

Coastal settlement and development

Environmental indicators reported in this section:

Environmental Indicator	
CO 7.6	Coastal population
CO 7.7	Coastal tourism

Coastal settlement [CO Indicator 7.6]

Increasingly, Australians are moving to coastal environments to live, to retire or to make a living. Some 83% of Australians lived within 50 kilometres from the coast in 1996.

The population of coastal areas is distributed unevenly along the coastline. For example, in Victoria, the most densely populated State with 85% of its population living on the coast, human habitation still occupies less than 10% of the coastline.

People are continuing to shift to the coastal margins of the continent, particularly to the coasts of Victoria, New South Wales, Western Australia and Queensland. These States had higher rates of population growth (1991–1996) in the three kilometre coastal zone compared to the rest of their State. In New South Wales and Queensland alone, an extra 179 000 people moved to the coastal margins (see the Human Settlements Theme Report).

The projections of population growth rates vary widely. For example, the projections for the Richmond Tweed area of northern New South Wales is for an increase in population from 210 000 in 1996 to 311 000 in 2026 (Coastal Council of New South Wales 2001). The critical issue is the impact of existing and future populations scattered in towns, villages and on individual properties along the New South Wales coast.

The projections for 2006 compared with 1996 indicate increases particularly in the areas around Sydney, Brisbane, Perth and the southern coast of Victoria including Melbourne and Geelong (Figure 18).

Coastal strip development along the coastal edge places increasing pressure on specific coastal habitats. Urban sprawl was identified as one of most important problems faced in the coastal zone by the Resource Assessment Commission (1993).

The effects of human activity can cause the loss, degradation or irreversible change in specific coastal habitats, alter both river and tidal flows, cause erosion of beaches and dunes, change water quality by adding stormwater and domestic and industrial sewage and add litter to the environment. In addition, coastal development often occurs on inappropriate soils, resulting in further environmental effects when these are disturbed. To some extent, changes in particular habitats have been documented in the preceding sections of this chapter. However, coverage of all significant habitats on a national scale is not possible at this time. There is insufficient information readily available on the nature and extent of coastal strip development, and about trends in current patterns of coastal development, to assess environmental impacts on the coastal zone.

Another set of more subtle impacts arises from increasing competition for the use of resources in the coastal environment. The provision of water supply to metropolitan areas can affect coastal water quality. For example, water from the Gippsland Lakes catchment is being diverted to the Thomson Dam and hence into a different catchment, the Port Philip Bay catchment.

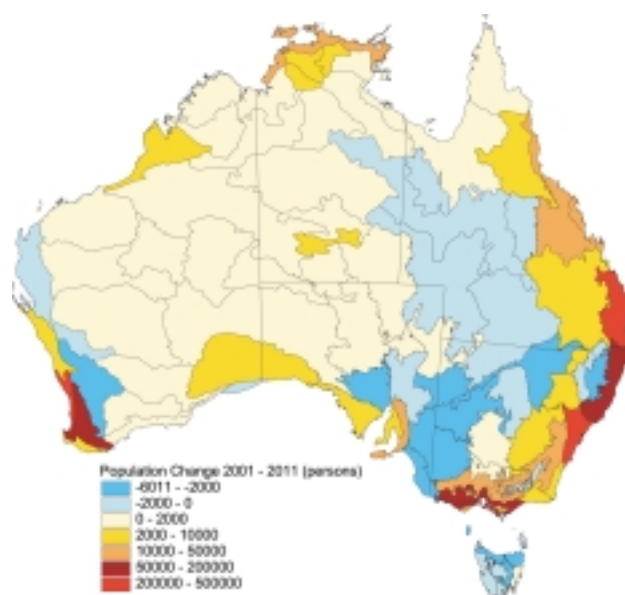


Figure 18: Projected population changes in population density by IBRA region.

Units are persons per square kilometre. Simple difference between 1997 and 2006 ABS projections. This uses IBRA version 5.

Source: Environment Australia 2001, using Australian Bureau of Statistics (1996) data.

Tourism [CO Indicator 7.7]

Marine and coastal-based tourism is important to Australia, not only for domestic tourism where Australians seek to

enjoy the heritage and natural values of the environment, but also for the 20% of tourists arriving from overseas who prize our natural and unspoilt marine environment. According to the Bureau of Tourism Research (DISR 2001a), 50% of international visits and 42% of domestic visits are to coastal and marine areas.

Marine tourism is now a significant part of the economy. It has been estimated that marine tourism and recreation contributed \$15 billion to the economy in 1997, or 50% of the economic activity of marine industries (Greiner et al. 1997). The Great Barrier Reef World Heritage Area, for example, has experienced a large increase in tourism since the 1980s when visitor numbers were 150 000 visitor-days. Tourism in the Great Barrier Reef World Heritage Area was worth \$1 billion, with 1.6 million visitor-days in 1997, and with 1.5 million visitors in 1998–99 and 1999–2000. With this type of use, tourism clearly depends on sustaining environmental and heritage values.

Some places are internationally recognised such as The Great Barrier Reef Marine Park, Sydney Harbour and city, the Gold Coast, and the Great Ocean Road in Victoria. There is, however, a great diversity of tourism experience within Australia and its territories, including:

- Antarctic tourism, with an estimated 10 000 people visiting the sub-Antarctic Islands in 1999 (IAATO 2000), although most vessels depart from South America rather than Australia,
- whale-watching off the coasts of Western Australia, Victoria, Queensland and New South Wales,
- bird-watching, e.g. Little Penguins on Philip Island, shorebirds in Western Australia, and seabirds around the coast,
- diving for fish or to observe marine life around the coast, including on the Great Barrier Reef, on the Ningaloo Reef in Western Australia, and off the coast of Tasmania,
- limited opportunities of swimming with dolphins at Monkey Mia in Western Australia, Port Phillip Bay, Victoria and in Moreton Bay, Queensland, and
- swimming, boating and fishing at the beach.

Six World Heritage Areas in Australia have a predominant marine component:

- The Great Barrier Reef,
- Lord Howe Island Group,
- Shark Bay in Western Australia,
- Fraser Island,
- Macquarie Island, and
- Heard Island and McDonald Islands.

Challenges and issues facing Australia's tourist industry include:

- allocating access to high quality environments (which are also sought for conservation reasons),
- ensuring that the environment is not degraded,
- integrating the interests of marine tourism operators with other users,
- promoting heritage tourism, including nature-based tourism, education and best-practice initiatives,
- ensuring that the overall planning, development, management and monitoring arrangements for marine tourism are well developed and are underpinned by a good information base, and
- ensuring that investment in regional infrastructure does occur.

Impacts

The growth in the number of people visiting an area is dependent on external factors, such as the targeted promotions run by the Australian Tourist Commission and the State and Territory tourism promotion agencies.

There are social, cultural, economic and environmental impacts caused by tourism. It is estimated that one-third of the Australian population is involved in recreational fishing, and in



The appeal of the Antarctic wilderness attracts growing numbers of tourists.

Source: R Ledingham, Australian Antarctic Division.

some areas recreational and commercial fishers compete for species. It is estimated that 700 000 people scuba dive each year, and there are over half a million registered, privately owned motor vessels in Australia and hundreds of thousands of other smaller craft. Activities associated with the use of this equipment have the potential to affect the environment through pollution of water (boat sillage) and disturbance of species and habitats. Recreational fishers tend to target reef ecosystems and remove larger predatory species. The effects of selective removal of such fish are largely unknown. Shore-based recreational fishing can have effects on shore populations of invertebrates that are collected for bait in intensively visited areas.

A major source of environmental impacts is the provision of infrastructure to support tourism. This can include airports, power generation facilities, accommodation, sewage treatment and disposal facilities, moorings, and marine transport. Often the infrastructure is required in fragile or pristine environments that are susceptible to disturbance and fragmentation.

Infrastructure needs are increasing both on the mainland and on the 19 resort islands within the Great Barrier Reef area for both day visitors and longer stay visitors. An increasing range of sites is now accessible, through the use of bigger and faster boats (since 1982), thus placing more sites potentially at risk of irreversible disturbance.

There are also social and community effects where tourism affects the lifestyle of residents in ways they perceive as intrusive. Negative social impacts may include real or perceived increases in crowding, prices, or crime. Increasing tourism may also result in increasing conflict between various uses and, within the same uses, between commercial, recreational and Indigenous interests.

Response

Because the environmental effects of tourism activities are regulated or controlled by a variety of agencies, it is not easy to summarise the effectiveness of responses to impacts on coastal and marine areas that are subject to tourism pressures.

However, on a national level, the Commonwealth Government developed a National Action Plan for Tourism in 1998. The Plan, which identifies conservation and careful management of the environment as essential to the long-term viability of the tourism industry, makes a commitment to ecologically sustainable tourism development, recognising that environmental considerations should be an integral part of economic decisions.

Management of a wide range of tourism activities within a specified area is a complex exercise. Activities within the Great Barrier Reef Marine Park are managed through broad-scale zoning plans which identify appropriate activities at a subregional level, and through a system of permits and licences, accreditation and self-regulation through Best Environmental Practice Guidelines for some activities. Greater self-regulation has been encouraged, and the marine tourism industry has produced a Code of Conduct which covers issues such as anchoring, removal of rubbish, fish feeding and preservation of World Heritage values. In March 2001 the launching by the Great Barrier Reef Marine Park Authority of a Tourism Operators' Handbook complemented the code. All licensed tourism operators are subject to an environmental management charge.

The Great Barrier Reef Marine Park Authority requires performance bonds to be posted where the construction of semipermanent or temporary structures is involved.

The siting and operation of infrastructure is subject to local government requirements or to the requirements of special-purpose agencies. Local government may also promote and monitor tourism in their areas.

Ecotourism in the Antarctic is generally well regulated, especially in the sub-Antarctic islands. All companies proposing to visit Heard or Macquarie Islands must submit detailed plans and undertake an environmental impact assessment before the trips will be approved.

As of February 2001, the CRC for Sustainable Tourism was working on the Nature Tourism National Review on current practices of Australian protected area management agencies relating to the use of protected areas by visitors. The CRC and CSIRO are also conducting research programs into techniques for monitoring the impact of tourism activities.



Tourists leave from Port Douglas to visit the Great Barrier Reef.

Source: J Jones, Great Barrier Reef Marine Park Authority.

A study on how the operation of dolphin-swim ecotours affects the dolphins in southern Port Phillip Bay found that the avoidance reaction of dolphins to humans varied significantly in response to location, approach strategy and tour operation. Direct, deliberate approaches to dolphins from tour vessels or swimmers resulted in higher levels of avoidance responses. The parallel approach provided the animals with the option of ignoring or interacting with swimmers.

Antarctic tourism is an emerging environmental issue. The level of tourism in Antarctica is currently very low, however, while the number of expeditioners associated with national operators is relatively constant, tourist numbers have doubled over the last eight years and tourist activities in the Antarctic continue to diversify. Tourists visiting some Antarctic sites over a short summer season are drawn by very high expectations of Antarctic wilderness.

Summary

Apart from the comprehensive overview of tourism in the Great Barrier Reef Marine Park, there appears to be little information available on a national scale to assess the impacts of tourism on coastal and marine environments. Although local government, tourism agencies, and States and Territories may collect this information, it is not readily available for collation at a national scale. Therefore it is difficult to assess the impacts of activities, and the success or otherwise of measures to maintain environmental quality in marine and coastal areas used for tourism.

Erosion of beaches and dunes

The movement of sand is a natural feature of beaches. Beaches can be described as eroding (losing sand and foredunes) or accreting (gaining sand). The frequency and severity of cyclonic or storm events and seasonal weather patterns can result in fluctuations of beach width and slope.

The causes of erosion can be classified as follows (Tomlinson 2001):

- short-term natural variability—beach fluctuations, storms,
- medium-term natural variability—periodic changes in coastal climate and beach conditions,
- medium-term erosion—disruption to local sediment budget due to people's activities, or
- long-term natural variability—sea level rise, geological realignment, reduction in sediment supply.

Where development has occurred, property and infrastructure integrity can be threatened by landward movement of the erosion. The south-east Queensland – northern New South Wales coastline has been greatly developed since the mid 1970s but has not experienced a significant erosion event similar to the 1967 event that caused five houses to collapse into the sea on the Gold Coast.

Structures designed to reduce the extent of beach erosion can sometimes result in the opposite effects; that is, increased erosion, either on the beach or on an adjacent stretch of coastline. Similarly, the increasing popularity of offshore undersea barriers to create surfing waves or to dissipate wave energy from sensitive beaches will have ecological impacts that have yet to be determined.

It should be an objective of any coastal management plan for an area such as the Gold Coast to proactively mitigate any erosion caused by groynes and retaining walls (Tomlinson 2001). It should also be an objective to enhance the capability of the natural system to respond to natural sand movement by encouraging dune rehabilitation, for example. However, long-term studies to assess the effectiveness of coastal management strategies are hard to find.

Beach and ocean litter

A visible indicator of human influence on beach condition is litter. This is more than an aesthetic matter in that debris forms a hazard to wildlife. Fishing debris such as discarded nets are particularly hazardous, by their very design. Plastic items, for example bags and 'six-pack' plastic binders, are known to kill animals by ingestion or strangulation.

The source of beach litter can be from coastal waters, from the land where it is transported by stormwater onto beaches, or by people discarding materials on a beach.

There is no nationally available information on the extent and significance of litter, although some studies have been carried out over the last five years.

The sources of ocean litter have been studied over the past five years, particularly for Northern Australia. In north-east Arnhem Land, the Dhimurru Land Management Aboriginal Corporation found many turtles entangled in discarded fishing nets (200 turtles in four years) and concluded that 80% of the nets came from foreign fishing boats (Kiessling and Hamilton 2000). A beach survey in this region in 2000 found more than 7561 items, including 500 derelict fishing nets, in 8.25 kilometres of coastline.

Even in remote regions on Heard and Macquarie Islands, litter from the fishing industry is found. The range of wildlife potentially affected by ocean litter includes: whales, sharks, scatefish, penguins and other seabirds, seals, and turtles.

Some studies of beach litter have been undertaken over the past five years; for example:

- an ANZECC survey of marine debris (ANZECC 1996) could not document any consistent information for litter on beaches and noted that there is inadequate information about trends and sources of marine debris,
- a 1996 survey by Ocean Watch Australia Ltd (Herfort 1997) on marine debris on New South Wales beaches reported proportions of debris as: land sourced plastics 73%, land sourced non-plastics 14%, debris attributed to commercial fishing 8%, debris from recreational fishing activities 5%, and
- an intensive marine debris survey of all accessible Groote Eylandt beaches in the western Gulf of Carpentaria Northern Territory was conducted by members of the Angurugu community over a seven-month period in 1997–1998. Debris relating to fishing gear comprised the overwhelming majority of the debris on all beaches (Sloan et al. 1999).

To address the litter problem derived from urban drainage, a number of local councils have installed litter traps, for example Moreland Council's (Melbourne) demonstration litter trap and floating traps on rivers such as the Yarra River. Education campaigns include television commercials and messages painted on stormwater drains in the street have also been used to raise awareness of the impacts of careless disposal of materials.

Garbage from ships is subject to controls under the MARPOL Convention. Under Annex V of that Convention there is a total prohibition on the disposal of garbage containing plastic into the ocean. The MARPOL convention is enforced in Australia through the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, which is administered by the Australian Maritime Safety Authority.

The Australian Seafood Industry Council has adopted a voluntary 'Code of Conduct for a Responsible Seafood Industry'. This Code commits the industry to strive to minimise all discards and waste associated with fishing activities, record and report the loss and recovery of fishing gear, and retain material such as derelict fishing gear and other garbage recovered during routine operations for disposal on shore.

There are also a number of codes of practice for specific fisheries that include principles to minimise ocean debris. These codes have been adopted by the Western Australian Western Rock Lobster Industry, the South East Trawl Fishery, the South Australian Marine Scale Fishery, the South Australian Inshore Net Fishery and the South Australian River Fishery, for example.

The National Code of Practice for Recreational Fisheries includes principles for behaviour of fishers aimed at minimising marine debris, including the removal and correct disposal of gear and rubbish from fishing sites. Recreational fishers have been targeted by educational campaigns to reduce littering, particularly with respect to discarded fishing gear.

Coastal weeds

Environmental weeds are plants that invade natural ecosystems and have impacts on biodiversity and ecosystem function. The National Weeds Strategy in 1997 listed 20 weeds of national significance. The list covered both environmental and agricultural weeds, but Bitou Bush is the only primarily coastal weed listed.

Bitou Bush was accidentally introduced in the early 1900s. It became established near Newcastle and was confined there for several decades. From the mid-1950s to the late 1960s it was deliberately planted along the New South Wales coastline to revegetate dunes after sandmining.

Bitou Bush is predominantly a problem on New South Wales coastlines. In Victoria, Bitou Bush (also known as Boneseed) is not so widespread. However, it is having a significant effect on important flora in some places. The total area of land infested in New South Wales is estimated to be about 70 000 hectares. The weed, however, continues to spread quickly through natural means. The fruits are eaten by birds and foxes and the seeds are dispersed widely through their scats. Mature plants may produce up to 48 000 seeds per plant per year, and much of what is not eaten or spread persists in the soil seed bank. Bitou Bush appears to be spreading more widely inland into the landscapes behind the coastal ecosystems.

Both State (New South Wales) and national strategies to manage the weed have been drafted. The most common management methods are aerial spraying with herbicides, and biocontrol. Fire and revegetation with native plants also are being investigated as a means of reducing the soil seed bank. An integrated pest management approach is being developed by government agencies and the CRC for Weed Management Systems.



Figure 19: Indicative distribution of coastal acid sulfate soils in Australia.

Source: After National Working Party on Acid Sulfate Soils (2000).

Disturbance of coastal acid sulfate soils

Coastal acid sulfate soils (CASS) have, over the last decade, been recognised as contributing to one of the most important water quality issues in coastal lowlands and estuaries. Areas containing disturbed acid sulfate soils have been identified primarily in Queensland and New South Wales, although areas of undisturbed acid sulfate soils are found in all States and the Northern Territory (Figure 19). They underlie coastal estuaries and floodplains where the majority of Australians live. They also underlie significant fish nursery areas and coastal agricultural industries such as sugar cane, dairying and beef.

No comprehensive mapping of acid sulfate soils has been done to date. However, it is known that potential acid sulfate soils cover approximately 2.3 million hectares in Queensland (EPA 1999a) and over 0.6 million hectares in New South Wales.

In their natural, undisturbed state these soils do not pose a threat to estuarine ecosystems. Their exposure to air, as a result of development and land management practices such as drainage and excavation, generates large quantities of sulfuric acid and other substances, which adversely affects estuarine and coastal ecosystems. Studies in the Richmond River in northern New South Wales estimated over 1000 tonnes of sulfuric acid, 450 tonnes of aluminium and 300 tonnes of iron were released from a 4000-hectare catchment following a major flood in 1994. This acidified a 90-kilometre reach of the river for seven weeks, with the pH falling as low as 2.6 (National Working Party on Acid Sulfate Soils 2000).

There have been significant effects on infrastructure; for example, the Tweed Shire Council in northern New South Wales spent nearly \$4 million replacing iron water pipes corroded by acid groundwater.

There is increasing recognition of CASS as a national problem needing a coordinated national approach. A National Strategy for dealing with acid sulfate soils has been developed and is being implemented. Through an initiative of Australia's Oceans Policy, the Coastal Acid Sulfate Soils Program, the Federal Government has allocated approximately \$3 million for demonstration projects to assist in the better management of coastal acid sulfate soils. Funding for some eight projects to demonstrate a range of options for the management of coastal soils was announced in September 2000.

State strategies and policies have also been developed; for example:

- New South Wales established an Acid Sulfate Soils Management Advisory Committee in 1994.
- Queensland formed an Acid Sulfate Soil Investigation Team in 1995, an Advisory Committee in 1996 and a Strategy in 1999, and
- Victoria developed the Industrial Waste Management Policy (Waste Acid Sulfate Soils) in 1998.

Where mangroves and low coastal land had been drained for sugar farming in the Tweed River region, acid drainage problems had resulted. However, New South Wales sugar farmers are now self-regulatory, CASS management techniques are widely accepted by the industry and individual farmers, and viable crops are being grown on previously drained CASS. Because of the actions taken, the environmental health of drainage systems running from the majority of Tweed sugar cane farms has improved markedly.