

Seagrass bed, *Posidonia australis* and *Amphibolus antarctica*, near Rockingham, WA.

Source: M Waycott, James Cook University.

deepwater beds in the Great Barrier Reef World Heritage Area indicates that our knowledge of seagrasses is still expanding.

Dunes and beach habitat represent about 50% of the coast, yet they are among the most poorly studied coastal habitats. They are under localised pressures from urban development around population centres.

Intertidal mud flats are species rich, and important in the routes of migratory bird species, but as with dunes and beaches, they are not particularly well studied.

Rocky reefs are found in intertidal and subtidal areas. They are important as a base for productive macroalgae, sponges and fish. About 50% of Australia's fisheries are supported by rocky reef habitats. The principal human pressures on rocky reefs come from land-based pollution and from fishing pressure.

### Trend: Key habitats

The condition of key coastal habitats has not changed significantly since 1996, pressures have remained constant and responses have been adequate in some respects.

Estuaries were the preferred site for European settlement. In an assessment of 972 estuaries, the National Land and Water Resources Audit found that almost half are degraded in some way, usually owing to land-use practices or human settlement pressure. For the other estuaries, pressure is assumed to be light owing to low levels of human use.

### Trend: Estuaries

The condition of estuaries has deteriorated since 1996, pressures are increasing and responses have been adequate in some respects.

Gulfs and bay habitats are robust because they are open to the ocean but are still vulnerable to sediment deposition which carries adsorbed nutrients and pollutants. In Hervey Bay, Queensland, there was a major loss of seagrasses (1000 km<sup>2</sup>) after a large flood in 1992 carried greater than normal amounts of eroded sediments into the Bay. For bays and gulfs near coastal cities and towns, habitat degradation occurs through enhanced nutrient and toxicant inputs and the introduction of pathogens to the water through sewage outfalls and septic tank overflows.

Coral reefs are exceptionally diverse marine systems that thrive in relatively low nutrient tropical waters. The Great Barrier Reef in north-east Australia is well known, but is not our only coral reef. Ningaloo Reef in Western Australia is Australia's largest fringing reef.

stretching for 230 km along a very lightly populated coastline. Cocos (Keeling) atoll is Australia's only true atoll.

Coral reefs are under great pressure globally. The Global Coral Reef Monitoring Network 2000 assessment indicated that about 20% of the world's reefs are seriously degraded or lost. A dramatic 'bleaching' event in 1998 accounted for the damage of 16% of the world's reefs within one year. Of the 16%, 50% will recover quickly. Coral bleaching occurs when the water temperature exceeds a certain threshold, usually just over 30°C. Symbiotic algae in the coral tissues are expelled, allowing the white calcium carbonate skeleton to show through the clear animal tissue cover. If the temperature remains high for more than a few weeks, the coral dies. Australia was fortunate in that only 3% of reefs were significantly affected by bleaching in 1998.

Australian coral reefs have been degraded by sediment and nutrient runoff at certain coastal locations in Queensland's wet tropics, and brought under pressure from increasing recreational and commercial fishing at others. The Crown-of-Thorns Starfish (*Acanthaster planci*) is reducing living coral over very large areas of the Great Barrier Reef, and could be the worst of the three recorded episodes since the 1960s. Yet the precise triggers for the outbreaks of this 'boom and bust' species remain uncertain, although high levels of freshwater runoff has been implicated as a possible cause.

#### Trend: Coral reefs

Coral reefs show signs of degradation in some areas, pressures have remained constant and responses have been adequate in some respects.

Australia's continental shelf and slope cover a huge area, some 2.5 million square kilometres, yet it remains poorly known. Soft sediments predominate over vast areas. Diverse communities of fish and sponge gardens occur and some of these may be very long-lived and slow to recover from disturbance. Our seamounts off southern Tasmania harbour unique long-living ecosystems.

#### Threats to marine species

Over 1000 species of echinoderms (seastars, sea urchins, sea cucumbers and brittle stars) have been recorded in the shallow coastal or reef waters of Australia. Some 10 000 species of marine molluscs known to science have been described.



Stalked Crinoid or Sea Lily.

Scale in cm.

Source: CSIRO Marine Research, Hobart.



Green Turtles eat algae and seaweed.

Source: G Carter, Great Barrier Reef Marine Park Authority.

A variety of invertebrates are exploited by fisheries with Australia's prawn, lobster and abalone fisheries representing very high value for relatively low volumes of harvest. Human effects on invertebrates come from coastal development and land-based pollution, and from some methods of trawling such as dredging.

In the past five years, there has been an increasing adoption of marine protected areas (MPAs) as a means of conserving marine invertebrates and protecting them from extractive industries. The MPAs rely less on precise knowledge of species population status and more on maintenance of areas of habitat types. However, not all attempts to establish MPAs at a state level have been successful.

The conservation status of fish species, as listed under the EPBC Act, shows one fish species is endangered (the Derwent River Spotted Handfish, *Brachionichthys hirsutus*); five species of shark are listed as vulnerable (including the Great White Shark, *Carcharodon carcharias*). The practice of setting nets for sharks near swimming beaches has affected shark populations, particularly the Grey Nurse Shark (*Carcharias taurus*), which has been reduced to about 1000 individuals and is listed as vulnerable under the EPBC Act. Shark mesh-netting around beaches has also killed many dolphins and dugongs.

Six of the world's seven species of turtles breed in Australia. The eastern Australian stock of the Loggerhead Turtle (*Caretta caretta*) is considered to be endangered, with a 70 to 90% decline in the nesting population in the last 30 years. Other species also show declines. The Hawksbill Turtle (*Eretmochelys imbricata*) is recognised internationally as critically endangered, and relies heavily on breeding sites in the northern Great Barrier Reef region. About 10 000 turtles are caught accidentally by trawl fishing each year in northern Australia. However, an estimated 90% of these are released alive. About 2000 to 4000 Green Turtles are caught by Indigenous peoples each year.

The vulnerability of turtles has led to a heightened international profile and national and state action plans to conserve turtle species. Fishing trawlers in most northern areas now use turtle excluding devices that prevent turtles being caught in trawl nets. Indigenous councils have implemented management plans to control their take of dugongs and turtles at several locations.

Seabirds and shorebirds are a highly visible and important component of our marine and coastal ecosystems. There are 73 species dependent on coastal habitat, even though many are migratory. Disturbance to seabird populations and their habitat come from a wide variety of sources, including urban development, airports, mining and minerals exploration, off-road vehicles, tourism at nesting sites, longline fishing, discarded fishing gear, and rats and feral cats

on offshore islands. There are a few examples of population reduction through Indigenous harvesting of seabird eggs (e.g. in the Torres Strait).

There have been several new developments aimed at reducing pressures on seabird populations (e.g. the Commonwealth's Threat Abatement Plan of 1998 to reduce effects from longline fishing vessels, where seabirds, such as albatross, are attracted and caught by baited hooks as they are cast into the water). Longline fishing operators are now trialing a bait chute-launcher that will prevent bird losses. Nesting areas are being protected in the Great Barrier Reef region, and in southern Australia there are programs to reduce disturbance from feral animal predators. Australia also has 32 coastal wetland areas declared as protected under the international Ramsar Convention, and 16 of these sites are significant for migratory birds.

### Trend: Seabirds and shorebirds

The populations of seabirds and shorebirds has thought to have declined since 1996, pressures such as habitat loss remain constant and the overall response is adequate in some respects.

Cetaceans (whales and dolphins) are visible and valued by Australians as charismatic species deserving maximum protection (Figure 12). Public concern at the decline of the great whales has led to measures through the International Whaling Commission. There are still some countries that regard whales as harvestable species (Japan and Norway). The Commonwealth government continues its fight to protect whales.

Conservation efforts have helped the numbers of Humpback Whale (*Megaptera novaeangliae*) recover. In 1998, the status of the species changed from endangered to vulnerable, and available evidence points to an increase in populations of about 10% per year. Other species such as the Blue Whale (*Balaenoptera musculus*) and Southern Right Whale (*Eubalaena australis*) remain at critically low numbers.

Whale watching is rising in popularity and is subject to state controls and national guidelines. The aim is for people to view cetaceans and learn about them without interfering with their migration, feeding and breeding. Several coastal towns have improved their economies by fostering whale and dolphin watching (e.g. Merimbula and Eden, NSW).

So little is known about some species, such as the inshore dolphins, that the population status cannot be categorised.

There are 10 species of seal occurring in Australian waters, all in southern temperate Australia and sub-Antarctic regions. Their population dynamics are complex,

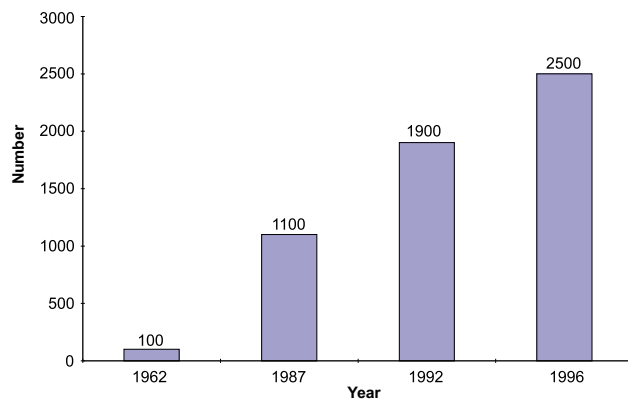


Figure 12: Estimated number of humpback whales migrating up the East Coast.

Source: EPA (1999).



Drowned albatross caught on a pelagic longline.

Source: G Robertson, Australian Antarctic Division.

## Antarctica: Cool science for global systems

Antarctica and the Southern Ocean are critical to the global environmental system. Interaction between the atmosphere, oceans, ice and biota affect the entire global system through feedbacks, biogeochemical cycles, circulation patterns, transport of energy and pollutants, and changes in ice mass balance.

The Antarctic Treaty, signed in 1959 by 12 countries, applies to the area south of 60°. The Protocol on Environmental Protection to the Antarctic Treaty (the Madrid Protocol) which entered into force in 1998, designates the Antarctic as a natural reserve devoted to peace and science, and forms the foundation for the comprehensive protection of the Antarctic.

The Australian Antarctic Territory comprises 5 896 500 square kilometres, equal to 77% of the land area of Australia and 42% of Antarctica. It is the coldest, driest, windiest and most remote continent. Antarctica is also the continent least affected by human activity, making it an ideal location for studying human effects and global background levels of anthropogenic agents such as PCBs.

Antarctica has many biological surprises. The biomass of krill rivals that of the human population while Crabeater Seals (*Lobodon carcinophagus*) may be the most numerous of all the world's larger animals apart from humans. At the other size extreme, Antarctic microbes

(algae, protozoa and bacteria) can be abundant and diverse in the marine terrestrial and lake environments. Marine algae in Antarctic waters have a major role in the absorption of atmospheric carbon dioxide and some produce chemicals that induce cloud formation that can influence global climate.

The catch of krill and fish harvested in Antarctic waters by member countries are regulated under the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) utilising an ecosystem approach. Illegal fishing for Patagonian Toothfish (*Dissostichus eleginoides*) in the Southern Ocean is, however, estimated to exceed the legal catch.

While fishing in the Southern Ocean may affect other Antarctic species, the Antarctic continent itself is unlikely to come under direct threat in the short term from resource extraction. Antarctic tourism is, however, an emerging environmental issue. Although 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. Hundreds of scientists and thousands of tourists visiting some Antarctic sites over a short summer season are drawn by very high expectations of Antarctic wilderness.

Source: Australian Antarctic Division (2001).



Moonrise over Matherway Island, Antarctica.

Source: G Dixon, Australian Antarctic Division (10-3435B6).



Tourists near Bunger Hills, Antarctica.

Source: R Ledingham, Australian Antarctic Division (1614-C2).

and it is thought that declines in Southern Elephant Seals (*Mirounga leonina*) at Macquarie Island may be related to rises in Fur Seals (*Arctocephalus pusillus*) and King Penguins (*Aptenodytes patagonius*) (both of which are rapidly becoming more numerous).

The dugong (*Dugong dugon*) is Australia's only strictly marine herbivorous mammal. Australian dugongs constitute a significant percentage of the world population. Some populations of Australian dugongs have declined dramatically since European settlement, largely as a result of human activities, but others do not appear to be currently threatened. Dugongs are vulnerable to mesh nets in shallow coastal waters and to loss of their seagrass feeding habitats. Commercial harvesting ceased many years ago, but they are legally hunted in northern Australia by Aborigines and Torres Strait Islanders. Dugong habitat is protected by legislation in Queensland and includes 16 Dugong Protection Areas declared in 1997.

### Trend: Marine mammals

Whale and seal populations seem to be recovering while dugong populations remain stable. Pressures remain constant and responses have been adequate in most respects.

### Effects of increased coastal settlement

The Australian coastline is lightly populated when measured against more highly populated countries, but about 80% of our population lives close to the coast. The trend to move to the coast is continuing (Figure 13).

Development of Australia's coastal strip is one of the major strategic issues confronting the conservation and management of the coastal zone. Effects of human activity cause the loss or degradation of specific habitat types, alter tidal water flows in wetlands and streams, cause erosion of beaches and dunes, and degrade water quality through stormwater runoff, sewage and litter. Developments may cause loss of familiar and loved landmarks and seascapes, obliterating cultural heritage and changing land use patterns (e.g. subdivision of farmland for housing).

Marine tourism is a significant part of Australia's economy. There is a tremendous range of activities including boat cruising, whale watching, visits to the Antarctic, bird watching, recreational scuba diving and snorkeling and exploring historic shipwrecks.

Environmental aspects of marine tourism are dealt with by regulations controlling discharges from vessels, island resorts and tourist pontoons, and the establishment of moorings for tourist vessels to minimise anchor damage and improve safety. These regulations are managed by the states and the Northern Territory with varying degrees of effectiveness.

A survey in 1996 found that 73% of beach litter was from land-sourced plastics, and a further 13% was debris from fishing. The disposal of plastic waste at sea is prohibited under the MARPOL Convention (International Convention for the Prevention of Pollution from

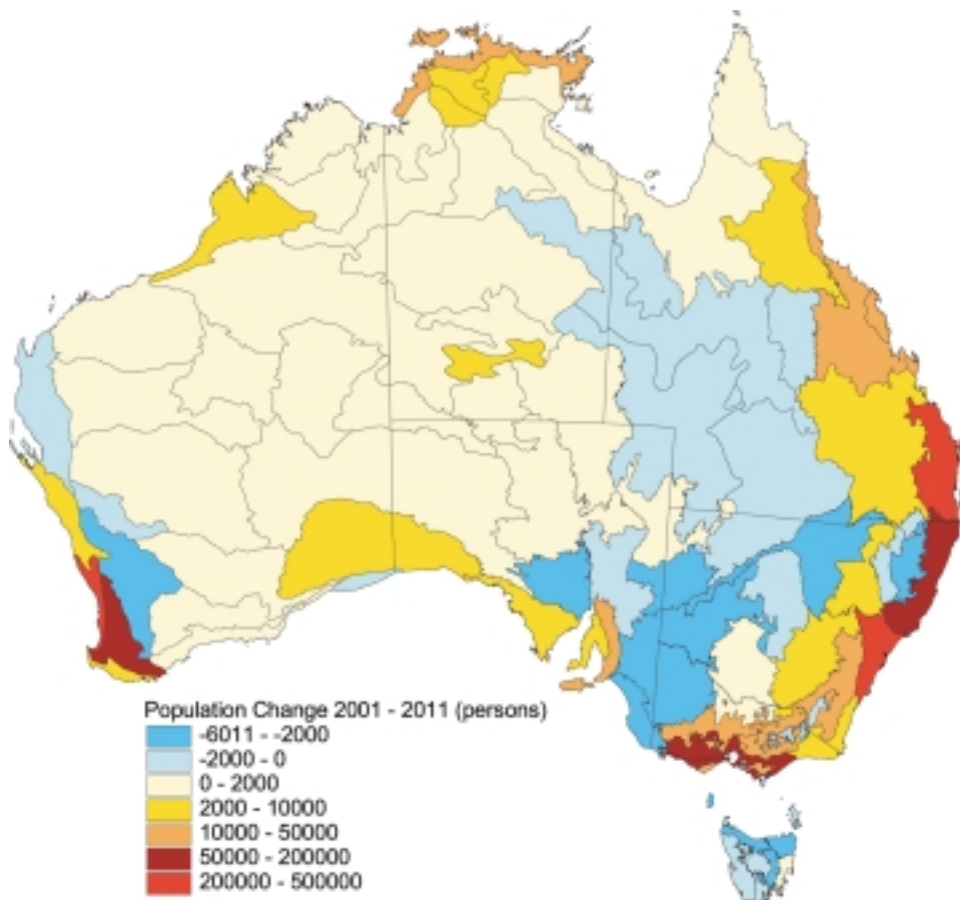


Figure 13: Projected changes in population density by Interim Biogeographic Regionalisation for Australia (IBRA) region.

Units are persons per square kilometre. Data are derived through simple difference between 1997 and 2006 ABS projections. IBRA version 5 used. Source: after ABS (1996).



Tourists leave Port Douglas to visit the Great Barrier Reef.

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

Ships) (Annex V) and enforced in Australia through legislation. In addition, there are national and fishery specific codes of conduct designed to minimise all discards and waste associated with fishing. Beach litter continues to be a problem in Australia despite community interest in 'Clean Up' days.

The creation of acid runoff through disturbance of acid sulfate soils in coastal areas has already had a major effect and this damaging phenomenon might expand. These soils underlie large tracts of the populated coastal zone, where alteration to drainage and the excavation of the soil creates very acidic runoff that causes fish kills and corrodes metal structures. Fortunately, acid runoff can be managed, and in some areas, water quality is improving. Recognition of the phenomenon by local, state and Commonwealth governments since 1996 has been an essential step.

### **Decline in coastal water quality**

Maintenance or restoration of water quality, particularly in coastal margins, is arguably the most critical marine environmental issue confronting Australia in 2001. Water quality is essential for ecosystem maintenance, for industries such as fishing and tourism, and for recreation and aesthetics. The incremental decline in quality makes it difficult for regulators to achieve the community support needed to reverse negative effects.



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

Source: R Ledingham, Australian Antarctic Division.

Table 8: Total nutrient emissions for selected coastal regions (1000 kg)

Coastal region	Land use	Phosphorus		Nitrogen	
		Point <sup>A</sup>	Diffuse <sup>B</sup>	Point <sup>A</sup>	Diffuse <sup>B</sup>
Peel-Harvey (WA)	Agriculture	NA <sup>C</sup>	260	NA	1 800
Esk/Tamar (Tas.)	Agriculture	150	360	390	1 600
Dawson River (Qld)	Agriculture	20	1 700	28	6 400
Latrobe–Thomson (Vic.)	Agriculture	18	410	44	3 800
Richmond River (NSW)	Agriculture	5.8	250	NA	1 700
Darwin Harbour (NT)	Mix	68	47	270	590
SE Queensland (Qld)	Mix	1 300	1 500	3 300	7 000
Water Catchment Adelaide (SA)	Urban/industrial	210	64	920	550
Port Phillip Bay (Vic.)	Urban/industrial	2 500	190	8 500	2 300
Botany Bay (NSW)	Urban/industrial	1 300	48	7 600	280
Lake Illawarra (NSW)	Urban/industrial	190	25	970	170

<sup>A</sup> Point sources: Emissions of Total Phosphorus and Nitrogen from reporting facilities (e.g. industry or wastewater treatment plants) 1999–2000.

<sup>B</sup> Diffuse sources: Emissions of Total Phosphorus and Nitrogen to water from aggregate sources: 1999–2000. Diffuse source pollution represents aggregated data for which there may be significant error of estimation, ranging up to +/- 50% for data for Western Australia and 3 to 13 times for diffuse source estimates in Tasmania. There are significant qualifications to the National Pollutant Inventory estimates and information on the website should be consulted before quoting and/or interpreting these figures.

<sup>C</sup> NA, none reported.

Source: <http://www.environment.gov.au/epg/npi/> (accessed October 2001).

Although many coastal areas have excellent water quality, there are also many that do not. The negative effects can come from land use practices occurring in catchments hundreds of kilometres from the coast. For example, deforestation, agricultural chemical use, poor cropping or grazing practices cause enhanced erosion and increased turbidity and nutrient supply to estuaries and coastal waters. Nutrient loads from different land use mixes in selected parts of Australia are shown in Table 8.

Individual jurisdictions are working on improving the situation. Point source pollution is increasingly subject to regulation. Cities such as Sydney are spending millions of dollars in managing the effluent contained in stormwater overflows.

There is no national overview of the extent and levels of toxicants found in coastal waters and sediments. Neither is there national-scale information on the emission of toxicants from diffuse pollution sources. It is the job of 'nobody' yet 'everybody' to do this. The degradation caused by diffuse sources remains largely unchecked and even identifiable, and local degradation is often not well managed.

Coastal water quality in areas of major river runoff from broad agricultural catchments, are of concern. Overgrazing during droughts can markedly increase the amount of erosion and subsequent runoff of sediment. This sediment is deposited from flood plumes close to the coast placing added pressure on nearshore ecosystems that may be sensitive to smothering in mud, or loss of plant growth through increased water turbidity. A review of the effects of river runoff in the Great Barrier Reef region has shown that effects of human activity onshore can be seen in sections of coast between Mackay and Port Douglas as far offshore as 20 km. The catchment-scale approach to understanding and managing the problem is the most logical approach and implementation should be encouraged wherever possible.

Overall, the quality of estuarine and coastal waters has not improved, although there are some locations where signs are positive, for example around Sydney's beaches and parts of the Harbour. But these improvements have required massive infrastructure investments by various authorities, for example Sydney Water and the Western Australian Water Corporation.

### Trend: Coastal water quality

Nutrient and sediment loads are causing deteriorating conditions in some coastal waters, pressures are increasing, while responses are adequate in some respects.





Commercial prawn trawl fishing on the Great Barrier Reef is important to the Australian economy.

Source: A Elliot, Great Barrier Reef Marine Park Authority.

### Fisheries and aquaculture

Many Australian fisheries are fully or overexploited. None is pushing species towards extinction, to the best of current knowledge, but clearly sustainable development demands much more than this benchmark. Many types of fishing gear have unwanted effects on the environment, taking species that are not the target of fishing operations. The effect of trawl nets on species such as sponges and other benthos remains a significant issue in some areas.

Commonwealth fisheries are developing Bycatch Action Plans. Plans have been developed for eight of the 21 Commonwealth fisheries with another six expected to be completed by the end of 2001. The longline fishing industry is addressing the problem of accidental capture of seabirds, although the problem is not yet under control.

Government regulators and the industry have recognised the need to accelerate sustainability into all aspects of the seafood industry. Since SoE (1996), a program has been underway with support from Commonwealth and state agencies and research and development (R&D) agencies. The ESD Framework Project aims to include environmental, economic and social indicators into fisheries management, and to address the effect of fishing on the environment beyond the immediate target species. As Commonwealth fisheries develop management plans they have to do a strategic assessment under the EPBC Act. There has been progress in implementing sustainable principles in some areas such as the Great Barrier Reef Marine Park where there is a plan to reduce the amount of trawling in the region.

The level of uncertainty in scientific assessments of the status of fisheries remains relatively high, although recent information shows a trend to fewer fisheries classified as 'underfished' and slightly more as 'uncertain'. Sustainable development of Australia's fishing industry may involve making greater returns for industry by increasing quality or value-adding to the wild-caught product rather than by increasing total tonnage of the catch.

About three-quarters of Australia's fisheries are under state jurisdiction. Western Australia, Queensland and New South Wales produce regular reports on status of fish stocks



Turtles being monitored by fishers before release.

Source: C Robins, Bureau of Rural Sciences.

with all reporting stocks either at or near their sustainable limits. There are few examples where fisheries management can claim clear success in achieving regulatory goals. An example is the Western Australian Western Rock Lobster Fishery, recently acclaimed as the first fishery to be accredited under the Marine Stewardship Council. In the early 1990s, scientists identified dwindling parent stock at a time when catches remained high. Management restrictions were introduced and subsequently there has been an increase in parent stock.

It is unknown whether the Eastern Gemfish (*Rexea solandri*), found in deep water off southern New South Wales, will recover from its depleted state after overfishing in the 1970s and 1980s. Orange Roughy (*Hoplostethus atlanticus*), taken off Tasmania and the South Tasman Rise, is also under strong management controls to restrict the catch of this long-lived species.

### Trend: Commercial wild capture fisheries

The status of many fisheries remains unchanged since 1996 while responses to the pressures have been adequate in most respects.

Recreational fishing is a popular sport in Australia. The best estimate indicates that 30 000 t of seafood is taken per year by about five million people. About 73% of recreational fishing activity is in saltwater. Controls on recreational fishing are usually through size limits, gear or bag limits, and closures by season or area. However, the precise status of most species taken by recreational fishing is unknown. Since SoE (1996), several States have introduced angling licences to include marine recreational fishing and a national survey was instigated in 2000 to gather information on the extent of recreational fishing and fishing by Indigenous peoples. The evidence is not yet available to determine whether species taken in recreational fisheries are overfished.

The value of aquaculture production has been growing at 14% per year since 1989 (Figure 14). Until the 1990s, most commercial aquaculture was for oysters (edible and pearl), and a limited amount of fish and prawn culture. Pearl culture yields about \$200 million, making pearls a sea gem rather than a sea food. Recently the cage culture of fish has grown rapidly. Atlantic Salmon (*Salmo salar*) in Tasmania and the fattening of caged Southern Bluefin Tuna (*Thunnus maccoyii*) in South Australia account for about one-third of Australia's \$600 million production. The growth of aquaculture has brought new environmental management issues under scrutiny. For example, The Great Barrier Reef Marine Park Authority introduced water quality standards for prawn farm discharges into the Marine Park. New South Wales has just introduced a State Environmental Planning Policy (SEPP) to provide guidance and control over an industry which is being encouraged as a state priority.

### Threat of introduced marine pests

Australia is highly dependent economically on the export of bulk commodities such as minerals, agricultural products and oil and gas. The vessels that carry these products usually arrive on our shores empty, except for massive volumes of ballast water, which when dumped in Australian waters can carry unwelcome hitchhikers. There have been some 200 species introduced unintentionally in ballast water. Many of these species slip quietly and unnoticed into our marine systems, forming small populations that do not interfere with the ecosystem. However, some species cause dramatic changes and threaten entire habitat types, and some cause toxic algal blooms that threaten oyster and mussel fisheries and the health of those who eat affected shellfish.

The Northern Pacific Seastar (*Asterias amurensis*) and the Giant Fanworm (*Sabella spallanzanii*) are having a major effect on waters on our southern coastline. The exotic Seastar eats oysters, mussels and other sedentary species. The Fanworm is a filter feeder, but covers existing habitat to the exclusion of other species living on the sea floor.

In 1999, specimens of the Black Striped Mussel (*Mytilopsis sallei*) were found in three marinas in Darwin Harbour during a harbour resurvey. Having witnessed the

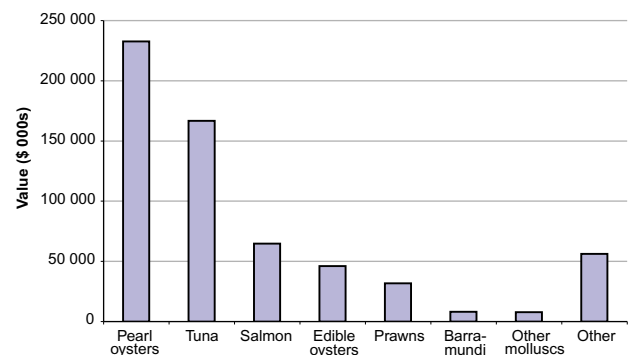


Figure 14: Value of aquaculture sectors.

Source: O'Sullivan and Dobson (2000).



The fouling caused by Black Striped Mussels.

Source: Centre for Introduced Marine Pests, CSIRO Marine Research.

ecological and financial disaster caused in the Great Lakes region of North America by its near relative the Zebra Mussel (*Dreissena polymorpha*), the Northern Territory and Commonwealth governments mounted a major effort to eradicate this pest. The effort involved 300 people and cost \$2.2 million, but was successful and is thought to be the first eradication of a population of a marine pest species.

The Consultative Committee on Introduced Marine Pest Emergencies was established in 2000, and a program of port survey is underway through the Australian Association of Ports and Marine Authorities and the CSIRO Centre for Research on Introduced Marine Pests. However, these surveys are not yet organised as a routine, repeated procedure across all ports.

Concerns about translocated organisms extend beyond ballast water transport. Exotic organisms may enter Australian waters on the outside of ship hulls (hull fouling) or through trans-shipment of live or frozen seafood products. Quarantine restrictions apply to normal importation of products and some products are excluded on the basis of risk assessments. There is no restriction on movement of the hundreds of species that are attached to ship hulls.

The largest recorded fish kill in Australian waters occurred in southern Australia between late 1998 and early 1999. Dead pilchards on the south coast of Western Australia were estimated at 28 000 t. The origin of the infectious agent that caused the massive kill is still unknown although scientists have hypothesised that the herpes virus may have been introduced via ballast water, seabirds or imported baitfish.

#### **Trend: Introduced marine pests**

Pest species are continuing to cause deterioration of habitats and species; the risk of new introductions is constant and significant, while responses have been adequate in most respects.

### **Marine industry development**

Australia is an island that depends heavily on shipping, and the infrastructure for this industry includes ports and navigation channels that require dredging. Disposal of the dredged material can be of concern to environmental regulators. In 1998, guidelines to assist applicants for dumping permits were released and the Commonwealth government has updated appropriate legislation.

Antifouling paint is, by definition, toxic to animals and plants. The phasing out of tributyl tin (TBT), the most common antifoulant, is still some years away. Concern over its effect remains high. In late 2000, a container ship was grounded on Sudbury Reef near Cairns,

and left a thick coating of antifouling paint on the seabed. Since then, a major cleanup program has removed paint flakes from 1500 square metres to allow more rapid recovery of the coral reef.

The possibility of oil spills in offshore waters remains a concern and four incidents with environmental effects have been recorded in the past six years. In 1999 in Sydney Harbour, 250 to 300 t of light crude oil were spilled during a cargo transfer, harbour foreshores were affected by oiling and people were affected by the odours. Since that incident, all vessels carrying oil are protected by a boom while in port. While the ocean can disperse oil, the visual effect of oil spills may be more problematic than their overall environmental impact. Offshore oil drilling effects have been restricted to the local impact of drill cuttings and drilling muds deposited adjacent to wells.

As knowledge of our marine biodiversity increases, the prospects for discovering biologically active compounds have also grown. Some useful molecules have already been discovered. Corals contain chemicals that are natural sun-blockers. Sponges and other sedentary plants and animals have chemical defence mechanisms that may find application as human drugs and herbicides. There have been concerns that discovery of a valuable compound may lead to overharvesting of the organism concerned. Current biodiscovery programs emphasise the need to protect natural biodiversity and synthesise, or grow by aquaculture, any valuable molecules or organisms rather than harvest them from the wild.

### Marine resource management

There are some 80 international agreements relating to the use of the oceans, and half of them relate to managing the marine environment, including fisheries. Some prominent ones include the UN Convention on the Law of the Sea 1980, the Convention on the Conservation of Antarctic Marine Living Resources 1980, the MARPOL Convention and the World Heritage Convention.

Rights of Indigenous peoples to the use of marine resources have been acknowledged in several court decisions relating to harvesting of traditional food species, and in legislation in the case of Torres Strait Islander use of the marine environment. The High Court decision establishes that the *Native Title Act 1993* recognises native title rights in relation to the territorial sea. The decision also establishes the primacy of the public rights to fish and navigate. (*The Commonwealth v Yarmirr, Yarmirr v Northern Territory* [2001] HCA 56).

Australia's Oceans Policy was released by the Commonwealth government in 1998, the International Year of the Ocean. This policy includes support for some innovative approaches to integrated oceans management, including the concept of regional marine plans. These acknowledge the need to take an ecosystem approach to natural resource management, striking a balance between environmental, economic and social objectives.

Australia has continued to pursue the establishment of MPAs. There are now about 194 protected areas covering 60 million hectares. Since 1996, 17.6 million hectares of marine reserves have been added to the reserve system in both state and Commonwealth-managed waters. Progress has been made in planning in most states, and declarations of new protected areas have been made in the Great Australian Bight, Macquarie Island, Solitary Islands, Jervis Bay, Lord Howe Island, Tasmanian Seamounts, extensions to the Great Barrier Reef Marine Park and Cartier Island. However, it is the implementation of management plans that will determine whether ecosystems and threatened species will benefit from the establishment of MPAs.



The largest recorded fish kill (pilchards) in Australian waters.  
Source: South Australian Research and Development Institute (Aquatic Systems).

### Trend: Marine resource management

There has been a very slow improvement in the state of marine resource management, pressures have remained constant and responses have been adequate in some respects.

Ecosystem-based management is ill-defined at the operational level of management but nevertheless creates a framework for policy development and decision making. Its key attribute is the recognition that the effects of any activity in a region should be assessed in light of the linkages and interdependencies within the whole ecosystem. A good example is Integrated Coastal Zone Management. This aims to overcome the fragmentation of management arrangements and the 'tyranny of small decisions' that lead to incremental degradation through the negative effects of many small decisions that seem, on their own, inconsequential. This principle is being embraced by some states in their coastal policy or strategy and being reinforced by proactive coastal councils (e.g. in Victoria and NSW).

Catchment management is a key response, and this has been recognised in most parts of Australia, and in all tiers of government. Implementation requires community involvement, cooperation of industries and governments, and alignment of regulatory regimes between Commonwealth, state and local government. There is still no nationally applicable coastal zone policy, and delivery of effective catchment management across all jurisdictions is still some way off.

The Coasts and Clean Seas Initiative of the Natural Heritage Trust (NHT) (see <http://www.nht.gov.au>), comprises 11 major programs. For example, the Coastcare program has funded over 1750 projects involving restoration of habitats, development of local management plans, education and training. How these programs will evolve under the Extension to the Natural Heritage Trust remains unresolved.

## Conclusion

Where human settlement and land use is light, Australian coastal waters are often in excellent condition. However, in some areas there is threat of, and actual loss of, shallow marine and coastal habitats through poor catchment management and development, and invasive species such as the Northern Pacific Seastar and the Giant Fanworm, and tropical pasture grasses in coastal lagoons in the north. Landowners, when land use is poor, are often unaware or apathetic of the downstream consequences. The damaging effects of acid soil runoff in some estuaries is a good example of both negative downstream consequences, and of how improving land use practices can remedy the problems.

Mechanisms for resource allocation remain poorly developed in most areas among commercial, recreational and Indigenous users of fisheries resources (e.g. the allocation of fishing rights). As the national capacity to measure use of these resources is poor, it is difficult to assess the achievement of equitable allocations and sustainable use. Measurement of resource use is most advanced for the commercial fishing sector.

How much information is readily available on the general state of the coasts and oceans environment? Unfortunately, not much, and it is 'nobody's job' to coordinate and deliver such information. An effective institutional solution would require specific resourcing and a mandate, and would probably involve Commonwealth, state and territory organisations, possibly through a Ministerial Council.

SoE (2001) has shown that developing indicators is necessary but not sufficient. Many of the important indicators require a national approach to the development of data collection and reporting systems, which is yet to occur. The effort to gather and publish high quality information on the state of the coastal and marine environment should be continuous and be integrated through the Commonwealth, state and territory, and local governments.

## Land

The word 'land' carries strong emotional overtones. Land is territory; it is what peoples and nations have always fought for. Land means food, security, wealth and power. Societies have a powerful need to feel and express a sense of place in the art, song, poems, pictures and fables of their culture.

At the end of its first century of federation, Australia is in the process of redefining its cultural identity through changing attitudes to land and landscapes. Nowhere is this more evident than in the increased recognition of the significance of what land means to Indigenous Australians since the passing of the *Native Title Act 1993*.

In many parts of Australia, the historical predominance of agriculture as the economic driver and user of land, water and vegetation is being challenged by new economic activities and different values. Native title rights, service industries, tourism and recreation are already important. However, emerging new attitudes are placing increased value on landscape