

# Fisheries

Environmental indicators reported in this section:

Environmental indicator	
CO 4.2	Aquaculture production
CO 4.3	Fish stocks
CO 4.4	Seafood quality
CO 7.8	Fishing effects on non-target species

Fishing occurs over the whole of Australia’s marine environment—in estuaries, coastal waterways, nearshore waters, deep oceans and sub-Antarctic waters. Some fisheries extend into international waters. It is one of the few industries operating on the basis of harvesting native species.

The commercial fishing industry is an important primary industry. Marine recreational fishing is a significant activity, and fishing is of great importance to many Aboriginal and Torres Strait Islander communities. Because the marine environment is very diverse in terms of the different physical features, species and ecosystems, fisheries management and conservation varies from region to region.

The Australian Fisheries Management Authority (AFMA) is the Commonwealth authority responsible for the management of Commonwealth fishery resources within the 200 nautical mile Australian Fishing Zone (AFZ) and, in some cases, by agreement with the States, to the low water mark.

Australia’s Fishing Zone is the world’s third largest, comprising some nine million square kilometres. Although Australia ranks only about fiftieth in world fish production in tonnage terms, many Australian fisheries target high-value species such as prawns, lobsters, abalone and tuna. In 1999–2000 the gross value of Australia’s fisheries production, including aquaculture, increased by an estimated 13% to A\$2.32 billion, despite a 7% decline in production to around 221 400 tonnes. Of this, the Commonwealth-managed component was about A\$413



Figure 20: Status of Australian fisheries, 1999.

Source: Bureau of Rural Sciences (2000).

million (ABARE 2001), contributing about 20% of Australian fisheries production, the major fisheries being the Northern Prawn, Southern Bluefin Tuna, and the South East Trawl and Non-Trawl Fisheries.

Major State-managed fisheries include the Western Rock Lobster, abalone, and Pearl Oyster fisheries.

Fishing activities affect not only the target species but also the ecosystems from which the fish are captured, and other species that are caught or otherwise affected. Protected species such as turtles, sharks and seabirds may be caught or killed incidentally by fishing activities. A wide range of benthic species may also be caught or affected in trawl nets and dredges. Bycatch species and discarded fish may also be removed from marine and coastal waters during commercial fishing activities.

The state of knowledge of the biology and the stock status of many fish species is incomplete. Around 3600 of Australia's estimated 4500 fish species have been described, but the status of most is unknown.

Fish are captured at the seafloor (demersal fishing with bottom trawls, dredges, traps) and from ocean waters (pelagic fishing with longlines and purse-seines). Aquaculture is conducted in coastal waterways, estuaries or in sheltered nearshore waters. The catch of fish can be related to the productivity of the populations, but is also influenced by technological factors.

Information on the conduct of fishing using lines and nets is given in a study undertaken for SoE reporting purposes (Commonwealth of Australia 2001b). The report found that the intensity of fishing varies greatly from place to place, and there was insufficient information to give a national overview of the spatial extent and intensity of net and line fishing.

The same report investigated trawl areas and intensities of fishing effort. The study identified that the intensity of trawling in the South East Trawl Fishery is increasing, while in the Northern Prawn Fishery the intensity and area have decreased substantially in the last decade. The area trawled in the East Coast Trawl Fishery off the coast of Queensland has increased steadily over the last two decades but has recently been restricted in the Great Barrier Reef World Heritage Area. Areas of high trawling intensity tend to be very small relative to the total area of the respective trawl fishery. The impact of trawling depends on the combination of trawl frequency and intensity, and the susceptibility of the habitats and species being trawled. Nonetheless, even infrequent trawls may still cause ecological damage in habitats that are slow to recover.

Information about gear or effort is useful for formulating management actions, such as capping fishing effort, targeting species better, or introducing mitigation measures.

The most important issue for fisheries in Australia is to ensure the ecological sustainability of fish stocks in the long term so that ecosystems that are fished remain diverse and healthy.

The environmental issues of most importance are:

- the management of fishing effort and activity so as to minimise impacts on habitats and ecosystems and maintain ecological sustainability;
- the sustainable management of target species;
- the reduction of impacts on species, other than target species, removed or injured during fishing activities;
- the impacts of marine pests on the environment (see page 60)
- fishing activities' effects on benthic and pelagic ecosystems; and
- the loss of inshore nursery habitats and pollution from land-based activities.

### Status of commercial wild capture stocks [CO Indicator 4.3]

The status of Commonwealth-managed commercial fisheries is assessed and summarised in the annual Bureau of Rural Sciences Fisheries status reports (Caton and McLoughlin 2000).

The level of uncertainty in scientific assessments of the status of fisheries remains relatively high, and the 1999 assessments showed a trend within Commonwealth-managed fisheries to fewer fisheries/species classified as 'underfished' and more classified as 'uncertain' (13 in 1998 and 15 in 1999). The increased number of 'uncertain' fisheries/species is a

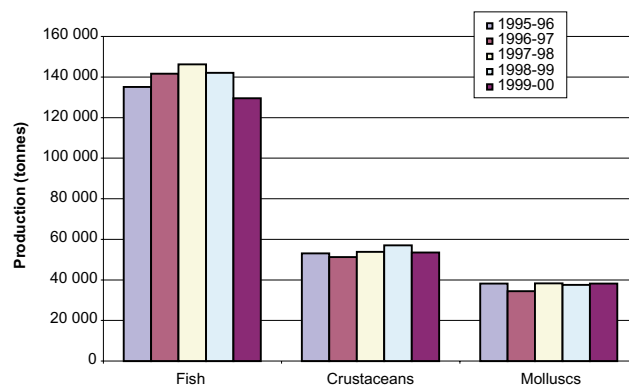


Figure 21: Australian fisheries production from 1995-96 to 1999-2000.

Source: after ABARE (2001).

combination of new fisheries and, with increased information, increasing uncertainty in previously assessed fisheries. The status of most bycatch species is uncertain.

Four Commonwealth fisheries/species groups are regarded as overfished. They are Southern Bluefin Tuna, school shark, tiger prawn in the Northern Prawn Fishery and Eastern Gemfish stocks. The species are also caught in State-managed fisheries.

About three-quarters of Australia's fisheries are under State and the Northern Territory jurisdiction. Statistics on catches are compiled by the Australian Bureau of Agricultural and Resource Economics each year (e.g. ABARE 2001). Most of the fish stocks managed by Western Australia are still productive, but are nearing the limit of their ability to support further fishing (Fisheries Western Australia 2000a). Queensland fisheries are generally fully fished (Williams 1997) and New South Wales' commercial wild-catch fisheries are fully fished (Fletcher et al. 1999).

A summary of the condition of all of Australia's fish stocks is not yet possible, owing to differing reporting approaches in the various States and the Northern Territory and the Commonwealth.

One of the problems in attempting to assess the overall status of fisheries is that there is no national fisheries statistics database from which to assess trends. As the fishing industry depends on the sustainability of species for its continuing viability, the need for information on the status of commercial fisheries is vital.

There are fisheries developing in Australia's external territorial waters. The Macquarie Island Fishery was established in late 1996 after two seasons of exploratory fishing. A precautionary total allowable catch (TAC) limit for Patagonian Toothfish (see 'The complexity of fisheries management' box on page 71) has been set. There are strict operating conditions for this fishery to protect fish stocks and non-target species.

It is widely held that the sustainable development of Australia's fishing industry will involve making greater returns by increasing quality or value-adding to the wild caught product rather than by increasing the total tonnage of fish.

### Good news—fisheries management

There are very few examples in which fisheries management can claim clear success in achieving regulatory goals. The Western Australian Western Rock Lobster Fishery and the Tasmanian abalone fishery have managed to rebuild stocks over several years.

#### Western Australian Western Rock Lobster Fishery

The Western Australian Western Rock Lobster Fishery is an example of a well-managed fishery. Although catches in 1991–92 and 1992–93 were high, scientists highlighted that the breeding stock had been fished down to about 15% of the unfished stock. This was below the internationally safe level of about 25% of breeding stock. Tight management arrangements introduced in 1993–94 were aimed at rebuilding the breeding stock. This aim is being achieved. Catches since 1994–95 have averaged around 10 000 tonnes, with the 1998–99 catch a record 13 009 tonnes (Penn 1999). The West Australian Western Rock Lobster Fishery is the first fishery in the world to attain certification under the Marine Stewardship Council (London) as well managed and sustainable (see <http://www.msc.org> [accessed 5 September 2001]).

As part of this certification, to ensure that environmental impacts continue to be minimal, the fishery has been required to improve specific aspects of its environmental performance. These include: the development and implementation of an Environmental Management Strategy based on a comprehensive ecological risk assessment, the increased participation of environmental organisations in decision-making in the fishery, and the implementation of an improved monitoring program for bycatch of species (e.g. sea lions and turtles).

#### Tasmanian abalone fishery

The Tasmanian abalone fishery is the largest wild harvest abalone fishery in the world. While other wild fisheries are currently grappling with the problems of overfishing, the Tasmanian fishery has been able to lift production following a period of stock rebuilding through the late

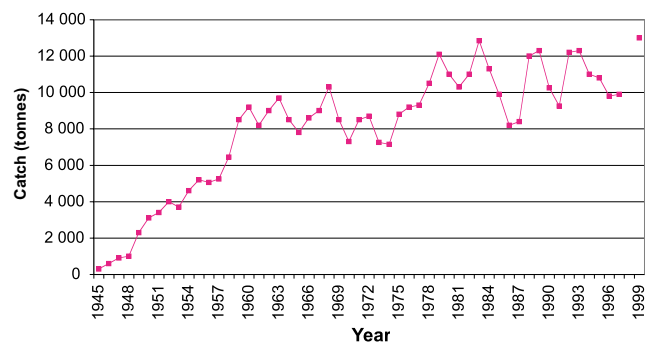


Figure 22: Western Rock Lobster annual catch.

Source: After SoE (1996) and Fisheries Western Australia Annual Reports.

1980s and 1990s. Three stepwise increases in the total allowable catch (TAC) have occurred since 1997, the most recent in 2001.

Concerns held by members of the fishing industry and the Tasmanian Fisheries Department saw the introduction of a quota system in 1985, associated with a significant reduction in the catch. The quota was further reduced between 1985 and 1989 to 2100 tonnes, a reduction of 45% over four years. The TAC (for Blacklip and Greenlip Abalone combined) remained static from 1989 to 1996 before the first increase in 1997 when the TAC was set at 2520 tonnes. The TAC rose to 2800 tonnes for 2001.

A feature of the fishery over the last few years has been an increasing concentration of effort in the south and south-east and a corresponding reduction of effort in the west and north of the State. It is noteworthy that previous stock assessments have shown high catch rates of above-average size abalone on the west coast, but effort has gradually moved to more accessible areas.

To redress this trend, and spread effort more evenly around the State, a system of regional zones was introduced in 2000, with the catch to be taken from each zone determined by the TAC. Two Blacklip Abalone zones were supplemented by a third zone in 2001 with the TAC allocated as follows: eastern zone 1120 tonnes; western zone 1260 tonnes; northern zone 280 tonnes; greenlip zone 140 tonnes.

The Tasmanian TAC for the entire abalone fishery for 2001 is the sum of these regional TACs, i.e. 2800 tonnes. Figure 23 shows the annual landings of abalone in Tasmania.

Another important facet of the fishery is marked geographical differences in growth rates of abalone around the State. For example, Blacklip Abalone generally grow faster in the south of the state than in the north. To address this issue, three different size limits now apply to both Blacklip and Greenlip Abalone.

The value of the fishery has fluctuated over the past eight years and shows little relationship to catch. Prices and catches have varied since the early 1990s with beach prices reaching historic highs over \$50 per kilogram during 2000. These strong prices saw the value of the fishery reach \$128 million in 2000.

### Uncertain news—fisheries management

#### Orange Roughy

Orange Roughy remains the most valuable single species in the South Eastern Trawl Fishery, with a value of A\$12.7 million in 1998 (Caton and McLoughlin 2000). This species is a long-lived, low breeding fish (it produces low numbers of eggs compared to other fish) that is vulnerable to fishing pressure because of its aggregating behaviour. Since 1992 catches of Orange Roughy have continued to decline in the South East Trawl Fishery. The assessment that in 1997 a catch reduction in parts of the Fishery was warranted, was not accepted by the industry. A second wave of Orange Roughy exploitation occurred in the South Tasman Rise (which straddles the AFZ) following discovery of aggregations in September 1997.

Both Australia and New Zealand have fished the South Tasman Rise since 1997 with varying degrees of success in allocating catch levels and capping the fishing of Orange Roughy.

#### Southern Bluefin Tuna

The Southern Bluefin Tuna is a highly migratory, long-lived species that was heavily overfished by a number of countries in the 1970s and 1980s. The international management of the fishery

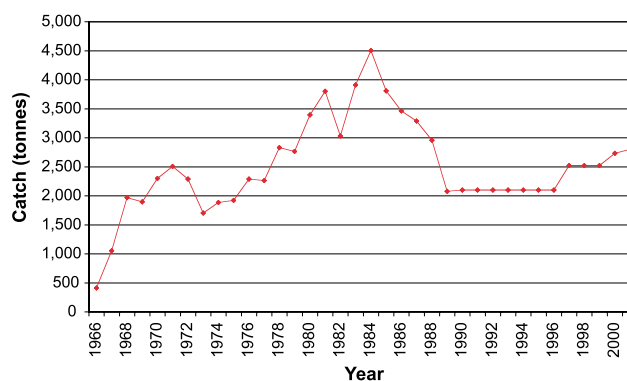


Figure 23: Annual landings of abalone in Tasmania.

Source: DPIWE Tasmania (2000).



An aggregation of abalone in a gutter on the north-west coast of Tasmania.

Source: Tasmanian Aquaculture and Fisheries Institute.

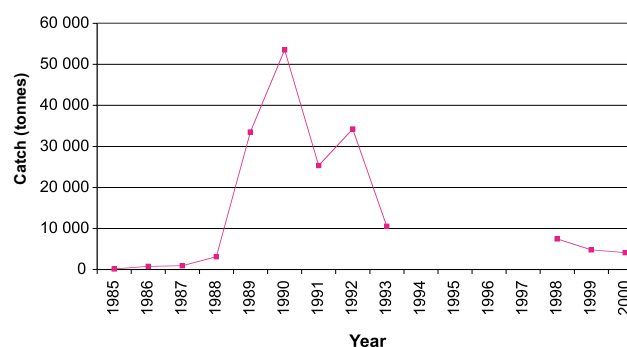


Figure 24: Orange Roughy annual catch.

Source: after SoE (1996) and Caton and McLoughlin (2000).

involves Australia, New Zealand and Japan, through the Commission for the Conservation of Southern Bluefin Tuna (CCSBT). Other countries also fish for Southern Bluefin Tuna outside the CCSBT management regime, though the Republic of Korea has announced it will accede to the Convention, South Africa is considering becoming a member, and efforts are in train to develop a mechanism that will enable Taiwan to participate in the Commission. Australia has actively engaged in international forums to bring the global catch of the species under effective management. The focus of this work has been to bring all major Southern Bluefin Tuna fishing countries into the CCSBT, so that all nations can comply with the Commission's objective of rebuilding the stock by 2020.

Australia has maintained catch limits agreed to in 1993 when the Commission established a total catch of 11 750 tonnes, with Australia getting 5265 tonnes, Japan 6065 tonnes, and New Zealand 420 tonnes. Southern Bluefin Tuna is considered overfished, with total global landings of about 19 000 tonnes, mostly landed in Japan or Australia (Caton and McLoughlin in press.).

There is uncertainty about the degree to which spawning stock will rebuild under the current global catch regime, given the complexities of management of a species that is not entirely within Australia's control. The nature of the fishery in Australia has changed, with more juveniles being caught and farmed (see page 77).

### Bad news—fisheries management

#### Eastern Gemfish

Eastern Gemfish is taken in the Commonwealth South East Trawl Fishery (SETF) off southern New South Wales. This slow-growing, long-lived species was fished excessively in the 1970s and 1980s and will take many years to recover.

A zero catch limit was set from 1993 to 1996. The total allowable catch (TAC) for 1997 was set at 1000 tonnes but the catch was only 393 tonnes. Scientific advice was that the TAC for 1998 should be zero, but a total of 500 tonnes was allocated to cover bycatch and reduce discarding. The catch, however, was only 214 tonnes. The 1999 allocated catch for bycatch was 250 tonnes (actual catch 158 tonnes) and in 2000 the allocated catch for bycatch was reduced to 200 tonnes.

Eastern Gemfish remains vulnerable to targeted fishing as it aggregates for its spawning run.

### Status of recreational fishing

Recreational fishing in Australia is an activity enjoyed by some five million fishers, who catch an estimated 30 000 tonnes per year (FRDC 2000). Recreational fishing in saltwater accounts for some 73 per cent of recreational fishing. The recreational sector is large and widely dispersed around Australia, and its management is generally the responsibility of State and Territory governments.

Recreational fishing is not controlled to the same extent as commercial fishing. It is limited by a variety of methods, including size limit, bag limit (number of fish per person), boat limit, seasonal closures of areas, and limits on equipment allowed.

Some States have introduced a general angling licence to include marine recreational fishing because of the pressure that recreational fishing is placing on fishery resources (for example, Victoria and New South Wales). Fisheries Western Australia has outlined a new framework for managing recreational fisheries in Western Australia (Fisheries Western Australia 2000b), given that an estimated 600 000 people target and catch a great variety and quantity of finfish and shellfish in that State.

There is little information available on a national scale on the total recreational catch or the catch and effort of recreational fishers. A study conducted for AQIS (McIlgorm and Pepperell 1999) reviewed existing literature in Australia on the structure, activity, expenditure and regional importance of recreational fishing. The study concluded that there is some information available relating to participation rates, fishing effort and catch. Some large-scale studies have provided estimates of the recreational catch for various fisheries. Recreational

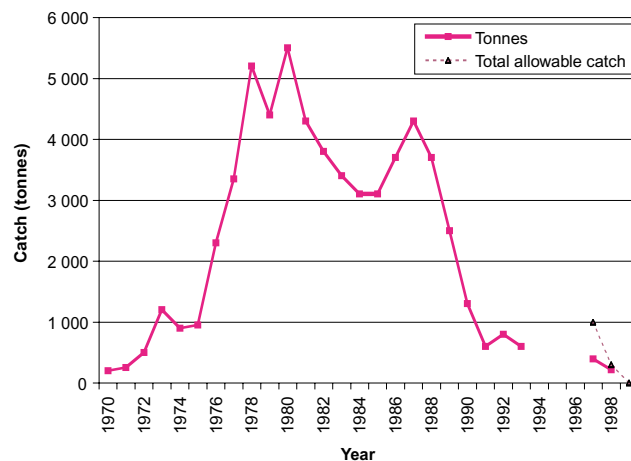


Figure 25: Annual Eastern Gemfish catch.

Source: after SoE (1996) and Caton and McLoughlin (2000).

## The complexity of fisheries management

In the late 1990s a Patagonian Toothfish (*Dissostichus eleginoides*) fishery was established around Heard Island, some 4000 kilometres south-west of Perth. This species is widely distributed in the Southern Ocean. It is large (over two metres long), long-lived (over 40 years) and takes 10–12 years to reach maturity, thus rendering it vulnerable to overfishing.

This and most other toothfish fisheries occur within the area of application of the Convention on the Conservation of Antarctic Living Marine Resources (CCAMLR). The objective of CCAMLR is the conservation of Antarctic marine living resources where conservation is defined to include rational use. The Commission established under the Convention comprises 24 members and takes an ecosystem approach to management of harvesting; i.e. it considers the effects of fishing on the dependent and related species in the ecosystem, not just on the target species. Total allowable catches and other management conditions are set annually by the Commission.

The Heard Island fishery is one of the few examples where research on the abundance and distribution of fish stocks was conducted before commercial fishing commenced. Further research using commercial fishing vessels has been conducted every year. Unlike other toothfish fisheries where longlines are used, fishing in Australian waters is limited to trawling to prevent the bycatch of seabirds, including endangered species such as albatrosses.

Management of the fishery is reviewed each year by the Australian Fisheries Management Authority (AFMA) to take account CCAMLR's decisions on the total allowable catch and other aspects. In addition to CCAMLR's requirements, AFMA has adopted other measures to minimise the environmental impacts of fishing, such as zero discharge of fishing offal and restrictions on waste disposal.

Within Australia's EEZ, the waters surrounding Heard Island are managed principally by the Australian Antarctic Division (territorial waters) and AFMA (waters between 12 nm and 200 nm). All of the Heard Island fishing grounds are within the CCAMLR Area.

A Notice of Intent was gazetted in January 2001 regarding the Government's intention to establish a Marine Reserve, with 'no-take' zones, in the EEZ.

Illegal, unregulated and unreported (IUU) fishing for toothfish throughout the Southern Ocean, including in the EEZ around Heard Island, has been a serious problem in recent years. IUU fishing has caused the commercial extinction of some toothfish stocks and significantly affected toothfish catches in other areas. Tens of thousands of seabirds, including endangered albatrosses, have been killed by IUU longline fishing which does not use mitigation measures.

The question of IUU fishing in the CCAMLR area is complex and involves the nationals and vessels of both parties to CCAMLR and non-parties. Generally, the latter are also not parties to other international fisheries agreements.

Enforcement activities by the AFMA and the Australian Defence Force are difficult in this vast expanse of ocean. Australia has been a leading advocate for strong international action to combat IUU fishing and has initiated many of the measures adopted by CCAMLR. These measures include stronger controls by flag States and port States and, more recently, an international scheme to prevent trade in IUU-caught toothfish.

Source: Australian Antarctic Division (2000).



Patagonian Toothfish.

Source: Australian Antarctic Division.

fishers catch large numbers of many species, but often only a few species constitute the bulk of the total catch. Information on hook-and-line fishing for finfish is reasonable, but information on recreational harvesting of invertebrates is poor. In one of the few studies on fishing for invertebrates that is available, it was found, for example, that the recreational catch of prawns in Lake Illawara was 50% of the total catch during the period 1992–1994.

To fill this gap, a National Recreational and Indigenous Fishing Survey commenced in May 2000 to gather data on fisher participation, catch and fishing effort, economic activity and the attitudes and awareness of fishers to fisheries regulations. Some 19 000 fishers will be interviewed as part of the survey, which will continue for 12 months.

In addition to landing fish, recreational fishers often return fish to the water. This may be in response to prevailing size and bag limits, or because of the popularity of catch-and-release fishing (e.g. for Barramundi in the Northern Territory and big game fishing).

The major issue of recreational fishing is bringing the recreational sector within a fisheries management system. This would of course deal with allocation of total allowable catch to

recreational and commercial fishers; but more importantly, both groups would be then required to abide by the same rules with respect to setting of the total allowable catch, environmental impacts of fishing, closed seasons and areas, and compliance. There is also the issue that some people claim to be amateur fishers, yet take large numbers of fish without paying for a licence, and sell the fish.

### Status of Indigenous fishing

Aboriginal and Torres Strait Islander people are involved in traditional, recreational and commercial fishing. The right of access to traditional marine foods (see the discussion of the Yanner High Court case, page 87) does not require traditional techniques to be used for capture. Aboriginal peoples and Torres Strait Islanders may use traditional or other methods when engaging in traditional fishing. Non-Indigenous commercial fishing may, however, affect Indigenous people's access to traditional marine foods, leading to conflicts over who has the primary right to these resources. Aquaculture may also reduce Indigenous access to traditional fisheries in estuaries and other aquatic areas.

The Torres Strait Islands have a strong social and economic association with fishing and seafood is an important part of the diet. The dependence on aquatic resources is illustrated by communities in the remote north of Australia and in the Torres Strait, whose daily consumption of seafood can exceed 500 grams—10 times that for Australia as a whole (FRDC 2000).

The customary diet can include turtle meat and eggs, Dugong, reef fish, shellfish and crustaceans. The Protected Zone Joint Authority (PZJA) for the Torres Strait fishery is responsible for monitoring and managing traditional fishing. A conservative approach to the harvest of turtles and Dugongs is promoted through a school and community education program run by AFMA.

### Status of illegal, unregulated and unreported fishing

Illegal, unreported and unregulated (IUU) fishing is a growing problem, contributing significantly to the decline in fish stocks and undermining their sustainable management both world-wide and within the Australian Fishing Zone (AFZ).

Australia, like most other countries, confronts threats from IUU fishing, concentrating on preventing unauthorised foreign fishing inside the AFZ and the detection and apprehension of foreign vessels suspected of fishing illegally.

Each year Australia apprehends and successfully prosecutes around 100 foreign fishing vessels illegally operating inside the AFZ. However, there are significantly more sightings where effective responses cannot be mounted due to the size of the AFZ (the third-largest in the world), and lack of response resources in the immediate vicinity of the sighting.

Illegal foreign vessels apprehended inside the AFZ are predominantly involved in small gill net, longline and sedentary organism gathering operations conducted mainly by people from neighbouring countries. These boats mainly target sea cucumber, shark, trochus shell and finfish.

Periodically, larger industrial vessels such as pair trawlers, single trawl and longliners of various nationalities are apprehended. The biggest impact for Australia has been on Patagonian Toothfish and Orange Roughy fisheries. Australia's apprehension of IUU Patagonian Toothfish vessels (e.g. the apprehension of the *South Tomi* in April 2001) operating in the AFZ surrounding Heard and McDonald Islands has been highlighted recently. New fisheries currently under development by Australian companies could also be at risk if illegal fishing is not addressed.

Illegal fishers generally damage marine ecosystems in a number of ways. They typically remove unsustainable numbers of their target species from the marine environment and often capture large amounts of bycatch (non-target species), due to indiscriminate fishing methods. They also often abandon fishing gear to avoid apprehension, endangering non-target species in the environment.

### Seafood quality [CO Indicator 4.4]

Seafood quality in Australia is crucial to maintaining a competitive advantage for the fish export industry in the future. An issue is the concentration of heavy metals that may be

accumulated through the food chain and reach high levels in long-lived fish such as sharks and Orange Roughy. But most important is the lack of pathogens in wild-caught fish and the high quality of our post-harvest handling procedures that maintain the quality of the seafood until it reaches consumers.

Seafood quality may be a significant issue in Indigenous fisheries owing to the high proportion of seafood in their diet, particularly for Torres Strait Islanders.

On a national scale, the residue levels in some wild fish species are monitored through the National Residue Survey (NRS 1998), which is designed to ensure that requirements for export certification are met.

Seafood products, in particular shellfish, have the potential to cause serious outbreaks of food poisoning due to contamination from either biotoxins or pathogens. There have been several incidents where bivalve shellfish have been contaminated with sewage effluent or biotoxins from algal blooms. In 1997, over 400 people in New South Wales were infected with hepatitis A after eating oysters grown in Wallis Lake and one man died as a result (Caton and McLoughlin 2000). The contamination was caused by poorly treated sewage entering the lake.

The Australian Shellfish Sanitation Control Program was developed in 1998 and aims to minimise the risk of harvesting contaminated shellfish through regular monitoring for possible contamination by toxic algae, microbes, antibiotics, hormones and toxins. State and Territory-based shellfish quality assurance programs support this program.

## Impacts of wild fish harvesting activity

Fishing activities have impacts well beyond the main target species and include the effects on ecologically related species and on marine ecosystems. In recent years, the effects on other fish species have been the major issue, but the emphasis is now changing to the effects on ecosystems.

### Non-target species [CO Indicator 7.8]

The components of fishing bycatch can be described as:

- the non-target species retained,
- the non-target species discarded, and
- the other non-target species affected by fishing gear, but which do not reach the deck.

In most fisheries non-target species may be retained. When there is a commercial market for them, this is described as byproduct and can comprise a significant proportion of a catch in some fisheries. Indigenous people who catch only what can be used are especially concerned about bycatch as a waste of resources.

There is very limited information on the non-target catch in many Commonwealth fisheries (Caton and McLoughlin 2000). Recording of bycatch is difficult because there is a need for a high level of taxonomic skills to reliably identify the organisms and because of a lack of skilled observers. The Commonwealth Sub-Antarctic Fisheries have perhaps the most extensive observer coverage.

The Northern Prawn Fishery was one of the first to introduce compulsory logbooks that were completed by fishers and cross-checked by processors. In 1995 it became compulsory for fishers to record the retained catch of non-target species and turtles.

In the far northern Great Barrier Reef Marine Park, for every tonne of prawns harvested, about six to ten tonnes of other species are discarded. A study on the environmental effects of prawn trawling (Poiner et al. 1998) found that about one-third of bycatch species were crustaceans and two-thirds fish.

Some State-managed fisheries record some non-target species, mainly byproduct and vulnerable species (e.g. turtles and marine mammals), but discards of the majority of non-target species are not recorded.

## Changes to benthic habitats

Trawling is one of the most widely used commercial fishing methods in Australia, with demersal trawling being the major technique. There are trawl fisheries for fish, scallops, scampi, prawns, and other seafood. The nature of the catch in trawl fisheries can include threatened species and invertebrate and other species.

Because demersal trawling and shellfish dredging makes contact with the seafloor, it can have substantial impacts on seabed habitats and benthic ecosystems (Harris and Ward 1999). The extent of essentially indiscriminate impacts can be significant, including physical removal of organisms and non-living components and increases in water turbidity. Impacts arise from the removal of target and non-target species and the removal and disturbance of invertebrate species and associated benthic habitat. Repeated trawling may prevent the recolonisation of benthic species, both sedentary and mobile.

CSIRO and the Queensland Department of Primary Industries completed a five-year study of the environmental effects of prawn trawling in 1996 (Poiner et al. 1998). The study area covered 10 000 km<sup>2</sup> in the far northern Great Barrier Reef Marine Park. The research showed that each pass of a trawl along the seabed removes about 5 to 25% of the seabed life. However, there is a cumulative effect; seven trawls over the same area of seabed removed about half of the seabed life, and 13 trawls removed 70 to 90%. Different species have different levels of vulnerability. Large sponges, for example, are particularly susceptible to trawling.

A few deep seabed sites have been studied, such as on the North West Shelf and on the continental shelf adjacent to the Great Barrier Reef. However, there is relatively little understanding of benthic communities in Australian waters. Seamounts are trawled for Orange Roughy, and some have been damaged by this activity. Seamounts are sites of highly valued marine biodiversity (see page 27).

### Loss of inshore habitat

Coastal habitat especially estuaries are nursery grounds for the juveniles of fish species. These habitats include seagrass beds, saltmarshes and mangroves and other coastal wetlands. Habitat loss or degradation may also result from land-based activities that cause nutrient enrichment (see page 55), pollution from pesticides, or sedimentation (see page 56).

Some States are actively addressing the protection or rehabilitation of inshore habitats. For example, in 1995 New South Wales Fisheries introduced Fish Habitat Protection Plans to facilitate habitat protection on a State, regional or local scale or for particular communities or species (Smith and Pollard 1998). The second protection plan was gazetted in 1997 and applies specifically to seagrass habitats.

Fisheries Western Australia is developing a series of Fisheries Environmental Management Reviews for each of the main regions of Western Australia to, among other things, identify habitats of importance for fisheries. Each Environmental Management Review is to be supported by a Management Plan that will develop and implement responses to the issues identified in the Reviews.

## Responses to fisheries issues

### Legislative responses

The management of fisheries is a mix of Commonwealth and State or Territory responsibilities. Formal measures to place some fisheries under a single jurisdiction are in place under the Offshore Constitutional Settlement agreement, while other fisheries require collaborative management arrangements.

There are both Commonwealth and State fisheries laws under which fisheries are managed through general regulations or other statutory methods. There are various methods to manage each fishery, such as size and catch limits, and gear restrictions.

Legislative changes in 1999 and 2000 will make a dramatic difference to the sustainable management of commercial wild fish stocks in the future. The most



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

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



Mangrove roots at Arnhem Land, Queensland.

Source: G Pure.

significant is the removal of the general exemption of most marine fish from export control regulation under the *Wildlife Protection (Regulation of Exports and Imports) Act 1982*. The removal of the exemption makes the taking of marine native species consistent with the taking of terrestrial native species. This change comes into effect in December 2003. Before a fishery can be exempted from the Act, it must be shown that the fishery is ecologically sustainable in terms of its impact on:

- target species,
- non-target species and bycatch, and
- the ecosystem generally (including habitat).

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) came into force in July 2000. It requires an assessment and approval process for activities that are likely to have a significant impact on the Commonwealth marine environment, on nationally threatened species and ecological communities, and on internationally protected migratory species. The Act also requires that all Commonwealth-managed fisheries have their environmental impact strategically assessed.

The Commonwealth Government has issued guidelines for the ecologically sustainable management of fisheries as the benchmark against which environmental performance of fisheries should be assessed.

With these changes to legislation and the management of fisheries and ecosystems, there has been a shift in the onus of responsibility, as reflected in Australia's Oceans Policy. Users of ocean resources such as fishers are increasingly expected or required to ensure the ecological sustainability of their activities and to meet their obligations to identify and implement precautionary measures.

### Management responses

One of the measures to assess the unintended consequences of fishing activities is the production and use of management regimes that include non-target species monitoring strategies and adaptive management. Some fisheries (such as rock lobster and abalone) are highly selective, and non-target catch is not a major issue with them.

A recent review (Commonwealth of Australia 2001b) reported the number of fishery management plans, as at June 1999, with these objectives and with criteria and performance measures for the effectiveness of those strategies. Of the 60 management plans in existence, only six dealt to some extent with impacts on non-target species. The three Commonwealth plans do not give specific details of the monitoring of non-target species and how the information is fed back into the management system. (Note that Western Australian plans were not made available for the study.)

Another management option that is being used by both State and Commonwealth fisheries is structural adjustment schemes. The purpose of these schemes is to reduce fishing effort in a fishery or, in some cases, to remove the overexploitation of a fishery. An example is the Southern Shark Fishery, where school shark stocks need to be rebuilt. School shark stocks are assessed as being unsustainable at present catch levels. In 1999–2000, government funding of \$2.6 million was secured for a fishery structural adjustment and initiation of a buy-back scheme. (AFMA 2001). In 2000–2001, \$20 million of Commonwealth and State funding was committed to reduce fishing effort by 10% in the Queensland Eastern Trawl Fishery, while industry contributed a nominal 5% reduction in effort to the scheme.

Western Australia has used a Government–industry buy-back system for some years to reduce the number of Fishing Boat Licences (Fisheries Western Australia 2000c). As a result, a total of 69 licences were sold to the general buy-back scheme between 1987 and July 1999 and were cancelled.

The Great Barrier Reef Marine Park Authority has been undertaking the negotiation of the East Coast Trawl Plan with the Queensland Government and industry. The introduction of the still disputed Plan follows years of challenging negotiations between the Authority, the Queensland Government and the fishing industry. Significant outcomes of the negotiations on the Plan to date include:

- a capped trawl effort at 1996 levels, with an immediate 15% reduction,
- mandatory turtle exclusion devices and bycatch reduction devices,
- the closure of lightly trawled and untrawled areas (approximately an additional 20% of the Marine Park), and

- strict monitoring and recording of bycatch species, which may result in further protective measures.

Increasingly, in the last four years, environmental management systems have been voluntarily adopted by the industry. The most effective of these so far has been the global market-driven ecolabelling program of the Marine Stewardship Council.

### Bycatch issue responses

The response to the significant issue of bycatch has improved over recent years. The Commonwealth developed a National Bycatch Policy in 1999 and a Commonwealth Bycatch Policy in 2000. The National Policy restricts its attention to non-target discard species and non-target organisms affected by fishing gear, and does not include byproduct.

A feature of the Commonwealth Policy is the commitment to prepare Bycatch Action Plans for all major Commonwealth fisheries. Plans for the Northern Prawn Fishery and the Torres Strait Prawn Fishery were implemented in 1999.

Turtle exclusion devices (TEDs) and bycatch reduction devices (BRDs) have been trialed in the Northern Prawn Fishery since 1993 and became compulsory in this fishery in 2000. Trials to improve their performance through modifications are continuing. Projects are currently under way to evaluate the effectiveness of these devices, in collaboration with the fishing industry. Seal excluder devices (SEDs) are currently being trialed in the South East Trawl Fishery.

A project by the Bureau of Rural Sciences, CSIRO and AFMA is monitoring the catch of sea turtles in the Northern Prawn Fishery. Results from these projects show that the use of TEDs and BRDs has resulted in a substantial decline in the catches of large animals such as turtles, stingrays and sharks. However, the use of BRDs in this fishery seem to have had little impact on the catch of the smaller, more abundant bycatch.

Bycatch Action Plans for other major Commonwealth fisheries were released in May 2001 by AFMA for the:

- South East Trawl Fishery,
- South East Non-Trawl and Southern Shark Fisheries,
- Sub-Antarctic Fisheries (the Macquarie Island Fishery and Heard Island and McDonald Islands Fishery),
- Great Australian Bight Trawl Fishery,
- Bass Strait Central Zone Scallop Fishery, and
- Southern Squid Jig Fishery.

By the end of 2001, Bycatch Action Plans will have been developed for 14 of the 21 Commonwealth fisheries.

The effects of Commonwealth fisheries on some non-target threatened species, such as albatrosses and turtles had been assessed under previous legislation, and these assessments and their listings have been carried over to the EPBC Act. Some fishing methods are recognised as 'key threatening processes' under the EPBC Act. Regulations were issued in February 2001 placing very specific obligations on longlining operations under the Threat Abatement Plan for the incidental catch of seabirds during oceanic longlining fishing operations. This Plan was developed in cooperation with the fishing industry. A nomination for otter trawling for marine turtles is currently (February 2001) being considered for listing.

The Commonwealth Government has provided \$1 075 000 from the Natural Heritage Trust to establish the SeaNet extension service. The project is focused on increasing the rate of adoption by the commercial fishing sector of new fishing gear and practices to aid bycatch reduction and to implement environmental best practice.

The States and the Northern Territory have also been addressing bycatch in different ways. Western Australia and the Northern Territory have adopted the National Policy.



Turtles being monitored before release.

Source: C Robins, Bureau of Rural Sciences.

Action plans or management plans for fisheries are being prepared in three States and the Northern Territory on a priority basis. The use of bycatch reduction devices (BRDs) in two estuarine prawn trawl fisheries in New South Wales has been made mandatory, to save large quantities of juvenile fish. In Queensland, New South Wales and Western Australia, the recording of bycatch is currently being considered for compulsory inclusion in management plans.

However, there has been little or no response to the assessment or management of the non-target retained species (byproduct) in relation to either the effects on the species or the effects on the ecosystems. An exception to this is the Western Rock Lobster Fishery that is developing a number of responses to deal with environmental issues in the fishery.

## Aquaculture [CO Indicator 4.2]

Over the past 30 years there has been a significant increase and diversification of aquaculture species farmed in Australia. Of the approximately 60 different species farmed, the major contributors are: pearl and edible oysters, Atlantic salmon, prawns, and Southern Bluefin Tuna (FRDC 2000).

Australia's ability to produce such diverse products is due mainly to its wide-ranging climatic conditions, from the tropical north to the temperate south. Australia is also fortunate to be free of many of the major diseases that affect aquaculture production in other parts of the world.

Over the last decade, aquaculture production has grown substantially, from 11 900 tonnes and a value of \$136 million in 1988–89 to some 32 360 tonnes worth around \$614 million in 1998/99 (O'Sullivan and Dobson 2000). Until the last decade, most commercial aquaculture was for oysters (edible oysters and pearl oysters) and a limited amount of fish and prawn culture. In recent years, the caged culture of fish has grown rapidly. Atlantic Salmon in Tasmania and the fattening of caged Southern Bluefin Tuna in South Australia account for one-third of Australia's production.

Wild-caught Southern Bluefin Tuna have been fattened in sea cages off Port Lincoln since 1994. There are now 110 cages operated by about 12 companies in an area of approximately 200 km<sup>2</sup>. Predator exclusion nets surround the main nets of many cages. Although the wild catch has been maintained at 5265 tonnes, most is now farmed, leading to significant value-adding of the product. The tuna are fed on pilchards and other bait fish for four to eight months, when they reach a size of about 30 to 40 kg.

However, tuna farming in feedlots can generate a significant amount of pollution (Parliament of SA 2000). Recent research suggests that pollution is causing the sudden appearance of strange micro-organisms capable of poisoning fish. It has been suggested that a toxic algae was the cause of death of the tuna in Boston Bay, Port Lincoln, in 1996.

The Parliamentary Committee (Parliament of SA 2000) noted that the Tuna Farming Code of Practice was still not finalised, and although some of the issues of concern are addressed in the Draft Code of Practice, in reality the Code is not being adhered to.

Dolphins, whales and seals can become entangled in the predator nets. The South Australian Museum has been collecting records of dead and stranded dolphins around the South Australia coast for many years. In an initial study of the problem (Kemper and Gibbs 1997), at least 13% of all dolphin carcasses studied were believed to have died as a result of entanglement, including many in the tuna feedlots near Port Lincoln.

There are several challenges for the Southern Bluefin Tuna Fishery in the future, a major one being to breed tuna in captivity and cease the total reliance on capturing wild stock, the availability of which is limited.

There are also many experimental and pilot schemes in place within the aquaculture industry, and some are becoming commercially viable. For example, a pilot-scale culture of the Fat-bellied Seahorse (*Hippocampus abdominalis*) in Tasmania has recently grown to a commercial scale.

Successful aquaculture depends on a combination of factors, including appropriate site selection, design and construction of facilities, good water quality, and suitable markets. Site selection and the associated impacts involved in initial developments can be a contentious

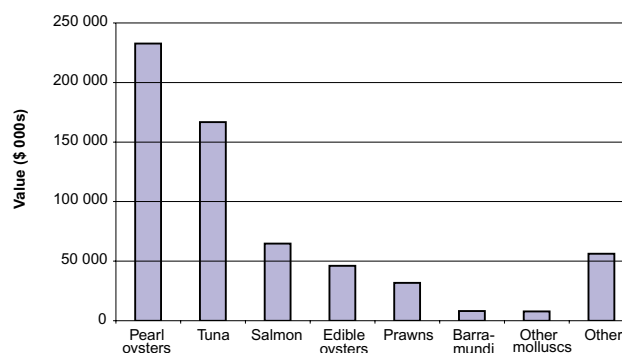


Figure 26: Value of aquaculture sectors.

Source: O'Sullivan and Dobson, (2000).

issue where there are competing uses of the coastal or marine environment, such as urbanisation, recreation or community interests (Preston and Rothlisberg 2000).

Local government and State planning agencies are the responsible land planners, and increasingly aquaculture operations will have to meet strict environmental controls in order to coexist with other land and coastal water uses. The major environmental issues for aquaculture are:

- water quality impacts from aquaculture operations,
- introduction of pest species through translocation and possible escape,
- introduction of disease through translocation,
- genetic impacts from possible escapes,
- sourcing of brood stock or juveniles, particularly if it is from wild populations,
- compromising habitat and amenity values, and
- sourcing of feedstock from wild-harvest fisheries.

## Environmental effects of aquaculture

### Sourcing of brood stock and juveniles

Where aquaculture operations depend on wild-caught juvenile fish, there can be an effect on the wild stock populations. As yet there is little evaluation of this aspect of aquaculture.

### Water quality

Aquaculture requires access to high-quality water but has the potential to increase nutrient enrichment of surrounding coastal or estuarine waters. Land-based practices such as urbanisation and industrial or agricultural practices may also have adverse water quality effects on aquaculture operations, leading, for example, to algal blooms that can affect shellfish quality.

There is the potential for fish feed and wastes to affect water quality through the accumulation of wastes in the vicinity of the farms or the movement of nutrients into the water column. The main source of nutrients in discharge water from prawn farms, for example, is undigested food. The contribution of prawn farming effluent into waters already experiencing impacts can be significant. For example, around 110 hectares of prawn farms are situated in the Logan River catchment in southern Queensland, producing around 45 tonnes of nitrogen effluent.

### Possible genetic effects

Unintentional escapes of aquaculture species, either native or exotic, into the wild could affect the genetic diversity of native species. In recognition of the possible risks associated with unintentional escapes, the Commonwealth, State and Territory governments have strict policies regarding the transfer and translocation of exotic species, including larvae.

## Responses to environmental issues

The responsibility for the development and regulation of aquaculture in Australia rests with local, State and Territory governments. Several States have aquaculture and coastal development plans in place.

Many industry associations have developed codes of practice for their particular aquaculture operations, e.g. the Australian Prawn Farmers Association and the Australian Tuna Boat Owner's Association (Caton and McLoughlin 2000).

There are a number of promising developments for the aquaculture industry. The use of saline groundwater is being trialed for aquaculture in pilot studies, and may become commercially feasible. The integration of aquaculture with conventional farming systems to allow multiple and sequential usage of water resources and related infrastructure is also attracting significant interest. Another developing trend is the use of genetic engineering in aquaculture.

The management of diseases that affect aquaculture is a challenge for the future. For example, the marine protozoan pathogen *Neoparamoeba pemaquidensis* that occurs seasonally in Atlantic Salmon in Tasmania is now regarded as a major disease which costs the industry \$10 to \$15 million annually.

The Australian Prawn Farmers Association recently (2001) decided at a workshop to implement national environmental practices that will ensure prawn farming has no detrimental effect on water quality. The workshop documented potential problems resulting

from the discharge of nutrient and sediment-laden pond water and decided to develop a plan with targets, deadlines and assigned responsibilities to achieve world's best practice within 10 years. This initiative was taken in the knowledge that the total pond area of prawn farms may double during that time to about 800 hectares.

Management of other land-based activities becomes crucial to the maintenance of coastal water quality for aquaculture, as these are generally conducted on a much larger scale. Increasingly, there is a need for planning authorities to engage in integrated catchment management considering all activities that may affect a waterway, rather than attempting to regulate aquaculture in isolation.

Considerable research is under way to develop more efficient and environmentally friendly food for aquaculture species, as the world supply of fishmeal—a major component of aquaculture food—is not increasing and its production is vulnerable to climatic variability. Improvement in feeds and feeding practices also has significant potential to boost the profitability of aquaculture through reduced wastage and costs, as some aquaculture operations are net consumers of fish products rather than net contributors (FRDC 2000). This would reduce the amount of bait fish, currently 50 000 tonnes per annum, used as aquaculture feed.