year per boat on average, with a total of $16 million per year for all fishing trips. These costs will often be shared with other individuals on trips. Total variable costs for non fishing trips are not known.

The total financial value of recreational fishing and boating for the 24 300 boats that make fishing trips to the Great Barrier Reef WHA is $90 million in 1990. Inflated to 1991–92 dollars, this figure is $94 million.

This figure underestimates the total financial value for all recreational fishing and boating as it does not include: expenditure by non fishers who make boat trips to the Great Barrier Reef WHA; the variable costs of non fishing trips by fishers; nor some types of annual expenditure, such as fishing gear replacement and club fees, for non boat owners. Nevertheless the $94 million represents the majority of expenditure, especially as it includes the more expensive offshore recreational fishing trips.

A multiplier of 1.7 best represents the range of multipliers for recreational fishing for the four economic regions that include the Great Barrier Reef (Driml 1987a). The direct plus indirect effects of expenditure on recreational fishing and boating are therefore estimated at $168 million, in 1991–92 dollars.

Economic values

The **net** economic benefits to boat owners from private boat recreational fishing are represented by the consumer's surplus, net of costs, and these are estimated at between $50 million and $120 million per year, in 1990 dollars. Converting these to 1991–92 dollars gives figures of $52 million and $124 million.

Calculating economic values

As stated in appendix 1 of this report, the economist is not content with just financial values, but seeks to determine net economic values (or consumer's surplus). In the context of recreational fishing, a comprehensive economic analysis would ideally estimate the yearly or per trip consumer's surplus accruing to each recreational fisher. It is also mentioned in appendix 1 that, although a range of valuation methods are available for estimating consumer's surplus, the reliability of such methods is often questionable.

Recognising this, Blamey (1991) attempted to provide some 'ball park' estimates of annual consumer's surplus accruing to recreational boat fishers in the Great Barrier Reef WHA region. Data was obtained by adding relevant questions to the boat-ramp questionnaire originally employed by Blamey and Hundloe. The low distances travelled by most fishers from home to their chosen boat ramp prevented use of the travel cost method, and as a result, estimates of consumer's surplus were obtained via the contingent valuation method (CVM).

Both willingness to pay (WTP) and willingness to accept compensation (WTA) CVM questions were employed, the former relating to the amount by which annual expenses such as petrol, maintenance and tackle would have to increase before the individual would stop fishing, and the latter relating to the minimum amount of compensation that the individual would require in order to sell his or her right to fish for one year. Whether WTP or WTA provides the more appropriate format for the estimation of consumer's surpluses derived from recreational boat fishing in the Great Barrier Reef WHA region depends largely on whether the (property) rights to fishing are assumed to lie with the fishers or with the management authorities. WTA is more appropriate when fishers are assumed to possess the right to fish, but in practice, this format may be difficult to implement in a satisfactorily bias free manner. In the case of recreational boat fishing, biased responses can easily arise if fishes perceive a likelihood that the CVM question is somehow related to the introduction of licence fees, bag limits, or other management restrictions. Although economic theory expects a certain degree of divergence between WTA and WTP estimates of consumer's surplus for the same environmental or recreational good (the former is not constrained by income, for example), results of CVM studies using both formats generally indicate a greater than expected difference. The results reported in Blamey (1991) are no exception, the ratio WTA/WTP being 7.7 using estimates of the means, and 5.9 using estimates of the medians.

Mean willingness to pay (WTP) was estimated at approximately $2000 for one year and median WTP at approximately $800. In contrast, mean willingness to accept compensation (WTA) was estimated at $15 500 for one year and median WTA at $4900. For the WTA estimates in particular, greatest confidence should probably be placed in estimates of the median, since the mean is more susceptible to deliberately biased responses by individuals. Although Blamey (1991) acknowledges that several biases may have influenced the above results, a ball-park estimate of between $2000 and $5000 for yearly consumer's surplus accruing to recreational boat fishers in the Great Barrier Reef WHA region may be used as a guide. If one assumes the rights to fish in the Great Barrier Reef WHA region currently lie with the fishing population, an estimate at the higher end of this range will be more appropriate.

These figures can be compared with the estimated annual fixed costs of fishing of $2000, and the average annual variable costs of $700, reported by Blamey and Hundloe (1993). Given the average number of adults on each fishing trip, reported by Blamey and Hundloe (1993), the approximate variable costs actually borne by the boat owner are $300 per year. This gives an average annual total expenditure of $2300 by boat owners. If we take estimated mean consumer's surplus (WTP) of $2000, as a conservative estimate of the consumer's surplus, this minimum estimate of consumer's surplus is approximately equal in magnitude to estimated costs. Adding these, the total yearly recreational value is estimated to be $4300 on average. If property rights are assumed to lie with the fishers, the consumer's surplus component of this total value will increase by $3000, resulting in a total value of $7300. If less conservative estimates are permitted, estimated consumer's surplus and total economic values will be greater again. This all applies only to boat owners.

The net economic benefits to boat owners from private boat recreational fishing are represented by the consumer's surplus, net of costs, and these are estimated at between $50 million and $120 million per year, in 1990 dollars. Converting these to 1991–92 dollars gives figures of $52 million and $124 million.

TABLE 2.2 GREAT BARRIER REEF WORLD HERITAGE AREA

USES	*DESCRIPTION*	*GROSS FINANCIAL VALUES*	*ECONOMIC VALUES*
PRIMARY USES			
Nature Conservation Conservation of cultural features Aboriginal contemporary use	348 700 km^2 of Marine Park and islands	Nil, however these attributes provide the resource base for potentially sustainable direct uses which generate financial values	These attributes provide the resource base for potentially sustainable direct uses **plus** the economic values of non-market indirect uses Economic values of non-market indirect uses estimated at a minimum annual value of $86 million (1991–92)
COMPATIBLE DIRECT USES			
Tourism	2.2 million visitors per year	Direct: $682 million (1991–92) Direct plus travel: $1 080 million Direct plus indirect: $1 159 million	Between $23 and $584 million annual value (1991–92)
Commercial fishing	Around 16 000 tonnes	Direct: $128 million (1991–92) Direct plus indirect $256 million	not known
Recreational fishing and boating	24 300 private boats	Direct: $94 million+(1991–92) Direct plus indirect: $168 million	$52 to $124 million annual value (1991–92)
Research	GBRMPA and AIMS	Direct: $19.4 million (1991–92)	not known

3. WET TROPICS WORLD HERITAGE AREA

3.1 Description[8]

Location, size
The Wet Tropics World Heritage Area (hereafter called the Wet Tropics WHA) is located in north-east Queensland north of Townsville and adjacent to Cairns. The area is 9 000 km^2 in size. The area is not continuous as it excludes areas that have been cleared and includes only those areas of rainforest and associated natural vegetation considered of World Heritage status.

Major natural features
The Wet Tropics WHA includes the largest area of tropical rainforest and associated habitats on the Australian continent. The rainforests of the Wet Tropics WHA are of international significance as they contain plant species (many rare or threatened) representative of major stages in the earth's evolutionary history, particularly the development of angiosperms. The rainforests are habitat for rare or threatened marsupials and other animal species. The Wet Tropics WHA also includes landscapes of outstanding natural beauty.

History
The Wet Tropics WHA was inscribed onto the World Heritage List in 1988. The area includes land under tenure as National Park (29 per cent), State Forest (38 per cent), Timber Reserve (9 per cent), other reserves (1 per cent), leasehold (16 per cent), freehold (2 per cent) and vacant (6 per cent). Prior to listing as a World Heritage Area, these tenures were managed by government or private individuals for different purposes as allowed by the different tenures. Following World Heritage Listing of the area, the Commonwealth government prohibited commercial forestry in the area.

Management arrangements
The Wet Tropics WHA has the most complex mixture of land tenures and ownerships of any World Heritage Area in Australia. The Queensland Government has tenure over the majority of public lands; there is some Commonwealth freehold title; 14 Local Authorities have jurisdiction over parts of the Wet Tropics; and there are 91 freehold and 110 leasehold parcels of land. The Commonwealth Government has power to prohibit activities that may threaten World Heritage values (under the *World Heritage Properties Conservation Act, 1983*). Management of the overall area has been established through agreement by the Commonwealth and Queensland Governments for joint management and funding. The Wet Tropics Management Authority (WTMA) has been established under Queensland legislation and is in the process of developing the first Management Plan for the area. Day-to-day management remains with the organisations with responsibilities for the land tenures, namely the Queensland Department of Environment and Heritage (QDEH), the Queensland Forest Service (QFS) and other State and local government authorities.

Management objectives
The Wet Tropics Management Authority has adopted the following as its primary goal for the Wet Tropics WHA. 'To provide for the implementation of Australia's international duty for the protection, conservation, presentation, rehabilitation and transmission to future generations of the Wet Tropics of Queensland World Heritage Area, within the meaning of the World Heritage Convention'.

Management funding
Funding for the Wet Tropics WHA is provided by the Commonwealth and Queensland Governments. In 1991–92, an amount of $8.36 million was spent by the WTMA on capital works and recurrent costs. The Commonwealth government provided $6.13 million of this and the Queensland government contributed $2.23 million. In addition, the agencies with day-to-day management responsibilities fund some management from their budgets. The two Queensland Government agencies with greatest responsibility are the QDEH and the

[8] Information for this section is drawn from the *Wet Tropics Plan: Strategic Directions*, WTMA, 1992 and personal communication from WTMA staff.

QFS and together these agencies spent $3.69 million on management in 1991–92. The total management funding for the Wet Tropics WHA was therefore $12.05 million in 1991–92.

Both the Commonwealth and Queensland governments fund the majority of management budgets from consolidated revenue. There is no entry fee to the Wet Tropics WHA as such but and both the QDEH and the QFS have some revenue raising programs in the form of fees for camping and commercial tourist operations.

Major uses

The relatively recent declaration of the Wet Tropics WHA over land tenures formerly under a range of different uses means that land use is in a transitional stage. The initial Wet Tropics Plan is still under development and so details of what uses are considered compatible with World Heritage status have not been finalised. A major decision has been taken with the prohibition of commercial forestry, which was formerly the primary use of State Forests and Timber Reserves that cover 47 per cent of the area.

The primary uses of the World Heritage Area are nature conservation and the conservation of sites of Aboriginal and non-Aboriginal cultural heritage. Contemporary Aboriginal use of and association with the area continues.

The major direct uses are tourism and recreation. These uses are discussed in more detail in section 3.2 below.

Other continuing uses are defence training, mining, quarrying, telecommunications, power generation and transmission, community water supplies and transport (roads and railway lines). People live on leasehold and freehold land within the area. Those on freehold and leasehold land continue to undertake grazing and agriculture.

According to the *Wet Tropics Plan: Strategic Directions* issued by the WTMA, 'There are a number of existing and proposed uses of resources within the Wet Tropics WHA which may be inappropriate for the conservation of World Heritage values. These include:

- Grazing, including Lands Department grazing leases, and Queensland Forest Service or DEH stock grazing permits;
- Aboriginal hunting and plant harvesting,
- Defence use;
- Mining (mainly tin and gold);
- Quarries;
- Maintenance tree felling and disposal;
- Commercial fishing;
- Scientific collecting;
- Harvesting of other plant products (seeds, cones, leaves, vines);
- Water harvesting; and;
- Refuse dumps' (WTMA, 1992, p74).

The *Wet Tropics Plan: Strategic Directions* also states that additional facilities for communications, electricity distribution, transport, and water supply etc. should be located outside the WHA where possible and that upgrading of existing facilities should be subject to environmental impact assessment. The document also suggests a need for management of tourism and recreational use.

The identification of financial and economic values of the Wet Tropics WHA is complicated by the fact that decisions have not yet been taken on which direct uses will continue within the WHA and which uses will be considered incompatible and reduced in scope or phased out. Thus, while it is possible to construct a list of current uses and attach financial values where these have been compiled, this might not reflect the situation in the short term future. In the case of economic values, if a decision is made that an existing use is incompatible with World Heritage status, the net benefits of that use become an opportunity cost of the World Heritage Area not an additional net benefit.

Table 3.6 below summarises uses and financial and economic values of the Wet Tropics WHA. It is somewhat different from the standard used in this report for all other protected areas, due to the degree of uncertainty over what uses and levels of use will be permitted in the Wet Tropics WHA once the initial Wet Tropics Plan is finalised. Unfortunately, very few of the entries have dollar values attached because information has not been compiled on financial values and the economic analysis necessary to estimate economic values has not been undertaken.

An annual value for gross revenue from mining of $25 million has been included but is subject to some uncertainty (NEC 1988). The value is derived from a report produced in 1988 which attempted to project future mining revenues, but it is unknown whether the projections have been achieved. The figure should be treated as an order-of-magnitude estimate only.

As noted in appendix 2, the values of water catchment services are likely to be significant. No information on the financial or economic values of water catchment services has been included in this report.

3.2 Wet Tropics WHA tourism and recreation

This section addresses all tourism and recreation visits to the Wet Tropics WHA by Australian and international tourists and local residents who make recreational day trips to the Wet Tropics WHA. The Wet Tropics WHA is a large area made up of National Parks and other forested areas and extends from north of Townsville to the Bloomfield River. There are many entry points and many roads and walking tracks providing access.

Tourism and recreation in the Wet Tropics WHA has recently been described in a report by the National Centre for Studies in Travel and Tourism (NCST&T 1992). This report drew on published and unpublished information from the Queensland Visitors Survey plus a survey of tourist operators and a survey of tourists at Cairns Airport. The majority of visits (70 per cent) are made in private vehicles by local residents, tourists who have driven their own vehicles to North Queensland and tourists who rent vehicles locally. In addition, there are commercial tours operating in the area: bus tours, the famous Kuranda rail tour, river cruises and whitewater rafting. In February 1992, there were 97 commercial tour operations within the Wet Tropics WHA.

The vast majority of visitors stay or live in the coastal towns and cities adjacent to the WHA and visit on day trips[9]. Of the 97 different tours offered in 1992, 63 per cent were half or one day tours and these accounted for 96 per cent of tour capacity.
The following table, 3.1, summarises 'indicative estimates of the numbers of visitors to the Wet Tropics WHA in 1991' (NCST&T 1992, p. 64). The table actually shows estimated visitor days.

The trends for tourism in the Townsville and Cairns regions of Queensland have been of significant growth, especially in the number of international visitors, in recent years. During the years 1985 to 1990, domestic visits increased by seven per cent per annum in the Townsville region and five per cent per annum in the Cairns region. In the same period, international visits have increased at an average of 19 per cent per annum for the Townsville region and 28 per cent per annum for the Cairns region. Future national trends for tourism growth are expected to be reflected or bettered in this area (NCST&T 1992).

[9] This is the same population of tourists and residents from which visitors to the Great Barrier Reef is drawn. The GBR extends further south and is also adjacent to the Mackay and Rockhampton regions.

Table 3.1 Visitor Numbers Wet Tropics WHA

Market segments by transport	Number of visitor days
Residents on commercial tours	87 000
Tourists* on commercial tours	719 000
Residents using own vehicle	820 000
Tourists using own vehicle	845 500
Tourists using rented vehicle	185 600
Total	2 657 100
Segment by commercial/private	
Commercial tours: residents and tourists	806 000
Private visits: residents and tourists	1 851 100
Segment by origin	
Residents	907 000
Tourists	1 750 100

* Tourist is used in the conventional sense of a person travelling at least 40 km and staying for at least one night away from their usual place of residence.
Source: NCST&T 1992, p. 64.

Financial values

The NCST&T (1992) reported an amount of $92 million was spent on private and commercial trips within the Wet Tropics WHA in 1991. An additional expenditure of $285 million for two days stay in the adjacent region was estimated in this present study. The total direct expenditure in the region is therefore estimated at $377 million. Applying a multiplier of 1.7 (Driml 1987a) gives an estimated value for direct and indirect output effects on the Cairns and Townsville regions of $678 million. These estimates are order-of-magnitude only.

Calculating financial values
The financial value of all tourism to the Cairns and Townsville Regions, in which the Wet Tropics WHA is located is shown in table 3.2. This data is from reports of the Queensland Tourist and Travel Corporation (QTTC). Travel to the regions is not included. Additional expenditure by local residents of these regions making day trips was estimated at $68.5 million in 1990 (QTTC 1991b). Expenditure attributable to the Wet Tropics WHA is a subset of these values.

The measure of the financial value of tourism and recreational trips by local residents to the Wet Tropics is expenditure by tourists and local residents who visit. Expenditure that can be attributed to the Wet Tropics is made up of:
(a) fares and expenditure on commercial tours
(b) costs of private trips
(c) a component of accommodation and expenditure by tourists in the adjacent region
(d) a component of expenditure on travel to North Queensland.

Components (a) and (b) have been estimated by the NCST&T in their 1992 report, see table 3.3.

Table 3.2 Tourist Numbers and Expenditure, Cairns and Townsville Regions (1991–92)

	Visitor nights	Tourists in commercial accommodation ($ million)	Tourists staying with friends and relatives ($ million)	Total expenditure ($ million)
All tourists	13 402 700	923.1	187.5	1110.6
Tourists on Holiday/Recreation	11 723 500	794.0	162.5	956.5

Sources: Queensland Visitor Survey 1991–92 (QTTC 1992), Survey of visitors staying with friends and relatives in Queensland 1989 and 1990 (QTTC 1991b), 1990 data inflated to 1991–92 dollars.

Table 3.3 Visitor Expenditure Wet Tropics WHA

Market segments by transport	Visitors	Average expenditure $ per day	Total expenditure ($ million)
Commercial tour passengers			
Local residents	87 000	$50.00	$4.35
Tourists	719 000	$50.00	$35.95
Visitors using own/rented vehicles			
Local residents	820 000	$15.60	$12.77
Tourists using			
Private vehicle	845 500	$31.00	$26.21
Rented vehicle	185 600	$70.40	$13.07
Total	**2 657 100**	**$34.80**	**$92.35**

Source: NCST&T 1992, p. 90.

The NCST&T point out that the estimated amount of $92 million spent on trips within the Wet Tropics WHA is less than eight per cent of regional tourist and daytripping expenditure and that the commercial tour component is less than four per cent of total tourist expenditure for the Townsville and Cairns regions.

The NCST&T consider this to be 'an incomplete picture of the significance of the Wet Tropics to the regional tourism industry and economy' (p. 91) as it does not include other visitor expenditure that can be attributed to the attraction of the Wet Tropics WHA.

A survey conducted by the NCST&T at Cairns Airport found that 71 per cent of respondents participated in scenic drives (the Wet Tropics WHA would at least be background to these) and 21 per cent participated in bushwalking and rafting. Fifty-one per cent of respondents found rainforest/jungle/wilderness to be a most appealing feature of the region. It is quite possible that the Wet Tropics WHA is an attraction to people who do not actually visit it directly.

Despite this, the value of components (c) and (d) are not known as tourists have not been asked what amount of money or what proportion of their total trip expenditure they would attribute to their visits to the Wet Tropics WHA.

It is important to note that the NCST&T did not attempt any estimation of additional expenditure by tourists, possibly because they did not consider there was sufficient good data on which to base an estimate. The following estimate made for this report should be interpreted in the light of this inadequate data base, as an order-of-magnitude estimate only.

An estimate of the expenditure by tourists on accommodation and other expenses in North Queensland associated with their visits to the Wet Tropics WHA has been made on the same basis used for the Great Barrier Reef, of assuming tourists spend one day before and one day after their trip in the adjacent area. In the case of the Wet Tropics WHA, figures are only available for visitor days, not visitors, and so this may overestimate expenditure by those tourists who visit for more than one day.

The number of visitor days spent by tourists was estimated at 1 750 100 (table 3.1). An average daily expenditure of $81.50 by tourists visiting for holiday/recreation has been derived from QTTC data reported in table 3.2 above. The total additional expenditure is therefore $142.6 million for one day and $285.2 million for two days.

Table 3.4 Estimated Financial Value of Tourism and Recreation Wet Tropics WHA

Expenditure category	($ million)
Direct expenditure in Wet Tropics WHA	92
Extra two days in region	285
Total direct expenditure without travel	**377**

The total direct expenditure in the region of $377 million, that is without travel to the region, has a multiplier effect in the regional economy. Applying a multiplier of 1.7 (after Driml 1987a) gives an estimated value for direct and indirect output effects on the Cairns and Townsville regions of $678 million. It must be reiterated that these estimates are order-of-magnitude only.

Financial values of tourism in the Daintree/Cape Tribulation area

It is interesting to note the method and results of a study of tourism in the Daintree/Cape Tribulation area of the Wet Tropics WHA (Cummings et al. 1992). In that study, the expenditure by 223 000 tourists who visit the area north of the Daintree River was identified by interviews with tourist operators and tourists. The researchers recognised that tourists who visited the study area would need to spend some additional nights in the Far North region. They assumed that visitors would stay one day and one night either side of their visit to Daintree/Cape Tribulation and calculated the expenditure that would involve. The results are shown in table 3.5. Travel costs to the region were not included. Direct expenditure in the Daintree/Cape Tribulation area and on tours to the area was measured at $17.89 million. The direct expenditure attributed to extra time spent in the Far North region was $26.6 million; together these make $44.5 million. Cummings et al. calculated flow-on effects based on a multiplier of 2.1. The total direct and indirect output effect was therefore estimated at $76.39 million.

The results of the Cummings et al. study are consistent with the financial values for the entire Wet Tropics WHA calculated above, on a proportional basis.

Table 3.5 Visitor Expenditure and Estimates of Additional Financial Impacts, Daintree/Cape Tribulation

Type	Direct ($ m)	Flow on effects ($ m)	Extra 2 nights/2days ($ m)	Flow on effects ($ m)	Total ($ m)
Accommodation	1.65	1.26	14.42	11.03	28.36
Food & beverage	4.38	2.55	11.64	8.90	27.47
Local tours/attractions	2.88	2.21	-	-	5.09
Safari/4WD tours	7.23	5.56	-	-	12.79
Other expenditure	1.75	0.93	-	-	2.68
Total	**17.89**	**12.51**	**26.06**	**19.93**	**76.39**

Source Cummings et al. 1992, p. ii.

TABLE 3.6 WET TROPICS WORLD HERITAGE AREA

USES	*DESCRIPTION*	*GROSS FINANCIAL VALUES*	*ECONOMIC VALUES*
PRIMARY USES			
Nature Conservation Conservation of cultural features Aboriginal contemporary use	9000 km^2 of relatively undisturbed natural environment. Aboriginal cultural sites. Historical sites.	Nil, however these attributes provide the resource base for potentially sustainable direct uses which generate financial values	These attributes provide the resource base for economic values of potentially sustainable direct uses **plus** the economic values of non-market indirect uses Economic values of non-market indirect uses have not been measured for the Wet Tropics WHA.
COMPATIBLE DIRECT USES			
Tourism and recreation	1.8 million visits by tourists, 0.9 million visits by local, residents, in 1991	Direct: $377 million (1991–92)	not known
Highways, roads, railways	1500 km roads	not known	not known
Telecommunications	Microwave and radio repeaters, fibre optic cables, radio, TV broadcast facilities	not known	not known
Water catchment services	21 community water supplies	not known	not known
Electricity generation and distribution	Tully River(Kareeya) and Barron Gorge power stations, main grid and feeder lines	not known	not known

TABLE 3.6 WET TROPICS WORLD HERITAGE AREA (CONTINUED)

USES	*DESCRIPTION*	*GROSS FINANCIAL VALUES*	*ECONOMIC VALUES*
DIRECT USES UNDER REVIEW		not known	not known
Grazing	55 leases and permits over 103 000 ha	not known	not known
Aboriginal hunting and plant harvesting	By an unspecified number of Aboriginal people for personal use and artefact sale	not known	not known
Defence training	16 470 ha on freehold and leasehold land	not known	not known
Mining	10 leases, 21 claims	$25 million (1988)	not known
Quarries	37 gravel quarries	not known	not known
Maintennance tree felling and disposal	extent not known	not known	not known
Commercial fishing	extent not known	not known	not known
Scientific collecting	extent not known	not known	not known
Harvesting plant products	extent not known	not known	not known
Refuse dumps	extent not known	not known	not known

4. KAKADU NATIONAL PARK

4.1 Description[10]

Location, size
Kakadu National Park is located in the Northern Territory, 120 km east of Darwin. It covers an area of 19 804 km^2.

Major natural features
The park encompasses areas of sandstone escarpment and dissected Arnhem Land plateau, low hills and the flood plains of several rivers which run north to the sea which bounds the park in the north.

The juxtaposition of these features results in a variety of habitats, representing all the major habitats in the Top End. There is a great diversity of native fauna and the wetlands of Kakadu are considered of international significance for waterfowl.

History
The Alligator Rivers Wildlife Sanctuary was declared over part of what is now Kakadu National Park in 1972. In 1979, Stage One of Kakadu National Park was declared and subsequent additions have been made: Stage Two in 1984, Stage Three in 1987 and further additions in 1989 and 1991.

In 1981, Stage One was inscribed on the World Heritage List and Stage Two was included in 1987. The entire park, including Stage Three was renominated and was included on the World Heritage List in 1992.

Management arrangements
Part of the area of Kakadu National Park is Aboriginal freehold land leased to the Director of the Australian Nature Conservation Agency (ANCA, formerly the Australian National Parks and Wildlife Service). The remainder is Commonwealth land and some of this is currently subject to land claims. Management planning is undertaken jointly by the Kakadu Board of Management (the majority of members being Aboriginal people nominated by the traditional owners of the land) and the Director of ANCA. The management intentions for the period 1991 to 1996 are presented in the 1991 Plan of Management. Day-to-day management is undertaken by ANCA.

Management funding
The majority of funding for management is provided to the ANCA by the Commonwealth Government. In 1991–92, ANCA allocated $10.8 million to park management.

Park entry fees are levied on every visitor. From July 1992, these fees are $10 per person or $40 per family for a single entry, or $30 per person annual entry. Camping fees for developed camp grounds are $7 per site per night.

Park revenue in 1991–92 was $1.02 million. In 1992–93, Park revenue was $1.28 million and of this, $1.17 million was from entry fees and $105 900 was from camping fees.

Management objectives
The following key management objectives have been developed in the Plan of Management 1991:

- to establish a plan of management in which Aboriginal people associated with the park play a major role;
- to give special protection to Aboriginal art sites, sacred sites and other sites of significance to Aboriginal people
- to institute an innovative park management regime conforming to the highest international standards;

[10] Information was compiled from Kakadu National Park Plan of Management (ANPWS 1991) and personal communication from ANCA staff.

- to protect park resources from the undesirable consequences of fire, erosion, environmental change, pollution and other activities of people;
- to rehabilitate areas damaged by feral and introduced animals and plants, and other recent human impacts;
- to cooperate with neighbours in complementary management programs which help to protect park resources;
- to develop an inventory of all relevant resources in the Park;
- to study the physical and biological processes operating in the park as an aid to management and as a contribution to scientific knowledge;
- to develop a range of facilities for public enjoyment of the Park;
- to stimulate interest in nature conservation and Aboriginal culture by the development and implementation of an imaginative communication program;
- to provide information and guidance to visitors about potential hazards in the Park and ensure their safety as far as possible.

Major uses
As identified in the management objectives, the primary uses of the Park are to provide for contemporary use by local Aboriginal people, protection of sites of cultural significance and nature conservation.

The major direct uses of the Park are tourism and recreation and these are discussed in more detail in section 4.2 below. There are Aboriginal residential settlements in the Park (about a dozen living areas with a total population of 300 people) and the township of Jabiru (population 1200) is within the Park. There is a research station run by the CSIRO and other research occurs within the Park. The total expenditure on research has not been ascertained for this report.

Mining is prohibited. The Ranger uranium mine and surrounding area is excluded from the Park. No agricultural activities (except a small buffalo herd) occur. Recreational fishing is allowed but highly regulated; no commercial fishing is permitted. The eradication of feral animals, particularly buffalo, is a source of income to private contractors who are paid by the ANCA and also sell the animals.

Prior to the inclusion of the former Conservation Zone into Stage Three of Kakadu National Park, the option remained open for mining to occur in the Conservation Zone. A series of assessments of whether or not mining should proceed culminated in an Inquiry by the Resource Assessment Commission. As part of that Inquiry, a contingent valuation study of the economic value of the conservation (no mining) option was undertaken. The results of the study and comments on interpretation within the context of this report are presented in section 4.3 below.

4.2 Kakadu National Park tourism and recreation

Tourism in Kakadu National Park is characterised by a majority of self drive or private travellers who stay overnight or longer within the Park. Eighty per cent of visitors are private travellers and the remaining 20 per cent arrive on commercial tours. Only five per cent of private visitors and 35 per cent of visitors on commercial tours make their visit a day trip. The majority of visitors stay at least overnight. The average length of stay is about four days for private travellers and two days for those on tours (ANPWS 1991).

Private visitors may camp independently (50 per cent bring camping gear and a further 29 per cent tow caravans) or they patronise the commercial accommodation located within the Park. This consists of four motels and lodges, one caravan park and a youth hostel. While in the Park, private visitors may take one or more of the popular short commercial tours available; boat tours for wildlife viewing or helicopter and fixed wing aircraft flights over the escarpment (ANPWS 1991a).

Visitors on commercial tours may stay in the motel/lodge accommodation or camp in safari style accommodation provided by tour operators. These tourists may also take boat and air tours offered by other operators within the Park.

The commercial tour sector consists of the accommodation establishments, the companies who run trips within the Park and regular or infrequent tours from Darwin and other parts of Australia. In 1992, there were 153 companies with permits to conduct commercial tours in the Park (ANPWS 1992).

The increase in numbers of people visiting Kakadu National Park has been dramatic in the last decade. Visitor numbers have more than trebled, see table 4.1.

Table 4.1 Visitor Numbers, Kakadu National Park

	Visitors	Visitor days
1982	45 800	150 000
1988		717 000
1990	240 000	
1991	211 000	

Source: 1991 data from ANPWS 1992, remainder from ANPWS 1991a.

Financial values

Total expenditure within the Park in 1990 was calculated at $34.375 million (Knapman et al. 1990). This figure was $103.6 million for 1988–89. On the same basis, the amount for 1991–92 was $122 million (NTTC 1992). This is the estimated direct expenditure without the cost of travel to the area.

Calculating financial values

The relevant measure of the financial value of tourism in Kakadu National Park is expenditure by visitors. A survey of visitors to the Park conducted in 1990 provided information on direct expenditure in the Park by private visitors and tourists on commercial tours (Knapman et al. 1990). International tourists spent an average of $51 dollars a day and domestic tourists spent $35 on average. Total expenditure within the Park in 1990 was calculated at $34.375 million (Knapman et al. 1990).

This amount is only a part of the expenditure on tourism and recreation in Kakadu National Park as it does not include expenditure on tours purchased outside the Park. Neither does the amount include a proportion of travel to and accommodation in the Northern Territory associated with visits to Kakadu.

Financial values would include expenditure on:
(a) all purchases of tours, accommodation and services within the Park
(b) the full cost of trips from Darwin to Kakadu National Park
(c) a component of travel to and accommodation in the Northern Territory associated with visits to Kakadu National Park by private visitors
(d) a component of travel to and accommodation in the Northern Territory associated with visits to Kakadu National Park by visitors on commercial tours.

Knapman et al. (1990) have measured (i) at $34.375 million in 1990. These researchers have also estimated a financial value that includes (i) plus part of items (ii) to (iv), excluding travel to the Northern Territory, from knowledge of total expenditure by tourists in the Northern Territory. Total expenditure by tourists in the Northern Territory was $414.67 million in 1988–89. Half of this was spent in the Top End, excluding Katherine. Knapman et al. have concluded that 'it is reasonable to assume that about one half of the tourism expenditure in the Top End was spent by people who visited Kakadu/CZ[11] (including expenditure within the Park and CZ, and elsewhere)' (Knapman et al. 1990, p 13-14).

This figure was $103.6 million for 1988–89. On the same basis, the amount for 1991–92 was $122 million (NTTC 1992). This is the estimated direct expenditure without the cost of travel to the area.

[11] CZ refers to the Conservation Zone now included within the Kakadu National Park World Heritage Area.

The following comment is made by Knapman et al. on the estimate used:
'It should be noted that this estimate is likely to be conservative. In particular, many people will argue that Kakadu and Uluru are economically important far beyond these calculations because they are widely known both nationally and internationally and draw attention to the other tourism possibilities in the NT. We do not disagree with this assessment but we are unable to assess the value of this effect' (Knapman et al. 1990, p 14).

Knapman et al. went on to construct an analysis of the regional economic impacts of Kakadu tourism on sectors of the Northern Territory economy, using the ORANI NT model (see appendix 1.). They separated out the contribution to various economic indicators of current levels of expenditure on tourism in Kakadu National Park (based on the $103.6 million figure noted above). They also simulated the impacts of a 10 per cent increase or decrease in Kakadu tourism on various economic indicators, see table 4.2.

Table 4.2 Regional Economic Impact Analysis, Tourism in Kakadu National Park

	All Kakadu tourism	10% decrease	10% increase
Real gross NT product	+ 4.52	- 0.38	+ 0.38
Employment	+ 6.26	- 0.52	+ 0.52
Real disposable income	+ 4.03	- 0.34	+ 0.34
Real consumption	+ 4.02	- 0.33	+ 0.33
Real investment	+ 4.02	- 0.33	+ 0.33
Locally raised NT govt. revenue	+ 0.80	- 0.07	+ 0.07
NT consumer price index	+ 2.48	- 0.20	+ 0.20

Source: Knapman et al. 1990.

The results show that at current levels, Kakadu tourism makes a notable contribution to the Northern Territory economy, for example, income is 4.03 per cent higher and employment is 6.26 per cent higher than it would be without this activity (assuming no other uses employ these natural environment, labour and capital resources in the Northern Territory). The effects of a 10 per cent decrease or increase are however small.

The ORANI model results as reported by Knapman et al. do not include a 'standard' output multiplier to convert direct expenditure to a direct plus indirect effects value.

Economic values

The economic value to tourists of access to Kakadu National Park is what they would be willing to pay, minus any fees charged. Knapman and Stanley (1991) calculated a willingness to pay equivalent to $36.6 million in 1991 dollars. In that year, tourists paid $1 million in fees, making the net economic value $35.6 million for 1991.

Calculating economic value

The economic value of direct visitor use of Kakadu National Park is measured as the consumer's surplus accruing to visitors. That is, the value that they are willing to pay above what they have to pay for

access to the attractions of the Park. An estimate of this value has been calculated by Knapman and Stanley (1991) using a Travel Cost Analysis.

Using data collected in their 1990 visitor survey, Knapman and Stanley modelled what it actually cost visitors from other parts of Australia to travel to Kakadu National Park. A demand curve for visits to Kakadu was successfully described. This was then used to model the effects on demand of a range of hypothetical entry fees from $5 per person to $350 per person. The consumer's surplus at zero entry fee was calculated to be $34.9 million (in 1990 dollars). There is an entry fee to Kakadu National Park which averaged at $3.70 per person at the time of the study. The total entry fees paid were about $0.9 million in 1990, resulting in a consumer's surplus of $34 million in 1990. Knapman and Stanley adopted an annual consumer's surplus of $34.9 million ($36.6 million in 1991), for technical reasons, and calculated the Net Present Value at an 8 per cent discount rate. This resulted in a NPV of $436.3 million ($458.1 million in 1991 dollars).

Table 4.3 Economic Values, Tourism in Kakadu National Park

	Consumer's surplus (1990 dollars)
Per person	$142.29
Per household	$384.18
Per person per day	$37.05
Total	$ 34.9 million
Net Present Value	$ 436.3 million

Source: Knapman and Stanley 1991.

In 1991, visitors paid around $1 million in fees to enter Kakadu National Park. Reducing the 1991 consumer's surplus value by this amount gives an annual economic value for tourism of $35.6 million in 1991 dollars.

4.3 Economic valuation of Kakadu National Park conservation

There is one piece of research that attempts to estimate preservation values for Kakadu National Park. Preservation values are considered to combine the components of existence, bequest and option values. These are the indirect use, non-market values arising from a protected area. As will become clear from the discussion following, there is some uncertainty about what the study actually measured. The results of the study are interpreted here as estimating an undefined part of the total preservation value of Kakadu National Park.

The results of the study can be interpreted as assigning a minimum economic value to Australians of $647 million per annum from preservation of Kakadu National Park in its current form.

Calculating economic values

The study was undertaken by the Resource Assessment Commission to provide an input to its Inquiry into the Kakadu Conservation Zone. The Conservation Zone has since been incorporated into the National Park and World Heritage Area. The Inquiry specifically assessed proposals to establish a gold and platinum mine at Coronation Hill.

The study attempted to estimate the economic value to the Australian community of preserving the Conservation Zone from mining and prevent any damage from mining that may spill over into other areas of the Park. The study employed the Contingent Valuation Method (CVM). This involved surveying a sample of the Australian population and a sample of the Northern Territory population for their willingness to pay to avoid damage. As the potential effects of mining were unknown at the time

of the survey, two scenarios of 'major' and 'minor' possible damage were developed and described to respondents.

The results for the sample of the Australian population were a median willingness to pay $123.80 per year for ten years to avoid the major impacts or $52.80 per year for ten years to avoid the minor impact. All results are in 1991 dollars.

The Inquiry determined that the minor scenario was the more likely, based on the information presented to the Inquiry on the impacts of mining. Extrapolation of the individual median willingness to pay to avoid the minor impact to the Australian population gives a value of $647 million per annum for ten years. The estimated Net Present Value of mining for the 14 years the mine was forecast to operate was $82 million.

The CVM and results obtained were criticised by some economists and commentators and supported by others. The RAC examined the various criticisms and have stood by the results to the extent that they have been published in their Inquiry report. However the Inquiry Commissioners stated that they did not use the results of the survey in considering the economic impacts of mining, having accepted that 'the values revealed by the study are most probably too high' (RAC 1991, p. 149).

Criticisms of the Conservation Zone CVM study fall into two general categories. The first is that the method is flawed by difficulties in getting people to nominate a 'realistic' willingness to pay. This type of problem is the subject of continuing critical analysis by the economics profession and there is no clear or unanimous judgement on the acceptability of the method as yet.

The second type of criticism applies specifically to the Conservation Zone CVM. It has been argued that the respondents did not understand the scenarios presented and were nominating values more in line with their willingness to pay to prevent potential major damage to Kakadu National Park as a whole.

While the perception is held by some people, including the Inquiry Commissioners, that the values were 'too high' for the issue at stake - potential minor damage from mining - it is interesting to consider what these values may indicate for preservation values of Kakadu National Park as a whole.

If respondents did misunderstand the scenarios and nominated willingness to pay for preservation of Kakadu National Park, the figure of $647 million per annum, or possibly the $1.5 billion based on the median value of the major damage scenario, is a reasonable figure to assign to the preservation value of Kakadu National Park. If the results of the Conservation Zone CVM are not 'too high' then $647 million is an undefined part, or minimum value, of the total preservation value of Kakadu National Park.

The interpretation of these values rests on the acceptance of the CV methodology.

TABLE 4.4 KAKADU NATIONAL PARK WORLD HERITAGE AREA

USES	*DESCRIPTION*	*GROSS FINANCIAL VALUES*	*ECONOMIC VALUES*
PRIMARY USES			
Aboriginal contemporary use	Population of 300 people	Nil, however these attributes provide the resource base for potentially sustainable direct uses which generate financial values	These attributes provide the resource base for economic values of potentially sustainable direct uses **plus** the economic values of non-market indirect uses Economic values of non-market indirect uses have been estimated at a minimum of $647 million pa.(1991)
Nature conservation	19 804 km^2 of relatively undisturbed natural environment.		
Conservation of cultural features	Numerous art sites, sacred sites and other features.		
COMPATIBLE DIRECT USES			
Tourism and recreation	240 000 visitors in 1990	Direct: $122 million (1991–92)	$35.6 million in 1991 NPV $458.1 million (1991)
Research	CSIRO (Kapalga), ANCA, OSS, CCNT etc.	not known	not known
Residential use	Living areas, Jabiru township	not known	not known

5. ULURU NATIONAL PARK

5.1 Description[12]

Location, size
Uluru National Park is located in central Australia, 335 km south-west of Alice Springs. The Park covers 1325 km^2.

Major natural features
The Park encompasses Uluru (Ayers Rock) and Kata Tjuta (the Olgas) in an arid landscape and protects a range of desert ecosystems.

History
Uluru National Park was declared under Commonwealth legislation in 1977. In 1985, the area of Uluru National Park was granted as inalienable freehold to the Uluru-Kata Tjuta Land Trust. Arrangements were put in place for the Park area to be leased to the Director of the Australian Nature Conservation Agency (ANCA, formerly Australian National Parks and Wildlife Service) and for the area to continue to be managed as a National Park (with emphasis on Aboriginal involvement). In 1987, Uluru National Park was inscribed on the World Heritage List.

Management arrangements
Planning and management is undertaken jointly by the Uluru-Kata Tjuta Board of Management and the Director of ANCA. Day-to-day management is undertaken by ANCA.

Management funding
The majority of funding for management is provided to ANCA by the Commonwealth Government. In 1991–92, ANCA allocated $2.9 million to park management.

Park entry fees are levied on every visitor. From July 1993, these fees will be $10 per person.

Revenue from all sources in 1991–92 was $1.85 million, and in 1992–93 it was $2.05 million.

Management objectives
Uluru is an Aboriginal National Park and the involvement of the traditional owners of the land governs management objectives. The Park not only includes many art sites signifying earlier use but the lands have contemporary significance to the traditional owners. Thus a principle management objective is 'to continue to take into account Anangu religious interpretations of landscape in all areas of Park management, particularly in relation to the nature and siting of developments in the Park' (p. 12). Other objectives include; managing visitors based on Anangu perceptions of appropriate behaviour, protecting and conserving rock art resources and other archaeological resources, and taking into account Anangu ecosystem knowledge and understanding in the planning and implementation of land management within the Park.

Major uses
As identified in the management objectives, the primary uses of the Park are to provide for contemporary use by Aboriginal people, protection of sites of cultural significance and nature conservation.

Tourism and recreation generate the greatest financial values, see section 5.2 below.

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[12] Information was compiled from *Uluru (Ayers Rock - Mount Olga) National Park Plan of Management* (ANPWS 1991b) and personal communication from ANCA staff.

A permit is required for commercial filming and photography. Guidelines have been developed to direct filming and photography away from sites with Aboriginal significance that would be compromised by the dissemination of images or verbal descriptions. The permit requirement is for management rather than to raise revenue. The financial value generated from photographic images of Uluru National Park is unknown.

5.2 Uluru National Park tourism and recreation

Tourism is the direct use which generates by far the greatest financial values of Uluru National Park. Due to the distance of Uluru National Park from other population centres, virtually all visitors are tourists (not local residents taking day trips). Uluru is open to visitors only during the day. Accommodation is provided at Yulara village which is 5 km from the park entry station and 13 km from Uluru (Ayers Rock).

Around a quarter of a million people currently visit Uluru National Park each year. A recent study of tourism in Uluru National Park found that many visitors made more than one trip into the Park during their stay, and estimated that the number of visitor days are more than twice the number of visitors (ES&S 1991). There are no estimates of visitor days for previous periods. Table 5.1 lists available information on visitor levels in the last decade and projections for the year 2000.

Table 5.1 Visitor Numbers Uluru National Park

	Visitors	Visitor days
1981–82	86 884	
1991–92	250 000	550 000
Projected 2000	370 000	814 000

Source: ES&S 1991, ANCA pers. comm.

The number of visitors grew by 187 per cent in the decade from 1981–82 to 1991–92. The rate of growth prior to the opening of Yulara in 1984 was 5 per cent per annum and this climbed to 16 per cent per annum in the four years after opening. The average length of stay at Yulara resort is 1.8 nights (ES&S 1991).

Visitors to Uluru either arrive in their own cars (52 per cent of visitors) or on commercial tours (48 per cent) of visitors. There is a variety of tours into the National Park, including bus tours from other parts of Australia on which Uluru is one of a number of tour highlights, and scenic flights and vehicle based tours from Yulara. Commercial facilities located within Uluru National Park which cater for visitors are the Ininti Kiosk which sells refreshments and souvenirs and the Maruku Arts and Crafts centre which retails work of local artists.

Financial values

An estimate of expenditure by visitors to Uluru National Park has been put at $38 million for 1991–92. This figure is an order-of-magnitude estimate only.

Calculating financial values

The financial value of tourism in Uluru National Park is made up of expenditure by tourists on:
(a) admission fees
(b) returns to retail facilities within the park
(c) commercial tours from Yulara
(d) accommodation and services at Yulara
(e) a proportion of travel costs to the region.

Information on expenditure by tourists is collected through the Northern Territory Tourism Monitor (NTTC 1992). Yulara and Uluru National Park are included in the Centre Region which also includes

Alice Springs and the MacDonnell Ranges. Unfortunately, expenditure at Yulara and in Uluru is not reported separately from that for the Centre Region. An estimate of expenditure at Uluru/Yulara has been based on estimates of visitor nights spent in the area of Uluru National Park (ES&S 1991). The average expenditure per visitor night for the entire Northern Territory of $83.80 for 1991-92 has been used in this calculation.

Table 5.2 Estimated expenditure at Uluru/Yulara 1991-92

	Centre Region	Uluru/Yulara
Visitors	348 000	250 000
Average stay	5 days	1.8 days
Visitor nights	1 849 000	450 000*
NT av. exp./visitor night	$83.80	$83.80
Expenditure	$155 million*	$37.7 million*

Source: Northern Territory Travel Monitor (NTTC 1992), ES&S 1991, and * calculated in this table.

The figure of $38 million dollars direct expenditure is an order-of-magnitude estimate only as it is not based on a direct survey of visitors to Uluru/Yulara. The figure does not include a component of expenditure on travel to the area.

TABLE 5.3 ULURU NATIONAL PARK WORLD HERITAGE AREA

USES	*DESCRIPTION*	*GROSS FINANCIAL VALUES*	*ECONOMIC VALUES*
PRIMARY USES			
Aboriginal contemporary use Nature conservation	1325 km^2 of relatively undisturbed natural environment.	Nil, however these attributes provide the resource base for potentially sustainable direct uses which generate financial values	These attributes provide the resource base for economic values of potentially sustainable direct uses **plus** the economic values of non-market indirect uses
Conservation of cultural features	Numerous art sites, sacred sites and other features.		Economic values of non-market indirect uses have not been measured for the Uluru National Park.
COMPATIBLE DIRECT USES			
Tourism and recreation	250 000 visitors in 1991–92	Direct: $38 million (1991–92)	not known
Commercial filming and photography	not known	not known	not known
Research	not known	not known	not known

6. TASMANIAN WILDERNESS WORLD HERITAGE AREA

6.1 Description[13]

Location, size
The Tasmanian Wilderness World Heritage Area (the Tasmanian WHA) is located in central, west and south-west Tasmania. It covers an area of 1.38 million hectares, which is around 20 per cent of the land area of Tasmania.

Major natural features
The area includes undisturbed forests and habitats of plants and animals that are endemic and rare or endangered, extensively glaciated landscapes and Aboriginal cultural sites including Ice Age cave art. The area has spectacular scenery and wilderness characteristics.

History
In 1982, the existing National Parks of Cradle Mountain-Lake St Clair, Franklin-Lower Gordon Wild Rivers, and Southwest were inscribed on the World Heritage List as the Western Tasmania Wilderness National Parks World Heritage Area (1.2 million hectares). A further 600 000 hectares including National Parks, Conservation Areas, Forest Reserves, Protected Archaeological sites and around 300 hectares of freehold land were incorporated and the renamed area inscribed on the World Heritage List in 1989.

Management arrangements
The area is managed and funded subject to joint arrangements between the Tasmanian and Commonwealth governments. The arrangements include a Ministerial Council and a Consultative Committee with members appointed by both governments. The Plan of Management has been developed by the Tasmanian Department of Parks, Wildlife and Heritage under these joint arrangements.

The majority of the Tasmanian WHA is reserved in National Parks and is managed on a day-to-day basis by the Tasmanian Department of Parks, Wildlife and Heritage. Forest Reserves are managed by the Forestry Commission, the Hydro-Electric Commission manages a small area, and freehold land is managed by the owners.

Management funding
Under the joint arrangements, the Commonwealth Government has provided funds for capital works and operational funding. The funding commitments by the Commonwealth and Tasmanian Governments to capital works and operational funding are covered by rolling three-year agreements. In 1991–92, the Commonwealth Government provided $3.2 million of a total of $4.8 million allocated by the Tasmanian Department of Parks, Wildlife and Heritage to the Tasmanian WHA.

In 1991–92 around $175 000 was earned from park fees for leases and concessions at sites within the Tasmanian WHA. In May 1993, visitor fees were introduced. These are for adults only and range from $5 per day to $40 for a one-year pass.

Management objectives
The overall management objectives of the Tasmanian WHA are to protect, conserve, present and, where necessary, rehabilitate the natural and cultural heritage.
Eleven primary objectives have been developed, these are to:

- protect the natural diversity of the WHA and maintain and restore its natural ecological processes and systems;
- maintain and enhance wilderness quality;
- maintain viable populations of all species;
- maintain and enhance scenic and environmental quality;
- protect and conserve cultural heritage;

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[13] Information was compiled from *Tasmanian Wilderness World Heritage Area Management Plan 1992*, and Department of Parks, Wildlife and Heritage, Tasmania, *Annual Report 1991-92.*

- develop, through research, a better understanding of natural and cultural processes and impacts;
- promote community awareness, acceptance, understanding and appreciation of the concept of World Heritage and the values of the Tasmanian WHA;
- assist visitor appreciation and enjoyment by developing and promoting an appropriate range of opportunities and facilities for public recreation and tourism both in and adjacent to the WHA;
- enrich the experiences of visitors through education and interpretation;
- develop public understanding of the principles and value of conservation;
- improve the basis for management through a better understanding of visitor use, expectations, satisfaction and community attitudes.

Major uses
The primary purpose of the Tasmanian Wilderness WHA is nature conservation and protection of archaeological features.

Tourism and recreation are the major direct uses of the Tasmanian Wilderness WHA and provide the greatest financial values, see section 6.2 below.

Minor direct uses include mining, salvage of Huon Pine, limited commercial fishing and apiary. There is one osmiridium mine producing at negligible levels. Beekeeping generated leatherwood honey to the value of $208 000 in 1990.

A number of highways and lesser roads pass through the WHA. There are some telecommunications facilities and power transmission lines located in the area. The water catchments of the WHA, specifically Lake St Clair, provide resources for hydro-electric power generation. As noted in appendix 2, the values of water catchment services are likely to be significant. No information has been included on the financial or economic values of these uses.

6.2 Tasmanian Wilderness WHA tourism and recreation

The Tasmanian WHA covers approximately 20 per cent of the area of Tasmania. Locations in the Tasmanian WHA are within 1.5 hours drive from Launceston, 1 hour drive from Hobart and are half an hour from many towns. The area thus provides recreational resources for Tasmanians as well as for visitors from other states and overseas.

Most visits to the Tasmanian WHA are day visits by people travelling from home or from accommodation outside the WHA. The few built accommodation facilities within the WHA are huts and only four of these are leased for commercial use. Camping is allowed throughout the Tasmanian WHA and camping grounds and facilities are provided in some locations. The major visitor facilities provided in the area are visitor centres at National Parks.

The Tasmanian WHA has a reputation for wilderness recreation. The following quote from the Management Plan sums up the character of recreation in the WHA:

'The WHA provides opportunities for a wide range of recreation pursuits. Although the majority of visitors to the area are on day trips undertaking activities such as picnicking and short walks, the region is widely recognised as the focus for remote area recreation in south-eastern Australia. The extensive tracts of high quality wilderness in the region set it apart from many other natural areas. Walking, rafting, canoeing, fishing, skiing, caving, climbing, boating and horse riding may all be undertaken in the area in a natural setting. The region provides people with the chance to experience solitude, challenge, independence, tranquillity and closeness to nature' (DPWH 1992, p. 56).

While much of this recreation is undertaken privately, there is a growing commercial tour industry that includes guided day or overnight walking tours, rafting, 4WD tours, a cruise on the Gordon River and trout fishing. Bus tours from other parts of the state bring visitors for day visits.

The number of visits to the Tasmanian WHA has been estimated by Buckman and O'Loughlin (1991). Table 6.1 is taken from their report of visitor statistics for 1990-91.[14] It is somewhat difficult to compare the figure for visits with data on the number of visitors or visitor days(nights) recorded in other tourism statistics series. The number of visits figure is based on counts made at different centres and locations within the WHA. People visiting more than one centre in a day may be counted more than once whereas those spending more than one day in the same general location would only be counted once. The average length of stay in the Tasmanian WHA is estimated at half a day. Buckman and O'Loughlin have multiplied the total visits number by 0.5 of a day to calculate an approximation of visitor-days at 298 544 for 1990-91.

Table 6.1 Visits to the Tasmanian WHA 1990-91

Centre	Total visits	No. days no data recorded	Period
Cradle Mountain	147 000	22	1990-91
Cradle Mountain accommodation	77 000	0	1990-91
Lake St Clair	131 000	19	1990-91
Lake St Clair accommodation	16 208	0	1990-91
Gordon River	69 380	0	1990
Maydena Gate*	30 000	126	1990-91
Marakoopa Cave	21 000	3	1990-91
Western Central Plateau**	16 500		1990-91
Hartz Mountains	11 000	0	Averaged
Liffey/Meander Forest Reserves***	48 000		1990-91
Other visits****	30 000		
Total	597 088		

*Only includes visits between November and June (inclusive). **Inland Fisheries estimate based on annual surveys. ***Forestry Commission estimate of twelve monthly visitation based on four months of road counter data. ****Includes walkers, fishing vessels, aeroplanes, unrecorded cars and other 'uncaptured' data. Special note: Some visitor entry points to the Tasmanian WHA are not included in the above table. The most popular of these are the Lyell Highways which are mainly used by people whose only interest is probably the use of the roads. A number of smaller centres including Recherche Bay and Liawenee are also excluded. Source: Buckman and O'Loughlin 1991, p. 44.

[14] Data for 1991-92 are published in the Annual Report of the DPWH but have not been used here as there were a large number of unrecorded days for the major centres of Cradle Mountain and Lake St Clair.

There is no doubt that the Tasmanian WHA experienced increasing annual visitation over the last decade. Although total visitor numbers are not available, trends in visits can be gauged by comparing records of visits to major centres across years. The amount of data available is limited. Table 6.2 below is based on figures in Buckman and O'Loughlin (1991). The data indicate an 193 per cent increase in visits to Cradle Mountain from 1984-85 to 1990-91 and a modest two per cent increase in visits to Lake St Clair from 1987-88 to 1990-91.

Table 6.2 Visits to the Tasmanian WHA 1984-92

	1984-85	1987-88	1990-91
Cradle Mountain	50 188	70 574	147 380
Lake St Clair		127 849	130 778

Source: Buckman and O'Loughlin 1991.

The Tasmanian Visitor Survey provides information on places in Tasmania visited by tourists from interstate and overseas. Figures for the number of visitors to the four most popular locations in the Tasmanian WHA in 1984 and 1992 are reproduced on table 6.3 below. Data for 1991 are also provided for a comparison with table 6.2 above.

Table 6.3 Interstate and overseas visitors to the Tasmanian WHA

Location	Visitors 1984	Visitors 1991	Visitors 1992	Change 1984-92
Cradle Mountain NP	35 664	99 144	141 337	+296%
Lake St Clair NP	57 885	78 505	106 699	+84%
Central Highlands/Great Lake	40 876	51 797	54 146	+32%
Gordon River	73 523	74 054	110 283	+50%

Source: Fisher 1993.

Financial values

Expenditure by visitors to the Tasmanian Wilderness WHA has been estimated at $59 million for 1991–92. This is an order-of-magnitude estimate only.

Calculating financial values

Financial values of tourism and recreation in the Tasmanian WHA are measured as expenditure by tourists. There is no up to date information on financial values of tourism and recreation in the Tasmanian WHA, either published or held by the relevant government agencies.

An estimate of the likely order-of-magnitude of financial values of Tasmanian WHA tourism and recreation is made here, based *inter alia* on a 1987 report by the Centre for Regional Economic Analysis (CREA), entitled 'The Contribution of the National Parks and Wildlife Service to the Tasmanian Economy 1986-87'. The study included a survey of expenditure by visitors to sites managed by the then NPWS (now DPWH) and from this, expenditure at **all** NPWS sites was estimated. These sites include National Parks in the Tasmanian WHA. They also include Port Arthur and Mt Field National Park and both these sites have higher visitation than any of the locations in the Tasmanian WHA.

Direct expenditure on visits to **all** National Parks was estimated at $27 million, and a total direct plus indirect income effect of $61.5 million was reported. This implies a multiplier of 2.27, or that the direct

figure is 44.1 per cent of the total direct plus indirect value. This figure includes expenditure by Tasmanians and visitors to Tasmania on local travel to National Parks, fares for commercial tours and other costs associated with the visit. Travel to Tasmania and accommodation other than in the National Parks are not included.

The number of visits on which this survey was based was approximately 940 000 in 1986-87. This implies an average expenditure of $28 per visit. This is equivalent to $36 per visit inflated to 1991–92 dollars. The direct expenditure for the 597 088 visits to Tasmanian WHA sites in 1990–91 could therefore be of the order of $21.4 million.

The CREA report acknowledged that this is not the full picture and that some proportion of expenditure by overseas and interstate visitors to Tasmania should be attributed to the attraction of National Parks. The CREA report contains information from another survey by CREA of visitors to Tasmania. One third of visitors surveyed said that their entire trip was due to the attractions of National Parks and so the entire expenditure for one third of visitors to Tasmania was calculated. The direct plus indirect amount was $119 million, implying that the direct expenditure was around $52 million. This value is for **all** National Parks and similar areas, including the Tasmanian WHA. It includes that part of the $27 million spent on visits to National Parks by visitors to Tasmania.

The best that can be done to translate 1986-87 findings to current estimates is to take one third of current expenditure by visitors to Tasmania as a proxy for direct expenditure. Direct expenditure by visitors to Tasmania was $429 million in 1992 (Fisher 1993) and one third of this is $143 million. This represents expenditure by visitors to Tasmania attributable to **all** National Parks and similar areas. It does not include travel to Tasmania. This expenditure figure provides an upper limit on expenditure that could be attributable to visits by tourists to Tasmania to the Tasmanian WHA.

An estimate of expenditure attributable to the Tasmanian WHA has been made from Tasmanian visitor statistics for 1992 presented in Fisher (1993). Total expenditure was $429 million. The number of visitors to Tasmania in 1992 was 398 134. The average length of stay was 11 nights. Average daily expenditure was $98.

The majority of the Tasmanian WHA is located across two tourism regions, Southern and West Coast. It is assumed here that all tourists to these regions visited the Tasmanian WHA. There were 86 000 visitors to the Southern region and 107 000 visitors to the West Coast region. It does not matter that some people may have visited both regions, it is the length of stay in each region that is important. The average length of stay in the Southern region was 3.8 nights and it was two nights for the West Coast. The figure of two nights is used for both regions here (consistent with the approach used for the Great Barrier Reef WHA and Wet Tropics WHA). Total expenditure for the two regions together comes to $37.7 million, in 1992 dollars.

Recall that the expenditure on visits to the Tasmanian WHA by Tasmanian residents and tourists to Tasmania was estimated at $21.4 million. The additional expenditure by tourists of $37.7 million should be added to this, but there is an element of double counting of expenditure by tourists involved. The resulting value of $59 million is therefore an upper estimate using the method described. Note however, that it is less than half of the $143 million possibly attributable to the attractions of **all** Tasmania's National Parks to tourism.

If the multiplier of 2.27 derived in the 1986-87 study by CREA is applied, the direct plus indirect effects are $133 million. This should be interpreted with caution given the time lapse since the research and the uncertainty of the current expenditure estimates.

TABLE 6.4 TASMANIAN WILDERNESS WORLD HERITAGE AREA

USES	*DESCRIPTION*	*GROSS FINANCIAL VALUES*	*ECONOMIC VALUES*
PRIMARY USES			
Nature conservation	1.38 million hectares of relatively undisturbed natural environment.	Nil, however these attributes provide the resource base for potentially sustainable direct uses which generate financial values	These attributes provide the resource base for economic values of potentially sustainable direct uses **plus** the economic values of non-market indirect uses
Conservation of cultural features	Aboriginal cultural sites including Ice Age cave art. Historical sites.		Economic values of non-market indirect uses have not been measured for the Tasmanian Wilderness WHA.
COMPATIBLE DIRECT USES			
Tourism and recreation	Approximately 597 000 visits per year	Direct: of the order of $59 million (1991–92)	not known
Beekeeping	45 apiary sites	$208 000 (1990)	not known
Limited mining	1 mine	negligible	not known
Limited commercial fishing	minor	negligible	not known
Huon pine salvage	60 m^3 per year	negligible	not known
Highways and roads	not described	not known	not known
Telecommunications	not described	not known	not known
Water catchment services	not described	not known	not known
Research	not described	not known	not known

7. KOSCIUSKO NATIONAL PARK

7.1 Description[15]

Location, size
Kosciusko National Park is located in the Snowy Mountains region of New South Wales. It covers 690 km^2.

Major natural features
The park incorporates the headwaters of major river systems. It includes Australia's highest mountain and some of the relatively small area of Australia which is alpine environment and snow covered during winter.

History
The National Park was reserved in 1944.

Management arrangements
Park planning and management and day-to-day management is undertaken by the New South Wales National Parks and Wildlife Service. A Management Plan was published in 1988, with draft amendments proposed in 1991.

Management funding
In 1992–93, around $7 million was raised from entry fees, commercial leases and other commercial activities in Kosciusko National Park. Around half the revenue came from Park entry fees. These funds were directed to the general budget of the NSW NPWS. In addition, around $3.85 million was raised on a fee for service basis from users (including the equivalent of municipal rates for services provided to the resort settlements) and this revenue went to Special Purpose Accounts to be spent on specific services. A total of $10.85 million was therefore generated from the Park.

Funds spent in the Park included the $3.85 million from the Special Purpose Accounts, plus $5 million in capital works and $2.6 million in salaries and general operations funded directly from the budget of the NSW NPWS. A total of $11.45 million was spent in the Park.

Management objectives
The management objectives identified in the 1988 Plan of Management are as follows:

- to preserve and protect the outstanding scenery and natural features
- to protect the mountain catchments
- to conserve wildlife
- to protect the natural features, landmarks and special scientific sites
- to maintain the natural environmental processes as far as possible
- to preserve and protect Aboriginal sites and historic features
- to protect recreational opportunities and wilderness values
- to encourage scientific and educational enquiry into environmental features and processes, prehistoric and historic features and Park-use patterns
- to encourage appreciation, understanding and enjoyment of the natural and cultural features and recreational opportunities by the public
- to provide the broadest possible range of opportunities for appropriate use and experience of the Park, consistent with other objectives
- to protect the Park against the damaging effects of fire, erosion, environmental pollution and other disturbances
- to seek the most efficient provision of facilities and allocation of management resources possible
- to co-operate with communities, local government councils and other organisations in the Park region to co-ordinate environmental planning and resource management.

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[15] Information was compiled from *Kosciusko National Park Plan of Management Second Edition*, NSW NPWS, 1988, and personal communication from NSW NPWS staff.

Major uses
The protection of water catchments was a major impetus for reservation of the Park in 1944. Subsequent construction of the Snowy Mountains Hydro-Electric Scheme resulted in aqueducts and reservoirs within the Park. As noted in appendix 2, the values of water catchment services are likely to be significant. No information on the financial or economic values of water catchment services has been included in this report. While water catchment protection remains important, the primary use of the Park today is nature conservation and conservation of cultural features.

Tourism and recreation is the major direct use of the Park, see 7.2 below.

Grazing has been phased out, though three stock routes are maintained. Other uses prohibited are timber harvesting, mining, agriculture and apiary. Limited quarrying is allowed.

7.2 Kosciusko National Park tourism and recreation

Kosciusko National Park includes the only snowfields in New South Wales and a significant ski industry has developed. The Park is also increasingly a focus for summer activities of walking, camping, horse riding and resort sports including golf and tennis.

The Park is currently estimated to receive 3 million visits per year; that is, people through the gates, whether they are day visitors or people staying for longer periods using accommodation within the park. It is thought that visits are becoming more evenly distributed across the seasons with 50 per cent of visitors in winter and 50 per cent in summer. Until recently, the distribution was thought to be 60 per cent in winter and 40 per cent in summer.[16]

A strategy for monitoring visits to Kosciusko National Park is currently being designed and when implemented should lead to better visitor information in the future.

Kosciusko National Park differs from many other National Parks and protected areas as it includes substantial built accommodation and tourist infrastructure within the Park. There are four resort areas; Thredbo, Perisher-Smiggins, Charlotte Pass and Mt Selwyn. In 1989, total accommodation capacity was 7614 beds. There are ski facilities (lifts, hire shops, retail shops, food outlets, ski schools) at most of these resorts and also at Guthega and Mt Blue Cow. The Skitube runs from Bullocks Flat to Mt Blue Cow. These resort areas also cater for summer visitors and the Skitube and some lifts provide transport for walkers and sightseers. Commercial cross country ski tours operate in the park. There is limited private snow camping. In summer, private camping is a popular activity.

Many visitors to the Park find accommodation in Jindabyne, Cooma and smaller adjacent towns, and visit the Park as day visitors.

Financial values

Expenditure by tourists to Kosciusko National Park is estimated at $640 million for 1991–92. This estimate is based on data from Alpine Resorts in Victoria and for this reason is an order-of-magnitude estimate only.

Calculating financial values
The gross financial value of tourism and recreation in Kosciusko National Park is the expenditure by visitors associated with their visits. This information is currently not available for Kosciusko National Park. A study to estimate direct expenditure and multiplier effects is currently underway and results should be available 1994.

A minimum estimate of expenditure can be derived from NSW Tourism Commission statistics for Local Government Areas. The Snowy Rivers Shire incorporates the Kosciusko resorts plus Jindabyne (but not

[16] Personal communication NSW NPWS.

Cooma). In 1991-92, the number of visitors who stayed overnight was 330 000 and they spent 1.3 million visitor nights in the shire. Their expenditure in the shire was $94 million.[17]

Information from a 1991 study of the Alpine Resorts in Victoria (Buckby et al. 1993) may be used to give a ballpark estimate of financial values of tourism and recreation in Kosciusko National Park. The Victorian Alpine Resorts attracted 807 000 visits in the winter of 1991. There were an additional 200 000 non winter visits to the Victorian High Country. The total number of visitor days was 1.64 million.

Gross expenditure by winter visitors was estimated at $230 million (an average of $285 per visit) with an additional $39 million spent by non winter visitors (an average of $195 per visit). The total expenditure for about 1 million visits was $269 million. This figure includes travel to the Alpine Region. Travel costs were relatively low as 85 per cent of visitors were from Victoria and used buses or private cars for transport. The total travel costs were around $20 million; an average of $20 per visit.

It is possible, but not necessarily accurate, to make a direct extrapolation from the data for Victoria to Kosciusko National Park on the basis of estimates of the number of visits to both sites. It is not clear that the basis for defining and measuring 'visits' is directly comparable (for Kosciusko, this is clearly an estimate made in the absence of comprehensive system for recording visits). Further, the average length of stay in resorts or adjacent accommodation will influence the total expenditure as will the proportion of visitors who stay in resorts or the generally less expensive off-snow accommodation.

A direct extrapolation from Victoria to Kosciusko National Park, has been made, based on average winter and non winter expenditure per visit in Victoria and 3 million visits to Kosciusko split evenly between winter and summer. This gives a figure of the order of $700 million gross expenditure associated with visits to Kosciusko National Park including travel to the Park. Excluding travel at $20 per visit, which is likely to be an underestimate for Kosciusko, the gross expenditure is estimated at $640 million. This should be treated as a ballpark estimate only. The results of the above mentioned study, due at the end of 1993 should give a much more accurate estimate.

It is interesting to note some of the other results of the Buckby et al. (1993) study. This study measured economic impacts using input output analysis. The authors calculated the net economic impact of the Victorian alpine resorts region to the state of Victoria by including the expenditure of all visitors to Victoria plus expenditure by only those Victorian residents who would have taken a holiday outside the state but were enticed to remain in Victoria by the attractions of the alpine resorts. The net economic impact was calculated at S200 million (contribution to Gross State Product), with 5700 associated jobs. It is not relevant to extrapolate these results to Kosciusko as they are based on characteristics of the Victorian economy.

[17] Personal communication NSW Tourism Commission.

TABLE 7.1 KOSCIUSKO NATIONAL PARK

USES	*DESCRIPTION*	*GROSS FINANCIAL VALUES*	*ECONOMIC VALUES*
PRIMARY USES			
Nature conservation	690 km^2 of relatively undisturbed natural environment.	Nil, however these attributes provide the resource base for potentially sustainable direct uses which generate financial values	These attributes provide the resource base for economic values of potentially sustainable direct uses **plus the** economic values of non-market indirect uses
Conservation of cultural features	Historical sites.		Economic values of non-market indirect uses have not been measured for Kosciusko National Park.
COMPATIBLE DIRECT USES			
Tourism and recreation	Approximately 3 million visits per year	Direct: of the order of $640 million (1991) Direct plus travel: of the order of $700 million (1991)	not known
Highways and roads	not described	not known	not known
Telecommunications	not described	not known	not known
Water catchment services	not described	not known	not known
Research	not described	not known	not known

8. NINGALOO MARINE PARK

8.1 Description[18]

Location, size
Ningaloo Marine Park is located on the western side of the Cape Range Peninsula, 1200 km north of Perth in Western Australia. The Marine Park covers a total of 4300 km^2. It abuts the coast and includes a narrow strip (40 m) of coastal land.

Major natural features
The Marine Park encompasses a fringing reef enclosing a shallow lagoon. It is the largest fringing barrier reef in Australia. The reef sits on the narrowest part of the Australian continental shelf and the park includes deep oceanic waters which occur immediately offshore from the reef.

History
The Ningaloo Marine Park was declared over Western Australian and Commonwealth waters in 1987.

Management arrangements
The Western Australian Department of Conservation and Land Management (CALM) manages the Marine Park on behalf of the Commonwealth and state governments, in cooperation with the Australian Nature Conservation Agency. Fisheries in the area are managed by Western Australian Fisheries and the Australian Fisheries Service in collaboration with CALM. CALM has produced a Management Plan for 1989 to 1999.

Management funding
Commonwealth and Western Australian government funding for management within the State waters of Ningaloo Marine Park in 1991-92 was $581 000. This covers salaries of local staff and half the cost of running the visitor centre located in Cape Range National Park that also services Ningaloo Marine Park, but not research or other overheads. Contributions were from CALM ($324 000), WA Fisheries Department ($152 000) and the (then) Australian National Parks and Wildlife Service through the Ocean Rescue 2000 program ($105 000).

Management objectives
The principle aim for park management as stated in the Management Plan is 'to provide for conservation of the marine environment, with recreational use to the extent that it is compatible with conservation of its natural environment' (CALM 1989, p. 1).

Major uses
The primary use of the Ningaloo Marine Park is nature conservation. Tourism and recreation is the major direct use, see section 8.2 below.

Commercial fishing is an existing direct use, but at very low levels A number of the fishing techniques used prior to the declaration of the Marine Park are to be phased out over the life of the Management Plan, or at least reviewed, with the possibility of other more environmentally benign methods being developed. In 1989, about 20 boats were working in areas including the Marine Park. More recent information is that commercial fishing is negligible with only two regular operators working within the Marine Park.

At the time of declaration of the Marine Park, three offshore and two onshore petroleum exploration leases were in effect. The offshore leases are within Commonwealth waters, and as Commonwealth legislation did not allow petroleum exploration in Marine Parks, these lease areas were excluded from the Marine Park. One of these leases has since lapsed and the area has been included in the Marine Park.

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[18] Information was compiled from *Ningaloo Marine Park Management Plan 1989 - 1999*, CALM 1989 and personal communication from CALM and WA Fisheries staff.

8.2 Ningaloo Marine Park tourism and recreation[19]

The current number of visitors to Ningaloo Marine Park is not accurately known. There are numerous points of entry, which makes overall monitoring difficult. In 1982, it was estimated that 55 000 people visited the area. By 1989, this was estimated to have doubled. Complete records are kept of visitors to the Milyering Visitor Centre which is the main visitor and interpretive facility for Ningaloo Marine Park and the adjacent Cape Range National Park. The number of visitors increased from 17 000 in 1989 to 19 000 in 1992.

Recreation and tourism are the major direct uses of Ningaloo Marine Park. Private recreation, mostly incorporating recreational fishing from the beach or private boats, is popular. Fishing is the highest priority activity for 84 per cent of visitors. Visitors generally arrive in their own vehicles and many camp by the beach, along the length of the Marine Park. A particular pattern noted in visitor studies is long term stays by retired Western Australian residents escaping the winter. These visitors influence the figures recorded for average length of stay in the region. High average stays of 28 days and 35.6 nights have been calculated from two separate surveys. This can be compared with an average stay of 4.9 nights per trip for the wider Gascoyne Region in which Ningaloo Marine Park is located (Insight Research et al. 1992).

Commercial accommodation, including in a number of caravan parks, is available at Exmouth and Coral Bay adjacent to the Marine Park. Commercial tour boats operate out of Exmouth and Coral Bay taking recreational fishing trips for both bottom and game fishing. Other commercial boat trips offer SCUBA diving, snorkelling, sightseeing trips to view whale sharks, and coral viewing via a semi submersible and glass bottom boats. In 1993, there were 15 commercial charter vessels operating in the Marine Park. Activity, and most probably passenger numbers, has increased since the time of the publication of the Management Plan in 1989, when there were eight boats operating. Visitor numbers are not currently available but will become so in the future as new regulations will require vessels to be licensed.

Financial values

The gross financial value of tourism and recreation in Ningaloo Marine Park, as measured by expenditure by tourists to the Marine Park, is not known. The Western Australian Tourism Monitor collects information on expenditure by tourists and reports on a regional basis. The towns of Exmouth and Coral Bay are included in the Gascoyne Region which also includes Carnarvon, Shark Bay and Gascoyne Junction. In 1990-91 this region hosted 228 000 visitors for 1 118 000 visitor nights. These visitors spent an estimated $57.6 million in the region, not including travel to the region (Insight Research et al. 1992). This figure is clearly higher than that generated by tourism and recreation in Ningaloo Marine Park alone and can only be interpreted as placing an upper limit on the relevant value attributable to Ningaloo Marine Park.

No multiplier has been applied to this figure as it is not sufficiently accurate in regard to Ningaloo Marine Park to warrant further interpretation.

[19] Much of the information presented here is taken from an as yet unpublished section on Ningaloo Marine Park in the forthcoming *State of the Marine Environment Report* (CALM 1993). This was compiled by CALM staff from surveys, visitor statistics and observations.

TABLE 8.1 NINGALOO MARINE PARK

USES	*DESCRIPTION*	*GROSS FINANCIAL VALUES*	*ECONOMIC VALUES*
PRIMARY USES			
Nature conservation	4300 km^2 of relatively undisturbed marine environment.	Nil, however these attributes provide the resource base for potentially sustainable direct uses which generate financial values	These attributes provide the resource base for economic values of potentially sustainable direct uses **plus** the economic values of non-market indirect uses Economic values of non-market indirect uses have not been measured for Ningaloo Marine Park.
COMPATIBLE DIRECT USES			
Tourism and recreation	Of the order of 110 000 visits per year	not known	not known
Commercial fishing	2 operators	neglibible	negligible
Research	minor	minor	not known

9. SOLITARY ISLANDS MARINE RESERVE

9.1 Description[20]

Location, size
The Solitary Islands Marine Reserve is located on the New South Wales north coast close to Coffs Harbour. The Marine Reserve is 70 km long and has an area of around 100 000 ha. It includes marine waters from the coast out to 50 m depth and adjoining rivers to the limit of tidal influence.

Major natural features
The Marine Reserve includes estuaries, beaches, headlands, islands and offshore waters. The waters of the area support marine life typical of tropical reefs, including coral communities, together with species found as far south as Tasmania. The Solitary Islands are important seabird nesting sites. The reserve abuts a mainland National Park for about half its length.

History
The Marine Reserve was declared in 1991. A draft Management Strategy was released in 1989, with a final pending.

Management arrangements
The Solitary Islands Marine Reserve includes 85 000 km^2 of waters under New South Wales jurisdiction and 15 000 km^2 of Commonwealth waters, the latter being entirely offshore. The New South Wales portion of the Marine Reserve is declared under legislation administered by NSW Agriculture and Fisheries. The Australian Nature Conservation Agency has responsibility for the portion of the Marine Reserve in Commonwealth waters. NSW Fisheries takes responsibility for planning and day to day management of the Marine Reserve. A community based Management Advisory Committee has been formed.

Management funding
Management funds come almost entirely from the budget of NSW Fisheries. Expenditure on the Marine Reserve is not separately identified. The agency has two inspectors and a boat located in Coffs Harbour and 50 per cent to 60 per cent of their time is dedicated to the Marine Reserve. In addition staff in the local region and in Sydney spend some of their time on Solitary Islands Marine Reserve matters. There is currently no regular revenue raising program. Some sponsorship has been received for publications. There are plans to try to develop a sponsorship base in the local community.

Management objectives
The management objectives of the Marine Reserve are to protect habitat to maintain high productivity of the marine resources and to protect areas of aesthetic and scientific importance.

Major uses
Nature conservation is the primary use of the Marine Reserve. Commercial fishing and recreation and tourism are the main direct uses of the area. The Marine Reserve is new and data collection programs are still under development.

Commercial fishing vessels based in Coffs Harbour and other ports undertake some of their fishing in the Marine Reserve area. Fishing methods used include, line and trap fishing and prawn trawling. Catch landing records are available for the ports of Coffs Harbour, Wooli, Arrawarra, Woolgoolga and Brooms Head (all adjacent to the reserve) but as fishermen are not currently required to supply information on where the product was caught, the volume taken from within the boundaries of the Marine Reserve can not be identified. Surveys in the past have revealed that 70 per cent of production from Coffs Harbour was from Commonwealth waters and the remaining 30 per cent from inshore fisheries (NSWAF

[20] Information was compiled from Clayton 1991, NSW Agriculture and Fisheries 1989 and personal communication NSW Fisheries staff.

1989). The landing records reported here would therefore overestimate the volume and value taken from within the Marine Reserve.

In 1991–92, the volume by whole weight of fish and shellfish landed in the ports listed above was 862 150 kg[21]. The revenue received by fishermen for this product is not available but an estimate can be made based on information available on the 1987–88 catch. In that year, the volume landed was 889 655 kg and the value was $4.8 million (NSWAF 1989). Given that the volume landed in both years is similar, adjusting the value of the catch for inflation provides an estimated value of $6 million for 1991–92.

Commercial tourist operators provide sightseeing and SCUBA diving trips within the Marine Reserve. Around six vessels operate from Coffs Harbour. A permit system has been introduced and information on the numbers of people carried will be required monthly, but no data are available yet.

Private recreational use of the Marine Reserve from the mainland and from boats is a feature of use of the area. No figures have yet been compiled on the extent of this use.

[21] Unpublished information supplied by NSW Fisheries.

TABLE 9.1 SOLITARY ISLANDS MARINE RESERVE

USES	*DESCRIPTION*	*GROSS FINANCIAL VALUES*	*ECONOMIC VALUES*
PRIMARY USES			
Nature conservation	100 000 ha of relatively undisturbed marine environment.	Nil, however these attributes provide the resource base for potentially sustainable direct uses which generate financial values	These attributes provide the resource base for economic values of potentially sustainable direct uses **plus** the economic values of non-market indirect uses Economic values of non-market indirect uses have not been measured for Solitary Islands Marine Reserve.
COMPATIBLE DIRECT USES			
Tourism and recreation	6 commercial tour boats, visitor numbers not known	not known	not known
Commercial fishing	Less than 862 000 kg catch weight	Less than $6million (1992)	not known
Research	minor	minor	not known

10. CONCLUSIONS

This report presents financial and economic values for eight Australian protected areas: the Great Barrier Reef World Heritage Area, the Wet Tropics World Heritage Area, Kakadu National Park, Uluru National Park, the Tasmanian Wilderness World Heritage Area, Kosciusko National Park, Ningaloo Marine Park and the Solitary Islands Marine Reserve.

The report draws on published information and available unpublished information. No new data was collected for this report. Financial value information is not available for all uses but it is believed that the major financial values have been included in this report (however the financial values of water catchment services have not been measured, and these may be significant). In some cases, order-of-magnitude estimates of financial values of major uses have been made for this report. There is a paucity of information available on economic values.

Financial values are the measurable flows of dollars generated by human use of the resources through industries including tourism and commercial fishing and expenditure on private recreation and research. All activities such as tourism and commercial fishing which generate financial values have 'multiplier effects' through the economy.

Economic values measure the net benefits to society of resource uses. Economic values include those values of conservation of natural and cultural heritage that do not generate dollar values because they are not traded in markets. Dollar value measures of economic values are only available for a few uses in protected areas.

The primary purposes of all the protected areas included in this report are nature conservation, conservation of cultural features, and for some, the continuation of contemporary Aboriginal use. These 'uses' do not generate financial value but do have economic values. Governments responsible for reserving these areas have implicitly judged the economic values arising from the protected area status as greater than the opportunity cost, that is, the values that could be generated by alternative land use patterns over the long term.

Direct uses allowed under legislation and Zoning and Management Plans vary from area to area. Tourism and recreation are allowed in all the protected areas studied and are the major direct uses in terms of numbers of people and infrastructure and financial values. Other uses include, commercial fishing, research, transport and communications facilities and the provision of water catchment services for hydro-electricity generation and consumption.

The first objective of this report is to present up-to-date information on financial and economic values of the Great Barrier Reef World Heritage Area. This area encompasses the Great Barrier Reef Marine Park, which forms 95 per cent of the World Heritage Area, and also islands and some coastal waters within the boundaries of the Great Barrier Reef Region.

The Great Barrier Reef WHA is a multiple-use area. Its primary 'use' is conservation of outstanding natural environments. Tourism is the direct use which generates the greatest financial value, estimated at $682 million in 1991–92. The financial values of other important uses for the same year were commercial fishing $128 million, private boating and fishing $94 million and research $19 million. Together, the value of these activities is estimated at close to $1 billion directly spent and earned in the Great Barrier Reef WHA and adjacent mainland regions, see table 10.1. Direct and indirect output effects on the Great Barrier Reef WHA and adjacent mainland regions are estimated to be of the order of $1.7 billion.

Table 10.1 Gross Financial Values Great Barrier Reef WHA, 1991–92

Direct Use	Description	Financial value $ million
Tourism	2.2 million visitors per year	682
Commercial Fishing	Around 16 000 tonnes catch	128
Recreational fishing and boating	24 300 private boats	94
Research	GBRMPA and AIMS	19
Total		**923**

The second objective of this report is to present financial and economic values of some other Australian protected areas, in order to place the characteristics of the Great Barrier Reef WHA into context. Findings for all eight protected areas are summarised in table 10.2. Financial values for tourism and recreation are shown separately. In some cases, these are order-of-magnitude estimates. Financial values for other uses are included where possible under 'other measured values' It is believed that all major financial values (with the exception of water catchment services) are included. Also listed in table 2 are the management budgets and revenue raised from users for each protected area. All data in the table are for 1991–92.

The total measured financial value was over $2.1 billion. This is a significant amount of economic activity, dependant on the natural resources of these protected areas. The Great Barrier Reef WHA contributed 42 per cent of this value, the largest amount for the protected areas studied. This arises from the significant tourism and recreation activity and the fact that the Great Barrier Reef WHA supports a sizeable commercial fishery.

Expenditure on tourism and recreation for the eight protected areas combined was significant. It was of the order of $1.9 billion. This is expenditure made in the protected areas and on accommodation and expenses in adjacent regions associated with visiting the protected areas. It **does not** include the cost of travel from other parts of Australia or overseas.

Government expenditure on management of these protected areas combined was of the order of $61 million in 1991–92, and the study reveals this is 3 per cent of tourist expenditure. This study did not investigate the adequacy of funding for management.

Revenue raised directly from visitors for park management was of the order of $15 million in 1991–92, and this was less than one per cent of all expenditure by visitors. The relatively small amount of revenue generated for park management points to a potential to capture more tourist expenditure for park management.

It is important to point out that the financial values reported are in almost all cases gross financial values. These really give no idea of the magnitude of any unpriced environmental costs arising as a consequence of producing these values or the sustainability of the level of production. For this reason, resource managers should treat financial values as important indicators of the magnitude of activities, but as less important than economic values as information for resource management decisions.

All direct use activities have multiplier effects which support further economic activity and employment in local regions and more widely. Regional output multiplier effects of gross financial values have been presented where the information is available. These should be interpreted carefully as unpriced environmental costs are not taken into account.

Table 10.2 Gross Financial Values, Management Budgets and Revenue from Users 1991–92

	Tourism and recreation* $ million	Other uses measured value** $ million	Total measured value*** $ million	Manage-ment Budget $ million	Revenue from users $ million
Great Barrier Reef WHA.	776	147	923	18.1	0.75
Wet Tropics WHA.	377	25	402	12.1	0.30
Kakadu National Park.	122	not available	122	10.8	1.02
Uluru National Park.	38	not available	38	2.9	1.85
Tasmanian WHA.	59	0.2	59	4.8	0.20
Kosciusko National Park.	640	not available	640	11.4	10.85
Ningaloo Marine Park.	not available	not available	not available	0.5	nil
Solitary Islands Marine Reserve.	not available	not available	not available	<0.5	nil
Total	**1918**	**262**	**2174**	**61**	**14.97**

* Gross expenditure by tourists and recreational visitors.
**Gross revenue. These include only values able to be measured.
***These include only values able to be measured.

The information presented is a static analysis. Current values are reported but the likely future values are not predicted. It is important to keep in mind that further expansions of the currently compatible direct uses may pose a threat to the primary use values. It would not be proper to extrapolate increasing levels and real values of direct uses, e.g. tourism, into the future as the point at which these uses may begin to reduce conservation values is unknown. It is likely that natural environments in their original state will become increasingly valuable over time as the supply of these diminishes world wide and the population increases.

Finally, this report has been assembled from available data and the inadequacies of this are obvious. The inadequacies stem from two sources. There has been a lack of effort in placing dollar values on those values for which there is consensus on techniques for measurement, such as water catchment services. More problematical are approaches to placing dollar values on non-market values. This study has provided a first pass at both a framework for classifying economic and financial values and valuing those uses for which information is available. Further research could develop this type of information into a useful tool for management of protected areas.

APPENDIX 1. MEASURES OF ECONOMIC AND FINANCIAL VALUE

A1.1 Types of value[22]

To most people, economic values mean dollar values. The discipline of economics, however, is concerned with considering how resources (labour, capital and natural resources) can be used to contribute most to the welfare of society. In considering how social welfare can be maximised, it is obvious that many of the things we value are not usually measured in dollar terms; the amenity derived from the existence of natural environments and cultural heritage features are important examples. It is also the case that many of the things we do to generate goods and services traded for dollars often have unpriced detrimental or beneficial side-effects (termed *externalities*). So, consideration of obvious dollar values alone does not tell the full story of the effects on the welfare of society of our actions.

Economists therefore use the term *financial values* for flows of dollar values and reserve the term *economic values* for measures of values in terms of their contributions to social welfare. Economic values include the net benefits of commercial activities plus any unpriced values, including environmental amenity. It is usually the aim of economists to measure as many of these values as possible in dollars in order to add, subtract and compare them on a common basis. Both financial and economic values are important in what they tell us, so they are discussed further below. A more detailed explanation of the basis of deriving financial and economic values is included in section A1.2 in this appendix.

Financial values

Financial values are the measurable flows of dollars generated by human use of the resources. In the case of protected areas, examples include commercial tours such as camping trips and boat tours, where there are financial flows from tourists who purchase tickets to the businesses operating the tours, and subsequently to wages, other costs of running the tours and profits to the operators. *Gross financial values* include the money spent on the *costs of production* of a service such as a commercial tour, plus the *profit* earned. These gross values are measured either by calculating the *total expenditure* by people buying a good or service (for example, tourists purchasing tours) or the *total revenue* received by people selling a good or service (for example, sales of fish from commercial fishing vessels).

The importance of financial values is that these illustrate the magnitude of economic activity. At a national level, financial values are the basis of calculations of *Gross Domestic Product (GDP)*. Financial values of industries may be compared to determine their relative importance in terms of contribution to GDP. Financial values are also used in calculating *multiplier effects* on the wider economy of any particular industry sector (see below).

Financial values are measured by adding together the values of all relevant transactions, for example all spending by tourists or all costs of production for tour operators. Comprehensive financial information is not collected regularly for any of the protected areas studied. There have been one-off studies conducted in a number of the protected areas and these have provided good quality data, although some of it is old. Information on tourism is collected regularly at a regional level but it is not possible to disaggregate data for the protected areas in question. For this reason, it has been possible to report gross financial values for only some of the commercial activities in the eight protected areas included in this report. In some cases, estimates have been made in this study based on what data was available.

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[22] Terms used in this section indicated in italics are briefly defined in the Glossary at Appendix 1.3.

Multiplier effects

Multiplier effects are a particular type of financial value. They are gross measures of the impact flowing on to the rest of the economy from a particular activity. All activities produce multiplier effects, but their magnitudes can differ. It is usual to calculate three different multipliers, output, income and employment. There are also different types of multipliers expressed as ratios of the total impact to the initial impact of some economic activity, or as the ratio of the flow-on impact to the initial impact. Multiplier effects have been calculated for only some of the activities in some of the protected areas studied.

A multi sectoral general equilibrium model of the Australian economy named ORANI has been built to explain the impacts of increases or decreases in economic activity in an industry in terms of effects on economic indicators including Gross Product, disposable income and the Consumer Price Index. This model is based on the input output analysis approach but has more sophisticated feedbacks to better simulate how the economy works. Tourism in Kakadu National Park has been modelled using ORANI (see section 4.2)

Economic values

What economics attempts to do is apply a common measuring rod to value all manner of things from which humans gain satisfaction. Some of these are goods and services that are traded in markets using dollars as the currency for exchange. Trade is possible where a person can gain exclusive ownership of a good, for example a fish, or exclusive rights to a service, for example a seat on a tour bus, in exchange for money. This type of good (and service) is called a *private good.* The dollar values people place on private goods are able to be observed from the functioning of competitive markets. These are termed *market values.*

Many attributes of natural environments are not regularly traded in markets. One reason for this may be historical. Protected natural environment areas are public lands and it has not been usual to charge for the services they provide. Another reason is that many of the services of natural environments have the characteristic of *public goods* and it is not possible to divide them up for exclusive sale, so it is not feasible to trade them in conventional markets. Clean air, biodiversity and functioning ecosystems, for example, have public good characteristics. The values of natural environments that are not able to be observed in markets are given the term *non-market values* by economists.

The total economic values of the protected areas covered in this study include both market values and non-market values. Non-market values are of two types; direct and indirect use values. *Direct use values* include the benefits accruing to people who visit, or live in, an area and enjoy its attributes. This obviously includes people who visit for tourism and recreation. *Indirect use values* accrue to people who may never visit an area but who nevertheless value the fact that it exists in its natural state.

It is widely acknowledged that natural environments produce a range of values to society associated with their roles as havens for conservation of biodiversity, contribution to global life support systems, and amenity arising from knowledge that wild and natural areas exist. *Existence, bequest, option* and *quasi-option values* have been identified as legitimate indirect use values arising from natural environments.

Existence value is the value people place on ensuring an area remains as a natural environment; bequest value is the value they place on ensuring it is available to future generations; option value is the value they place on ensuring that it remains as a natural environment so that they may visit in the future; and quasi-option value is the value people place on conserving a natural environment for the new information which may emerge in the future.

Together, market and non-market values cover all the benefits to humans flowing from the resource whether or not these are normally measured in dollar terms. Economic values are necessarily anthropocentric and do not recognise any value of nature conservation to the non-human elements of nature involved.

The economic values of most interest in describing an activity are its *net economic benefits*, that is *total economic benefits* minus *total economic costs*. In identifying total economic costs, a firm's financial costs of production may need to be adjusted. Adjustments are required when the markets fail to take account of positive or negative externalities (or markets fail for other reasons not further discussed here). Negative externalities such as damage to the environment require the costs to be increased while positive externalities require the opposite.

The basis of measuring total economic benefits is the total *willingness of consumers to pay* for goods and services. For most goods and services that are purchased in competitive markets, the purchase (market) price can be taken to represent willingness to pay. This readily observed measure of value is not available if the good or service is not sold. This is clearly the case with regard to indirect uses of protected areas.

It is important to point out that monetary transactions observed from markets that are not working in a competitive mode will not reflect total economic benefits. This is generally the case for tourism and recreation in the protected areas studied. Park management agencies do not charge access (entry) fees for private recreation or commercial tours to cover the full costs of providing the services of the natural environment, in the way a private supplier operating in a competitive market would. It follows that entry fees and prices of commercial tours are below what they would be in a competitive market and do not reflect the full willingness to pay by visitors.

In order to measure total economic benefits of indirect uses and those direct uses where competitive markets do not exist, economists attempt to measure willingness to pay using a variety of valuation techniques. These include *related market methods* and the *Contingent Valuation Method (CVM)*. In the former method, markets for related goods are examined to provide information on how the market for the good in question might function. The most relevant example for protected areas is the *travel cost method* where expenditure on travel to the areas is used to estimate how much visitors would be willing to pay for entry, if entry fees were charged at market rates.

The CVM involves asking people what they would be willing to pay contingent upon a proposed change in the state of things, for example to provide more nature conservation reserves or to avoid damage to existing reserves. The contingent valuation approach can in theory be used to address public good issues and to cover the full range of direct and indirect non-market values that people perceive to flow from protected areas. Considerable debate is occurring about philosophical and technical aspects of this approach (Wilks 1990). It would be fair to say that CVM is not totally accepted inside and outside the economics profession, yet no satisfactory alternative to actually asking people what they would be willing to pay for non-market values has been developed.

These valuation techniques are used on the assumption that it is conceptually possible and ethical to place dollar values on everything. Many people would disagree with this, in which case it is necessary to at least describe these values in other ways. Ignoring them altogether means that they are given zero value in economic analysis.

Economic analysis

Economic analysis may be employed to help answer resource use questions such as: Will a particular natural environment area bring greater net benefits as a protected area or if it was converted to another form of land use?; or, What combination of allowed uses within a protected area brings greatest net benefits? To examine the first question, the net benefits of the protected area may be compared with the net benefits of alternative land uses. This form of analysis is termed *Benefit Cost Analysis*. The approach taken is that the net benefits from the alternative land uses are the *opportunity costs* of the protected area option[23]. It is obvious that for this type of analysis, it is important to try to take account of the net benefits

[23] Implicit but worth emphasising is that the decisions by governments to confer protected area status incorporate judgements that the total economic value of the protected area is likely to be greater than the opportunity costs (benefits of alternative land use pattens) over the long term.

in dollar terms as far as possible. A similar approach can be taken to the second question by comparing net benefits of various levels of allowed uses to select the mix which provides the greatest overall net benefit. The net benefit measures should take into account any costs of environmental impacts or positive externalities.

The comparisons made in Benefit Cost Analysis are made in *Net Present Value (NPV)* terms. The NPV is one number that represents future annual values added together. These future values are usually discounted using a positive annual *discount rate.* A positive discount rate assumes that future net benefits are valued less than net benefits in the present. NPVs have been calculated for some of the protected areas included in this study.

The use of positive discount rates is being questioned in the context of the long term view that is central to aiming for ecologically sustainable development. Many environmental economists believe that as environmental goods and services become increasingly scarce over time, they will become relatively more valuable compared to human made goods and services for which there are substitutes. It is believed that relative increases in prices of natural environment resources over time will offset the effects of discounting.

A1.2 Financial and economic values

The difference between the financial and economic values can be illustrated using the graphical analysis adopted by economists. Two cases are presented, the first being for a market good, commercial tours in a protected area, where the tours are provided by private enterprise operators. The second case is of a non-market good, entry to a protected area for private recreation.

In the first case, the demand by all tourists for commercial tours is illustrated in Figure A1.1 by the demand curve DD on the basis that at lower prices more tours will be made. The area under the demand curve is the total willingness to pay for the tour service.

The supply curve SS illustrates the rate at which commercial tour operators are willing to supply their services. The market solution to these schedules is that quantity Q_1 tours will be supplied and consumed at price P_1.

The gross financial value, that is total dollars exchanged, will be P_1 multiplied by Q_1, represented by the area OP_1BQ_1. As the cost of production is represented by the area $OABQ_1$, the profit to producers is represented by the area AP_1B.

The net benefit is interpreted differently. The total area under the demand curve is willingness to pay. Total benefit is the area under the demand curve out to the quantity consumed. At quantity Q_1, this is represented by the area $ODBQ_1$. Total cost is the cost of production, area $OABQ_1$. The net benefit is represented by the triangle ADB. The net benefit is composed of two areas; AP_1B that represents *producer's surplus* and P_1DB that represents *consumer's surplus*. Producer's surplus is the same as the financial value measure of profits, that is returns above cost of production. Consumer's surplus represents benefits that consumers experience because they are willing to pay, but do not have to pay, more than P_1 to consume the service.

A complete economic analysis takes account of externalities. If the tour activities cause some environmental damage and the commercial tour operators are not required to include expenditure on avoidance or rehabilitation of damage in their cost of production, it is said that the social cost differs from the private cost and a negative externality occurs. A social cost (supply) curve is introduced into Figure A1.2. This lies above the supply curve of the private operators because at any quantity, the cost to society is actually higher than the cost faced by the private operators. It can be seen that the efficient quantity consumed would be Q_2 at price P_2 and that the net benefits would be smaller. The gross financial values (price by quantity) may be greater, smaller or unchanged (depending on the elasticities of demand and supply).

The above example was for a market good with consumers and private producers and transactions involving dollar payments. For non-market goods, the concept of the demand curve remains the same and illustrates willingness to pay. If use, for example entry to a National Park, is free of charge (price equals zero), there is no evident financial value of this activity. Thus the net benefits in this case equals the consumer's surplus which equals the total willingness to pay, see Figure A1.3.

If there are social costs associated with environmental impacts of visits, and/or actual management costs bourn by government, there is a social supply curve as illustrated in Figure A1.4. In this case, net benefits are less than if there were no cost associated with use. They are represented by the area ADB.

It is becoming increasingly common for entry fees to be charged to National Parks and other protected areas. These are usually set at nominal and constant levels and do not necessarily cover the full social costs of resource use. A nominal entry fee P_2 is illustrated on Figure A1.4. An entry fee based on full cost recovery might be P_1 (as discussed above) which would have the effect of reducing the number of visits from Q_2 to Q_1.

Demand and supply for commercial tours to a National Park

Fig. A1.1

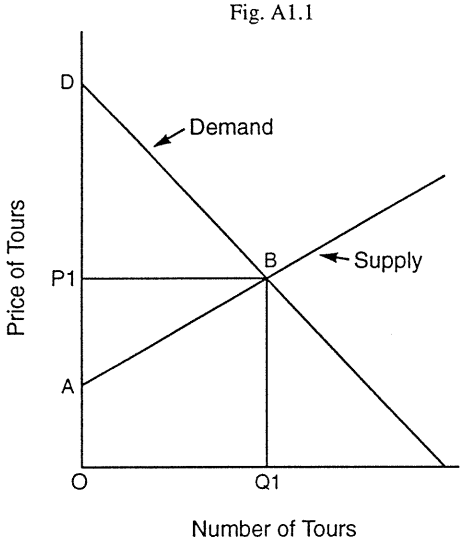
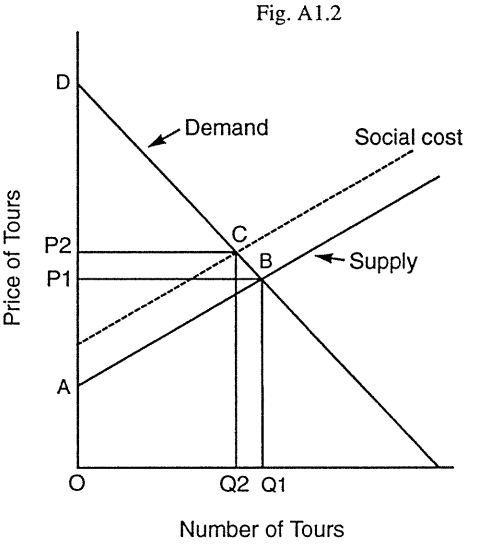


Fig. A1.2



Demand and supply for private visits to a National Park

Fig. A1.3

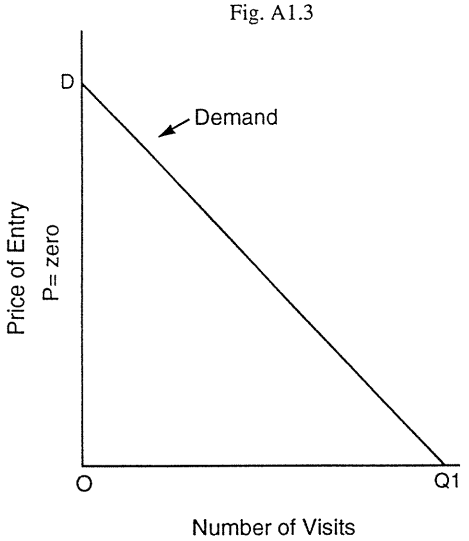
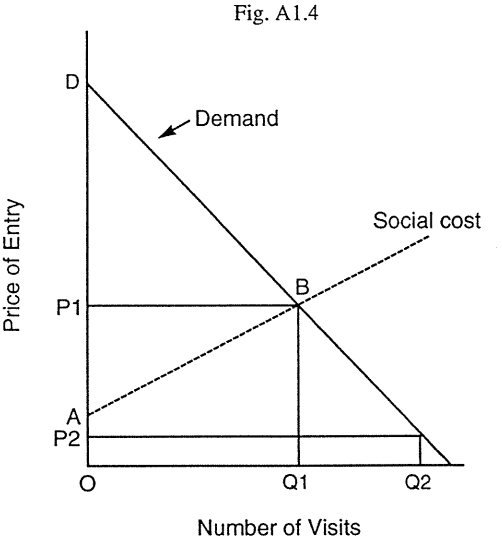


Fig. A1.4



A1.3 Glossary

This glossary contains economic terms used in this report.[24]

backward linkage
The links between an economic activity and the inputs required for that activity, for example, the inputs of boats, fuel etc. into commercial fishing.

Benefit Cost Analysis
The appraisal of a resource use project which includes all financial and social costs and benefits. The expected benefits of a project being appraised are compared with the opportunity costs of the resources, that is, expected benefits in their next best alternative use.

bequest value
Bequest value is the value people place on ensuring natural environments and cultural heritage is available to future generations.

compatible direct use
A term used for this report - it refers to uses involving visiting protected areas or extracting resources, allowed in protected areas under Management Plans.

consumer's surplus
The difference between what a person would be willing to pay for a good or service, rather than go without it, and the lesser amount they usually actually have to pay.

Contingent Valuation Method (CVM)
A technique for estimating values for non-market goods by asking people what they would be willing to pay for them, if payment were required.

cost of production
Cost of materials, wages and salaries and usually payments to government used in producing goods and services.

direct (output) effect
The gross financial value of production of goods and services in a defined regional or national economy.

direct employment effect
The employment generated in a defined regional or national economy associated with the direct output effect.

direct use value
The values accruing to people who visit or observe protected areas or consume resources extracted from protected areas (including fish, plant products).

discount rate
The annual rate by which future values are reduced, on the basis that returns in the future are worth less than returns in the present.

economic values
Economic values measure the net benefits to society of resource uses. Economic values encompass those values of nature conservation that do not generate dollar values because they are not traded in markets.

existence value
Existence value is the value people place on ensuring an area remains as a natural environment and that cultural heritage is conserved.

externalities
Consequences for social welfare not fully accounted for in the price or market system. Positive externalities are social benefits, such as increased recreational opportunities, arising from projects but for which the producers of the benefits are not compensated. Negative externalities include pollution costs which are not met by those who produce the pollution.

financial values
Financial values are the measurable flows of dollars generated by human use of the resources through industries including tourism and commercial fishing and expenditure on private recreation and research.

flow-on effects
Another term for indirect effects, being the dollar values of the economic activity generated within a defined regional or national economy due to the direct output effects of production of goods and services.

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[24] The sources for these definitions are Bannock et al. 1987, Hufschmidt et al. 1983, and Krutilla and Fisher 1975.

Gross Domestic Product (GDP)
A measure of the total flow of goods and services produced by the economy over a specified time, normally a year or a quarter. It is obtained by valuing outputs of goods and services at market prices and then aggregating them.
gross financial value
The total dollar value of output at market prices, measured as total expenditure or total revenue, without deductions for cost of production or environmental costs.
indirect (output) effects
The dollar values of the economic activity generated within a defined regional or national economy due to the direct output effects of production of goods and services.
indirect use value
The values accruing to people who do not visit protected areas but place a value on knowing it is being conserved. It includes bequest, existence, option and quasi-option values.
Input Output Analysis
A technique for modelling flows of production and consumption in a defined regional or national economy. The flow-on, indirect or multiplier effects throughout the economy of output or employment produced in any one sector may be examined with the model.
market values
Market values or market prices are those realised through sales of goods and services using money as a currency in a conventional market.
multiplier effect
The flow on of increased activity in an economy due to increases in one sector, measured for output income and employment.
multipliers
Indices used to convert direct effects to direct plus indirect effects.
net economic benefits
Total economic benefits obtainable from a project minus total economic costs.
Net Present Value (NPV)
The discounted value of a stream of values arising in the future.
non-market values
Values of goods and services which are not usually traded in conventional markets but which accrue to people, and for which people are willing to pay.
option value
Option value is the value people place on ensuring natural environments and cultural heritage remains as they are so that they may visit in the future.
opportunity cost
The benefits of using the resources in question in their next best alternative use.
primary uses
A term used for this report - it refers to the uses of nature conservation and conservation of cultural heritage (and for some areas, the continuation of contemporary Aboriginal use) which are the main reasons the protected areas have been conferred special status.
private goods
Private goods are able to be traded with exclusive use rights attached.
producer's surplus
The excess of the revenue received by a supplier of goods or services over the minimum they would be willing to accept to maintain the same level of supply.
profit
The residual financial return to suppliers of goods or services over costs of production.
public goods
Public goods have the characteristics of being *non-rival* in consumption (consumption by one person does not reduce the amount available for others) and *non-excludable* (it is impossible, or at least not efficient, to exclude any person from consuming the good or service). Many features of natural environments have public good properties and are not efficiently delivered through private markets.
quasi-option value
Quasi-option value is the value people place on conserving a natural environment for the new information which may emerge in the future.
related market methods
Techniques for estimating dollar values for goods and services that are currently not traded in the market, which look at markets for similar or related goods. Hedonic pricing is a

related market method where property values are used to estimate the value of environmental factors such as noise or views which affect these property values. Another related market method is Travel Cost Analysis, see below.

total economic benefits

All financial benefits plus positive externalities.

total economic costs

All financial costs of production plus costs of negative externalities.

total economic value

All direct use plus indirect use, market plus non-market values arising from a resource. In the case of natural environments total economic value includes all values to all people regardless of whether or not these are usually traded for dollars in a market.

total expenditure

Dollar values of payments for goods and services, for example, tourists purchasing tourism services.

total revenue

Dollar values of payments accruing to people selling a product, for example, sales of fish from commercial fishing vessels.

Travel Cost Analysis

A technique to estimate the dollar value of benefits of recreation, in the absence of a market for access for recreation. In travel cost analysis, the costs of travel to protected areas are modelled to derive a demand curve for visits which is then used to estimate benefits of recreation.

willingness to accept compensation (WTA)

The willingness of people who currently have rights to use a resource to accept compensation for a reduction in the quality or quantity of the resource or their rights to use it.

willingness to pay (WTP)

The willingness of people to pay for a good or service, regardless of what they currently have to pay to acquire the good or service or whether the good or service is currently available free of charge.

APPENDIX 2. APPROACHES TO VALUING USES

As explained in the Introduction, the uses identified for the protected areas studied include both the conservation of natural and cultural features and direct uses. Approaches to valuing these are described below.

Conservation

The non-market indirect use (primary use) values of protected areas are the most difficult to value in dollar terms yet they are the main reason for the special protection given to these areas. Considerable research is underway on means of valuing environmental services such as biodiversity, and valuing the risks of losses and potential discoveries. The main approach currently used to value such attributes as existence, bequest and option values is the Contingent Valuation Method (CVM). This method has been applied to the Great Barrier Reef WHA and Kakadu National Park. While the results of these studies may be open to interpretation, there is no question that primary uses of protected areas do have considerable value, and they have been judged to override the dollar values of alternative development uses of these areas.

It should be pointed out that (consistent with present economics practice) the values derived in the CVM studies of the Great Barrier Reef WHA and Kakadu National Park represent values held by the Australian population only. As both the sites are World Heritage listed, using the Australian population as the reference point is likely to prove an underestimate of the population to whom the value of these areas is relevant. There is no information available to indicate what value the rest of the world places on Australian World Heritage Areas or other protected areas. Consider however the following scenario. The population of North America and Europe is around 600 million people. If these people had existence, bequest and option values of $1 per annum for Australian World Heritage Areas, this would give the considerable value of $600 million per annum. This possible scenario has been presented to illustrate that these non-market values may be very significant in comparison to some direct use values. It also highlights that significant values can exist, even if they are not captured in markets or if the research has not been done to measure them.

Commercial and recreation uses

Activities which are dependant upon the resources of the protected areas analysed in this study include tourism and recreation, commercial fishing, harvesting of plants and animals, beekeeping and mining.

The approach to measuring financial values of tourism and recreation is to identify expenditure by visitors. (This is generally more efficient than identifying the diverse producers of goods and services that cater for tourists and adding up all sales to 'tourists'). Measuring values of tourism and recreation is discussed in more detail below.

The gross financial values of activities such as commercial fishing, mining, beekeeping, and extraction of other saleable products, is the value of sales by the producers.

Transport and communication

A number of the protected areas considered in this study are traversed by such transportation and communication links (depending on the nature of the area) as roads, railways, shipping routes, power lines, or aqueducts and have telecommunications or navigation facilities located within. These transport and communication facilities were usually present before declaration of protected area status and have been allowed to continue to exist, though expansion may be limited. These facilities generate financial value on the same principle that any transport and communications facility adds value to goods or services carried.

While these values are generated *in* the protected areas, it can not be considered that value is generated *due* to the protected areas, with the exception of facilities developed to allow visits

by tourists to the protected areas. (The financial and economic values of these tourism facilities are implicitly included in those of tourism and recreation). For this reason, no financial or economic values have been included in this study for transport and communications services within protected areas.

Research and education

Some research is undertaken in all the protected areas included in this report. The evaluation of the benefits of research is complex. The financial and economic value would take into account benefits arising from the research. These benefits may include information with direct commercial application, information that becomes one link in a chain to a commercial result and information that is a beneficial input to management to avoid costs (RCMIS&T 1989). A full evaluation of the net benefits of research would need to address each research program separately[25]. Economic benefits of research have not been identified for any of the protected areas included in this study. The only readily available data is the financial cost of the research.

Education is an important function of protected areas. Educational services are provided in a variety of ways, for example; school text books, 'coffee table' books, school and university excursions, visitor centres and commercial tours. It would be very difficult to trace all the educational benefits which result from the existence of protected areas. The only data which are relatively easy to collect are financial costs to management agencies.

Water catchment services

Water in Australia is a scarce and valuable asset. Its value comes from its role as an input to agriculture and manufacturing, as a source of hydro-electric power, a source of amenity and ecosystem services, a waste disposal conduit and as an essential ingredient to human life. By and large, water has not been charged at prices reflecting its scarcity in Australia, although this is starting to change, particularly in urban areas where the supply costs can be readily converted to charges per volume used. The 'proper' pricing of water for rural and urban services has consequences for giving a greater appreciation of the value of water catchment services, and the relative values arising from different conditions in catchments. The contribution of catchments in their natural state to the quantity and quality of water used elsewhere is an important value of protected areas. While it would be possible to assign financial values to water catchment services of the protected areas covered in this report, this research has not been done to date.

The research required to attribute a value to the contribution of the Kosciusko National Park, Wet Tropics WHA or Tasmanian WHA catchments to the generation of hydro electricity is also beyond the scope of this report. Collectively, the value of water catchment services of the protected areas is likely to be significant.

Tourism and recreation

This study actually covers all visits/visitors to the protected areas; including tourists from overseas, Australians on trips for overnight or longer, and local residents on day trips. The visitors to the protected areas include: tourists travelling on commercial tours; tourists providing their own means of transport; local people travelling on commercial day tours; and local people who provide their own means of transport.

One task of this study is to report published or available unpublished information on the economic and financial values of tourism and recreation in selected protected areas. As there are no cases where the required information is readily available in regularly updated form, it has been necessary to make estimates based on what information is available. The extent and form of information available differs for each protected area considered.

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[25] A major inquiry into marine science and technology in Australia found such a task beyond its brief and did not attempt to evaluate net benefits of research in its 1989 report, *Oceans of Wealth?* (RCMIS&T 1989).

The first step taken was to seek information on visitor numbers. Visitor numbers are most likely to be recorded systematically where areas have few entry points, a continual management presence, and particularly where entry fees are charged. Kakadu and Uluru National Parks fall within this definition, as does Kosciusko National Park but visitor numbers for this Park are estimates only. Managers of areas including the Great Barrier Reef WHA, the Wet Tropics WHA, the Tasmanian WHA and Ningaloo Marine Park, which have multiple entry points must rely on surveys to provide estimates of visitor numbers. Such information is usually only collected periodically and often only on an ad hoc basis. Information on visitor numbers has not been collected for the Solitary Islands Marine Reserve.

The next step taken was to seek information on which to derive financial values. As discussed previously, the gross financial value is the actual expenditure by visitors associated with visiting an area.

Expenditure by visitors is made up of the following:
(a) that directly made within the protected area,
(b) payment for tours and accommodation etc. to be 'consumed' within the protected area but purchased outside it,
(c) spending on accommodation and services adjacent to the protected area in order to visit the area, (for tourists only, not local residents) and
(d) a proportion of travel from home to the area.

A major question arises about how much tourism expenditure, additional to that made directly on trips within the area (items (a) and (b)), to ascribe to a protected area. For some tourists, the protected area is their only destination on a trip and all their spending is directed towards visiting that particular area. For other tourists, the visit is only part of a wider itinerary. The question also arises as to whether to include expenditure made outside Australia.

The best way of calculating the values of items (c) and (d) is to interview tourists and ask them to apportion part of their total trip expenditure to their visit to the protected area. This is not done on a regular basis for any of the protected areas included but has been done on a one-off basis for the Great Barrier Reef.

Alternatively, item (c) may be estimated based on average expenditure on accommodation and services in the adjacent region. There are many cases where people stay outside, but adjacent to, protected areas in order to visit them. It is essential for all visitors to Uluru National Park to stay outside the Park as there is no accommodation in the Park. Most visitors to the Great Barrier Reef WHA and the Wet Tropics WHA stay in accommodation on the coast and make day or longer excursions into the areas. A large number of visitors to Kosciusko National Park stay overnight in the township of Jindabyne and other locations outside the Park.

The estimation of item (c) requires information on the number of visitors, how many of these are local residents and how many are tourists, average tourist expenditure in the adjacent region (often available from regional tourism surveys), and an informed assessment of the length of stay in the adjacent region due to the attraction of the protected area (generally a stay of two days extra has been used in estimations). Where reasonable information is available these estimations have been made.

With the exception of the Great Barrier Reef WHA, there is insufficient information available on the cost of travel or the proportion that could be reasonably attributed to visits to protected areas to allow inclusion of item (d) in this study. This means that most visitor expenditure values included in this report are underestimated.

The form of information available has meant that it has not been possible to take one consistent approach to estimating financial values of tourism and recreation. The values reported thus must be carefully interpreted and direct comparisons avoided.

The economic value measure of net benefits of tourism and recreation is the amount visitors are willing to pay above the cost of access. Economic values can only be elucidated by surveying visitors and asking appropriate questions. Such studies have only been undertaken for two of the protected areas included in this report. The results of studies of tourism and recreational fishing on the Great Barrier Reef WHA and tourism to Kakadu National Park are reported.

APPENDIX 3. GREAT BARRIER REEF WORLD HERITAGE AREA

A3.1 Great Barrier Reef tourism: financial values

The relevant measure of the financial value of Great Barrier Reef World Heritage Area (Great Barrier Reef WHA) tourism is expenditure by tourists. This section of appendix 3 covers the calculation of financial values of Great Barrier Reef WHA tourism.

To report the financial value, information is required on the number of tourists and their expenditure. Unfortunately, none of the existing regular surveys of tourism in the vicinity of the Great Barrier Reef WHA provides either the financial value of Great Barrier Reef WHA tourism or all the necessary information to calculate this. This appendix presents options for estimating financial values, but first discusses the sources of data available, and relevant information on Great Barrier Reef WHA tourism derived from these sources.

Great Barrier Reef WHA tourism considered in this appendix consists of:
(a) tourists who stay on island resorts
(b) tourists who camp on islands
(c) tourists who visit the Great Barrier Reef WHA for day or longer trips via commercial passenger vessels
(d) a component of time spent on the adjacent mainland associated with reef and island visits and the attraction of the Great Barrier Reef WHA
(e) a component of travel to the region associated with reef visits.

The adjacent mainland is defined as the cities and towns of coastal north and central Queensland. For data collection purposes these are generally equivalent to the following Statistical Divisions: Far Northern (Cairns), Northern (Townsville), Mackay, and Fitzroy (Rockhampton). The Great Barrier Reef WHA islands are included in these regions but information on Great Barrier Reef WHA islands is also reported separately.

Data sources

Information on tourism to the Queensland mainland regions adjacent to the Great Barrier Reef WHA and Great Barrier Reef WHA islands is collected on an annual basis by a number of organisations. In addition, a number of one-off surveys have been undertaken to address Great Barrier Reef WHA tourism. These surveys are summarised in table A3.1.

The Bureau of Tourism Research (BTR) recently undertook an assessment of tourism statistical needs for the Great Barrier Reef Marine Park Authority (GBRMPA) and included a review of existing data bases (BTR 1991). The BTR pointed out that the annual surveys (listed in table A3.1) all address different populations and understandably came up with different results that are not directly comparable. Nevertheless, all surveys showed an increase in tourist numbers to the relevant regions.

The BTR found that many of the important questions about tourism on the GBR could not be answered from the existing annual surveys. This is because these surveys do not ask sufficiently defined questions on how many tourists actually visited the Great Barrier Reef WHA, how long they might have spent visiting the Great Barrier Reef WHA, expenditure associated with Great Barrier Reef WHA visits or other characteristics of these tourists. The BTR concluded that accurate information on tourist visits to the Great Barrier Reef WHA should be gathered by regularly surveying tourist operators for visitor numbers carried and by surveying tourists themselves about other characteristics such as length of stay and expenditure.

The GBRMPA has developed a data collection system for operators of commercial passenger vessels (all of whom need a permit to operate) to gather information on the number of passengers carried. This does not yet have complete coverage of all operators but estimates of total passengers carried for 1992 have been developed. This system does not collect information from passengers on expenditure or provide the necessary information to link passenger numbers to the existing annual surveys.

Table A3.1 Data sources for Great Barrier Reef Tourism

Annual Surveys			
Name and organisation	*Population represented*	*Variables included*	*Method*
International Visitor Survey (Bureau of Tourism Research)	All international tourists, staying in commercial accommodation and with friends and relatives	Visitors Visitor nights Expenditure	Survey of departing international visitors at airports by known population of visitors.
Domestic Tourism Monitor (Bureau of Tourism Research)	All domestic tourists, staying in commercial accommodation and with friends and relatives	Visitors Visitor nights	Survey of households Australia wide
Queensland Visitor Survey (Queensland Tourist and Travel Corporation)	International and domestic tourists, staying in commercial accommodation	Visitors Visitor nights Expenditure	Survey of tourists at commercial accommodation establishments
Survey of Tourist Accommodation (Australian Bureau of Statistics)	All commercial accommodation establishments	Guest arrivals Length of stay Takings	Survey of proprietors of commercial accommodation establishments
Queensland National Parks Camping Permit Data Base (QNPWS)	All campers who obtain a permit	Campers Camping nights Fees	Data collected from permit applications and fees collected
Great Barrier Reef Marine Park Authority Tourist Operation Permit Database (GBRMPA)	All Tourist Operators	Passengers	Data collected from returns supplied by operators

One-off studies			
Survey of visitors staying with friends and relatives in Queensland 1989 and 1990 (Queensland Tourist and Travel Corporation)	All international and domestic tourists staying with friends and relatives	Visitors Visitor nights Expenditure	Surveys of Queensland households

Environmental Issues and Usage of National Parks 1986 (Australian Bureau of Statistics)	All Australians who visited the GBR in the previous year	Number of visits to GBR	Survey of households Australia wide
Survey of tourists attitudes, expenditure and economic values, 1986 (Reported in Hundloe et al. 1987, Vanclay 1988)	All international and domestic tourists, staying in commercial accommodation and with friends and relatives, who visited the GBR	Expenditure Willingness to pay Attitudes	Random survey of visitors to GBR

Current tourism to the Great Barrier Reef WHA and adjacent mainland

Tourism to the Great Barrier Reef WHA and the mainland regions of Queensland adjacent to the Great Barrier Reef WHA is reported here to place Great Barrier Reef WHA tourism in context. Table A3.2 shows visitor nights spent in this area as recorded by the Domestic Tourism Monitor and the International Visitor Survey for the years 1984–85 to 1991–92.

Table A3.2 Visitor nights ('000) 1984–85 to 1991–92

1984–85	1985–86	1986–87	1987–88	1988–89	1989–90	1990–91	1991–92
13 137	15 079	17 537	18 201	20 025	21 401	20 917	22 393

Source: Bureau of Tourism Research, unpublished data.

Expenditure by tourists is recorded by the various surveys of the Queensland Tourist and Travel Corporation (QTTC), table A3.3.

Table A3.3 Tourist Numbers and Expenditure, Great Barrier Reef WHA and Adjacent Mainland (1991–92)

	Visitor nights	Tourists in commercial accommodation ($ m)	Tourists staying with friends and relatives ($ m)	Total expenditure ($ m)
All tourists	19 042 000	1318.8	239.4	1558.2
Tourists on Holiday/ Recreation trips	16 307 000	1097.8	206.8	1304.6

Sources: Queensland Visitor Survey 1991–92 (QTTC 1992), Survey of visitors staying with friends and relatives in Queensland 1989 and 1990 (QTTC 1991a), 1990 data inflated to 1991–92 dollars.

The total expenditure recorded for all tourists was $1.5 billion in 1991–92. Both the number of people who visit and their expenditure is greater than the subset which can be attributable to the attractions of the Great Barrier Reef WHA. Tourism statistics include all people who travel, so those on holiday/recreation trips have been separately identified. Their total expenditure was $1.3 billion in 1991–92. These data do not include the cost of travel to the regions.

The average expenditure per visitor night comes to $82 across all categories. The QTTC reports an average expenditure of $35 per day across all regions for people staying with friends and relatives. For people staying in commercial accommodation, daily expenditure ranges from $77 per visitor night for the Townsville region to $131 for the Cairns region and $174 for island resorts.

The significance of the Great Barrier Reef WHA to tourism

The attraction of the Great Barrier Reef WHA for tourism extends beyond the time and money spent within the boundaries of the WHA. A number of surveys in which visitor attitudes were sought give qualitative and quantitative information on the significance of the Great Barrier Reef WHA in attracting visitors to the area including the adjacent mainland.

In a 1986 survey of tourists, Vanclay found that the most frequently stated answer to an open ended question about their reason for visiting North Queensland was 'the weather' (31 per cent of respondents) followed by 'the reef' (20 per cent of respondents) (Vanclay 1988). More recently, the Queensland Visitor Survey reported that almost half of the people surveyed nominated the 'Barrier Reef' as a feature which prompted their visit to the Cairns region, and this was the most important of all features nominated. Only 13.4 percent of visitors to the Townsville region nominated the Barrier Reef in the same survey (QTTC 1991, reported in NCST&T 1992). A survey of visitors undertaken at Cairns airport found that 85 per cent of respondents nominated a 'beach, ocean, reef related' activity as their main outdoor activity on their holiday, and 79 per cent said that such an activity was the most appealing feature of their holiday (NCST&T 1992).

The information indicates that the Great Barrier Reef WHA is particularly important in attracting visitors to the Cairns region. The other conclusion that may be drawn is that the Great Barrier Reef WHA is not the main attraction to all tourists. It is not clear from the survey results reported how much tourist expenditure outside the boundaries of the Great Barrier Reef WHA can be attributed to its attractions.

Current Great Barrier Reef WHA tourism

Island resorts

Information is available on the number of tourists who stay on island resorts, and their expenditure, from the annual survey conducted by the QTTC. This survey consistently reports lower visitor night numbers than the combined DTM and IVS figure, however the sample sizes used for the national level surveys are such that for small areas like the Great Barrier Reef islands, errors could be significant. The QTTC data has been used as expenditure figures have been collected directly from respondents. Travel costs to the area are not included but local travel is included. For 1991–92, the QTTC reports that 243 800 visitors spent 1.08 million visitor-nights and $188 million at island resorts (QTTC 1992).

Island camping

The Queensland National Parks and Wildlife Service maintains a data base on the number of people who camp in National Parks and fees paid. The most recent year for which information is available is 1990. In that year, 16 690 people obtained permits to camp on Great Barrier Reef WHA island National Parks. They spent 66 460 nights camping and paid $90 699 in permit fees.

No further information is available to identify the amount spent by these people on transport to islands, other costs of camping or travel to and accommodation on the adjacent

mainland. These people are included amongst the passengers on commercial passenger vessels and this component of their expenditure is included in the following section.

Commercial passenger vessels

The GBRMPA has estimated the number of visitors carried on commercial passenger vessels at 2.291 million for 1992[26]. The GBRMPA does not collect information on the number of visitor days spent or how much these tourists paid in fares and other services offered.

Expenditure on fares has been estimated on the basis of trip types. Three major trip types were identified and the number of passengers carried on each estimated by GBRMPA staff on the basis of information provided by individual vessels. The three trip types are: 'reef day trips', 'island transfers', and 'other'. The fares selected as common to each trip type were based on information on fares for individual trips held by the Queensland Tourist and Travel Corporation[27].

The reef day trips include only those carried on vessels with a capacity of over 100 passengers. These vessels and trip types make up a distinct market segment with fairly uniform fares of around $100 per day for an adult. The number of passengers equals the number of visitor days provided.

Island transfers include the regular ferry services to Magnetic Island which service commuters as well as holiday makers. The other island transfers are generally for tourism and recreation and include water taxis, drop offs to islands for resort stays or camping, and day trips. The number of passengers equals the number of visitor days provided.

The 'other' category includes a large variety of day and longer trips carried by smaller vessels. These include dive trips, game fishing, other fishing charters and island cruises. As some trips are longer than one day, the number of visitor days spent is greater than the number of passengers recorded here. Estimates of fares paid per passenger were based on information from the range of trip types included in this category and the expenditure figure derived is considered to be conservative. Total expenditure of trips on commercial passenger vessels is estimated at $168 million for 1992 (table A3.4).

Table A3.4 Commercial Passenger Vessels Great Barrier Reef WHA 1992

Trip type	Number of passengers	Range of fares	Expenditure
Reef day trips	743 600	$100 per day	$74 360 000
Island transfers	947 272	$10 to $50 per day	$33 996 000
Other	600 740	$100 per trip	$60 074 000
Total	**2 291 324**		**$168 430 000**

Source: GBRMPA unpublished data, QTTC brochures.

Financial values

The appropriate measure of the financial value of Great Barrier Reef WHA tourism is expenditure by tourists. This expenditure includes that made by people staying on island resorts, camping on islands and travelling on commercial passenger vessels. The problematical issue is how much expenditure on the adjacent mainland and travel to the region to attribute to the attractions of the Great Barrier Reef WHA. Two alternative

[26] Estimate provided by the Great Barrier Reef Marine Park Authority, based on data returns from operators of commercial passenger vessels.

[27] The information was taken from current (1993) advertising brochures.

questions could be posed. Firstly, one could ask; What is the expenditure on the adjacent mainland and on travel to the region by people who visit the Great Barrier Reef WHA? The alternative question is; What expenditure on the adjacent mainland and travel to the region is due to the attraction of the Great Barrier Reef WHA?

The answer to the first question would encompass all the expenditure made by that population of visitors who included a visit to the Great Barrier Reef WHA in their holiday. It is this question that was posed and answered by Hundloe et al. in their 1986 study of Great Barrier Reef WHA tourism. To put this into some perspective, the average length of stay in the region of the Great Barrier Reef WHA and adjacent mainland by respondents to this survey was 14.4 days and their average time spent visiting coral reef sites was 1.6 days. This approach would place a maximum value on expenditure attributable to the Great Barrier Reef WHA.

It is assumed that the answer to the second question would be a more constrained amount, accounting for the likelihood that visitors who enjoyed other attractions in addition to the Great Barrier Reef WHA would attribute some expenditure to those attractions. The only way to answer this question would be to ask people to make their own judgements as to the expenditure to attribute to the attraction of the Great Barrier Reef WHA. This has not been done for the Great Barrier Reef WHA. What can be done is to estimate an absolute minimum value for this by assuming that at least one night must be spent on the adjacent mainland on either side of a reef day trip. This approach would place a minimum value on expenditure attributable to the Great Barrier Reef WHA.

In both cases, the costs of travel to the region of the Great Barrier Reef WHA and adjacent mainland could be included or excluded depending upon what one wishes to measure. If measuring expenditure in the region of the Great Barrier Reef WHA and adjacent mainland, travel costs would be excluded. If measuring expenditure in Australia, airfares to companies other than Qantas would be excluded. If measuring total expenditure regardless of national boundaries, the appropriate proportion of travel costs attributable to visiting the Great Barrier Reef WHA would be included.

Maximum value approach

The 1986 survey conducted by Hundloe et al. is the most recent example of the comprehensive approach to information collection necessary to describe the economic and financial values of Great Barrier Reef WHA tourism. The values obtained are reported here in 1986 dollars and then adjusted for increased tourist numbers and inflation.

Hundloe et al. surveyed a sample of tourists to the Great Barrier Reef WHA and adjacent mainland and obtained information on the total expenditure on their trip, the number of days spent away from home altogether and the number of days spent in what they called the 'GBR Region', which is the area of the Great Barrier Reef WHA and adjacent mainland. Expenditure for the days spent in the Great Barrier Reef WHA and adjacent mainland was calculated *pro rata* as a proportion of total trip expenditure. Note that this method includes travel to the region, including international airfares that may not even accrue to Australia. The sample results were weighted to approximate the best information available at the time on the population of Great Barrier Reef WHA visitors. The population data was taken from the International visitor Survey and a one-off Australian Bureau of Statistics national survey.

The average length of stay reported from the sample seems high at 14.4 days in the light of data from the QTTC on the average length of stay in Queensland regions and Queensland as a whole. These are reported on the following table, A3.6. While it is possible for people to stay in more than one region, the overall average for Queensland suggests that the average length of stay reported by Hundloe et al. is high.

To convert the 1986 data to an estimate of 1992–93 tourist expenditure, three adjustments have been made (table A3.7). The dollar value has been adjusted for inflation using movement in the Consumer Price Index. The number of visits has been increased to an

Table A3.5 Characteristics of Great Barrier Reef WHA Tourism 1986

Variable	1986 value
International visits	182 700
Domestic visits	486 200
Total visits	**668 900**
Average length of stay	14.4 days
Average expenditure per visit	$977
Average expenditure per day	$67
Total expenditure	$653 700 000

Source: Hundloe et al. 1987.

Table A3.6 Average Length of Stay for Holiday/Recreation Visits

Region	Days
Great Barrier Reef Islands	4.5
Cairns region	6.6
Townsville region	3.2
Mackay region	4.3
Fitzroy region	2.9
Total Queensland	6.4

Source: QTTC 1992.

Table A3.7 Maximum Value Approach to Estimating Expenditure

Variable	1986	1991–92
International visits	182,700	
Domestic visits	486,200	
Total visits	668,900	1,990,000
Average length of stay	14.4 days	6.4 days
Average expenditure per day	$67	$94
Average expenditure per visit	$977	$601
Total expenditure	$653 700 000	$1,197,000,000

estimate for 1992 by taking the number of visitors to the Great Barrier Reef WHA on commercial passenger vessels reported by GBRMPA, but some ferry trips have been excluded[28]. The average length of stay has been adjusted downwards to a maximum of 6.4 nights based on QTTC data. If a trip length of 14.4 days were used, average expenditure per visit would be $1353 and total expenditure would be $2.7 billion. Using the more conservative approach, the expenditure has been estimated at $1.2 billion.

Minimum value approach

The minimum value approach involves adding together expenditure made at island resorts, on camping permits and on commercial trips into the Great Barrier Reef WHA together with an estimate of expenditure made on the adjacent mainland and for travel to the region.

The average expenditure per day on the adjacent mainland has been estimated, from table A3.3 at $82 per day in 1991–92 dollars. Using a population of 1 990 000 visitors to the Great Barrier Reef WHA, (which is assumed to include people who stay on island resorts and camp on islands), the additional expenditure for these people for each day they stay on the adjacent mainland is $163 million. A stay of two days was taken as the minimum required to participate in a day trip to the Great Barrier Reef WHA. If a stay of six days were to be assumed, this would entail expenditure of $978 million and would boost the total expenditure to $1.7 billion.

It has been necessary to estimate travel costs to the region as the QTTC does not collect this information in their survey. Hundloe et al. found in their 1986 survey that the *pro rata* expenditure was $499 per adult travelling by plane and $358 for visitors travelling by car. These figures however needed to be weighted (reduced) to take account of under representation of visitors from Queensland and the actual amount used in their calculations is not reported separately. For this exercise, a conservative estimate of $200 per visitor has been adopted.

The expenditure by category and estimated total expenditure are shown in table A3.8.

Table A3.8 Minimum Value Approach to Estimating Expenditure

Category*	1991–92 $ million
Island resorts	188
Commercial passenger vessels	168
Adjacent mainland 2 days	326
Total without travel	682
Travel to region ($200/visitor)	398
Total with travel	1 080

*Island camping fees of $90 699 are not shown on this table

Findings

The financial value of tourism to the Great Barrier Reef WHA including travel to the region can confidently be valued at over $1 billion per year. This is a conservative estimate. Of this amount, at least $356 million in spent on stays on island resorts and trips on commercial passenger vessels within the Great Barrier Reef WHA. Excluding travel to the

[28] This has been done to try to exclude commuter travel by local residents. The basis of this estimate cannot be described further in order to protect commercial confidentiality.

region, at least $682 million is spent by tourists in the region of the Great Barrier Reef WHA and adjacent mainland.

The multiplier effect of this expenditure can be estimated using multipliers calculated for the Cairns, Townsville, Mackay and Rockhampton regions (Driml 1987). For island resorts, these ranged from 1.7 to 1.8 and for commercial passenger vessels they were 1.6 to 1.8. Applying a multiplier of 1.7, the direct plus indirect output effect of $1 billion expenditure is approximately $1.7 billion but this includes impacts of expenditure on travel, some of which will occur outside Australia. The impacts within the region of the Great Barrier Reef WHA and adjacent mainland should be calculated on total expenditure excluding travel, that is on a figure of around $682 million. Adopting a multiplier of 1.7, the direct plus indirect output effect of $682 million expenditure is $1 159 million. All these values are in 1991–92 dollars.

A3.2 Great Barrier Reef economic values: tourism and nature conservation

This section of appendix 3 addresses economic values arising from tourism to the Great Barrier Reef, plus the results of research undertaken to place a dollar value on non-market indirect use values of nature conservation.

Hundloe et al. (1987), undertook economic analysis that revealed values for a number of the non-market aspects of attributes of the Great Barrier Reef WHA. Specifically, the study addressed the consumer's surplus of tourists who visit the Great Barrier Reef WHA, and the consumer's surplus to the Australian population who did not visit the Great Barrier Reef WHA (termed 'vicarious users'). This latter consumer's surplus is for management of the Great Barrier Reef WHA to conserve environmental values, maintaining bequest and existence values and the option that the vicarious users may experience the environment as it is now, if they visit in the future.

As the study by Hundloe et al. was undertaken in order to assess the economic impacts of outbreaks of crown of thorns starfish (COTS), the economic value of research into and control of COTS was investigated. This was measured for tourists and vicarious users and was in addition to the other values listed above.

In terms of the categorisation of values used in this present study, the consumer's surplus from tourism is the economic value of the compatible direct use, tourism. The consumer's surplus to vicarious users of management is part of the economic value of the primary use of nature conservation. The consumer's surplus of research into and control of COTS, to both tourists and vicarious users, is another part of the economic value of the primary use of nature conservation in as much as research and control are aimed at maintaining ecological balance if human causes of outbreaks are identified.

Economic value of tourism

The relevant measure of the economic value of tourism is the consumer's surplus experienced by tourists to the Great Barrier Reef WHA. The cost to tourists of their visits to the Great Barrier Reef WHA is currently the amount paid to commercial operators for transport, accommodation and other services. The consumer's surplus measures what tourists would be willing to pay above this for access should there be an entry fee on access to the Great Barrier Reef WHA itself. It is important to note that at the time of the study, there were no user fees in place for reef visits. (A fee of $1 a visit was introduced in July 1993, but as will be illustrated below, this will not capture the full consumer's surplus experienced by reef visitors.)

The study by Hundloe et al. presents three consumer's surplus measures for tourism. The first is for the population of visitors to 'the Great Barrier Reef Region' which, as defined by Hundloe et al, includes the Great Barrier Reef WHA and adjacent mainland. This consumer's surplus measure is based on an average visit of 14.4 days. It is considered here that this could give an overestimate of consumer's surplus for visits to the Great Barrier Reef WHA *per se*.

The second consumer's surplus measure is for the population of visitors who visited coral sections of the Great Barrier Reef WHA whether outer reefs, cays or fringing reefs. Hundloe et al. found from their survey that 86 per cent of visitors went to coral sites. The third measure is specifically for visits to coral sites. The latter two measures are subsets of the first. It is considered that the consumer's surplus for visits to the Great Barrier Reef WHA lies somewhere between the second and third measure.

Causes of the wide variation include difficulty in defining what is being measured and the use of different methods to assess non-market values. The consumer's surpluses for visitors to the Great Barrier Reef WHA and for that subset who visited coral sites were calculated using the Travel Cost Method. The consumer's surplus for visits to coral sites was determined using the Contingent Valuation Method and refers specifically to actual trips taken[29]. The average time spent by these people actually visiting coral sites was 1.6 days.

The results from Hundloe et al. 1987 are presented in table A3.9. The Net Present Value is a standard means of projecting values over time. Hundloe et al. actually carried out a sensitivity analysis using a range of discount rates and time periods. Table A3.9 shows the results for an eight per cent discount rate (the lowest rate used) and a 10 year time period, which is but a short period in the projected lifetime of a protected area resource such as the Great Barrier Reef WHA.

Table A3.9 Economic Values of Tourism, 1986

	Consumer's surplus 1986 $ million	NPV, 10 years at 8% $ million
Visitors to GBR WHA	144.1	1 019
Visitors to GBR WHA who visited coral sites	88.7	746
Visits to coral sites	5.6	393

Source: Hundloe et al. 1987.

All three estimates are presented in table A3.10, adjusted for inflation and increased visitor numbers (2.9 times more visitors) to estimate the consumer's surpluses in 1991–92 values. The wide variation in values points to a need for more research to develop a consistent approach to estimating consumer's surplus for the Great Barrier Reef WHA.

Table A3.10 Economic Values of Tourism, 1991–92

	Consumer's surplus 1991–92 $ million
Visitors to GBR WHA	584
Visitors to GBR WHA who visited coral sites	357
Visits to coral sites	23

Source: Derived from Hundloe et al. 1987.

[29] It is interesting to note that for visits to coral sites, the sample mean willingness to pay an entrance fee to visit was $11 per adult and that this is higher then the $1 per person fee recently introduced.

Economic value of nature conservation

As noted above, the economic values of nature conservation include values measured by Hundloe et al. for vicarious use for management of the Great Barrier Reef WHA and for research and control of crown of thorns starfish.

The vicarious use value for management was derived from a mail survey of a sample of the Australian population, seeking information on what respondents would be willing to pay as an entry fee to visit coral sections of the reef if that fee was to used to fund management. The result of this Contingent Valuation method study was a mean willingness to pay $4.13, translating to a total of $45.3 million per annum.

This same survey sought a willingness to pay by vicarious users of an **additional** amount for research and control of crown of thorns starfish either as an addition to the entry fee or as a one off donation to a trust fund. This resulted in an annual willingness to pay by the Australian population of $15.6 million. Alternatively, the population would be willing to pay $30.1 million in once off donations.

The sample of tourists were also asked for their willingness to pay an additional amount both by entry fee or once off donation. The additional entry fees nominated translate to $1.3 million per annum and the alternative once off donation was calculated at $5.6 million for all tourists.

Table A3.11 Willingness to pay for Nature Conservation, Great Barrier Reef WHA, 1986

	Annual payment 1986	Net Present Value
	$ million	$ million
Vicarious users WTP for management	45.3	not available
Vicarious users WTP for COTS	15.6	30.1
Tourists WTP for COTS	1.3	5.6
Total	**62.3**	

Source: Hundloe et al. 1987.

The figure of $62 million for 1986 inflated to 1991-92 dollars is $86 million. Hundloe et al. stressed that vicarious use values are likely to be an underestimate, possibly considerable, as no values to people in the rest of the world have been included.

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