A Socio-economic Analysis and Description of the Marine Industries of Australia's South-west Marine Region

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Table of contents

List of figures, tables and plates

Figures

Tables

Plates

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Summary

This report provides a description and analysis of the main commercial marine users active in the South-west Marine Region (SWMR). The SWMR stretches from Kangaroo Island in South Australia, to Shark Bay in Western Australia – from the Territorial Sea Baseline out to 200 nautical miles.

Human use of the SWMR started with Aboriginal settlers who first moved into the region some 40 000 years ago. European exploitation of the resources of the region began with sealing and whaling in the early nineteenth century, but fishing, shipping and ports soon became important components of the region's economy. The range of uses expanded in the twentieth century, particularly in the post World War II period, with a substantial expansion in industrial and minerals activity in both South Australia and Western Australia. Today, the region has a complex socio-economic structure based on a wide range of industries. The focus of this report is on those industries which are most closely associated with the SWMR. These industries are:

- ports
- shipping and ship and boat-building
- oil and gas
- marine tourism and marinas
- submarine cables
- defence
- commercial fishing
- recreational fishing
- aquaculture
- emerging industries (such as petroleum and biotechnology).

These marine uses have been addressed in terms of current activity and distribution within the region, expected growth, key management and institutional arrangements, and main pressures affecting them. The report shows that the key industries of the region have grown rapidly over the past decade or so. The most notable growth has occurred in marine tourism and recreation, ship building, and aquaculture. At the same time, ports and commercial fishing have remained important commercial activities in the region.

All of these industries underpin economic growth, employment, and social wellbeing in the cities, towns and small communities of the region.

It is also clear that the industries of the region are far from static, and have experienced dynamic changes in their economic structure and geography. Recent years have also seen the emergence of new industries such as marine biotechnology and desalination, and the prospect of oil, gas and minerals extraction.

This report emphasises that existing and emerging industries also face a number of risks associated with factors such as international trade, global and domestic economic growth, interest and exchange rates, labour market constraints, policy reform and demographic change. Furthermore, there are potential risks to the marine environment; these risks are

associated with virtually all of the industries operating in the region. This report points out that from a marine planning perspective, it is important to recognise that many of these industries are also dependent on the ecological sustainability of the region’s natural environment.

1 Introduction

1.1 Background and project rationale

Australia's Oceans Policy was launched in 1998, outlining the Australian Government's commitment to the sustainable management of ocean uses. At the heart of the policy is ensuring that our oceans are managed in such a way that the economic, social and ecological needs of future generations are not compromised by current uses. A *use* is defined in Australia's Oceans Policy as "a human activity that has a physical or legal presence within [a] region" and incorporates activities as diverse as commercial fishing, tourism, shipping and conservation (National Oceans Office 2002, p. 4).

The National Oceans Office was established in 1999 to implement *Australia's Oceans Policy* and to lead the development of regional marine plans across Commonwealth waters. In 2004 the Office became a branch of the then Department of the Environment and Heritage (now Department of the Environment and Water Resources). In October 2005 the Australian Government announced that it would bring its marine planning programme under the provisions of the *Environment Protection and Biodiversity Conservation Act* (1999). Now referred to as Marine Bioregional Planning, the programme is underway within Australia's five marine regions:

- the South-west Marine Region (from kangaroo Island to Kalbarri)
- the North-west Marine Region from Kalbarri to the WA/NT Boarder)
- the North Marine Region (from the WA/NT boarder to the tip of Cape York (excluding Torres Strait))
- the Central east Marine Region (from the tip of Cape York to a point near Bermagui in NSW); and
- the South-east (from Bermagui in NSW to Kangaroo Island in SA).

In March 2005, the Department commissioned this report to describe the historical, current and emerging patterns of marine commercial use in the SWMR, and the socio-economic links with the adjacent coastal communities. This report is an important information source for the scoping stage of the marine plan. It also provides a resource that can be used to inform stakeholders of the commercial uses within the region.

Specifically, this report:

- reviews the history and geography of the marine uses in the SWMR and how they have changed over time;
- profiles the socio-economic status of the costal a communities of the region;
- describes the characteristics of marine commercial uses occurring in the region
- identifies the macro and micro level drivers of change in the region, including the impediments to the development of marine industries;
- outlines jurisdictional and administrative boundaries, and current management arrangements; and

- identifies key knowledge gaps where more detailed research is required.

1.2 Methods

The findings presented in this report are drawn from a number of secondary sources, including official statistics from Australian and state government agencies, historical archives, published scientific papers and reports. Key information providers include the:

- Australian Bureau of Statistics – census data on population geography, demographic change, and labour force structure; and trade and economic growth statistics
- Australian Trade Commission – export- and trade-related statistics
- Australian Bureau of Agricultural and Resource Economics (ABARE) – economic conditions; trade and fisheries statistics
- Bureau of Rural Sciences – economic uses and fisheries statistics
- Bureau of Transport and Regional Economics – transport data including shipping, port and freight statistics
- Department of Fisheries (Western Australia) – fisheries and aquaculture statistics
- South Australian Research and Development Institute (SARDI) – fisheries and aquaculture statistics.

Other statistical data were collected from agencies such as the Department of Defence, the Tourism Commission of Western Australia, the Department of Conservation and Land Management (Western Australia), the Department of Industry, Tourism and Resources, the Department of Agriculture, Fisheries and Forestry, and the Department of Planning and Infrastructure (Western Australia). Management reports and relevant legislation were also collected for the relevant users of the SWMR.

It is important to note that one of the limitations of the statistical data and other information collected for this report is that they do not always neatly match the geographical boundaries of the SWMR. Often data are available only at a state level, or as part of some other spatial unit. However, where possible, data were aggregated to fit the region as closely as possible. In other cases, wider state or regional data have been used as a means of providing a more general indication of the trends affecting the SWMR.

Data on economic and employment multipliers were derived in large part from the report *The Economic Contribution of Australia's Marine Industries* by the Allen Consulting Group (2004). This report provides an analysis of the ways in which various marine industries make both direct and indirect contributions to the economy. However, as with some of the other data sources, one limitation of this report is that it focuses on trends in either the national or state levels, and does not deal explicitly with the SWMR. As such, the data provide simply an indication of the contributions of marine industries to the SWMR. This report provides a detailed explanation of how these figures were calculated, and the limitations in using these figures in assessing the economic performance of marine industries.

Where appropriate, interviews (either by telephone or face-to-face) were conducted with representatives from the various industries discussed in this report. These interviews provided information on industry objectives, risks and various aspects of management. Not

only did the interviews provide valuable primary information, they were also a valuable means of cross checking the statistics and other data derived from other sources.

1.3 The South-west Marine Region

The South-west Marine Region (SWMR) extends from the eastern-most tip of Kangaroo Island in South Australia to Shark Bay in Western Australia and covers more than one million square kilometres of water (see Figure 1.1). The region includes both inshore state waters (from the low water mark to three nautical miles outside the territorial baseline) and Commonwealth waters that extend to the edge of Australia's Exclusive Economic Zone (EEZ) (from 3 to 200 nautical miles outside the territorial baseline). It also includes areas of the continental shelf beyond the EEZ, to the west and north-west of Perth, that are claimable under the United Nations Convention on the Law of the Sea (Figure 1.2).

It should be noted that while the SWMR extends from the low water mark to the edge of Australia's EEZ, for the purposes of regional marine planning the Australia Government only undertakes planning within Commonwealth waters (from 3 nautical miles out to 200 nautical miles). Planning inside three nautical miles is the responsibility of the state governments.

The SWMR waters border the Southern and Indian oceans and are characterised by a mix of temperate and tropical communities. This is due to the Leeuwin Current flowing south along the Western Australian coast and turning eastward at Cape Leeuwin to flow into the Great Australian Bight. These warm waters bring a range of tropical marine species further south than anywhere else in the world. The region provides important habitats for a diverse range of marine mammals, fish species and seabirds, many of which are endemic to the area. The SWMR's relative isolation and small human population have resulted in marine and coastal environments that are relatively undisturbed and which have significant conservation values.

The SWMR also hosts a range of economic, social and cultural activities. At present the major industries within the region are commercial fishing, marine-based tourism and shipping. The region is also utilised for other marine-based activities including oil and gas exploration, ports and marinas, ship and boat-building, defence, aquaculture and submarine cables. The commercial and other uses of the SWMR make an important economic and social contribution to settlements along the coast, which range from small fishing towns to the metropolitan regions of Perth and Adelaide, both of which dominate the population and economic geography of the region

Figure 1.1 Location of the South-west Marine Region

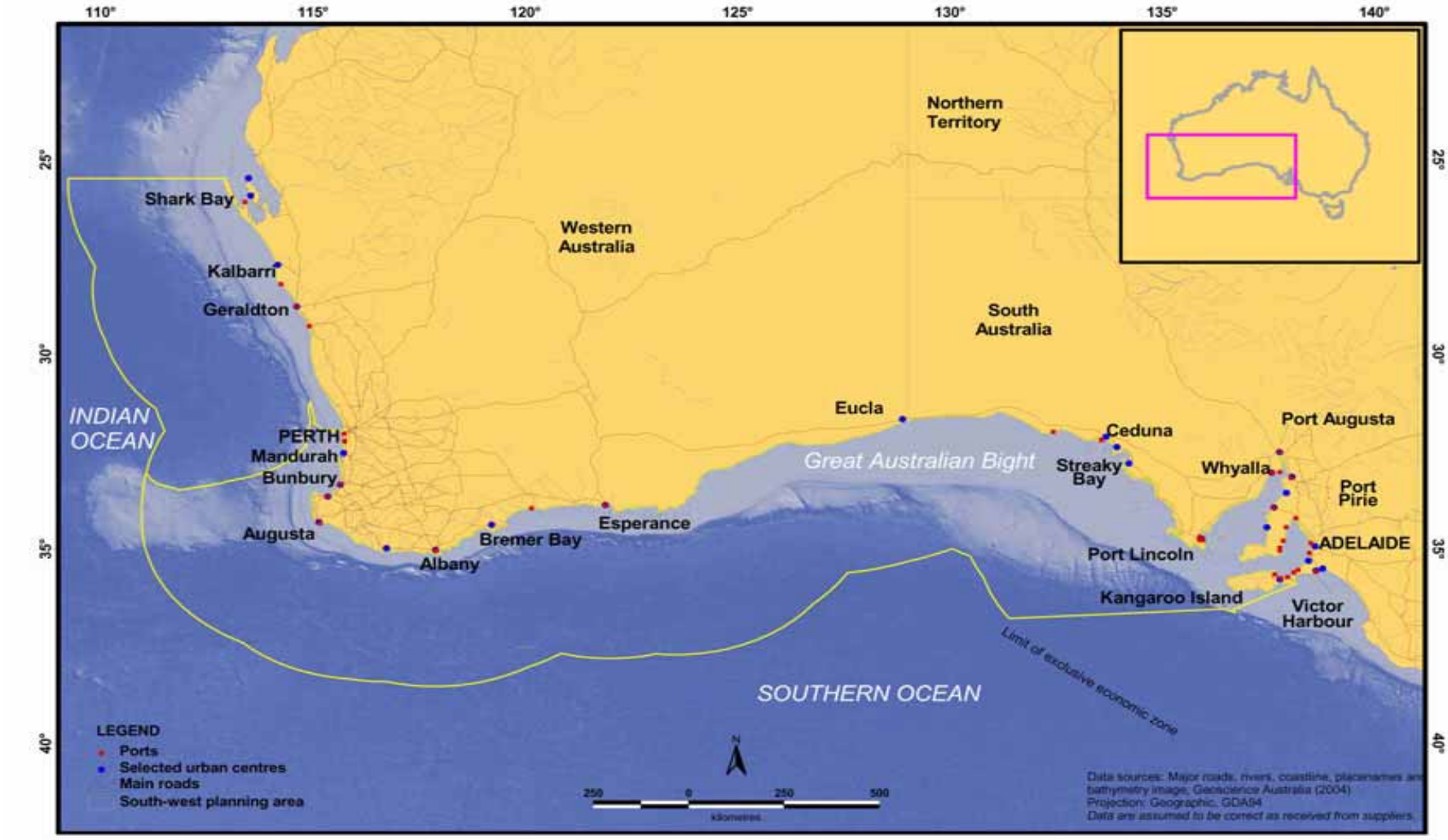
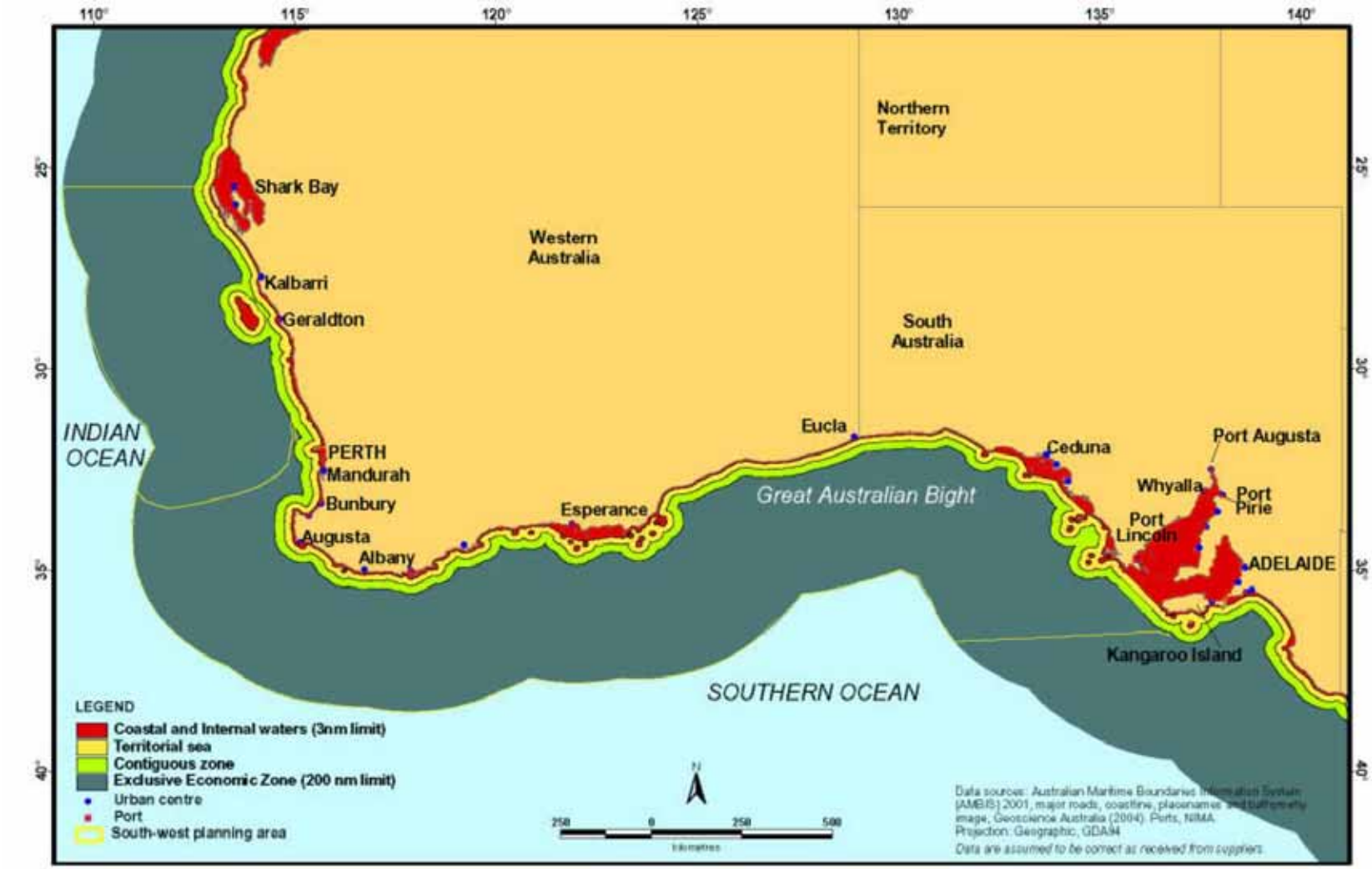


Figure 1.2 Commonwealth and state government jurisdictional boundaries in the SWMR



2 Regional demographic profile

The population along the SWMR coast is concentrated in and around the major urban centres of Adelaide (see Figure 2.1) and Perth (see Figure 2.2), and a number of other regional centres such as Geraldton, Albany, Esperance, Port Lincoln and Whyalla. Large parts of the coast have very small populations consisting of rural communities and dispersed settlement. This population geography reflects not only the history of European settlement, but also the availability of natural resources. The establishment of Perth and Adelaide as colonies in the nineteenth century, and the subsequent rise of these centres as political capitals played an important role in their subsequent dominance of the population and economic geographies of their respective states (a theme discussed in detail in section 3).

Outside the capital cities, the distribution of population is linked largely to primary industries, particularly agriculture, mining and fisheries. In the areas between Geraldton and Esperance in Western Australia, and Ceduna and the South Australia – Victorian border, settlement is dominated by small agricultural service settlements and fishing communities, many of which have diversified into tourism. In the remoter, more arid parts of the region, the population is extremely sparse, with a handful of fishing towns comprising the main form of settlement.

2.1 Population growth

Between the 1986 and 2001 censuses, the population of the region grew by 19.7 per cent to just over 2.7 million people (Table 2.1). Much of this growth was concentrated in Perth, which increased from 994 472 to 1 339 993 people, an increase of 34.7 per cent (Figure 2.2). Perth's growth has been caused largely by strong international immigration, as well as a flow of people from the eastern states (O'Connor et al. 2001). A number of factors have underpinned this growth, including the ongoing expansion in the resources sector, rapid growth in parts of the service economy and lifestyle-led migration (Forster 2003). In contrast to the rapid expansion of Perth, Adelaide's growth has been much slower, recording a 4.2 per cent increase between 1986 and 2001. In part this is the result of difficulties in the manufacturing sector, a relatively slow rate of economic growth, and a pattern of out-migration to Australia's other capital cities (Forster 2003).

Table 2.1 Population change in the SWMR, 1986–2001

	1986	**2001**	**Absolute change, 1986–2001**	**% Change, 1986–2001**
Adelaide	1 029 267	1 072 585	43 318	4.2
Perth	994 472	1 339 993	345 521	34.7
Regional centres	139 133	174 698	35 565	25.6
Other	123 049	148 764	25 715	20.1
Total	**2 285 921**	**2 736 040**	**450 119**	**19.7**

(Source: ABS 2004)

Figure 2.1 Population size and distribution in South Australia, 2001

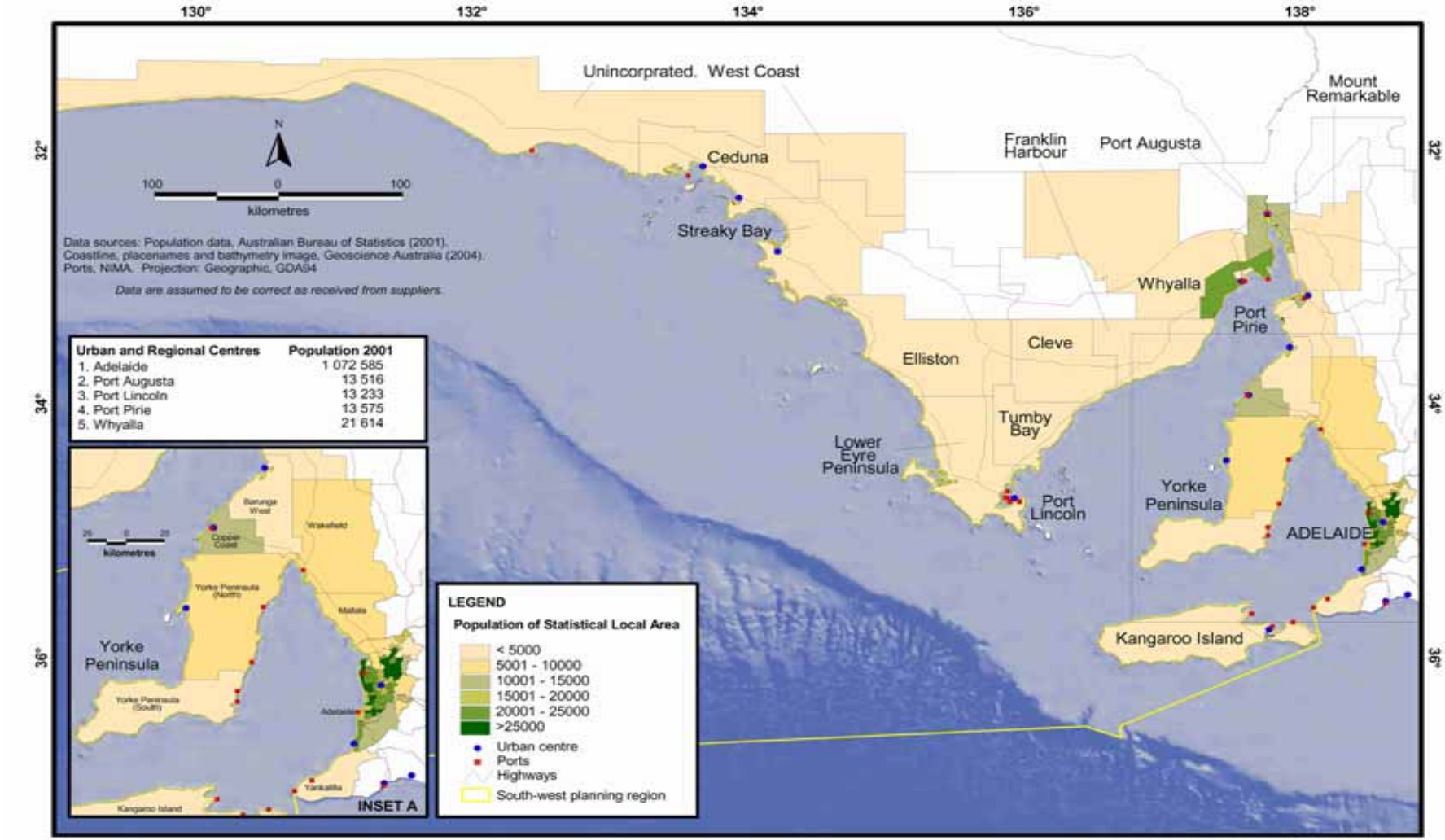
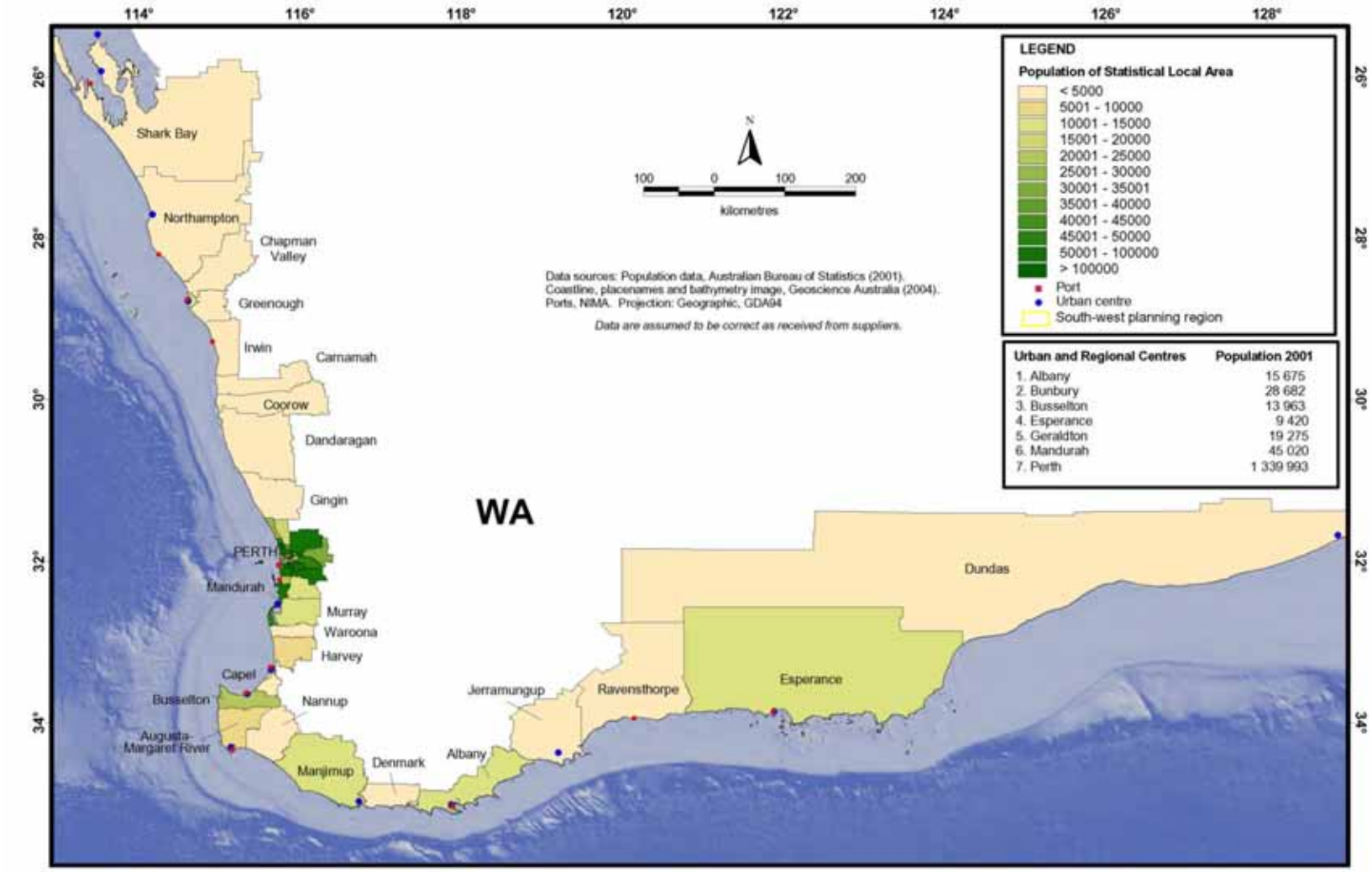


Figure 2.2 Population size and distribution in Western Australia, 2001



As in other parts of the country, many coastal settlements in the SWMR have recorded significant increases in population over the past decade or so (see, for example, Burnley & Murphy 2004). This coastal population growth tends to be concentrated in areas of high environmental amenity, or within the extended metropolitan commuter belts of Perth and Adelaide.

There are a number of drivers of population growth, including lifestyle and retiree migration to coastal communities (Murphy & Burnley 2004), a general movement of people from inland agricultural regions to the coast (Tonts 2005), and the rise of tourism and recreation in marine and coastal areas (Harvey & Caton 2003). Given Australia's ageing population and rising levels of affluence, together with the increasing popularity of coastal and marine tourism, there is no reason to suggest that this trend will not continue into the foreseeable future. However, it is important to stress that not all coastal areas in the SWMR have experienced population growth. Indeed, many remote communities have experienced a general pattern of out-migration and population decline.

2.2 Age profiles across the region

The age structure of the SWMR's population varies depending on the size of settlement (see Figure 2.3). One of the most striking features of Figure 2.3 is the relatively low proportion of young people (aged 15–30 years) living in the region's smaller settlements and rural communities. This trend is common throughout much of rural Australia, and is generally attributed to the out-migration of those people seeking the greater educational, employment and lifestyle opportunities available in larger centres (Tonts 2000). The other key characteristic evident across all settlement types is the ageing of the population. In all of the settlement types, more than 15 per cent of the population is aged 65 or older. This has contributed to a range of pressures in the coastal areas of the SWMR, including increasing levels of tourism, recreation and population growth associated with retirement migration. Given the relatively large proportion of people in the 40–65 age cohort heading towards retirement, these trends are likely to intensify over the next two decades.

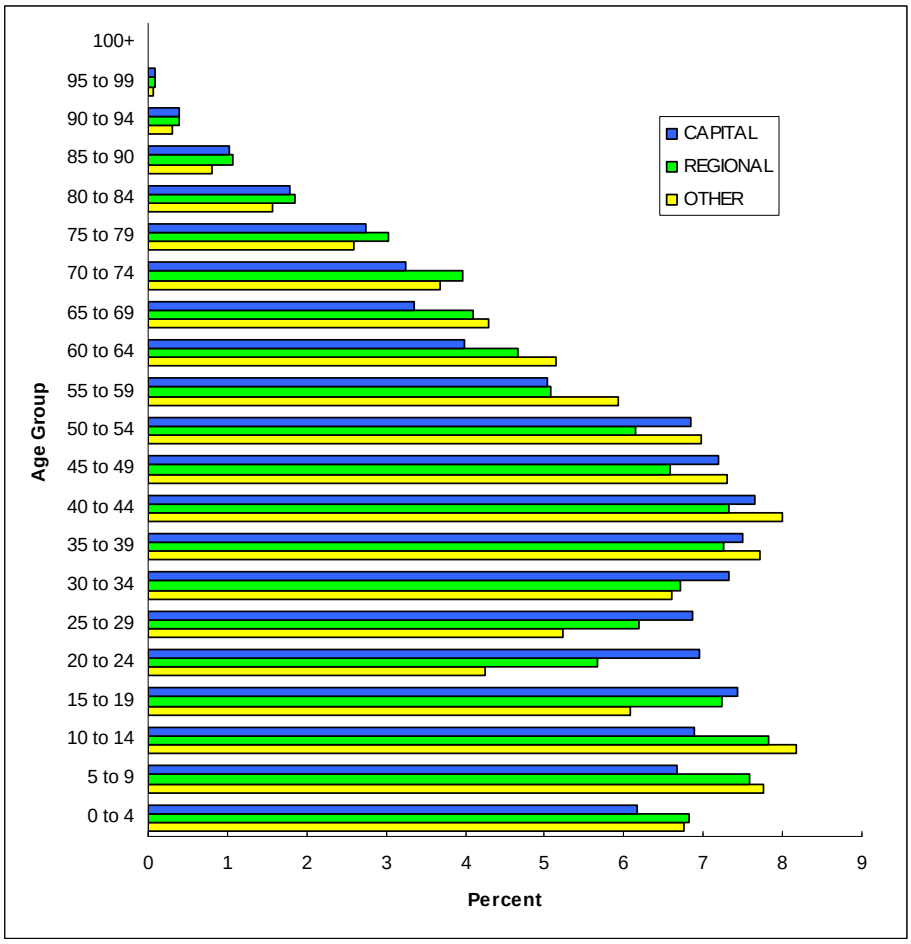
2.3 Employment profiles

Of the population aged 15 years and older living in the SWMR in 2001, approximately 59.7 per cent were in the labour force (Australian Bureau of Statistics 2004). This is on par with the national average of 59.6 per cent. The aggregated labour force statistics for the region indicate that the majority of people are employed in retail trade (15.3 per cent), manufacturing (12.6 per cent), property and business services (11.1 per cent) and health and community services (10.9 per cent) (Figure 2.4). The education and construction industries also account for a considerable proportion of the labour force, with employment within these sectors of 7.3 per cent and 6.8 per cent respectively.

The aggregated labour force statistics for the SWMR tend to mask significant geographical variations. Figure 2.5 shows the labour force structure according to different settlement types. The most apparent feature is the importance of agriculture, forestry and fishing in settlements with fewer than 10 000 people. This reflects the dependence of these economies on the primary sector, particularly agriculture and, to a lesser extent, fishing. By contrast, secondary

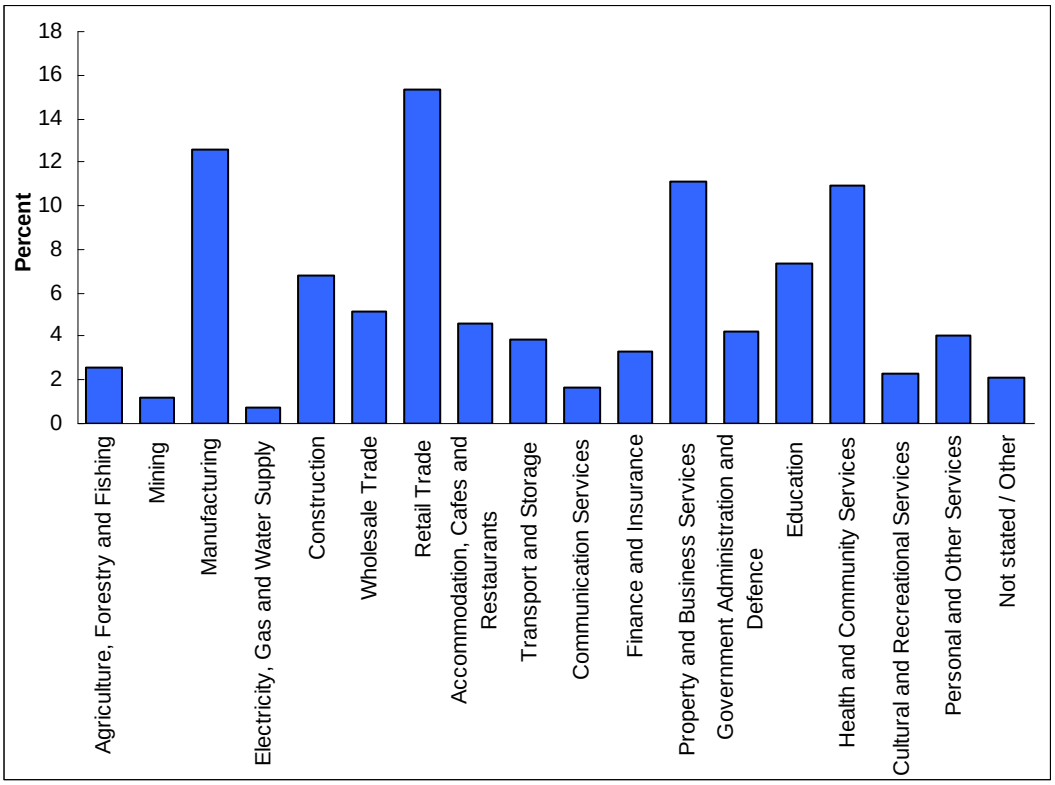
and tertiary activities are concentrated in large centres and cities. In terms of marine uses, these activities incorporate industries such as shipping, ship and boat-building, tourism and defence.

Figure 2.3 The population structure of the SWMR by settlement type, 2001



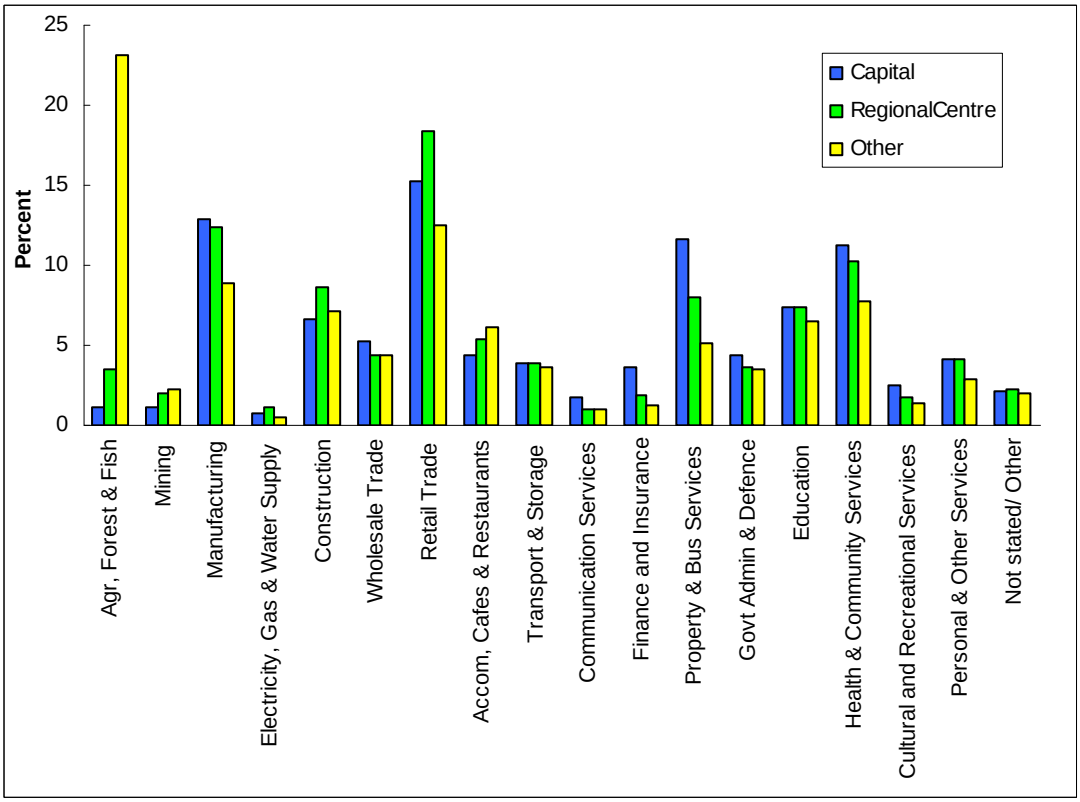
(Source: ABS 2004)

Figure 2.4 Proportion of the SWMR labour force in different industry sectors, 2001



(Source: ABS 2004)

Figure 2.5 Proportion of the SWMR labour force in different industry sectors by settlement type, 2001

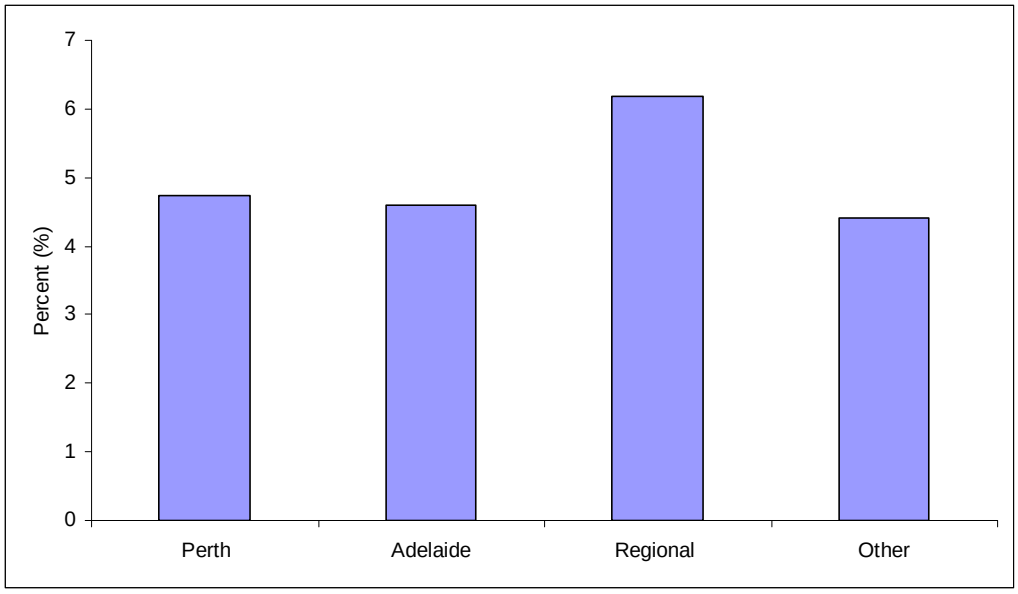


(Source: ABS 2004)

2.4 Unemployment by settlement type

Unemployment rates in the SWMR were relatively low in all settlement types, at the time of the 2001 census. In Perth and Adelaide, unemployment was less than five per cent, reflecting the relative health of the economies of these cities and the strength of the labour market. Unemployment was slightly higher in the SWMR's regional centres such as Whyalla, Port Lincoln Geraldton and Esperance. Deindustrialisation in some of these centres – particularly manufacturing centres in South Australia – contributed to this, although at an average unemployment rate of less than 6.5 per cent, the labour market remains quite robust. In the region's smaller rural settlements, unemployment reflects national trends and remains at less than five per cent. However, it is worth noting that although low rates of unemployment are generally regarded as a sign of a strong economy, they can also indicate other problems in the economy. One of the major issues facing industries in the region is a shortage of labour, particularly skilled labour. While shortages of skilled labour are a national problem, it is a significant issue in Western Australia where a strong resources sector is drawing labour out of other sectors. Other trends such as changing demographic profile (notably the impending retirement of large sections of the "baby boomer" population) and the emergence of new industries requiring specialist skills are also important employment issues in the SWMR.

Figure 2.6 Unemployment rates in the SWMR by settlement type, 2001



(Source: ABS, 2004)

3 History of the region's settlement

3.1 Indigenous history

Humans have inhabited the terrestrial environment adjacent to the South-west Marine Region for at least 40 000 years (Broeze & Henderson 1986). While the nature of our use of the region may have changed over the millennia, there remains a close association between the region's resources and the patterns of settlement and use within the region.

Aboriginal groups, that first settled within the region some 40 000 years ago, were highly mobile, inhabiting different areas depending on the season and availability of local food and water resources (Jarvis 1979). While it is difficult to generalise across the many groups that used the region, the evidence suggests that the main sources of food in winter included kangaroos, possums and other smaller game, native fruits and edible roots. In summer the pattern of migration took many groups closer to the coast where wild stocks of wild fowl, turtles, frogs and fish were exploited (Broeze & Henderson 1986). Evidence remains of the use of fish traps, ponds, and stone weirs (Griffin & McCaskill 1986).

3.2 Early European settlement and development

The first European contact with the SWMR can be traced to the 1600s when merchants travelling to the Dutch East Indies made occasional landings on the Western Australian coast (notably Dirk Hartog in 1616). The first comprehensive assessments of the coastline were made in the early 1800s. The most extensive of these was Matthew Flinders' voyage along much of the Western Australian and South Australian coasts in 1802–03. Commercial use of the region followed soon after these initial explorations.

The first commercial industries in the region were sealing and whaling. An American whaling ship wintering at Kangaroo Island in 1804 is the first clear record of a commercial resource being harvested in the region, pre-dating official settlement of the area by more than 20 years (Kostoglou & McCarthy 1991). In the following years the number of vessels involved in sealing and whaling gradually increased, and by the 1830s sealing and whaling was a vibrant industry, with semi-permanent camps set up on the Eyre Peninsula, Kangaroo Island, the Esperance area of Western Australia and as far north as Shark Bay (Plate 3.1).

Plate 3.1 Whalers in Western Australia, c1900–10

(Courtesy of Library and Information Service of WA)

The industry continued to expand in the early 1840s, with as many as 300 American whaling vessels working off the Western Australian coast alone (Whaleworld, 2005). Much of the whaling activity in Western Australia was based out of Albany and Fremantle, while in South Australia there were at least 18 onshore whaling locations (Kostoglou & McCarthy 1991). As with many open access resources, whale and seal populations are prone to overexploitation, and by the mid to late 1840s these resources had begun to dwindle. The economic viability of the industry was further challenged by the replacement of whale oil with mineral oil as a source of lubricants and fuel (see Tull 1990, Kostoglou & McCarthy 1991). The problems facing the industry were also compounded by the loss of labour in the 1850s as workers left whaling and joined the Victorian gold rush.

While whaling in South Australia had ended by the 1860s, a small industry survived in Western Australia up until World War II, largely due to foreign whaling fleets frequenting the coast at times of high oil prices. Whaling ceased during World War II, but by 1948 a global shortage of fats led to whale oil prices increasing to six times the pre-war value (LISWA 2001). The industry was revived and became highly valuable, continuing until 1978 when declining numbers and growing political opposition to the industry resulted in the closure of the last whaling station at Cheynes Beach near Albany.

In some parts of the SWMR, the demise of whaling and sealing during the 1850s was counterbalanced by the emergence of other export industries. In Western Australia, the harvesting and export of sandalwood (*Santalum spicatum*), which is found throughout the southern parts of the state, became one of the SWMR's major cargo industries (Tonts & Selwood 2003). Sandalwood was (and still is) highly valued in South-east Asia for its aromatic wood, which is burnt as incense in Buddhist and Hindu religious ceremonies. The wood is also carved into jewellery boxes, fans and fan handles, letter openers, card cases, pen-holders and a host of other items. Sandalwood is also prized for its santalol oil, distilled from the heartwood of the plant and traditionally used as a fixative in soaps and perfumes. The first five tonnes of *S. spicatum* was shipped from Fremantle to Ceylon in 1845. By 1848 exports of sandalwood had increased to 1356 tonnes, contributing 45 per cent of Western Australia's export income (Tonts & Selwood 2003). Most of the wood was exported from Fremantle, although Albany, Hopetoun, Esperance and Geraldton were also significant points of departure (Plate 3.2). The wood was exported into China, the Dutch East Indies, Singapore and other Asian ports (Statham 1987). Eventually over-clearing saw sandalwood resources gradually decline, and although the industry has survived, its economic significance is now marginal.

Plate 3.2 Stockpiles of sandalwood on the Fremantle docks, 1890

While industries such as whaling, sealing and sandalwood had an important early influence on the economic geography of the SWMR, it was the gradual emergence of a large-scale, export-oriented agricultural industry that has had the most sustained impact. It was the expansion of farming, particularly from the 1890s, that underpinned the development of extensive port and shipping industries throughout the region, and which formed the socio-economic basis of many coastal communities.

In both Western Australia and South Australia, the export of wool and some cereals commenced in the 1830s, but grew spasmodically until the 1890s (Powell 1988). During much of the nineteenth century, agriculture in both South Australia and Western Australia struggled in the face of relative isolation, difficult environmental conditions, and inadequate infrastructure and development incentives. The most successful commodity under production was wool, followed closely by wheat (Powell 1988). These were exported through a number of ports and coastal towns in the SWMR, notably Fremantle and Port Adelaide, as well as a number of smaller towns, such as Geraldton, Bunbury, Albany and Port Augusta.

3.3 Minerals and agricultural development

The 1890s represented a significant turning point in both colonies. In Western Australia, the discovery of gold at Coolgardie (1892) and Kalgoorlie (1893) provided an important stimulus to economic development and population growth. Importantly, the colonial government was determined to create an “economic backstop” should the deposits of gold run out, and saw broad acre wheat farming as the best means of retaining population and securing economic growth (Tonts 2002). Consequently, the government invested heavily in agricultural development schemes, immigration programs and infrastructure. The most significant investments in terms of infrastructure were railways and ports, since it was widely held that inadequate transport infrastructure was the main barrier to the establishment of a viable agricultural industry (Glynn 1975). Between 1890 and 1930, an extensive network of railways was constructed, radiating out from coastal towns such as Esperance, Albany, Bunbury and Geraldton. The colonial (and later state) government invested heavily in port infrastructure in these towns in order to improve the efficiency of transporting wheat and wool to overseas markets (Crowley 1960). The expanded role of sea transport in the region also led to the widespread construction of jetties, lighthouses, and ferries.

In a similar vein, the government of South Australia invested heavily in agricultural development from the 1890s. Self-government in 1857 improved South Australia's capacity to manage its economic development, which was consolidated by significant revenues generated by the minerals industry from the 1890s. The outcome was a series of large-scale, state-sponsored agricultural development schemes in areas such as the Eyre and York peninsulas, and Kangaroo Island. As in Western Australia, the government also upgraded port facilities in order to deal with the increasing production of wool, wheat and other cereals destined for overseas markets. Significant port facilities underpinned the development of towns such as Port Lincoln, Port Augusta, Port Pirie, Whyalla and Kingscote.

The global economic boom that followed World War II saw increasing production of agricultural commodities (particularly wheat and wool), and the expansion of farming into new regions. Between 1945 and the late 1970s, land was opened up across much of the southern coast of Western Australia. The outcome was further development of the port and shipping industries in Albany and Esperance. In South Australia, continuing improvements in the scientific basis of farming resulted in substantial increases in production, and a greater role of the region's port and sea transport industry.

The SWMR's port and shipping industry has also been shaped by other primary industries. Mining has been a particularly important part of this. In South Australia, copper was discovered near the town of Walleroo on the Yorke Peninsula in 1859 and was exported until the 1920s. At one point, copper reserves constituted as much as two-thirds of South Australia's total exports in terms of value (Griffin & McCaskill 1986). The copper was exported through Port Augusta to Port Adelaide for smelting, until the construction of local smelters in the early 1900s. The development of Port Pirie was also closely linked to the minerals industry, with three smelters and major port facilities constructed to refine and then export ore being railed from Broken Hill. Other minerals that were exported from various ports prior to World War II included iron ore, gold, silver and uranium, with Port Augusta, Port Adelaide and Port Pirie all playing important processing and exporting roles.

Plate 3.3 Miners operating a Dryblower, Western Australia, 1900–10

(Courtesy of the Library and Information Service of WA)

Mining has also played a significant role in influencing the development of the Western Australian section of the SWMR (Plate 3.3). The 1890s gold rush saw Esperance briefly emerge as a port facility for the Coolgardie goldfield, although the opening of the Perth–Goldfields railway in 1896 meant that its importance was short lived. Not long after, in 1901, Hopetoun, to the east of Esperance, emerged on the basis of copper and gold mining.

However, dwindling resources in the 1920s saw the mine closed and, by the mid 1930s, the port and jetty facilities were used by only a handful of itinerant fishing vessels (Jarvis 1979).

Commercially viable minerals discoveries were relatively rare in a southern Western Australia until the 1960s. Small deposits of mineral sands were mined and exported from Cheynes Beach near Albany (1949) and at Koombana Bay near Capel (1956), while tin was exported from Bunbury between 1889 and the mid 1990s. The 1960s, however, proved to be a watershed for the minerals industry, with major discoveries of bauxite in the Darling Range and the subsequent establishment of an extensive mining industry. The first alumina refinery was established in 1963, with three more constructed during the 1970s and 1980s. All of the alumina is exported through the port facilities at Kwinana and Bunbury. The 1960s also saw the expansion of the mineral sands industry near Capel, with minerals such as rutile, ilmenite, zircon and monazite processed near Bunbury and then exported through the town's port facilities. Further mineral sands mines were established north of Perth at Eneabba in the 1970s.

3.4 Post World War II industrialisation

The growth of the minerals sector was accompanied by the emergence of a range of processing and other sectors. Following World War II, the Western Australian and South Australian governments attempted to diversify their economies by attracting a range of processing and other industries. In Western Australia, heavy state investment in the Kwinana Industrial Area during the early 1950s, including the construction of port facilities, contributed to the establishment of a major oil refinery, fertiliser works and various light industrial activities. This was followed in the 1960s and 1970s by a range of industries that were linked directly to the resources boom, including a nickel refinery, alumina refinery and, for a number of years, a blast furnace and steel mill. Other industries to emerge during this time included ship and boat-building at Kwinana, Henderson and Fremantle, as well as a range of industries supporting the burgeoning oil, gas and minerals sectors in the state's north-west.

Similar resource-related developments also affected Bunbury, largely through the growth of alumina processing and the mineral sands industry in the 1980s. Bunbury has also traditionally been an important port for the timber industry (Plate 3.4). From the 1830s, the timber industry used a range of small ports and landing areas along Western Australia's south-west and southern coasts, including Busselton, Hamelin Bay, Augusta and the Rockingham area (Plate 3.5). As railways were constructed through the southern parts of the state, the timber industry became more concentrated on Bunbury, although the growth of the plantation timber industry in high rainfall agricultural areas over the past decade has seen Albany emerge as an important port for woodchips.

Plate 3.4 Loading support timber at Bunbury, Western Australia, c1930

(Courtesy of the Library and Information Service of WA)

Plate 3.5 Hamelin Jetty (549 metres) 1899, a major timber port in Western Australia

(Courtesy of the Library and Information Services of WA)

A similar process of industrialisation occurred in South Australia from the 1940s. The most significant initial investments were in the steel industry, centred on Whyalla. In 1941, BHP's blast furnace came on stream and made a major contribution to steel production during World War II. The blast furnace was soon accompanied by an expanding ship and boat-building industry. The steel industry continued to flourish during the 1950s and 1960s with substantial Australian and state government support. Much of the development concentrated on Whyalla, Port Augusta and Port Pirie as part of the so-called Iron Triangle at the head of the Spencer Gulf.

The 1940s and 1950s also saw a rapid expansion of the manufacturing sector, with companies such as General Motors Holden, Chrysler and Philips Electrical Industries all establishing large factories in Adelaide (Griffin & McCaskell 1986). These new industries not only depended on shipping routes in the SWMR for inputs to production, but also for exporting products to other Australian cities and, in some cases, overseas.

The ongoing expansion of the minerals sector, notably the expansion of uranium mining, also contributed to further economic activity for the SWMR. By the 1970s, however, increasing competition on global markets, and the gradual reduction of tariffs and other forms of

industry protection began to impact on the viability of Adelaide's large manufacturing and processing sector (Forster 2003).

3.5 Fishing and other industries

In addition to agriculture, mining, timber and the transportation of processed or manufactured commodities, other marine industries have played an important role in the development of the SWMR. One of the most widely dispersed and ubiquitous uses has been fishing (Plate 3.6). While less economically significant than some other industries, fishing nevertheless has contributed to substantial direct and indirect employment. The main fishing industries were initially limited by transport and storage technology. The fisheries were coastal-based and located close to markets, such as Fremantle and Port Adelaide, to enable the same-day transportation of produce. The expansion of the rail network from the 1880s enabled better access to markets, as did improvements in storage technology (LISWA 2001). Fishing industries were consolidated with the introduction of trawling techniques in the early part of the twentieth century. The industry continued to expand following World War II in line with population and economic growth.

Plate 3.6 Salmon fishing at Hopetoun, 1949

(Courtesy of the Library and Information Service of WA)

Other uses that have been important in the development of the SWMR include:

- Cargo facilities for both the import and export of goods. While Fremantle and Port Adelaide have traditionally been important in this regard, so too have places such as Port Lincoln, Port Pirie, Geraldton and Esperance.
- Defence, which had traditionally been dispersed across a number of the SWMR's ports, including Bunbury, Albany, Fremantle and Port Adelaide. However, the past two decades have seen Stirling Naval Base at Garden Island near Fremantle emerge as one of the most significant defence facilities in Australia. While other ports still often receive visits from naval vessels, their defence role is generally quite limited.
- Tourism and recreation, which has become increasingly prominent since the 1950s. Many of the towns and sections of coast have been important holiday and tourist destinations since the nineteenth century. Often this utilised both formal tourism facilities and accommodation, although it often involved numerous illegal "squatter" settlements along the coast (Selwood and May 1992). Following World War II, a

combination of rising affluence, greater mobility and more leisure time has seen tourism and recreation levels rise throughout the region. Tourism activities range from wilderness-based camping, to recreational fishing, to commercial marine tourism operations.

- A range of fledgling industries that have started to emerge since the 1970s, including aquaculture which expanded rapidly in South Australia during the late 1980s and became more prominent in Western Australia from the early 1990s.

An important feature of the historical development of the uses of the SWMR is its changing economic and social geography. The early development of commercial uses tended to be dispersed across a large number of very small ports and settlements, with the obvious exceptions being Fremantle and Port Adelaide. Over time, however, there has been a gradual concentration of economic activity in a smaller number of ports, largely as a result of the radial nature of railway networks and the economies of scale associated with centralisation (Powell 1988). At the same time, however, it is apparent that lower intensity uses have gradually emerged along other parts of the coast. These uses include suburban and other residential developments within the region, and the development of significant tourism and recreational industries; while there is a degree of concentration associated with both, they are now affecting quite large parts of the coastline adjacent to the region. The other apparent trend is the emergence of new industries, usually in areas that offer specific ecological or economic advantages.

3.6 The region today

The SWMR today reflects its economic, social and political history. The region's economy remains highly dependent on agricultural commodities, minerals and other raw materials. The Western Australian section of the region in particular is a major exporter of commodities such as grain (especially wheat), wool, timber, alumina, gold, and mineral sands. Similarly, South Australia's minerals and agricultural sectors are important drivers of the economy and agricultural development, although manufacturing is considerably more prominent than in Western Australia.

The past three decades have also seen a degree of economic diversification in the region. Industries such as tourism, ship and boat-building, and aquaculture have become increasingly important commercial uses. Other emerging industries include marine biotechnologies, desalination and those related to defence. While some of these industries (e.g. aquaculture and some tourism enterprises) are located in non-metropolitan areas, most are concentrated in the major metropolitan regions of Perth and Adelaide. This trend towards concentration emphasises the importance of these cities in the social, economic and political structure of the SWMR.

4 Economic contribution of marine-based industries in the South-west Marine Region

A wide range of marine-based industries are supported by the waters of the South-west Marine Region (SWMR). These industries provide a significant economic contribution to the local communities as well as the regional and national economies. Industries analysed within this section are:

- ports
- shipping, and ship and boat-building
- oil and gas
- marine tourism and marinas
- submarine cables
- defence
- commercial fishing
- recreational fishing
- aquaculture.

This list of industries is not exhaustive, but these industries have been identified by the National Oceans Office as priority uses of the region and therefore will be the focus of this part of the report. This chapter also reviews fledgling industries – such as biotechnology – that are currently developing in the region, and are expected to expand in the future.

The marine uses will be addressed separately in terms of their current activity and distribution within the region, their expected growth and their management arrangements. In addition, key pressures impacting on the industries will be identified, as will any information and data gaps that need to be addressed as part of the development of the SWMR plan. Although each industry will be reviewed individually, it is important to note that they are all utilising the same resource (the ocean) and thus need to be considered in an integrated manner.

4.1 Ports

4.1.1 Industry objectives

Ports form one of Australia's key marine industries, contributing significantly to trade, economic development and employment. The main industry objective of ports in the SWMR is to facilitate trade and maximise the potential for national and regional economic growth (e.g. Geraldton Port Authority 2005; Esperance Port Authority 2005). This broad objective is underpinned by the *Australian Logistics Industry Strategy* (ALIS) (2002), which emphasises the need to address impediments in the freight industry and to capitalise on opportunities for sustainable economic growth in a competitive global environment. More specifically, the ALIS aims to develop an industry that:

- is recognised for its contribution to the Australian economy
- has a world-wide reputation for reliability, service, innovation and competitiveness
- is respected as a dynamic and sustainable industry with attractive career options.

In the longer term, the strategy aims to contribute to:

- a more efficient and competitive freight delivery to Australian and international markets
- environmentally friendly and socially responsible logistics solutions.

The Australian Logistics Council was formed to implement these industry objectives, and consists of representatives from the private sector, as well as Australian and state governments.

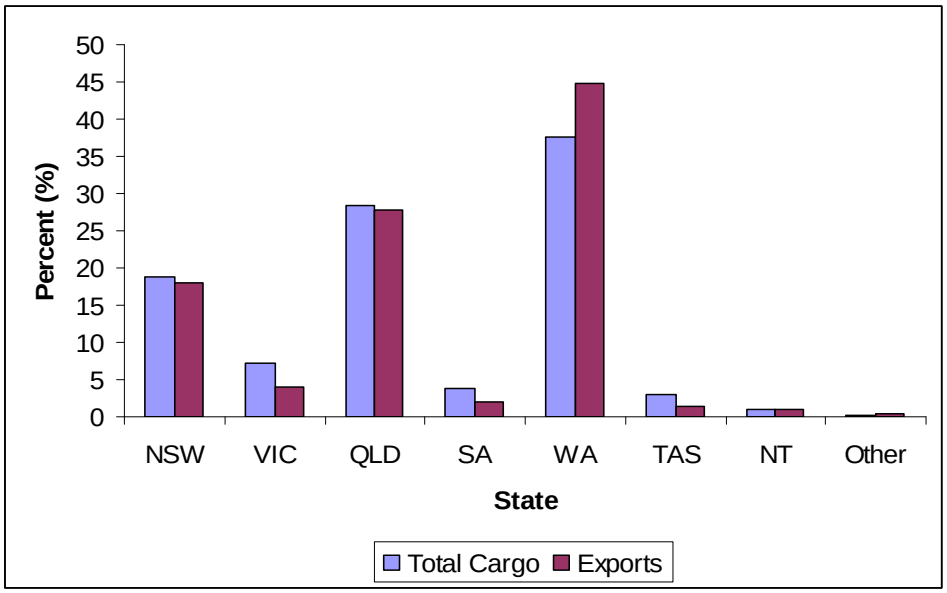
4.1.2 National activity

Ports are an essential component of Australia's transport network and trade activities, emphasised by the fact that approximately 99 per cent of Australia's trade, by volume, is carried by sea (National Oceans Office 2002). Ports play a vital role in the movement of import and export cargo and, to a lesser extent, passengers. Port activities generate employment and revenue for local populations and as such have been an important factor in the development and expansion of many coastal communities. For these reasons, ports are critical to the functioning of the nation's economy (Bureau of Transport Economics 2000). Ports also provide secure anchorages for commercial fishing fleets and recreational vessels (National Oceans Office 2002).

The majority of Australia's ports are owned by state/territory governments and are managed by port authorities or corporations that operate on a commercial basis. These authorities are usually autonomous agencies operating under their own legislation (Department of Planning and Infrastructure 2004). While state and territory governments and the private sector are mainly responsible for provision of port infrastructure, all levels of government receive revenue from taxes and charges on port activities (Bureau of Transport Economics 2000). In May 2005 the Australian Government announced a plan to take regulatory control of some of Australia's principal export ports from the states/territories and replace the state port regulators with a national body, with the goal of improving investment and infrastructure (Kennedy 2005).

The number of ship calls at Australian ports was 23 454 in 2002–03, an increase of 9.8 per cent from 2001–02. The number of international voyages made to Australia also increased over this timeframe by 1.8 per cent (Bureau of Transport and Regional Economics 2005a). During this period, 712 million tonnes of cargo moved through Australian ports, an increase of 6.2 per cent from 2001–02. Of this cargo, 76.1 per cent was international exports, and 8.9 per cent international imports, while coastal cargo represented 15 per cent. Of the 106.3 million tonnes of coastal cargo handled in 2002–03, 52.8 million tonnes was loaded and 53.5 million tonnes was discharged. The majority (87.6 per cent) of coastal cargo was bulk cargo, or cargo that can be poured or dropped into a ship's hold without being damaged. A large proportion of cargo handled was concentrated in Western Australia, Queensland and New South Wales (Figure 4.1). These states were also the most significant in terms of exports (Bureau of Transport and Regional Economics 2005a).

Figure 4.1 Percent of total cargo handled, and total exports by state, 2001–02



(Source: Bureau of Transport and Regional Economics, 2005a)

International sea freight was valued at a total of $188.4 billion dollars in 2003 and had a gross weight of 591.6 million tonnes. Australia's principal export by value is coal, followed by petroleum products, confidential items, iron ore and concentrates, meat, transport equipment and cereals. Coal and iron are the leading exports in terms of weight; machinery is the main import by value, followed by road vehicles. Petroleum products and chemicals dominate imports by weight (Bureau of Transport and Regional Economics 2005a). The nation's biggest trading partner in terms of import and export value is Japan, with China and the United States following. Since 1999–2000, trade with China has increased, whilst trade with the United States has declined. Australia's regional neighbours (New Zealand, Indonesia and Papua New Guinea) are also important trading partners (Bureau of Transport and Regional Economics 2005a). Europe is Australia's largest supplier of imports in terms of value ($21.32 billion), while South-east Asia is the predominant source of imports by weight (22.74 million tonnes). Australia's dominant export market by weight (276.63 million tonnes) and value ($28.47 billion) is Japan/north Asia (Bureau of Transport and Regional Economics 2005a).

4.1.3 Regional activity

There are 21 ports within the South-west Marine Region, of which 20 are currently in operation (Figure 4.2). Other smaller ports in the region that are no longer open provide access for recreational boats and marine tour operators as well as providing a harbour for fishing vessels.

Within the Western Australian section of the SWMR are the following ports: Albany, Esperance, Bunbury, Fremantle, Geraldton and Useless Loop. These are state owned and managed by port authorities operating under their individual legislative Acts (Department of Planning and Infrastructure 2004). The majority of exports from Western Australian ports are transported to Japan (21 per cent), China (14.2 per cent) and the Republic of Korea (9.6 per cent), whilst the largest suppliers of imports are the United States (11.9 per cent) and Japan (11.1 per cent) (Department of Foreign Affairs and Trade 2005a).

In South Australia, seven of the major ports in the region are managed privately by Flinders Ports: Port Adelaide, Port Lincoln, Port Pirie, Port Giles, Thevenard, Klein Point and Wallaroo. These ports handle a variety of containerised, bulk and break-bulk cargoes (Flinders Ports 2004). The remaining eight ports (Port Bonython, Whyalla, Ardrossan, Kingscote, Penneshaw, Cape Jervis, Ballast Head and Stanvac) are managed under a variety of arrangements, usually involving some form of public–private partnership. Port Stanvac was operational until 2003, but is included in this discussion as it may be reopened in the future. The bulk of South Australia's exports are destined for the United States (17.3 per cent), followed by the United Kingdom (11.3 per cent) and Japan (8.9 per cent). The state's principal suppliers of imports are Japan (16.1 per cent) and Singapore (12.8 per cent) (Department of Foreign Affairs and Trade 2005b).

Figure 4.2 Major and minor ports in the SWMR

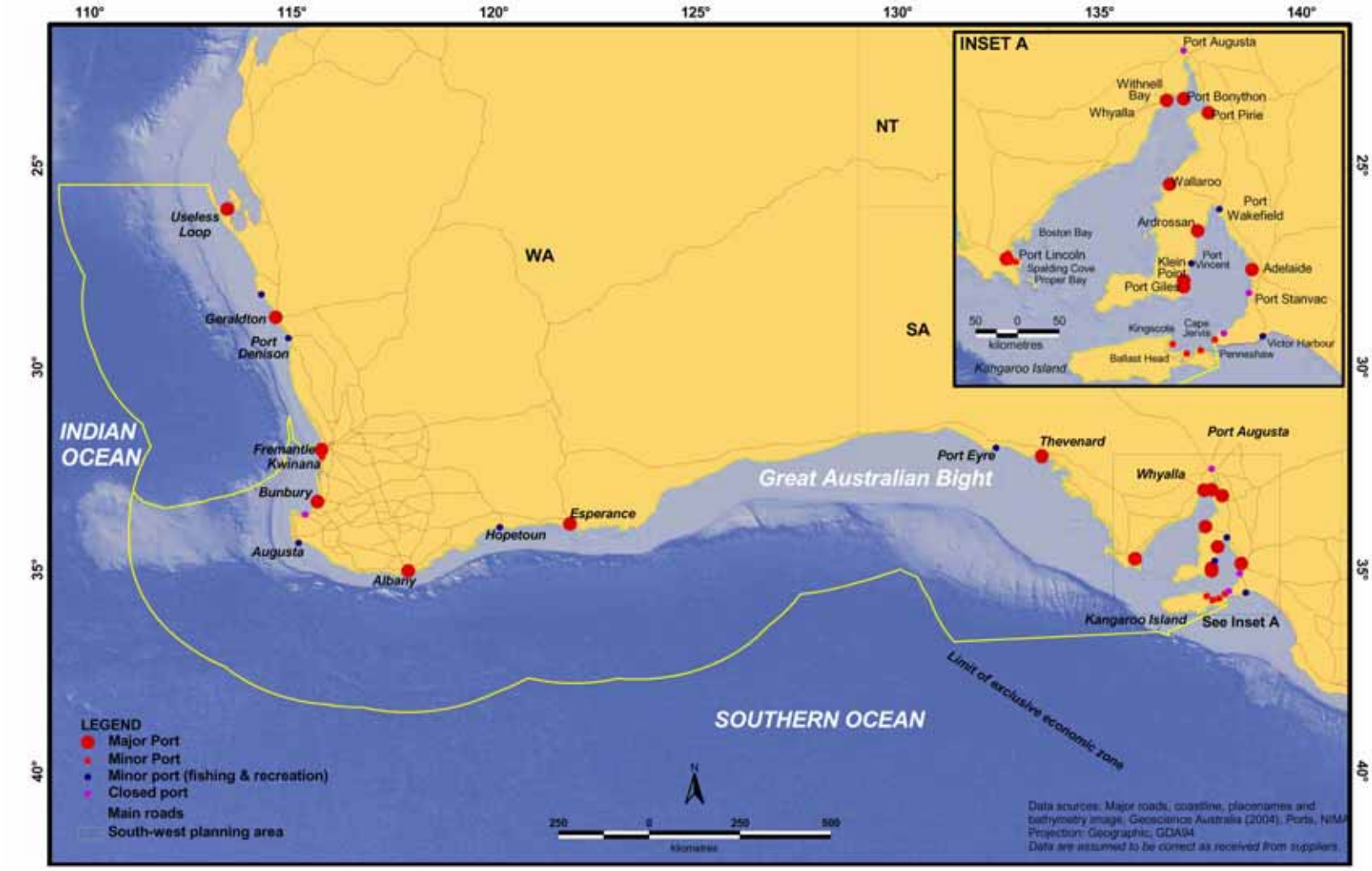
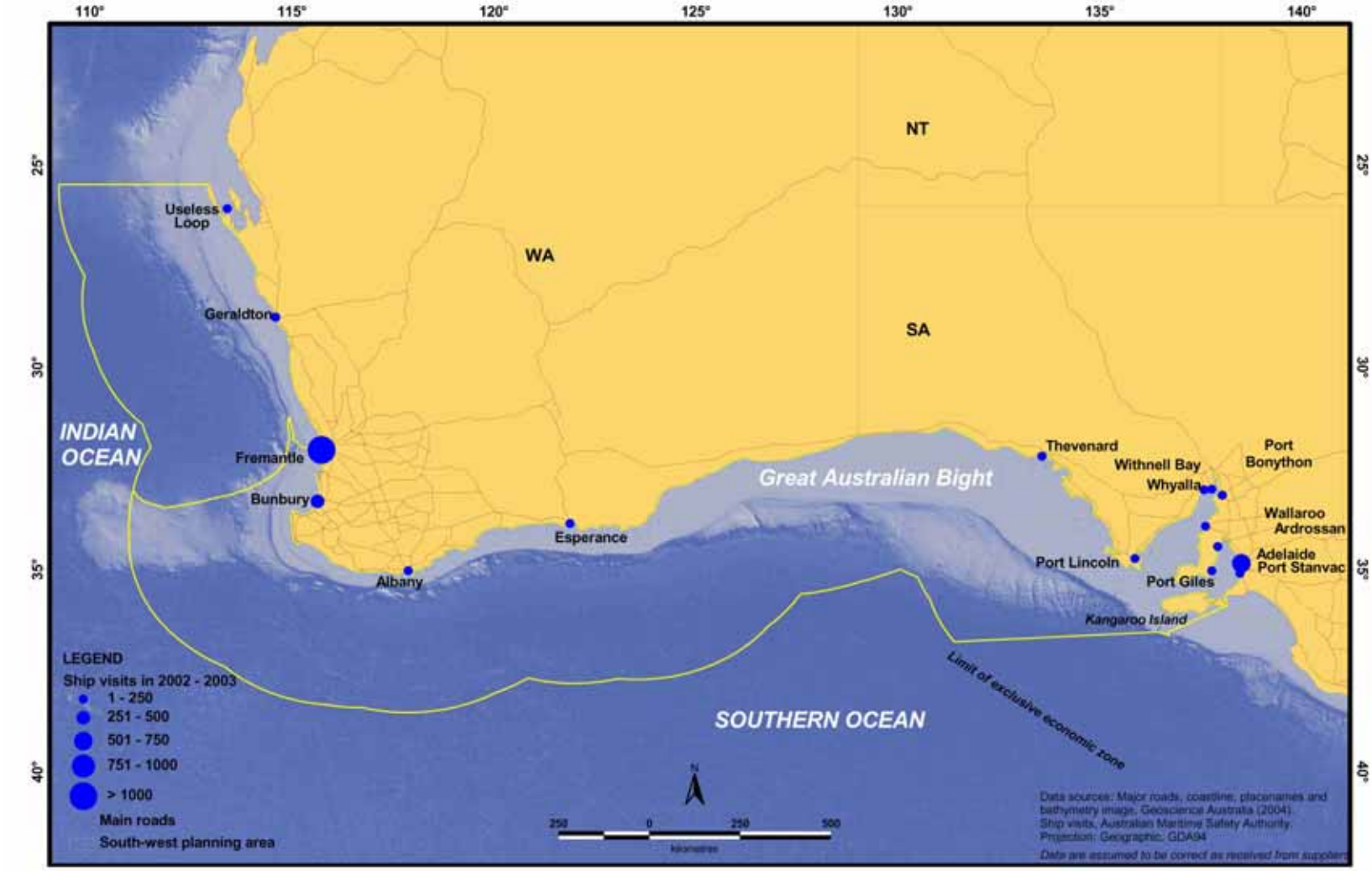


Figure 4.3 Ship visits to major ports in the SWMR



4.1.4 Western Australian ports

Table 4.1 Summary of main port activity Western Australian section of the SWMR, 2002–03

Port	Operated by	Total coastal cargo (tonnes) 2002–03	Total imports/ exports (tonnes) 2002–03	Total imports/ exports ($'000s) 2002–03	No. of ship visits to port 2002–03	Major exports/imports
Albany	Albany Port Authority	97 395	1 830 610	428 303	95	Exp: wheat, woodchips Imp: fertilisers
Bunbury	Bunbury Port Authority	501 631	10 427 430	2 344 314	321	Exp: alumina, woodchips, mineral sands Imp: caustic soda
Esperance	Esperance Port Authority	363 979	5 766 803	841 969	141	Exp: nickel, iron ore, grain. Imp: fuel, fertilisers
Fremantle	Fremantle Port Authority	6 361 553	17 881 561	15 356 115	1594	Exp: grain, alumina, refined petroleum Imp: crude petroleum
Geraldton	Geraldton Port Authority	189 085	2 302 732	935 337	215	Exp: grains, iron ore, mineral sands Imp: petroleum products, fertilisers
Useless Loop	Shark Bay Salt Joint Venture	0	1 117 795	24 438	10	Exp: Salt

(Source: Albany, Bunbury, Esperance, Geraldton & Fremantle Port Authorities 2004, Bureau of Transport and Regional Economics 2005)

The Port of Albany

The Port of Albany is located on the south-west coast of Western Australia. Albany was initially settled as a garrison town and base for sealing and whaling in 1826. Before the Port of Fremantle had its facilities upgraded at the start of the twentieth century, Albany was the primary port for Western Australia, with goods and passengers being transported from Perth by rail and road (Department of Planning and Infrastructure 2004). Today the main commodity exported from Albany is grain (mostly wheat), which is grown in the Great Southern agricultural region. One of Albany's main imports is fertiliser for agricultural production (Albany Port Authority 2004, Department of Planning and Infrastructure 2004). Albany is set to expand with the more recent export of woodchips from local blue gum plantations; this trade is anticipated to expand significantly over the next few years. A $100 million commitment from Corporate Bulk Handling to upgrade their grain facility will also increase future activity (Department of Planning and Infrastructure 2004).

The Port of Bunbury

The Port of Bunbury is located 185 kilometres south of Perth. It is one of Western Australia's main exporting ports, and has recorded an almost four-fold increase in throughput over the last two decades. Bunbury is the world's largest exporter of alumina, with over eight million

tonnes exported for the year ending June 2004. Woodchips and mineral sands are other major export commodities. The main import to Bunbury is caustic soda, with over 900 000 tonnes imported in 2003–04 making up more than 85 per cent of total imports for that year (Bunbury Port Authority 2004, Department of Planning and Infrastructure 2004).

Esperance Port

Esperance Port is located approximately 720 kilometres to the south-east of Perth. The port developed following the discovery of gold in the Kalgoorlie area in 1890s and expanded to service agricultural production that started in the surrounding region in the 1920s. In the 1960s the port developed rapidly following the discovery of nickel in the area, and in 1995 began exporting iron ore. Esperance is now the biggest exporter of nickel concentrates in the southern hemisphere. Exports of nickel are expected to increase substantially by 2007 as a result of a BHP nickel and cobalt mine being developed at Ravensthorpe (Department of Planning and Infrastructure 2004). Upgrades of the Esperance Port in 2002 resulted in the port becoming the deepest port in southern Australia, and also enabled an increase in iron ore and grain exports. The main imports at Esperance are fuel and fertilisers (Department of Planning and Infrastructure 2004, Esperance Port Authority 2004).

Plate 4.1 Iron ore loading at Esperance Port, Western Australia

(Source: Department of the Environment and Water Resources)

The Port of Fremantle

The Port of Fremantle was built in 1829 to service the developing colony on the Swan River. It is made up of the Inner Harbour and the Outer Harbour. The Inner Harbour was opened in 1897 and is situated next to the City of Fremantle at the opening of the Swan River. The Outer Harbour, which is located 20 kilometres south at Cockburn Sound, was built in 1955 to service the Kwinana industrial area, which underwent a rapid expansion in the 1960s and 1970s. Today Fremantle is the main general cargo port for Western Australia and is vital to the state's economy, with total trade through the port worth more than $15 billion per year, and with six thousand jobs created as a result. In 2003 Fremantle's trade accounted for over 90 per cent by value of the state's sea-based imports and almost 30 per cent of sea-based exports (Western Australian Planning Commission 2004). The primary trade serviced by the Inner Harbour includes container trade, livestock exports, motor vehicle imports, and other general cargo; the Inner Harbour is also a port for cruise ships and navy vessels. The Outer Harbour handles bulk cargo including alumina, petroleum, grain, liquefied petroleum gas,

fertilisers, mineral sands and other bulk commodities. Whilst the capacity of the Inner Harbour is not expected to be realised for another 10 years or so, plans are currently in place to expand the Outer Harbour to cope with any overflow (Department of Planning and Infrastructure 2004). In 2003–04 Fremantle's principal export commodity was grain, followed by alumina and refined petroleum. Crude petroleum made up almost half (46.4 per cent) of the major imports for this period (Fremantle Port Authority 2004).

The Port of Geraldton

The Port of Geraldton is located approximately 400 kilometres north of Perth and is one of the busiest regional ports in Australia (Department of Planning and Infrastructure 2004). The first export from Geraldton was lead ore in 1849. The port is critical to the area's economy and supports the export of commodities from the agriculture, fishing and mining industries. Some of the exports include grains, iron ore, mineral sands, talc, copper/zinc concentrates, garnet and livestock. Petroleum products and fertilisers are two of the main imports (Department of Planning and Infrastructure 2004). Geraldton Port underwent a major $103 million enhancement in 2003 that involved deepening the harbour basin and channel allowing some Panamax and all Handymax size vessels to be fully loaded at Geraldton. Following completion of the project, benefits to the local economy were being realised; with the deepening of the harbour, vessels were no longer departing the port only partially full to be loaded with more cargo in southern ports. This project also enabled iron export trade to return to Geraldton Port, which is expected to expand in coming years (Geraldton Port Authority 2004).

Useless Loop

The northernmost port in the Western Australian section of SWMR is Useless Loop, located 675 kilometres north of Perth. The Useless Loop townsite is a closed mining town run by Shark Bay Salt Joint Venture. Shark Bay Salt exports the purest grade salt from the Useless Inlet solar salt fields. These salt fields have been in operation since 1967. Western Australia is responsible for about 97 per cent of Australia's salt production and is the nation's major exporter of salt; Shark Bay Salt produces around one million tonnes of salt each year (Department of Industry and Resources 2004, Centre for Water Research 2005).

4.1.5 South Australian ports

Table 4.2 Summary of main port activity within the SWMR, 2002–03

Port	Operated by	Total coastal cargo (tonnes) 2002–03	Total imports/ exports (tonnes) 2002–03	Total imports/ exports ($'000s) 2002–03	No. of ship visits to port 2002–03	Major exports/imports
Adelaide	Flinders Ports	3 567 966	7 169 495	7 228 203	729	Exp: wine, meat, flour, fruit, metals, Imp: timber, sulphur, paper, fertiliser, iron
Ardrossan	ABB Grain	541 968	66 600	680	18	Exp: grain
Klein Point	Flinders Ports	1 775 290	No data	No data	No data	Exp: Limestone
Port Bonython	Santos	456 757	626 502	295 377	27	Exp: naphtha, crude oil, propane, butane
Port Giles	Flinders Ports	46 393	No data	No data	26	Exp: grains, seeds Imp: crude petroleum
Port Lincoln	Flinders Ports	145 656	1 580 879	493 949	90	Exp: grains, seeds Imp: fertiliser, petroleum products
Port Pirie	Flinders Ports	659 901	376 814	161 970	79	Exp: zinc, lead Imp: minerals, coals, ore
Port Stanvac	Mobil Oil	No data	No data	No data	No data	Exp: oil products
Thevenard	Flinders Ports	1 183 920	424 786	42 384	96	Exp: gypsum, grains, seeds, salt Imp: fertilisers
Wallaroo	Flinders Ports	98 124	419 972	119 018	41	Exp: seeds, grains Imp: fertilisers
Whyalla	One Steel (formerly BHP)	2 423 285	366 641	30 622	62	Exp: iron ore and steel products

(Source: Flinders Ports 2002, Bureau of Transport and Regional Economics 2005)

Port Adelaide

Port Adelaide was one of the earliest settlements in South Australia and today services the bulk of shipping in the state (Flinders Ports 2002). It acts as an international access point for the state's export activity, and is experiencing an ongoing growth in the export of grains, wine, motor vehicles and components, ores and concentrates. Port Adelaide has undergone a significant increase in container trade and now handles 96 per cent of all container cargoes transported out of South Australia (Flinders Ports 2002). The port is comprised of an inner and outer harbour. Bulk and break-bulk cargoes are handled through the Inner Harbour. Export commodities include wine, meat, grains, flour, fruit, wool, cement clinker, iron and steel scrap, tallow, soda ash, non-ferrous metals and a large range of manufactured products. Timber, sulphur, refined petroleum, paper and related products, fertiliser, iron and steel, and motor vehicles and components are some of the cargoes that are imported (Flinders Ports 2002). The Outer Harbour is comprised of four berths designed to cater for specialised cargo; the Outer Harbour is also the site of the Adelaide Container Terminal. There is a motor vehicle berth that handles roll-on roll-off trade, a passenger terminal and facilities to deal

with livestock and general cargo. The Adelaide Container Terminal is designed to enable the quick turnover of cargo and is linked to the national road and rail system to facilitate effective movement of goods (Flinders Ports 2002).

Ardrossan

Established in 1878, the port at Ardrossan is one of the oldest in South Australia. Ardrossan is situated on the eastern coast of Yorke Peninsula and has a population of around 1000. For a number of years it was used by BHP to export dolomite mined near the town but today it is the principal eastern port on the peninsula servicing the mining and grain sectors (NetYP 2000, Wilkins Tourist Maps 2001). The port is now operated by ABB Grain Ltd, and has the third largest grain handling facility in South Australia. The facility is capable of handling in excess of 250 000 tonnes of grain. The port also hosts a number of passenger vessels, with services linking Port Adelaide twice a week.

Klein Point

Nearby Ardrossan on the south-eastern coast of the Yorke Peninsula is Klein Point, a single-purpose, restricted access facility used for the export of limestone. In 2002–03 it had exports of 1.7 million tonnes.

Port Giles

Another port located approximately 200 kilometres from Adelaide is Port Giles, on the eastern side of Yorke Peninsula. The port was developed to export grain and seed from the lower half of the peninsula. In 2003–04, 720 210 tonnes of cargo were exported, almost double the previous year's exports, but on par with those recorded for the 2000–01 financial year, most likely reflecting annual fluctuations in harvests (Australian Association of Port and Marine Authorities 2003a).

Port Lincoln

Port Lincoln is located on the southern point of the Eyre Peninsula around 680 kilometres west of Adelaide. The port is based around a natural deepwater harbour, which makes Port Lincoln attractive to large bulk grain carriers. Those vessels that originate from some of the shallower ports in South Australia and Victoria use the deeper water Port Lincoln to top up their loads. The main export commodities for the port are grains and seeds, while fertiliser and petroleum products are the principal imports (Flinders Ports 2002). The port is also the base for a significant fishing industry.

Port Pirie

Port Pirie is 223 kilometres north of Adelaide. The town has a population of over 16 000. One of the world's biggest smelters, Zinifex Port Pirie Smelter, is situated at the port and produces significant amounts of zinc concentrates and lead for export. Like Port Lincoln, grains and seeds are also important export commodities for Port Pirie, whilst the major imports are minerals, coals and ores (Flinders Ports 2002).

Port Stanvac

Close to Adelaide is Port Stanvac, which was underpinned by the oil industry. In 1958, Mobil Oil released plans to construct an oil refinery at the port, which was in operation by 1963

(Mobil no date). The refinery was closed in 2003, but is being maintained in a state that would enable operations to be recommenced if deemed viable in the future (Roarty & Barber 2004).

Port Thevenard

The Port of Thevenard is situated three kilometres from the town of Ceduna (population around 4000) and is the westernmost South Australian port. The principal commodities exported through the port include gypsum, grains, seeds and salt and fertilisers are the major import.

Wallaroo and Port Bonython

Several of the South Australian ports are located in the Spencer Gulf. Wallaroo is located on the eastern side of the gulf and has a small population of around 2500. The bulk of activity at Wallaroo is export trade (90.2 per cent), with the principal exports being seed and grain; fertiliser is the main import (Flinders Ports 2002, Australian Association of Port and Marine Authorities 2003a). Port Bonython is situated on the west coast of the Spencer Gulf, and is owned by Santos, an Australian oil and gas company. The port was constructed as a shipping terminal to export products such as naphtha, crude oil, propane and butane. Liquid hydrocarbons are mixed at Moomba and sent through a 659-kilometre underground pipeline to Port Bonython where the liquids are processed via distillation at the Santos fractionation plant into their various components. Approximately 25–30 ships are loaded annually with a maximum tanker capacity of 110 000 tonnes (Santos 2005, Tourism Eyre Peninsula 2005).

Whyalla

South of Port Bonython is Whyalla, a privately operated commercial port. In the late nineteenth century the town was effectively established by BHP (now One Steel) as a port from which to transport iron ore. Between 1938 and 1840, BHP dredged a harbour and developed a blast furnace and shipyard. From 1941–78 Whyalla was the largest ship-building port in Australia, constructing 63 ships. Today One Steel exports iron ore and steel products including railway lines and rolled steel joists (The Sydney Morning Herald 2004).

Other South Australian Ports in the region

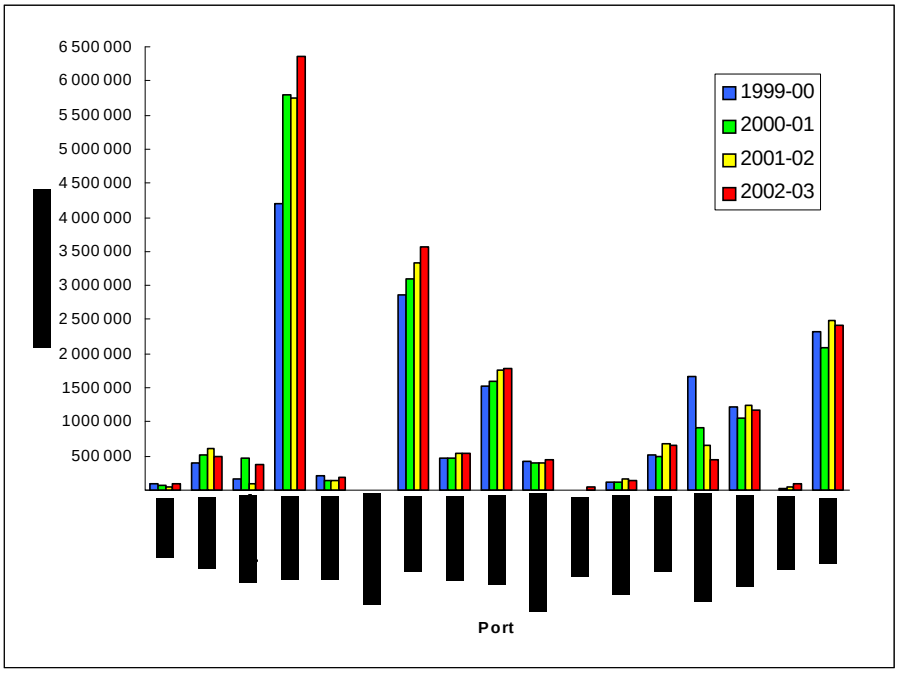
The remaining operational ports in South Australia are located on Kangaroo Island. Kingscote is the largest town on the island and was the site of first free settlement in Australia (Tourkangarooisland.com.au no date). Today the port provides access to the island for freight and passenger ferries (Office of Infrastructure Development 2005). Penneshaw can be found on the north-east coast of Kangaroo Island on Dudley Peninsula and is 16 kilometres from the mainland separated by Backstairs Passage. This port is predominantly used by vehicle and passenger ferries running daily services to and from Cape Jervis, on the tip of the Fleurieu Peninsula (Tradeway.com.au no date). Ballast Head is located on the north-eastern side of the island and new facilities are being considered to service the blue gum plantation industry (Office of Infrastructure Development 2005).

4.1.6 Economic dimensions

Volume and value of port activities

Of the ports in the SWMR, Fremantle and Adelaide handle the largest volumes of coastal cargo (Figure 4.4). At Fremantle over six million tonnes of cargo was handled in 2002–03, representing a relatively even spread between cargo loaded and discharged. For this same period the amount of cargo discharged at Adelaide was more than two and half times the amount of cargo that was loaded. Klein Point and Whyalla also handled large volumes of coastal cargo. No coastal cargo was handled at Useless Loop in Western Australia between 1999–2000 and 2002–03.

Figure 4.4 Total volume of coastal cargo handled by ports in the SWMR, 1999–2000 to 2002–03

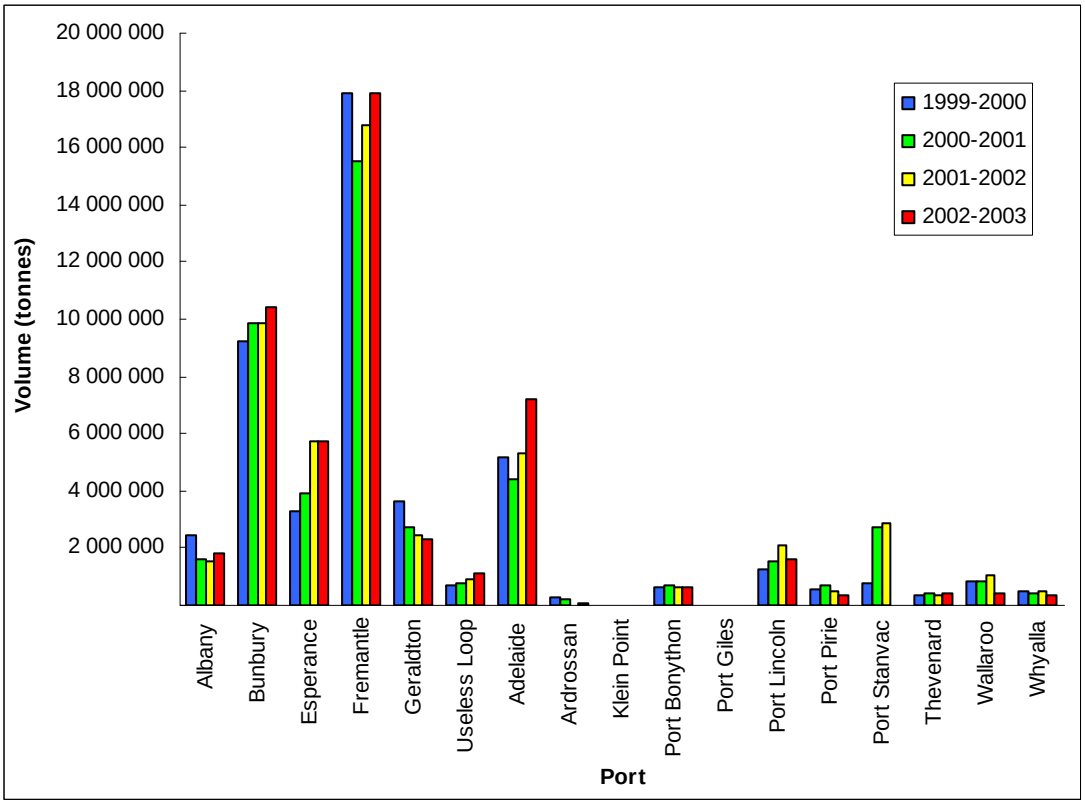


(Source: Bureau of Transport and Regional Economics 2002–2005a)

In 2002–03 the total volume of international sea freight loaded and discharged by ports within the SWMR exceeded 50 million tonnes (Figure 4.5). The majority of international cargo was loaded and discharged at the Port of Fremantle, followed by Bunbury, Adelaide and Esperance. This reflects the fact that Western Australia in 2002–03 was again the largest exporting state (by weight and value) (Bureau of Transport and Regional Economics 2005a).

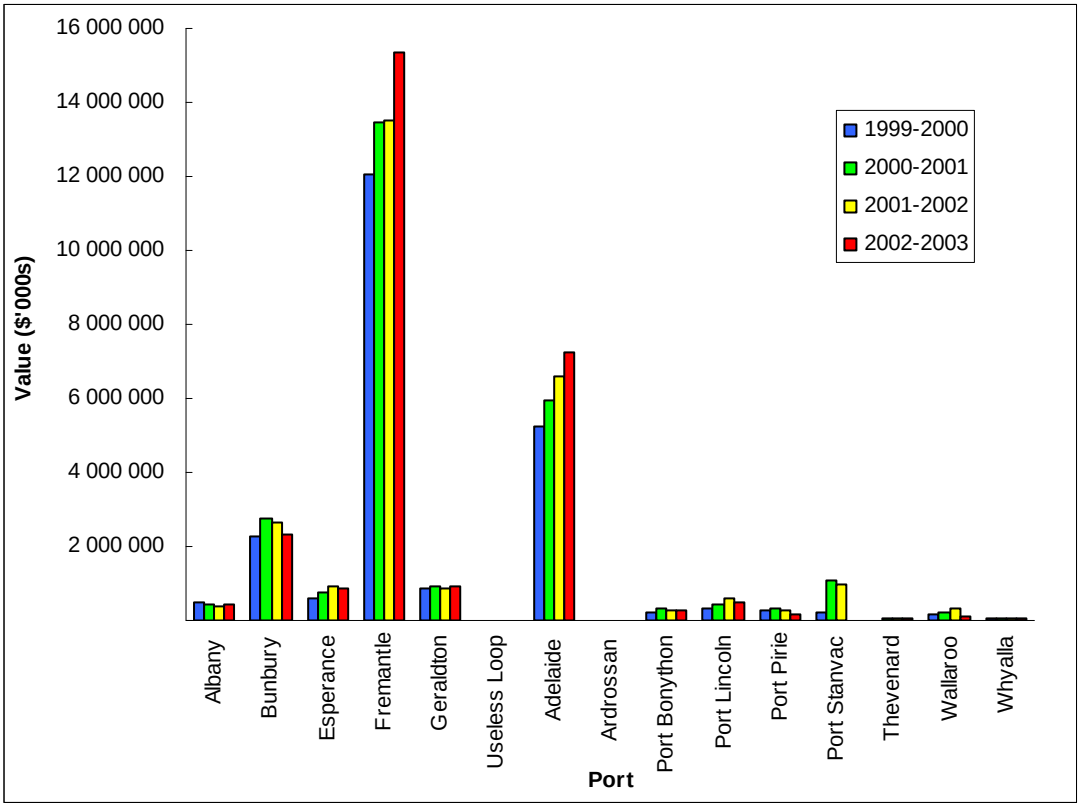
The value of imports and exports from ports within the SWMR has grown from $22.9 billion in 1999–2000 to over $28.3 billion in 2002–03, highlighting the importance of the port industry to this region. Again the highest value of cargo was moved through Fremantle and Adelaide reflecting the high volume of imports and exports. Whilst Bunbury had one of the highest volumes of cargo movement, the value of this was quite low, largely because the commodities represented low-value raw materials (e.g. woodchips) and minerals (e.g. alumina) (Figure 4.6).

Figure 4.5 Total volume of international sea freight handled by ports in the SWMR, 1999–2000 to 2002–03



(Source: Bureau of Transport and Regional Economics 2002-2005a)

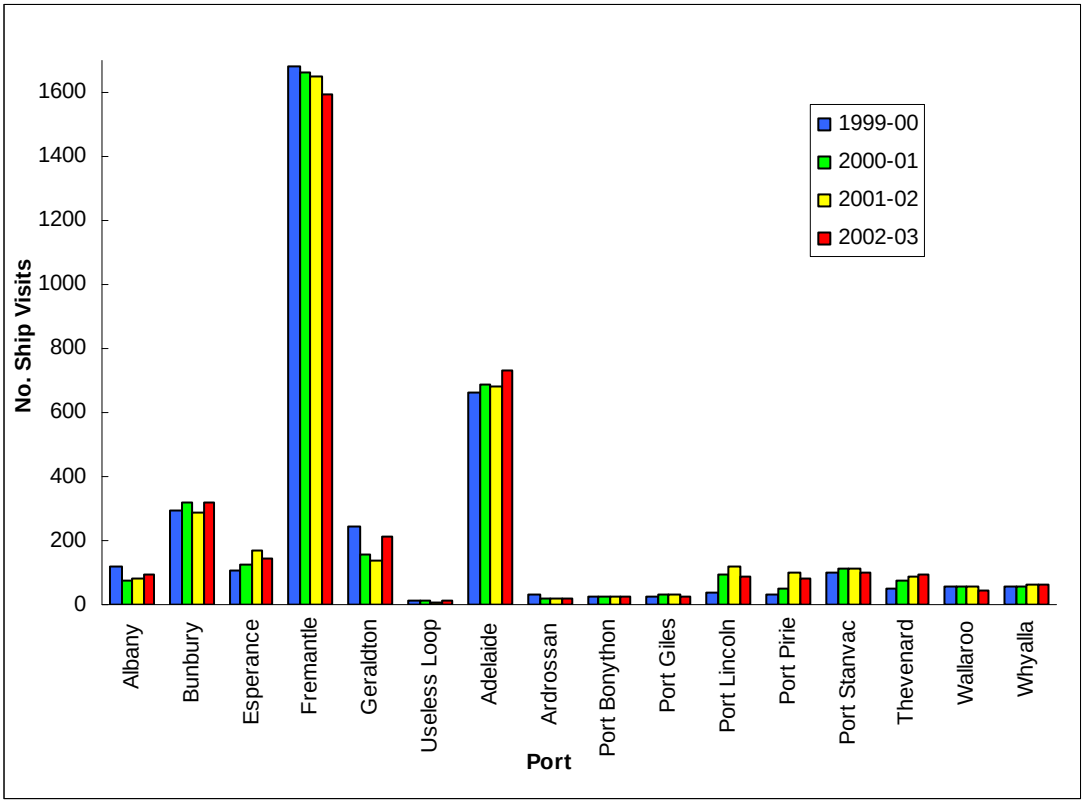
Figure 4.6 Total value of international sea freight handled by ports in the SWMR, 1999–2000 to 2002–03



(Source: Bureau of Transport and Regional Economics 2002–2005a)

In terms of activity, in 2002–03 the busiest port in the region was Fremantle, which received a total of 1594 visits by ships (this may include more than one visit by the same ship); however, this number represented a slight decline on the previous three years. Adelaide, the second busiest port, showed a reverse trend with numbers on the rise over the four-year period to 2002–03, with a total of 729 ship visits (Figure 4.7). The trend in the total number of ships calling at the ports in the region was very similar.

Figure 4.7 Number of port calls made by ships involved in coastal and international voyages to ports in the SWMR, 1999–2000 to 2002–03



(Source: Bureau of Transport and Regional Economics 2002–2005a)

Regional and national economic importance

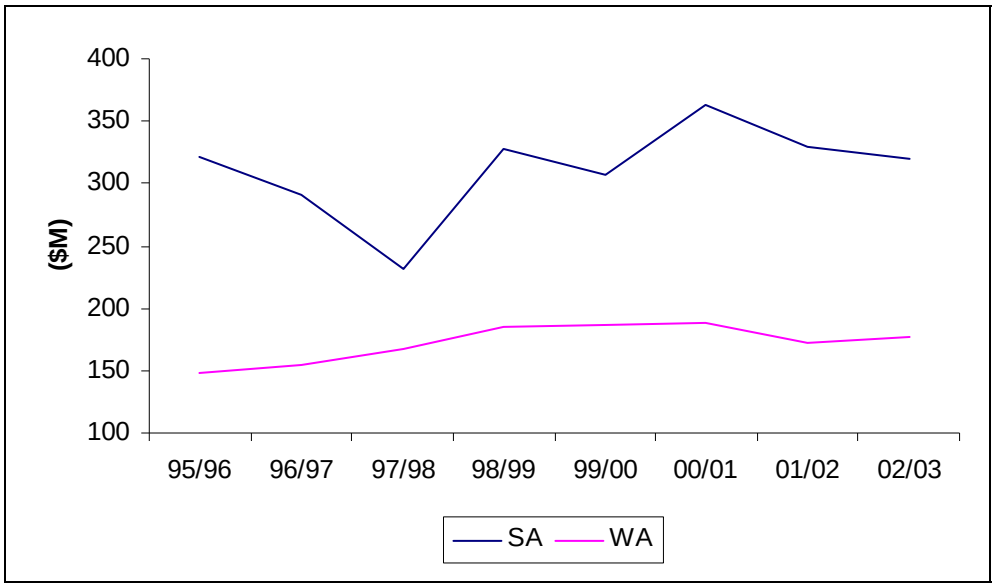
Because ports are key facilitators of economic activity, it is difficult to calculate all the economic benefits that flow from port activities. However, estimates can be calculated on those industries directly related to port activities such as (Allen Consulting Group 2004):

- stevedoring
- water transport terminals
- port operation
- other services to water transport.

For Australia as a whole, in 2002–03 port-based activities were the third largest marine industry by added value, contributing 6.4 per cent of the national marine industry value added total of $1.7 billion (Figure 4.8). In the same year, the indirect flow-on effects of port activity into other related business amounted to $1.9 billion (4.1 per cent of the national marine industries total).

In the SWMR, port activity in 2002–03 generated around $ 236 million in direct added value. Figures suggest that each unit of port added value generates a multiplier effect of around 1.10 through inducing other activities in the wider economy such as services provided to port based businesses. As a result, the total direct and indirect added value for port activities in the region was around $495 million.

Figure 4.8 Direct and indirect added value in South Australian and Western Australian port-based industries, 1995–96 to 2002–03



(Source: Allen Consulting Group 2004)

The importance of ports to local and regional economies is demonstrated by an economic impact assessment undertaken for the Port of Fremantle in 2000 covering the financial year 1998–99 (Fremantle Port 2000). In that year, port activities at Fremantle were estimated to provide the following economic benefits:

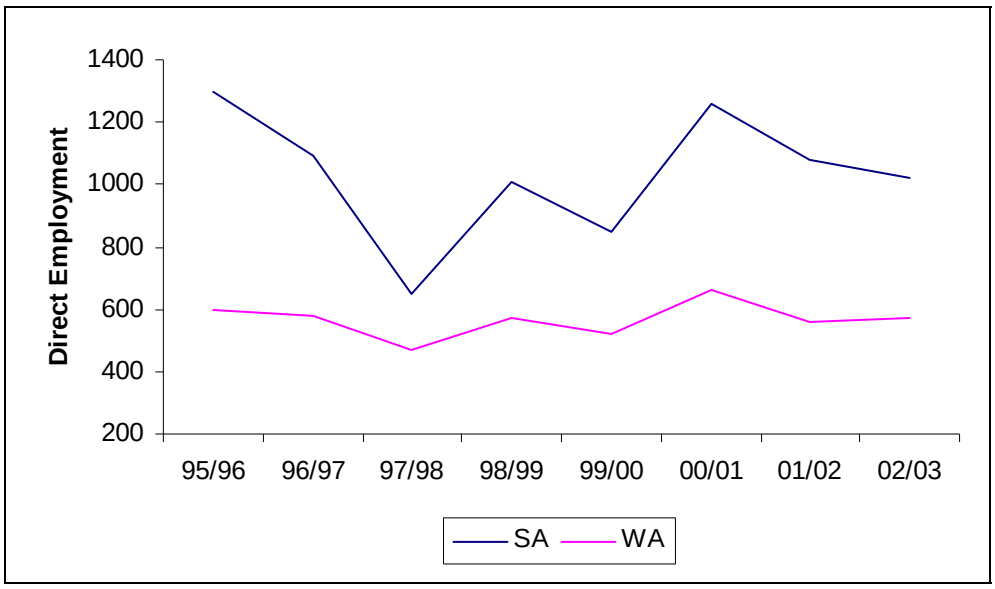
- economic output of port activities (excluding the value of cargoes) – $728 million
- household income – $223 million
- payments to government (taxes and other payments) – $125 million.

Employment

It is difficult to determine exact figures for the number of people employed in the port industry within the SWMR. Stevedoring and port operating are two categories of employment that can be attributed directly to the industry. Figures indicate that port-based industries are generally a small employer within the marine industries (Allen Consulting Group 2004). In 2002–03 the port industry contributed 4.6 per cent of marine industry direct employment and 4.2 per cent of marine industry indirect employment. Between 1996–96 and 2002–03, employment in port-based industries grew by an average of two per cent per year, which is slightly higher than across the marine industries as a whole (1.4 per cent per year). While the trends reported by the Allen Group are national, it is likely that broadly similar trends affected South Australia and Western Australia.

In total, stevedoring and port-operating within the region directly employed 1500 people in 2002–03, and indirectly generated employment of around 3700 people. These figures are made up of 3500 people directly and indirectly employed in South Australia and around 1900 directly and indirectly employed in Western Australia.

Figure 4.9 Direct employment in port-based industries in South Australia and Western Australia, 1995–95 to 2002–03



(Source: Allen Consulting 2004)

4.1.7 Management arrangements

Within the SWMR the responsibility for regulating and managing ports rests with the state governments. In general, the operation of ports lies with port authorities or corporations. In the Western Australian section of the SWMR there are four port authorities (Albany, Bunbury, Esperance and Geraldton), and Fremantle Ports which is a government trading enterprise. Ports in Western Australia operate under the *Port Authorities Act 1999* and are responsible to the Minister for Planning and Infrastructure. Port authorities are responsible for the development and maintenance of port facilities, the coordination and management of transport logistics, land management, and the ensuring of safety and security, and compliance with relevant planning and environmental management regulations.

Since 2000, the situation in South Australia has been somewhat different from that of Western Australia following the privatisation of port operations. For example, Port Adelaide, Port Lincoln, Port Pirie, Thevenard, Walleroo, Port Giles and Klien Point are all operated by Flinders Ports, a private consortium. The disposal of port facilities and their subsequent management are governed by the *South Australian Ports (Disposal of Maritime Assets) Act 2000*. As in Western Australia, the main role of the port corporation is to ensure the development of port facilities and the efficient movement of goods and commodities. In both Western Australia and South Australia, the port authorities/corporations are regulated by independent departments or agencies, rather than by the ports themselves.

While port facilities are a primarily a responsibility of state governments, the Australian Government also plays an important role. The Australian Maritime Safety Authority (AMSA), for example, regulates ship safety and provides navigational aids. Other Australian Government agencies include the Australian Customs Service and the Australian Quarantine and Inspection Service, both of which play a role in regulating and controlling imported goods.

4.2 Shipping

4.2.1 Industry objectives

Within Australia, foreign shipping companies predominantly service the movement of goods by sea. While there are over 9000 Australian-owned commercial or trading ships, the main Australian-owned trading fleet consisted of only 74 Australian-owned vessels in 2002–03. The key objective of the shipping industry is the efficient and safe transport of goods and services, and the facilitation of trade (ALIS 2002). Moreover, the Australian Shipowners Association, which "works to promote the interests of Australian ship owners and operators, ship managers and towage operators" (ASA 2005), includes the following objectives:

- ensuring that users of shipping can access cost-effective shipping services
- ensuring that Australians operating in Australia's interstate and intrastate sea transport industry are subject to the same regulatory regime as that applied to foreign entities operating in the Australian interstate and intrastate transport industry
- ensuring that Australians can participate in the global shipping industry in a way that reflects world best practice in the world shipping industry and that they can do so in Australia to the benefit of the Australian economy
- ensuring that Australia's defence capability has access to a merchant navy which is based on Australians who have been trained to appropriate international standards in ship operations, ship management and ancillary maritime skills
- ensuring that Australia's whole maritime infrastructure grows as a result of removal of anti-competitive regulatory constraints on Australian industry.

In addition, the Department of Industry, Tourism and Resources 2004 released the *Marine Industries Action Agenda Discussion Paper* in 2004. This discussion paper highlights the need for marine industries to remain globally competitive and to develop new markets to ensure growth. Other key objectives include:

- improving innovation across the marine industry
- improving the quality of training and addressing skills shortages
- expanding research and development in the industry
- improving awareness of the economic and social significance of the marine industries.

4.2.2 National shipping activity

Shipping in Australia encompasses the movement of cargo, international trade and passenger services. With Australia's extensive coastline and Exclusive Economic Zone covering some 10 million square nautical miles, it is not surprising that Australia is the fifth largest user of shipping services (in terms of tonnes per kilometre) in the world, with around 99 per cent of trade carried by ship (National Oceans Office 2002). Shipping is fundamental to Australia's economy; the value of Australia's seaborne trade was worth over $180 billion in 2003–04, a slight decline from 2002–03 (Australian Shipowners Association 2004). Australia's share of the global sea trade (measured in tonnes) increased from 9.5 per cent in 2001–02 to 9.8 per cent in 2002–03. The shipping industry itself earns in excess of $1.2 billion dollars annually

and directly employs over 4000 Australians (My Future 2003). Australia's three major export commodities are coal, non-monetary gold, and iron ore. The three largest import commodities are passenger motor vehicles, crude petroleum, and computers (Department of Foreign Affairs and Trade 2005c).

Over 9000 Australian-owned commercial or trading ships (of 24 metres or more in tonnage length) are registered (Australian Bureau of Statistics 2003a). However, the main trading fleet consisted of only 74 vessels in 2002–03, of which 55 were major trading vessels (deadweight tonnes over 2000) and 19 were minor trading vessels (150–2000 deadweight tonnes). Sixty-two of these vessels were Australian registered and 12 were overseas-registered vessels (Bureau of Transport and Regional Economics 2005a).

The number of ships entering Australia from overseas has increased slightly over the last eight years, whilst the number of voyages to Australia by passenger ships from overseas has declined marginally. The number of ship calls at Australian ports has increased to slightly more than 23 400 (Bureau of Transport and Regional Economics 2005b) (Table 4.3).

Table 4.3 Summary of Australian shipping activity, 1998–99 to 2003–04

Year	Number of ships entering Australia from overseas[a]	Number of voyages into Australia from overseas	Number of ship calls at Australian ports[b]
1998–99	3187	9744	20 899
1999–2000	3165	9893	21 683
2000–01	3162	9738	21 493
2001–02	3144	8824	21 351
2002–03	3140	8935	23 454
2003–04	3368	9265	23 408

a Excludes ships that do not leave the Australian coast
b Includes ships coasting around Australia
(Source: Bureau of Transport and Regional Economics 2005b)

4.2.3 Regional shipping activity

Of the 9040 Australian-owned commercial or trading ships registered in Australia, 1210 are located in Western Australia and 639 in South Australia. The majority of Western Australian vessels are registered for recreational purposes (53 per cent), whilst the largest proportion of South Australian vessels are registered for fishing purposes (49 per cent) (ABS 2003a).

When travelling through Australian coastal waters, commercial vessels report their position each day to the Australian Maritime Safety Authority as part of the AUSREP ship reporting system. Participation in AUSREP is mandatory for some vessels, but most commercial ships partake voluntarily (Australian Marine Safety Authority 2003). These data show that the number of commercial voyages through the SWMR has declined over the last few years. In 2001, 6117 voyages were reported in the region; in 2002 it was 6374; there were 5936 in 2003; and in 2004 it was down to 3861 voyages (AMSA 2001-04). This represents a change of 36.9 per cent between 2001 and 2004. Much of this decrease appears to be the result of an increasing number of large vessels using the region, rather than any real decrease in shipping activity.

Using ship position data, it is possible to determine the major shipping routes of vessels moving through the SWMR (Figure 4.10). Running east–west through the Southern Ocean, bypassing the Great Australian Bight, there is a shipping route that originates from outside the region, and another that stems from within the region, approaching the shipping route

from both the Gulf of St Vincent and the Spencer Gulf. These two routes form a single shipping lane and the traffic increases as they round the coast at Albany and Augusta. From there, the route runs north–south as far as Shark Bay and beyond, with a large increase in traffic around Perth, Fremantle and Geraldton. This traffic includes international and national cargo trade and passenger services.

Plate 4.2 Kangaroo Island ferry

(Source: Department of the Environment and Water Resources)

Aside from the occasional visit from navy and cruise ships (discussed in Defence and Marine Tourism sections), the main passenger activity within the SWMR comes from regular ferry services between the major capitals and their tourist islands. Rottnest Island in Western Australia and Kangaroo Island in South Australia are two of the region's most popular island destinations. Access to Kangaroo Island is primarily by boat or ferry (Plate 4.2), although there are also regular flights to the island. Two ferries run to and from Kangaroo Island; the ferries have a capacity for 354 people and up to 55 cars, and up to 244 passengers and eight fuel tankers and 18 cars respectively (Kangaroo Island Sealink 2005). There are three companies that run regular ferry services to and from Rottnest Island, each of which has its own fleet or single vessel. During peak season, all three companies run ferry's every day, each making up to 14 return trips per day.

4.2.4 Economic dimensions

Regional and national economic importance

In terms of regional economic and employment impacts, shipping is a relatively minor contributor compared to other marine industries. This is because despite Australia's reliance on shipping services, the vast majority of the fleet servicing this trade are both foreign owned and crewed.

In 2002–03 the shipping sector created two per cent of marine industry direct added value, 3.3 per cent of indirect added value, and three per cent of total turnover (Allen Consulting Group 2004). Between 1995–96 and 2002–03, the shipping sector was the only marine industry to decline in added value terms, with an average annual rate of -3.7 per cent. While these are wider national trends, the shipping industry in the SWMR is broadly similar in

structure to the national industry, which suggests that the general trends are likely to be quite similar within the region.

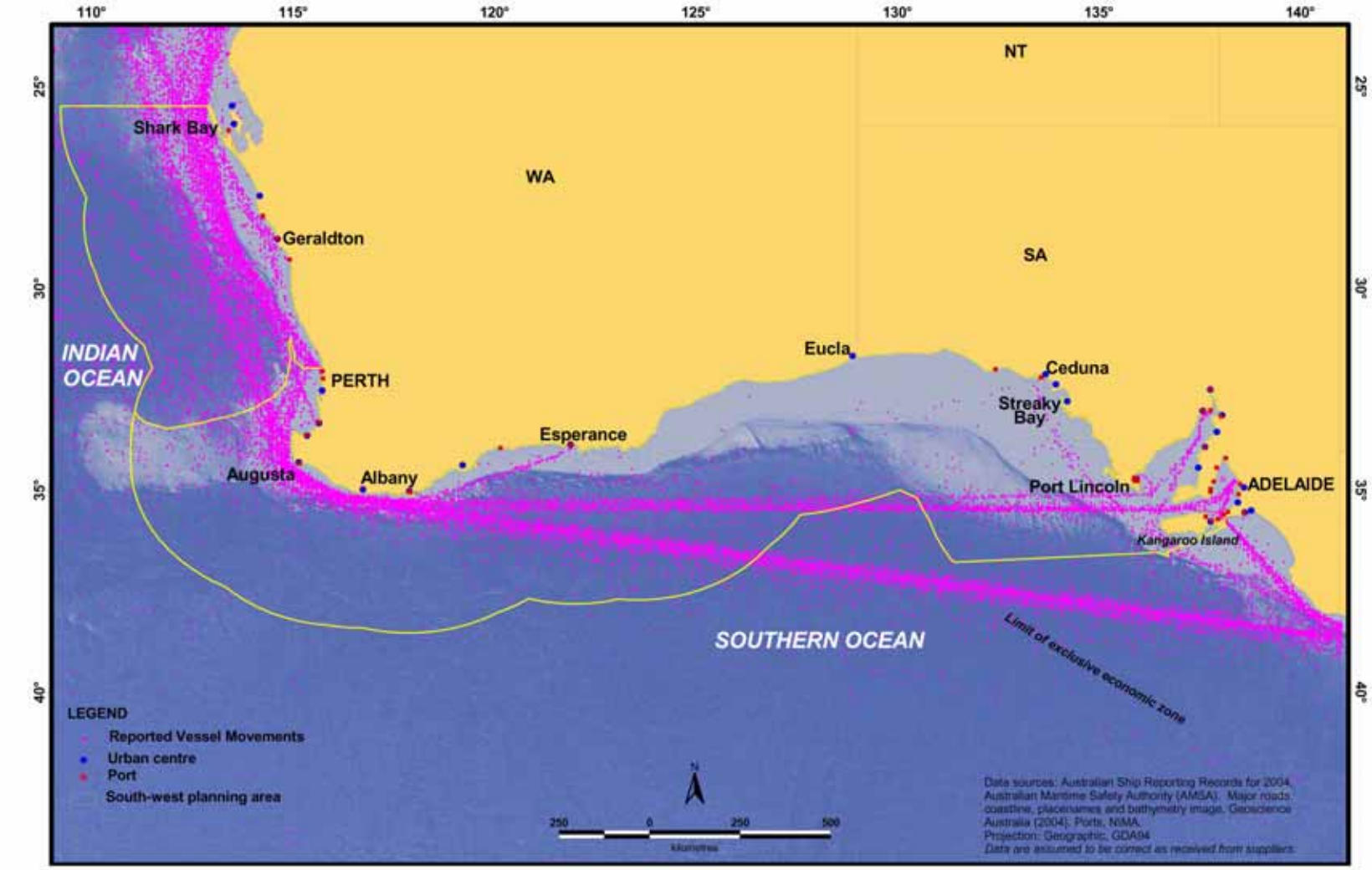
Regionally, the industry created over $11 million in added value to the regional economies of the SWMR. This represents approximately 4.9 per cent of the national shipping added value total for Western Australia and less than one per cent for South Australia. This activity also contributed to the creation of added value in other associated industries of around $30 million.

Employment

In employment terms shipping is also relatively small. In 2002–03 shipping contributed 3.3 per cent of direct employment for marine industries, and 3.4 per cent of indirect employment (Allen Consulting Group 2004). In addition, shipping tends to be a relatively volatile industry in terms of employment, depending largely on economic conditions, particularly in terms of international trade.

In terms of actual numbers employed in the region, less than 10 people were full time employed in shipping activities in South Australia with around 180 employed in Western Australia. Indirect employment associated with shipping activity was calculated at approximately 500 people (Allen Consulting Group 2004).

Figure 4.10 Shipping routes in the SWMR



4.2.5 Management arrangements for shipping

Vessels moving through the region are subject to Commonwealth legislation, as well as the regulations of the respective state governments. The Western Australian and South Australian governments control their coastal waters out to three nautical miles. From the three nautical mile limit out to the 200 nautical mile limit, the waters are the responsibility of the Commonwealth.

There are several key legislative Acts administered by the Commonwealth that apply to all Australian waters. The following are Commonwealth Acts that apply directly to shipping (by no means is the list exhaustive):

- *Environment Protection and Biodiversity Conservation Act 1999*
- *Environment Protection (Sea Dumping) Act 1981*
- *Australian Maritime Safety Authority Act 1990*
- *Carriage of Goods by Sea Act 1991* (amended 1998)
- *Lighthouses Act 1911*
- *Maritime Transport Security Act 2003*
- *Navigation Act 1912*
- *Protection of the Sea (Civil Liability) Act 1981*[1]
- *Shipping Grants Legislation Act 1996*
- *Shipping Registration Act 1981*
- *Ships (Capital Grants) Act 1987*
- *Stevedoring Industry Acts (Termination) Act 1977*[2]
- *Submarine Cables and Pipelines Protection Act 1963.*

Each of these acts is applicable in the SWMR, though there may be slight variations in the interpretation depending on whether the legislation is being applied in Western Australia or South Australia. There is also key state/territorial legislation that is directly related to shipping in coastal waters.

Western Australia:

- *Marine and Harbours Act 1981*
- *Marine Navigational Aids Act 1973*
- *Shipping and Pilotage Act 1967*
- *Western Australian Coastal Shipping Commission Act 1965*
- *Western Australian Marine (Sea Dumping) Act 1981*
- *Crimes at Sea Act 2000*
- *Environmental Protection Act 1986.*

[1] There are several other "Protection of the Sea" Acts relating to pollution, intervention and levies not listed here.
[2] There are several other "Stevedoring Industry" Acts relating to termination, finance, and levies not listed here.

South Australia:

- *Environment Protection (Sea Dumping) Act 1984*
- *Harbours and Navigation Act 1993*
- *Protection of Marine Waters (Prevention of Pollution from Ships) 1987*
- *Sea-Carriage Documents Act 1998*
- *Crimes at Sea Act 1998*.

4.3 Ship and boat-building

4.3.1 Industry objectives

The ship and boat-building industries meets both domestic and international demand for the construction and maintenance of ships and boats. The scale of operations varies considerably, from small family-owned operations to large corporations. As a consequence, the industry does not necessarily have a set of unified objectives, but rather a more general ambition to expand sales and contribute to local and regional economic and employment growth (Department of Industry, Tourism and Resources, 2004). The *Marine Industries Action Agenda Discussion Paper*, released in 2004, highlights the need for the industry to remain globally competitive and to develop new markets to ensure growth (Department of Industry, Tourism and Resources 2004).

4.3.2 National activity

Australia's ship and boat-building industry is largely export oriented, with 95 per cent of production sold on the international market, the total value of which came to $125.6 million in 2000 for recreational boats alone (Australian Trade Commission 2005a, Australian Trade Commission 2005b). Australia is well recognised internationally for its high quality fibreglass, composite and aluminium boats. Australia produces around 30 per cent of total world production of commercial aluminium ships (Australian Trade Commission 2005a). In the past, the industry was involved in a variety of ship and boat-building enterprises. Since the 1980s, however, Australia has almost completely ceased building large conventional steel vessels (Australian Trade Commission 2005a). Contemporary production focuses mainly on large high-speed aluminium vessels, such as car and passenger vessels, tugs and offshore oil and gas industry vessels.

4.3.3 Regional activity

There are a number of boat/ship-builders within the region; much of this building activity is linked to the high levels of recreational boat ownership and use. In Western Australia there are more than 100 000 recreational vessels and, in South Australia, residents own almost 75 000 recreational boats (Henry & Lyle 2003). Although these figures are for Western Australia and South Australia as a whole, they do give an indication of levels of recreational boat ownership in the SWMR. Western Australia has nearly 200 yacht/boat builders/repairers, over 90 per cent of which are within the region. South Australia has over 90 smaller yacht/boat builders/repairers, over 75 of which are located within the region (Telstra Corporation Ltd 2004).

At the larger end of the scale, there are three major ship-building companies located within the SWMR that service contracts for the Australian Defence Force as well as producing large passenger ferries and fishing vessels. Tenix Henderson and Austal are located in Perth, and ASC Osborne is located in Adelaide.

Tenix's facility south of Fremantle employs approximately 200 people and is very modern with a number of important capabilities (Tenix 2005, pers. comm.). Instead of a traditional dry dock facility, Tenix has a ship lift. The ship lift extends out from the water's edge and can lower or lift ships of over 8000 tonnes. The Tenix facility is used in the design, construction maintenance and refit of naval and paramilitary vessels. It also provides repair services, both to naval vessels and commercial vessels. Tugs, ferries, fishing vessels, high-speed passenger catamarans and offshore support vessels are also built at the facility (Tenix 2004).

Austal, which is situated in Fremantle, has also recently forged a strong relationship with the Department of Defence. The company has come to an agreement with the Defence Force to provide skills training as part of the "Skilling Australia's Defence Industry Program" (Austal 2005). The shipyard is situated on the Jervoise Bay waterfront in Henderson, eight kilometres south of Fremantle. Austal's Australian shipyard employs 1314 people and takes on 100 new apprentices per year (Austal 2005, pers. comm.).

ASC Osborne's South Australian facility has submarine building capability, though this capability is not yet fully operational. The facility employs almost 1000 people, 150 of whom are based in Western Australia (ASC 2005, pers. comm.). ASC Osborne's most recent significant contract involves the building of air warfare destroyers worth $6 billion (Government of Western Australia 2005a). Although South Australia was the state to bid for this contract, it was supported by Western Australia, and potentially half of the work will be completed in Western Australia. The contract is expected to create approximately 1000 jobs (Government of South Australia 2005).

4.3.4 Economic dimensions

Regional and national economic importance

While nationally ship and boat building is a relatively minor marine industry (with around six per cent of the direct value-added marine industry total), it is of major importance to the South Australian economy and to a lesser extent the Western Australian economy. In 2002–03, ship and boat-building in South Australia generated some $144 million of direct added value for the South Australian economy and $18 million into the Western Australian economy. This activity generated an extra $460 million of added value in associated industry sectors.

Employment

Over 25 per cent of people employed in the ship and boat-building industry in Australia reside in the SWMR (over 80 per cent in the two capital cities) (Australian Bureau of Statistics 2001). In South Australia 1037 people are employed in ship and boat-building; 870 of these people work out of Adelaide. Western Australia has 2569 people employed in ship and boat-building, 2204 of whom work in the Perth metropolitan area (Australian Bureau of Statistics 2004). While direct employment in the ship and boat-building industries is relatively low when compared to other manufacturing industries, it does have significant flow-on effects. According to a report by Allen Consulting Group (2004), ship and boat-

building contributes around 3.9 per cent of direct employment for marine industries, and 9.5 per cent of indirect employment.

4.4 Oil and gas

4.4.1 Industry objectives

The oil and gas industry play an important role in the Australian economy. Not only are they direct contributors to economic growth and employment, but also both sectors have a significant indirect impact on local and regional economies (Allen Consulting Group 2004). The core objective of the industry is to produce a reliable and efficient supply of oil and gas to both domestic and international markets (Australian Petroleum Production and Exploration Association 2001). The industry also recognises its contribution to other sectors of the economy, and to Australia's export income as well as its responsibility to act in a way that maximises environmental sustainability. The industry is also committed to identifying and resolving institutional and other impediments to growth. (Department of Industry, Tourism and Resources 2005)

4.4.2 National activity

Energy contributes significantly to Australia's economy and lifestyle, with expenditure on energy valued at $50 billion in 2002–03 (Department of the Prime Minister and Cabinet 2004). The petroleum industry is a major source of energy in Australia. In 2001-02, 71 per cent of the fuel for final energy consumption in Australia was either oil (51 per cent), gas (21 per cent) or from oil and gas products (Australian Petroleum Production and Exploration Association 2004a). It is expected that Australia's energy will continue to come from natural gas, oil and coal, at least for the immediate future (Australian Petroleum Production and Exploration Association 2004a).

At present around 40 per cent of final energy use in Australia is accounted for by the transport sector. The bulk of this energy comes from petroleum products. The demand for transport energy is increasing at 2.4 per cent a year, and it is expected that by 2019–20, 90 per cent of the total rise in final consumption of petroleum will be attributable to the transport sector (Department of the Prime Minister and Cabinet 2004).

In 2003–04 Australia generated approximately 66 per cent of its net liquid petroleum needs and all of its required gas. Petroleum production for this year included 129.0 million barrels of crude oil, 45.3 million barrels of condensate, 29.2 million barrels of LPG and 33 222 million cubic metres of natural gas (Department of Industry, Tourism and Resources 2005a). The production of oil and gas is valued at more than $15 billion annually and the industry has an asset base worth more than $40 billion. Furthermore, governments in Australia receive over $5 billion a year in company and resource taxes from the upstream petroleum industry (Australian Petroleum Production and Exploration Association 2004a). The industry is thought to directly employ (including contractors) approximately 14 000 people (Australian Petroleum Production and Exploration Association 2004b).

Petroleum is a very important export to the Australian economy; in 2002–03 was valued at $11.1 billion, which is comparable to other major export commodities such as coal ($11.9 billion), meat ($6.0 billion) and iron ore ($5.31 billion). Imports of crude oil were valued at $8.6 billion for the same year. These imports are necessary because the bulk of oil discovered in Australia has been of a lighter grade, so crude oil is imported to refine into lubricating oils, grease and bitumen (Department of Industry, Tourism and Resources 2005a). The value of

petroleum to the nation as an export commodity is reflected in the amount of investment in exploration and development. In 2002–03, $995 million was expended on exploration, with $804 million spent exploring offshore. A total of 256 wells were spudded (the first stage of drilling) and 10 000 square kilometres of three-dimensional surveys were conducted (Australian Petroleum Production and Exploration Association 2004b).

Australia's known oil reserves are substantial but without new discoveries and increasing demand, they are expected to decline (Department of the Prime Minister and Cabinet 2004). Almost 90 per cent of petroleum in Australia is found offshore in the marine environment, which is a high risk and expensive area to operate within (Australian Institute of Petroleum 2002a, Department of the Prime Minister and Cabinet 2004). Efficient offshore production really only began in the 1960s, leaving large areas of Australia's marine environment unexplored. There are around 40 offshore basins that are thought to have petroleum potential (Department of Industry, Tourism and Resources 2005a).

In order to secure Australia's future energy requirements, Australian and state governments view promoting exploration of these basins as a priority to ensure the ongoing prosperity of the industry and to ensure that Australia's domestic production is sustained, avoiding potentially expensive imports (Australian Petroleum Production and Exploration Association 2003, Department of Industry, Tourism and Resources 2005a). In the 2003 federal Budget, the Australian Government allocated additional funding for petroleum-related research to be carried out by Geoscience Australia in offshore areas (Australian Petroleum Production and Exploration Association 2003). More recently, in the 2004 Budget, the government allocated resources to increase the value of exploration deductions in designated frontier areas from 100 per cent to 150 per cent for Petroleum Resource Rent Tax determination, thus lowering the risk to investors operating in those unexplored basins (Department of Industry, Tourism and Resources 2005a). As a result of these initiatives it is likely that there will be an increase in exploration and production in the marine environment of the SWMR.

4.4.3 Regional activity

Currently there is no offshore production of oil and gas within the SWMR. However, oil and petroleum are imported through several ports in the region and exported from Fremantle and Port Adelaide (Table 4.4). Gas is also exported from Fremantle.

Table 4.4 Oil and petroleum trade in the SWMR, 2003–04

Port	Oil and petroleum (mass tonnes)	
	Imports	Exports
Fremantle (WA)	6 179 002	2 578 737
Albany (WA)	24 427	0
Esperance (WA)	274 017	0
Geraldton (WA)	186 179	0
Port Adelaide (SA)	1 933 959	4 271
Port Lincoln (SA)	112 491	0

(Source: Australian Association of Port and Marine Authorities 2003b)

Although there is currently no offshore production within the SWMR, exploration activity has been undertaken, including the release of exploration acreage and permits, seismic surveys and drilling of wells (Plate 4.3). The current exploration permit areas, seismic surveys and wells present in the region are illustrated in figures 4.11 and 4.12. In addition, three basins within the region have been identified as frontier areas with petroleum potential: the Perth Basin, the Naturaliste Plateau and the Bight Basin (Figure 4.13). As a result of the

recent government incentives, it is anticipated that exploration activity will increase in the region for the foreseeable future. If exploration is successful and subsequent production occurs, there will be a need for greater investment in associated infrastructure such as ports and port facilities in the region.

Plate 4.3 Exploration rig, *Ocean Bounty*

(Source: Department of the Environment and Water Resources)

Figure 4.11 Petroleum titles and wells in the SWMR

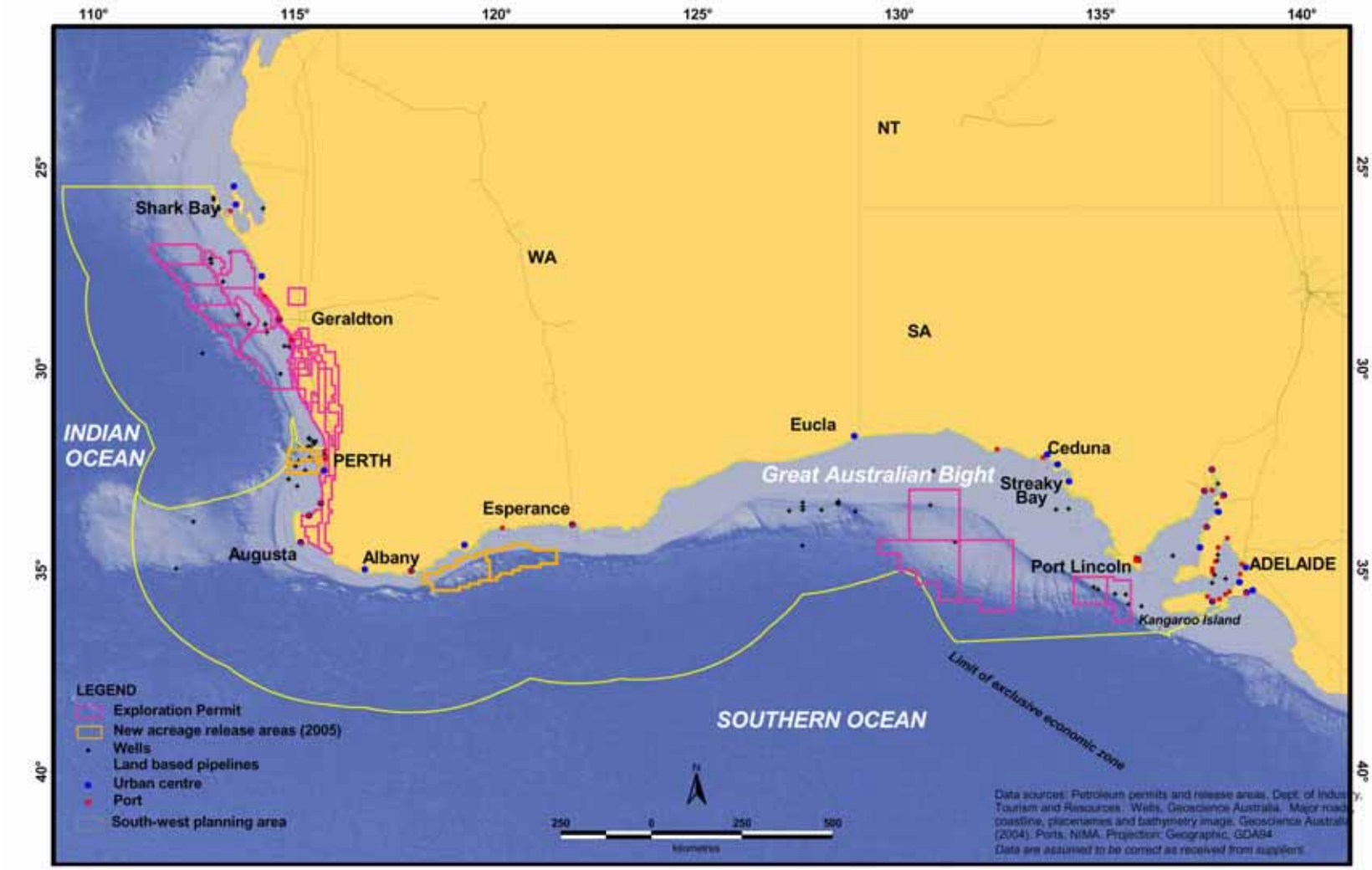


Figure 4.12 Seismic surveys in the SWMR

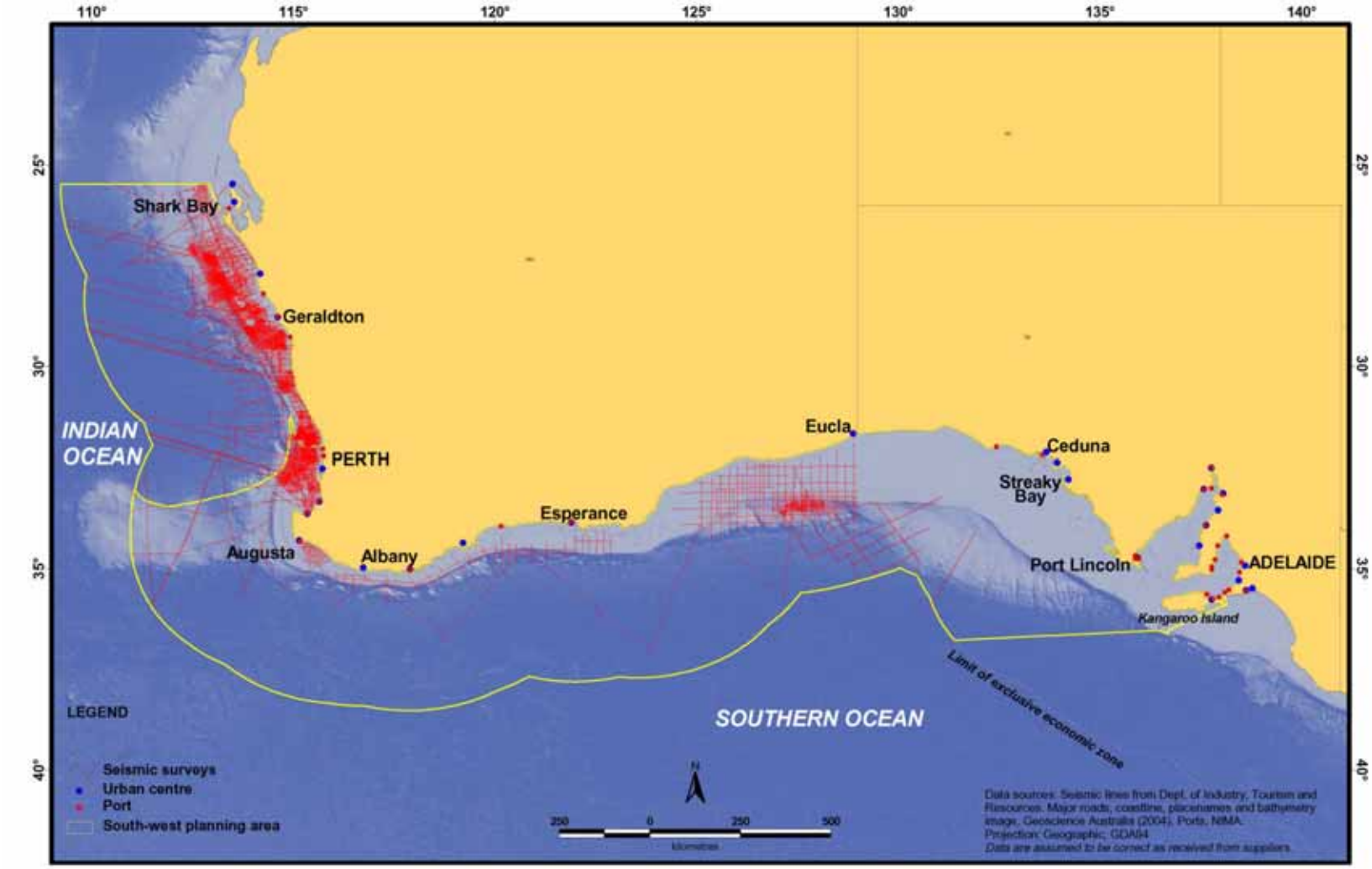
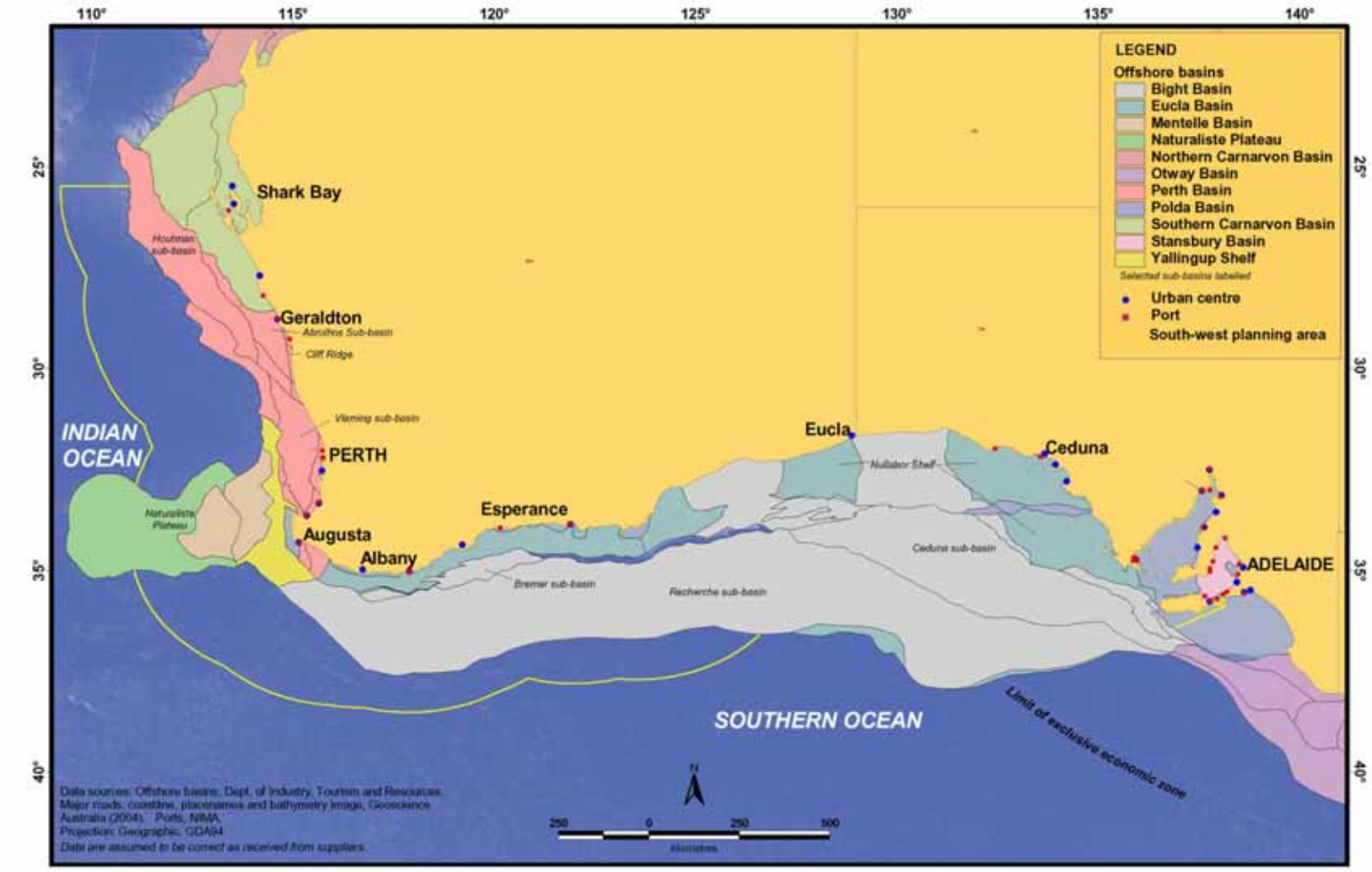


Figure 4.13 Offshore petroleum basins in the SWMR



4.4.4 Prospective petroleum areas in the South-west Marine Region

The Perth Basin extends approximately 1300 kilometres along the south-western edge of the Australian continent from south of Augusta to north of Shark Bay, and out into waters up to 4500 metres in depth (Figure 4.13). This complex sedimentary basin is 172 300 square kilometres in size and comprised of a substantial onshore section and an offshore sedimentary basin. Exploration of the offshore section of the Perth Basin only began in 1965, and since then has been limited, with only 32 wells drilled as of December 2003. In contrast, onshore exploration started in the late 1940s and since then over 200 wells have been drilled.

At present there are 10 offshore permits active, all of which are located in the Abrolhos and Houtman sub-basins. Twenty-six petroleum accumulations have been discovered in the Perth Basin to date, thirteen of which have been confirmed as commercial and the majority of which have come from the onshore north Perth Basin. Three discoveries have been made in the offshore Perth Basin, the most significant of which is the Cliff Head oil field located on the Beagle Ridge just east of the Abrolhos Sub-basin. Cliff Head is thought to contain recoverable reserves of approximately 20–30 million barrels of oil. This discovery has generated renewed interest in exploration of the Perth Basin. The other two discoveries were in an area of the basin known as the Vlaming Sub-basin, located about 25 kilometres offshore from Perth City. These included a non-commercial gas accumulation in the Lower Carnac Member at Marri 1 and a non-commercial oil reserve at Gage Roads near Fremantle (Geoscience Australia 2004a).

New offshore petroleum acreage in the Vlaming Sub-basin was released in 2005 by the Australian Government. In addition, to support this release, Geoscience Australia acquired new seismic data for the sub-basin in 2004, the first in over a decade (Department of Industry, Tourism and Resources 2005b).

The second frontier basin within the SWMR is the Naturaliste Plateau, located just south of Cape Leeuwin, Western Australia (Figure 4.13). The Naturaliste Plateau is approximately 90 000 square kilometres in size and lies in water depths of 2000–5000 metres; it is separated from the Perth Basin by the Naturaliste Trough. The eastern half of the Naturaliste Plateau falls within the SWMR while the western half lies within the “extended continental shelf” and beyond the Australian Economic Zone. The majority of drilling and seismic surveying of the plateau occurred in the early 1970s. Petroleum prospectivity on the plateau appears to be limited but the Naturaliste Trough contains similar sediments to those of the southern Perth Basin indicating that the petroleum potential may be similar (Geoscience Australia 2004b). The strong potential of the Perth Basin is likely to increase the exploration interest of the Naturaliste Plateau.

The third basin in the SWMR is the Bight Basin, which spans over 800 000 square kilometres from the southern tip of Western Australia to the western edge of Kangaroo Island, and varies in depth from 200 metres to over 4000 metres (Figure 4.13) (Department of Primary Industry and Resources South Australia no date, Geoscience Australia 2004c). The Bight Basin is one of the least explored areas in the world, and further exploration is necessary to identify its full potential. From the late 1960s to the early 1990s only nine offshore wells were drilled. However, since 1999 the Australian Government has focused on the Great Australian Bight for the release of exploration acreage, with three large exploration permits awarded in the Ceduna Sub-basin and several smaller permits granted. This, combined with a renewed interest from industry, has generated more information on the petroleum potential of the Bight Basin. In 2003 the first well in the basin for a decade was drilled by Woodside and partners, but was unsuccessful (Geoscience Australia 2004c). In April 2005, further offshore

exploration acreage was released by the Australian Government in the Bight Basin, in an area known as the Bremer Sub-basin (25 kilometres from Bremer Bay). To date no wells have been drilled in this region. Until November 2004, when 12 lines of seismic data were collected by Geoscience Australia, the only previous exploration activity in the Bremer Sub-basin was a seismic survey conducted by Esso in 1974 (Department of Industry, Tourism and Resources 2005b, Department of Industry, Tourism and Resources 2005c).

4.4.5 Economic dimensions

At present, as noted above, there is currently no offshore production of oil and gas within the SWMR. Although there is economic activity generated by oil and gas exploration in the region, currently there is no data available on this portion of the industry. However, should economically viable deposits be discovered, these would be worth many billions of dollars to the national economy and would result in thousands of jobs being created.

4.4.6 Management arrangements

Within Australia, the Crown owns petroleum. In other words, governments own the resource on behalf of the Australian community. These rights are formally granted to Australia under the United Nations Convention on the Law of the Sea. Companies are permitted to explore and produce oil and gas under government regulations, and in return they provide all the information on the resources and a portion of pre-tax profits to the governments (Australian Institute of Petroleum 2002b). Individual state and territory governments are responsible for managing petroleum activities within onshore and coastal waters (within three nautical miles of the territorial baseline), which are regulated by relevant state/territory legislation, which also includes the environmental management of projects (Department of Industry, Tourism and Resources 2005a).

Operations in offshore waters from three to 200 nautical miles off the coast are the responsibility of the Commonwealth (Department of Industry, Tourism and Resources 2005a). Offshore activities are governed by the *Commonwealth Petroleum (Submerged Lands) Act 1967*. Under this legislation the Commonwealth and the states and territories manage offshore petroleum activities jointly; however, the day-to-day regulation is undertaken at the state/territory level (Department of Industry, Tourism and Resources 2005a). The Commonwealth Petroleum Act enables offshore acreage to be released for exploration under a work program bidding system. Permits are initially granted for six years (Cadman et al. 2005). There are several types of titles that can be awarded to companies, including exploration permits to conduct seismic surveys and drilling, retention leases to enable permit holders to retain the option to develop a currently non-commercial discovery in the future, and production licences for the commercial extraction of petroleum (Department of Industry, Tourism and Resources 2005a).

Under the *Petroleum (Submerged Lands) Act 1967*, petroleum companies are required to provide an environmental plan (outlining risks, environment performance standards, monitoring/reporting arrangements, and contingency plans for spills) to the relevant management agencies before any activity can commence. Offshore petroleum activities are also subject to environmental management under the *Commonwealth Environmental Protection and Biodiversity Conservation Act 199*9. This Act controls assessment of proposed operations that may affect a matter of national environmental significance such as interaction with threatened species and communities. All petroleum activities are required to adhere to the regulations and standards outlined in the relevant legislation, but other factors

must also be considered, including navigation, fisheries, native title and interactions with cetaceans and marine protected areas (Department of Industry, Tourism and Resources 2005a). This is particularly important within the SWMR as the area is frequented ever year by migrating humpback and southern right whales and by blue whales feeding in the Perth Canyon.

4.5 Submarine cables

4.5.1 Industry objectives

There is no single set of industry objectives for submarine cables. In most cases, submarine cables are used to facilitate communication or supply electricity. Communication cables are particularly important in region, providing access to global telecommunications services, data transfer capabilities, and voice traffic. The main objective of the industry is to ensure reliable access to high quality telecommunications services (Department of Communication, Information Technology and the Arts 2005). In terms of electricity cables, the key objective of the industry is to provide reliable power supply in the region.

4.5.2 National activity

The first seabed telegraph cable was laid in 1850 across the English Channel. In the 1950s the first submarine telephone cables were installed. This technology was then replaced in the late 1980s by fibre optic cables, which are now the leading means of communications across oceans. Fibre optic cables now carry more than two thirds of all telephone, fax and data transmissions. Protection of submarine cables is of primary importance to the communications industry as the cables are vulnerable to a number of impacts including various fishing practices, general boat activity (notably anchor drag) as well as seismic activity (Drew & Hopper 1996).

Establishing reliable, permanent communications lines with the rest of the world has been a priority of successive Australian governments. At present up to 99 per cent of Australia's international voice and data traffic is carried by submarine cables, at a calculated value of more than $5 billion to the Australian economy.

4.5.3 Regional activity

Within the SWMR a total of six submarine cables have been laid since 1901, two of which are still in use (Figure 4.14).

1901: Cable from Cocos (Keeling) Islands – Perth – Adelaide
System length: 1721 and 1525 nautical miles (nm) (no longer in use)

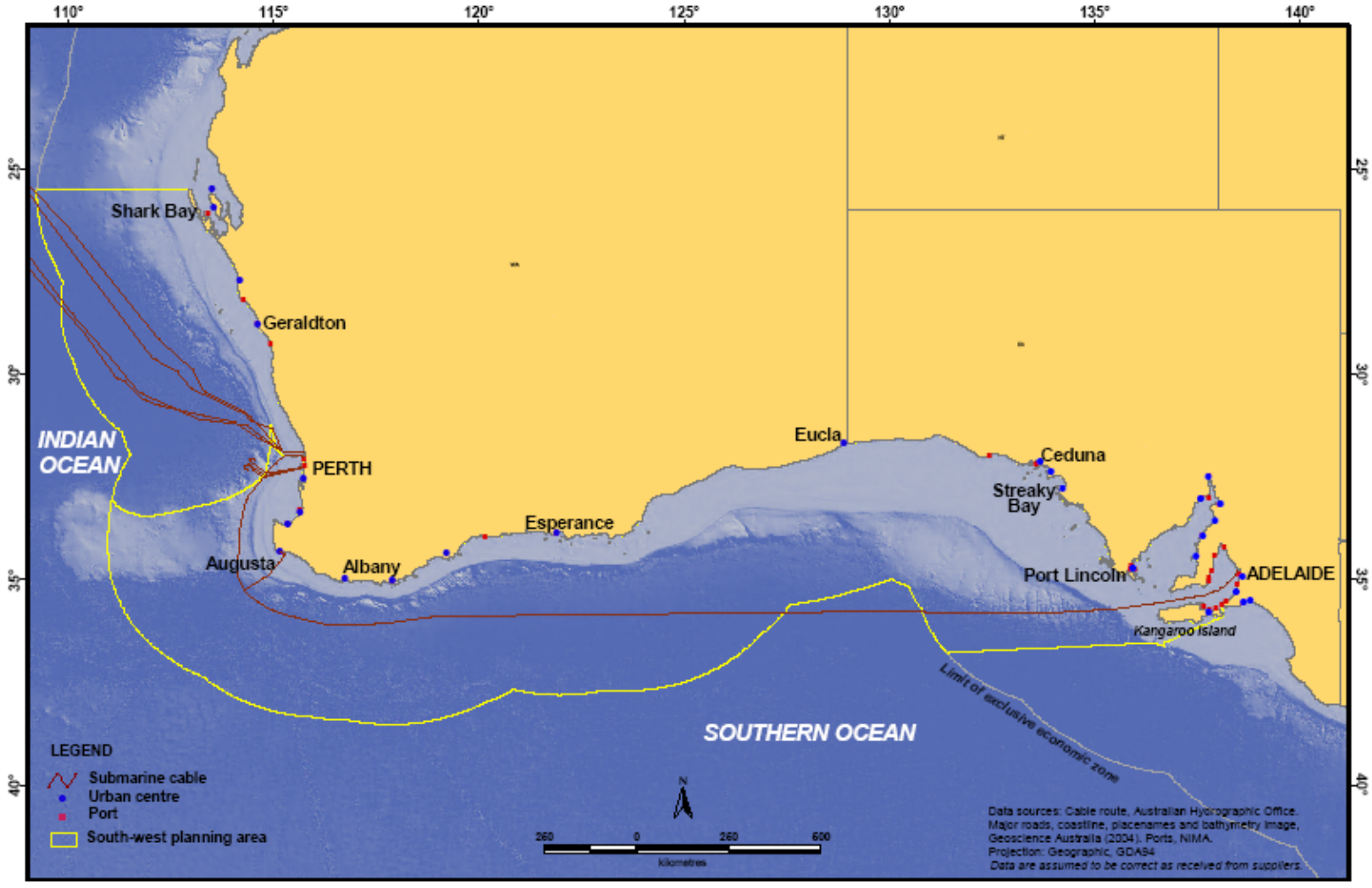
1935: Cable from Fremantle – Rottnest Island, Western Australia
System length: 11 nm (no longer in use)

1985–1989: Cable (power) from Cape Jervis – Kangaroo Island, South Australia
System length: (at least) 140 nm from Willunga to Kingscote (still in use)

1986: Cable from Perth, Western Australia – Ancol, Indonesia – Singapore (AIS 1)
System length: 2517 nm (no longer in use)

1999: Cable (communication) from Tuas, Singapore – Ancol, Indonesia – Perth, Western Australia (Sea Me We 3: Segment S3)
System length: 2567 nm (still in use)

Figure 4.14 Submarine cables in the SWMR



Still operational today is the Sea Me We 3 cable, from Singapore to Indonesia to Perth. It is part of the largest intercontinental submarine cable network, stretching 38 000 kilometres. It has 39 landing points across Northern Europe, Asia and Australia and consists of 32 communications providers. Segments of this cable are in the process of being upgraded; however, the segment joined to Perth (known as segment 3), is not due for an upgrade at this time (Fujitsu 2005). As mentioned above, this cable is of primary importance to the Australian economy through its provision of essential telecommunications services.

The submarine cable from Cape Jervis connects Kangaroo Island to the South Australian mainland power grid, thereby providing the island with electricity. The system is over 15 years old and is subject to numerous supply interruptions. These are due to the frequency of storms along the Fleurieu Peninsula, the extensive radial distribution of the network, the terrain that the cable traverses and the length of the sub transmission feeder. At present Kangaroo Island relies on this connection as its primary source of electricity. Any serious damage could cost the island up to $6 million to replace the cable, and it could leave the island without adequate electricity for up to four months (Sun, Wind, Water – Energy Solutions 2003).

4.5.4 Economic dimensions

While the initial construction of submarine cables stimulates economic activity in the construction phase, the cables, once in operation, primarily generate economic activity through their use by other sectors of the economy (e.g. the internet). At present no work has been undertaken on the economic value of the submarine cable to the SWMR economy.

4.5.5 Management arrangements

In the past, the *Submarine Cables and Pipelines Protection Act 1963* governed the protection of submarine cables. A new bill was introduced to the Australian Parliament in June 2005: the Telecommunications and Other Legislation Amendment (Protection of Submarine Cables and Other Measures) Bill 2005. Under this Bill, the Australian Communications Authority is now authorised to declare protection zones over submarine telecommunications cables of national significance, which is important as these cables are susceptible to damage from a range of activities (Australian IT 2005). Main elements of the regime include:

- the declaration of protection zones over submarine cables of national significance
- mandatory consulting of marine users prior to a protection zone being enacted
- prohibition of activities within protection zones which could damage cables
- criminal penalties for damaging cables and for engaging in prohibited activities within a protection zone
- immunity for carriers from certain state laws within protection zones
- environmental considerations.

Within these protection zones certain activities are prohibited such as using trawl gear, fishing line and nets designed to work on or near the seabed. Also prohibited is exploring for or exploiting resources (other than marine species), because of the potential damage that these activities can do to cables. Other activities are *restricted*; for example, using nets that are above the seabed at all times or lures or bates attached to a line towed behind a ship (Parliament of the Commonwealth of Australia 2005). The enactment of this new Bill is

important to protect the submarine cables in the SWMR as deep-sea fishing is an essential industry in the region and oil and gas exploration activity is on the rise, thus increasing the risk of damage to the cables.

4.6 Defence

4.6.1 Objectives

The main objective of the Australian Defence Force is to defend Australia and its national interests. The Defence Force structure consists of three major components: The Australian Army, The Royal Australian Navy and The Royal Australian Air Force (Department of Defence 2004a). Its operations can be broadly summarised into three categories: military, constabulary and diplomatic. The Department of Defence works in collaboration with other government departments to achieve its objectives; these agencies include the Australian Federal Police (AFP), Department of Foreign Affairs and Trade (DFAT), Australian Customs Service, the Department of Immigration, Multiculturalism and Indigenous Affairs (DIMIA), the Australian Quarantine Inspection Service, and the Australian Fisheries Management Authority (AFMA) (Trinder & Cole 2003).

4.6.2 National activity

One of the Defence Force's greatest challenges is defending Australia's vast coastline and maritime borders. Australia's maritime border is shared with neighbouring Indonesia, Papua New Guinea, The Democratic Republic of Timor-Leste, New Zealand, the Solomon Islands and New Caledonia.

The Defence Portfolio receives a relatively large portion of the Australian Budget and in 2004–05 had available resources to the total of $18 684 000 (Defence Portfolio 2004). The Defence Force employed a total of 62 246 people in 2001 (Australian Bureau of Statistics 2001).

4.6.3 Regional activity

The SWMR has a long history of defence activity. Immediately following European settlement, the region was under the protection of the British Navy, with major bases established in Adelaide, Albany and Fremantle. Following the granting of self-government to South Australia and Western Australia, both colonies began to take greater control of defence activities. In 1884, the *Protector*, which was at the time the most powerful and modern warship in service in any colonial navy, was purchased by the South Australian Government. In 1879, the Fremantle Naval Artillery was formed to assist in the defence of Fremantle Harbour. Following federation in 1901, greater investment was directed towards marine-based defence capabilities, although it was not until World War II that the Royal Australian Navy began to play a significant role in the region. Indeed, World War II saw the establishment of one of Australia's most important naval installations, Stirling Naval Base, at Garden Island near Fremantle.

The Royal Australian Navy undertakes a range of maritime activities in the SWMR (Figure 4.15); training exercises, transit of naval vessels, ship-building and repairs, hydrographic and survey work, surveillance and enforcement, and search and rescue operations are all part of naval activities in the region.

HMAS Stirling is one of Australia's largest Royal Australian Navy fleet bases, and harbours 13 naval vessels in total: six frigates, one fleet-replenishment vessel and six Collins Class

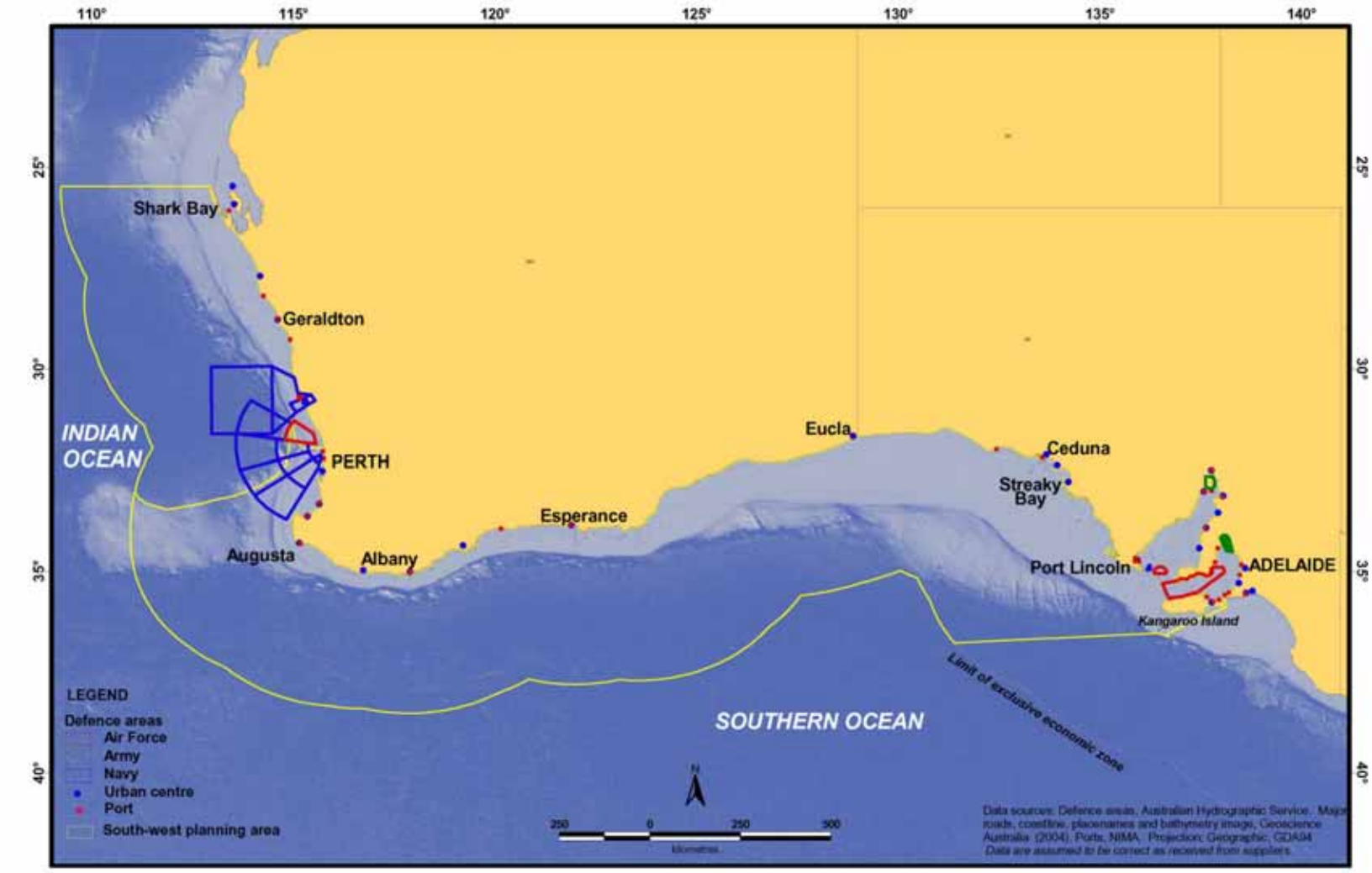
Submarines. The HMAS Stirling Base is also an important hub for the Royal Australian Navy's exercises. These are conducted in the Western Australian Exercise, or WAXA, which is the major military maritime training area on the western seaboard of Australia (Department of Defence 2003). The types of firing occurring within the training areas include bombing practice from aircraft, air to air and air to sea, or ground firing, anti-aircraft firing, firing from shore batteries or ships, remote-controlled craft and rocket and guided weapons firing (Australian Hydrographic Service 2005). In addition to WAXA, there are five other areas for navy and army training exercises within the SWMR in Western Australia: Swanbourne, Greenough, Lancelin, Flat Rock and Stirling. Military flying, firing and explosive demolition are practised in Lancelin. Flat Rock is used exclusively for air to surface weapons firing; Stirling is used for gunnery and military flying (Australian Hydrographic Service 2003). Greenough is an onshore rifle range used for firing practice by the Army, and is located north of the navy training areas.

In South Australia, the areas used for defence training are smaller than in Western Australia. The body of water known as Investigator Strait, situated between Kangaroo Island and the tip of the Yorke Peninsula, hosts the largest training area in South Australia, referred to as Edinburgh, which stretches around into the Gulf of St Vincent. Located right in the head of Spencer Gulf is another training area known as Alamein, in between Port Augusta and Whyalla. Toward the end of Spencer Gulf between the Eyre and Yorke peninsulas is another small defence training area. This area is divided into three smaller training areas known as North East Rock, Thistle Island and Dangerous Reef. Finally, the head of the Gulf of St Vincent also plays host to a small training area, north-west of Adelaide, referred to as Port Wakefield. Firing is practised in Alamein, Port Wakefield (24 hours a day), North East Rock and Edinburgh. Unspecified naval operations occur at Dangerous Reef and Thistle Island, and military flying also occurs at Edinburgh (Australian Hydrographic Service 2003).

An ongoing Navy operation in the SWMR is "Operation Mistral", which is run in collaboration with Coastwatch (Australian Customs) and the Australian Fisheries Management Agency. Australia's southern oceans are vulnerable to illegal fishing and the operation's role is to enforce "Australian sovereign rights and fisheries laws in the Southern Oceans" (Australian Bureau of Statistics 2003b).

Transit of international defence force vessels also occurs in the SWMR. Australian sovereignty of maritime boundaries stretches only as far as 12 nautical miles, outside of which international forces are legally allowed to conduct exercises without Australia's permission or knowledge (National Oceans Office 2002).

Figure 4.15 Defence training exercise areas in the SWMR



4.6.4 Economic dimensions

Regional and national economic importance

South Australia and Western Australia are economically important in terms of the supply of new naval vessels. In Western Australia, Austal has been chosen as the preferred tenderer for the Royal Australian Navy's replacement patrol boat contract. This involves building 12 new vessels worth approximately $380 million dollars. In South Australia, the Australian Submarine Corporation (ASC) was responsible for designing and manufacturing six Collins Class submarines for the Royal Australian Navy. ASC also has responsibility for maintenance and enhancement of the submarines until the end of their operational lives. This facility has also recently won a $6 billion contract to supply three frigates to the Australian Navy. Current planning will see the three ships delivered to the navy from 2013 to 2017.

Employment

While exact figures on defence force employment in the SWMR are not readily available, the industry is a relatively small employer within the region. At the state level, 2479 permanent personnel are based on South Australia, and 3900 are based in Western Australia (Table 4.5). In terms of the SWMR, the employment in the navy has the most significance, and represents only 2700 personnel. According to the Department of Defence (2005), these figures have remained relatively stable over the past five years, and are not likely to change significantly in the immediate future.

Table 4.5 Defence Force employment in South Australia, Western Australia and the whole of Australia, 2005

	South Australia	Western Australia	Whole of Australia
Permanent forces			
Navy	70	2636	12 855
Army	656	838	25 113
Air Force	1753	426	13 241
Subtotal	*2479*	*3900*	*51 209*
Reserve numbers			
Navy	137	431	3 132
Army	1245	1734	16 261
Air Force	261	198	2 575
Subtotal	*1643*	*2363*	*21 968*
Total	**4122**	**6263**	**73 177**

(Department of Defence 2005)

4.6.5 Management arrangements

Defence Force activities have the potential to impact on the marine environment. Australia's environment is protected by the *Commonwealth Environmental Protection and Biodiversity Act 1999* (EPBC Act). Any defence activity that has, will have, or is likely to have a "significant impact on the environment within or beyond Australia" must first be approved under the EPBC Act. Activities that are unlikely to have a significant impact may still require an Environmental Clearance Certificate (ECC). ECCs are an internal defence mechanism and can impose conditions that ensure that environmental impacts are "removed or minimised".

In addition, the Department of Defence introduced its own environmental policy in 2001 (Department of Defence 2004c).

In addition to complying with environmental legislation, there is a substantial body of other Commonwealth legislation that governs the operation of the Australian Defence Force. This includes (National Oceans Office 2002):

- *Air Force Act 1923*
- *Approved Defence Projects Protection Act 1947*
- *Control of Naval Waters Act 1918*
- *Defence Act 1903*
- *Geneva Conventions Act 1957* (Part IV)
- *Naval Defence Act 1910*
- *Supply and Development Act 1939.*

The Defence Force is also required to provide support for a number of government agencies, including those responsible for (National Oceans Office 2002):

- search and rescue – conducted under the *International Maritime Organisation Search and Rescue (SAR) Convention 1979* and the *International Convention for Safety of Life at Sea (SOLAS)*
- suppression of piracy irrespective of the nationality of the vessel
- marine pollution.

4.7 Marine tourism

4.7.1 Industry objectives

Marine tourism covers a variety of activities from whale watching, diving and recreational beach use through to cruise ship visits. As a result, the industries that service this sector are equally diverse, ranging from small industries that directly facilitate tourism experiences such as charter boat operators through to associated services such as bait suppliers and service stations. As a result, there is no single set of objectives that cover all facets of the tourism industry sector.

Because of the diverse characteristics of the marine tourism industry, those objectives that do encompass the industry are by their nature quite broad. For example, the 1998 National Action Plan for Tourism, sets out the following objectives:

- optimising tourism employment and investment growth
- developing the potential of new and emerging markets
- encouraging the conservation and presentation of Australia's unique natural and cultural heritage
- encouraging the diversification of the industry's product base.

In short, the objective of the marine tourism industry is to support economic development and employment growth by utilising marine environmental resources in a sustainable manner (Orams 1999).

4.7.2 National activity

Tourism is playing an increasingly important role in the Australian economy. It directly employs almost six per cent of the workforce, contributes $73 billion in expenditure per annum and is worth more than 12 per cent of total exports (Tourism Forecasting Council 2001). In 2003–04, tourism accounted for $32 billion (or 3.9 per cent) of Australia's total GDP (World Tourism Organisation 2004).

Importantly, the economic value of tourism is not restricted to the major metropolitan areas. Indeed, the Department of Industry, Tourism and Resources (2005d) suggests that 48 cents in every tourism dollar earned in Australia is spent in regional areas. A significant portion of this is spent in marine areas (Harvey and Caton 2003). The Australian coastline is 36 735 kilometres in length, incorporating some 7000 beaches, more than any other nation (Tourism Australia 2005). Marine tourism, as defined by Orams (1999, p. 9), includes "those recreational activities that involve travel away from one's place of residence and which have as their host or focus the marine environment (where the marine environment is defined as those waters which are saline and tide-affected)". This broad definition includes a number of activities such as scuba diving and snorkelling, wind surfing, fishing, observing marine mammals and birds, the cruise ship and ferry industries, sailing and motor yachting, sea kayaking, all beach activities, visits to fishing villages and lighthouses, maritime museums and maritime events. All of these activities are present in the SWMR.

4.7.3 Regional activity

Marine-based tourism in the SWMR has expanded rapidly over the past two decades, largely as a result of the environmental qualities of the region. The region adjoins the Shark Bay World Heritage Site, a large number of marine parks (e.g. The Great Australian Bight Marine Park in South Australia and the Marmion Marine Park in Western Australia), and unique terrestrial and coastal environments (e.g. the Fitzgerald Biosphere in Western Australia). Areas apart from these reserves are also important in attracting visitors, many of whom are attracted to the region's towns and other coastal amenities.

Within the SWMR, four Western Australian marine/coastal tourism regions and six South Australian key tourism areas have been identified. The distribution of visitors to these different areas within the SWMR is outlined below (Table 4.6). In both states, visitors are concentrated in Adelaide and Perth. However, there are significant numbers of visitors to non-metropolitan regions, notably the south-west of Western Australia, and the so-called Coral Coast to the north of Perth. In South Australia, visitor numbers are particularly strong in the Eyre, Yorke and Fleurieu peninsulas and in the Flinders Ranges area.

Table 4.6 Domestic and international visitors to the SWMR, 2003/2004

State	Tourism area	Total no. visitors	Domestic visitors (%)	International visitors (%)
Western Australia (2004)*	Perth	3 732 800	85	15
	Coral Coast	716 000	90	10
	South West	2 150 100	95	5
	Esperance/ Ravensthorpe	199 300	89	11
South Australia (2003)*	Adelaide	2 467 000	89	11
	Eyre Peninsula	430 000	97	3
	Flinders Ranges	680 000	92	8
	Yorke Peninsula	526 000	99.5	0.5
	Fleurieu Peninsula	565 000	98	2
	Kangaroo Island	127 000	77	22

*Data for WA are from 2004 and data for SA are from 2003
(Source: South Australian Tourism Commission 2004, Tourism Western Australia 2005a)

Western Australia

In Western Australia in 2004 there were 613 800 international visitors and 6.4 million overnight domestic visitors, with a combined expenditure of $3.1 billion (Tourism Western Australia 2005b). The importance of tourism for the state is evident in the level of employment directly or indirectly involved in tourism, which stood at 7.7 per cent in 2004.

Within the Western Australian section of the SWMR, approximately 90 per cent of all visitors are domestic, and social/sightseeing and outdoor/nature activities are the most common activities undertaken. Outdoor/nature activities are the most popular option undertaken by international tourists (Tourism Western Australia 2005a). Off the coast of Perth are three islands that operate as marine and nature-based tourism destinations: Rottnest Island, Carnac Island and Penguin Island. Rottnest Island and Carnac Island are registered as "A Class" under the *Land Administration Act 1997*, which affords the greatest degree of protection for heritage/environmental resources. Rottnest Island is a recreation and holiday destination for many Western Australians and international visitors, with 500 000 visitors annually (Plate 4.4) (Rottnest Island Authority 2003). Carnac Island, once a whaling station, is an important habitat of the Australian sea lion, one of the world's rarest seal species, and a breeding island for many seabirds. Similarly, Penguin Island acts as a breeding station for a

variety of bird species including the little penguin, the Australian pelican and terns (Department of Conservation and Land Management 2003). The main activities for tourists on the islands include swimming, surfing, diving, windsurfing, fishing, marine wildlife watching, picnicking and cruising.

Plate 4.4 Wilson Bay, Rottnest Island

(Source: Ian Eliot)

Outside the Perth region, the Western Australian coastline has a range of resources including islands, reef systems, beaches and coastal reserves. Much of the tourism activity is concentrated in larger settlements including Esperance (see Plate 4.5), Albany, Busselton and Geraldton. Smaller towns around the entire coast also have significant tourism resources and facilities. Many of the smaller coastal settlements are extremely seasonal in their visitor patterns, with peak periods concentrated around the summer holidays and Easter (Sanders 2000). As a result, pressures on the natural environment in these localities are often very high for a relatively short period of time.

Plate 4.5 Thistle Cove in Cape le Grand National Park, east of Esperance

(Source: Ian Eliot)

Until relatively recently, much of the tourist activity in the Western Australian part of the SWMR tended to be concentrated south of Perth but over the past 15 years or so there has

been a growing appreciation of the environmental resources of the areas between Perth and Shark Bay (and beyond to the North West Cape). This has placed greater pressure not only on the coastline, but also islands off the coast. One example is the Abrolhos Islands, which lie approximately 60 kilometres west of Geraldton. The Abrolhos consist of 122 islands that extend for 100 kilometres north to south. The diverse fish life, unique coral reef formations, bird life, shipwrecks and the coastal landscape of the Abrolhos are enticing increasing numbers of visitors to the region each year (Department of Fisheries 2005a). Similarly, the Shark Bay area has experienced increasing visitor numbers, especially since the declaration of the Shark Bay World Heritage Area in 1991. The Heritage Property is approximately 2.2 million hectares in size, of which about 70 per cent is marine waters. The many bays, inlets and islands in the Shark Bay region support a profusion of aquatic life including dugongs, whales, turtles, sea snakes, sharks, coral, sponges and tropical and temperate fish (Plate 4.6). Shark Bay also has the largest area of seagrass as well as the largest number of species of seagrass ever recorded in one place in the world. Monkey Mia at Shark Bay is a beach where several bottlenose dolphins regularly visit and are a major tourist attraction (Australian Tourism Commission 2005). Increasing use of this area by both international and domestic tourists clearly requires careful management to ensure the sustainability of the natural environment.[4]

Plate 4.6 Peron Peninsula, Shark Bay

(Source: Ian Eliot)

South Australia

Similar to the Western Australian section of the SWMR, the majority of visitors to the South Australian section of the region are domestic (92.1 per cent in 2003). The bulk of visitors to Adelaide in 2003 were also domestic, with sightseeing and visiting friends and relatives among the most common activities (South Australian Tourism Commission 2004a).

South Australia recorded 6.1 million tourists in 2004. South Australians travelling in their own state accounted for 40 per cent of this total, whilst visitors from interstate accounted for 39 per cent and international visitors 21 per cent (South Australian Tourism Commission 2005a). In 2001, tourism generated $3.4 billion of expenditure. This expenditure supported (directly and through inputs into production) employment estimated at 36 800 full time equivalent jobs (South Australian Tourism Commission 2005b).

The Eyre Peninsula is the fourth most visited region in South Australia, with annual visitor numbers exceeding 455 000. Indeed, tourism is the third largest industry in South Australia,

behind agriculture and fishing (South Australia Tourism Commission 2004a). The Eyre Peninsula offers a variety of natural landscapes, ranging from inland regional areas to coastal landscapes. A high proportion of visitors to the peninsula are residents of regional South Australia (41 per cent), or visitors from Western Australia (six per cent). According to the South Australian Tourism Commission (2004), one of the most popular activities in the area is recreational fishing, followed by visiting the beach.

The region defined as "Flinders Ranges and Outback" by the South Australian Tourism Commission covers 80 per cent of the state. The region extends from the head of the Spencer Gulf northwards to include most of regional South Australia. The majority of tourists in the region are from Victoria (15 per cent) and New South Wales (15 per cent) and identify themselves as adventurers (29 per cent) or nature-based travellers (25 per cent) (South Australian Tourism Commission 2004). However, given the size of the region, it is difficult to determine the extent to which this tourism activity is based on the coast and directly affects the SWMR.

In the case of the Yorke Peninsula, tourism is more squarely focused on coastal and marine environments. The area is one of Australia's great surfing drawcards, and is also popular amongst divers, with two underwater maritime heritage trails providing excellent diving opportunities (Yorke Peninsula South Australia no date). According to the South Australian Tourism Commission (2004), in addition to surfing and diving, the most popular activities amongst tourists visiting the area are going to the beach, fishing and picnics/barbecues. Similar activities were also reported as popular on the Fleurieu Peninsula. One of the other main attractions of the peninsula is the large number of conservation parks where wildlife can be seen in natural settings; the wildlife includes fairy penguins, whales, seals, dolphins, sea lions and penguins (Australian Tourism Net 2003).

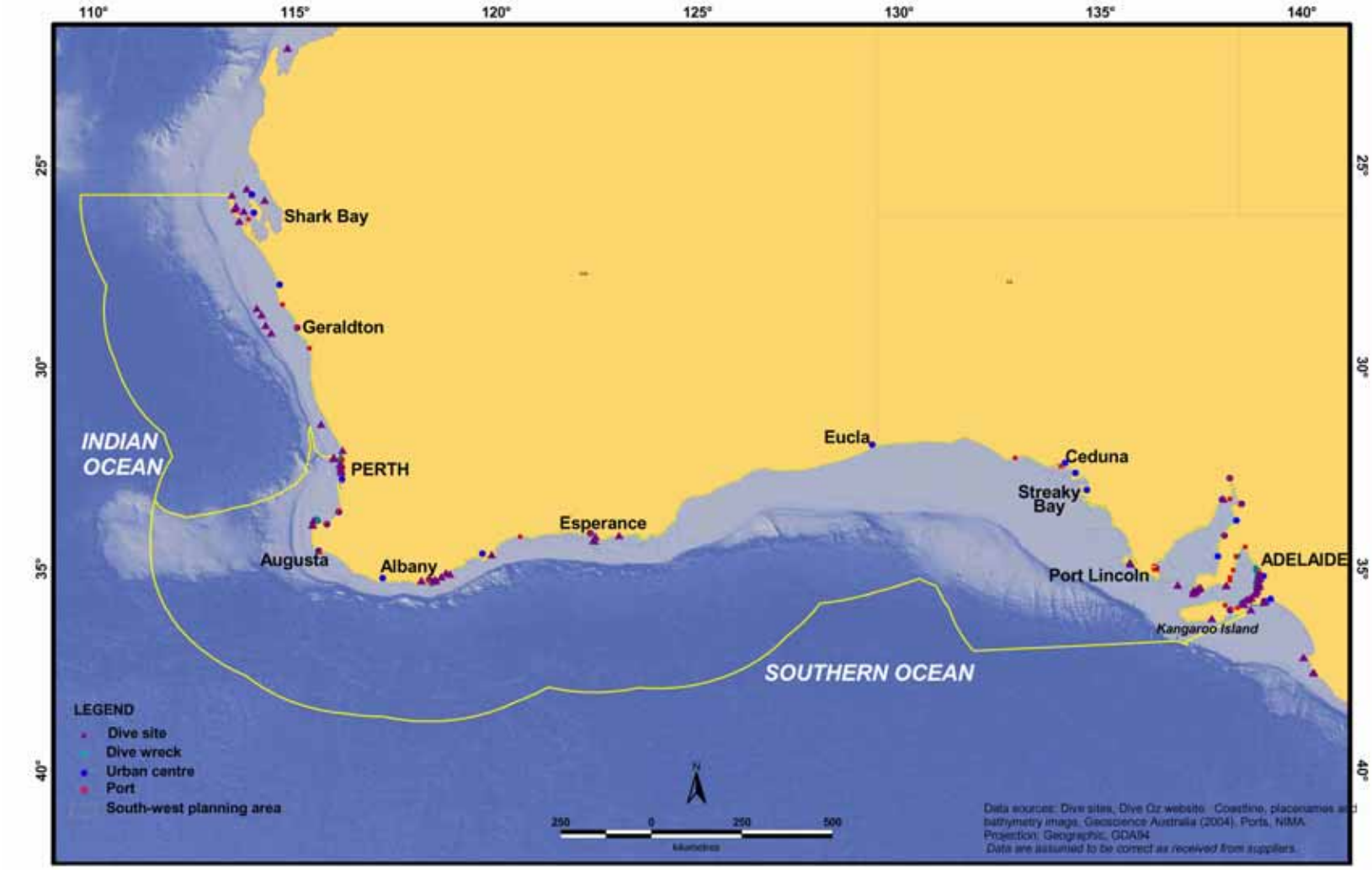
Kangaroo Island, which is 16 kilometres from Cape Jervis on the Fleurieu Peninsula, is listed by the Australian Tourism Commission (2005) as one of the nine unique wonders of Australia. Limited development on the island has ensured that an abundance of wildlife remains including sea lions, penguins, dolphins, koalas and kangaroos (Australian Tourism Commission 2005). The activities undertaken by tourists on the island include going to the beaching, wildlife viewing, bushwalking or sightseeing (South Australian Tourism Commission 2004a).

4.7.4 Marine tourism activities

The marine tourism activities described for the SWMR include:

- recreational beach use: sightseeing, swimming, surfing, snorkelling
- diving
- marine mammal watching
- charter boating
- recreational boating
- yacht racing
- cruise ship visits
- fishing (see the section on recreational fishing).

Figure 4.16 Dive sites and dive wrecks in the SWMR



Diving and shipwrecks

There are over 300 000 regular divers in Australia, with 50 000 new divers accredited each year. It is estimated that the dive tourism industry is worth approximately $600 million to the Australian economy (Love 2004). It is a particularly popular marine activity within the SWMR due to the pristine reefs, the diverse marine wildlife and the many shipwrecks that surround the region's coast. There are 260 dive sites in Australia, 52 of which are located in the SWMR (Dive Oz no date). Additionally, there are 134 wreck dive sites with 56 located in the region (Figure 4.16) (Dive Oz no date). These include "naturally occurring" shipwrecks, and ships that have been sunk specifically for tourism purposes. For example, in May 2005, a 400-tonne ship was sunk off Rockingham, Western Australia, to create a dive wreck to boost tourism in the area. Artificial reefs can also be created to deliberately to mimic the characteristics of a natural reef. Recently, Geographe Bay in Busselton, Western Australia, has been identified as a potential location for an artificial reef designed to increase fish stocks and boost recreational fishing (Tait 2005). The placement and construction of artificial reefs is regulated under the *Commonwealth Environment Protection (Sea Dumping) Act 1981*.

Rottnest Island near Perth and the Abrolhos Islands off Geraldton are famous for their reefs and historic shipwrecks (Figure 4.16). Approximately 20 shipwrecks lie off the Abrolhos, the best known of which are the Dutch East India Company vessels *Batavia* (1629), and the *Zeewijk* (1727) on Half-Moon Reef; the18 other historic wrecks that lie off the Abrolhos are mostly from the nineteenth century (Department of Fisheries 2005a).

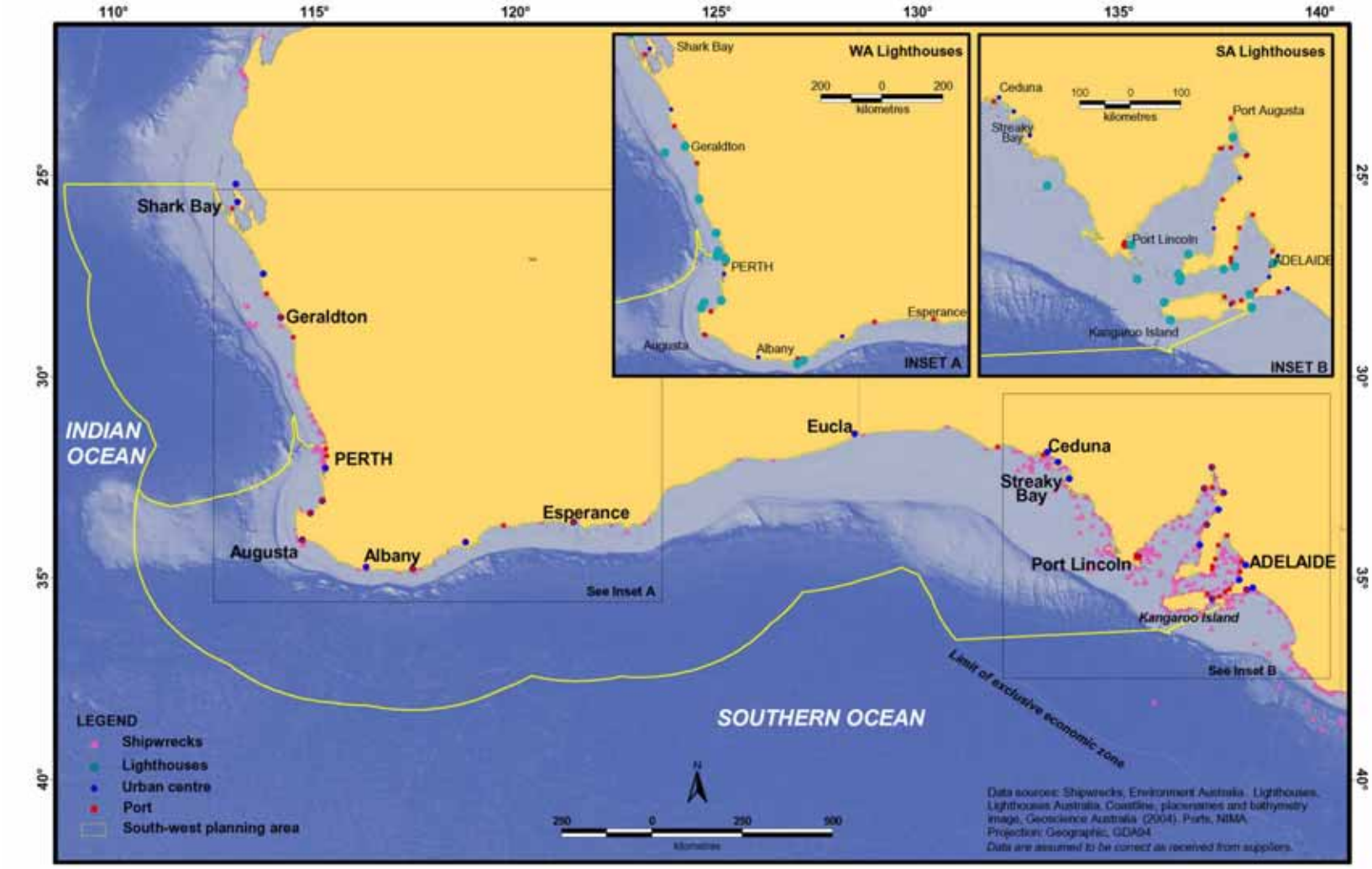
In South Australia, Port Adelaide has some of the most significant and diverse shipwrecks in the SWMR, many of which are also accessible to non-divers. The majority of these wrecks are concentrated around the mouth of the Port River and the surrounding mudflats, where the remains of more than 40 sailing, steam and motor vessels are located. The shallow waters of the Gulf of St Vincent are also the location of numerous wrecks, many of which are popular as dive sites.

The *Commonwealth Historic Shipwrecks Act 1976* protects certain shipwrecks and relics of historic significance. Shipwrecks are automatically protected under this Act if they are at least 75 years old and are situated in Australian waters, or waters above the continental shelf of Australia. Shipwrecks less than 75 years of age can also be protected following an evaluation to ascertain historic significance (Attorney-General's Department 2001). There are also various forms of state legislation to protect shipwrecks. For example, in South Australia the Heritage Branch of the Department of Environment and Heritage is responsible for the identification, conservation and protection of shipwrecks through the *Heritage Places Act 1993* and the *Historic Shipwrecks Act 1981*.

Lighthouses

Vessels avoid the shipwrecks and reefs throughout the SWMR: lighthouses and navigation aids are in place. At present there are 29 active lighthouses in the region, 14 within Western Australia and 15 within South Australia (National Oceans Office 2005b). These are shown in Figure 4.17. Operation of lighthouses is regulated under the *Commonwealth Lighthouses Act 1911*.

Figure 4.17 Shipwrecks and lighthouses in the SWMR



Marine mammal watching

In 2001, whale watching (including whales, dolphins and dugongs) worldwide was a USD$1 billion industry attracting more than nine million participants a year in 87 countries and territories (Hoyt 2001). Since this time, whale watching in Australia has experienced an annual growth of 15 per cent per year, with the number of whale watchers totalling more than 1.6 million in 2003 (Table 4.7) (International Fund for Animal Welfare 2004). In South Australia, 159 900 people participated in whale watching in 2003, with an estimated total expenditure of just over $10 million; this represents an increase of 38.5 per cent since 1998 (International Fund for Animal Welfare 2004). In Western Australia, the industry was worth approximately $45 million in 2003, though the number of people participating was slightly lower (153 081).

Table 4.7 Whale watchers in Australia, 2003

Location	Operators	Whale watchers			Direct expend. ($)	Indirect expend. ($)	Total expend. ($)
		Boat based	Land based	Total			
Australia	290	558 336	1 059 691	1 618 027	29 413 499	246 891 019	276 304 518
WA	197	46 717	106 364	153 081	4 893 244	40 764 627	45 657 871
SA	9	30 580	129 320	159 900	1 990 550	8 253 349	10 243 899

(Source: Adapted from International Fund for Animal Welfare 2004)

In the SWMR there are several locations for whale watching (Plate 4.7). In South Australia, whale watching occurs in two main areas: along the coast of the southern Fleurieu Peninsula, 80 kilometres south of Adelaide, and at the Head of Bight Marine Park (International Fund for Animal Welfare 2004). Southern right whales visit the region on their annual breeding migration, spending the winter months in the protection of the bay at the head of the Great Australian Bight (Tourism Eyre Peninsula 2005). The area to view the whales in the Bight is located on the Yalata Indigenous Protected Area and revenues from land-based whale watching are earned for the local indigenous community (International Fund for Animal Welfare 2004). This is a significant tourist drawcard for such an isolated location, due mainly to its consistent whale sightings in season at such a close proximity to the land (International Fund for Animal Welfare 2004).

The South Australian Department of the Environment and Heritage is currently responsible for the management of whale watching and the formation of policy and guidelines surrounding the industry within South Australia. There are six licences held within South Australia: one on Kangaroo Island, and five within Encounter Bay, which is outside of the SWMR. The department does not issue licences for other marine mammal watching (e.g. dolphins or seals) but the guidelines surrounding all marine mammal interactions are currently under review (Department for the Environment and Heritage 2005, pers. comm.).

Plate 4.7 Whale watching

(Source: Department of the Environment and Water Resources)

In Western Australia, a commercial whale-watching industry was established in the waters off Perth in 1989, based on humpback whales migrating southwards from September to late November (Department of Conservation and Land Management 2005). Since then, the interest in whale watching has expanded, with charter vessels now operating from a range of locations including Albany, Geographe Bay and Denham.

Other marine mammals are also important components of the tourism industry of the SWMR. The most significant of these are dolphins and seals. For example, at Baird Bay a tourism industry has developed around visitor interactions with sea lions and dolphins. Seal watching has also become popular along the southern coast of Western Australia, particularly around the town of Esperance. New Zealand fur seals and Australian sea lions are also common along the southern coast of the SWMR, and are becoming an increasingly important drawcard for tourists. Dolphin watching tours are now operated from a number of locations including Bunbury, Rockingham and Monkey Mia. Indeed, Monkey Mia, located in the Shark Bay World Heritage area, is probably one of the best known dolphin watching locations, continuing to attract large numbers of visitors for dolphin watching and feeding (International Fund for Animal Welfare 2004).

The Department of Conservation and Land Management (CALM) in Western Australia manages the permits for whale and dolphin watching in Western Australia (International Fund for Animal Welfare 2004). The number of whale watching permits has increased slightly from 91 to 110 between 1997 and 2005, whilst the number of dolphin watching permits has increased more than five fold over the same period (tables 4.8 and 4.9).

Table 4.8 Number of marine mammal permits issued by CALM, 1997–2005

Year	Whale (vessel)	Dolphin	Seal	Sea lion	Dugong/whale (aircraft)	Total
1997	91	18	4	0	4	**117**
1998	85	30	10	5	2	**132**
1999	96	40	17	6	2	**161**
2000	112	66	34	5	1	**218**
2001	107	67	32	5	2	**213**
2002	114	79	41	3	1	**239**
2003	109	88	42	3	1	**243**
2004	113	95	52	2	1	**263**
2005	110	95	49	2	1	**257**

(Source: Department of Conservation and Land Management 2005, pers. comm.)

Table 4.9 Distribution of marine mammal licenses in Western Australia, 2001

Location	Whale	Dolphin	Dugong	Seal	Aircraft	Total
Esperance	2	0	0	0	0	**2**
Bremer Bay	1	0	0	1	0	**2**
Albany	3	0	0	1	1	**5**
Augusta	3	2	0	3	0	**8**
Geographe Bay	8	3	0	1	0	**12**
Bunbury	2	6	0	0	0	**8**
Cervantes	8	4	0	4	0	**16**
Dongara	1	0	0	0	0	**1**
Kalbarri	4	5	0	0	0	**9**
Shark Bay	10	11	5	0	0	**26**
Total	**42**	**31**	**5**	**10**	**1**	**89**

(Source: Department of Conservation and Land Management 2005, pers. comm.)

Recreational boating

Recreational boating in Australia has increased dramatically over the past two decades due to the increase in disposable incomes and the general decrease in boating costs associated with the introduction of new technologies and materials (Widmer & Underwood 2002). It is particularly popular in the SWMR; almost 75 000 boasts are owned by South Australians, while more than 100 000 recreational vessels are owned in Western Australia. There are approximately 440 boat ramp facilities situated on the coast and inland waters of the SWMR. When including other boat launching facilities such as slipways, boat lifters and over-beach launching facilities, this number increases to over 470 (Figure 4.18).

Management of recreational boating in Western Australia is governed by the Department of Planning and Infrastructure which is responsible for registering vessels, as well as promoting and communicating marine safety issues and standards to recreational boaters (Department of Planning and Infrastructure 2005). Similarly, in South Australia the Department of Transport, monitors recreational boat use through the delivery of boat operator permits.

Marinas

There are 17 existing marinas in the SWMR: three in South Australia and 14 in Western Australia (Figure 4.18). Hillary's boat harbour in Western Australia is the largest commercial and recreational marina in the region. Although it is primarily a boat harbour, Hillary's has been established as a popular tourist precinct with a large selection of specialty shops, restaurants, bars, cafes, accommodation and a leisure park with water slides and mini golf.

The popularity of Hillary's marina as a tourist spot has resulted in recent upgrades to the harbour that will be implemented over the next four years. Upgrades include changes to signage to help direct the increasing number of visitors and decrease congestion at the facility (West Australian Planning Commission & City of Joondalup 2004).

Marinas are also an important commercial activity in other towns in the Western Australian section of the SWMR, including Fremantle, Bunbury, Geraldton and Albany. These facilities generate direct and indirect employment through marina management, boat maintenance, and associated tourism activities. Increasing levels of recreational boat ownership are likely to contribute not only to the expansion of existing marinas, but also to the development of new facilities.

South Australia has fewer marinas than in Western Australia, with a clear concentration of facilities in the coastal areas around Adelaide. In part this is linked to South Australia's smaller coastal population, and its more concentrated pattern of settlement. However, there is an ongoing pressure to improve existing facilities. In August 2005, the South Australian Government announced a $17.4 million joint venture with a private consortium to expand the number of boat bays available in Port Adelaide's Inner Harbour. One of the other major marinas in the area is the Lincoln Cove Marina at Port Lincoln. This marina was established in 1986, and is in the process of being upgraded. The outcome is likely to be a significant increase in visitors to the Lower Eyre Peninsula.

Charter boats

Coastal tourism includes an increasing number of commercial passenger vessels that take tourists sightseeing, fishing, diving, marine mammal watching, and ferry them to island resorts. In the SWMR there are 258 registered charter boat operators (Figure 4.18). This has increased from 184 in 2003 (National Oceans Office 2004b). Fremantle, Western Australia, has the largest number of charter boat operators in the SWMR. The large number of charter boat operators in Fremantle can be attributed to the variety of marine life and coastal recreational opportunities off the coast. Humpback and southern right whales pass Fremantle from September to November. Game fishing is very popular, with snapper, cod, shark, tuna and marlin common catches. Additionally, charter boat operators travel to Rottnest Island, 18 kilometres off the coast of Fremantle.

Charter boat operators in Western Australia also operate from a number of other bases, particularly the larger towns of Albany, Esperance, Jurien Bay, and Geraldton. Most of these charter boats are closely aligned with the recreational fishing sector; however, whale and other mammal watching activities are also important. In the Shark Bay World Heritage Area a number of charter boats operate in the nature-based tourism sector.

In Western Australia, management of charter boat tour operations is governed by a variety of state departments. The Department of Fisheries manages the "Aquatic Tour Sector", which includes any aquatic tour activity, excluding those operated in marine reserves. Management involves licensing of tour operators under the following categories: fishing tours, restricted fishing tours and aquatic eco-tours (Department of Fisheries 2005b). The Department of Transport surveys vessels and issues licenses to ensure the vessel is safe for the type of work intended, and the Department of Conservation and Land Management (CALM) manages operators conducting commercial activities within marine nature reserves and marine parks (Tour Operators Fishing Working Group 1998). All operators, with the exception of those conducting fishing activities, are required to obtain a license from CALM (Tour Operators Fishing Working Group 1998).

In South Australia, charter boats are concentrated around Port Adelaide, although some of the larger towns in the South Australian section of the region have charter operators of some description. According to Charter Guide Australia (2005), there are around 32 charter boats licensed to operate in the SWMR, with eight of these boats based on Kangaroo Island. The most common activity for these boats is recreational fishing, closely followed by nature-based tourism. The lack of charter boats along much of the South Australian coast reflects the often stormy and rough conditions common in the area and the lack of major population centres.

In South Australia, new management arrangements for charter boat operators were announced in 2005. License requirements were established as a means to sustain and manage fish stocks. There was a need to ensure that the charter fishing sector, along with the recreational and commercial fishing sectors, was included in management arrangements (Presser & Mavrakis 2005). As a result, from July 2005 all charter boat operators in South Australia require a license for operation.

Yacht racing

There are 56 yacht clubs in the SWMR, with a membership of approximately 24 000 people (Yachting South Australia no date, Yachting Western Australia no date). This number has increased substantially since 1995, when there were a little over 17 000 members in the region (Yachting South Australia & Yachting Western Australia 2005, pers. comm.). It should be noted that data on membership levels for Western Australia includes four clubs north of the SWMR boundary; however, as these clubs have small memberships, the totals presented here are assumed to be reflective of the total membership of the region. There are two annual yacht races held in the SWMR: the Perth to Geraldton yacht race held in October and the Melbourne to Adelaide yacht race which runs in December (Figure 4.19). In South Australia, the Blue Water Classic Adelaide to Port Lincoln yacht race, held in February, attracts more than 50 entrants. The socio-economic impact of yacht racing in the region is minor compared to the eastern states of Australia, where there are 12 major yacht races held each year, including the high profile Sydney to Hobart yacht race (Yachting Western Australia 2005, pers. comm.).

Figure 4.18 Charter boat operations and marinas in the SWMR

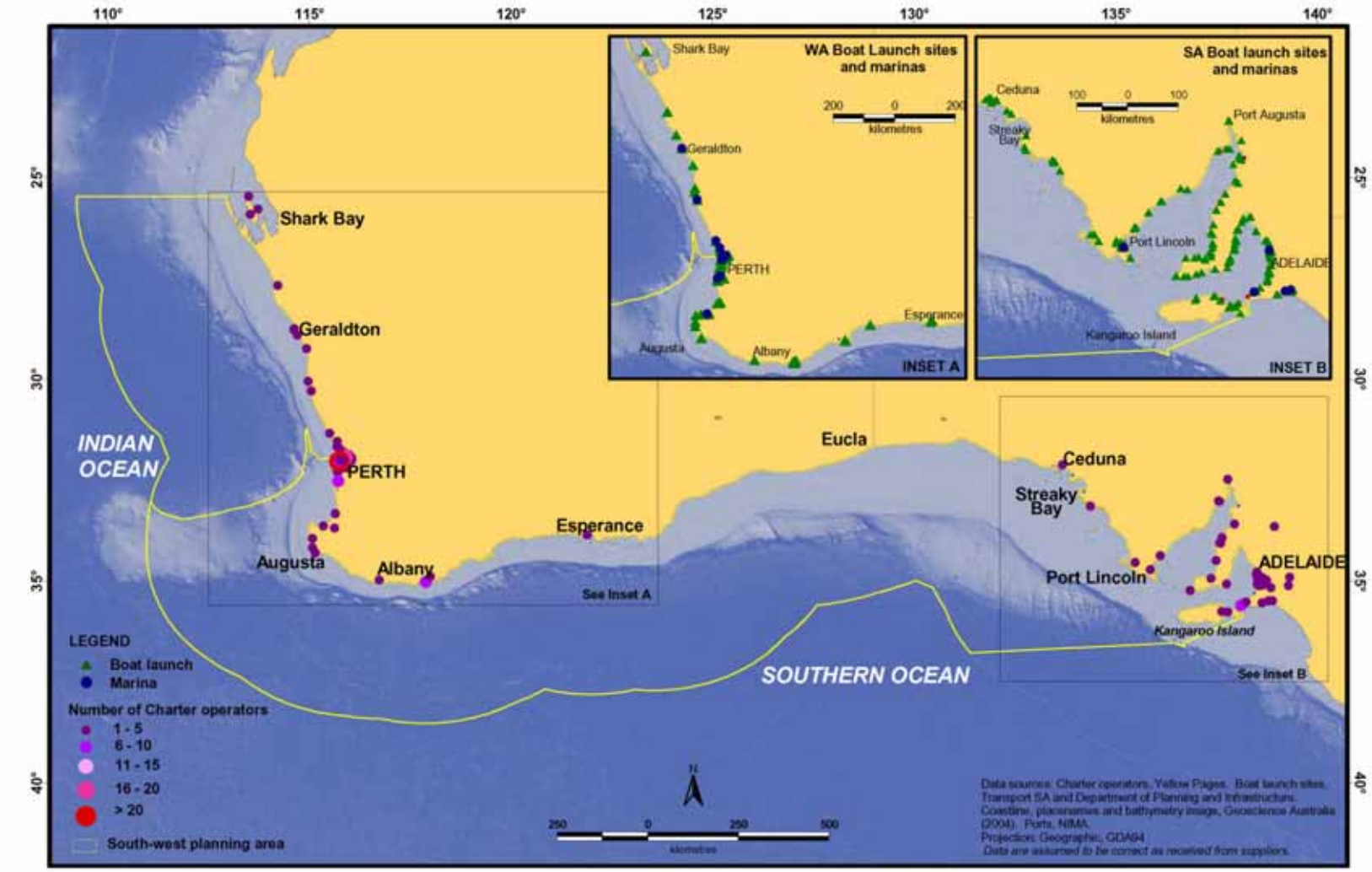
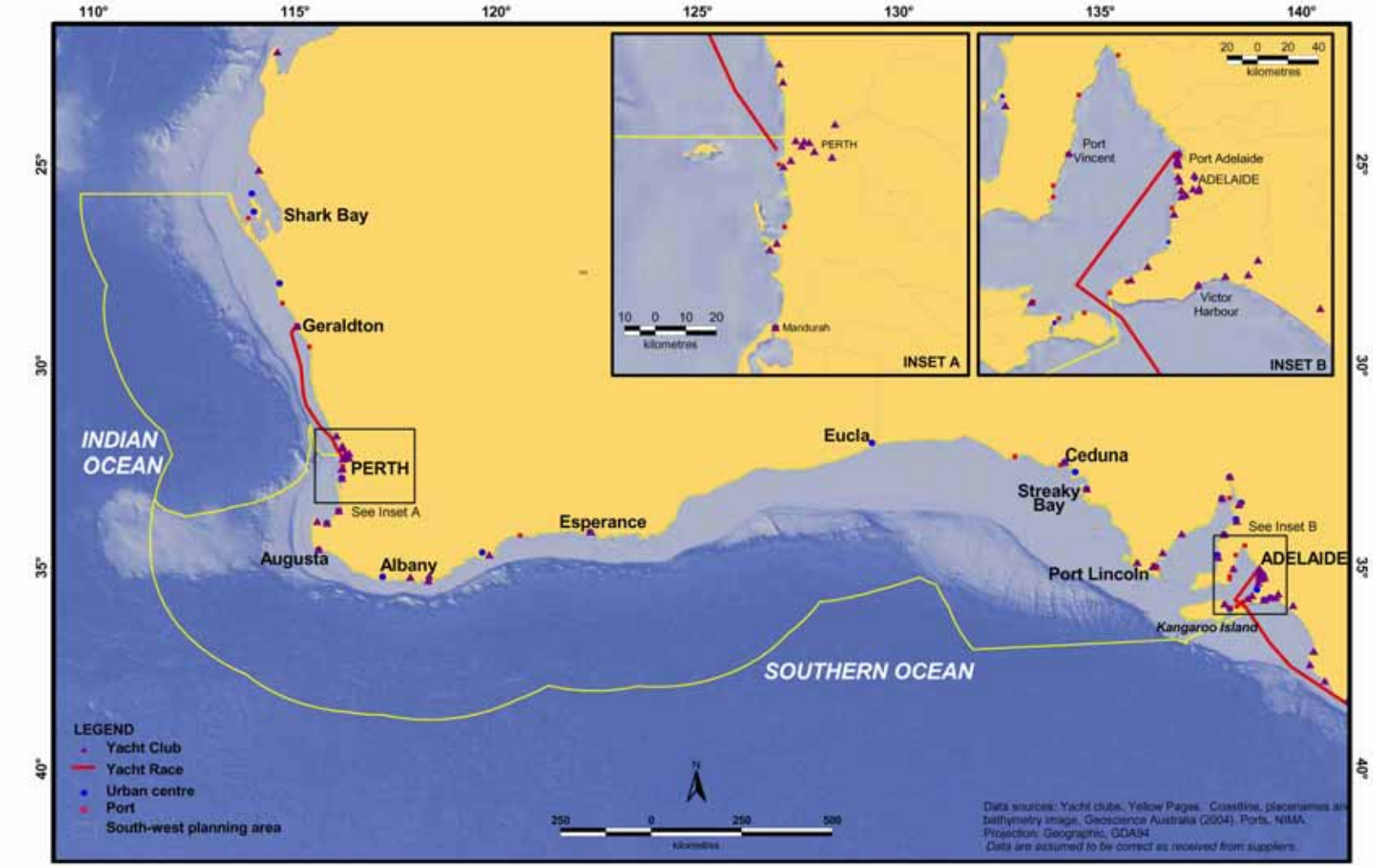


Figure 4.19 Yacht clubs and major yacht races in the SWMR



Cruise ship visits

Cruise ships transit through the SWMR, and stop at some of the region's key ports. The number of cruise ship visits to the SWMR increased moderately in the period between 2000–01 and 2003–04 (Table 4.10). The minor decline from 2002–03 to 2003–04 occurred during a period of world instability with worldwide tourism levels decreasing due to the perceived threat of terrorist attacks, the Iraq conflict, SARS, and a weak global economy (World Tourism Organisation 2004). Despite the decline, it is anticipated that the rapid increase in cruise ship visits seen prior to 2003–04 (Australian Association of Port and Marine Authorities 2004) will continue, with Australian Tourism Industry forecasting increases in tourism across Australia.

Table 4.10 Cruise ship visits to ports in SWMR, 2000–01 to 2003–04

	2000–01	2001–02	2002–03	2003–04
Albany Port Authority	2	2	3	3
Bunbury Port Authority	0	0	1	0
Esperance Port Authority	0	0	0	0
Fremantle Port Authority	6	5	19	13
Geraldton Port Authority	4	0	0	1
Klein Point	0	0	0	0
Port Giles (Flinders)	0	0	0	0
Port Lincoln (Flinders)	0	0	0	0
Port Pirie (Flinders)	0	0	0	0
Thevenard (Flinders)	0	0	0	0
Wallaroo (Flinders)	0	0	0	0
Total	**12**	**7**	**23**	**17**

(Source: Australian Association of Port and Marine Authorities 2004)

At present, all of the cruise ship visits in the region are to ports located in Western Australia. Fremantle Port had the largest number of cruise ship visits of all the ports in the region. The direct and indirect economic impact of cruise ship visits to the SWMR is difficult to determine, with little research to date focused on this area. However, in general terms it would appear that cruise tourism is an increasingly valuable source of income for a number of port cities, given that cruise tourists tend to spend higher amounts per day than other international tourists (Hall 2001). The large increase in cruise tourism (an increase of almost four fold in Fremantle from 2001–02 to 2002–03) may see cruise tourism become an important industry for the SWMR in the near future.

Plate 4.8 The QE2 departing Fremantle

(Source: Department of the Environment and Water Resources)

4.7.5 Economic dimensions

Regional and national economic importance

Marine tourism, because of its diverse nature, is extremely difficult to measure in terms of economic importance. While the ABS collects data on the tourism industry (e.g. see ABS's Tourism Satellite Series), recent studies cast doubt on some tourism data such as the recent report by the Productivity Commission (2005) entitled *Assistance to Tourism: Exploratory Estimates.* Within this report the following is noted (PC 2005, p. xi):

> The TSA [Tourism Satellite Accounts] compiled on this basis records that the Australian tourism industry accounts for more than 4 per cent of GDP [Gross Domestic Product], and nearly 6 per cent of employment. Adjustments to this estimate by the Commission to reflect the more common definition of tourism and, consistent with the treatment of other industries, to exclude upstream activities suggest that the tourism industry accounted for between 1.6 and 2.2 per cent of GDP, on average, for the three years to 2002–03.

Despite these concerns, the data outlined here are consistent with the Tourism Satellite Accounts. As a result, readers should be aware of the debate surrounding these figures.

Allen Consulting Group (2004) calculates the marine tourism sector, in 2002–03, as being the largest of the marine-related industries, in terms of direct added value, and employment. Marine tourism was calculated to:

- create 42.3 per cent of direct added value for the marine sector ($11.3 billion)
- create 60.8 per cent of indirect added value within the marine sector ($28.2 billion)
- contribute 75.3 per cent of marine sector direct employment (190 620 people)
- contribute 65.3 per cent of indirect employment (450 960 people).

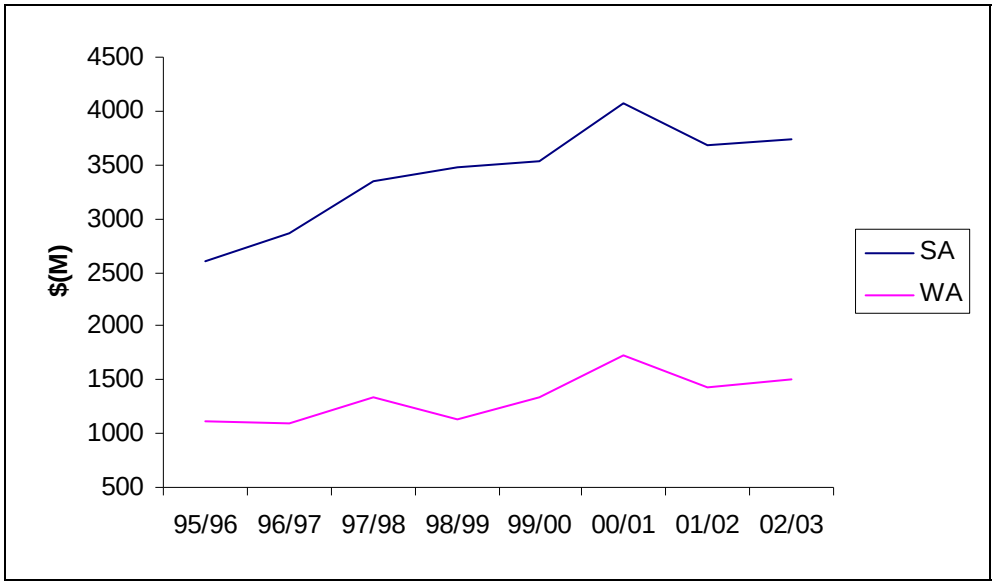
In addition, the importance of marine tourism to the national and regional economy is demonstrated by two facts:

- First, the wide range of associated industries including travel agents and tour operator services; taxi transport; air and water transport; accommodation; cafés, restaurants etc.; clubs and pubs etc.; other retail trade; fuel retailing; and food manufacturing all benefit from marine tourism activity.
- Second, tourism activities, particularly nature-based tourism activities, are widely dispersed and are therefore of integral importance to regional centres.

Within the region, marine tourism is calculated to have contributed – directly and indirectly – over $5.2 billion to the South Australian and Western Australian economies in 2002–03. This was made up of $3.7 billion in South Australia ($1.06 billion direct and $2.66 billion indirect) and around $1.5 billion in Western Australia ($0.43 billion direct and $1.07 billion indirect).

Between the years 1995–96 and 2002–03, the direct and indirect added value created by marine tourism within the region grew at an annual average rate of some 5.2 per cent per annum (see Figure 4.20). Note that the large growth between 1999–2000 and 2000–01 was primarily driven by the one-off impact of the GST inflating the price of tourism services.

Figure 4.20 Direct and indirect added value from marine tourism in Western Australia and South Australia, 1995–96 to 2002–03



(Source: Allen Consulting Group 2004)

Employment

Marine-related tourism is a major employer across Australia. In 2002–03 it contributed 75.3 per cent of total direct employment in marine industries, and 65.3 per cent of indirect employment (Allen Consulting Group 2004). In terms of actual numbers employed in the region, over 18 000 people were full time employed in the tourism sector in South Australia with around 7000 people employed in Western Australia. Indirect employment associated with marine tourism activities was calculated at nearly 60 000 people.

4.7.6 Management arrangements for marine tourism

Marine tourism in Australia is not regulated by one particular act of legislation. Rather, the activities are regulated by all tiers of government and by legislation relating to the marine environment. The SWMR lies across two states, and is managed under the key

Commonwealth environment legislation, the *Environmental and Biodiversity Conservation Act 1999*.

At a state level, the key agencies involved in management of marine tourism in Western Australia include the Department of Conservation and Land Management (CALM) and the Fisheries Department. CALM is responsible for administering the *Conservation and Land Management Act 1984* which applies to state land or waters comprising marine nature reserves, marine parks and marine management areas. Marine parks within the region include the Jurien Bay, Shark Bay, Marmion, Shoal Water Islands and Swan Estuary Marine parks (Department of Conservation and Land Management 2004). The Department of Fisheries is responsible for managing recreational fishing and charter boat operators (Department of Fisheries 2005b).

In South Australia the two main agencies managing marine tourism are the Department of Primary Industries and Resources, and the Department of the Environment and Heritage (Baker 2000). These agencies administer the *Fisheries Act 1982* and the *National Parks and Wildlife Act 1972–1982* respectively. Within the South Australian section of the SWMR are the Great Australian Bight Marine Park and 14 Aquatic Reserves including Seal Bay/Seal Beach Aquatic Reserve on Kangaroo Island in South Australia. Additionally, the *Coastal Protection Act 1972* governs coastal management and makes provisions for the conservation and protection of beaches and coasts in South Australia (Department for the Environment and Heritage 2005).

4.8 Recreational fishing

4.8.1 Industry objectives

In many respects, recreational fishing is closely related to marine tourism. Currently the motivation behind most recreational fishers is to relax and unwind outdoors, fish for sport, and spend time with family. Only a small percentage of fishers view catching fish for food as their main reason for going fishing (Henry & Lyle 2003). This is shift in motivation is also reflected in the fact that recreational fishing is becoming a more conservative practice involving approaches such as catch and release (Recreational Fishing Industry Review Committee 2001). Given the nature of recreational fishing, there is not clear set of industry objectives, although organisations such as Recreational Anglers Network of South Australia and Recfishwest do actively support recreational fishing.

4.8.2 National activity

Recreational fishing is a very popular activity in Australia and involves the harvesting of fish and other aquatic resources for non-commercial use (National Oceans Office 2002). Fishing is thought to have been one of the first recreational activities undertaken by Europeans in Australia and is now the second most popular outdoor activity after swimming (Australian Recreational and Sport Fishing Industry Confederation & Fisheries Research and Development Corporation 2001). Recreational fishers use a variety of methods including line fishing, pots and traps, nets and diving. These methods are employed in a range of habitats including onshore, coastal, offshore, and estuarine, as well as in freshwater rivers, lakes and dams (Henry & Lyle 2003). Development of technologies such as GPS and echo-sounders has seen recreational fishers become more efficient and has resulted in an increase in the number of offshore species being targeted.

A rising population, increasing tourism activity and improved access to remote coastal areas has seen a marked growth in recreational fishing in Australia. Recreational fishing is now an important industry contributing significantly to the nation's economy. Between May 2000 and April 2001, fishers spent about $1.8 million on fishing-related items including boats and trailers, fishing gear and travel costs. This equated to recreational fishers on average spending $552 per fisher per year during this period (Henry & Lyle 2003).

In the 12 months prior to May 2000, 19.5 per cent of the nation's population participated in recreational fishing, representing approximately 3.36 million Australians (five years or older). Almost 25 per cent (1.8 million) of Australian households had at least one recreational fisher present. Fishing was more popular among males, and the highest number of fishers was aged 30–44 years. During this same period Australians fished for approximately 20.6 million fisher days, or 102.9 million fisher hours of effort. This resulted in an estimated 136 million aquatic animals or more than 30 000 tonnes being harvested (Henry & Lyle 2003). The national catch of marine finfish (in numbers) was dominated by whiting, flathead, Australian herring and Australian salmon, bream, mullet, garfish, tailor and pink snapper. Squid/cuttlefish, blue swimmer crabs, mud crabs, lobsters and abalone were the main non-fish species harvested (Henry & Lyle 2003).

The majority of states have licences for particular recreational fishing activities, and in the year ending May 2000 an estimated 445 000 Australian residents (aged five years or older)

held a recreational licence. The bulk of recreational fishing during this period occurred in coastal waters (41 per cent) while only four per cent was undertaken in offshore waters. More than half a million boats with a value of $3.3 billion were used for fishing. Ninety-three per cent of the total boat-based fishing effort was from private vessels, whilst fishing from charter boasts accounted for 3.7 per cent and hire boats 3.3 per cent of the total effort (Henry & Lyle 2003).

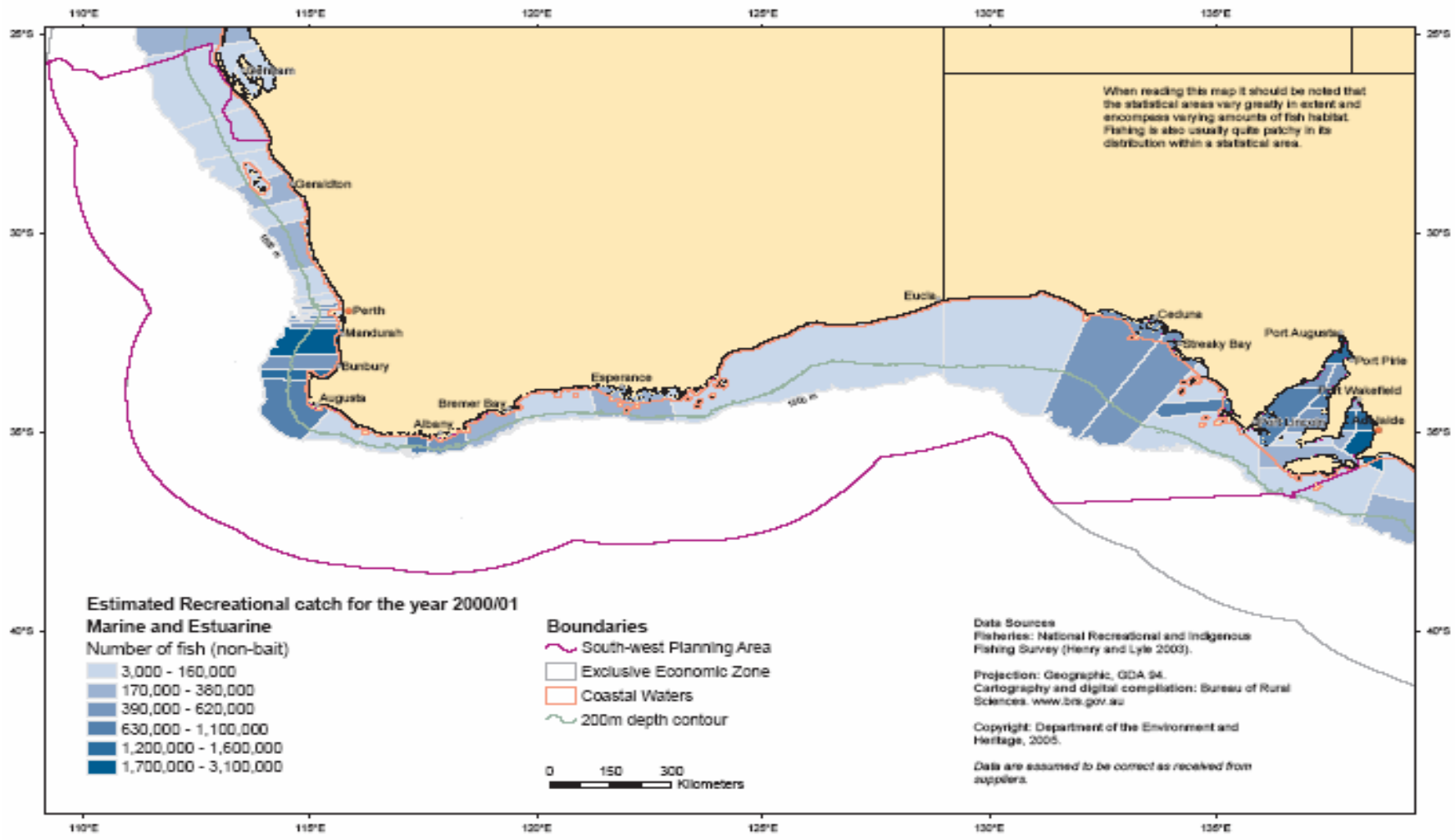
4.8.3 Regional activity

Recreational fishing is an important industry in the SWMR due to its extensive coastline and diversity of marine species. For ease of discussion, recreational fishing in the region is separated into South Australian activity and Western Australian activity. Unavoidably, the statistics for each state will include areas outside the SWMR. Also, whilst the discussion will focus on recreational activity within marine and coastal environments where possible, some of the data will include activity in other environments such as estuaries. This is one of the constraints of the available information, but it nevertheless provides a good indication of the regional trends in recreational fishing. Figure 4.21 gives an overview of the recreational fishing catch in the SWMR during the year 2000–01.

Plate 4.9 Fishing at Cheynes Beach near Albany

(Source: Ian Eliot)

Figure 4.21 Recreational fish catch in the SWMR, 2000–01



(Source: Department of the Environment and Heritage 2005)

Western Australia

In the 12 months prior to May 2000, Western Australia had 479 425 recreational fishers and a participation rate of 28.5 per cent, which was above the national rate of 19.5 per cent. More than one in three households contained recreational fishers (34.2 per cent), compared to the Australian rate of 24.4 per cent. Similar to the national trend, recreational fishing was more popular with males than females, and the greatest number of fishers was aged 30–44 years. Particular types of recreational fishing in the state require a licence, and in 2000, 14.7 per cent of fishers held a licence.

From May 2000 to April 2001 Western Australia recorded 3.4 million fisher days, or 19.7 million fisher hours. Sixty-six per cent of this recreational activity (fishing events) took place in coastal areas, compared to only 41 per cent nationally. Whilst line fishing was one of the main methods employed, the use of pots and traps was significantly higher (45 per cent) than the Australian average (24 per cent), reflecting the importance of the state's recreational harvest of rock lobster and blue swimmer crabs. Diving effort was also above average, again reflecting the collection of lobsters as well as abalone. Almost 11 per cent of recreational fishing occurred in offshore waters, which was markedly higher than the national level of four per cent. Shore fishing was slightly more popular than boat-based fishing, but the majority (more than 90 per cent) of both activities were undertaken in saltwater (Henry & Lyle 2003).

The bulk of the boat-based activity involved privately owned vessels (94 per cent), with charter and hire boats accounting for six per cent of the activity. Of the more than 100 000 recreational boats owned in Western Australia, 60 per cent were used for fishing and had a total value of more than $600 million (Henry & Lyle 2003). The estimated attributable expenditure by recreational fishers in Western Australia was about $338 million or $706 per fisher per year (for the period May 2000 to April 2001). This was the second highest level of expenditure behind Victoria, which had the highest level. Sixty-eight per cent of this spending was by people residing in Perth, while the remaining 32 per cent of expenditure was by residents outside the capital. The highest expenditure items were boats and trailers, followed by travel and camping gear (Henry & Lyle 2003).

In Western Australia from May 2000 to April 2001 the total recreational harvest was 5800 tonnes (Penn et. al 2005). The marine finfish species harvested by recreational fishers in the greatest numbers included whiting, Australian herring, tailor and bream. Blue swimmer crabs, prawns and lobsters were the dominant non-fish species. The Western Australian catch of Australian herring constituted 56 per cent of the total national harvest of this species, and came predominantly from coastal waters. The harvest of lobsters (59 per cent), abalone (56 per cent) and blue swimmer crabs (57 per cent) from the inshore coastal waters of Western Australia constituted more than half of the total national catches of these species (Henry & Lyle 2003). The main species caught offshore include whiting, wrasse and groper, Western Australian dhufish and snapper (Penn et. al 2005).

South Australia

Over 300 000 South Australian residents aged 5 years and older undertook recreational fishing in the 12 months to May 2000, representing a participation rate of 24.1 per cent. Almost 30 per cent of householders contained recreational fishers and twice as many males participated in fishing than females during this period, following the trend of Western Australia. The proportion of South Australian fishers holding a recreational licence was much lower (4.4 per cent) than Western Australia (14.7 per cent) and lower than the national

average (13.3 per cent). This is because the only recreational licence required in the state is for lobster pots (National Oceans Office 2002, Henry & Lyle 2003).

South Australia recorded 1.9 million fisher days, 2.2 million events and 9.8 million fisher hours from May 2000 to April 2001. The bulk of recreational fishing events involved line fishing (84.5 per cent) while 10.7 per cent used pots and traps, again to catch lobster (Henry & Lyle 2003). The majority of this activity (fishing events) occurred in coastal environments (74.2 per cent), while only 3.3 per cent took place offshore. Subsequently 62.3 per cent of recreational fishing effort was shore-based and 37.6 per cent was from boats. Ninety-five per cent of this boat-based activity was from privately owned vessels and the remainder was a combination of charter and hire boats.

Over half of the 74 892 recreational boats owned in South Australia are used for recreational fishing and have a value of almost a quarter of a million dollars. In the months between May 2000 and April 2001 South Australians spent approximately $148 million or $452 per fisher per annum on recreational fishing; the main expenditure items were the boat and trailer, travel and camping gear. Just over half (57 per cent) of this expenditure was by residents of Adelaide (Henry & Lyle 2003).

From May 2000 to April 2001 South Australia's recreational catch was 4200 tonnes. Australian herring, King George and other whiting, mullet and garfish dominated the harvest of marine finfish, whilst squid/cuttlefish, blue swimmer crabs and macrobrachium/cherabin were the non-fish species caught in the highest numbers. The South Australian catches of King George whiting and garfish both represented 62 per cent of the total national recreational harvest for these species and the bulk of the catches came from coastal waters. Of the 1.7 million squid/cuttlefish harvested annually in Australia by recreational fishers, the bulk (61 per cent) came from South Australian coastal waters (Henry & Lyle 2003).

Recreational fishing case studies in the South-west Marine Region

Recreational Rock Lobster Fishery

One of the commonly taken recreational species in the SWMR is the rock lobster. In Western Australia the fishery mainly targets western rock lobsters (*Panulirus cygnus*) but also catches southern and tropical rock lobster species. The bulk of the effort occurs in inshore regions between Perth and Geraldton and involves pots (traps) and diving. The recreational catch for the 2002–03 season was 890 tonnes with a direct value of approximately $18 million. A total of 33 700 licences were used for lobster fishing, representing 75 per cent of the total licences purchased for the season. The average catch rate for pots was 1.7 lobsters per person per fishing day and 1.9 for diving. The annual catch is expected to continue to increase at an average rate of six per cent per annum. This fishery is managed through a series of controls including the requirement of a licence, together with size, bag and pot usage limits. In addition, the fishery is only open between 15 November and 20 June each year (Penn et al. 2005).

In South Australia southern rock lobster (*Jasus edwardsii*) is the main species taken. The fishery is divided into two zones, Northern and Southern. Only the Northern Zone Rock Lobster Fishery falls within the SWMR; it extends from the Western Australian border to the mouth of the Murray River and covers 20 000 square kilometres. Recreational fishers take the lobsters either by diving or using "drop nets" and pots. Pot numbers are restricted through a limited number of allowed registrations (Ward et al. 2002). The Recreational Rock Lobster Fishery operates during the same season as the commercial fishery, which is from 1

November to 31 May each year. The catch of lobster by potting was approximately 67 tonnes in 1998, representing 2.6 per cent of the total combined recreational and commercial harvest for the season. In 2000 an estimated 12 tonnes of lobster were harvested by recreational divers, which equated to 1.4 per cent of the total catch by commercial and recreational fishers in the fishery for the season (Ward et al. 2002).

Recreational Abalone Fishery

A second important recreational fishery in the SWMR is the abalone fishery. In Western Australia the fishery targets Roe's, greenlip and brownlip abalone. The fishery is divided into three zones: the West Coast Zone (from Busselton Jetty to Greenough River Mouth – near Geraldton), the Southern Zone (from Busselton Jetty to the South Australian border) and the Northern Zone (from Greenough River Mouth to the Northern Territory border). Only part of the Northern Zone occurs within the region, from the Greenough River Mouth north to Shark Bay.

Wading or snorkelling for Roe's abalone occurs mainly between Geraldton and Augusta, with high levels of activity around the population centres of Perth and Geraldton. Greenlip and brownlip abalone are harvested by divers in deeper waters south of Cape Naturaliste and on the south coast. In 2003 the Perth recreational Roe's abalone fishery recorded a harvest of over 47 tonnes from an effort of 28 700 days and an average catch rate of 17.1 abalone per fisher day. The rest of the West Coast Zone recorded a catch of 15.2 tonnes of Roe's abalone, 4.4 tonnes of greenlip abalone and 2.4 tonnes of brownlip abalone. In the South Coast Zone 9.6 tonnes of Roe's, 11.7 tonnes of greenlip and 3.2 tonnes of brownlip abalone were harvested in 2003. The West Coast Zone is open from the first Sunday in November for six Sundays for an hour on each day. This is due to the easy access and proximity of the abalone to highly populated areas. The Northern and Southern zone season is from 1 October to 15 May each year. In addition to seasonal controls, fishers require a licence and there are daily bag and size limits in place (Penn et. al 2005).

In South Australia the abalone fishery is also divided into three zones: the Western Zone (from the Western Australian border to Dutton Bay), the Central Zone (from Dutton Bay to the mouth of the Murray River) and the Southern Zone from the Murray River to the Victorian border). Only the Western and Central zones occur within the SWMR. The fishery targets different species from those targeted in Western Australia; it targets greenlip and blacklip abalone, but not brownlip or Roe's abalone (Nobes et al. 2004). Recreational fishers mainly harvest abalone for consumption. Access to the fishery is unrestricted, with no licence required and no set season. However, there are daily bag and boat limits and size controls in place. The bulk of the effort occurs in the Central Zone (50 per cent) and the Western Zone (30 per cent). Half of the recreational catch is taken in the Western Zone and 35 per cent from the Central Zone. It is estimated that 8.82 tonnes and 4.02 tonnes are taken annually from the Western and Central zones respectively. The overall recreational take is low compared to the commercial take indicating that participation in the recreational fishery is low (Nobes et al. 2004).

4.8.4 Economic dimensions

Regional and national economic importance

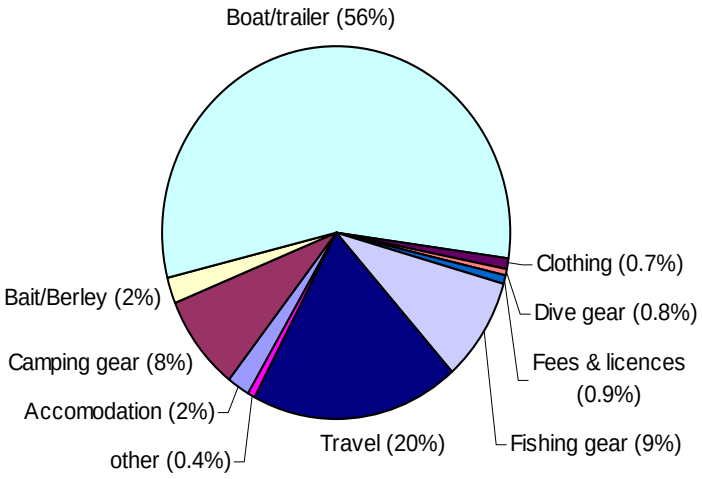
Unlike other marine industries, recreational fisheries are not a distinct class of industry activity. While the activity itself generates employment and profits for associated industries

such as service stations, boat manufactures, and bait and tackle shops, those who participate in recreational fishing are not traditionally classed as an industry sector in the same way as ship and boat-building or commercial fishing. However, the recreational fishery sector is important. This is demonstrated by the fact that in 2000–01 recreational fishers spent some $148 million in South Australia and some $338 million in Western Australia on recreational fishing and associated goods and services (see Figure 4.22)

Recreational fishing activity is also important because a large percentage of activity and expenditure occurs outside of the major metropolitan areas of Adelaide and Perth. For instance, in South Australia 43 per cent of total expenditure was spent outside the metropolitan area and in Western Australia the figure was 32 per cent (Henry & Lyle 2003).

Some studies have attempted to calculate the value of fishing to recreational fishers by estimating the weight of total fish caught and dividing this by total expenditure. For instance, using the figures above and data for total weight of catches in South Australia and Western Australia (Henry & Lyle 2003), fishers in South Australia and Western Australia spent, on average, over $52 to catch each kilogram of fish.

Figure 4.22 Expenditure on recreational fishing, South Australia and Western Australia combined, 2000–01 (%)



(Source: Henry & Lyle 2003)

Note that care should be taken in comparing the above figures with economic data for other marine users. Previously in this report *added value* has been used to showcase the importance of marine industries. This term is akin to the economic term “value added”, which is defined as profit plus wages earned from an activity. However, total revenue figures cannot be compared with added value figures to make assumptions about the economic value of one marine activity over another.

4.8.5 Management arrangements

The Offshore Constitutional Settlement provides the basis for state responsibility for the management of recreational fishing within Australia's waters (both within and outside three nautical miles).

The management of recreational fishing seeks to ensure that marine resources are harvested in a sustainable way. In addition, management generally seeks to maximise fishing opportunity but not necessarily to guarantee a catch (Pepperell 2001). It is this distinction that makes recreational fisheries management unlike the management of other marine users. For instance, commercial fisheries are managed to ensure that harvest rates are sustainable – not to maximise harvest opportunities.

While the Australian Government has no direct responsibility for the management of recreational fishing, it may become involved where recreational fishers are targeting fish species of importance to Commonwealth-managed fisheries (e.g. species targeted by the tuna and billfish fisheries). As a result, there is scope for the Australian Government to monitor and manage recreational fisheries under species managed under Commonwealth fisheries management plans.

In terms of state management, Western Australian recreational fisheries are managed by the Western Australian Department of Fisheries under the *Fish Resources Management Act 1994*. In South Australia, the Department of Primary Industry and Resources has primary responsibility for recreational fishing activity within South Australian waters through powers granted within the *Fisheries Management Act 1982*.

States use a range of strategies to both maximise fishing opportunities and minimise impacts of targeted fish stocks. These include, amongst other measures:

- catch limits and boat limits
- seasonal closures
- gear restrictions
- size limits
- licensing.

4.9 Commercial fishing

Fisheries in the SWMR are managed either solely by the Australian Government or state governments, or through Commonwealth – state/territory joint authorities. Generally the Australian Government manages those fisheries that operate in waters beyond three nautical miles from the land, and the states manage fisheries that operate inside three nautical miles. Also the within the region, the Southern Bluefin Tuna Fishery has a component of international management; as a signatory to the Convention for the Conservation of Southern Bluefin Tuna, Australia has agreed to limit catches in line with the international agreement.

4.9.1 Industry objectives

The commercial fishing industry is extremely diverse in terms of the target species, the distribution of activities, and economic structure. Broadly, however, the industry aims to harvest wild fish stocks in line with the principles of ecologically sustainable development (Western Australian Department of Fisheries 2003).

At the Commonwealth level, the Australian Fisheries Management Authority (AFMA) states that its vision for Australia's fisheries is to ensure the maintenance of highly productive fisheries managed in an ecologically sustainable way with the support of community and industry (AFMA 2006). At the industry level, the Australian Seafood Industry Council (ASIC) in its 2004 policy statement outlines seven key goals. These goals centre on security of access to fish resources; that environmental management measures pursued by governments do not adversely impact upon fishery operations, access to markets, education and training, research and development, and that there is adequate surveillance of Australia's waters (ASIC 2004).

At the state level the South Australian Government has recently released a "blueprint" for marine innovation, called 'Charting the Course', a program that covers the wild-capture fisheries and the aquaculture sector. The stated aim of this program is to double the industry's value to $2 billion by 2015 and create and additional 3500 jobs across the state through growth in the value of the tuna sector and improvements in seafood product quality, value-adding, aquaculture innovation, ecosystem services and bio-security.

4.9.2 National activity

Historically, fishing has been a very important in Australia. Indigenous people have been utilising near shore marine resource for tens of thousands of years (FRDC no date). Prior to European settlement, Aborigines gathered, speared, trapped and line-fished for a wide range of species for subsistence and trade.

The first European settlers used whales and seals for oil production, and fish and other marine species as a food source for the increasing population. The majority of this activity was undertaken in coastal waters and inland rivers and estuaries. In the early 1900s the first significant offshore fishing occurred with the development of trawling gear and an otter trawler to undertake a survey of Australian waters (Department of Agriculture, Fisheries and Forestry 2002). By the early 1950s Danish seining was becoming popular, but by the 1970s otter trawling had become the main method used (AFMA 2004a). During this period the western rock lobster industry was growing rapidly; it is now Australia's most important

single-species fishery, valued at more than $400 million in 2003–04 (Department of Agriculture, Fisheries and Forestry 2002, ABAREs 2005).

Today commercial fishing is a vital primary industry in Australia, and is fifth in terms of input to the economy from primary industries, behind wool, beef, wheat and dairy production (AFMA 2004, Department of Agriculture, Fisheries and Forestry 2004). Australians consume approximately 13 kilograms of fish per person per annum and total domestic consumption is around 200 000 tonnes per year (ABS 2003c).

Fisheries play an important role in the creation of employment and economic activity, particularly in regional areas, not only through the catch, but also from associated industries such as processing, distribution and retailing (AFMA 2004). It is estimated that around 20 000 people are currently directly employed in the fishing industry in Australia (ABS 2003c). There are around 10 000 commercial fishing vessels in Australia; a large proportion of these are operated by one or two people, and many use several types of gear (Department of Agriculture, Fisheries and Forestry 2004).

The Australian Fishing Zone (AFZ) is an area of approximately nine million square kilometres extending 200 nautical miles from the coast and includes the waters of external territories (Department of Agriculture, Fisheries and Forestry 2004). The AFZ is the third largest fishing zone in the world and extends over an area that is 16 per cent larger than the nation's landmass (ABS 2003c). However, commercial fishery production is less than in other countries due low nutrient levels in Australia's waters, the narrow continental shelf and limited nutrient upwelling (Department of Agriculture, Fisheries and Forestry 2004). Despite the low productivity, Australia has a high diversified fish population, with an estimated 4000–4500 species, of which around 200 are harvested commercially, along with more than 60 crustacean species, 30 mollusc species and some echinoderms such as sea cucumbers (ABS 2003c, Department of Agriculture, Fisheries and Forestry 2004).

Commercial fisheries in Australia are a mix of Commonwealth-managed and state-managed fisheries. In 1994–95 the Commonwealth-managed fisheries accounted for around 20 per cent of the total value of production (including aquaculture). By contrast, in 2003–04 Commonwealth-managed fisheries constituted 15 per cent of total fisheries in terms of value and state-managed fisheries accounted for the remainder. In part, this is because of the increasing value of rock lobster and abalone production, and a general fall in the value of production in Commonwealth-managed fisheries. In 2003–04, Western Australian and South Australia generated approximately a quarter each of the total Australian production (ABS 2004).

Since 1988 Australia's fisheries production (including aquaculture) has been valued at more than a billion dollars, and in 2003–04 the 267 000 tonnes produced was worth $2.2 billion. The value of Australia's fisheries exports increased from the mid 1990s until 2000–01, but it has been decreasing since then and, in 2003–04, exports were valued at about $1.65 billion. Australia's harvest of fish is comparatively low; for many fish species caught there is considerable competition from overseas producers. As a result, export prices received by producers are set in world markets, and Australian fishers are generally price takers. As a result, the current strong Australian dollar has resulted in falling prices (in $AUD). The majority (80 per cent) of Australia's fisheries production exports are edible products, such as rock lobster and tuna, with the remainder (20 per cent) being non-edible such as pearls and fish-meal. The main destinations for Australia's exports are Japan, Hong Kong and the United States (ABARE 2005).

Whilst the nation's domestic market acquires the majority of its supplies from the local catch, Australia does import some fisheries products including frozen fish fillets, prawns and canned fish (Department of Agriculture, Fisheries and Forestry 2004, ABARE 2005). Non-edible products such as ornamental fish are also imported. The value of imports was $1.1 billion in 2003–04. Edible fisheries products are mainly imported from Thailand and New Zealand, while the non-edible products come from New Zealand as well as Peru, the United States and Indonesia (ABARE 2005).

4.9.3 Regional activity

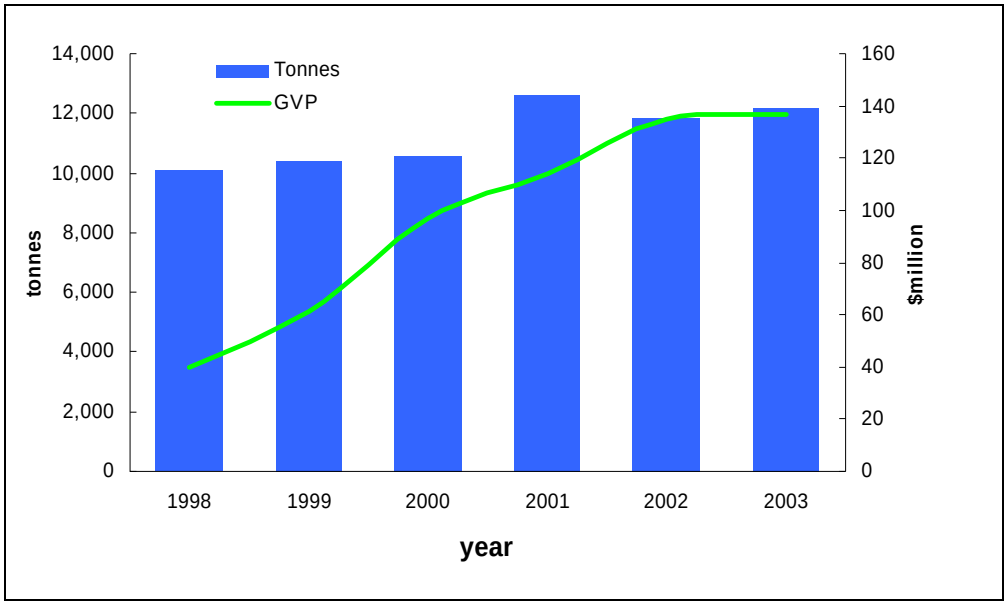
Commercial fishing is a significant industry in the SWMR due to the extensive coastline and the diversity of marine species found in the area. This is reflected in the large number of commercial fisheries in operation in the region and the wide variety of species that are harvested. As stated above, both Commonwealth-managed and state-managed fisheries operate within the coastal and offshore waters (not including estuarine or inland fisheries) of the SWMR. The distribution of the combined catch of all the fisheries from the region is shown in Figure 4.24.

Commonwealth-managed fisheries of the South-West Marine Region

The Commonwealth-managed fisheries located within the SWMR are described in Table 4.11.

The combined catch of the Commonwealth-managed fisheries in the region has increased slightly from around 10 000 tonnes in 1998 to over 12 000 tonnes in 2003. However, the combined GVP (gross value of product) of the fisheries has increased over the same period markedly from $40 million to $136 million (Figure 4.23). This is mainly due to the growth of the Small Pelagic Fishery and the Southern Bluefin Tuna Fishery.

Figure 4.23 Catch volume and GVP for combined SWMR Commonwealth-managed fisheries, 1998–2003



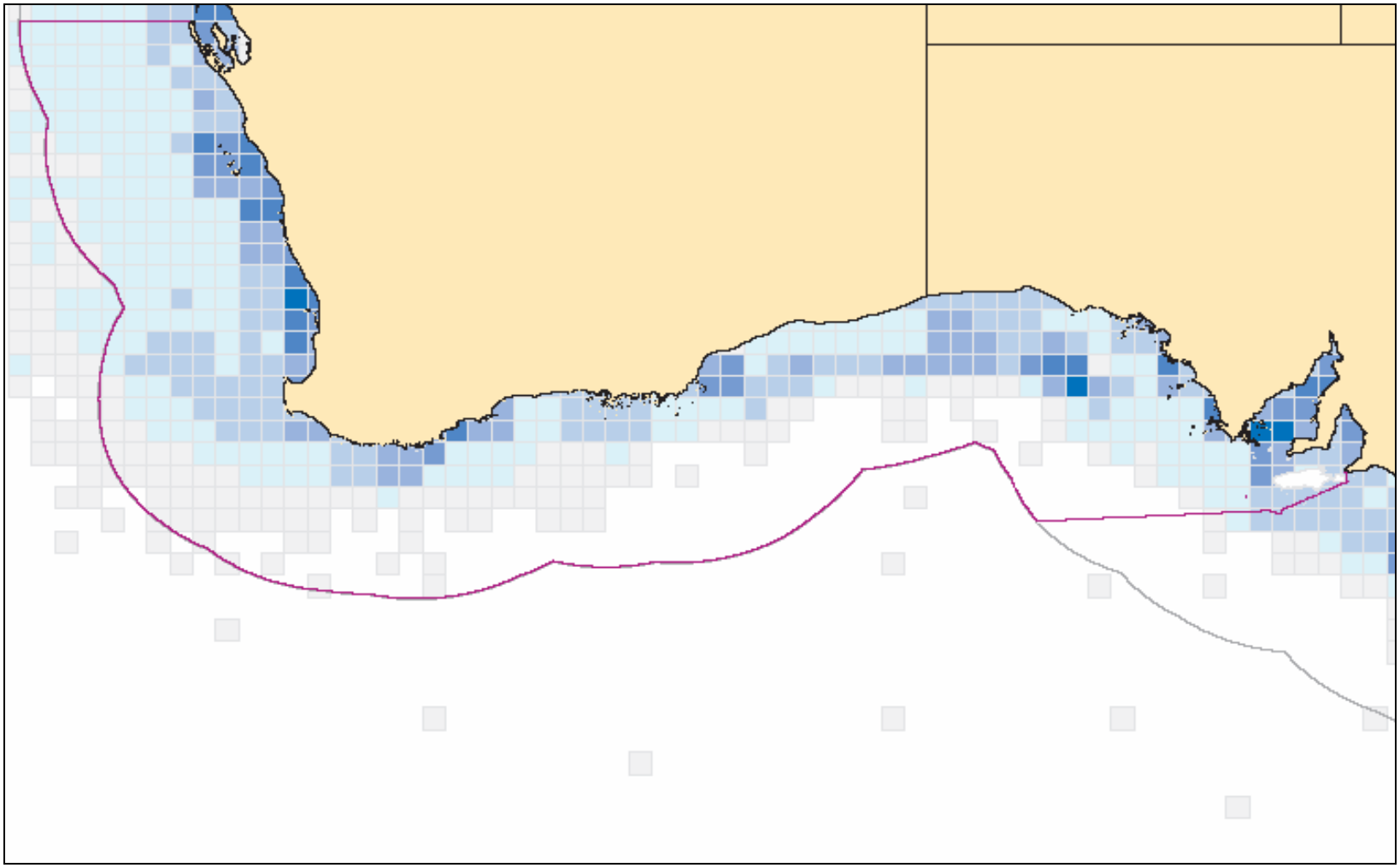
(Source: Bureau of Rural Sciences 2005)

Table 4.11 Commonwealth-managed commercial fisheries active (wholly or partly) within the SWMR, 2003/2004

Fishery	Area	Species	Main fishing method	Number 2004	GVP 2003 ($ million)
Great Australian Bight trawl	Commonwealth waters between Cape Leeuwin, WA and Kangaroo Island, SA	Deepwater flathead, orange roughy, bight redfish	Demersal otter, limited midwater trawl	10 vessels	8.6
Southern Bluefin Tuna	Commonwealth waters esp. the southern and south eastern parts of the AFZ	Southern bluefin tuna	Purse seining, pole and line, longline, trolling	64 vessels	77.8
Gillnet, Hook and Trap	Commonwealth waters off south Qld, NSW, Vic, Tas and SA	Mixed fish species, particularly pink ling, blue-eye trevalla, gummy shark	Demersal gillnet, demersal longline, dropline, trotline, trap, purse seine	205 vessels	3.0
Western Tuna and Billfish	Commonwealth waters from Cape York around northern Australia to the SA/Victorian border	Yellowfin, bigeye, skipjack, albacore tuna, some billfish species	Pole and line, purse seine, pelagic longline, troll, rod and reel, handline	125 permits	13.3
Western Deepwater Trawl	Commonwealth waters off WA	Mixed fish species	Otter trawl	7 permits	1.3
Small Pelagics	Commonwealth waters, purse seine and midwater trawl from north of the NSW/Qld border along southern Australia to near Perth, WA	Greenback, yellowtail, Peruvian jack mackerel	Purse seine, midwater trawl	77 permits	N/A (commercial in confidence)

(Source: Australian Bureau of Agricultural and Resource Economics 2005, pp.13–14)

Figure 4.24 The combined catch of all the fisheries within the SWMR



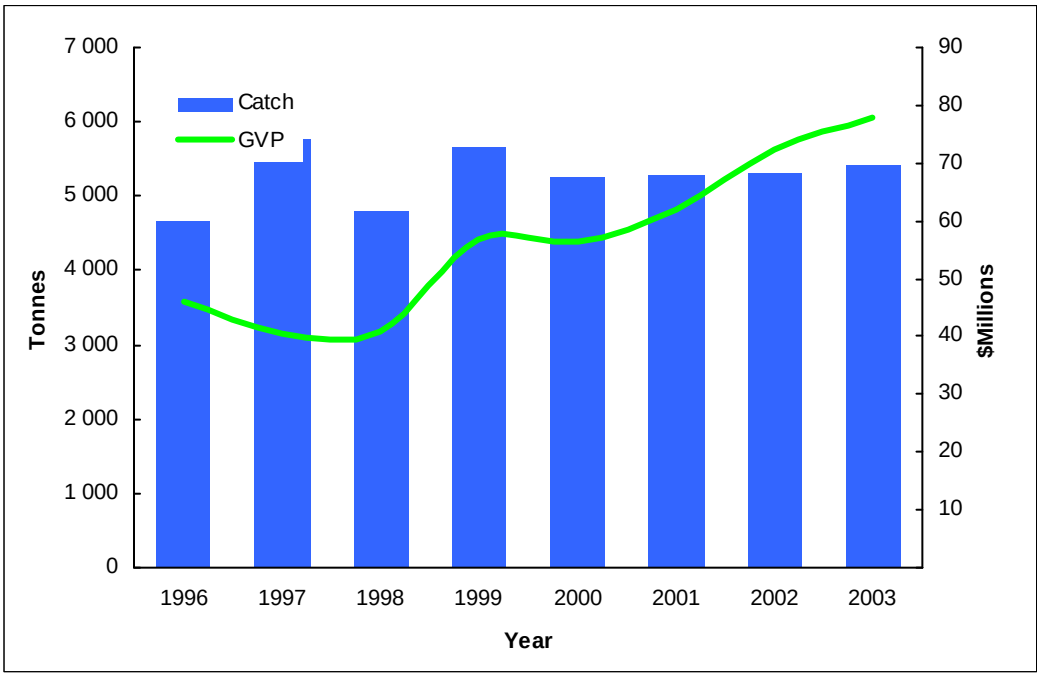
(Source: Department for Environment and Heritage 2005)

Southern Bluefin Tuna Fishery

One of the most valuable fisheries in the SWMR is the Southern Bluefin Tuna (SBT) Fishery, with 5406 tonnes caught in 2003 with a GVP of more than $77 million. The volume caught by this fishery from the region has remained relatively stable, but has steadily increased in value from 1996 to 2003 (Figure 4.25).

SBT are slow-growing, reaching maturity at about eight years of age. They live to about 40 years and migrate widely in the southern hemisphere. The SBT stock is exploited by a number of nations along its migration pathways. For this reason the Australian Government manages the fishery in conjunction with other nations (Japan and New Zealand) under the Convention for the Conservation of Southern Bluefin Tuna.

Figure 4.25 Catch volume and GVP for the Commonwealth-managed Southern Bluefin Tuna Fishery in the SWMR, 1996–2003



(Source: Bureau of Rural Sciences 2005)

One of the unique features of the region's SBT industry is that it is both a wild capture fishery and an aquaculture activity. Most fish are caught in the Great Australian Bight and towed in cages back to Port Lincoln where they are "grown out" ready for export. As a result, the SBT Fishery is covered within this section as well as within the following section of this report which covers the region's aquaculture industry. Note that the dollar value of this fishery as shown in Figure 4.25 is calculated on the "beach price" of the fish (i.e. the value of the fish if they had been sold on landing in Port Lincoln). In reality, however, the fish are not sold to the fish farms but are part of integrated fishery operations that span both the capture and the aquaculture side of the industry.

Currently around 98 per cent of Australia's SBT quota is taken by 5–10 purse seine vessels. There is also a valuable and largely incidental catch for longline vessels operating in southern Australian waters of approximately 100 tonnes per year (AFMA 2005).

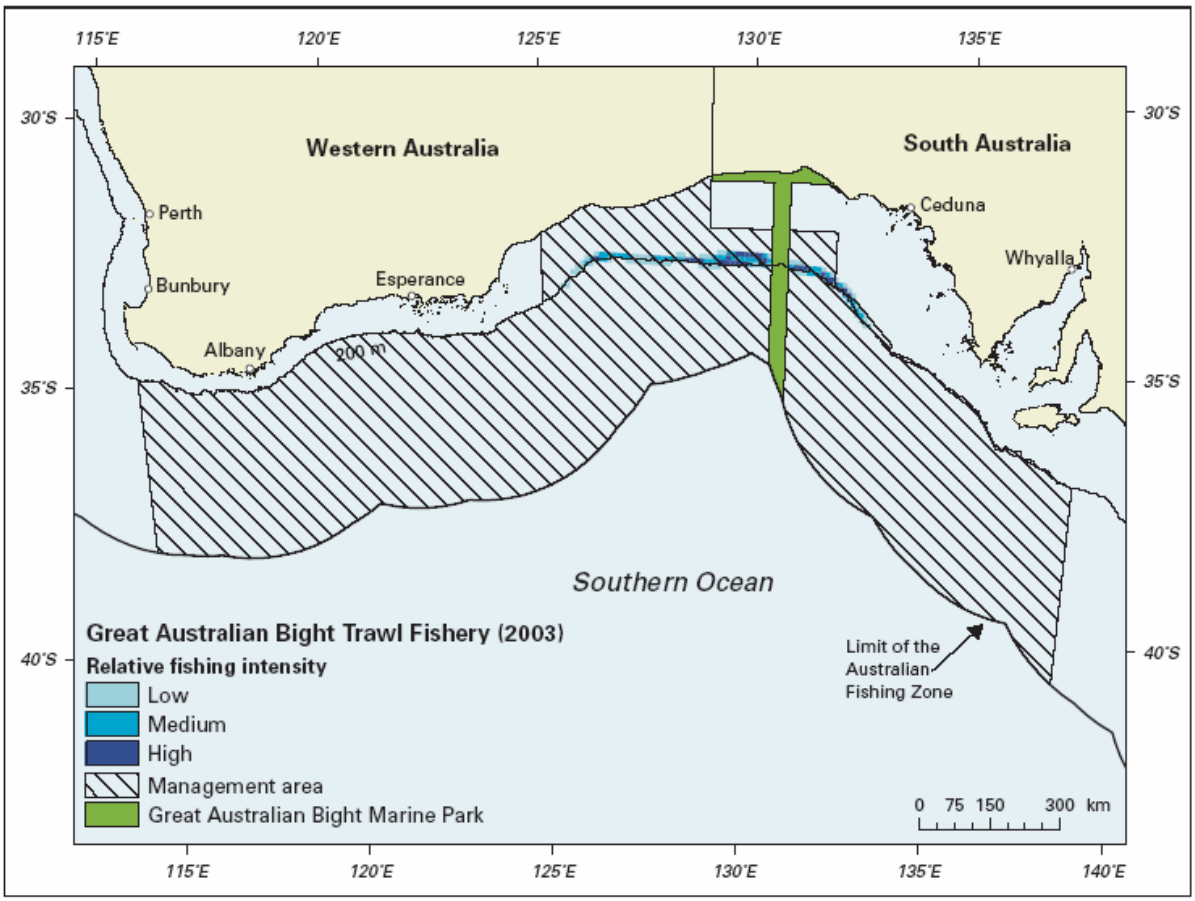
The history of the SBT Fishery is an interesting example of changes in a fishery driven by emerging export opportunities as well as by shifts in management. Prior to the introduction of

individual transferable quotas (ITQs) into the fishery in 1984, the fishery was widely dispersed with fishers operating from Western Australia out into the Pacific. However, following the introduction of ITQs, the fishery quickly consolidated. For instance, 136 individuals and companies were issued quota holdings in 1984 and within three years this number had dropped to 63 quota holdings. South Australian operators purchased much of the quota and as a result, the fishery became concentrated in Port Lincoln. Progressively, over the mid to late 1980s, the Australian fishery focused on supplying the Japanese sashimi market, and an increasing amount of the catch was transhipped to Japanese freezer vessels in the Great Australian Bight. In 1990–91, farming of SBT commenced off the South Australian coastline. The catch of SBT for farming purposes increased rapidly and by the 2000–01 season, the aquaculture component utilised over 98 per cent of the Australian Total Allowable Catch (TAC). The Australian component of the world TAC is currently set at 5265 tonnes.

Great Australian Bight Trawl Fishery

The Great Australian Bight (GAB) Trawl Fishery operates between Kangaroo Island in South Australia and Cape Leeuwin in Western Australia (see Figure 4.26).

Figure 4.26 Extent of the Commonwealth-managed Great Australian Bight Trawl Fishery

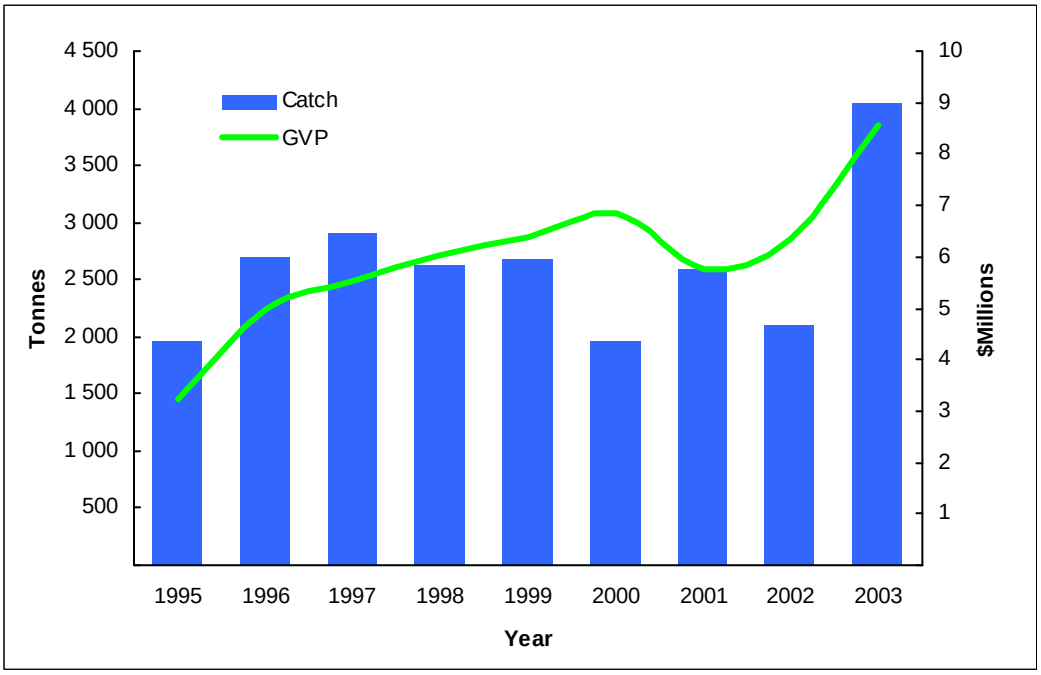


(Source: AFMA 2005)

The fishery catches a relatively large range of species, regularly catching over 80 species. However, the main catch in recent years has been derived from only five species: orange roughy, deepwater flathead, bight redfish, angel shark, and leatherjacket (AFMA 2003). In

2003 the total catch in the fishery was some 4044 tonnes, with a GVP of $9 million (Figure 4.27).

Figure 4.27 Catch volume and GVP from the Commonwealth-managed Great Australian Bight Trawl Fishery in the SWMR, 1995–2003



(Source: Bureau of Rural Sciences 2005)

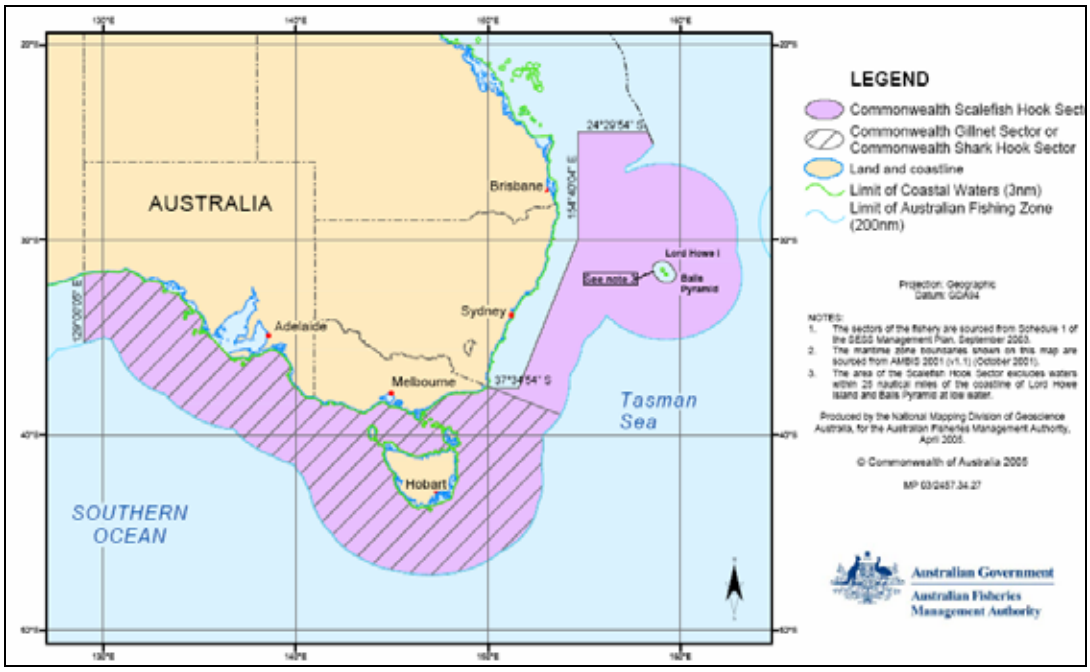
The fishery, which stated in 1912 with demersal trawling, was characterised by sporadic effort concentrating on shelf species up until the mid-1980s. This was primarily due to distance from markets, a lack of long distance fishing technologies operating within the Australian fleet, and uncertainty regarding the location of fish resources in the area. However, the fishery quickly expanded following the discovery of commercial quantities of orange roughy off the continental shelf. Since 1988 the focus of the fishery has moved from deep water onto the shelf.

Fishing in the GAB Trawl Fishery is controlled by limiting entry into the fishery. Currently there are 10 vessels with permits to fish within the GAB Trawl Fishery. The fishery mainly supplies the domestic market, although there is a small volume of exports to Europe.

Gillnet, Hook and Trap Fishery

The Commonwealth-managed Gillnet, Hook and Trap Fishery operates along the South Australian border and up to Queensland (Figure 4.28). Hook and line methods have been used since the early 1900s to catch fish over continental shelf waters. Historically this fishery was managed across a range of fisheries comprising the south-east non-trawl sector and the Southern Shark Fishery. In 2003 these fisheries were merged into a single fishery called the Gillnet, Hook and Trap Fishery. The fishery comprises a range of fishers utilising a range of technologies to capture a range of species. Currently the fishery comprises the following sectors: scalefish hook sector; shark hook sector; gillnet sector; and trap sector.

Figure 4.28 Extent of the Commonwealth-managed Gillnet, Hook and Trap Fishery

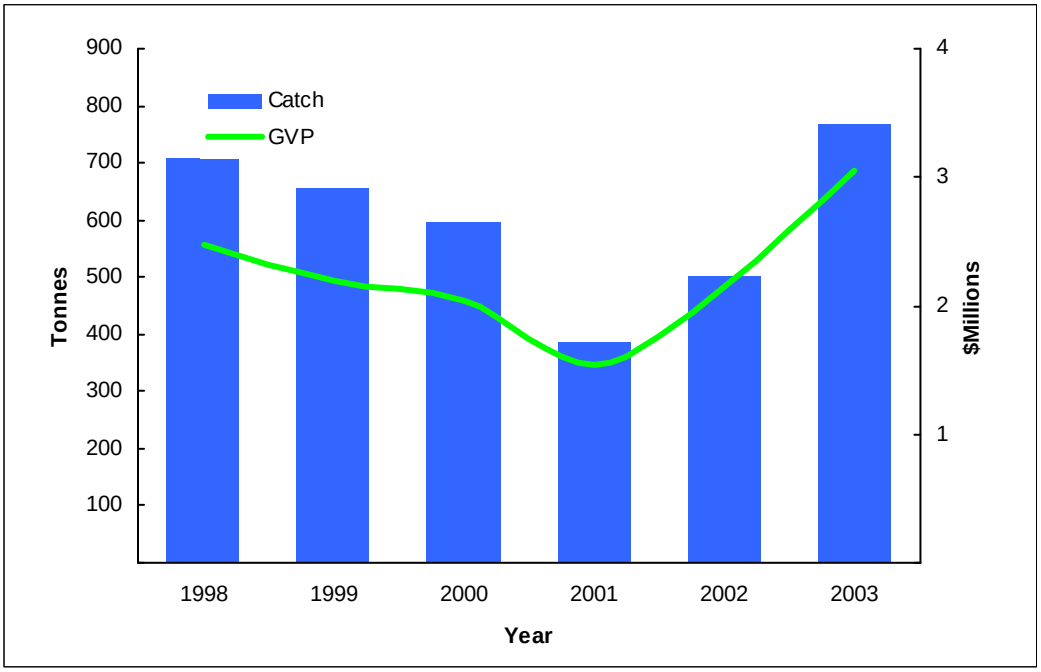


(Source: AFMA 2005)

A wide range of species is landed by this fishery, with blue-eye trevalla, ling and shark comprising the major part of the fishery's catch. In 2003 the portion of the fishery operating within the SWMR landed approximately 766 tonnes with a GVP of over $3 million (Figure 4.29). This represents around 15 per cent of the total fishery catch caught within the SWMR.

The fishery predominantly supplies the eastern Australian seaboard fresh fish market.

Figure 4.29 Catch volume and GVP for the Commonwealth-managed Gillnet Hook and Trap Fishery in the SWMR, 1998–2003



(Source: Bureau of Rural Sciences 2005)

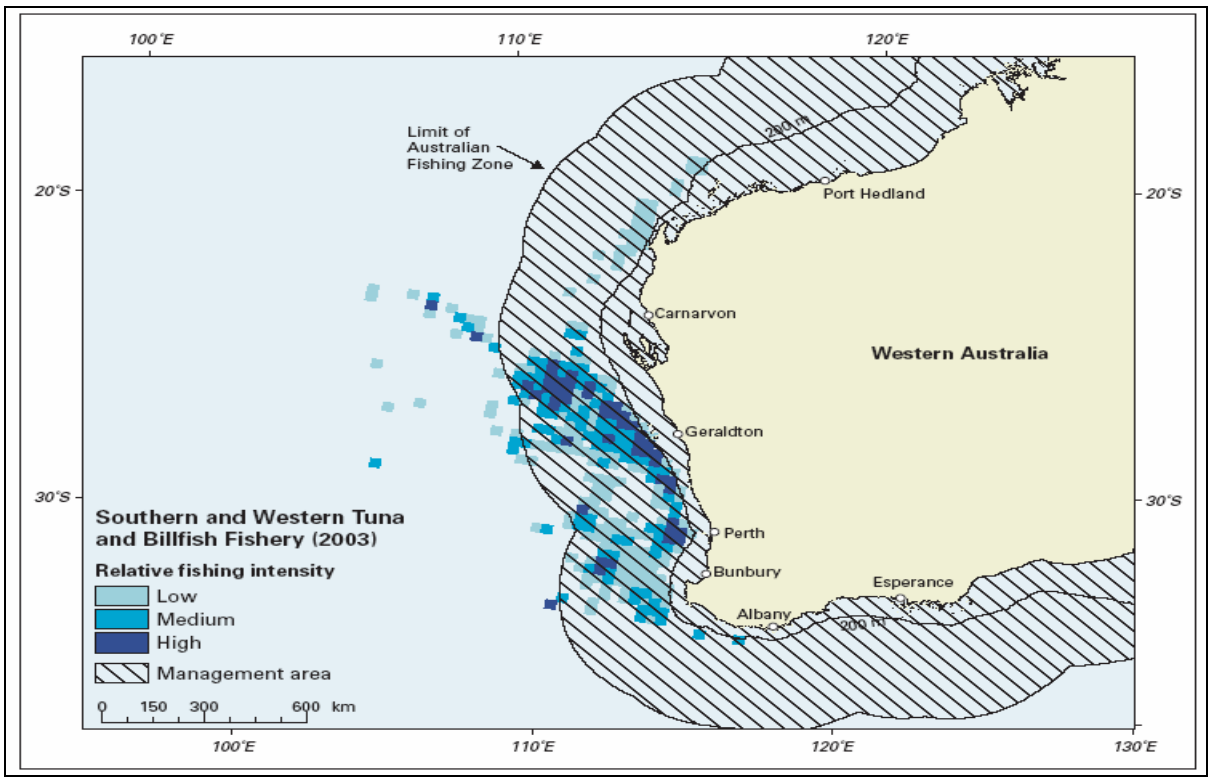
Twenty-one key target species caught by the fishery are currently managed using individual transferable quotas. The remainder of the species caught by the fishery have no catch limits, but the catch of these species is monitored by the Australian Fisheries Management Authority (AFMA) to ensure that the catch is sustainable.

Prior to 1985 the only regulation applied to these fisheries was the requirement to have a Commonwealth fishing boat licence. In 1985 a freeze was put on the issuing of new licences, of which there were over 2000 at the time. In 1992 the number of non-trawl permits to take demersal scalefish was reduced to about 550. Currently there are around 205 vessels operating in the fishery.

Western Tuna and Billfish Fishery

The Western Tuna and Billfish Fishery operates from the Gulf of Carpentaria around to the South Australian – Victorian border, but the vast majority of the fishing effort is concentrated off the coast of Western Australia (Figure 4.30).

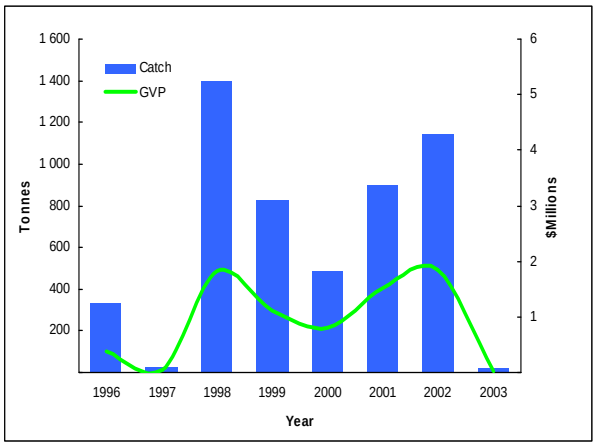
Figure 4.30 Effort intensity in the Commonwealth-managed Western Tuna and Billfish Fishery, 2003



(Source: Department for Environment and Heritage 2005)

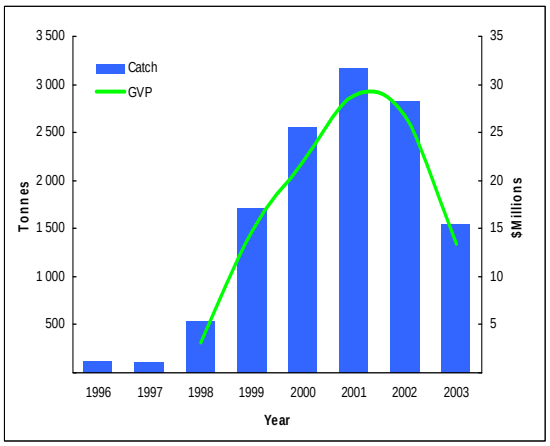
The fishery targets bigeye tuna, yellowfin tuna and broadbill swordfish predominately by purse seine and pelagic longline. In 2003, fishers operating within the fishery landed an estimated 1548 tonnes with a GVP of over $13.4 million (figures 4.31 and 4.32).

Figure 4.31 Catch volume and GVP for the Commonwealth-managed Southern and Western Tuna and Billfish Fishery (purse seine) in the SWMR, 1996–2003



(Source: Bureau of Rural Sciences 2005)

Figure 4.32 Catch volume and GVP for the Commonwealth-managed Southern and Western Tuna and Billfish Fishery (longline) in the SWMR, 1996–2003



(Source: Bureau of Rural Sciences 2005)

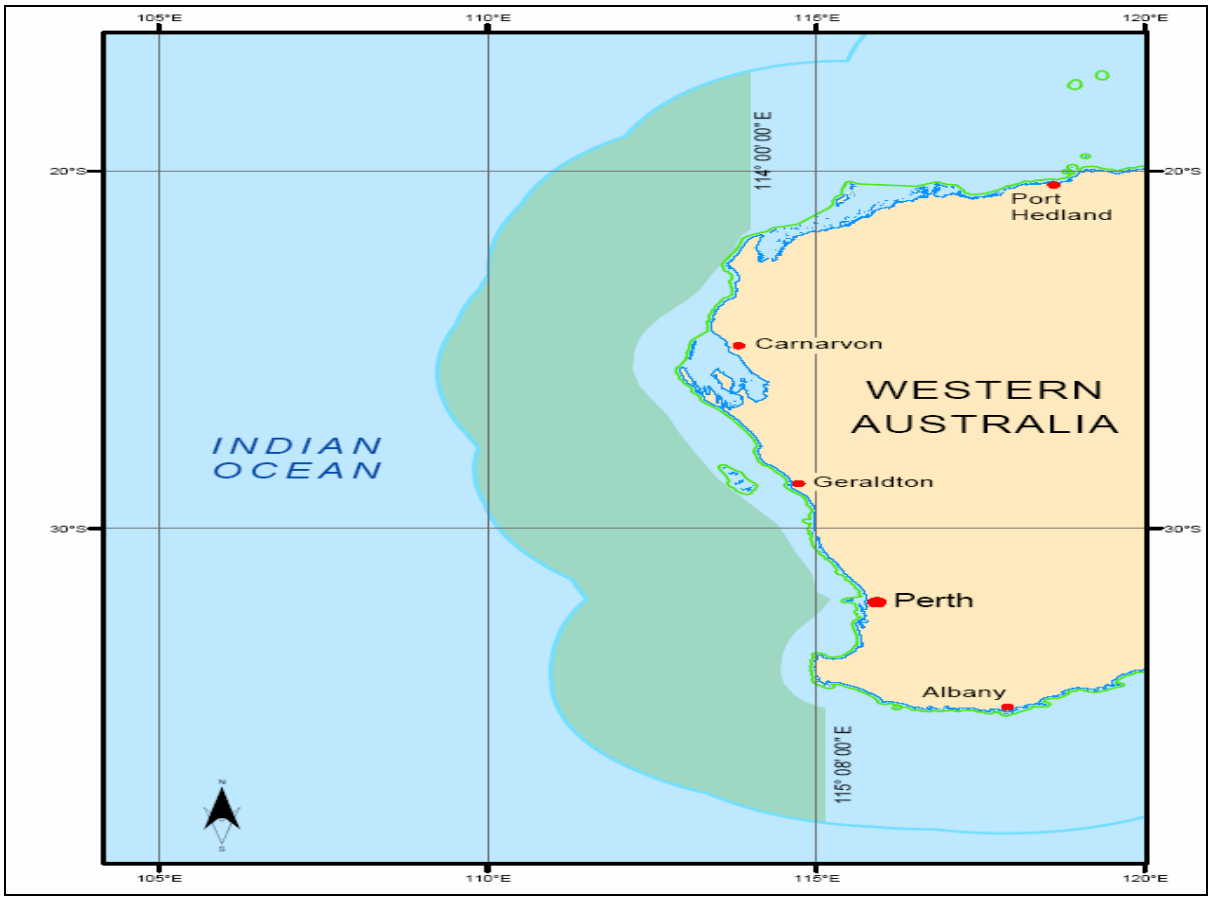
As illustrated in figures 4.31 and 4.32, the fishery experienced a marked decline in catch in 2003. This was due to low prices and high operating costs in the fishery impacting upon fishing effort (AFMA 2003). The fishery supplies markets within Australia as well as suppling fresh fish to Japan and the United States markets.

Currently the fishery is managed by both input (number of licences and gear restrictions, etc.) and output controls (catch limits). For example, there is limited entry into the fishery in place, as well as individual transferable quotas in place for all three target species.

Western Deepwater Trawl Fishery

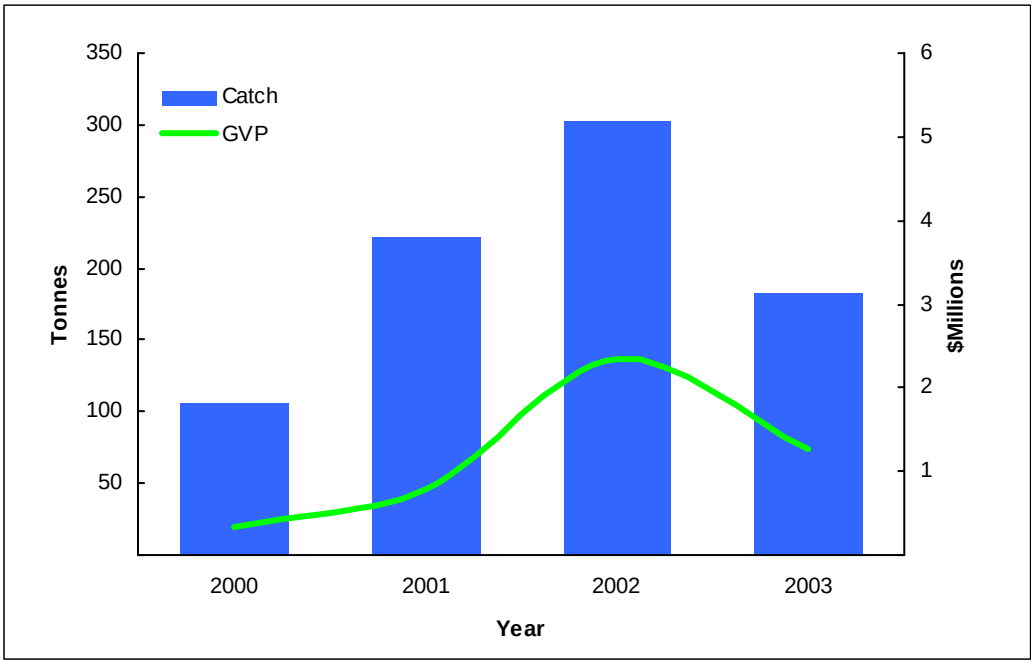
The Commonwealth-managed Western Deepwater Trawl Fishery operates off the coast of Western Australia in depths greater than 200 metres (Figure 4.33). Over 50 marine species are caught within this fishery, with the main catch comprising bugs (white-tailed and deepwater velvet), snapper, deepwater flathead, gemfish, mirror dory, boafish and oreo species (AFMA 2004c). In 2003 the fishery landed just over 170 tonnes of fish with a GVP of around $1.2 million (Figure 4.34).

Figure 4.33 Extent of operation of the Western Deepwater Trawl Fishery



(Source: AFMA 2005)

Figure 4.34 Catch volume and GVP for the Commonwealth-managed Western Deepwater Trawl Fishery in the SWMR, 2000–2003



(Source: Bureau of Rural Sciences 2005)

The fishery, which had its beginnings in the mid 1980s initially concentrated on scampi and deepwater prawns. During this time, vessels predominantly fished off Geraldton and Fremantle. The fishery has experienced large fluctuations in its catch, depending on the number of vessels operating within the fishery and the species targeted. For instance, in 1987–88 the catch, predominantly prawns and scampi, was in the region of 116 tonnes. However, in the following year the catch had fallen to three tonnes, with only four vessels in operation. Currently the fishery is split between two types of effort; vessels now target upper-continental slope demersal species in the northern region and orange roughy at depths greater than 700 metres in the southern region (Bureau of Rural Sciences 2002). The fishery predominately supplies fresh fish to the domestic market.

Currently the fishery is managed by limited entry, with 11 permits currently endorsed.

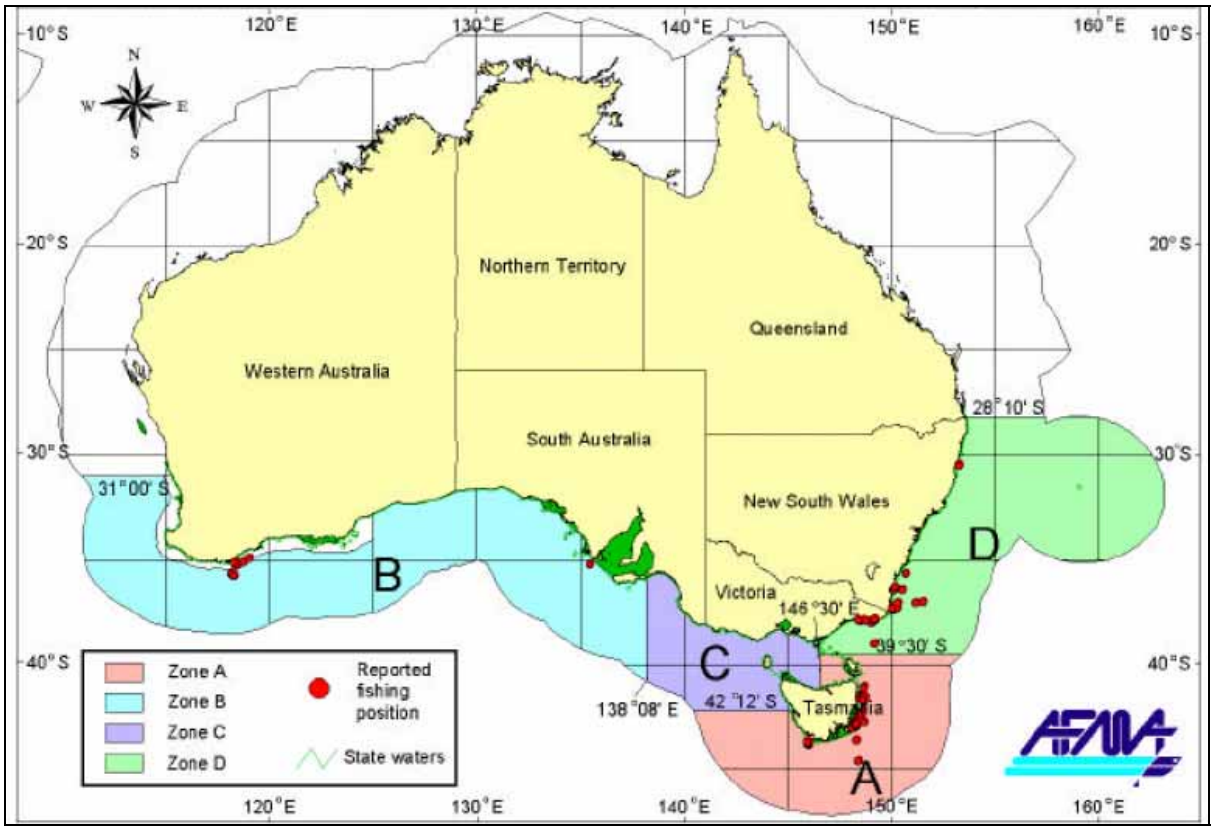
Plate 4.10 Trawl catch

(Source: Department of the Environment and Water Resources)

Small Pelagic Fishery

The Commonwealth-managed Small Pelagic Fishery operates from the New South Wales – Queensland border to a point north of Perth, near Lancelin, in Western Australia (Figure 4.35). The Small Pelagic Fishery targets five species on the shelf: jack mackerel, blue mackerel, red bait, Peruvian jack mackerel and yellow-tailed scad (AFMA 2004b). The fishery has historically operated predominantly off the east coast of Tasmania but greater effort is being made to target the species in other parts of the fishery due to the increasing domestic demand for small pelagic species for feed for the aquaculture industry (amongst other sectors).

Figure 4.35 Extent of operation of the Commonwealth-managed Small Pelagic Fishery



(Source: AFMA 2005)

At present there is no catch data for the fishery as catch data is commercial in-confidence due to the small number of boats active in the fishery (currently less than five). This is despite there being 75 licences distributed for the fishery. The Australian Fisheries Management Authority has noted, however, that the current total catch is "significantly lower than trigger catch limits" (AFMA 2005, p. 1). It is therefore reasonable to expect that as more boats enter the fishery and catches significantly rise, data should soon be publicly available and catches will rise.

State-managed fisheries of the region

Within the region there are at least 28 state-managed fisheries active, either wholly or partly in the waters covered by the SWMR. In Western Australia there are 20 commercial fisheries in operation in the region, and in South Australia there are nine commercial fisheries. These fisheries range from coastal dive fisheries, such as abalone, coastal trap fisheries targeting rock lobsters, through to net fisheries targeting Australian herring and Western Australian salmon and trawl fisheries targeting scallops, prawns and other species (see tables 4.12 and 4.13).

Table 4.12 Western Australian commercial fisheries operating within the SWMR, 2003–04

Fishery	Species	Main fishing method	Number 2003–04*
West Coast Rock Lobster	Western rock lobster	Pots	549 boats and 56 915 pots
Abalone	Greenlip, brownlip and Roe's abalone	Diving	29 licence holders
Shark Bay Prawn	King, tiger, and endeavour prawns; scallops	Trawling	27 licence holders
Shark Bay Scallop	Scallops	Trawling	41 licence holders
Abrolhos Islands and Mid West Trawl	Southern saucer scallops, western king prawns	Trawling	Not available
South-west Trawl	Saucer scallops, western king prawns	Trawling	18 vessels (2003)
West Coast Blue Swimmer Crab	Blue swimmer crab	Traps, gill nets, drop nets, trawling	37 licence holders (2004)
West Coast Deep Sea Crab	Giant (king) crabs, crystal (snow) crabs, champagne (spiny) crabs	Pots	7 permits issues (five full time, two part time) (2004)
Cockburn Sound	Mussels, crabs, garfish, Australian herring	Pots, handline, longline, beach seine, haul net, jig	14 licence holders (2003)
West Coast Beach Bait	Whitebait	Beach seine net, purse seine, haul net	3 licence holders (2003)
West Coast Purse Seine	Pilchards, tropical sardines	Purse seine	4 operators (2004)
West Coast Demersal Scalefish	West Australian dhufish, pink snapper, baldchin groper	Demersal handline, drop line	262 licensed vessels (2003)
South Coast Crustacean	Southern rock lobster, western rock lobster, giant crabs, crystal crabs, champagne crabs	Pots	44 licensed vessels (2003)
South Coast Trawl	Scallops	Otter trawl	4 licensed vessels (2003)
Western Australian Salmon	Western Australian salmon	Beach seine net	33 licence holders (2003)
Australian Herring	Australian herring	Herring trap net (also known as a "G" trap net)	11 licence holders (2003)
South Coast Purse Seine	Pilchards	Purse seine net	16 vessels (2003)
Demersal Gillnet and Longline	Dusky whaler shark, whiskery shark, gummy shark	Demersal gillnet, demersal longline	83 licence holders (2003)
Shark Bay Beach Seine and Mesh Net	Whiting, sea mullet, tailor, yellowfin bream	Beach seine, haul net	11 licence holders (2003)
Shark Bay Snapper	Pink snapper	Mechanised handlines	51 licence holders (2003)

*Number specified is for the entire fishery, which in some cases may extend outside the SWMR
(Source: Australian Bureau of Agricultural and Resource Economics 2005, p. 16, Penn et al. 2005)

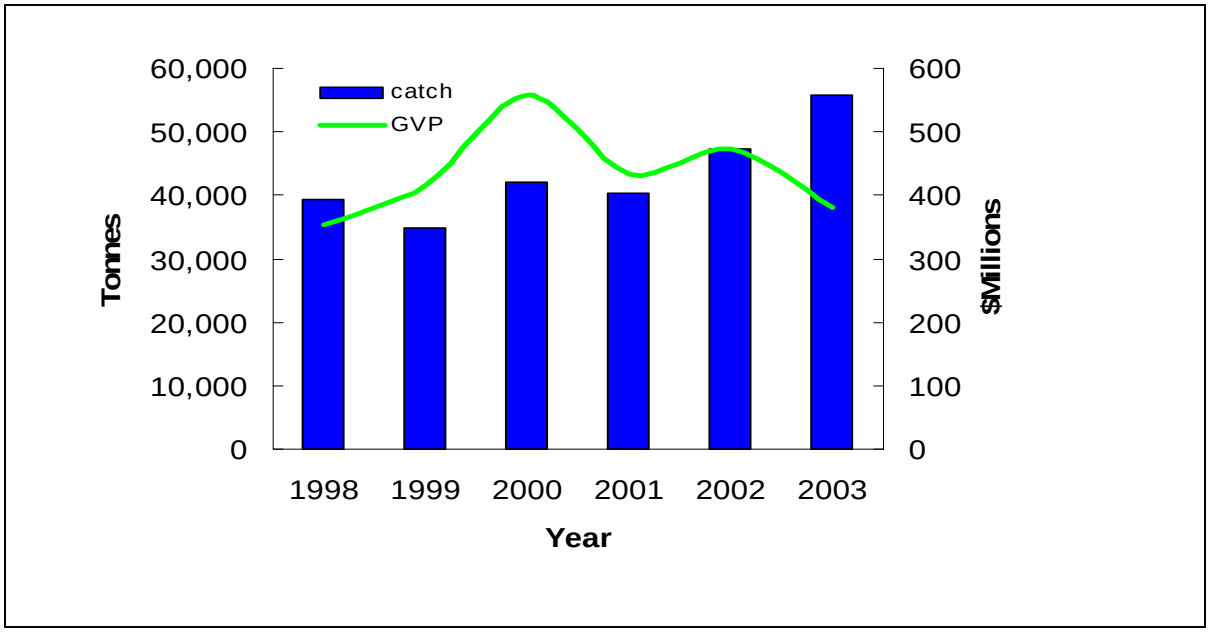
Table 4.13 South Australian commercial fisheries operating within the SWMR, 2003–04

Fishery	Species	Main fishing method	Number 2003–04*
Northern Zone Rock Lobster	Southern rock lobster	Pots	181 licence holders
Western Zone Abalone	Greenlip and blacklip abalone	Diving	23 licence holders
Central Zone Abalone	Greenlip and blacklip abalone	Diving	6 licence holders
Blue Crab	Blue crab	Pots	8 licence holders
West Coast Prawn	Western king prawn	Trawling	3 licence holders
Spencer Gulf Prawn	Western king prawn	Trawling	39 licence holders
Gulf St Vincent Prawn Fishery	Western king prawn	Trawling	10 licence holders
Marine Scalefish	King George whiting, snapper, tommy ruff, pilchards, Australian salmon, garfish, crustaceans, molluscs	Netting, line fishing, handlines, traps	377 licence holders
Restricted Marine Scalefish	Various finfish, crustaceans, molluscs	Netting, line fishing, handlines, traps	29 licence holders

*Number specified is for the entire fishery, which in some cases may extend outside the SWMR
(Source: Australian Bureau of Agricultural and Resource Economics 2005, p. 17)

In 2003, state-managed fisheries of the region landed a combined total catch of nearly 56 000 tonnes of fish with a GVP of over $380 million. This was split between Western Australia fishers, who harvested around 20 000 tonnes of fish (GVP of over $250 million), and South Australia fishers, who harvested nearly 36 000 tonnes of fish (GVP of around $130.2 million) (Figure 4.36).

Figure 4.36 Catch volume and GVP for combined state-managed fisheries in the SWMR, 1998–2003

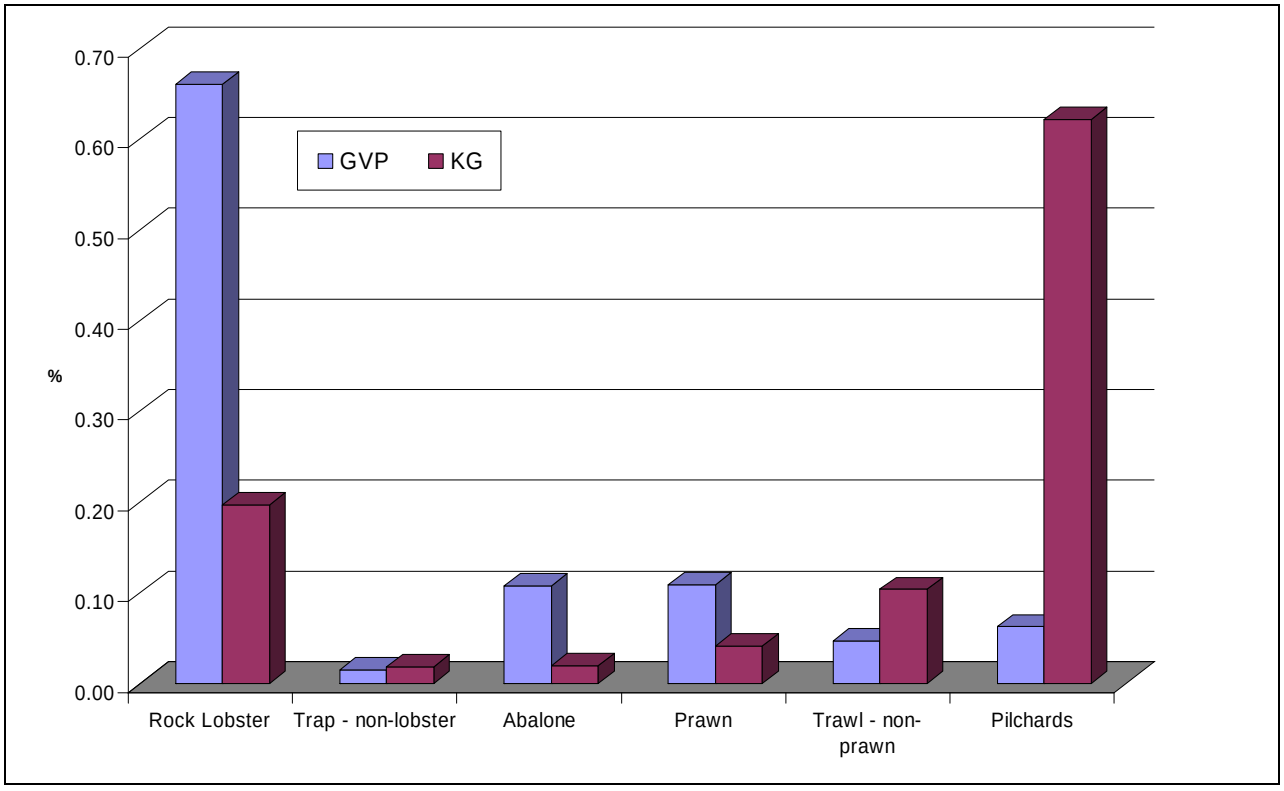


(Source: Bureau of Rural Sciences 2005)

Within the state-managed fisheries of the region, the revenue derived from the rock lobster fisheries constituted some 66 per cent of the region's total fisheries revenue in 2003. State-managed prawn and abalone fisheries are the second most important fisheries in the region;

revenue from these fisheries constituting 11 per cent each to total revenue. This is in contrast to the figures derived from the actual weight of the fish caught. These figures show that in terms of weight, the pilchard fishery is by far the biggest fishery in the region, with rock lobster fisheries the second largest and trawl fisheries the third largest (see Figure 4.37).

Figure 4.37 State fish catch by GVP and weight (per cent), 2003



(Source: Bureau of Rural Sciences 2005)

Because of the number of state commercial fisheries in operation in the region, this report does not cover each state-managed fishery individually; instead, this section of the report will give a general overview by type of fishing effort, with some single species coverage.

Rock lobster fisheries

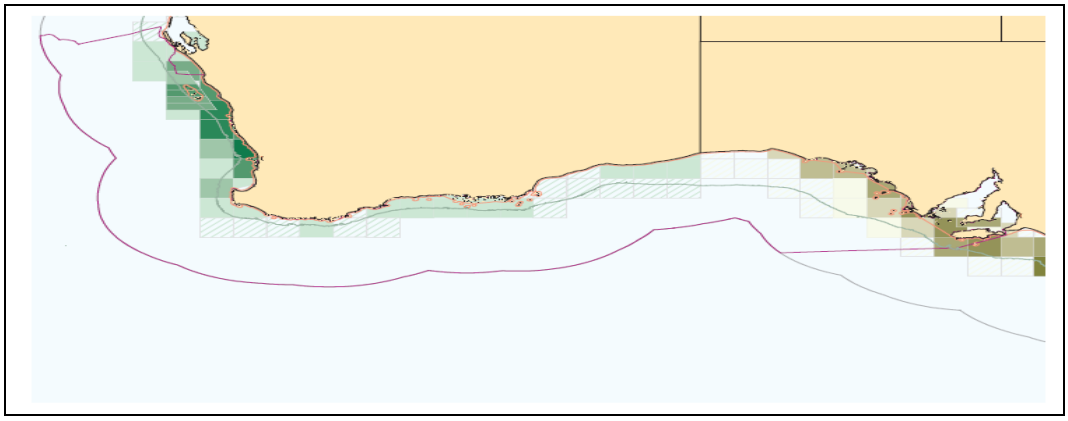
The rock lobster fishers of the SWMR target two distinct species of rock lobster: the western rock lobster (*Panulirus Cygnus*), which is found on the west coast of Western Australian from Shark Bay down as far as Cape Leeuwin, and the southern rock lobster (*Jasus edwardsii*), which inhabits much of southern Australia from Western Australia to New South Wales and around Tasmania.

The region's rock lobster fisheries are managed as three distinct fisheries: the Western Australian West Coast Rock Lobster Fishery; the South Coast Rock Lobster Fishery; and the South Australian Northern Zone Rock Lobster Fishery. Figure 4.38 shows the location of fishing effort within the region by the value of fish caught between the years 1998 and 2003.

Plate: 4.11 Commercial fishing boat leaving Port Lincoln, South Australia at dawn

(Source: Department of the Environment and Water Resources)

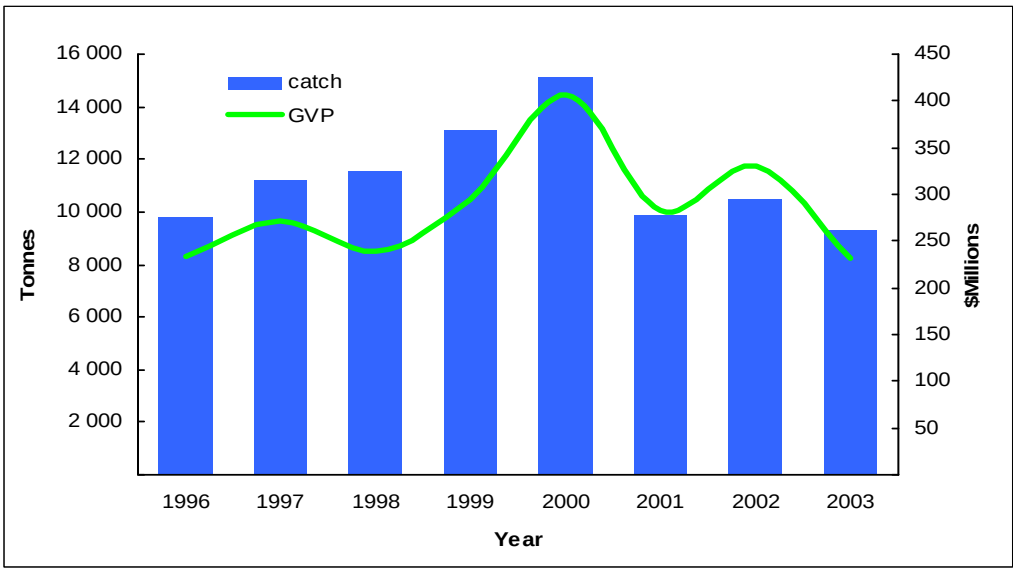
Figure 4.38 Location of rock lobster fishing by value, 1998–2003



(Source: Department for Environment and Heritage 2005)

Within the region the rock lobster catches have traditionally been subject to variability from year to year due to the influence of both previous harvests and the success of recruitment of juveniles into the cohort in previous years. Figure 4.39 shows the changes in both catch and GVP between the years 1996 and 2003. It is evident that over this period, catch and GVP steadily climbed until 2000 (a record year for the fishery), with catches since 2000 settling to between 9000 and 10 000 tonnes per annum. It is interesting to note that the Asian SARS crisis had the effect of reducing revenue into the fishery in 1998. In 2003 the combined value of the catch was worth around $232 million derived from over 9290 tonnes of lobsters caught in that year (Source: Bureau of Rural Sciences 2005).

Figure 4.39 Catch volume and GVP for the state-managed rock lobster trap fisheries in the SWMR, 1996–2003



(Source: Bureau of Rural Sciences 2005)

In terms of economic importance, the West Coast Rock Lobster Fishery is the most important, catching some 90 per cent of the total catch by value ($210 million in 2003). The South Coast Rock Lobster Fishery and the South Australian Northern Zone Rock Lobster Fishery represent one per cent ($2.3 million) and nine per cent ($18.8 million) respectively of the total catch by value (Bureau of Rural Sciences 2005, Department of Fisheries 2005e). The bulk of the region's catch is exported live to Japan, Taiwan, China, Europe and the United States (Department of Fisheries 2005e).

Reflecting the different management requirements of the three crayfish fisheries, all are subject to different management regimes (Table 4.14). However, in general, management is undertaken through a combination of input control measures (e.g. controls over such factors as size or sex of fish caught, gear used, times allowed for fishing and/or allowed fishing areas).

Table 4.14 Examples of management arrangement for rock lobster fishing in the SWMR

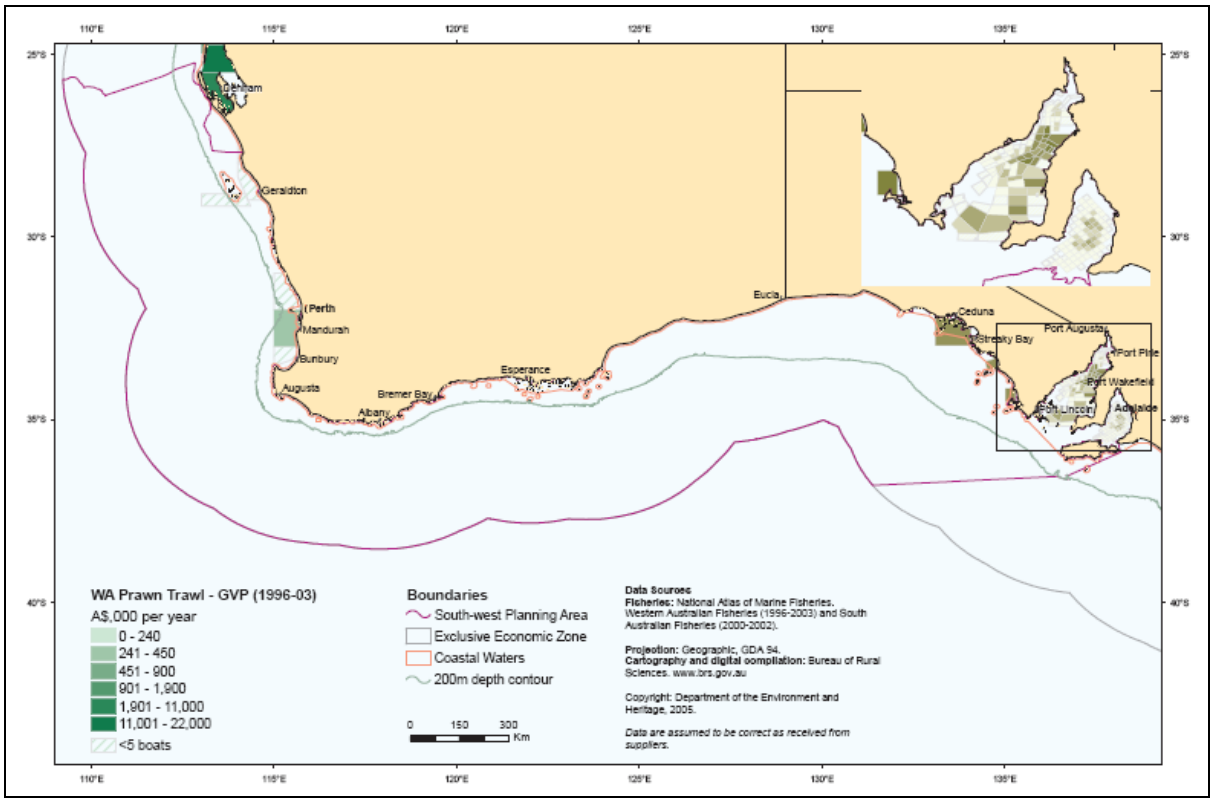
Fishery	Input controls
The West Coast Rock Lobster	license limitations (a limit to the total number of pots which can be used in the fishery (56 906)); a minimum and maximum size limits; gear restrictions; seasonal closures; closed areas; controls over when pots may be lifted; restrictions on the take of berried, setose, and tar-spot females.
The South Coast Rock Lobster	Minimum size limits; protection of all female rock lobsters carrying eggs; protection of western rock lobsters carrying spermataphores (tarspots); seasonal closures; gear restrictions
Northern Zone Rock Lobster	Seasonal and in-season closures; minimum size restrictions; gear restrictions; boat restrictions; maximum pots per licence (70); maximum allowable pots in the fishery (3950)

(Source: Department for Environment and Heritage 2005)

State-managed prawn fisheries

Prawn fishers of the region target western king prawn (*Penaeus latisulcatus*) in both South Australian and Western Australian waters. In Western Australia, prawn fishing is concentrated around Perth, and in South Australia fishing occurs from Ceduna to the west of the Ayre Peninsula, up into the Spencer Gulf and the Gulf St Vincent (Figure 4.40). Off Western Australia, fishing for prawns is a component of the South West Trawl Managed Fishery; off South Australia the fishery is more species specific, operating within the Spencer Gulf Prawn Fishery (SGPF), the Gulf St Vincent Prawn Fishery (GSVPF) or the West Coast Prawn Fishery (WCPF).

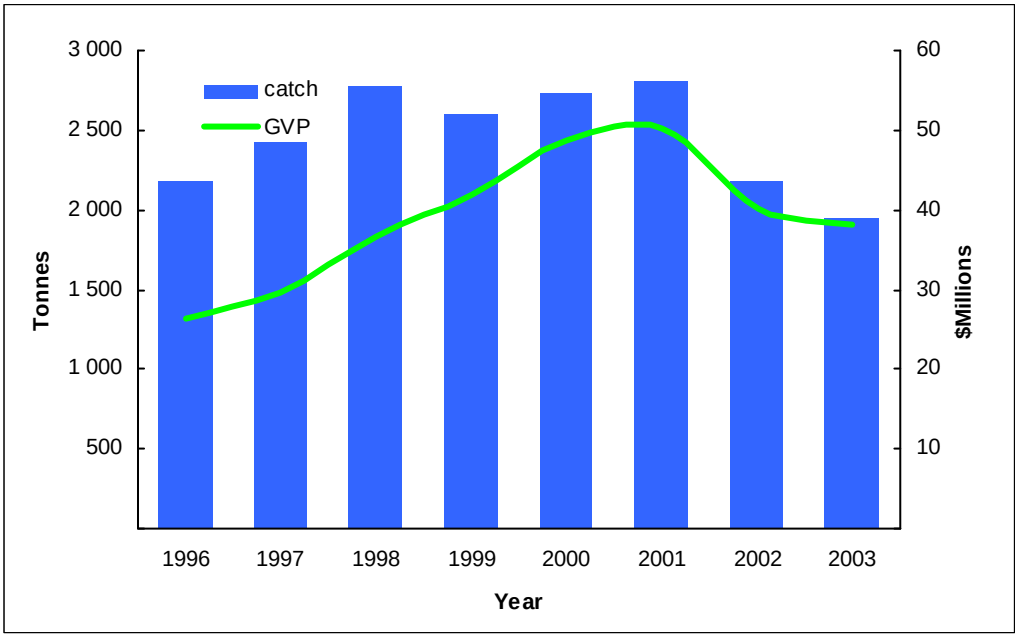
Figure 4.40 Distribution of state-managed prawn fisheries



(Source: Department for Environment and Heritage 2005)

In 2003, prawn trawling in the region harvested almost two million tonnes, with a GVP exceeding $38 million. Previous years have seen a catch from the region of over 2.5 million tonnes, with a value of over $50 million (Bureau of Rural Sciences 2005) (Figure 4.41). In terms of economic value, the South Australian Prawn Fishery is the most important of the prawn fisheries of the region. In 2003 the South Australian Prawn Fishery caught nearly 2000 tonnes of prawns valued at around $38 million (Bureau of Rural Sciences 2005). This represented around 99 per cent of the region's total prawn catch by volume as well as value. While the prawn fisheries of Western Australia predominantly service the Perth metropolitan market, those off South Australia are geared to supply both the local market and the export market; Japan and China are the most important export destinations (Department of Fisheries 2005e).

Figure 4.41 Catch volume and GVP for the state-managed prawn trawl fisheries in the SWMR, 1996–2003



(Source: Bureau of Rural Sciences 2005)

The states in the region use a range of input controls to manage the prawn fishery. In Western Australia, management controls include (Department of Fisheries 2004b):

- seasonal closures (normally between December and February)
- temporary closures to protect spawning stocks
- nursery areas in which trawling is banned
- limiting vessel numbers and licences
- restrictions on the type of trawl gear and vessels used.

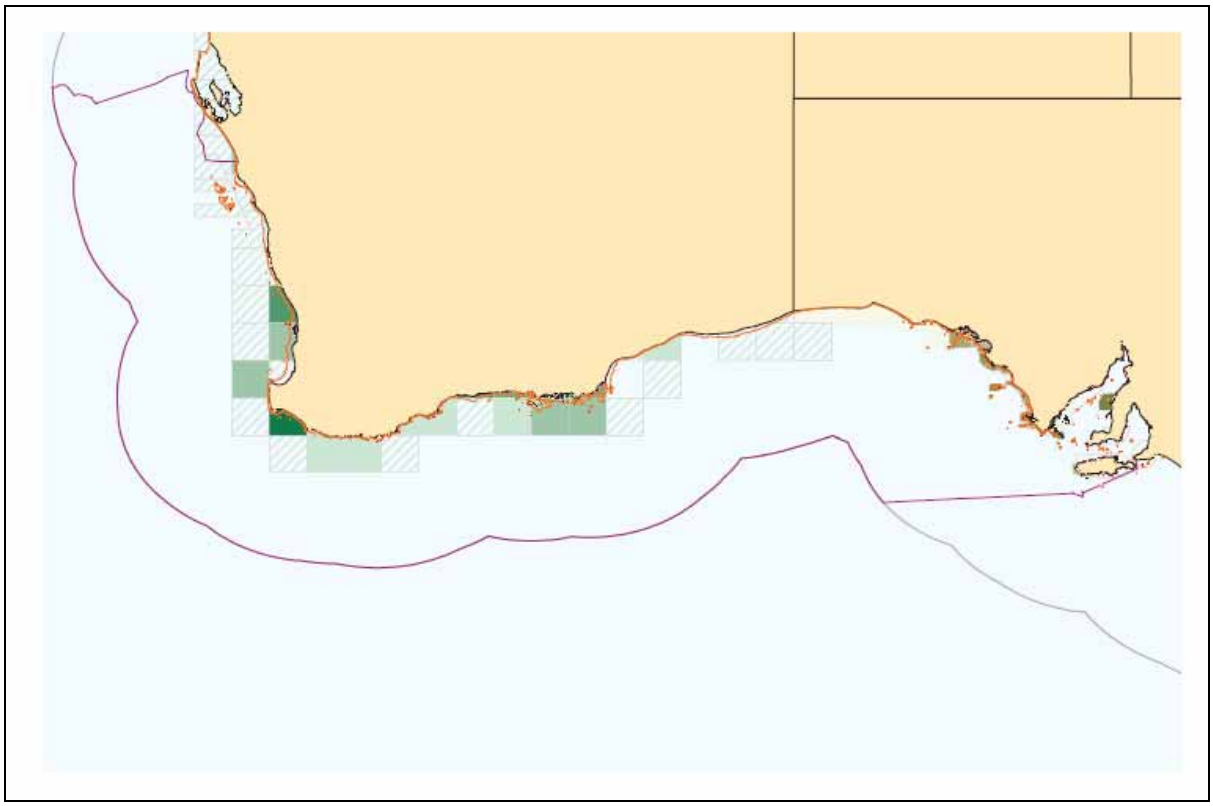
Similar arrangements are in place to manage the prawn fishery in South Australian waters; these include (Department for Environment and Heritage 2005):

- limited entry (39, 10 and four permits for the SGPF, GSVPF and WCPF respectively)
- permanent spatial closures (SGPF only) and seasonal and area closures
- daylight and full moon trawling prohibited
- limits on the total number of fishing nights
- gear restrictions
- by-product restrictions
- 10-metre minimum trawl depth.

Abalone fisheries

Abalone fishers of the region target four main species: greenlip abalone (*Haliotis laevigata*), brownlip abalone (*Haliotis conicopora*), blacklip abalone (*Haliotis rubra*) and Roe's abalone (*Haliotis roei*). In South Australia, fishers commercially target greenlip and blacklip abalone. In Western Australia, greenlip, brownlip and Roe's abalone are the main commercial species. The region's abalone fishery is dispersed between Shark Bay in Western Australia and Kangaroo Island in South Australia (see Figure 4.42)

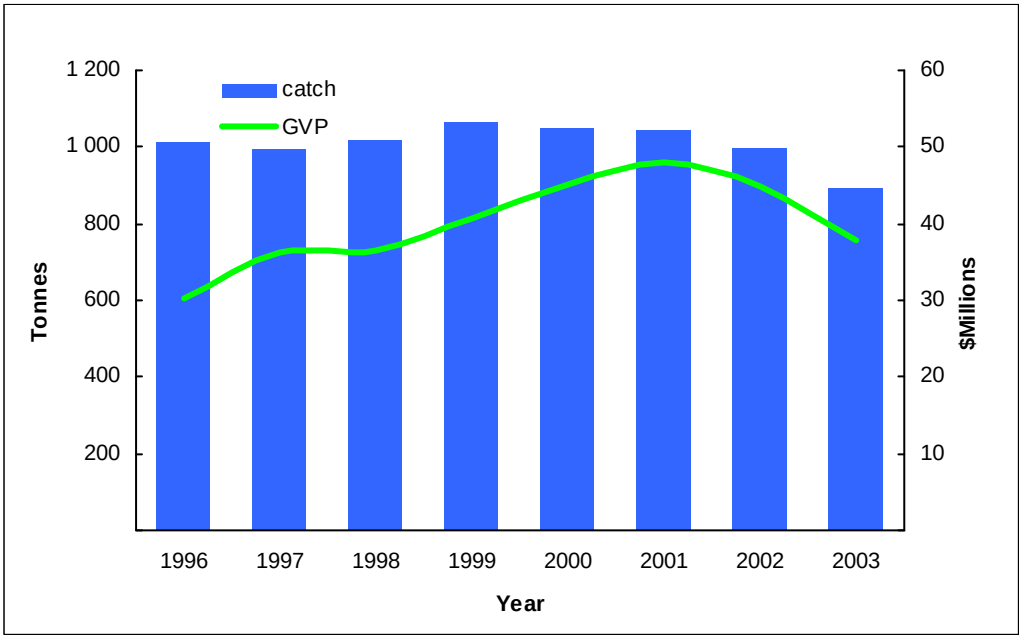
Figure 4.42 Location of commercial abalone fishing activity, 1996–2003



(Source: Department for Environment and Heritage 2005)

The South Australian Abalone Fishery is the most economically important in the region. In 2003 the South Australian fishery caught 82 per cent of the region's catch by weight (730 tonnes) and 80 per cent by value ($29.8 million) (Bureau of Rural Sciences 2005). Figure 4.43 shows that the catch rate of abalone in the region has been relatively stable between 1996 and 2003, with average catches sitting between 900 and 1000 tonnes per annum. Most of the region's catch is exported to China, Taiwan and Singapore.

Figure 4.43 Catch volume and GVP for state-managed abalone dive fisheries in the SWMR, 1996–2003

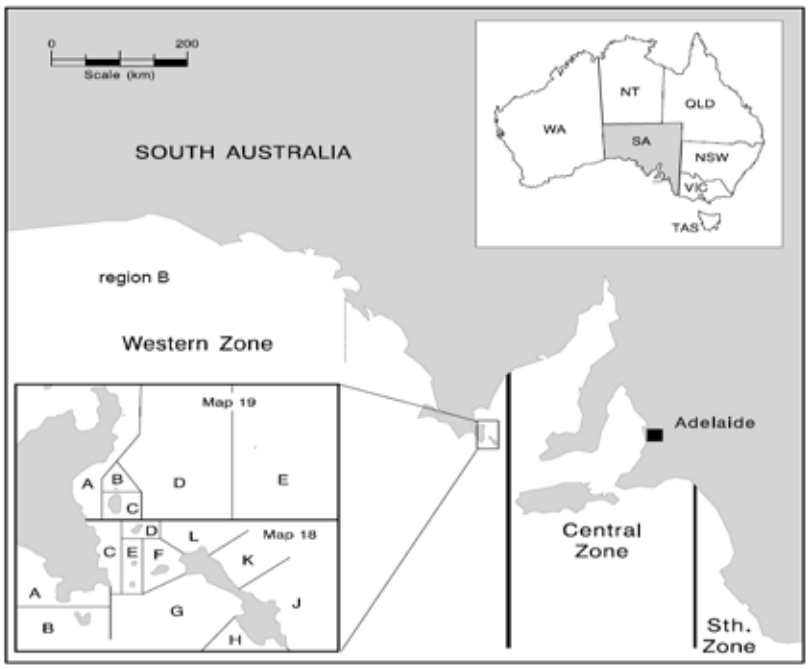


(Source: Bureau of Rural Sciences 2005)

Like much of the rest of Australia, the abalone fisheries are managed under a system of individually transferable quota. This means that each year the responsible agencies decide upon a total allowable catch that is then divided up amongst quota holders. In addition, all abalone fisheries are dive fisheries, meaning that the only legal way to catch the fish is to physically dive for them.

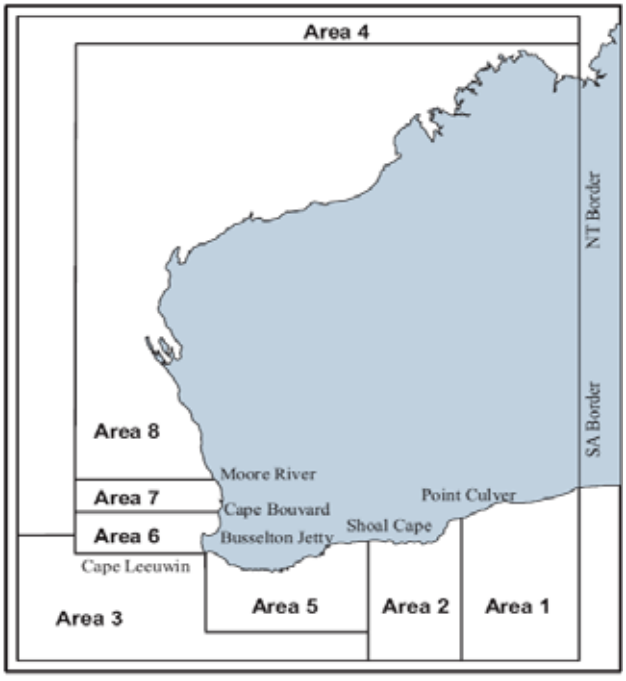
To control over-exploitation of the region's abalone stock, both South Australia and Western Australia divide their abalone fisheries into management zones. Within South Australia, the fishery is managed within three fishing zones: the Western Zone Abalone Fishery; the Central Zone Abalone Fishery; and the Southern Zone Abalone Fishery (see Figure 4.44). In Western Australia there are eight management zones in use (see Figure 4.45). Each management zone is used to differentiate the fishery in terms of the quota year, the total allowable catch, and fish size and weight.

Figure 4.44 South Australian abalone management zones



(Source: PIRSA 2004)

Figure 4.45 Western Australian abalone management zones



(Source: Department of Fisheries 2005e)

Other state-managed fisheries of the region

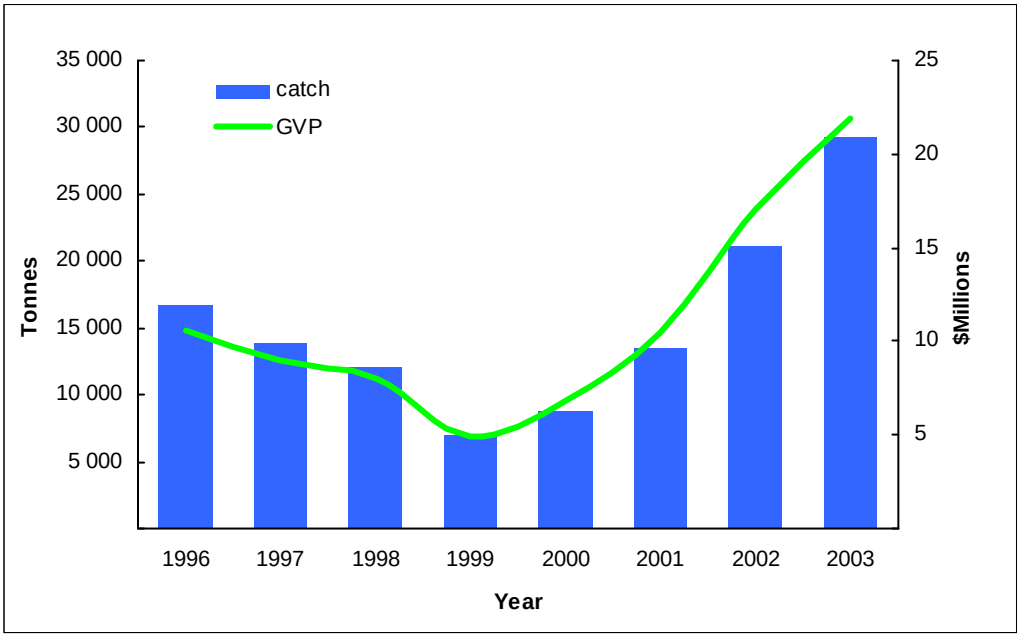
In addition to the fisheries covered above, Tables 4.11 and 4.12 illustrate that there are a range of other species targeted in the region, often in conjunction with the three fisheries detailed above. Fisheries include those targeting pilchards, trawl fisheries targeting crabs, scallops and other fish species, purse seine, and net fisheries targeting whiting, bream, sea

mullet, Australian herring, Australian salmon and a range of shark species. Most of these smaller fisheries service the local or wider Australian market.

Fishing for pilchards in the region occurs in both South Australian and Western Australian waters. Pilchards are an important and growing fishery, largely as a result of increasing demand for the fish as an input into aquaculture feed and pet food, and as bait for the recreational fishing sector. There is also a small proportion of the catch that is consumed as an eating fish, and a small proportion which is exported.

Since 1999, the catch and GVP of the pilchard net fisheries in the region has progressively increased. In 2003 almost 30 000 tonnes of pilchards (valued at more than $21 million) was caught by the regions fisheries (Figure 4.46). It is expected that due to growing demand for pilchards, this expansion will continue.

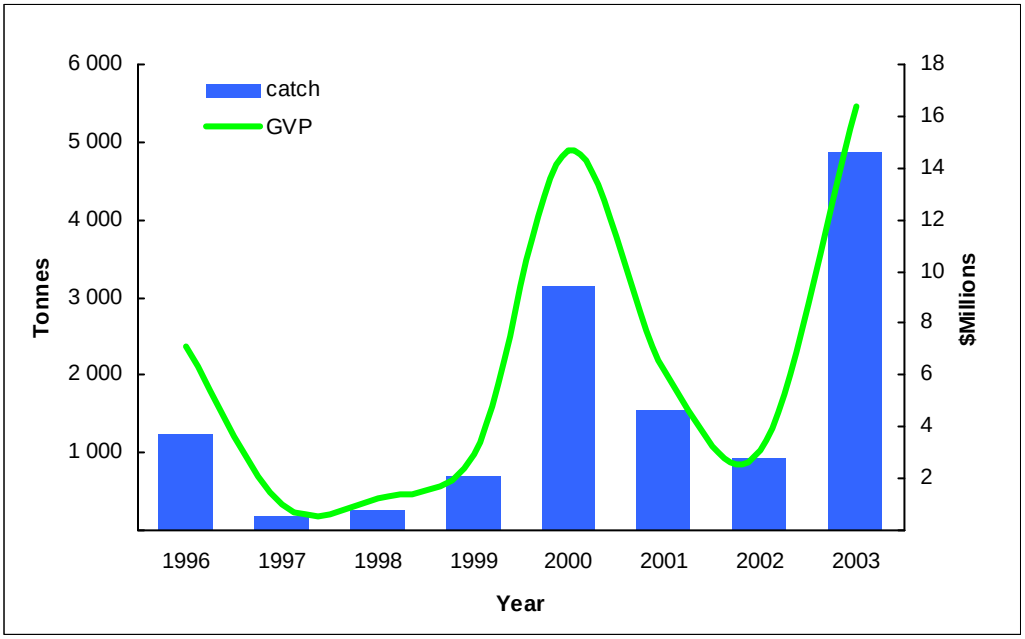
Figure 4.46 Catch volume and GVP for state-managed pilchard net fisheries in the SWMR, 1996–2003



(Source: Bureau of Rural Sciences 2005)

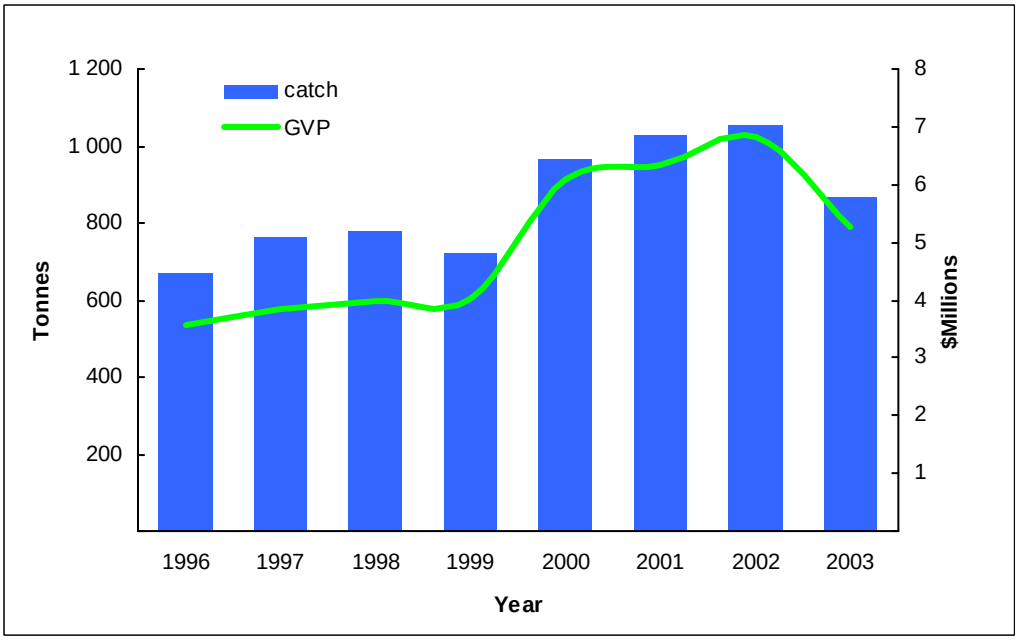
Catches from state-managed trap and trawl fisheries in the SWMR are also important. Species caught, other than lobster, generated a GVP of over $5 million in 2003 (Figure 4.47). For the same year, the non-prawn trawl harvest (only from Western Australia) was greater than four tonnes and worth almost $16 million; however, the catch and value of these trawl fisheries has fluctuated significantly in the past (Figure 4.48).

Figure 4.47 Catch volume and GVP for state-managed trawl fisheries (non-prawn) in the Western Australian section of the SWMR, 1996–2003



(Source: Bureau of Rural Sciences 2005)

Figure 4.48 Catch volume and GVP for other state-managed trap fisheries in the SWMR, 1996–2003



(Source: Bureau of Rural Sciences 2005)

4.9.4 Status of fish stocks

The status of the region's commercial fish stocks is monitored to assess the ability of fish species to withstand fishing activities. All jurisdictions in the region undertake stock assessment in order to inform their fisheries management regimes. The Australian Fisheries Management Authority and the Bureau of Rural Sciences undertake assessment of the status of fisheries for the Australian Government; the respective state fisheries agencies have this responsibility within the state governments.

Knowledge on the status of fish stock is of upmost importance to fisheries managers as it allows them to gauge the success of their management regimes and make adjustments where necessary. Knowledge of the status of fish stocks is also important to anyone interested in the long-term potential of the region's fish industries. This is because stocks that are currently overfished or fully fished are unlikely to experience significant growth in catch rates in the future and may need to be the subject of significant management measures.

Since 1992, the Bureau of Rural Sciences has provided governments, industry and the community with analyses of the status of fish stocks for which the Australian Government has management responsibility. One of the advantages of the Bureau of Rural Sciences reports is that they provide a basic and consistent interpretation of status across a range of fisheries. Four basic classifications are used (Caton & McLoughlin 2004):

1 *Not overfished*: a fish stock that has potential to sustain catches higher than those currently taken, or one for which current catches and fishing pressure are close to the optimum or target reference points.

2 *Overfished*: in simple terms, there are too few fish left, or more precisely, the fish stock has a biomass below the limit reference point.

3 *Overfishing*: the stock is experiencing too much fishing

4 *Uncertain*: the fish stock might or might not be overfished, or it might be subject to overfishing, but there is inadequate information to determine its status.

Table 4.15 indicates that a number of Commonwealth-managed fisheries in the region are overfished, and there is little certainty about their long-term potential yield.

Table 4.15 Status of selected fish stocks in the SWMR, 2003

Fishery	Status	Long-term potential yield
Southern and Western Tuna and Billfish	Bigeye tuna not overfished; yellowfin tuna and broadbill swordfish uncertain; overfishing of bigeye tuna is occurring in the broader Indian Ocean	Uncertain
Southern Bluefin Tuna	Overfished, and overfishing is occurring	Higher than current stock if spawning stock rebuilds
Great Australian Bight Trawl	All species uncertain	Uncertain
Western Australian Southern Demersal Gillnet and Longline	Dusky shark and whiskery shark overfished; gummy shark not overfished; school shark overfished	Uncertain

(Caton & McLoughlin 2004)

Within state fisheries trends fishery status trends apparent within Australia Government management fisheries are also apparent. In South Australia, the Department of Primary Industries and Resources have also provided analyses of the status of various fisheries (e.g. Ferguson & Ward 2003; Ward et al. 2002). In Western Australia, the Department of Fisheries

provide stock status reports through their annual *State of the Fisheries* reports (see Table 4.16). Table 4.17 provides similar information for South Australian fisheries. In both states, it is clear that there is limited capacity for further exploitation of wild fish stocks, with most fisheries being fully exploited.

Table 4.16 Stock status of selected Western Australian fisheries within the SWMR, 2003

Fishery	Exploitation status	Breeding stock levels
West Coast Rock Lobster	Fully exploited	Adequate
Abalone	Fully exploited	Adequate
Shark Bay Prawn	Fully exploited	Adequate
Shark Bay Scallop	Fully exploited	Adequate
Abrolhos Islands and Mid West Trawl	Fully exploited	Adequate
South-west Trawl	NA	NA
West Coast Blue Swimmer Crab	Not assessed	Adequate
West Coast Deep Sea Crab	Not assessed	Adequate
Cockburn Sound	Not assessed	Not assessed
West Coast Beach Bait	Fully exploited	Adequate
West Coast Purse Seine	Fully exploited	Increasing
West Coast Demersal Scalefish	Not assessed	Not assessed
Western Australian Salmon	Fully exploited	Adequate
Australian Herring	Fully exploited	Adequate
South Coast Purse Seine	Fully exploited	Adequate
Demersal Gillnet and Longline	Fully exploited	Low
Shark Bay Beach Seine and Mesh Net	Fully exploited	Adequate
Shark Bay Snapper	Fully exploited	Adequate

(Source: Department of Fisheries 2003)

Table 4.17 Stock status of South Australian fisheries within the SWMR, 2005

Fishery	Status	Breeding stock levels
Northern Zone Rock Lobster	Fully exploited	Low (stock rebuilding strategy in place)
Pilchard	Fully exploited	Adequate
Greenlip Abalone	Fully exploited	Adequate
Blacklip Abalone	Fully exploited	Adequate
Marine Scalefish (12 key species)	Fully exploited	Adequate
Blue Crab	Fully exploited	Adequate
West Coast Prawn	Fully exploited	Low (opportunistic ocean fishery at end of species geographic range)
Shark (mainly bronze whalers; excludes school and gummy sharks)	Unknown	Unknown
Scallop	Fully exploited	Unknown
Sea Urchin	Under-exploited	High

(Source: PIRSA 2006)

4.9.5 Economic dimensions

Regional and national economic importance

Like other marine industries, it is difficult to gain exact data on the regional and national economic importance of the commercial fisheries in the SWMR. While South Australia produces annual series on economic indicators for commercial fisheries, other jurisdictions undertake surveys on a less regular basis, often utilising methods which differ from one another. Using the data that are available, however, it is possible to build a general picture of the importance of commercial fisheries to the region.

Allen Consulting Group (2004) calculates that nationally in 2002–03 the Australian fisheries and seafood industry created:

- 4.3 per cent of marine industry direct added value ($1.3 billion);
- 6.1 per cent of indirect added value ($2.8 billion); and
- 6.9 per cent of marine industry turnover ($4.0 billion).

In terms of Western Australian and South Australian fisheries, the industry was responsible for:

- $125.7 million of direct added value and $285.34 million of indirect added value in South Australia, and
- $135.55 million of direct added value and $307.70 million of indirect added value in Western Australia.

As stated above, South Australia produces more specific annual assessments of economic indicators than other fisheries. Table 4.18 provides a selection of this data for 2002–03, and illustrates the importance of the industry to the state's economy. For 2002–03, South Australian fisheries provided in total $501 million in direct income, and an additional $143.8 million in added value. This translates into $416 100 per tonne in direct income, and $239 633 per tonne in added value. The industry also makes an important contribution to household income, providing some $74 million in direct income and $68 million in indirect income.

Table 4.18 Economic impacts of select South Australian commercial fisheries active in the SWMR, 2002–03

	Abalone	GSV Prawns	SG & WC Prawns	Nth'n Zone Rock Lob.	Blue Crabs	Marine Scalefish	Pilchards
Turnover							
Fishing (direct) ($m)	36.3	4.2	28.2	18.8	5.4	20.8	17.8
All other sectors (indirect) ($m)	30.3	7.0	40.9	42.4	10.0	39.9	16.6
Total ($m)	**66.6**	**11.2**	**69.1**	**61.2**	**15.5**	**60.7**	**34.4**
Total/Direct	1.8	2.7	2.4	3.3	2.8	2.9	1.9
Total/Tonne ($)	74 800	47 700	45 800	102 900	26 500	14 700	1 500
Value added							
Fishing (direct) ($m)	32.0	2.5	20.8	10.3	3.9	11.2	14.9
All other sectors (indirect) ($m)	15.1	3.3	19.3	20.3	4.7	19.2	8.4
Total ($m)	**47.2**	**5.8**	**40.2**	**30.6**	**8.7**	**30.4**	**23.3**
Total/Direct	1.5	2.3	1.9	3.0	2.2	2.7	1.6
Total/Tonne ($)	53 000	24 700	26 600	51 300	14 800	7 300	1 000
Household income							
Fishing (direct) ($m)	10.2	1.4	10.7	7.2	2.3	9.9	7.5
All other sectors (indirect) ($m)	7.1	1.6	9.1	9.7	2.2	9.1	3.7
Total ($m)	**17.3**	**3.0**	**19.8**	**16.8**	**4.5**	**19.1**	**11.3**
Total/Direct	1.7	2.2	1.8	2.3	2.0	1.9	1.5
Total/Tonne ($)	19 400	12 600	13 100	28 300	7 700	4 600	500

(Source: Modified from Econsearch 2004)

Employment

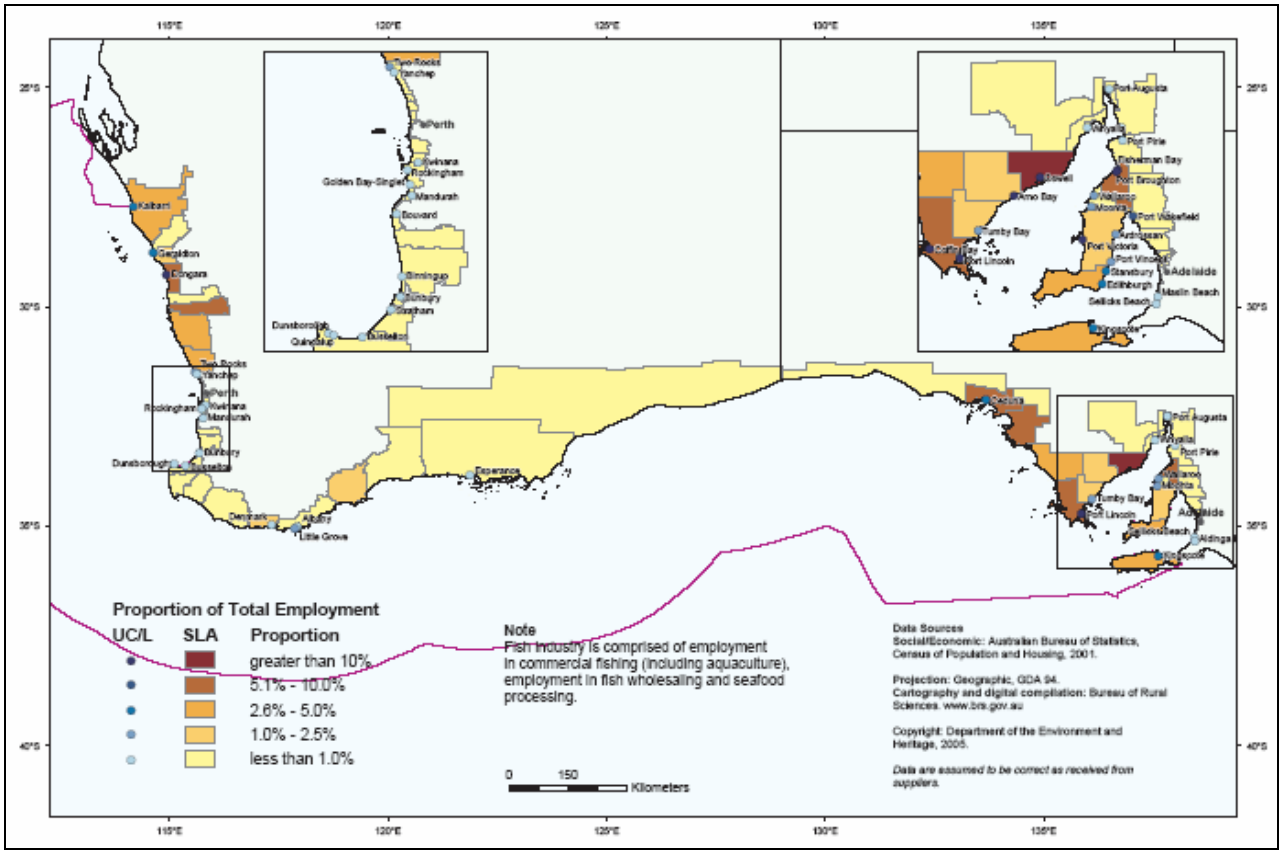
The fishing industry is one of the most labour intensive of Australia's marine industries, spending over 50 per cent of total costs on labour (Econsearch 2004). The numerous regional and remote communities in the SWMR depend in part or completely on commercial fishing for employment and economic vitality (Fisheries Research and Development Corporation no date). As an indication of the significance of this industry, employment in the fishing sector for Western Australia and South Australia is outlined in Table 4.19. It is evident how important rock lobster fishing is in the region, with 65 per cent of the people employed in this industry Australia-wide based in Western Australia and South Australia. This industry plays a vital role in regional development, and helps to underpin the economic base of towns such as Lancelin, Jurien Bay and Cervantes. The downstream economic impacts of fishing are also particularly important, with fish and seafood wholesale and processing sectors providing around 2000 jobs in South Australia and Western Australia. Given the distribution of the industry, most of these jobs are likely to be concentrated in areas adjacent to the SWMR (Figure 4.49).

Table 4.19 ABS estimates of employment in the commercial fishing industry, 2001

Industry	Western Australia	South Australia	Australia
Marine fishing	245	237	1611
Rock lobster fishing	722	221	1459
Prawn fishing	150	109	1040
Finfish trawling	27	40	288
Squid jigging	0	3	12
Line fishing	10	26	91
Fish wholesaling	742	583	5 540
Seafood processing	239	457	2 213
Commercial fishing, undefined	493	459	3 152
Total	**2 628**	**1 935**	**10 146**

(Source: Australian Bureau of Agricultural and Resource Economics 2005, p. 8)

Figure 4.49 Proportion of total employment in fisheries in the SWMR



(Source: Department for Environment and Heritage 2005)

4.9.6 Management arrangements

Many of Australia's fisheries resources are either fully fished or becoming overfished, making effective management vital to ensuring that stocks remain sustainable and that the commercial industry continues to be economically viable. It should be noted, however, that Australia has numerous examples of effectively managed fisheries that are internationally recognised, such as the Western Rock Lobster Fishery (Department of Agriculture, Fisheries and Forestry 2004).

The Australian and state/territory governments either manage Australia's fisheries independently, collaboratively, or through Commonwealth – state/territory joint authorities. In general, Commonwealth-managed fisheries involve species with a wide distribution such as tuna, whereas nearshore and sedentary species such as abalone and lobster are administered by the states/territories (Department of Agriculture, Fisheries and Forestry 2002)

The Australian Government first became involved in the management of domestic fisheries with the introduction of the *Commonwealth Fisheries Act 1952*. This Act was rewritten to become the *Fisheries Management Act 1991* and includes provisions to establish the statutory Australian Fisheries Management Authority (AFMA). This agency undertakes daily management of the Commonwealth-managed fisheries including licensing, policy development and surveillance of foreign fishing activities. Traditionally the division between Commonwealth and state/territory authority for fisheries was based on the three nautical mile limit. In the early 1980s, the Offshore Constitutional Settlement (OCS) was introduced to enable effective arrangements that more accurately reflect fishing practices. The OCS means that between the low water mark and the Australian Fishing Zone boundary, either Commonwealth or state/territory legislation will be applied (Department of Agriculture, Fisheries and Forestry 2002).

In Western Australia the Department of Fisheries administers five acts of legislation that regulate fisheries within state waters, with the key legislation being the *Fish Resources Management Act 1994* and the *Pearling Act 1990*. The department's main responsibilities include compliance, research, education and surveillance (Department of Fisheries 2005d). The responsibility of fisheries management in South Australia falls with the Department of Primary Industries and Resources, which administers the *Fisheries Act 1982* (South Australian Fisheries Research Advisory Board no date). Both the Australian and state governments regulate the fisheries using a range of input controls (e.g. gear specifications and closures), output controls (e.g. bag and size limits) and methods designed to conserve species and their habitats (e.g. bans on certain types of gear) (Department of Agriculture, Fisheries and Forestry 2004).

4.10 Aquaculture

4.10.1 Industry objectives

Aquaculture is the farming of aquatic organisms such as fish, molluscs (shellfish), crustaceans and marine plants. It involves intervention practices to enhance production, such as regular stocking, feeding, and/or protecting stock from predators (ZL and Associates 2003, Mazur et al. 2005). While it is still a fledgling industry in Australia, aquaculture is growing relatively rapidly and has attracted considerable institutional and other support. It has been supported by a national Aquaculture Action Agenda, which aims to promote the development of a "sustainable, vibrant and rapidly growing aquaculture industry" that will achieve at least $2.5 billion in annual sales by 2010 (Department of Industry, Tourism and Resources 2005).

4.10.2 National activity

On a worldwide scale, aquaculture production (including inland and marine culture) constituted 31.7 per cent of the total fisheries production in 2003, a rise of 25.6 per cent since 1998 (Table 4.20). In Australia, since the start of annual data collection in 1988–89, there has been approximately a 200 per cent increase in volume, and a 400 per cent increase in the value of production (Maunsell Australia 2004). Today aquaculture production constitutes around 30 per cent of total fisheries production in Australia by value (Australian Bureau of Agricultural and Resource Economics 2005).

Table 4.20 World fisheries production (aquaculture and wild capture), 1998–2003

	1998	1999	2000	2001	2002	2003
Production INLAND (million tonnes)						
Capture	8.1	8.5	8.7	8.7	8.7	9.0
Aquaculture	18.5	20.2	21.3	22.5	23.9	25.2
Total inland	26.6	28.7	30.0	31.2	32.6	34.2
Production MARINE (million tonnes)						
Capture	79.6	85.2	96.8	84.2	84.5	81.3
Aquaculture	12.0	13.3	14.2	15.2	15.9	16.7
Total marine	91.6	98.5	101.0	99.4	100.4	98.0
Total capture	**87.7**	**93.8**	**95.5**	**92.9**	**93.2**	**90.3**
Total aquaculture	**30.6**	**33.4**	**35.5**	**37.8**	**39.8**	**41.9**

(Source: FAO Fisheries Department 2004)

The Australian aquaculture industry produces over 35 000 tonnes of produce each year, with total farm gate production valued at about $700 million per annum (Maunsell Australia 2004). The location of aquaculture sites within Australia is dependent on, amongst other things, seasonal conditions, the type of species being cultivated, and differing requirements at different stages of the species life cycle (Australian Bureau of Statistics 2003d).

Aquaculture products in Australia tend to be of high value and targeted at niche markets. Some products are sold locally, whilst others are sold interstate or exported internationally. Japan and East Asia are the main export destinations (Australian Bureau of Agricultural and Resource Economics 2005). The key species produced throughout the various states of

Australia include oysters in New South Wales, trout in Victoria, prawns in Queensland, pearls in the Northern Territory and Western Australia, salmon and oysters in Tasmania and southern bluefin tuna in South Australia (Maunsell Australia 2004).

4.10.3 Regional activity

Aquaculture is an important marine industry within the SWMR. In 2003–04, total South Australia (38 per cent) and Western Australia (21 per cent) production accounted for almost 60 per cent of Australia's total value of production ($435 million). In the same period, the industry employed 601 people in Western Australia and 764 in South Australia (Australian Bureau of Agricultural and Resource Economics 2005).

There are several key areas within the SWMR where aquaculture activities are concentrated (Figure 4.50). In Western Australia these areas include Shark Bay, Geraldton, the Perth Metropolitan Area, and Albany; in South Australia these include Ceduna and Streaky Bay, Port Lincoln, the east coast of the Yorke Peninsula and Kangaroo Island.

South Australia

The aquaculture industry in South Australia has expanded rapidly since its inception in 1988–89, with production increasing from around 100 000 kilograms per year to over 15 000 tonnes per year, with a value of over $277 million. The main species cultivated in South Australia are tuna and oysters, whilst emerging industries include the culture of rock lobster, mussels, yellowtail kingfish and mulloway (Table 4.21) (SARDI 2005a). The majority of aquaculture activity in South Australia occurs within waters of the SWMR.

Table 4.21 Aquaculture production in South Australia, 2000–01 to 2003–04

SA Aquaculture	2000–01		2001–02		2002–03		2003–04	
	tonnes	$'000	tonnes	$'000	tonnes	$'000	tonnes	$'000
Atlantic salmon	0	0	64	596	0	0	0	0
Yabbies	17	172	8	95	7	93	10	153
Marron	8	196	11	282	22	533	18	480
Oysters	2 055	11 011	2 425	13 303	2 706	15 116	4 382	21 152
Southern bluefin tuna	9 051	263 793	9 245	260 500	9 102	266 907	9 290	242 000
Barramundi	264	2 743	255	2 653	471	6 166	216	2 255
Trout	13	176	26	192	18	156	40	330
Abalone	53	2 677	34	1 901	59	3 080	105	3 155
Mussels	111	260	171	371	254	466	400	697
Other	480	4 322	270	2 779	1 077	8 769	894	7 534
Total	**12 052**	**285 350**	**12 509**	**282 672**	**13716**	**301 286**	**15 355**	**277 756**

(Source: ABARE 2003 and 2005)

Southern bluefin tuna

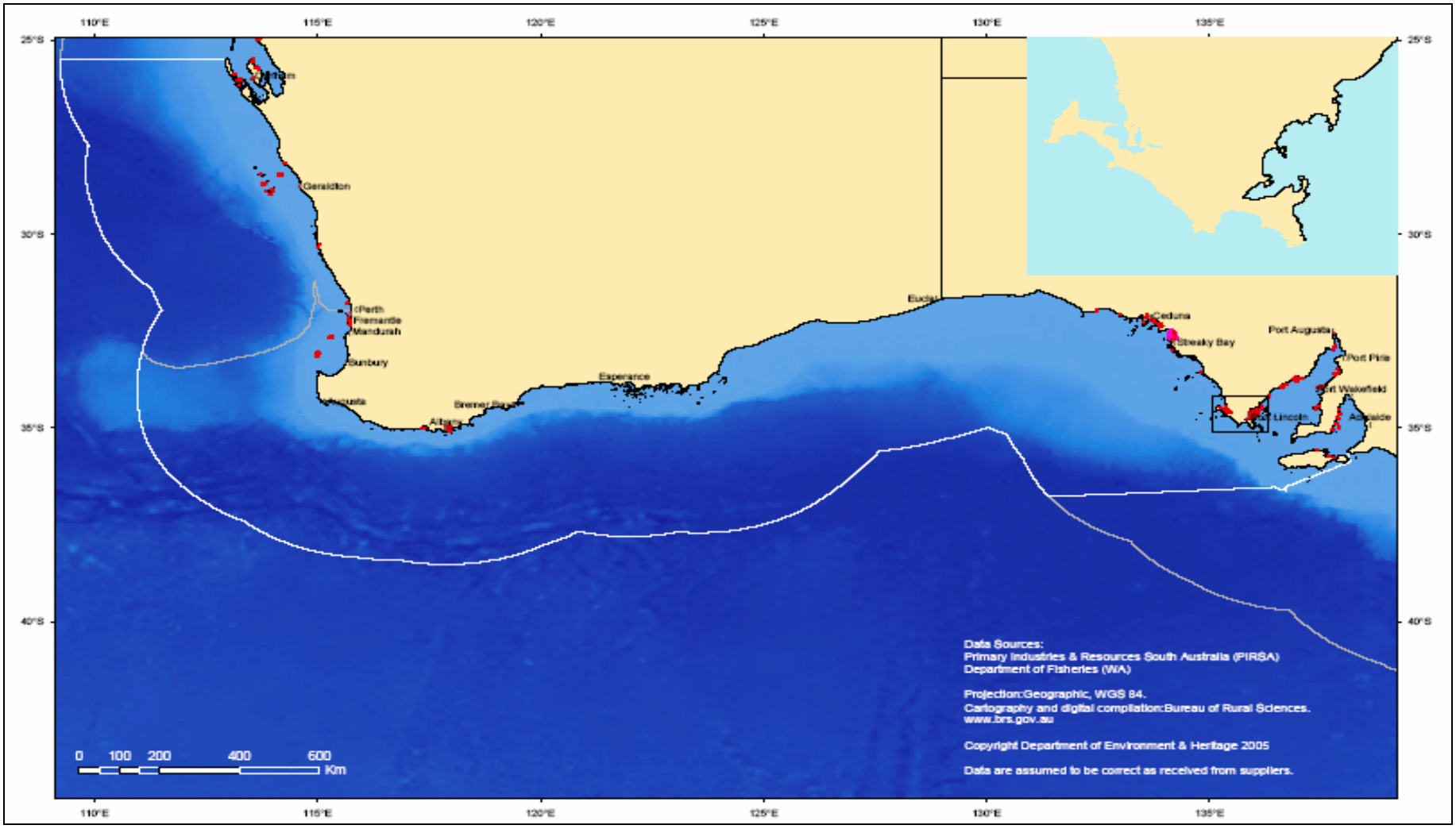
South Australia is the location of the only commercial farming of southern bluefin tuna (SBT) in the world. This farming is based at Port Lincoln on the Eyre Peninsula (Plate 4.12, Figure 4.50). The farming of SBT was established in Port Lincoln in 1991 and it now dominates the aquaculture industry in South Australia in terms of volume and value of production (EconSearch 2003, Maunsell Australia 2004). In 2001–02, Australian SBT

production at the farm gate had a total value of $260.5 million and a unit value of $28.18 per kilogram (Maunsell Australia 2004). Currently there are a total of 27 farms, ranging in size from 20–30 hectares, on 43 lease sites. SBT are marketed almost exclusively in Japan as sashimi (Hays 1997, AFMA 2001, Department of Agriculture Fisheries and Forestry 2005).

Plate 4.12 Hand catching southern bluefin tuna in farm pens off Port Lincoln

(Source: Department of the Environment and Water Resources)

Figure 4.50 Aquaculture activity within the SWMR



South Australian oyster industry

The South Australia oyster industry is South Australia's second largest aquaculture industry. It is considered that this industry has the potential for further expansion due to the water quality of South Australia in comparison to other areas of Australia eg. the highly developed coastline of New South Wales (Maunsell Australia 2004). From the early 1900s attempts were made to culture the native mud or flat oyster, until the 1960s when the focus shifted to the hardier Pacific oyster. Today, farming of Pacific oysters is located in five main areas: Murat Bay, Smoky Bay, Streaky Bay, Coffin Bay and Franklin Harbour, as well as on the eastern side of Yorke Peninsula and the north-eastern side of Kangaroo Island (Figure 4.50) (Department of Primary Industries and Resources 2000).

Oyster production in 1999–2000 was 1761 tonnes, and had a value of more than $9 million. By 2003–04 there were 290 licence holders and more than 4000 tonnes was produced with a value of more $21 million (ABARE 2005). The rapid growth in the industry can be associated with the demand for oysters exceeding supply (Department of Primary Industries and Resources 2000).

Abalone

South Australia also has a growing abalone industry (Maunsell Australia 2004). Abalone is farmed near Port Lincoln and Streaky Bay on the Eyre Peninsula and on Kangaroo Island (Figure 4.50) (Zaluski 2005b). The culture of abalone in South Australia began in the 1990s (Zaluski 2005b). In 2003–04 there were 64 licence holders using raceways and ocean rafts to culture abalone. The industry has grown in economic terms from $2 million in 1999–2000 to over $3 million in 2003–04 (Australian Bureau of Agricultural and Resource Economics 2005).

Western Australia

Aquaculture in Western Australia dates back to the 1930s with the cultivation of trout in a number of river systems. During the 1970s and 1980s, marron and mussels were farmed and more recently yabby (*Cherax albidus*) and algae (betacarotene) production has begun (ZL and Associates 2003). Currently the major species under commercial aquaculture production within the region include mussels, abalone, oysters and marine algae (Department of Fisheries 2005c).

Compared to the total Western Australian aquaculture production (table 4.22) there is currently little aquaculture activity within the region beyond the relatively small-scale farming of mussels, abalone and marine algae. As of 2003–04, production in the region for these species was worth approximately $2.5 million. The Aquaculture Council of Western Australia compiled a report in March 2004, outlining the issues confronting the state's aquaculture industry. Positive issues such as a pristine environment and the state's research and development capacity are advantageous to the industry. However, there were a number of issues identified which would continue to constrain growth in the industry, including such factors as a fragmented production base and lack of market focus, dedicated infrastructure and funding (Porter et al. 2004).

Across the state (which includes both waters inside and outside the SWMR) aquaculture is dominated in terms of value of production by the *Pinctata maxima* pearling industry, which began in Broome in the early 1880s. Pearling currently constitutes 96 per cent of total aquaculture production in Western Australia (Table 4.22). Although most pearling activities

lie outside the bounds of the SWMR, black pearls are harvested from the Gascoyne Bioregion at Shark Bay and the Abrolhos Islands. The first commercial harvest of black pearls from Shark Bay and the Abrolhos Islands took place in 2001–02 (Maunsell Australia 2004).

Western Australia's aquaculture industry production increased from 993 tonnes in 1999–2000 to 1188 tonnes in 2003–04. The value, however, decreased from $195 million to $157 million over the same period, which was mainly due to a decline in the value of pearl production (Table 4.22) (Australian Bureau of Agricultural and Resource Economics 2005).

Table 4.22 Aquaculture production in Western Australia, 2000–01 to 2003–04

WA aquaculture	2000–01		2001–02		2002–03		2003–04	
	tonnes	$'000	tonnes	$'000	tonnes	$'000	tonnes	$'000
Pearls	NA	150 000	NA	175 000	NA	150 000	NA	150 000
Yabbies	201	2 510	102	1 281	75	1 040	32	458
Marron	52	1 183	47	1 099	46	1 082	49	1 090
Mussels	964	2 267	989	2 817	653	1 607	763	2 063
Fish	95	679	94	894	246	1 776	344	2 385
Goldfish / koi carp	NA	122	NA	122	NA	85	NA	115
Ornamental	NA	130	NA	399	NA	206	NA	189
Other	NA	104	NA	255	NA	507	NA	542
Total	**1312**	**156 995**	**1231**	**181 867**	**1020**	**156 303**	**1188**	**156 842**

(Source: Australian Bureau of Agricultural and Resource Economics 2003 and 2005)

Western Australia undertakes analysis of its fisheries, including aquaculture, by the bioregion in which they are located within. The analysis of Western Australia's fisheries including aquaculture is completed at the scale of bioregions. There are six bioregions within the state, three lying within the bounds of the SWMR. These include the Gascoyne Bioregion extending south from the mouth of the Ashburton River to just north of Kalbarri; the West Coast Bioregion, which runs from north of Kalbarri to Black Point, east of Augusta; and the South Coast Bioregion, that extends from Black Point to the South Australian border. The key aquaculture industries differ between the bioregions (Penn et al. 2005).

Within the West Coast Bioregion, the two key locations for aquaculture are Perth and the Abrolhos Islands off the coast of Geraldton (Figure 4.50). In the areas surrounding Perth, mussels are the predominant aquaculture industry, with farms located in and around Cockburn Sound and Warnbro Sound (Zann & Sutton 1996).

Aquaculture in the South Coast Bioregion is concentrated in Albany; licences are also held in Bremer Bay and Esperance. During 2003–04 the Department of Fisheries supported the emerging abalone industry through the development of a strategic development plan and environmental management strategy (Penn et al. 2005). There is also a developing oyster industry in Albany (Maunsell Australia 2004).

4.10.4 Economic dimensions

Regional and national economic importance

Within the SWMR the growing-out of southern bluefin tuna (SBT) off the Lincoln Peninsula dominates production figures. It has been calculated that each dollar of tuna produced stimulates an additional $1.57 of output in the wider economy (Econsearch 2004). Looking at the aquaculture calculations across a range of sectors, this stimulation effect appears

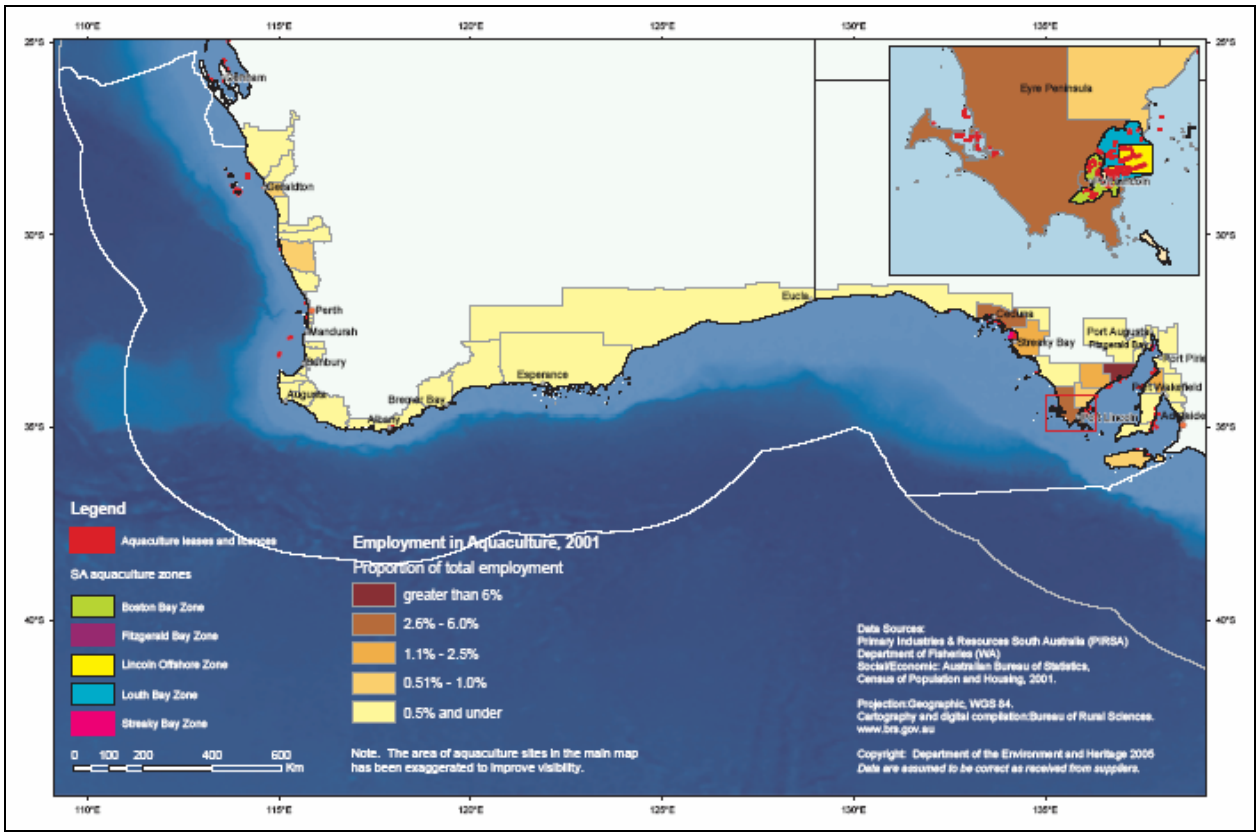
relatively constant. For instance, calculations for abalone, mussels and yellowtail kingfish produce a multiplier of 1.60, and for oyster, barramundi and mussels a multiplier of 1.69 has been calculated. Taking these calculations as representative of the broader regional aquaculture activity produces an estimate of total output for the region's aquaculture of around $0.5 billion. In terms of added value, this activity generated approximately $256 million (51 per cent of the total output figure).

In addition to calculating total output and added value figures, household income generated by aquaculture activities can be calculated from data produced by the South Australian Government. For instance, in 2002–03 total household income generated by aquaculture activities within the region was $70.5 million of which $60.9 million was generated by SBT alone (Econsearch 2004). By extending this data to Western Australia, total income for Western Australia from aquaculture activities can be estimated at around $625 000.

Employment

Employment in aquaculture ventures is important because aquaculture often occurs in regional areas, areas where there is generally little other employment opportunity. Within the region it can be seen that direct employment within the industry is concentrated in close proximity to the aquaculture ventures (see Figure 4.51).

Figure 4.51 Distribution of employment in aquaculture in the SWMR, 2001



(Source: Department for Environment and Heritage 2005)

For South Australia, it has been calculated that total direct employment for the region's aquaculture industry is approximately 990 people, with a further 2017 jobs created in the wider economy (Econsearch 2004). This represents around one job (both directly and indirectly created) for every $93 000 of aquaculture product sold. By extending this analysis

to the Western Australian figures, total employment from the region's aquaculture activity (direct and indirect) can be estimated at 3034 people (1000 created directly and the remainder created in associated sectors).

4.10.5 Management arrangements

The majority of marine-based aquaculture is undertaken in coastal waters and thus it is regulated by the relevant state/territory governments; this is in contrast to wild fisheries, which are often within Commonwealth waters (Maunsell Australia, 2004). However, some Commonwealth legislation is involved in the regulation of aquaculture processes, such as the *Environment Protection and Biodiversity Conservation Act 1999* that governs issues relating to environmental protection and impact. Other Acts include the *Native Title Act 1993* which controls the use of public land and waters in certain cases, and the *Quarantine Act 1908* which regulates access to new species, brood stock and feed sources (Maunsell Australia 2004).

In South Australia the Department of Primary Industries and Resources manages the aquaculture industry under the *Aquaculture Act 2001*. The department is responsible for the formation of policy, and for tenure allocation, licensing, and industry development (Maunsell Australia 2004). The South Australian Research and Development Institute (SARDI) maintains a database of all aquaculture production within the state. This involves, amongst other things, monitoring the location of fish farms, the species sold, the extent of processing, total sales and total value. The information gained is used for resource planning and management purposes (SARDI 2005b).

The aquaculture industry in Western Australia is managed by the Department of Fisheries. The department establishes policy, allocates tenure and releases licences under the *Fish Resources Management Act 1994* and the *Pearling Act 1900* (Maunsell Australia 2004). The Aquaculture Council of Western Australia is a non-profit organisation that was established in 1987 to help manage and coordinate the development and servicing of the aquaculture industry within the state (Aquaculture Council of Western Australia no date).

Currently no aquaculture is carried out in Commonwealth waters; however, the Australian Government supports aquaculture through national programs for research, ecologically sustainable development, quarantine, fish health, food safety, market access and trade, business development, and farm management assistance and by working with the states and the Northern Territory on aquaculture issues requiring national coordination. Through the National Aquaculture Policy Statement, Australian and state governments have committed to working in partnership with the aquaculture industry to achieve maximum sustainable growth whilst also meeting national and international expectations for environmental, social and economic performance.

4.11 Developing industries

There are a number of emerging industries in the SWMR, most of which make direct use of the region's natural resources. These industries, including marine biotechnologies, desalination, energy production, and minerals extraction, all have the potential to contribute to economic growth and employment in the region. However, at this stage their long-term economic sustainability has not been established. Importantly, in addition to presenting the region with new opportunities, these industries all carry risks for the marine environment. The following provides a brief profile of some of the sunrise industries in the region, their growth characteristics, and the potential risks associated with these industries.

4.11.1 Marine biotechnology

Biotechnology is a broad term that describes the use of biological processes, systems and organisms to make or modify products. Biotechnology is commonly used in industry, technology, medicine and agriculture. The products generated or modified can include food and medicine, renewable energy resources, improved plants and animals, micro-organisms and synthetic hormones and enzymes (Biotechnology Australia 2005).

In July 2000 the National Biotechnology Strategy was launched to provide a framework for the development of biotechnology in Australia (Biotechnology Australia 2005). Since this time, the development of biotechnology in Australia has been extensive. There are approximately 400 core biotechnology companies, which is a significant increase from 190 in 2001 (Invest Australia 2005). On a worldwide scale, Australia has the sixth largest number of biotechnology companies, behind the United States, Canada, Germany, the United Kingdom and France (Australian Government 2003). In 2005 the number of people employed by biotechnology companies was over 6000 and total revenue generated was in excess of $2 million (Invest Australia 2005).

The marine environment of the SWMR supports a wide range of marine species. The biodiversity of the region has been relatively unexplored from a biotechnology perspective. Research to date has been largely based on terrestrial organisms, which are less diverse than the marine species of the SWMR. This marine diversity provides a broad base for the development of new industries.

Biotechnology in the region involves state and national research organisations. The Australian Institute of Marine Science (AIMS) is a national research organisation that was established by the Australian Government to create and share knowledge specifically aimed at the sustainable use and protection of the marine environment. The biotechnology branch of AIMS is responsible for advances in aquaculture and the development of compounds for medicine, industry and environment (Australian Institute of Marine Science 2005).

Marine biotechnology in Western Australia is largely concentrated on measuring the environmental impacts of industry through cataloguing biodiversity and environmental monitoring (West Australian Technology and Industry Advisory Council 2000). In a review of biotechnology in Western Australia it was noted that although the development of products through biotechnology has re-commenced in the state, there is great scope for future development.

The South Australian Research and Development Institute (SARDI) and other organisations such as Bio Innovation (established by the Department of Primary Industry and Resources)

are undertaking marine bioscience in South Australia. SARDI has an aquatic science strategic research area that focuses on marine and inland fisheries, aquaculture, marine biotechnology and the development of commercial opportunities (South Australian Research and Development Institute 2001). Bio Innovation was set up to expedite the development of the state's bioscience industry, including marine bioscience. There are over 70 companies in South Australia covering all areas of biotechnology – not just marine – that employ approximately 1000 people (Bio Innovation South Australia 2005).

The Australian and the state governments are responsible for the regulation of biotechnology. In October 2002 the Australian and the state governments signed an inter-government agreement on genetic resource management. Since then the Australian Government has been developing regulations that address biotechnology in Commonwealth waters. These regulations are expected to be enforced under the *Environmental Protection and Biodiversity Conservation Act 1999*. Additionally, Biotechnology Australia, a multi-departmental Australian Government agency was established in 1999 to manage the National Biotechnology Strategy, provide information on biotechnology to the public, and coordinate non-regulatory biotechnology issues for the Australian Government (Biotechnology Australia 2005).

Due to advances in biotechnology and because of its biodiversity of marine species, the SWMR is well placed to benefit from biotechnology, both economically and socially. In the short to medium term, the outlook for the commercial biotechnology sector in Australia is for increased consolidation through research collaborations, mergers and acquisitions. Although this will result in a decrease in the total number of companies, consolidation is predicted to help the Australian sector become more sustainable and internationally competitive (Australian Government 2003).

4.11.2 Desalination

Desalination is the creation of fresh water from seawater through the removal of dissolved minerals and other impurities (Water Corporation 2004). Desalination is used for industry and as an option to provide sustainable water resources. In the SWMR there are several desalination plants associated with industries such as mining (Water Corporation 2005a). However, it is the use of desalination as a sustainable water management option that will develop most rapidly and will be under scrutiny in the coming years.

Desalination is a topical issue in the SWMR due to the limited rainfall and subsequent imposition of water restrictions on residents. There are a variety of methods for desalination, which are often more costly than present methods of supplying residential water. A study undertaken for the Commonwealth Department of Agriculture, Fisheries and Forestry, and Land and Water Australia, found that desalination will become a more attractive option if the quality of Australia's water supply continues to decline (National Dryland Salinity Program 2002).

The two main environmental considerations related to desalination are:

- greenhouse gas emissions associated with the large amounts of energy required by the process
- the concentrated waste stream requiring appropriate disposal (Water Corporation 2005b).

The first desalination plant in Australia designed to provide drinking water was built in South Australia in 1999. The plant was built at Penneshaw on Kangaroo Island at a cost of $3.5

million and now provides 300 kilolitres of fresh water every day to the town (South Australia Water 2005). A new $300 million seawater desalination plant is currently being planned for the Upper Spencer Gulf to meet the demand of the expanding Olympic Dam mine (Austin 2005). South Australia Water, which is responsible for sustainable water management in the state, has developed a 20-year strategic plan to secure water supplies for Adelaide and its surrounds. South Australia Water found that, at present, Adelaide does not need to resort to seawater desalination because sufficient cost-effective water sources are still available (South Australia Water 2005).

The Water Corporation in Western Australia is responsible for the sustainable management of water resources for the state. A desalination plant is proposed for Kwinana south of Perth, to be built at an estimated cost of over $350 million (Government of Western Australia 2005). Although there are at present alternative water source options that may have lower costs than desalination, due to the uncertain nature of climate and rainfall, the Water Corporation has concluded that desalination provides a viable option for the future (Water Corporation 2005b). In addition, the government has announced that the plant will be powered by renewable energy supplied by a wind farm 30 kilometres east of Cervantes, thus overcoming the issue of greenhouse emissions (Government of Western Australia 2005b).

There are, however, risks associated with desalination. The process of desalination is dependent on high levels of energy. The cost of is increasing and thus the cost of desalinisation presents a risk in terms of economic sustainability. Desalination also carries risks for the marine environment. The discharge of hyper-saline water into coastal waters, such as Cockburn Sound off Fremantle, has the potential to have a direct impact on coastal and marine ecosystems, altering the chemical and biological structure of these ecosystems.

4.11.3 Ocean based energy sources

Ocean waves can be used to generate energy. A wave energy converter can turn the mechanical energy of a wave into emission-free electrical power and fresh water. A number of companies and organisations around the world have begun designing wave energy converters for the processing of energy (Seapower Pacific Pty Ltd 2005).

One company based within the SWMR is a Western Australian company that over the last three years has developed the CETO renewable wave energy converter. CETO is the first wave power converter to sit on the seabed and requires only a small-diameter pipe to transport seawater onshore to either a turbine to generate electricity, or to a reverse osmosis filter to produce fresh water (Seapower Pacific Pty Ltd 2005). The CETO generator was sunk in Fremantle Harbour in May 2005 and will now undergo a year-long trial (Melville Times 2004). It is expected that the prototype will generate up to 100 kilowatts of electricity, enough for 100 homes.

In addition to the use of ocean waves to generate energy it is possible that the ocean will be increasingly viewed as a potential site for the placement of wind turbines. Examples from overseas (for instance off the Netherlands and the United Kingdom coastlines shows that there are many advantages to siting wind farms in marine areas (despite the often onerous technical requirements) including higher average wind speeds and more consistent wind velocities over marine areas.

4.11.4 Offshore minerals

Australia has a wealth of minerals and metals. Globally, Australia is one of the top six producing nations for bauxite, coal, copper, diamonds, gold, iron ore, lead, mineral sands, lithium, nickel, uranium, zinc, manganese, tantalum and silver (Department of Tourism, Industry and Resources 2005e). While a large proportion of these minerals and metals are sourced onshore, mineral exploration and mining do occur in offshore waters. The majority of offshore mineral exploration thus far has centred on known distributions of diamonds, gold, heavy mineral sands and tin in adjacent onshore locations. Phosphorus and manganese nodules are also found in deeper water (Geoscience Australia 2002).

Within the SWMR the only offshore mining activity occurs in state waters near Fremantle, Western Australia. Since 1972, Cockburn Cement Limited has been dredging shell sand from Owen Anchorage for the production of quick lime (Environmental Protection Authority 2001). A long-term proposal is now in place to dredge shell sand from additional locations in the area which would see an additional 30 million tonnes removed by 2014 and a further 60 million tonnes from 2015 to 2034 (Surf Casting and Angling Club of WA 2002).

Other mineral sources that have been identified within the SWMR include a discovery of manganese nodules and crusts in deep waters of south-west Western Australia. In South Australia near Kangaroo Island and in the Spencer and St Vincent's gulfs there are potential offshore diamondiferous placer deposits (Sait 2001). With identification of these potential resources and as exploration continues in the region, it is probable that offshore mining will continue to develop as an important industry.

Exploration and production of minerals (other than petroleum) in Commonwealth waters, (three nautical miles from the territorial baseline of the states and territories) is regulated by the *Commonwealth Offshore Minerals Act 1994*. Both the Commonwealth and the states/territories share the administration of the Act. A Joint Authority, consisting of the relevant Australian Government minister and state/territory minister is responsible for major decisions. However, the state/territory minister is known as the Designated Authority and undertakes the normal daily administration of the Act (Geoscience Australia 2003). In Commonwealth waters, a total of 66 offshore mineral exploration licence applications have been made to the Designated Authority from 1990 to August 2003. As of 2003, only one licence was active, but it was located in Tasmania which is outside the SWMR (Geoscience Australia 2003).

Within coastal waters, mineral exploration and production is regulated by the relevant state/territory legislation (Department of Tourism, Industry and Resources 2005f). Until recently the *Western Australia Mining Act 1978* applied to all mining activity onshore and in coastal waters out to three nautical miles. However, a new *Offshore Minerals Act 2003* was introduced which now controls mining and exploration in coastal waters, and effectively mirrors the Commonwealth Act (Department of Industry and Resources 2003). Similarly in South Australia, the *Mining Act 1971* regulated onshore and offshore mining, until the introduction of the *Offshore Minerals Act 2000* (Parliament South Australia 2000).

There are concerns about the environmental risks associated with minerals extraction from marine environments. Not only does mining have the potential to radically alter patterns of sediment movement, but it also has the potential to alter the biological environment, with impacts on seagrasses, reef systems, and marine wildlife.

5 Drivers of change, future directions and risks for the marine-based industries of the South-west Marine Region

This chapter provides an overview and broad analysis of the drivers of change affecting the South-west Marine Region. This underpins a discussion about the future directions of the commercial uses of the region, and the risks that may be faced.

5.1 Drivers of change affecting the industries of the South-west Marine Region

Drivers of change in relation to marine industry activities are those external factors that affect the economic behaviours of marine industries (and the firms that make up those industries). Knowledge of what factors are important in changing industry and firm behaviour and knowledge of how different marine industries behave in response to external factors is of upmost importance to marine planners. This is because any changes in behaviour, such as changes in location or intensity of effort, or changes in technology, will have varying environmental consequences.

In previous reports commissioned by the National Oceans Office, various methods have been used to understand the drivers of change affecting marine industry activity. This report uses the framework outlined by the Australian Bureau of Agricultural and Resource Economics (ABARE) (2004). The main factors outlined within this section are:

- Global drivers:
  - economic growth
  - changes in world trade
  - energy trade and prices
  - international politics and policies
- Australian drivers:
  - economic growth
  - exchange rate
  - population dynamics
  - labour market constraints
  - resource constraints
  - government policies

5.1.1 Global drivers of change

The performance of the Australian economy is, in a large part, determined by wider international economic trends. As a trading nation, Australia is linked to other economies through a series of factors such as trade, international financial markets and capital flows.

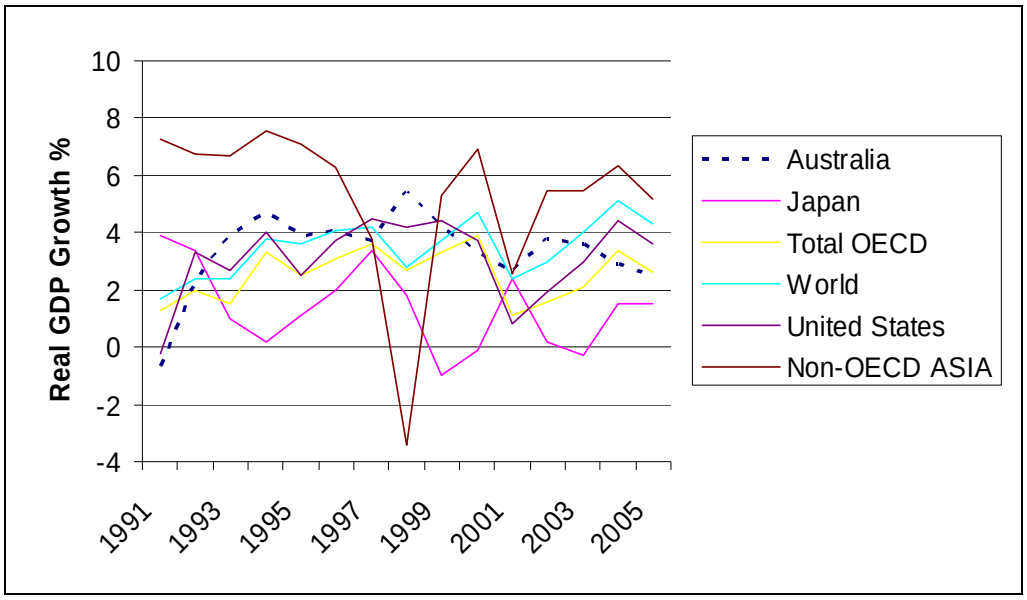
Economic growth and world trade

Of particular importance to Australia is the economic growth rate of our major trading partners such as China, Japan, the United States and the countries of South-east Asia. Over the past decade, the growth of these economies has impacted directly on the commercial users of SWMR through rising demand for agricultural commodities, fisheries products, oil and gas, tourism and leisure, ships and other commodities. The increase in the volume of exports to this market has had a direct impact on the volume of shipping, the movement of freight and commodities through ports and the level of marine related employment in the region. Consequently, for many of the local economies in the SWMR, the outcome has been relatively steady economic growth over the past two decades (see Chapter 2). The positive multipliers associated with this have often had broader consequences for employment, population and service provision. However, relatively high levels of dependence on these export sectors also mean that a downturn in international markets carries a degree of economic risk.

Despite the short-term effect of the 1997 Asian financial crisis, exports from the region have experienced relatively steady growth over the last two decades. Between the years 1988 and 2005, the value of exports from both Western Australia and South Australia has increased by around eight per cent per annum (ABS 2005). It is expected that the demand for raw resources and energy from these states will continue for the foreseeable future. This will be driven by a number of factors including the relative health of the world economy and the continued growth of China as a provider of goods into the world market and as a growing source of final demand.

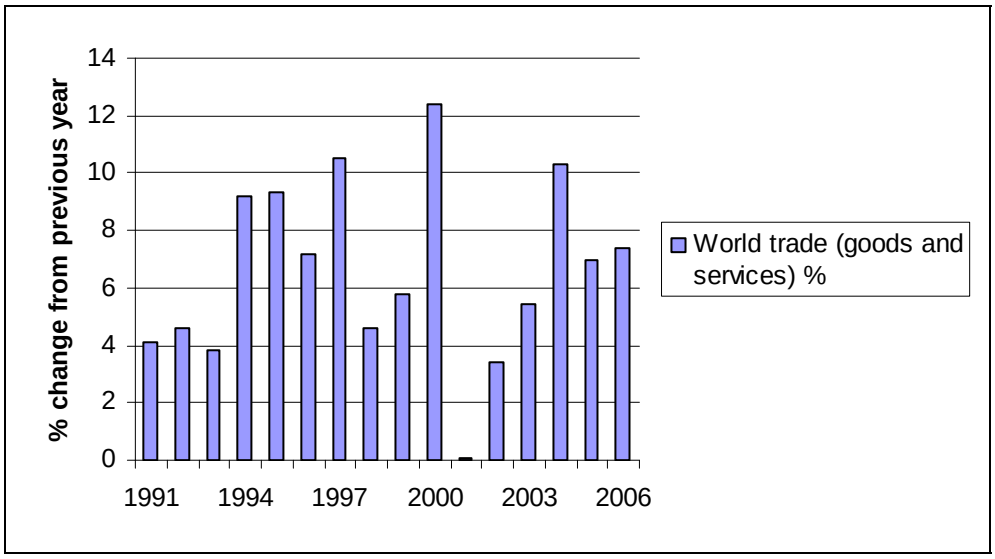
It is expected that growth in world trade will continue at a rate well in excess of the rate of growth of the world's economy. Between 1990 and 2002, world output grew at a rate of three per cent per year while world merchandised trade grew at a rate of just under seven per cent (see figures 4.1 and 4.2) (ABARE 2004). The move to integrate national economies into the "world" economy will drive greater interdependence and bring with it both risks and opportunities for the region's industries.

Figure 5.1 Real GDP growth in selected countries and regions, 1991–2005



(Source: ABS 2005)

Figure 5.2 Growth in World Trade, 1991–2006



(Source: ABARE 2005)

Another factor driving world economic growth is demographic change. At a global level, rapid population growth, particularly in parts of East Asia (especially China), South-east Asia and the Middle East (see United Nations 2005), has the potential to contribute to expanding markets and economic opportunities for industries based in the SWMR. More than 55 per cent of the world's population live in Asia alone; this represents significant market opportunities (United Nations 2005). Of particular significance here is the demand for mineral resources, oil and gas, agricultural commodities and fisheries products. While birth rates in these countries are slowing, these countries continue to experience natural rates of population growth in excess of 2.5 per cent per annum (United Nations 2005).

Energy trade and prices

Rising energy cost is one of the risks facing the SWMR. A recent report by the Organisation for Economic Cooperation and Development (2005) suggests that ongoing international oil price rises are likely to have a direct impact on the performance of the world economy. The report claims that prices above US$50 per barrel have the potential to contribute to a rise in inflation by as much as one per cent per annum and reduce global economic growth in the order of 1–2 per cent. While the geographical impact of this is likely to be extremely uneven, a slowing world economy does have the potential to undermine growth in the SWMR. The extent of this impact hinges in a large part on any changes to the growth rates of major trading partners China and Japan. However, it is also important to point out that rising energy prices have the potential to stimulate greater activity in the oil and gas sector of the region, particularly in terms of exploration.

International policies and politics

The international political and policy environment plays an important role in shaping the economic and social characteristics of the SWMR. Of particular significance over the past two decades have been international trade policies, especially issues associated with agricultural subsidies (particularly in the Europe Union and North America), protectionism and free trade. Indeed, it has long been argued that subsidies and import protection in other parts of the world have negatively impacted on Australian industries, notably those industries that are export oriented (Beer et al. 2003). These industries include many of the commercial industries linked to the SWMR such as agriculture, fisheries, and manufacturing. Protectionism has also restricted Australia's access to markets for these industries, particularly the markets of Europe, Japan and some parts of East and South-east Asia. However, Australia does have free trade agreements with New Zealand, Singapore, Thailand and the United States, which has improved the trading basis for many of the SWMR's industries. Free trade agreements are also being discussed with China, the United Arab Emirates and Malaysia. While there is considerable evidence to suggest that free trade agreements will increase international market penetration for certain industries (e.g. agriculture), it is important to recognise that the benefits will not always be in Australia's favour. Indeed, in some cases goods and services that are produced at a lower cost elsewhere are likely to have significant competitive advantages over those produced by local industries.

5.1.2 Australian drivers of change

While the SWMR is influenced by international economic trends, the domestic influences are arguably the most important factors influencing the long-term survival of the region's marine industries. Factors influencing the region's marine industries include Australian economic growth, population dynamics, government policies and resource constraints such as those involving natural resources and labour.

Economic growth

The past decade has seen Australia maintain relatively strong economic growth. A recent study suggested that this is likely to continue over the medium term, with an expected growth rate of around 3.5 per cent per year (Penn & Fisher 2004). In the SWMR, growth is likely to be even stronger given the rate of expansion of the Western Australian economy. Between 2000 and 2004, the Western Australian economy grew by more than five per cent per annum, with growth in 2003–04 exceeding eight per cent (Department of Treasury and Finance

2004). Much of this is linked to the relatively high levels of demand for oil, gas and key minerals, together with a relatively buoyant agricultural economy. In terms of the SWMR, this influences a range of industries including port services, ship and boat-building and minerals processing. It also has the capacity to spill over into a range of other sectors including fisheries products, and tourism and leisure services.

In South Australia, the rate of growth has been more modest, fluctuating between 1.5 per cent and four per cent per annum over the past five years (Department of Treasury and Finance 2005). However, sustained domestic demand for manufactured goods (particularly for cars and car components), improving conditions in the rural sector and an increasing amount of tourism activity have helped to underpin economic activity in the South Australian sections of the SWMR.

Exchange rates

The regional and local economies of the SWMR are also influenced by exchange rates. Exchange rates affect the prices that overseas customers pay for Australian goods and services, and the prices that Australians pay for imported goods and services. Over the past five years, the Australian exchange rate has appreciated against other major currencies such as the US dollar and the Japanese yen. This trend has stabilised in the past two years (the Australian dollar buying between 72 and 78 US cents). The outcome has been that Australian goods and services have become relatively expensive to overseas buyers, and imports have become relatively cheap. As a result, those industries that have a large export component (as a percentage of their output) are more exposed to decreases in demand as a result of foreign exchange driven price rises. The rising cost of the region's products is likely to result in some buyers seeking alternative suppliers from other countries; suppliers producing similar products which may now be relatively cheaper than those produced in Australia. A depreciation of the Australian dollar would have the reverse effect. For example, the cost of ships made in the region would increase for foreign buyers should the Australian dollar appreciate against other currencies. At the same time, imports would become cheaper, which could increase the volume of inbound cargo. Conversely, a depreciating dollar would make Australia a cheaper destination for overseas visitors, thereby increasing the number of international tourist arrivals and encouraging more tourist activity in the region.

Government policies

Government policies are another important driver of change affecting marine industries within the region. Government policies not only affect the activities of regional industries (through, for instance, denial of access to resources), but also directly impact on the demand for the region's products through the government's wider role in managing the economy.

Governments are involved in marine resource management primarily for two main reasons. The first is that marine resources are owned by all Australian citizens and are managed on our behalf by the Australian Government. As a result, democratic values may influence how we manage these resources. Second, governments intervene to correct what is termed "market failures". Broadly, market failures are those situations where the market is not acting in an economically efficient manner; for example, where environmental degradation or pollution is not reflected in the prices charged for use of a particular resource. Thus, governments through their constitutional powers can often improve the situation without imposing net costs on society.

While it is not possible to provide a comprehensive overview of the various ways in which domestic policies at Commonwealth, state and local levels affect the region, there are a number of policy arenas that are of significance to the SWMR:

- Economic policy, particularly in relation to taxation, employment and industry assistance. These policy areas all have the potential to affect the economic conditions in the region through their impacts on specific industry sectors and local and regional economies.
- Public infrastructure, particularly investment in ports, railways, roads, tourism facilities and telecommunications services.
- Environmental policy, notably the implementation of marine bioregional plans (including new marine protected areas to be enacted in Commonwealth waters), the *Environmental Protection and Biodiversity Conservation Act 1999*, various state government environmental regulations (e.g. marine area protection, recreational fishing regulations) and local government planning schemes.
- The relationship between the different tiers of government. One of the key challenges facing the Australian, state and local governments is ensuring a degree of cross-institutional consistency in policy approach when managing particular regions (see Conacher & Conacher 2000). The absence of policy integration and coordination not only has the potential to impact on the economic performance, but also has the potential to impact on social development.

Population dynamics

One of the major structural factors affecting the SWMR is population change. Australia's population recently passed 20 million, and latest estimates suggest that the population will reach 23.4 million by 2021, an increase of 19 per cent between 2002 and 2021 (Australian Bureau of Statistics 2002). This growth will make direct and indirect contributions to economic growth, through expanding markets, greater demand for goods and services and rising levels of spending.

In terms of the SWMR planning, what is particularly important is not simply national population growth figures, but also the changing distribution of the population. As outlined earlier in this report, a number of key trends are evident:

- the continuing dominance of Perth and Adelaide
- the growth of coastal centres in those areas that are relatively accessible to Perth and Adelaide or other large regional centres
- a gradual ageing of the population, in line with national trends (see Hugo 2005)
- the continued loss of young people (aged 15–30) from smaller rural communities.

5.1.3 Other factors affecting South-west Marine Region marine industries

There are a range of other domestic economic factors that impact upon business activity within the region, including:

- interest rates
- unemployment

- the availability of skilled and unskilled labour
- rates of public and private investment in business and infrastructure.

While many potential drivers of change have been described above, in reality, there are a myriad of drivers of change that could affect both the production of goods from the region and the consumption of those goods: from cyclical drivers such as el Niño, changes in labour availability, and world and local interest rates, to longer-term systemic drivers such global climate change and resource depletion. These all have a greater or lesser effect on the industries of the region. Other potential drivers of change such as a lack public and private investment in critical infrastructure will also affect supply.

Two good examples of these further drivers of change are emerging labour constraints in Western Australia and the current status of fish stocks in the region.

Australia's labour market

As the Western Australian Department of Treasury and Finance (2005, p. 1) recently noted:

> Conditions in Western Australia's labour market remain tight. Employment grew by 1.5% in the three months to February 2005, which is the fastest rate of growth over a three month period in the past six years. Over the three months to February 2005, the unemployment rate averaged 4.6% in Western Australia. The labour market is expected to remain tight, as job advertisements data and surveys of business intentions point to further strong demand for labour over coming quarters.

Driving the tightening of the Western Australian labour market is the continued economic growth fuelled by Western Australia's resources boom. Demand for labour within the minerals sector of the Western Australian economy is drawing labour from other industries and regions. Anecdotal evidence points to problems with many marine employers having difficulty attracting suitable applicants because of the tight labour market and competition from the minerals sector which are currently able to pay wages far in excess of many marine employers. .

Fish stock status in the region

One of the key drivers of change in the region is the status of natural resources. In the case of fisheries, biological conditions can have a direct impact on the economic performance of the industry. In the SWMR, many fish species are being fished at or near their biological limit. This is evident in both the Commonwealth-managed fisheries in the region and those fisheries monitored by state authorities (see tables 4.15, 5.16 and 4.17).

It is evident from the stock status data from the regions wild capture fisheries that there is limited ability for the region's fisheries to expand much beyond the current extraction rates. As a result, expansion in the industry will have to come, at least in the short term, from production efficiencies and possibly through more value adding activities post capture. Further information on the stock status of the region's commercial fish species can be found in Section 4.9.

5.2 Future directions and risks for marine-based industries in the South-west Marine Region

This section provides an overview of the future directions and potential risks for industries operating in the SWMR. The section considers the future economic and social scenarios for the industries, and how these might be shaped by a range of exogenous and endogenous factors. It is important to recognise that it is impossible to predict with any certainty how an industry might evolve into the future, or to determine the entire range of risks that might be present. As such, this section is relatively broad and aims to provide a more general indication of economic and social futures and risks.

5.2.1 Ports

Future directions

In the near term, ports in the region are likely to experience an increase in the volume of imports and exports. This is largely as a result of the strong domestic economy, and the rapid growth of a number of key trading partners, including China and countries in South-east Asia. While the increased size of vessels that visit ports is placing pressure on existing facilities, there has already been a degree of reinvestment in new infrastructure and facilities in some ports, notably Port Adelaide and Geraldton. Fremantle and Port Adelaide remain the largest ports in the region, though increasing production of agricultural and minerals commodities are likely to result in a greater number of vessels visiting other ports in the region. For example, the expansion of plantation forestry in the south-west and great southern regions of Western Australia has seen an increase in the volume of woodchips being exported from Bunbury and Albany. This increasing diversity in commodity mix being transported through the SWMR's ports is expected to be an ongoing trend.

Industry risks

The continuing growth in global and Australian trade is likely to result in the SWMR's ports experiencing rising levels of activity in the short to medium term. However, as Love (2004) has pointed out, there are a number of challenges facing the industry:

- In order to reduce the cost of moving freight, ship owners are moving towards larger ships, particularly for containers and bulk cargo (e.g. grain transportation). The outcome is increasing pressure on existing ports to accommodate larger ships or risk losing business to those ports that can handle large vessels.
- As a result of this increasing pressure to expand their operations, ports are forced to finance new infrastructure, thereby raising costs and reducing financial returns.
- The failure to better integrate ports with land-based transport has the potential to result in increased costs for ports.
- The expansion of ports and the associated increase in the amount of ship traffic has the capacity to increase conflict with users in other sectors, such as tourism and fisheries, and with other adjacent landholders.

There are a number of other more general risks to the port industry, all of which are largely associated with changing global and national economic conditions. These include:

- slow-downs in economic growth, which can affect levels of imports and exports
- trade barriers or subsidies that affect levels of exports and, in some cases, levels of imports
- industrial or labour unrest
- rising labour costs, or labour shortages
- under-investment in port infrastructure leading to inefficiencies
- changing international or national shipping routes or transport modes for particular commodities.

5.2.2 Shipping

Future directions

The evidence suggests that the volume of cargo shipped is likely to increase slowly in the foreseeable future. Much of the shipping activity in the region is related to the movement of bulk goods, particularly agricultural commodities. This is unlikely to change significantly. While any slowdown in the domestic or international economies may impact on cargo, the direct impact on the region is likely to be limited to the major ports of Fremantle and Adelaide. Should oil and gas exploration in the region prove successful, in the longer term there may be an increase in shipping in these sectors.

Industry risks

The main risks facing the shipping industry in the region tend to relate to the economic conditions in a range of markets, including agricultural commodities, minerals, and domestic and international consumption. The most apparent risk is a downturn in either the domestic or the international economy, which has the capacity to reduce levels of trade and the movement of commodities. The shipping industry is also affected by rising oil prices, which impact directly on transport costs and profit margins. An additional risk facing the ship industry is that under-investment in port facilities may, in the medium to long term, reduce the efficiency of cargo movement. Other risks to the shipping industry in the region include:

- industrial or labour unrest, either in the port sector or the shipping industry itself
- competition from other modes of domestic cargo transport (e.g. road, rail and air)
- changes shipping routes.

5.2.3 Ship and boat-building

Future directions

The ship and boat-building industries of the region are likely to remain as relatively stable industries in the short to medium term. Boat building is a relatively mature industry, though it is highly dependent on the economic and political conditions outside the region. Larger firms in the region tend to be highly dependent on successfully tendering for international contracts for the construction of specialist vessels (e.g. in the defence sector). Indeed, the ship and

boat-building industry in the region has shown ability to service high-value niche markets. While its flexibility and innovation suggest that this is likely to continue, it is difficult to say with certainty how these niche markets will perform in the longer term. Larger companies such as Austal and Tenix are in the process of diversifying their income through the sale of other capabilities, such as ship and boat design and engineering skills, and intellectual property. In the future, this "human capital" is likely to be an important economic resource for the region in general and, more specifically, for the local economies in which these firms are based.

Industry risks

The performance of the ship and boat-building industries in the region are linked largely to demand from a range of sectors, including recreation, fishing, passenger and cargo transport, and defence. Accordingly, the risks that the industries face are generally linked to specific economic, political and environmental changes in these individual sectors. For example, changes in the management of fisheries in the SWMR, particularly changes to regulations associated with catch size and the application of technologies, have the capacity to alter demand for the number of or design specifications for fishing boats. Similarly, the emergence of new technologies or military threats in the defence sector has the potential to alter the market requirements of naval or defence vessels.

In addition to industry-specific risks, there are some more generic risks that face the industry (see Love 2004). First, a strong Australian dollar has the capacity to raise the price of Australian-built ships and boats in international markets, thereby reducing competitiveness. Second, the demand for new warships by the Australian and other navies is likely to be lower in the medium to long term. Third, current government's moves to reduce institutional supports to the local ship and boat-building industries may have an impact on the region. However, it is important to recognise that increased tourist and recreational use of the region is likely to play a role in supporting local ship and boat-building enterprises.

5.2.4 Oil and gas

Future directions

In recognition of Australia's future energy needs and our current capacity, the Australian Government has instigated a program to increase the level of government research into offshore areas, and increase the amount of private sector exploration activity in offshore areas. Given that more than half of Australia's offshore basins which show signs of petroleum potential remain unexplored, the government has committed $25 million to Geoscience Australia to acquire new geoscience data in offshore areas. This is coupled with the 150 percent deduction allowance on pre-appraisal exploration costs in frontier areas. We will therefore undoubtedly observe greater petroleum exploration and production activity within the region's marine environments.

Within the SWMR the government has designated the Perth Basin, the Naturaliste Plateau, and the Bight Basin as frontier areas. As a result, it is expected that significant exploration activity will occur over the coming years. The increased levels of exploration and eventual production in these areas will require investment in improved infrastructure and expansion in other services to the industry such as ports and port facilities.

In the short to medium term, exploration for oil and gas reserves is likely to increase, largely as a result of government incentives and relatively high global oil and gas prices. While

commercial production has yet to commence, there does appear to be at least some potential for the industry in the medium to longer term. Ultimately, however, this will depend on the potential economic value and profitability of production.

Industry risks

The oil and gas industry in the SWMR is affected by a number of key economic, political and technological factors. Arguably, the most important of these factors is the interaction of global oil and gas supply and demand. Given the relatively low substitutability of these commodities, and the relatively small global inventories that are held, relatively minor disruptions to supply can affect prices. Rising world oil prices have the capacity to contribute to rising inflation and a slow-down in economic growth. At the same time, however, rising prices do have the potential to increase the profitability of oil and gas producers. As a consequence, there is considerable interest in finding and exploiting new reserves. In part, this has driven the increasing level of exploration activity in the SWMR. There are, however, a number of potential risks for the industry:

- Increasing levels of global production, particularly from OPEC nations, would contribute to downward pressure on oil and gas prices, thereby reducing the short-term attractiveness of exploration in the region.
- The ecological value of many components of the region's ecosystem which may prevent resource extraction or increase the cost of production.
- Broader macro-economic risks, including interest rates, labour costs, exchange rates, and transport costs.

5.2.5 Submarine cables

Future directions

The laying of submarine cables within the SWMR is likely to remain a relatively minor commercial use in the SWMR. There is little prospect of a large number of new cables being laid, largely because of the recent investment in this infrastructure, and the relatively small population in the region. In the longer term, it is likely that a number of the cables will be upgraded or replaced.

Industry risks

The main risks to the submarine cables industry include changing technological needs, and the requirement for ongoing upgrades or the laying of new cables. Alongside this is the cost-effectiveness of maintaining cables in the marine environment. Cables are subject to damage from fishing nets, trawl gear, anchor drag and other seabed activities.

5.2.6 Defence

Future directions

In 2000 the Australian Government released *Defence 2000: Our Future Defence Force*. This paper outlined Australia's strategic defence needs over the next decade. Following the release of this report, defence became a greater priority, largely as a result of the terrorist attacks on the United States in 2001, the subsequent war in Afghanistan, and the war in Iraq. This was

coupled with a stronger focus on border protection as a result of illegal immigration. The outcome has been increased spending on defence. This appears unlikely to change in the short to medium term, given the ongoing global political instability. As a result, there is likely to be continued support for existing Defence Force industries and capability in the SWMR.

Risks

It is extremely difficult to determine the likely risks facing the Defence Force in the SWMR, given the unpredictability of problems such as geopolitical instability and terrorism. Nevertheless, these factors do have the potential to have serious impacts on the Defence Force. Given that the Defence Force is an arm of the Australian Government, another risk is clearly linked to budgetary allocations. Any reduction in spending on defence is likely to result in a contraction of jobs and expenditure in the region.

5.2.7 Marine tourism

Future directions

While the industry does face a number of risks, marine tourism and marinas are likely to remain an important part of the economic and social structure of the SWMR. Domestic tourism has remained relatively strong over recent years, and there appears to be improving conditions in the international tourism market. Both the South Australian and Western Australian governments are investing heavily in tourism, in terms of basic infrastructure and promotion and marketing. The outcome is likely to be continuing expansion of the industry, and a significant contribution to local employment growth. An increasing focus on environmental and tourism planning in both states is aimed at protecting those resources that tourists value.

Industry risks

The marine tourism industry is highly susceptible to a range of economic, social and political risks, both domestic and international in nature. In terms of international visitors, global political insecurity presents a major risk, with much of the evidence suggesting that issues such as terrorism have impacted directly on visitor numbers from overseas (Raby 2003). However, there is the prospect that a decrease in international visitors might be countered by an increasing number of Australians who decide not to travel overseas and instead visit local destinations. The challenge for the SWMR is to capture both domestic and international visitors in a market that is highly competitive on a regional and local basis.

There are a number of other risks facing the tourism industry:

- the impact of rising oil prices on transport costs, which has the potential to decrease both domestic and international travel
- the potential lack of public and private investment in a range of different facilities and infrastructure
- broader macroeconomic issues, such as interest rates, labour costs, and exchange rates
- the degradation of tourism resources, particularly natural features and environments

5.2.8 Recreational fishing

Future directions

The recreational fishing industry is an important component of some local economies in the SWMR. Given the expanding population in the region, and the continuing popularity of recreational fishing, this is likely to continue for the foreseeable future. However, ongoing threats of stock depletion mean that recreational fishing is likely to be more closely scrutinised in the future. This may involve stricter limits on catch size, or a greater focus on public education and awareness. These issues have already caused some conflict between fisheries agencies and recreational fishing organisations in the region. In the longer term, it would seem likely that the balance between a sustainable catch and the social and economic dimensions of recreational fishing will continue to represent a challenged to fisheries managers.

Industry risks

Given that recreational fishing is closely related to marine tourism (see section 5.7), some of the risks facing that industry also face recreational fishing. However, there are also a range of risks that are specific to recreational fishing:

- Population growth and an increasing proportion of the population involved in recreational fishing have the potential to decrease fish stocks.
- Improving fishing and related technology has the potential to decrease fish stocks.
- Increasing fisher numbers and the tendency for some fishing activities to be spatially concentrated has the potential to significantly decrease stocks in particular locations.
- If fish stocks fall, there will be reduced expenditure in businesses servicing recreational fishing.

5.2.9 Commercial fishing

Future directions

The prospects of relatively strong conditions in most of the key markets for Australian fisheries products are likely to see the industry remain relatively buoyant in the short to medium term. Changes in management structures are gradually being rolled out across most of the fisheries, resulting in some rationalisation of fishing fleets and processing operations. In general, though, fisheries continue to be a valuable source of employment and economic development in many of the SWMR's coastal communities. Perhaps the most significant medium- to long-term threat to the industry is the prospect of falling yields. As a consequence, the Australian Government, together with the Department of Primary Industries and Resources in South Australia and the Department of Fisheries in Western Australia, are likely to maintain careful control and management of the fisheries in the region. The industry is also likely to face the exclusion of fishing effort in some areas through the national rollout of marine protected areas under the National Representative System of Marine Protected Areas program.

Industry risks

There are a number of potential risks that face the commercial fishing sector. Love (2004) points out that one important issue is the potential impact of lower fish prices, which may lead to increased pressure to harvest wild fish stocks, conflicting with the need to manage fish stocks in a sustainable way. Indeed, overexploitation of wild stocks is a major issue and has the potential to undermine the viability of some commercial fisheries. Assessments conducted in South Australia and Western Australia suggest that most fisheries are fully exploited and need to be managed carefully to sustain yields.

Other risks to the industry include:

- technological change, which can not only increase input and capital costs, but can also raise productivity, potentially leading to overexploitation of fish stocks
- increasing competition from recreational users for limited fish stocks
- regulatory and management changes including shifting jurisdictional boundaries, governance changes, and catch limits
- environmental changes including carrying capacity, the spatial distribution of species, migration patterns and recruitment patterns
- broader macroeconomic issues such as rising oil prices, labour costs, exchange rates and interest rates.

At the industry level, users that spend a larger proportion of production costs on energy may be harder hit if fuel prices stay high. In their 1994 study of Western Australia's commercial fisheries, McLeod and McGinley calculate that on average commercial fishery operations spend approximately 17 per cent of total costs of operation on energy products, namely fuel. However, it should be noted that this average masks great variability. For instance, within South Australia's fisheries, fuel costs as a percentage of total fishing costs vary between 12 per cent for the blue crab fishery down to only three per cent for the abalone fishery (Econsearch 2004). All things being equal, it would seem that those with a greater proportion of their expenditure going towards energy products will experience greater difficulty as fuel prices rise.

5.2.10 Aquaculture

Future directions

Aquaculture production is expected to expand significantly in the region, particularly in the waters off Western Australia. Not only will this be driven by the expansion of existing enterprises, but also by emerging industries that will concentrate on a new range of species. Species currently being investigated for their suitability in the region include rock lobster, mussels, scallops, yellowtail kingfish and mulloway.

In terms of future growth, the suitability of South Australia's coastal waters, together with opportunities for marine-based grow-out, mobile systems and product development, there is the potential for increased growth in South Australia's farmed abalone sector (Zaluski 2005b).

The Abrolhos Islands are recognised as one of the most important marine environments within Western Australia (Department of Fisheries 2004a). As such, aquaculture industries within the islands are subject to rigorous environmental assessment and public scrutiny.

Species recognised as having cultivation potential within the Abrolhos include oysters, western rock lobster, yellowtail kingfish, snapper, cod, tuna, and trout (Department of Fisheries 2004a). In the bioregion, between 2001–02 and 2002–03, there was an 11.3 per cent increase in the value of aquaculture, and increase in tonnage of 22.9 per cent (Penn et al. 2005).

Notwithstanding the potential risks facing aquaculture, the industry appears to have a very strong future. Demand for aquaculture products in Australia and overseas is strong and growing, and with many wild fish stocks in decline the industry has the opportunity to fill an emerging market gap. There is an ongoing need for investment in production and research, although a range of Australian and state government strategies have begun to tackle these issues. The most significant of these is the National Aquaculture Policy Statement in 2003, which set out a framework for the expansion of the industry.

Industry risks

The aquaculture industry faces a number of potential risks, including:

- ensuring security/stability of supply to key markets, given the relatively small scale of production
- restricted growth capacity due to limited investment capital being available to the industry
- conflicts with other industries, including agriculture, tourism and recreation
- ecological or biological factors such as disease, contamination etc.
- changing tastes in consumer markets
- broader macro-economic factors such as world fish prices, labour costs, transport costs, exchange rates, and interest rates.

6 Discussion and conclusion

Over the past decade, the extent of commercial activity in the South-west Marine Region has grown rapidly. The most notable growth has occurred in marine tourism and recreation, ship and boat-building, and aquaculture. Ports, shipping and commercial fishing are also important commercial activities. All of these industries underpin economic growth, employment, and social wellbeing in the cities, towns and small communities of the region. From a marine planning perspective, it is important to recognise that many of these industries are also dependent on the ecological sustainability of the region's natural environment. Accordingly, the careful management of the marine environment will help contribute to the viability of the economic and social systems of the region. However, it is also clear that the industries of the region are far from static, and have experienced dynamic changes in their structure and geography since European settlement. Not only have these changes been the result of environmental determinants, but they have also been the result of a range of political, economic and social factors. These factors continue to shape the commercial activities of the region, and are likely to contribute to a range of opportunities and threats for the SWMR's existing and emerging industries. Understanding these opportunities and threats is an important part of the marine regional planning process. This section provides a brief discussion and analysis of these issues, based on the trends evident in the key industries described in Chapter 4 of this report. It also considers some of the key socio-economic information gaps and future research needs.

6.1 Opportunities and threats for industries in the region

The opportunities and threats for industries in the region have been broadly summarised in Table 6.1. While these are by no means exhaustive, they represent some of the future scenarios facing the various commercial users of the SWMR. The opportunities and threats tend to link closely with the human drivers of change outlined in Chapter 1. Thus, of particular note are:

- International macroeconomic trends, including the impact of exchange rates, energy costs, economic growth and market conditions. This is significant for those sectors dependent on exports, such as ship and boat-building, ports, commercial fishing and marine-based tourism. The key opportunities for the SWMR include relatively steady economic growth, particularly amongst key trading partners (e.g. the United States, China, and the countries of South-east Asia) and some emerging markets, including the Middle East and India. The potential risks facing the region are largely associated with possible downturns in economic activity in these countries, a rising Australian dollar, and increasing competition from other nations or Australian regions. The rising price of oil, and the associated increases in production and transport costs is also a significant threat not only to the economic conditions amongst trading partners, but also to the direct profitability of firms operating in the region.
- National economic trends, including interest rates, employment patterns, levels of consumption and economic growth. Clearly a strong Australian economy is likely to contribute to increasing levels of economic activity in much of the SWMR. Industries such as tourism, ports (mainly import activity), ship and boat-building (especially

leisure craft), and the consumption of marine food products are affected by domestic economic trends. In addition to consumption, domestic economic conditions affect private investment in infrastructure and facilities, with stronger economic conditions generally associated with such investment. One of the key threats to the region is the national shortage of skilled labour. This has the potential to undermine the productive capacity of key industries, including ship and boat-building, tourism, and aquaculture.

- Political and institutional factors, including geopolitical conditions, government regulations (both domestically and abroad) potentially influencing the performance and development of commercial uses in the region. Clearly global political stability has the potential to underpin strong economic growth in sectors such as tourism, as well as underpinning other components of the economy such as shipping and ports. The willingness and capacity of the Australian and the state governments to invest in public infrastructure, such as ports, other transport infrastructure, and research and development is important in securing the future of many of the SWMR's key industries.

In developing a more complete picture of the future patterns of development opportunities and threats to existing industries, there remains a need for more detailed process of scenario analysis with the region's key stakeholders. This will provide a basis for a more spatially and sectorally sensitive assessment of the region's future. There is also an opportunity to investigate in more detail the economic and institutional drivers of change in the region, focusing on the specific issues facing each of the industries covered in this report.

Table 6.1 Selected opportunities and threats for the industries of the SWMR

Industry	Key opportunities	Key threats
Ports	• Growing international economy leading to expanding export market • Growing Australian economy leading to increasing demand for imports • Increasing level of public investment in port and allied transport infrastructure	• International economic slow-down reducing exports • Domestic economic slow-down reducing imports • Under-investment in port infrastructure leading to structural inefficiencies • Trade barriers and subsidies
Shipping	• Growing Australian economy leading to increasing demand for imports, and expanding export market • Growing Australian economy leading to increasing demand for imports	• International economic slow-down reducing exports • Domestic economic slow-down reducing imports • Rising costs associated with rising oil prices • Trade barriers and subsidies
Ship and boat-building	• Expanding markets in the Middle East and South-east Asia • Increasing demand for smaller, leisure-related craft	• Strong Australian dollar leading to decreasing international competitiveness • International and domestic economic slow-down leading to falling demand • Shortages of skilled labour
Oil and gas	• Increasing level of public and private investment in oil and gas exploration • Growing South-east Asian and domestic markets • Existing capability in the industry	• Lack of private and public investment in exploration and production • Strong Australian dollar leading to decreasing international competitiveness
Marine tourism and marinas	• Quality of the natural environment • Proximity to South-east Asian market • Growing numbers of domestic tourists	• Strong Australian dollar leading to decreasing international competitiveness • Geopolitical insecurity and perceived risks

	• Capacity to build on existing infrastructure and facilities	• Lack of ongoing private and public investment in infrastructure, particularly marinas
Submarine cables	• Improved telecommunications links with neighbouring countries and offshore islands • Improved electricity connection for offshore islands (notably Kangaroo Island)	• Damage from other commercial activities in the region (especially shipping and commercial fishing)
Defence	• Increasing levels of public investment in defence and border protection	• Geopolitical instability
Commercial fishing	• Expanding international and domestic demand for fish products • Greater efficiency of catch technologies	• Overexploitation of fish stocks • Strong Australian dollar reducing international competitiveness
Recreational fishing	• Increasing levels of tourism activities linked to recreational fishing	• Overexploitation of fish stocks • Regulatory constraints
Aquaculture	• Expanding international and domestic demand for marine products	• Strong Australian dollar reducing international competitiveness • Lack of public and private investment in the industry

6.2 Information gaps and future research needs

This study drew on a wide range of information resources, including those held by Australian and state government agencies, local governments, industry organisations, private firms, archival resources and non-government organisations. In undertaking this process of data collection and interpretation, it was clear that, although extensive information on the SWMR does exist, it is often highly fragmented, inconsistent and incomplete. In summary, there are a number of specific limitations with current data sources:

- time-series data is often difficult to obtain for two main reasons (i) most research is conducted on the basis of one-off cross-sectional analysis; (ii) the terms of reference, research questions or collection and analytical techniques change over time. As such, it is often not possible to provide an analysis of change over time, which is crucial for establishing trends and, potentially, future scenarios.
- much of the data are available only at a state-wide level, and do not conform to the SWMR. In addition, data are often not available at a fine enough spatial scale to establish significant differences between places. This is an important issue given the diverse environmental, economic and social geography of the SWMR, and the need to take these spatial variations into account in the regional planning process.

Given the range of agencies, tiers of government, jurisdictions, firms, and non-government organisations involved in the collection of these data, addressing these issues remains problematic. Notwithstanding this, agencies such as the Department of the Environment and Water Resources have produced a range of publications and resources that attempt to draw diverse datasets together into a coherent temporal and spatial framework (see, for example, National Oceans Office 2004a).

In addition to these broader methodological issues, it is clear that a number of specific information gaps exist. These include:

- data on the economic impacts of various commercial uses on local and regional economies, incorporating a consideration of employment and other economic multipliers
- data on the potential economic and social impacts of new industries in the region
- information relating to the economic and social linkages between different users in the region, in terms of resource use and employment
- an understanding of the social values of the region, particularly as they relate to marine uses and activities
- analysis of the demographic trends in the region, focusing on future population structures (e.g. age/sex, socio-economic status), migration patterns, and settlement sizes
- scenario analysis with the users of the region to determine future threats and opportunities for different areas and sectors.

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