Staff Papers

Neale, R.

"Don't love me to death". Part 1 : managing recreation in the Great Barrier Reef Marine Park.

Lecture 1 - Lecture series, School of Biological Sciences, Flinders University, September 1993

Staff Paper 1993-34

For more information contact:

Librarian
Great Barrier Reef Marine Park Authority
PO Box 1379
Townsville Qld 4810 Australia
Phone: +61 7 47500701
Fax: +61 7 47726093
email: library@gbrmpa.gov.au

Great Barrier Reef
Marine Park Authority
P.O. Box 1379
Townsville, 4810

"DON'T LOVE ME TO DEATH" - Part 1

Managing Recreation In The Great Barrier Reef Marine Park

LECTURE 1

Lecture Series. Flinders University
School Of Biological Sciences
September 1993

Ray Neale
Director,
Corporate and Strategic Projects
Great Barrier Reef Marine Park Authority
Townsville Queensland, Australia

"DON'T LOVE ME TO DEATH"
Managing Recreation in the Great Barrier Reef Marine Park

Ray Neale.
Director, Corporate and Strategic Projects
Great Barrier Reef Marine Park Authority
Townsville Qld 4810.

Lecture 1
Lecture Series. Flinders University Adelaide 12 Sept 93

Acknowledgment: Much of the material for this paper comes from: "The Great Barrier Reef - Its Health and Hazards" Graeme Kelleher, Chairman, GBRMPA, and Dr.Wendy Craik, Executive Officer GBRMPA - paper presented to Colloquium and Forum on Global Aspects of Coral Reefs. Sacramento USA July 1992 and "Review of Management of Impacts of Commercial Tourism, and Private Recreation in the Great Barrier Reef Marine Park", unpublished report by Dr.Jan Carey, GBRMPA 1993.

Summary
This first of two lecture papers deals with the impacts of recreational activity in the Great Barrier Reef Marine Park and includes tourism. The second paper concentrates more on wider management issues and includes matters such as water quality, pollution and biological impacts on the Reef

The Great Barrier Reef is protected by a system of management which relies heavily on peoples' commitment to ensuring the sustainability of the Reef and their use of it. Tourism and recreational use are increasing rapidly and are expected to double by the year 2000, so the management of impacts has to adapt quickly and continuously to the changing levels of use. whilst ensuring that decisions are made on the basis of knowledge, that research provides the knowledge and ensure that Marine Park users are meaningfully involved in the management processes.

"Don't Love Me To Death": This often quoted line epitomises the inherent conflict between the overwhelming desire for people to see, enjoy and love, and the very real prospect of "killing" the object of our affection; for example, tourists love Egypt's "Valley Of The Kings" but they have caused it irreparable damage. If Romeo and Juliet had managed their relationship better, perhaps their end might not have been so sticky; and Cleopatra might have gone on to better things too!

Ensuring the sustainablity of the relationship between humans and the beautiful Great Barrier Reef is what managing the GBR Marine Park is all about.
This relationship includes not only those humans who visit the Reef but also those humans who have indirect effects on it.

A proper perspective must be kept about the extent of individual impacts, the time frames involved, the sustainability of the various activities and the management

effort involved in all impacts on the Reef from the most obvious threats such as anchor damage, to the insidious, surreptitious and long term impacts such as degraded water quality. There is no real point in spending a lot of management effort hounding to death a low impact activity while spending too little time on a stealthy threat such as the slowly increasing levels of nutrients entering Reef waters from terrestrial sources.

This is not to say that low impact recreation does not endanger parts of the Reef and that it doesn't need managing - that danger exists and is managed, but it does say that a sense of perspective must apply and that dangers greater than recreation impacts exist and need a greater proportion of effort directed at their management.

Graeme Kelleher, Chairman of the Great Barrier Reef Marine Park Authority, (Kelleher, Craik.1992) described the essentials of that relationship in Sacramento USA last year as:

> *"The Authority believes that any use of the Reef or associated areas should not threaten the Reef's essential ecological characteristics and processes.*
>
> *Activities depending on the Reef's renewable resources should generally be held at or below maximum sustainable intensities indefinitely."*
>
> This belief has led the Authority to adopt as its primary goal:
> **'To provide for the protection, wise use, understanding and enjoyment of the Marine Park in perpetuity through the development and care of the Great Barrier Reef Marine Park' "**

The Great Barrier Reef Marine Park:

The GBRMP is not a Marine Park in the same sense as a terrestrial National Park. It is a multiple use protected area and has received considerable international recognition. Last week in Canberra, the Authority was awarded the coverted "Einstein Gold Medal" by UNESCO in recognition of its outstanding contribution to the conservation of the world heritage and to the advancement of environmental education.

The Great Barrier Reef was listed as a World Heritage Site in 1981 and the Marine Park covers the major part of it. It is also the first "Particularly Sensitive Area" to be nominated by the International Maritime Organisation. and it conforms to the requirements of the Biosphere Reserve concept. It is an area of high scientific interest and was described at the 7th International Coral Reef Symposium as the only large system of coral reefs remaining in the world in pristine or near pristine condition.

The Great Barrier Reef is the largest system of corals and associated life forms in the world. The G B R Marine Park, embracing most of the Reef region, has an area of 347,000 square kilometres - larger than either Victoria and Tasmania combined or the United Kingdom. The Reef extends over 2,300 kilometres along the north-eastern coast of Queensland. It is not one reef, but many - 2,900 individual reefs ranging from less than one hectare to more than 100 square kilometres. It includes a range of reef types from shelf edge reefs (the ribbon reefs) to coastal fringing reefs, about 350 sand cays and reef shingle islands, 120 of which are vegetated, and 600 continental islands up to 35,000 hectares in size. In some places the reefs are separated by channels of no more than 200 metres in width, while elsewhere they may be up to 20 kilometres apart.

The living inhabitants of the Great Barrier Reef include about 400 species of coral of which 350 species are the hard reef building corals and 1,500 species of fish, a very comprehensive range of Indo-Pacific invertebrates, 240 species of birds, 6 species of turtles, species of cetaceans (including humpback, minke and killer whales and several dolphin species) and the dugong.

This great diversity of life forms makes the Great Barrier Reef of enormous scientific significance.

The Reef has developed over several million years but the "modern Reef" is estimated at approximately 18,000 years. It and its adjacent mainland coastline provide unique habitats and breeding sites for several endangered species including the dugong (Dugong dugon), the saltwater crocodile (Crocodilus porosus), and contains nesting grounds of world significance for the green turtle (Chelonia mydas) and the loggerhead turtle (Caretta caretta) Giant clams occur in sizeable populations in the Marine Park though seriously depleted elsewhere and there is a significant "nursery" site for the marlin and sailfish who gather in large numbers near the mouth of the Horton River just south of Townsville. These prized sportfish are the juveniles of the 500kg blue and black marlin which frequent the deeper waters at the edge of the continental shelf.

Many people use the Reef for many things. The only activities that are prohibited within the Park are commercial mining, oil drilling and spearfishing with SCUBA gear. The major activities are tourism and fishing. In its early years, reef tourism grew forty fold between 1940 and 1980 and is now the fastest growing activity in the Great Barrier Reef Region expanding at an estimated 10% per year. In some areas, for example, Cairns, tourism has been growing at an estimated 30% annually until recently.

Tourism, as well as undergoing a rapid increase in growth in the last five years, has also undergone a dramatic change in style. It has changed from unsophisticated, relatively inexpensive, generally slow, family style of tourism to high technology, high speed, corporately financed and in many cases, up-market tourism.

Fishing, the other major activity in the Marine Park, is either commercial fishing for prawns and scallops and reef or pelagic species, or recreational fishing with line or spear, but there are also minor fisheries for aquarium fish, coral, beche de mer and trochus as well as limited traditional fisheries adjacent to aboriginal communities.

Management Objectives and Approach

Present Management, generally

The management approach for Marine Park was established by the Great Barrier Reef Marine Park Act, 1975, which specifies that the GBRMP Authority is responsible for its overall management, and the Emerald Agreement, under which day-to-day management is carried out by Queensland Department of Environment and Heritage (QDEH). The Goal and Aims of the Authority set the principles for its activities. Annual Corporate Plans detail management objectives and strategies for each year.

Public support and co-operation is vital to the work of the Authority. Consultation and public participation in the planning and management of the Marine Park are practised, particularly in the process of preparing and reviewing zoning and

management plans by the Planning and Management Section, and recently, in the development of a user pays system for commercial activities.

The Authority is beginning to involve Aboriginal people and Torres Strait Islanders much more in the management of the Marine Park, especially in managing and maintaining their cultural heritage. Permits for traditional hunting for dugong and turtle are granted, and communities, through community councils and community rangers, are taking an active role in the management of these protected resources, as well as sites of cultural significance. Following the Mabo case, which confirmed the existence of traditional native property rights, Aborigines and Torres Strait Islanders are seeking a greater role in management of the lands and "sea country" that they see as theirs. Achieving this involvement will challenge GBRMPA in future years.

The Authority's role in education and extension extends beyond serving the regional community through its very productive Education and Information Section, to the Great Barrier Reef Aquarium, and more widely, to international marine conservation through the External Services Section. Interpretive programs are required for tourist programs to extend an understanding of the Marine Park to all visitors.

Zoning plans form the basis of managing activities in the Marine Park.
The Great Barrier Reef Marine Park is divided into four sections each of which has a zoning or management plan which spatially regulates usage within the area. This has been likened to rooms in a house or areas in a town plan that allocate spaces to particular uses.

The use of, or entry into, a zone is for some activities "as of right," but for others, including most commercial uses, an application must be made to the Authority for permission, i.e. a **permit**. Impacts of permitted tourism activities and programs are managed in part by limiting the intensity of use, restricting access, and controlling the kinds of activities allowed in certain areas. Since permits are not required for private recreational use, it is not limited to the same extent as commercial tourism activities.

Permit applications are assessed with regard to criteria in the regulations. Permits commonly include conditions intended to safeguard the Park and its users against ecological and amenity impacts. Major development projects which have the potential to cause significant impacts require permits and may be designated under the Environment Protection (Impact of Proposals) Act, 1974. Monitoring of construction and operation of structures and developments is usually required to enable prediction of the effects of activities and to establish whether the impacts that may result are acceptable or otherwise.

Surveillance and enforcement are performed using vessels and aircraft provided by a number of different agencies. QDEH patrols provide for interaction between users and managers, detection of infringements and also to undertake works such as maintenance and monitoring. However user education is GBRMPA's main tool for ensuring compliance with Marine Park legislation.

Recreational fishing accounts for some three-quarters of the total catch in the GBRMP. With commercial fishing, it is managed through the zoning system and through seasonal closures and replenishment areas, not through permits (except for research and aquarium fish collecting). The Authority liaises with Queensland

Department of Primary Industries(QDPI) and the Queensland Fish Management Authority (QFMA) in the management of Marine Park fisheries.

Site allocation for permitted commercial activities is on a "first-come, first-served basis." In the past supply has exceeded demand, but rapid tourism growth has reduced the supply of favoured sites in Cairns and the Whitsundays, prompting investigation of other of site allocation mechanisms, including "environmental tenders," ballots, and concessions with resource rents and competitive bidding.

Marine Park management is also achieved through joint projects with other agencies, including the Department of Primary Industries (DPI), James Cook University (JCU) and the Australian Institute for Marine Science (AIMS), expert consultancies, and a number of advisory committees.

The Great Barrier Reef Marine Park Authority is funded primarily by the Commonwealth Government, with the exception of the Great Barrier Reef Aquarium, which aims to operate at no cost to Government. The total estimated expenditure for 1993-94 of $23,191,000 will be funded through Commonwealth appropriations (70%), the Queensland government contribution for day-to-day management (14%) and the Aquarium (8%).

Zoning Plans in the Marine Park

The development of a zoning plan takes two to three years with a significant focus on public participation in which detailed constructive input and comments are sought before a plan is prepared and issued as a draft (Craik, 1992).
Through zoning, conflicting activities are separated, areas are provided which are suitable for particular activities and some areas are protected from use. Levels of protection vary from zones in which almost no human activities are permitted to zones in which very few activities are prohibited.

Major Categories of Zones
and their relationship to the IUCN (World Conservation Union) classification system

Preservation zones and Scientific Research zones
Equivalent to IUCN Category I, Scientific Research/Strict Nature Reserve. The only human activity permitted is strictly controlled scientific research.

Marine National Park zones
Equivalent to IUCN Category II, National Park. The major uses permitted are scientific, educational and recreational.

General use zones
Equivalent to IUCN Categories IV, Managed Nature Reserve and VI, Resource Reserves. Uses held at levels which do not jeopardise the ecosystem or its major elements. Commercial and recreational fishing are generally permitted; bottom trawling is prohibited in one of these two zones.

(Kelleher 1990)

Details of the zones, maps and other information for each section are published in zoning plans. They must be accepted by both houses of Federal Parliament.
Zoning plans mainly separate extractive from non-extractive uses in the Marine Park on a broad scale. They do not address the appropriate levels of the activities or the allocation of resources between permitted uses. For example, they do not

allocate areas for tourism or mariculture or other uses. **Management plans** relate to smaller areas and are intended to provide detailed planning in specific areas for the management of activities, to establish limits necessary to safeguard the environment and avoid conflicts, and to maintain a wide spectrum of recreational opportunities.

Human Use of the Great Barrier Reef Marine Park

Edges between the tourism and recreation categories of use are blurred (e.g. dive-tour operators act commercially taking people who are acting recreationally, Charter and bare-boats are commercial ventures which allow recreational experience for tourists and others) so there is little point in this lecture trying to deal separately with tourism as distinct from recreation.

The only uses prohibited throughout the Marine Park are oil exploration, mining (other than for approved research purposes), littering, spearfishing with SCUBA and the taking of large specimens of certain species of fish. Tourism, shipping, commercial fishing, traditional hunting and fishing, mariculture, marinas, scientific research, commercial collecting of corals, shells and aquarium fish, recreational pursuits such as fishing, collecting, diving, snorkelling and camping, Defence Department exercises and waste discharges all occur within the Marine Park. Twenty-four major user groups were identified in the Cairns Offshore Area by analysis of aerial surveillance, surface patrol records and Marine Park permit records (GBRMP & QDEH, July 1992).

Eco-tourism; or nature-based tourism that fosters environmental awareness and enhances understanding of the ecological features of natural attractions, is one of the fastest growing segments of international tourism (Department of Conservation and Environment, 1992). Defining ecotourism as programs that rely on and promote the natural features of the Marine Park, about 70% of permitted tourism operations are for ecotourism (Shurcliff and Williams, 1992). Most tourist program permits carry a condition requiring the operator to promote the Marine Park through on-site interpretation, such as talks by marine biologists, educational videos, guided snorkel swims or reef walks and educational brochures. However, a minority of operators provide interpretation of a desirable standard.

Recreational use of the GBRMP is part of the way of life of many North Queenslanders. Sailing, sailboarding and boating clubs, fishing clubs, swimming and diving associations, etc. have large memberships. Because people lived in the Reef region before the Marine Park was declared, and had established patterns of use of the resources, their co-operation is essential if the conservation goal is to be achieved. For this reason a strong emphasis has been placed on public consultation in all areas of management. The requirement for public consultation is set in the legislation. The community's views are sought on zoning and management plans and significant policy matters. The Authority accommodates those views in management policies and strategies through negotiation and compromise.

Any of these uses and activities may have effects on the structure, processes and sustainability of the Great Barrier Reef. Their impacts are often highly visible and become matters of concern to the public. In addition, uses and activities are sometimes incompatible when practised in the same area, generating conflicts and amenity impacts. Both ecological and amenity impacts may adversely affect the natural and cultural heritage of Aboriginal people and Torres Strait Islanders.

In terms of **visitors**, an estimated 2,000,000 visitors to the Great Barrier Reef Region generate an estimated 2.5 million visitor nights per annum in the Great Barrier Reef Region and those visitors produce a direct and indirect output estimated in excess of $1,000 million per year, including the adjacent mainland. The major activities undertaken by tourists in the Great Barrier Reef include diving, snorkelling, reefwalking and coral viewing. As with the general trend in Australia, tourism in North Queensland has grown rapidly in recent years. There is no doubt that the **weather** and **the natural environment** are the features which attract visitors to North Queensland. Foremost amongst the natural environment features is the Great Barrier Reef. For Australian tourists, seeing the Great Barrier Reef is the second most important reason for visiting North Queensland (after the weather) and international tourists come to North Queensland primarily to see the Great Barrier Reef (Vanclay, 1988). A recent Gallup Poll (October 26 - 27 1991) reported that 71% of Australians say they will be likely to take a holiday in the next two years, and the Barrier Reef was the favourite destination (mentioned by 29%) above the Gold Coast (20%) Tasmania (19%) and Kakadu (18%) (Anon, 1991).

The **ecological value** of the Great Barrier Reef for tourism/recreation lies in the fact that it is the largest accessible, relatively pristine system of corals and associated life forms anywhere in the world. The broad range of natural phenomena which may be observed in the Great Barrier Reef Region make it an area of the highest recreational value. In addition to the values outlined above, the Reef provides outstanding opportunities for persons to experience and observe first-hand the functioning and interdependence of ecosystems.

About thirty **wrecks** of historic importance are known to exist in the Great Barrier Reef area. One of the earliest, the wreck of HMS "Pandora" dates from 1791 and lies near the Reef in the northern sector to which it gave its name. In the central sector is the well preserved wreck of the coastal vessel SS "Yongala" which sank with the loss of 122 passengers and crew members during a cyclone in April 1911 (Lawson and Gesner, 1988)..The hazards of **navigation** in the Great Barrier Reef resulted in the construction of a large number of lighthouses, some of which have particular historical importance. The Raine Island lighthouse, constructed by convict labour in 1844 under the direction of Captain Blackwood of HMS "Fly", is now derelict but has been listed by the National Trust of Australia. The lighthouses at Lady Elliott Island (built 1866) and North Reef Island (1878) still operate and are fine examples of nineteenth century riveted steel plate construction (Kelleher, 1990).

The tourism/recreational attractions of the Great Barrier Reef stem from the qualities outlined above and their setting in a tropical (mostly sunny) environment. Early access to the reef was for fishing, to island resorts, fossicking on mainland fringing reefs, charter trips in slow monohulled vessels and through glass bottom boats or viewing tanks. The adjacent population was limited; roads to North Queensland were poor and the trip from southern states lengthy; much of the tourist infrastructure was low cost; and family-owned and overseas tourism was not great.

Changes in **technology**, disposable incomes and leisure promotion have radically altered Great Barrier Reef tourism. Initially face masks and later scuba equipment made watching the reef much easier, the **reef diving industry** has grown enormously; it is estimated that divers along the Great Barrier Reef spend some $380 million per year (Wilks, unpublished data, 1990). Of 900 people interviewed on their first reef dive, more than 85% rated the dive as an "exceptional experience", giving it an 8, 9 or 10 out of 10 (Wilks, unpublished data, 1990).

The changes in the diving industry also reflect other changes in reef tourism. Fishing and collecting, which used to be the main impetus for reef visits, have been overtaken by **nature appreciation** by tourists coming to see the beauty of the reef and to learn about it. Large stable high speed vessels enabling fast access to outer barrier reefs; pontoons; semi-submersibles and glass bottom boats; guided and interpreted dive and snorkel tours, have displaced fishing as the major activity on charter boats. The focus is on **appreciation** of the reef as part of a professional and well-serviced day trip. Roving charter vessels accommodate those who do not wish to participate in mass tourism.

Many of the Great Barrier Reef Islands are National Parks on which **camping** (with a permit) is permitted. Improved access and facilities have meant that more visitors are able to enjoy a reef camping experience, where access to both island and reef environments is immediate. As limits are placed on numbers of campers, the amenity and relative solitude of the experience is not compromised. Some 80,000 camper days were spent in the Reef in 1988.

Resorts offer a variety of non-reef associated recreational experiences eg terrestrial activities plus parasailing, water skiing, etc as well as reef-based recreational experiences. The importance of the reef as a backdrop to these activities cannot be underestimated.

An increasing recreational group is that of **yachting**. Bareboat chartering has grown from its inception in 1978, to support significant fleets in the Whitsundays Islands, in particular. Additionally, it is estimated that some 10,000 yachts pass through the Great Barrier Reef each year (Chester, pers comm).

Attributes and features of the Marine Park that are highly valued by tourism operators for their contribution to tourist programs include ecological and other natural aspects and the experiences that these stimulate:

the coral, colourful and unspoiled
clear clean water
the diversity of fish
large fish
fish that come to be fed
interesting inconspicuous organisms (invertebrates)
calm anchorages
"wilderness experience"
appreciation, enjoyment, wonder
peace, tranquillity, escape.

Features rated as most significant by private recreational users are similar, but focus on fishing.

Historical and cultural values include those important in the history and culture of Aboriginal people and Torres Strait Islanders, particularly those in the northern sector.

People's expectations for the future of the Great Barrier Reef World Heritage Area as pictured in the 25 Year Strategic Plan are shown below.

The 25 Year Vision

In the Great Barrier Reef World Heritage Area in 25 Years there will be:

A healthy environment: an Area which maintains its diversity of species and habitats, and its ecological integrity and resilience, parts of which are in pristine condition.

Sustainable multiple use: non-destructive activities which can continue forever, that is, in such a way that maintains the widest range of opportunities for appropriate sustainable use, and does not adversely affect the ecological integrity of its natural systems.

Maintenance and enhancement of values: the continuation and enhancement of diverse aesthetic, ecological economic, cultural and social values, providing for the aspirations of residents, users, Aborigines and Torres Strait Islanders and the global community.

Integrated management: management of activities which takes into account the ecological relationship between the Area and other adjacent areas, particularly the mainland.

Knowledge-based but cautious decision making in the absence of information: decisions based on a commitment to research, monitoring and review using data and experience from all sources and erring on the side of caution in the absence of information.

An informed, involved, committed community. (GBRMPA, 1992)

Managing Tourism and Recreation

• Tourism and Recreation

All of the general management approaches developed for the Marine Park have an effect on tourism activity. As outlined earlier, the main method of Marine Park management is zoning.

Tourism is allowed to occur under permit within all except preservation and scientific research zones, that is, in 99.8% of the total area of the Marine Park.

A major innovation that has been introduced in the rezoning of the Cairns Section of the Marine Park is the creation of a No-structures sub-zone. This sub-zone overlies approximately 22% of reefs. Its principal purpose is to ensure that a proportion of those parts of the reef that are near centres of human population and are therefore subject to heavy human use do not become covered with permanent or semi-permanent structures.

All tourist programs and facilities within the Marine Park require a permit. This requirement allows the Authority to assess each proposed tourist operation individually in terms of its suitability. A spatial regulation management measure which relates particularly to tourism is the ability to declare Reef Appreciation Areas or Special Management Areas in zones, in which fishing and collecting are normally permitted. These provisions allow up to 20% of the area of a reef to be declared a 'look, don't take' area to complement the provision of tourism facilities.

The factors considered when assessing a permit application are detailed in Great Barrier Reef Marine Park Regulations and include the objective of the zone to be entered and conservation, cultural heritage and amenity considerations, existing and future uses, and likely impacts of the activity. Concern to prevent unacceptable ecological impact is paramount in the Authority's management of tourism development. The types of activities which may be associated with reef-based tourism operations and which may have biophysical impacts include: discharge of

waste, litter and fuel; physical damage to reefs from anchors, people snorkelling, diving and reef walking; disturbance of fauna (especially seabirds); over-fishing or collecting. All of these may be managed to some extent by education, incentive, design, prohibition or limitation.

Proponents of large-scale developments or those which have the potential to produce impacts may be required to prepare Environmental Impact Statements or Public Environment Reports. Through environmental impact assessment, the potential impacts can be identified and steps taken to prevent or mitigate the impacts. Often the prevention of impacts is a matter of adopting the appropriate design and operational guidelines. Another dimension of the tourism impacts issue focuses on amenity - the impacts of tourism on other tourists and users of the Great Barrier Reef. The opposition to some commercial development on the Great Barrier Reef in the future has been recorded (Vanclay, 1988). Whilst the precise meaning of development was not defined by many respondents, this response revealed a disquiet about levels of crowding and tourist facility which may occur in the future.

The **amenity issue** is important at two scales. Overcrowding, reef degradation or an inappropriate mix of facilities at a particular reef site may detract from the experience of tourists. The Authority has had to address this issue a number of times where new operators have applied for permits to operate at sites already being used by an existing operator. The solutions have included time sharing, delineating operating areas, encouraging use of alternative sites and limiting the number of operators and people visiting a particular site.

Research has been undertaken on one occasion with the aim of resolving conflict between two different types of tourist operation wishing to use the same site (eg seaplane landing sites in relation to swimmers and snorkellers at Green Island). On the larger scale there is a need to ensure that the appropriate mix of tourism developments, which provide a range of recreation opportunities is provided in an area within reasonable access from major towns and that some areas remain free from the 'hardware' associated with tourist facilities - as discussed earlier in relation to No-structures subzones.

However, the size of the Great Barrier Reef is such that the concept of overdevelopment from tourism currently can hardly be considered a serious threat to conservation of the Great Barrier Reef as a whole. There are around 3000 reefs and islands within the Great Barrier Reef Region. There are twenty-four resorts on islands and 19 reef sites are regular day trip destinations, with permanently moored tourist platforms, while a larger number of sites are visited by intermittent operations. The fact, however, that concentrations of people in particular areas and the presence of tourist facilities may detract from the experience of some users, is of concern to the Authority.

The offshore Cairns area and the Whitsunday region are two sites where tourism pressure needs careful consideration. The Authority is addressing this issue by undertaking regional planning exercises in areas of increasing tourism demand and undertaking research into identifying the important factors which affect amenity and social carrying capacity. Jointly with the Queensland Department of Environment and Heritage, responsible for Island National Parks and Queensland Marine Parks, the Authority is developing "area statements" and "management plans" for groups of islands and reefs and individual islands and reefs respectively. These plans, which will involve periods of public comment, will identify existing and recommended

activities and acceptable levels of impact, to attempt to ensure that a range of recreational experiences is available and that the cumulative effect of activities is addressed before acceptable levels of impact are exceeded through a series of individual permit decisions. Within each "area" a range of experience "settings" is proposed to ensure that tourism does not preclude alternative opportunities.

Whilst not wishing to unnecessarily restrict tourism development, the Authority's foremost responsibility is to ensure that the facilities and activities are not causing impacts on a scale which could lead to unacceptable long-term damage. To this end, the Authority expends considerable effort to assess and manage tourist programs and facilities. The Authority expects tourist operators to also care for the environment which provides their livelihood. Further, the Government has adopted a policy called "user pays". This policy is based on the philosophy that people who benefit from the use of a public good or property, especially for commercial purposes, should contribute to the cost of managing or protecting that property. The application of this policy to the Great Barrier Reef has led to the tourism industry being asked to contribute to the cost of protecting it. In considering this issue, the Government has recognised that it retains a responsibility to provide core funds to protect the reef over and above contributions from the tourism and other industries. The Government has announced that charges on commercial operators which will translate to approximately $1 per person per day will be introduced in July 1993.

- **Fishing**

Within the Great Barrier Reef Marine Park there are two major fisheries, which together generate an estimated $400 million of direct output per year. The first of these is the **trawl fishery** - an otter trawl fishery with about 980 commercial operators, bottom trawling for a variety of prawns (Penaeus spp) and scallops (Amusium spp), with incidental catches of bugs (Thenus orientalis), sand crabs (Portunus pelagicus), squid (Sepioteuthis sp) and whiting (Sillago sp). Under Queensland Fish Management Authority (QFMA) management, the fishery is a limited entry fishery, with restriction on vessel replacement and gear. Seasonal closures are applied. The fishery is generally regarded as overcapitalised and some fishermen are expressing concerns about the resource (QFMA 1990). The annual catch is about 8,000 tonnes of product. Under the zoning plans put in place by the Great Barrier Reef Marine Park Authority, 80% of the Great Barrier Reef Park or about 95% of the trawlable area (as identified by fishermen) is available for trawling and about 70% of the trawlable seabed is trawled at least once each year (Shorthouse pers comm).

The second major fishery is the **reef line fishery** - a line fishery comprising both recreational and commercial operators, who may use up to six hooks per line. About 200 -300 commercial operators are the major commercial component of the fishery (Gwynne 1990) each operating from a primary vessel with up to six small tenders. Currently 1963 commercial fishing vessels hold endorsements entitling them to operate in the fishery. These vessels can utilise 2027 tender vessels. The recreational component consists of about 24,000 speedboats (Blamey & Hundloe 1991) and about 150 charter vessels (Hundloe et al. 1987)

Log book data put the current annual commercial catch at about 4,000 tonnes (Trainor, pers. comm.) and the speedboat catch is uncertain. The charter boat catch is unknown, but believed to have been about 500 tonnes 10 years ago (Hundloe 1985). To date, the commercial fishery has been a limited entry fishery (to a possible maximum of 1,963 vessels), with gear limitations (6 hooks) and more recently a limit

on number of tenders. Minimum size limits apply to the major species of the genera (Plectropomus, Lutjanis, Lethrinus). The QFMA has recently introduced management plans for the fishery, which include restrictions on both commercial and recreational fishermen, including bag limits (Gwynne 1990). Under Great Barrier Reef Marine Park Zoning Plans, line fishing is permitted in the vast majority of the Marine Park. No distinction is drawn between commercial and recreation operators in this fishery by GBRMPA. As a result of reported perceptions particular to a decline in mean fish size and in catch per unit effort, coupled with a 25 % increase in effort in the recreational fishery (Blamey & Hundloe 1991), it is suggested that the fishery may be beginning to face a resource problem.

Minor fisheries occur for inshore fish species, trochus, beche de mer, aquarium fish, coral, seasnakes, shark, lobster and tuna.

While observance of closures under Marine Park zoning plans has not been perfect, a combination of aerial surveillance (both night and day), surface patrols and industry intelligence suggests that observance is such that generally the closed areas are significantly less heavily fished than the open areas, increasingly so away from boundaries. There have been no studies of the biological effects of closures to the trawl fishery in the Great Barrier Reef Marine Park. In fact, little is known about the effects of trawling in this area, because very little work has been undertaken (Craik et al. 1989).

A major interagency research program (Craik et al. 1989) comparing trawled and generally untrawled areas has been started in the Great Barrier Reef Marine Park and this should provide quantitative information on the effects of trawling on non-target species and the environment. The program has been developed and agreed by industry, recreational users, managers and the scientific community.

Assessments of the effects of closures of fisheries on major seagrass beds along the coast of the Great Barrier Reef Marine Park have not been undertaken. The closures are supported and believed to be largely observed by trawler operators who regard seagrass areas as important prawn nurseries. Additionally, seagrass beds provide the major nutrition for the endangered dugong (Dugong dugon) and large dugong populations are correlated with the largest seagrass beds (Marsh 1989). A recent re-survey of dugong numbers in the northern Great Barrier Reef showed no change in population numbers compared with a survey undertaken five years earlier (Marsh, pers comm); dugong are harvested by coastal Aboriginal communities and there is a reportedly very small incidental take in gill nets by commercial fishermen (Marsh 1989).

Only anecdotal evidence is available on the effects of closures on the catches of the trawler fleet (Brett Shorthouse, pers comm). Trawler operators, originally opposed to a 60 mile North-South cross shelf closure in the Far Northern Section of the Great Barrier Reef Marine Park, seem now to be more favourably disposed towards the closures. They apparently report that significantly better catches of prawns are to be had fishing "on the boundaries" of the closed area. Additionally, trawler operators are beginning to favour longer term closures as (in zoning plans), rather than short seasonal closures. Inshore fisheries closures have now been matched to Marine Park Zoning Plans.

Considerably greater assessment of the effect of closures to line fishing has been undertaken, although there is still much to be learned. Because of the paucity of

catch and effort data at an individual reef scale for the Great Barrier Reef Marine Park, with a few exceptions studies have focussed on collection of broad scale catch and effort data and diving surveys to undertake visual censuses at individual reefs.

Using coral trout (Plectropomus species) as indicators of the status of reef fish, some 220 reefs, (about 7% of the total number of Great Barrier Reef reefs), have been surveyed using visual census methods to provide an assessment of the relative length frequency distributions of coral trout prior to zoning plans being introduced (Ayling 1983a,b; Ayling & Ayling, 1984a,b 1985a,b 1986). As sections of the Marine Park are rezoned, coral trout populations are resurveyed to attempt to determine the effects of reef closures (Ayling & Ayling, 1984b, 1986; pers comm). To date the results have shown:

- comparing Plectropomus leopardus at reefs in the Capricornia Section which have been open to fishing continuously, against those which had been closed for 3 to 6 years showed 16% more trout on closed reefs and double the number of trout less than 35cm on fished reefs. The mean length of trout on closed reefs was 9cm greater than on fished reefs (Ayling & Ayling, 1986).

- Plectropomus leopardus at reefs in the Cairns Section of the Marine Park which had been closed to fishing for 7 years supported the same numbers of trout as those always open, but, as in Capricornia, there were significantly more juveniles on fished reefs (Ayling pers comm).

Ayling has suggested that there is a possible predation effect at the closed reefs; others have suggested that food may be limiting at closed reefs.

The extent to which the closure of a reef to fishing can have spin-off effects caused by fish movement to adjacent reefs or areas is, on the basis of the limited information available for the Great Barrier Reef, not believed to be great. Early tagging studies in Capricornia (Craik and Mercer, unpublished data) showed that of about 6,000 reef fish tagged, and over 100+ recaptures, most recaptures were within 1km of tagging. However, tag loss was high and returns were generally over short time periods (days to several months). Twenty-five percent of coral trout returns had moved reefs (up to 30km). A more detailed study of tagging and movement at a single reef investigating the desirable size of partial reef closures, showed that the majority of tagged Plectropomus leopardus, Lethrinis chrysostomus and Lutjabus amabilis were located in the tagging vicinity for the month, but that a 1000m "buffer zone" to account for "leakage" seemed desirable (Beinssen and Beinssen 1989).

In a detailed study of the effects of reopening a reef closed to fishing for 3.5 years in the Capricornia Section of the Great Barrier Reef Marine Park, fishermen were encouraged to expend fishing effort to amplify any potential effects. In the two weeks following the reef reopening about 25% of the total number (estimated by visual census), of Plectropomus leopardus at the reef were caught, showing that fish stocks can be very rapidly depleted (Beinssen 1988). Eighteen months after reopening, a decline in the sizes of trout was evident compared with the size at reef reopening (Beinssen 1988).

Anecdotal evidence of the effect of closures for reef fish catches comes from disgruntled commercial fishing operators who claim that by fishing legally at "open" reefs it takes 20 days to make $A10,000 compared with operators alleged to fish illegally in closed areas making $A20,000 in 10 days. The economic imperatives

operating in most fisheries (over-capitalisation resulting in greater expenditure of effort to provide an adequate return) ultimately affect the resource, and potentially, (though this is rarely examined) also affect non-target species and the habitat. These economic imperatives, coupled with the unpredictability of fisheries production, suggest that the use of standard input and/or output controls alone to manage fisheries on an ecologically sustainable basis are unlikely to be successful. Conversely, however, areas closed to fishing also appear to be ineffective as the sole tool of fisheries management.

The QFMA has just introduced a management plan for reef line fishery but it also seems essential the Great Barrier Reef Marine Park Authority, in the revision of zoning plans, examines several issues carefully. These include:

- links between source and sink reefs to protect appropriate source reefs in particular;
- protect critical habitat, eg identified spawning areas;
- the need for information on the degree of movement of reef species.

While the volume of existing data on the effects of closures is small, there seems to be evidence of localised benefits from closures. To ensure these benefits have a more widespread effect, it will be necessary to look more carefully at the issues above and possibly to close a greater percentage of area to fishing.

A major research program has been proposed to experimentally investigate the effects of line fishing on the ecosystem.

Growth of Tourism and Recreational Use of The Marine Park

Tourism is among Australia's most economically significant industries, contributing 5.4% to Gross Domestic Production in 1990-91. Export earnings from tourism could rise from 7.2 billion in 1990-91 to $14 billion (in 1990-91 prices) by the year 2000 if the Federal Government's national tourism strategy targets are met (Stutchbury 1992).

The World Tourist Organisation estimates that in the 1990s tourist arrivals to the Asia/Oceania region will increase at an average annual rate of over 8%. For a number of reasons including our unique natural attractions, proximity to expanding Asian markets, safety and stability, Australia is considered likely to capture a sizable share of this market. An annual average growth rate for 1990-2000 of 8% for inbound tourism and 2% for domestic tourism is based on forecasts by the Bureau of Tourism Research (Commonwealth Department of Tourism 1992).

The direct economic value of the Great Barrier Reef Marine Park has been estimated as $1000-$1500M per annum (Ottesen, 1992). Tourism is the commercial activity of highest value. The offshore expenditure at island resorts, on commercial boating trips and on private recreational boating is estimated to be in the order of $300M (Great Barrier Reef Marine Park Authority, 1992a). Private investment in Queensland tourism has increased from around $500M in 1980 to $9.6 billion or half the Australian total in 1990 (Queensland Tourist and Travel Corporation, April 1991).

Tourist expenditure and subsequent expenditure in related industries provided employment for an estimated 120,000 people in Queensland in 1991 (Queensland Tourist and Travel Corporation, June 1992) and "eco-tourism" has been predicted to

create more than 75,000 jobs by the year 2000 (Queensland Tourist and Travel Corporation, quoted in The Australian, 12 September 1992).

Domestic tourism in Queensland is expected to grow at 3-6% in the ten year period and international tourism at 8-15%, and at these rates the Great Barrier Reef Region could experience 5.5 -7.5 million domestic visits and 1.6-3.3 million international visitors at the year 2000 (Ansett Transport Industries Limited, September 1991: source data Domestic Tourism Monitor, Bureau of Tourism Research).. International visitation to the Cairns region - 18% of visitors to Australia - is higher than that to Tasmania(3%), Northern Territory (9%), ACT (10%), South Australia (11% and Western Australia (14%) (Cummings 1991). The Great Barrier Reef is the most popular destination for Australians planning a holiday (Morgan Gallop Poll, 1991).

Domestic tourism within the Great Barrier Reef region has consistently grown at more than double the rate experienced by Queensland. Projections for the ten years 1990-2000 for the Cairns region (Cummings 1990) have shown an increase of 51% in the Cairns residential population and 86% in visitors. This will inevitably result in increased use of the Great Barrier Reef Marine Park.

There are no comprehensive figures on actual use of the Marine Park but a large proportion of international visitors and a lesser proportion of domestic visitors may be expected to visit the Reef during their stay. For Australian tourists, seeing the Great Barrier Reef was given as the second most important reason (after the weather) for visiting North Queensland, while international tourists visit the region primarily to see the Reef (Vanclay 1988). In 1989-90 the most popular reason for visiting the Mackay/Whitsunday region was for holiday purposes which accounted for around 92% of domestic visitor nights (Ansett Transport Industries January 1992) while about 12% of the total visitor nights are calculated to be "marine based."

Thomas (1992a) forecast international, domestic and total visits and visitors to the Great Barrier Reef Region and sub-regions to the year 2002/03, using two primary sources of data that yielded reasonable agreement. Total visits to the Region were forecast to increase from about 5.5 million in 1992-93 to 8.8-10.2 million in 2002-03. Total visitors to the Region were forecast to increase from about 3 million in 1992-93 to 4.7-5.0 million in 2002-03.

There are 22 resort islands with a total of 26 resorts. The number of visitor nights at resorts has increased at an average of 8% per year since 1976 (Ottesen 1992). Most of these islands are National Parks, managed by the Queensland Department of Environment and Heritage. The Great Barrier Reef Islands experienced a 19% increase in visitor nights in commercial accommodation in the year ending March 1992 (Queensland Tourist & Travel Corporation June 1992).

Diving is an activity that has expanded in recent years. In the Cairns area one site offering "resort diving" attracts some 12,000 novice divers per year, and there is fast becoming a shortage of suitable sites. Thomas (1992b) surveyed dive operations in the GBRMP, gathering detailed information on dive activities and operators' perceptions of the environment and its management. Of the 60 operators who responded, 29 conducted 116,350 scuba dives per year in the Cairns section alone.

The number of permitted commercial tourist vessels in October 1991 was 411. Fast stable catamarans, including state-of-the-art "wave piercers," capable of carrying 400 or more passengers have allowed much larger numbers of people to be transported

Large pontoons anchored in the lagoons of reefs within 2.5hr travel time are serviced by the big cats, bringing tourists for diving, snorkelling, swimming and coral-viewing from glass-bottomed boats and semi-submersibles. Bareboat charters operate in the Whitsundays in particular (about 410 in 1991). Fishing charter boats and game fishing boats are numerous (permitted charter vessels numbered 411 in 1991). Aircraft, particularly helicopters and small seaplanes, are also used to transport visitors to the reefs.

There were 21 international cruise line visits in Cairns Port in 1992, although 1993 visits/bookings are down to 14. From 1985 to 1992 cruise line visits grew at about 30% per annum.

On the basis of these diverse and sometimes divergent data, tourism activity in the Great Barrier Reef Marine Park appears likely to at least double by the year 2000.

Growth in Recreational Use of the GBRMP

The Great Barrier Reef Marine Park is a recreational resource for the local communities who live in the region. At least 36,000 and possibly 42,000 private motor boats are registered in locations adjacent to the Great Barrier Reef from Cooktown to Bundaberg, and an estimated 24,000 of these are used for fishing in the Marine Park (Kelleher & Craik,1991; Blamey & Hundloe 1991; Fernandez 1991). Some 3,000 international yachts are thought to pass through the region each year.

A Department of Transport estimate of the mean number of visits to the Marine Park in 1990 by private recreational users was 1.8M.

Projected population growth in the region for the fifteen year period 1986-2001 ranges from about 12% for Bundaberg and 14% for Townsville to 122% for Whitsunday and approaching 140% for Thuringowa and Douglas, although the Hinchinbrook percentage rate was projected to decline slightly (Skinner *et al.*, 1989; Australian Bureau of Statistics, 1990a).

The Queensland population has been aging in recent years and the median age is projected to increase to 35 by 2001. The proportion of people under 15 years is projected to fall to 20% by 2001, while the proportion of people aged 65 years or more is projected to reach 12% of the total population (Australian Bureau of Statistics, 1990b). Other factors being equal, it might be suggested that there will be a larger proportion of the population able to afford time and money for the use of private pleasure craft.

In summary, overall population in the GBR region may double by around the year 2000 and it is an aging population, suggesting that recreational use of the GBRMP may also double by the turn of the century.

Ecological Impacts of Tourism and Recreation Use

Positive impacts of tourism and recreational use of the Great Barrier Reef Marine Park include its economic and therapeutic benefits, and its effects in raising the environmental awareness of many visitors.

Potentially adverse ecological impacts include:

- site impacts from structures, moorings and anchoring;
- coral damage from diving and reef walking;
- removal of coral, shells and other organisms;

- garbage disposal and littering;
- sediment disturbance and dredging;
- water pollution - increased nutrients;
- heavy metal pollution;
- oil pollution;
- sewage discharge from vessels and outfalls;
- impacts of marinas;
- impacts on islands;
- fishing impacts;
- fish feeding;
- impacts of research and monitoring.

Impacts on the natural and cultural heritage of Aborigines and Torres Strait Islanders may include all of the above.

Social Impacts of Tourism and Recreation Use

General social impacts of tourism in the Marine Park include socio-economic effects on adjacent communities, "amenity" issues, effects on the range of recreational opportunities, and changing use patterns and social trends. The Authority has powers, expressed in the Act and Regulations, to consider existing and future amenity in decisions about use of the Marine Park. Aesthetic impacts, perceptions of crowding at some sites, user conflicts and mutual antagonism between commercial and recreational fishers, and loss of opportunities for "wilderness" experience, are some of the amenity impacts experienced by users. The latter was the most frequently raised amenity concern in the GBRMPA Management Review workshops.

Managers will manage amenity impacts more effectively when they understand better the nature of experiences that visitors expect and attain. Research needs for amenity impacts and socio-economic aspects of Marine Park use have been documented and programmed by the Authority for future action.

Impacts on the Natural and Cultural Heritage of Aborigines and Torres Strait Islanders

To Aboriginal people and Torres Straits Islanders the land is "source, self and sustenance" (Barlow, 1992). For those from coastal descent groups, the sense of their identity with the seascape, beach, estuary, reef, islands - of belonging to "sea country" - is as strong as their linkage with the land. The storehouse of Aboriginal cultural knowledge of coastal land and sea contains not only the understanding of ownership responsibilities, special places and customs, but also the individual's relationship with particular animal or plant species. This relationship may involve management obligations and usage limits, based on size or age or times for harvesting and not taking the resources (Johannes, 1985; Smith, 1987; Smyth, 1992b).

This kind of wisdom (ethnobiology) is resource management knowledge and would benefit the management of the Marine Park. The fact that it is not, can be felt as an insult by Aboriginal and Islander people and also a source of great concern, for it means that the sea and reef and their resources are not being properly cared for. They may also feel powerless because they are not in a position to contribute to management.

Before European settlement the coastal land and sea provided all that was needed for subsistence, shelter, clothing, tools, weapons, boats and ceremonial objects. Many Aboriginal and Islander communities still gain economic benefit from

subsistence hunting, fishing and gathering. The dugong is still of great significance in ceremony, religion, economy and culture. Any decline in its numbers is viewed with concern by Aboriginals and Islanders; it is classed as vulnerable to extinction (Marsh, 1985; Baldwin, 1985). Commercial harvesting of crayfish, trochus and pearl shell is practised, and many Islanders are employed in coastal industries such as pearl farming and fishing (Smyth, 1992b).

Given the personal and communal spiritual and cultural significance of the land and sea and its resources, as well as the economic importance of the resources, many Aboriginal and Islander people feel strongly about the violation of territory and custom that may come with activities such as commercial fishing, mining and tourism.

Smyth (1992b) groups the concerns and conflicts as:

- government processes that fail to give adequate opportunities for Aboriginal and Islander participation in decision-making;
- when Aboriginal and Islander people *have* been involved and the government failed to make what they felt was the proper response;
- the lack of benefits to Aboriginal and Islander people from projects that commercially exploit their resources.

The economic benefits are not the primary concern. Many in remote areas do not want tourism. In submissions to the Coastal Zone Inquiry, Aboriginal people and Islanders stressed the fragility of the coastal ecosystems, their special relationship with land and sea and their responsibility for protecting their environment from the lack of respect shown by many tourists and recreational users. They argued that Europeans have forgotten their dependence on the land and its natural systems (Resource Assessment Commission 1992).

Recreational anglers often enter traditional land and sea areas without permission. They take the resources and leave litter. Like commercial fishermen who discard their by-catch and fillet fish, their activities may be seen as wasteful of the resources. Tourism and private recreation, along with mining, commercial fishing, building and other activities result in people entering their lands and desecrating significant places, destroying the ecological and spiritual values at the heart of Aboriginal and Islander life. Specific impacts of tourism development have included:

- destruction of archaeological and sacred sites;
- dispersal of communities because of increased land rates and rents;
- social and economic impacts.

Other communities close to growing tourist destinations wanted to be involved in tourism, providing it was on acceptable terms. International visitors provide a demand for Aboriginal art, music and dance. However, the problems for many Aboriginal communities in developing tourist activities centre on their isolation and the lack of infrastructure such as roads, water, waste disposal, capital investment and support facilities.

Issues such as cooperative management, "sea rights" etc remain to be resolved and will occupy considerable resources over the next decade. It is GBRMPA's intention to play a leading role in the resolution of these issues for offshore areas in Australia.

The Future

The Future

The concept that development should be ecologically sustainable is not new. It has existed in virtually every group of humans who have lived and depended on the earth's natural bounty. One of the most important factors in eroding the commitment to ecological sustainability in theory and practice in the 20th Century has been the application of modern economic analysis involving benefit-cost analysis and the calculation of net present worth using discount rates. The application of these methods and concepts together tends to lead to decisions which state tacitly or explicitly that anything that happens more than twenty years hence is irrelevant.

Marine areas may be particularly vulnerable to the negative impacts of the uncontrolled operation of the market because they are traditionally considered to be "commons" and development in marine areas is not usually closely controlled.

Unfortunately, it seems that the pressure in peoples' relationship with the Reef can be towards maximising profits in the shortest time whilst limiting cash outflow especially if "the commons" can be used for no cost. In the case of the sea these common resources are the air and the water, their natural qualities and their pollution assimilative capacity, scenic vistas, wildlife habitat and the wildlife itself, such as corals, fish, whales and birds.

Before and since Garrett Hardin's essay "The Tragedy of the Commons", (Hardin 1968) there has been sufficient study to demonstrate conclusively that those market force incentives work. Consequently, the usual long-term effects on the commons of the uncontrolled operation of the free market is that the commons are destroyed. General awareness of the fact, even in the absence of a clear perception of the processes involved, has led to demands by the public, particularly in the past two decades, for the right to participate in decisions affecting the commons, and for governments to protect these public properties.

Australia has a comparatively small population, great natural resources and a strong emotional and intellectual commitment by the people to protect the Great Barrier Reef. Even with these advantages, the Authority is continually struggling to prevent insidious degradation of the Great Barrier Reef ecosystem. The pressures for over-exploitation are not confined to the direct uses of the Great Barrier Reef. They come also from the effects of activities that release pollutants into the Reef's waters.

We are entering a new and more difficult phase. Direct use of the Marine Park is increasing; government expenditure as a proportion of Gross Domestic Product is decreasing; there are proportionately fewer resources for management; management agencies are being forced to recover costs from users who are reluctant to pay; and there is evidence that nutrient levels in the waters of some parts of the Marine Park are at times above those at which some corals can thrive (Kelleher, 1992).

In addition to the strategies outlined above we are also finalising a 25 year Strategic Plan for the Great Barrier Reef World Heritage Area. sets a 25 year vision and short and long term objectives to achieve that vision. The plan, believed to be a world first in its extent and style (ie. joint decision making), is almost complete and will hopefully further reinforce the level of cooperation and commitment of all to the future well being of the Great Barrier Reef.

The relationship we want between humans and the Reef looks towards "forever" but certainly must learn from the past, be based on knowledge and must demonstrate commitment in the face of temptations or expediencies for short term gain.

The coming years will determine whether that commitment is sufficient in the minds and hearts of Australians to ensure that the Great Barrier Reef is protected from insidious degradation.

REFERENCES

Ayling A M and A L Ayling, 1984a. Determination of most accurate survey size and method for visual counting of coral trout (Plectropomus spp). Report prepared for GBRMPA.

Ayling A M and A L Ayling, 1984b. Distribution and abundance of coral trout species (Plectropomus spp) in the Swain group of reefs: Capricorn Section of the Great Barrier Reef Marine Park. Report to GBRMPA.

Ayling A M and A L Ayling, 1985a. Central Section Survey of the Great Barrier Reef Marine Park. Survey Report to GBRMPA.

Ayling A M and A L Ayling, 1985b. Far Northern Section of the Great Barrier Reef Marine Park: Survey Report to GBRMPA.

Ayling A M, 1983a. Distribution and abundance of coral trout species (Plectropomus spp) in the Cairns Section of the GBRMPA. Report to GBRMPA.

Ayling A M, 1983b. Distribution and abundance of coral trout species (Plectropomus spp) in the Townsville and Whitsunday areas of the Great Barrier Reef. Report to GBRMPA.

Baldwin, C.L., 1988 (Ed). Workshop on Nutrients in the Great Barrier Reef Region. Great Barrier Reef Marine Park Authority Workshop Series No. 10 pp 191.

Beinssen K and P Beinssen, 1989. *Heron Reef* Demersal Reef Fish Movement Study. Interim report for the Department Conservation, Park and Wildlife. 24pp.

Beinssen K, 1988. Boult Reef revisited. Reeflections. March 1988 pp 8-9.

Blamey R.K. and T.J.A. Hundloe, 1991. Characteristics of recreational boat fishing in the Great Barrier Reef Region. Report to GBRMPA.

Brundtland g et al 1987. World Commission on Environment and Development. Our Common Future p.xi. Oxford University Press

Bulletin. 1991. Barrier Reef and Gold Coast Preferred destinations. Bulletin Monday November 19, 1991. p.22.

Connel, D.W., 1974. Water Pollution. University of Queensland Press, St Lucia.

Craik, W., 1992. The Great Barrier Reef Marine Park: Management of a large marine ecosystem In Proc. Florida Keys National Marine Sanctuary Coral Reef Coalition. 1st Annual Conference. March 1992, Key West Florida.

Craik W, J Glaister and I Poiner (Eds), 1989. Effects of Fishing in the Great Barrier Reef Region Fishing, 1989. Proc. Workshop held under the auspices of the Advisory Committee on the Efffects of fishing in the Great Barrier Reef Region, 1989.

Department of Transport and Communications, 1989. Reefplan Marine Pollution Plan for the Great Barrier Reef. Department of Transport and Communications and Great Barrier Reef Marine Park Authority.

Dight, I., 1992. Computer models show us where starfish larvae disperse. pp 10-12. Crown-of-Thorns Starfish Research Update 1991-92 GBRMPA 1992.

GBRMPA 1991. Corporate Plan. GBRRMPA 32pp.

GBRMPA 1983. Great Barrier Reef Marine Park Cairns Section Zoning Plan. GBRMPA, 36pp and maps.

GBRMPA 1985. Great Barrier Reef Marine Park Far Northern Section Zoning Plan. GBRMPA, 43pp and maps.

Gwynne L, 1990. A review of the reef line fishery and proposed management measures. QFMA discussion paper 16pp.

Hardin G, 1968. "The Tradgedy of the Commons". Science Vp;162 pp, 1243-1248.

Harrison, P. L., Collins J. D., Alexander, C. G., & Harrison, B. A. (1992). The effects of fuel oil and dispersant on the tissues of staghorn coral Acropora formosa: A pilot study. Proceedings of the second National Workshop on The Role of the Scientific Support Coordinator in Oil Spill Response. March 1990, Victoria.

Hundloe, T.J.A., 1985 Fisheries of the Great Barrier Reef.

Hundloe T J A. R Newman and L Willis, 1987. Survey of charter boats in the Great Barrier Reef Region. Report to GBRMPA.

James M. K., I.I. Dight and J.C. Day 1990. Application of larval dispersal models to zoning in the Great Barrier Reef Marine Park. Pacon. Tokyo 1980. 6pp.

James M.K. 1989. Effectiveness of reefs in the Cairns Section Great Barrier Reef Marine Park, as sources of larval dispersal. Report prepared for Great Barrier Reef Marine Park Authority.

Kelleher, G. 1990. Identification of the Great Barrier Reef as a Particularly Sensitive Area. International Seminar on the Protection of Sensitive Sea Areas. Malmo. 1990. 9pp.

Kelleher G. 1992. The Great Barrier Reef Marine Park, A model for management of Coastal Areas. 23pp

Marsh, H., 1989. Biological basis for managing dugongs and other large vertebrates in the Great Barrier Reef Marine Park. 5 volumes.

Moran, P., 1992. The current status of outbreaks. pp 6-8. Crown-of-Thorns Starfish Research Update 1991-92 GBRMPA 1992.

Poiner I, 1989. Abstract: Epibenthos. Craik, W. J., Glaister and I Poiner (Eds) Effects of Fishing in the Great Barrier Reef Region. Proc. Workshop held under the auspices of the Advisory Committee on the Effects of Fishing in the Great Barrier Reef Region, 1989.

Queensland Department of Harbours and Marine, 1970. Report on the Grounding of the Tanker Oceanic Grandeur in the Torres Strait. Old. H & M Report.

Queensland Fish Management Authority 1990. A review of the East Coast Trawl Fishery and Proposed Management Measures. A discussion Paper. QFMA 1990. 16pp.

Rasmussen, C.E., 1986. An investigation of morphological changes Low Isles, Great Barrier Reef Australia. Hons. Thesis, James Cook University.

Rasmussen, C.E., 1988. Effects of nutrients carried by mainland runoff on reef area: a research plan and preliminary results. Proc. Workshop on Nutrients in the Great Barrier Reef Region. Great Barrier Reef Marine Park Authority Workshop No. 10 pp 66-91.

Sainsbury K J, 1987. Assessment and management of the demersal fishery on the continental shelf of northwestern Australia in Polovina, J and Ralston, S (Eds). Tropical Snappers and Groupers: Biology and Fisheries Management, pp 465-503. Westview Press. Press. Boredly, Colerado.

Sainsbury K J, 1989. Abstract: Effect of trawling on the northwest shelf and its management in Craik W, J Glaister and I Poiner (Eds) Effects of Fishing in the Great Barrier Reef Region. Proc. Workshop held under the auspices of the Advisory Committee on the Effects of Fishing in the Great Barrier Reef Region, 1989.

Vanclay, F. 1988. "Tourist Perceptions of the Great Barrier Reef". Unpublished report to the Great Barrier Reef Marine Park Authority.