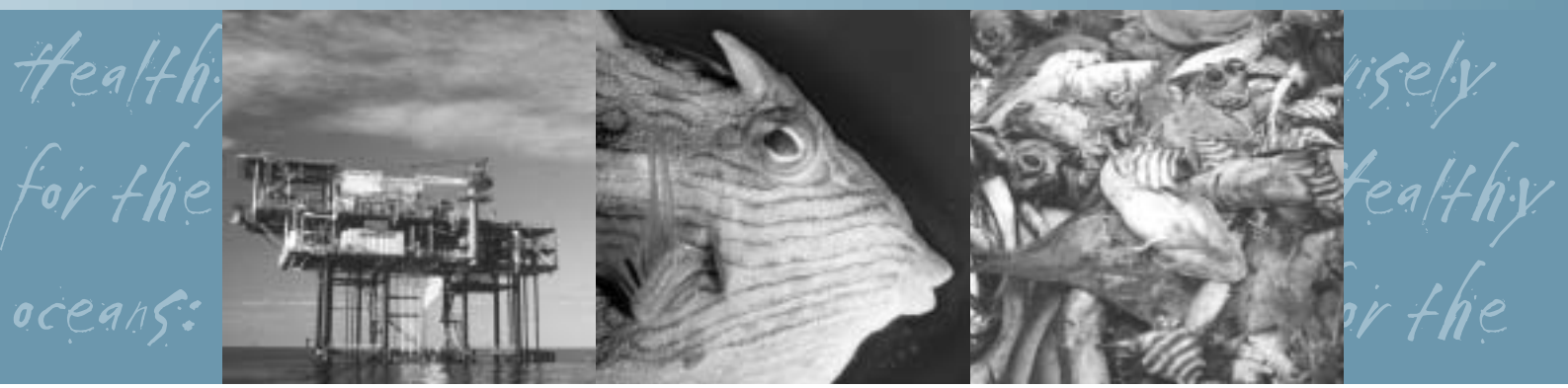
Assessment REPORT

Resources

using the ocean



THE SOUTH-EAST REGIONAL MARINE PLAN

Title:
Resources – using the ocean
The South-east Regional Marine Plan
Assessment Reports

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Copies of this report are available from:
The National Oceans Office
Level 1, 80 Elizabeth St, Hobart
GPO Box 2139
Hobart TAS 7001
Tel: +61 3 6221 5000
Fax: +61 3 6221 5050
www.oceans.gov.au

For further information about this report, contact Ester Guerzoni, Public Affairs Officer, tel (03) 6221 5000.

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Contents

Executive Summary

The Uses Assessment Report provides information on the current and possible future uses of the South-east Marine Region. For the purpose of this report, uses are defined as 'human activity that has a physical or legal presence within the Region'.

This Report is part of a package of assessment products designed to support a wider understanding of the uses of the Region. Within this process the National Oceans Office and the Bureau of Rural Sciences have explored the nature and location of the uses in the Region and the socio-economic links of uses with coastal communities. As well, two consultancies have investigated two other areas of importance to regional marine planning: non-market economic values and pressures on uses in the Region.

Of the uses within the South-east Marine Region, the most important in terms of their financial and employment contributions are the petroleum, tourism, shipping, ports and fisheries industries. However, there are many other uses which may be either developing in importance or are of specific importance to local communities or to Australia's cultural identity. Uses explored are:

aquaculture – where production in the Region was worth over $100 million in 1999-2000 and is growing at an annual rate of around 13%

biotechnology – where there are over 120 biological collection sites in the Region to collect samples for the burgeoning biotechnology industry

commercial fisheries – where in 1999 some 46 000 tonnes of fish was landed from the Region, worth approximately $321 million

conservation – where the world's largest highly protected zone is contained within the 16.2 million hectare Macquarie Island Marine Park

defence – where defence activities in the Region, such as training exercises in specified areas, lead to increased national security flowing from a well-trained defence force

emerging industries – where new developments for renewable energy production by wave, tidal and wind power are now being developed in the Region

heritage – where natural, cultural and maritime heritage sites contribute to the shared heritage of all Australians

Indigenous – where the coast and ocean are of continuing cultural and spiritual significance to Indigenous communities

marine research and education – where the Region is home to CSIRO Marine Research, Australia's largest marine research organisation

minerals – where sites exist offering future opportunities for new sources of minerals, such as in Ringarooma Bay off north-eastern Tasmania where there is a current exploration permit for tin

ocean waste disposal – where the Region's oceans were used to dump chemicals, ammunition and scuttled ships and land-based sources such as sewage and stormwater run-off continue

petroleum – where in 1999-2000 199 977 barrels of oil valued at $3.6 billion and $490 million of gas was produced from the Gippsland Basin in Bass Strait

ports – where in 1998-99 the Port of Melbourne alone handled international cargo to the value at over $3.6 billion

recreational fishing – where over three million people living in the States bordering the Region regularly engage in recreational fishing activities

shipping – where cargo shipping alone accounted for nearly 9000 ship movements in the Region in 2000-2001

submarine cables and energy transmission lines – where the seafloor in the Region supports telecommunication lines and petroleum pipelines and activity is continuing with new gas pipelines and the possibility of cables carrying electricity

surveillance – where the Royal Australian Navy and Coastwatch conduct surveillance activities for illegal fishing and other activities

tourism and offshore charter – where the Region hosts many yacht races, is used to support the offshore charter fishing industry and provides other tourism opportunities such as eco-tourism ventures, cruise ships and diving expeditions.

In addition to financial values this assessment extends economic analysis to include a discussion of non-market economic values – those values that while not signalled through a market are nevertheless important for cultural and environmental reasons. Discussion includes cultural and personal values such as existence values and vicarious values as well as the many values related to the Region's ecosystems as providers of environmental services (such as carbon and waste sequestration). While the contributions made by the Region's ecosystem services cannot be quantified at present, they are substantial and contribute to both financial and other aspects of community wellbeing.

In addition, the nature of pressures on the uses within the Region are also briefly analysed within this report. To assist in this process, pressures have been categorised into six key areas:

- economic and market based – those affecting users including through changes in demand for products, changes in costs of inputs etc
- lifestyle – those brought about through changes in peoples' preferences or attitudes
- resource use – impacts on resource use on the environment and the provision of environmental services
- institutional – those arising from legal, regulatory or other institutional requirements, including resource management arrangements
- environmental change – those arising from changes in the environment either through natural cyclical change, natural disaster or evolutionary change
- cross cutting – those which either arise when one use affects a number of others or where a particular issue, for example native title, has potential implications across a range of uses.

The report then investigates how uses may develop within the Region into the future. Industries such as petroleum and minerals have discovered new areas of known future economic potential which, depending on market forces, may come under production some time over the next 25 years. The major commercial fisheries in the Region on the other hand, are in a period of consolidation with target species under management to ensure the recovery of stocks to sustainable levels (eg orange roughy, school shark). For other industries such as shipping, new technologies such as larger ships may necessitate changes in ports and channels. For tourism, changes in consumer demands will lead to increased tourism activity in the Region's offshore areas.

The report concludes with ten multiple use studies to help the reader gain an understanding of the complexity of uses in the Region. These studies seek to provide the reader with examples of the nature and management of interactions between uses in the Region.

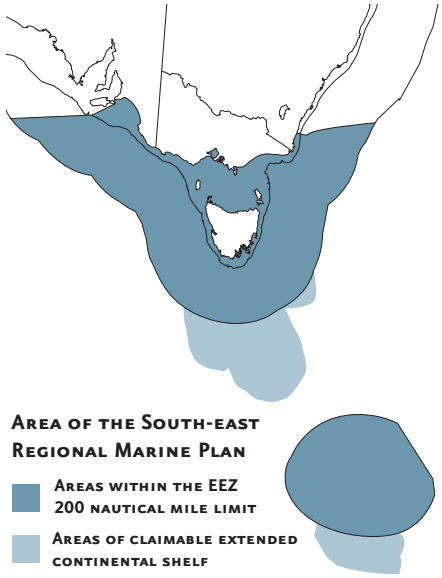
Preface

Australia's Oceans Policy and regional marine planning provides a framework for the people of Australia to explore, use, protect and enjoy our extensive marine resources. As its base, the Policy recognises the need to protect the biological diversity of the marine environment while at the same time promoting and encouraging sustainable, secure marine industries.

Regional marine planning is a way of achieving the *Oceans Policy* vision. It uses large marine ecosystems as one of the starting points for the planning process by creating planning boundaries that are based on ecosystem characteristics – a major step towards ecosystem-based management.

This assessment report is one of six that are an initial step in better managing Australia's oceans. They provide a knowledge base for developing the South-east Regional Marine Plan – the first regional marine plan being implemented under *Australia's Oceans Policy*.

The South-east Marine Region brings together three of the large marine ecosystems: the South-eastern, the South Tasman Rise and Macquarie.



The South-east Marine Region covers over 2 million square kilometres of water off Victoria, Tasmania (including Macquarie Island), southern New South Wales and eastern South Australia.

The Region includes both inshore (State) waters (from the shore to three nautical milesoutside the territorial basline) and Commonwealth waters (from three to 200 nautical miles outside the territorial baseline), as well as the claimable continental shelf beyond the Exclusive Economic Zone.

To build a solid understanding of the complexities of the Region, information on ecosystems and human activities were gathered for both State and Commonwealth waters across six areas:

- biological and physical characteristics – identifying the key ecological characteristics in the Region, their linkages and interactions

- uses within the South-east Marine Region – describing our knowledge of the nature and dimension of human uses and their relationship with each other
- impacts on the ecosystem – providing an objective analysis of how activities can affect the Region's natural system
- community and cultural values – ensuring community wishes and aspirations are reflected in the planning process
- Indigenous uses and values – gaining an understanding of and support for Indigenous interests in the Region
- management and institutional arrangements – analysing current legislative and institutional frameworks to determine the best mechanism for implementing regional marine plans.

Specific scientific projects have filled gaps in our knowledge wherever possible and have clarified some areas in our understanding of the deep ocean's ecosystems. Specialist working groups of stakeholders and experts in their fields have provided invaluable direction and input to the planning process. As well, stakeholder workshops, community surveys and consultations have all helped build our knowledge base and have provided a voice for the people of the South-east Marine Region. Without this consultation, the picture would not be complete.

Moving forward

The six assessment reports are about increasing our understanding and appreciation of the Region's wealth and ecosystem diversity, and starting to define what we want for the Region. From this shared understanding, we will move forward to define a plan that maintains ocean health and supports competitive yet sustainable industries, as well as enhancing the enjoyment and sense of stewardship the people of Australia feel for the oceans.

While the Region includes State coastal waters, the South-east Regional Marine Plan will focus on the Commonwealth ocean waters.

The shared values and understanding of the Region gathered during the assessment stage give us a foundation for building a plan for the Region. The National Oceans Office has produced an Assessment Summary which brings together the key findings of the six assessment reports.

Supporting this Summary is a Discussion Paper which provides topic areas to help communities, industry and government begin discussion on the planning objectives, issues and concerns for the South-east Regional Marine Plan. The Discussion Paper also details the next stage of the planning process for the South-east Regional Marine Plan.

Your input into the regional marine planning process is important. To register your interest or for more information about the South-east Regional Marine Plan, *Australia's Oceans Policy* and the National Oceans Office, visit www.oceans.gov.au, or phone (03) 6221 5000.

Role and objectives of the Uses Assessment

In line with the planning process objectives stated in the *Scoping Paper for the South-east Regional Marine Plan*, the uses assessment for the South-east Marine Region seeks to provide an understanding and appreciation of three issues:

- current uses and pressures
- future uses and opportunities
- the value of marine resources.

In doing so the assessment is designed to:

- allow stakeholders in the South-east Marine Region to gain an understanding and appreciation of all uses in the Region
- help inform the regional marine planning process.

The uses assessment provides an overview of uses within the Region – the main vehicle for reporting the outcomes of the assessment is this report. Other outcomes from the process include:

- the Bureau of Rural Sciences' (BRS) *Marine Matters: Atlas of marine activities and coastal communities in Australia's South East Marine Region* (2002) – jointly funded by AFFA and the National Oceans Office
- two socio-economic reports from BRS – one on offshore tourism, and the other on the South East Trawl Fishery and petroleum facilities
- GIS layers and metadata of uses in the Region produced by BRS
- consultants' reports on "Non-market economic values and the South-east Marine Region" and "Pressures on Uses"
- *Resources – Macquarie Island's Picture* – which provides an overview of the uses in the Macquarie Island Large Marine Domain.

The BRS *Atlas of the South East Region* is particularly important in that it provides readily available and easy to understand spatial information on the extent of each of the uses in the Region. The Atlas is a substantive volume and provides maps and supporting text on each of the Region's commercial fisheries (Commonwealth and State) and a number of other uses in the Region, including petroleum, shipping, marine protected areas and aquaculture. It also provides social, economic and demographic information on the Region's coastal communities. The Atlas was funded by Agriculture Fisheries and Forestry Australia (AFFA) through the Fisheries Resources Research Fund (FRRF). The National Oceans Office provided additional funding for the mapping of the non-fisheries uses in the Region. Some of the maps and supporting information from the Atlas have been used in this assessment report. BRS has also produced additional maps specifically for this report, particularly to support the interaction studies in Chapter 7.

The uses assessed are based on those initially identified in the *Scoping Paper* through input from the South-east Regional Marine Plan Steering Committee and the Ministerial Board agencies. A 'use' has been defined as a human activity that has a physical or legal presence in the marine Region. It therefore includes obvious uses such as commercial and recreational fishing and petroleum production wells to less obvious uses such as conservation, heritage and areas set aside for petroleum and mineral exploration lease and defence exercise areas – neither of which can be physically seen on the ocean. A full list of the uses in the South-east Marine Region is provided in Chapter 3 of this report.

Questions addressed

To assess the current status of the major uses in the Region the following questions are being addressed in this assessment:

- what is the use and what is it doing?
- what are the pressures on the use?
- where is the use occurring?
- what is the importance of the use to the national and regional economies?
- what are the management arrangements?

Report structure

The 'Uses' chapter examines uses within the Region.

The 'Pressures' and 'Future uses and opportunities' chapters summarise the reports undertaken by consultant's Hassall and Associates and DCafe respectively. Copies of the full reports can be obtained from the National Oceans Office or by visiting www.oceans.gov.au.

'Pressures' discusses non-market economic values (existence values, bequest values, etc.) and values related to the Region's ecosystems as providers of environmental services – such as carbon sequestration and existence values. Chapter 5 examines a range of pressures within the Region.

'Future uses and opportunities' outlines future uses in the Region, with respect to both the expansion (or otherwise) of current uses and potential new uses.

The 'Multiple use studies' chapter explores how uses in the Region interact and co-exist.

Consultancies

Four components of this assessment were contracted out by the National Oceans Office:

- mapping of non-fisheries uses – Bureau of Rural Sciences
- offshore tourism case study – Bureau of Rural Sciences
- non-market economic values – Hassall and Associates
- pressures on Uses – DCafe (David Campbell and Associates).

BRS completed two other case studies, which further support the planning process – studies on the South East Trawl Fishery and petroleum industry (funded by AFFA), and a study on the social and economic links between coastal communities and resource use (funded by the National Oceans Office). These studies are presented in the reports entitled:

- *Marine Matters: Social Contributions of Marine Uses to Communities in the South East Region of Australia*
- *The Right Bait: Social Contributions of Tourism Fishing Charter Operations to St Helens, Tasmania*.

The reports can be accessed on line at www.oceans.gov.au.

Uses Assessment Reference Group

An important component of this assessment process was the creation of the Uses Assessment Reference Group. The terms of reference for the Group were to:

- provide comment and assist with the scope and content of the Uses Assessment Report
- provide expertise in relation to cross-sectoral issues addressed in the Uses Assessment Report.

The members of the Reference Group brought a range of expertise

Member	Expertise
Neil Bryon (Chairman)	Economics / Fishing / Environment
Geoff Wescott	Conservation / Management
Russ Neal	Marine Industry / Fisheries and Aquaculture
Peter Taylor	Marine Industry / Environment
Jane Reynolds	Marine Industry / Economics

Consultation processes

The broad range of users in the Region dictated the consultation process for this assessment. The consultation process was extensive and covered the broad spectrum of relevant Commonwealth and State Government agencies and industry groups in the Region. Consultations involved:

- gathering of base information
- explaining the regional marine planning process
- seeking expert input into the development of the report
- commenting on drafts by industry groups and government agencies.

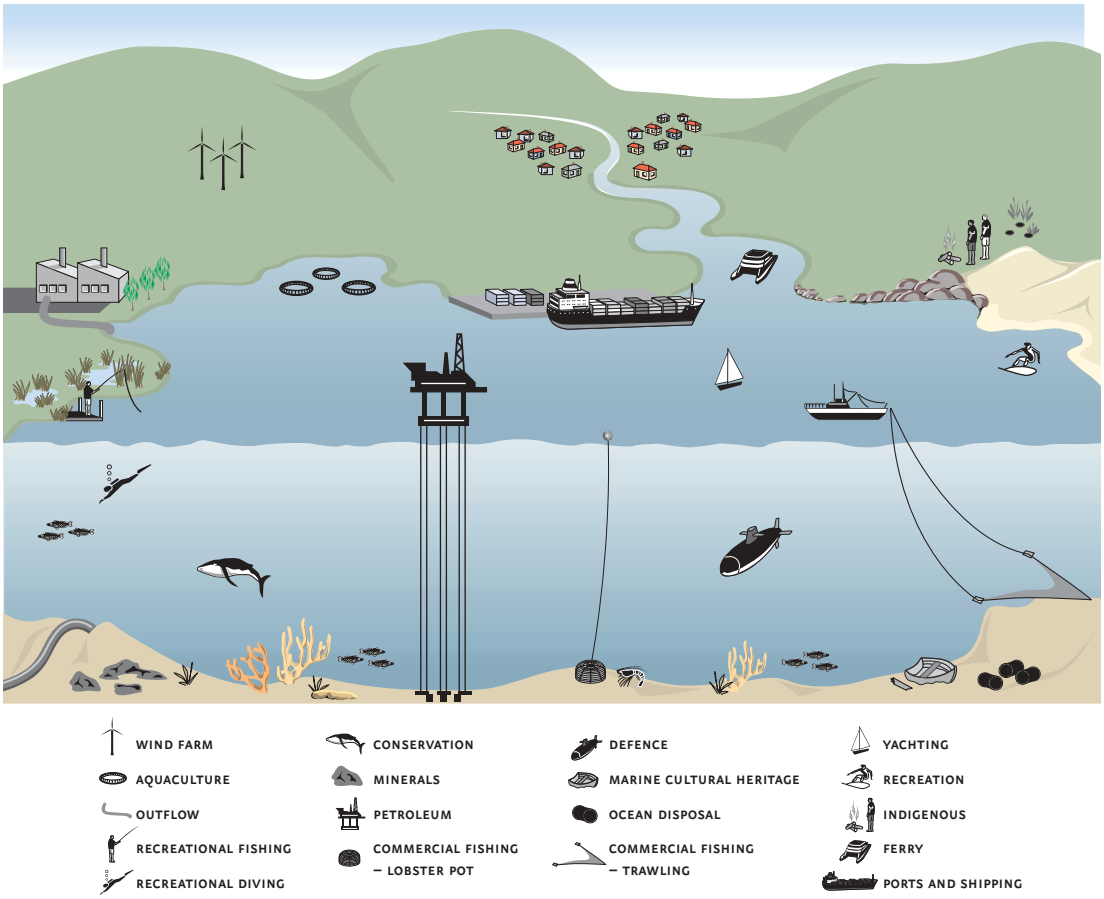
Uses

A use is defined as a human activity that has a physical or legal presence within the Region. The following uses are discussed in this chapter:

- aquaculture
- biotechnology
- commercial fisheries
- conservation
- defence
- emerging industries
- Indigenous uses
- marine heritage
- marine research and education
- offshore minerals
- ocean waste disposal
- oil and gas
- ports and marinas
- recreational fishing
- shipping and ship/boat building
- submarine cables and energy transmission lines
- surveillance
- tourism and offshore charter.

While each use is addressed separately, they are of course interrelated and should be considered holistically. Figure 1 illustrates the range of uses that occur within the Region.

Figure 1:
Pictorial representation of the diversity of uses occurring within the South-east Marine Region.



Aquaculture

In 1999-2000 Australia produced a total of 40 632 tonnes of both freshwater and marine aquaculture produce worth approximately $680 million. This compares with $433 million in 1996-97 and only $188 million in 1989-90 (ABS 2001a). It has been forecast that by 2010 the value of Australia's total aquaculture production will reach $2.5 billion – the industry is currently experiencing an annual growth rate of 13%.

Coastal aquaculture production in the Region represented around 16% of Australian aquaculture production by value in 1999-2000 (ABS 2001b) with over $100 million worth of produce. In addition the industry has created many thousands of jobs both directly and indirectly – many of which are in regional areas.

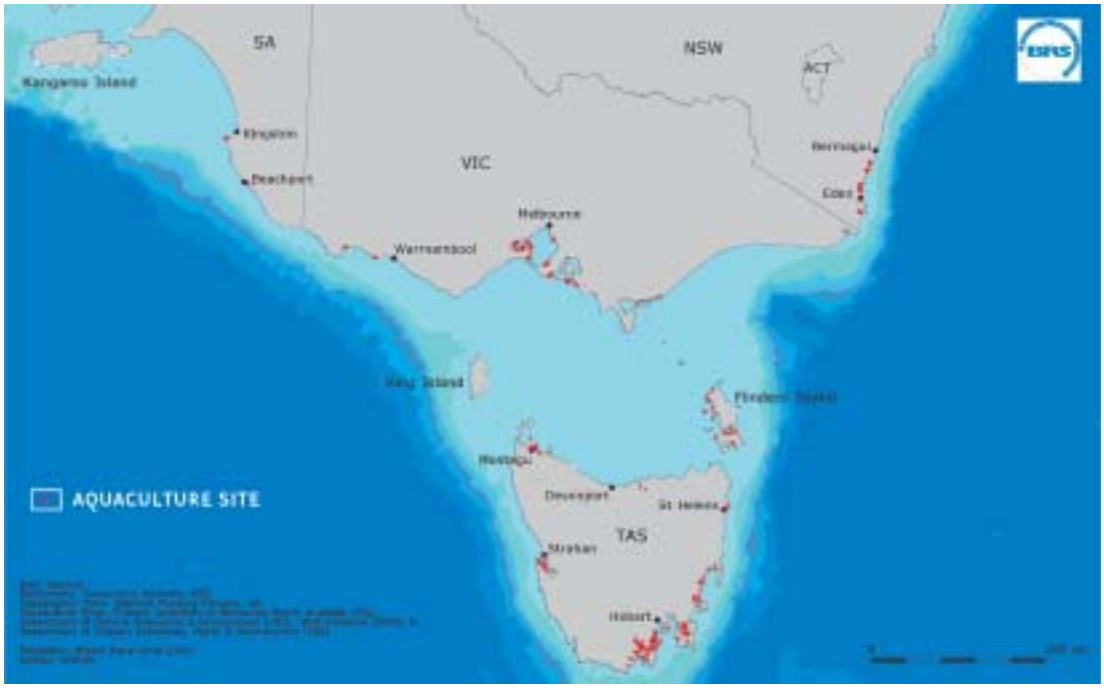
Regional activity

Aquaculture production is spread throughout the inshore waters of the Region. However, only Tasmania and Victoria have any significant aquacultural activity at present (see Map 1). Presently, no aquacultural activity occurs in Commonwealth waters.

The most important aquacultural industry in the Region, in terms of its value, is the Atlantic salmon industry, based in the cool clear waters of southern Tasmania. This industry alone contributes over 83% of the Region's total aquacultural production value with 10 907 tonnes produced in 1999-2000 worth around $85 million.

There are also a number of significant aquacultural products currently produced or in development, including Pacific oysters, abalone, Sydney rock oyster, scallops, mussel and freshwater trout (produced in Macquarie Harbour, Tasmania).

Map 1:
Aquacultural production in the South-east Marine Region. *Source: BRS 2002.*



Aquaculture species of the Region are currently reared using a variety of methods including (TAFI 1999):

- Atlantic salmon fry are hatched and grown in freshwater nurseries to around 70 g in weight. The salmon are then transported to sea cages and spend around 30 months growing to the market size of 3.5-4.5 kg
- Pacific oysters are produced by specialist hatcheries. The spat (juvenile oysters) are then transported to inter-tidal or sub-tidal areas where they are grown to market size within baskets hanging from racks. The oysters reach market size in around two to three years
- mussels are collected as spats from collectors hung on long lines, from salmon cages, as part of the cleaning process and, more recently, from hatcheries. Mussels are then grown out on long lines taking 15 months to two years to reach marketable size
- scallops spats have been traditionally collected from the wild via mesh bags hung on long lines. However, more recently there has been some success in producing spats in hatcheries. Spats are then hung in cages on long lines and take up to four years to reach marketable size
- abalone spats are produced in hatcheries. Spats are then grown out either on land based 'runways' or in barrels suspended in the sea where they take between three to four years to reach market size.

Of the species currently being produced only the Atlantic salmon and the Pacific oyster are introduced species. The Pacific oyster was introduced by the CSIRO in the 1940s and the Atlantic salmon was introduced in 1985. Native species such as mussels, abalone and scallops are presently farmed on a smaller scale.

Most aquaculture production within the Region is based in Tasmania where Atlantic salmon contributes over 83% of the Region's total aquacultural production value or $85 million in 1999-2000. In Victoria, aquaculture is at present conducted on a smaller scale with coastal production primarily concentrated on mussel farming (worth $2.3 million in 1999-2000) (Gooday et al. 2001). In South Australia, there is currently little production with only three small farms in operation. In New South Wales production in the Region is based upon the Sydney rock oyster grown in inlets and bays (Larcombe et al. 2002). As of 1999-2000, oyster production within the South-east Marine Region of NSW was worth approximately $1.3 million (NSW Fisheries 2001).

Aquacultural production is of particular significance to regional development and employment. The vast majority of aquaculture concerns are small to medium operations located outside major population centres. As aquaculture and the associated service and support industries develop, coastal and rural communities tend to benefit both socially and economically.

The expansion of aquaculture has led to some expansion of employment opportunities in some parts of the Region. Employment is not only generated directly by employment on aquaculture farms but extends to associated industries such as feed suppliers, equipment suppliers, repair industries, technical advice and educators (ASIC 1996a). Current industry growth rates suggest its economic and social importance is likely to increase within the Region (ABS 2001a).

Tasmania

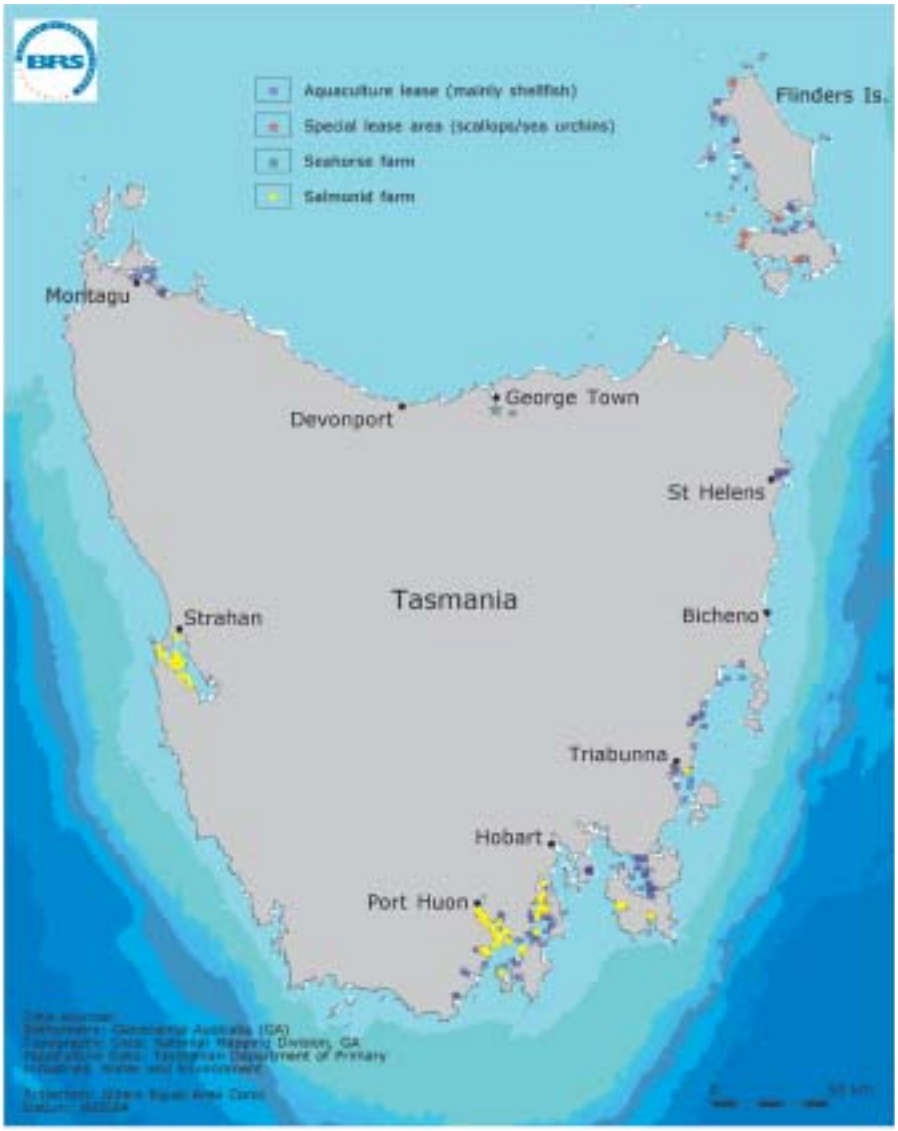
In 1999, 145 marine farms were registered in Tasmania, occupying some 20 square kilometres of coastal water. Currently production in Tasmania is predominantly based upon Atlantic salmon and Pacific oyster but the importance of scallops, mussels and abalone is increasing.

While production is widespread, the majority of fish farms are located in the south of Tasmania due to a number of factors including the availability of sheltered sites and their proximity to markets, airports and other facilities (TAFI 1999). Map 2 shows current aquacultural activities in Tasmanian waters.

Aquacultural production in Tasmania has experienced high growth rates over the last 10 to 15 years. In the five years between 1994-1995 and 1999-2000, the value of Tasmania's aquacultural production increased from around $71 million to just under $100 million (ABARE 1997, ABARE 2001). This contrasts with a total production value of only $27 million in 1988-99 (TAFI 1999) – representing an increase of about 270% in 11 years or an average growth rate of just under 13% a year.

Growth in aquaculture production value in Tasmania is predominantly due to the growth in Atlantic salmon production, which has averaged annual growth rates of 15% per annum since its commencement. Currently, it is forecast that this growth rate will continue (NAC 2000).

Map 2: *Tasmanian marine farms/lease areas as of 2001.* *Source: BRS 2002.*

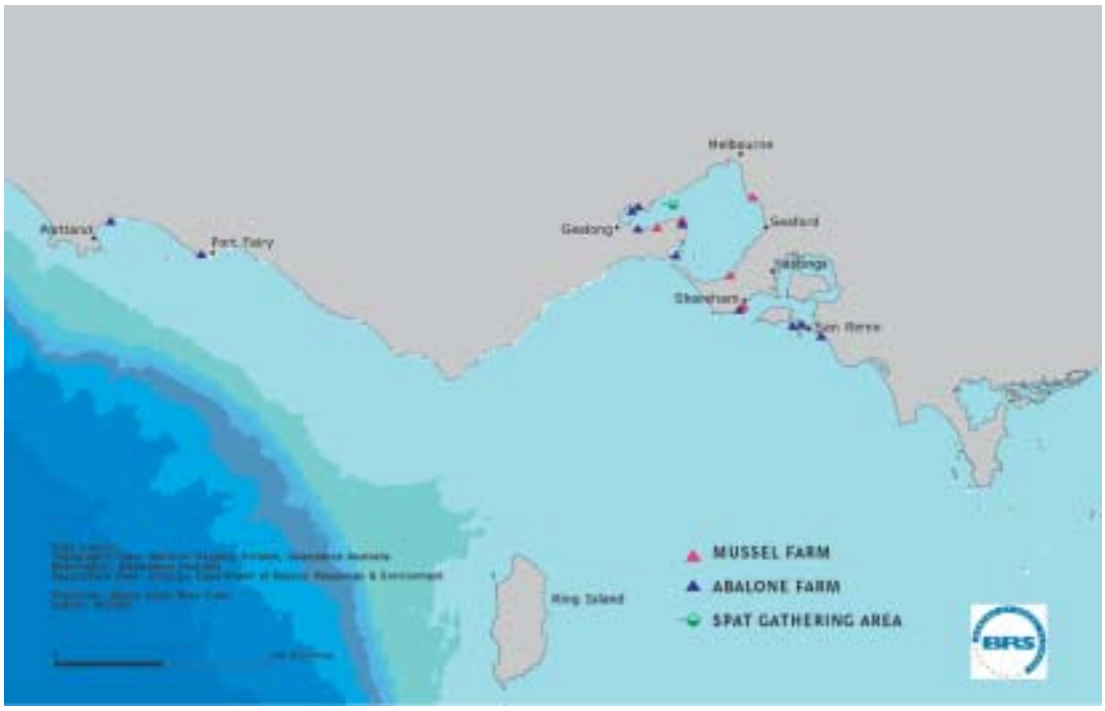


Victoria

As of 1998, there were 25 holders of mussel and other shellfish aquaculture licences in Victoria. Aquaculture of marine species in Victoria is mainly based upon mussel cultivation. Blue mussels are grown in Port Phillip Bay and near the western entrance to Westernport Bay. In total, around 800 ha of Victorian coastal waters are currently zoned for mussel production. In addition, there are currently six hatcheries and farms for abalone production located along the coast although most abalone facilities are located onshore (Larcombe et al. 2002). It is expected that by 2004 abalone production will become the largest sector of the Victorian aquaculture industry (Larcombe et al. 2002). For current aquaculture production sites in Victoria see Map 3.

At present, Victoria earns around $2.3 million a year from mussel production up from $0.5 million in 1994-95 (ABARE 1997, ABARE 2001). Like Tasmania, growth in coastal aquacultural production, though still at a low base, has been strong.

Map 3:
Victorian marine farms/lease areas as of 2001. *Source: BRS 2002.*



South Australia

Although South Australia had a total aquacultural production of over $217 million in 1999-2000, the vast majority of this production occurred outside the South-east Marine Region. Within the Region there is currently only three small experimental farms located near Cape Jaffa and Beachport (Larcombe et al. 2002). Map 4 details the location of the aquaculture farms and the current zoning regime in the area.

New South Wales

Production in the Region is based on the Sydney rock oyster grown within bays and estuaries such as Merimbula Lake, Pambula River and Wonboyn River. In 1999-2000, production from these areas totalled around 483 000 dozen oysters worth approximately $1.3 million (NSW Fisheries 2001). Map 5 gives an overview of aquacultural activity within the Region.

Map 4:
Aquaculture in southeast South Australia.
Source: BRS 2002.

Map 5:
Aquaculture production location in southeast New South Wales 2001. *Source: BRS 2002.*

Economic dimensions

Volume and value of production

As outlined above the, Tasmanian Atlantic salmon industry dominates regional aquacultural production. Figure 2 illustrates the relative importance, in terms of value, of the various species farmed in the Region in 1999-2000.

Between 1994-95 and 1999-2000 the value of aquaculture production in the Region increased from around $73 million to around $103 million (ABARE 2001, NSW Fisheries 2001). Currently, the Region produces around 16% of Australia's total aquacultural production by value (ABARE 2001). Figure 3 highlights the growth in value of production between 1994-95 and 1999-2000.

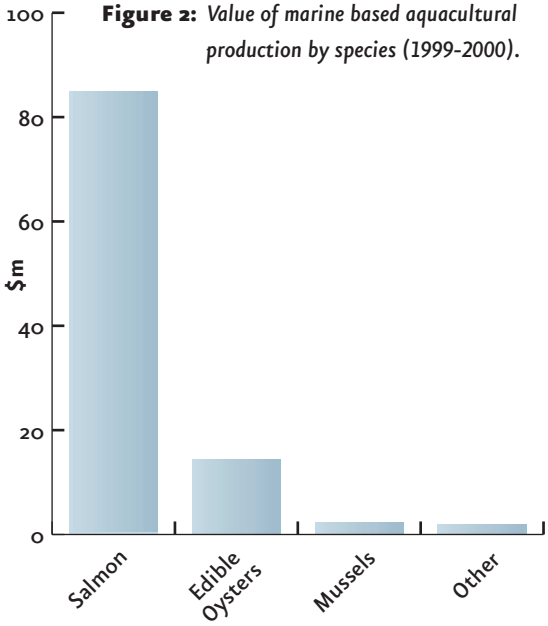


Figure 2: *Value of marine based aquacultural production by species (1999-2000).*

Source: Modified from ABARE 2001.

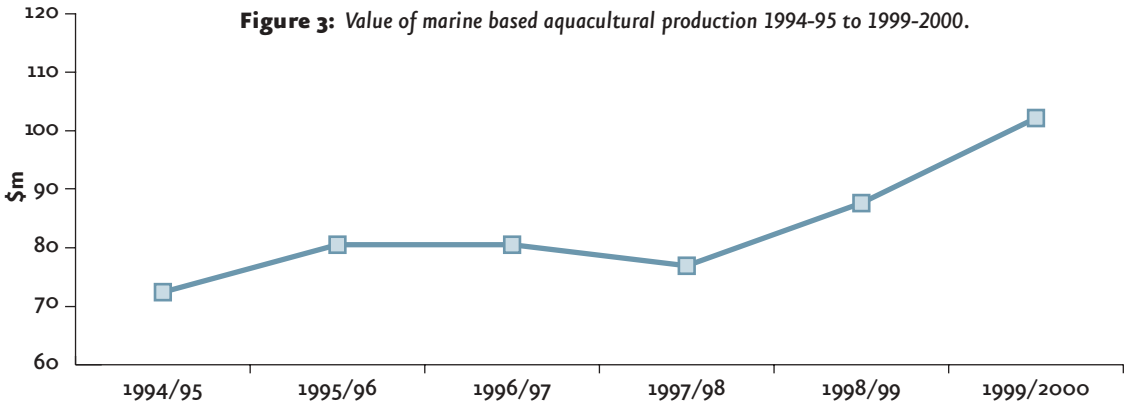
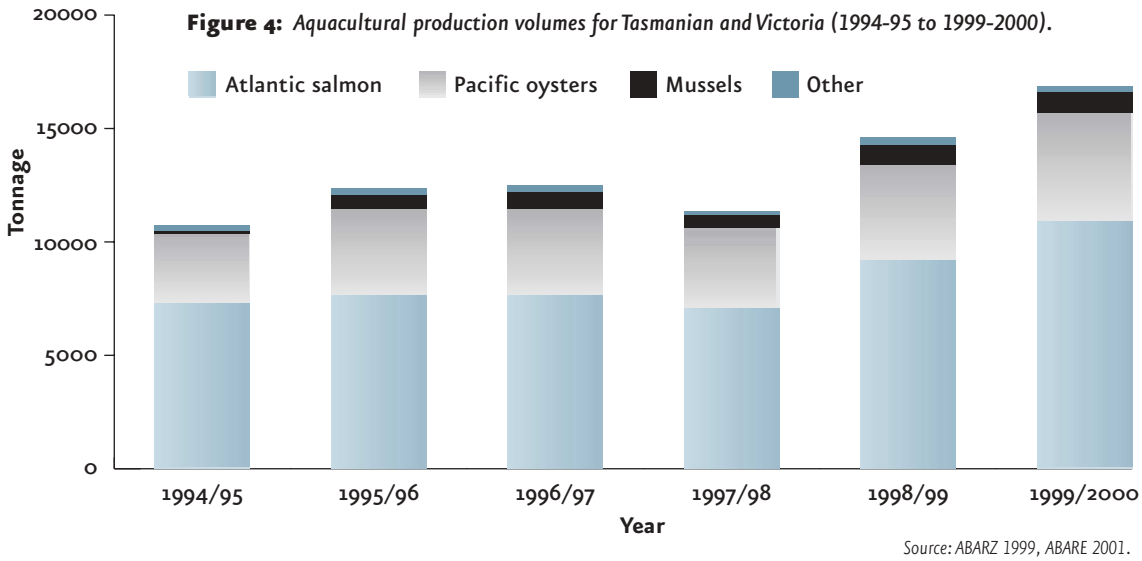


Figure 3: *Value of marine based aquacultural production 1994-95 to 1999-2000.*

Source: Modified from ABARE 2001.

Figure 4 shows the growth in volume of production of the main species between the years 1994-95 and 1999-2000 for Tasmania and Victoria. Production volume increased from 10 745 tonnes in 1994-95 to 16 851 in 1999-2000 (ABARE 2001).

Figure 4: *Aquacultural production volumes for Tasmanian and Victoria (1994-95 to 1999-2000).*



Source: ABARZ 1999, ABARE 2001.

Employment

The Tasmanian Atlantic salmon industry is the biggest aquacultural employer in the Region with over 800 people directly employed in 1999 (NAC 2000). In Victoria, as of 1998, there were 48 permanent and 36 casual position within the mussels and other shellfish section of the Victorian aquaculture industry (Fisheries Victoria 1998). No estimates are currently available for the southeast portion of either New South Wales or South Australia due to difficulties in dis-aggregating total State aquacultural employment at present for these States.

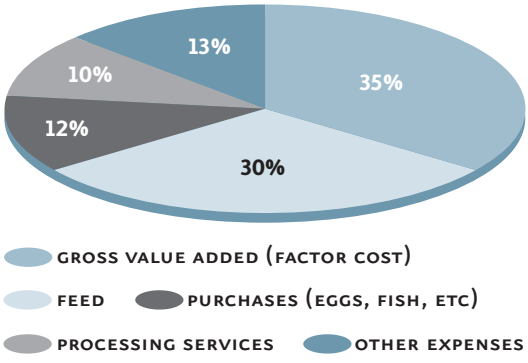
It has been estimated that in 1998-99 the Tasmanian and Victorian aquaculture industries in total created around 1100 jobs directly with a further 4500 jobs created indirectly (CRC for Aquaculture 1999, Fisheries Victoria 1998).

Cost of production

Unlike the commercial wild capture fisheries, where the main costs borne by producers are those related to the harvesting of the resource, aquaculture producers must purchase or breed their stock and rear it until it is ready to harvest. Capital investment in aquaculture is concentrated in pens, nets and other necessary infrastructure. Although aquaculture is more labour intensive than commercial fishing, returns on labour and capital in the industry represents a smaller share of the total cost of production. This is because fish farms incur costs not present in wild capture fisheries such as the cost of infrastructure and feed.

For instance, the Atlantic salmon industry is heavily reliant on fishmeal as a protein feed for farmed species. On average feed presently accounts for around 60% of grow-out production costs and around 30% of the market price of Atlantic salmon (see Figure 5).

Figure 5:
Indicative breakdown of aquaculture farm cost structure.



Source: Modified from Ministry of Finance & Corporate Relations 2001.

Markets and demand

Following is a brief overview of the main markets and, where possible, demand analysis for the main aquacultural species produced within the Region:

- **Atlantic salmon** – as of 1997-98 two thirds of the 7069 tonnes (partially processed) of salmon produced in the Region was sold as fresh chilled products with the remaining fish processed into value added products. Approximately one quarter of production is exported to Asia with the majority of the remainder sold within Australia
- **Pacific oysters** – the majority of oysters are sold as live product into the Australian domestic market with Victoria historically the most important market. Over recent years other States, particularly Queensland and New South Wales, have taken more produce (DPIWE 1999)
- **Sydney rock oyster** – total production of the species appears to be consumed within Australia. Around 35% of total New South Wales production is sold in the Sydney market with a further 46% sold in the rest of New South Wales – the remainder is sold interstate (NSW Fisheries 2001)
- **mussels** – mussels are shipped live to the main markets of Melbourne and Sydney. Within the domestic market they compete for market share with New Zealand. Currently, Australia imports around 4000 tonnes of mussels from New Zealand annually (DPIWE 1999, ABARE 2001).

Management arrangements

Management responsibility for aquaculture in Australia rests with the States. A number of States have aquaculture and coastal development plans in place. These are designed to take into account the needs of both aquacultural developments and other user groups.

All marine farms are licensed by the relevant State authority. Licences include a number of conditions (such as environmental standards) which must be met during the operation of the enterprise. In Tasmania and South Australia, licences are only granted within areas already zoned for aquacultural production as dictated by aquaculture zoning plans. State arrangements are as follows:

- **Tasmania** – the Department of Primary Industries, Water and Environment is responsible for managing and regulating the extraction and farming of marine resources under the *Living Marine Resources Act 1995* (Tas). It is also responsible for aquaculture planning under the *Marine Farming Planning Act 1995* (Tas). The Department of Health and Human Services manages the Tasmanian Shellfish Quality Assurance Program under the *Public Health Act 1997* (Tas) and the *Food Hygiene Act 1998* (Tas)
- **Victoria** – the Department of Natural Resources and the Environment administers aquaculture licences under section 43 of the *Fisheries Act 1995* (Vic). Particular classes of aquaculture licence apply dependent upon the species cultivated
- **New South Wales** – the NSW Fisheries manages aquaculture under the *Fisheries Management (Aquaculture) Regulation 1995*. Particular classes of aquaculture licences apply dependent upon the species cultivated
- **South Australia** – the Department of Primary Industries and Resources South Australia manages aquaculture under management plans relevant to various coastal waters. For instance, the South East Aquaculture Management Plan 1996 governs aquaculture development in the area.

Throughout the Region, marine farm planning processes also include extensive community consultation to enable public concerns and issues to be raised and solutions proposed (ASIC 1996b). Areas of concern may include reduced aesthetic or scenic beauty, noise, environmental concerns and loss of traditional areas to industries such as commercial wild capture fisheries.

Despite not having direct responsibility for aquaculture, the Commonwealth also plays a major role in management and development within the industry. A Commonwealth Aquaculture Action Agenda released in May 2000 includes actions (and associated responsibilities) in a number of areas such as:

- environmental management
- water and land use planning
- education and training
- product research and development.

Biotechnology

Biotechnology is a broad term for a group of technologies based on applied biological science and includes any technique that uses living organisms (or parts of organisms) to make or modify products; to improve plants and animals; or to develop micro-organisms for specific uses. It has diverse existing and potential applications in medicine, agriculture, food processing, manufacturing, energy production and environmental management.

The estimated value of the international biotechnology industry was in excess of $US200 billion in 2001. The Australian biotechnology industry is comparably small (but expanding rapidly) with a market capitalisation of almost $15.5 billion (Deloitte Touche Tohmatsu 2001).

World-wide demand for biotechnology products and services is forecast to reach $A50 billion by 2005 (Invest Australia 2001). This projection contrasts sharply with Australia's biotechnology sector's annual turnover of around $1 billion (DISR 2001). In the context of Australia's abundant biological resources base and competitive industry cost structures, the Australian biotechnology industry is well placed to share in a growing market (DISR 2000).

Australia is one of the 12 most biologically diverse regions in the world. This is attributed to a number of factors including the long isolation of the continent and its range of climatic conditions. These factors have contributed to produce a range of plant and animal life that displays unique chemical traits.

Background

Traditionally, biotechnology covers fermentation technologies such as bread, cheese or beer making, and animal and plant breeding. Modern biotechnology includes a range of techniques from recombinant DNA technology, molecular and cellular biology, biochemistry and immunology through to information technology. Gene technology is a specific subset of biotechnology, based on the manipulation and modification ('recombination') of the genetic material of living organisms to develop new characteristics, processes and products (Colwell 1999).

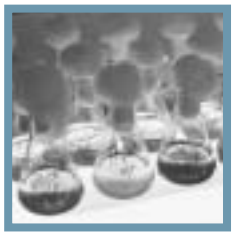
Biotechnology has applications with the potential to revolutionise many industry sectors including agriculture, forestry, fishing, pharmaceuticals and health (AFFA 2000). Australian marine biotechnology focuses on new pharmaceuticals, enzymes and bio-molecular materials (eg bio-ceramics).

Examples of marine environment biotechnology

1) Observations that reef building corals appeared to be protected against ultra violet light led to research at the Australian Institute of Marine Sciences to show this was due to specialised amino acids with simple but very efficient light absorbing ability. Such compounds are found in many organisms including sponges and sea anemones. Work is in progress to commercialise this discovery.

2) Researchers at the University of Melbourne are studying metabolites that inhibit specific enzyme systems of southern Australian and Antarctic marine sponges, to develop safer, more specific drugs and agrochemicals.

3) Work at the University of New South Wales has identified a group of natural products from marine algae that deter the settlement and growth of fouling organisms. The compounds ability to prevent bacteria forming biofilms is significant because biofilms are responsible for complicating treatment of human infections as well as creating a range of industrial problems. In cooperation with multinational organisations, commercial applications are being pursued including development of an antifouling paint and contact lens cleansing solution.



A coral performance

(an example of the commercialisation leading from bioprospecting)

Scuba divers and snorkellers have long marvelled at the intricate patterns of coral reefs. These patterns may lead to help for people with certain kinds of bone injuries. A product made from the rigid exoskeletons of marine coral can fill voids caused by fractures or other trauma in the upper, flared-out portions of long bones.

Called hydroxyapatite (HA), the material is similar in structure to human bone. When HA is implanted into a bone void, its web-like structure allows surrounding bone and fibrous tissue to infiltrate the implant and make it biologically part of the body.

Although it is possible for patients to donate bone from other sites on their body to repair a fracture, this causes extra trauma. One of the real advantages of using coral-based implants is that they avoid a second surgery that would be necessary if a donor site is used.

Source: Henkel 1998

Regional activity

There are over 120 sampling and biological collection sites scattered throughout the Region. Collection methods vary from targeted trawls and grabs to opportunistic collection and bycatch from fisheries. Biotechnology research in the Region has been primarily undertaken by the Australian Institute of Marine Science (AIMS), CSIRO and the University of Tasmania. Table 1 details phyla[1] collected in the Region with potential biotechnology application.

Maps 6a to 6j show collection sites in the Region by phyla or in some cases species.

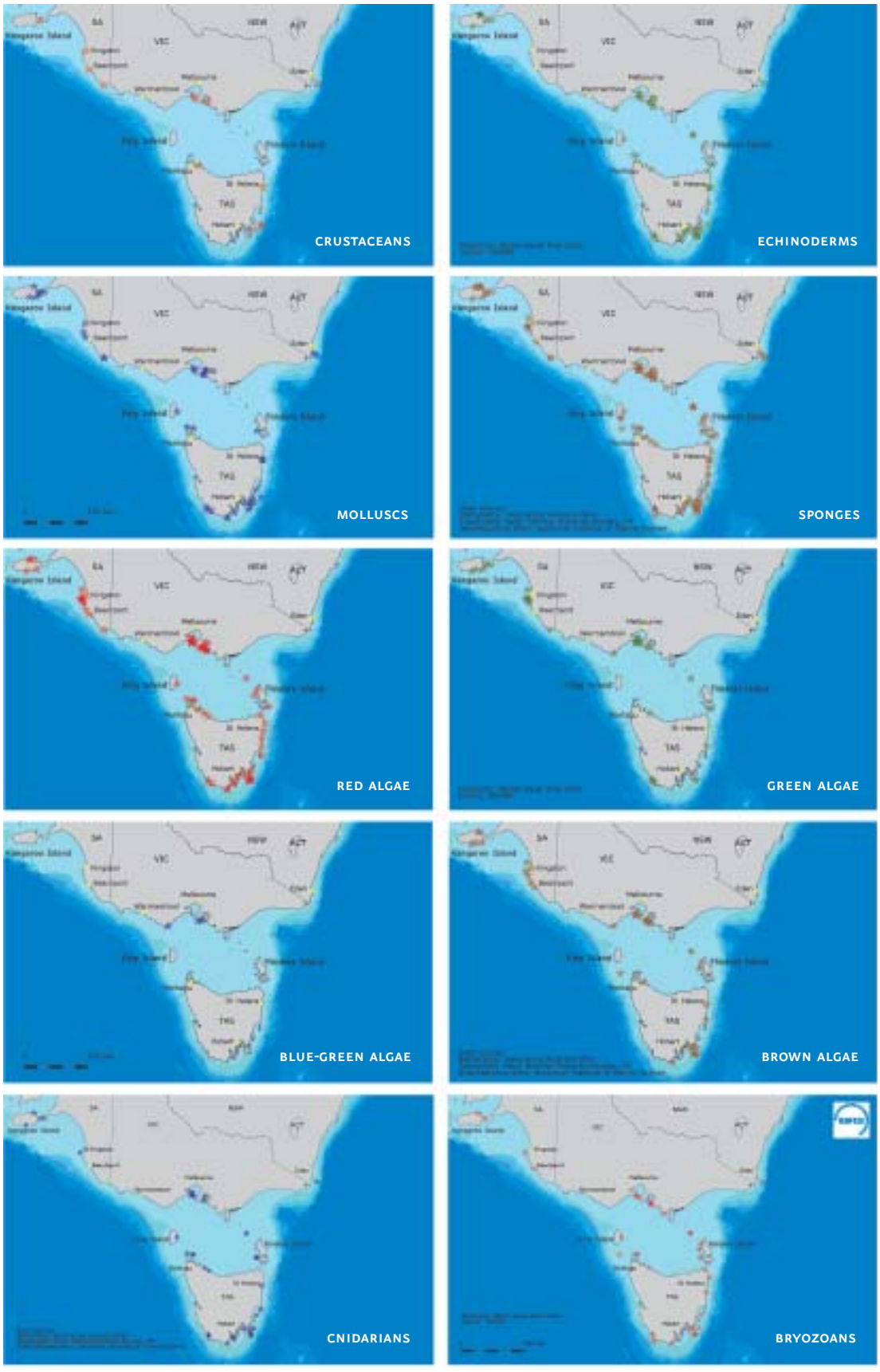
Table 1:
Details of phyla's collected within the South East Region with potential biotechnology applications.

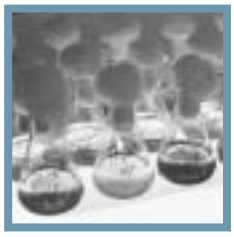
Angiospermata	includes seagrasses
Phaeophyta	includes brown algae and brown seaweeds
Porifera	includes sponges
Cnidaria	includes anemones, jellyfish and bluebottles
Rhodophyta	includes the red algaes and red seaweeds
Annelida	includes segmented worms
Chordata	includes ascidians, sea squirts and tunicates
Mollusca	includes squid, clams, snail and chitons
Bryozoa	include moss animals, lace corals
Echinodermata	includes seastars, brittlestars, sea urchins, sea cucumbers, and feather stars
Crustacea	a subphylum of the phylum arthropoda which differ from most arthropods by having two pairs an antennae in front of the mouth

Source: AIMS 2001.

[1] Phylum (plural Phyla) is the second highest classification in a system known as biological nomenclature where animals, plants, fungi, protists and bacteria are hierarchically arranged into groups with similar characteristics.

Maps 6a – 6j: *Bioprospecting areas within the South-east Marine Region.* Source: BRS 2002.





Economic dimensions

There are two phases in the marine biotechnology process:

- bioprospecting/biodiscovery – the search for valuable chemical compounds and genetic material from plants, animals and microorganisms
- commercialisation – the development of products and marketing.

Marine bioprospecting is the search for novel biochemicals from marine biota. These chemicals are identified by examining the basis of the adaptations of marine organisms to their unique environments. For example, harmful and aggressive environments may result in the production of biotoxins and venoms, antifoulants, signalling agents, and other molecular defences.

The commercialisation of biotechnology requires the integration of research business acumen and investment to take promising biodiscoveries through to a marketable product and viable business ventures.

Employment

There is estimated to be in excess of 5700 full-time equivalent employees in the Australian biotechnology industry. There is also significant support provided to the industry by way of contract research, through universities, research institutes and contract research organisations that is not captured in these estimates.

At the national level the average employees per biotech firm is 30-40. This figure includes CSL Ltd (formerly Commonwealth Serum Laboratories), which has over 1300 staff. Excluding CSL brings the average employment size down to around 15 staff (Biotechnology West 2001).

The service sector is a vital part of biotechnology-related industry. Services such as banking and finance (particularly venture finance) are required to provide funding for research and development over a long period. Patents and intellectual property advice is needed to protect inventions. Regulatory affairs advice is required to ensure products can be successfully registered and comply with good manufacturing practice.

There is currently no comprehensive breakdown of employment data available specifically for the South-east Marine Region.

Tasmanian biotechnology

There are 31 Tasmanian organisations involved in providing research services on a contract basis, or developing biotechnology for their own use or developing with the expectation of a future market opportunity. Turnover of the sector is estimated to exceed $145 million per annum.

Tasmania has clusters of biotechnology research and development in agriculture, aquaculture, environment, and human health/genomics. The State has a strong research and development base in the public sector, with 63% of research activity focussed on developing commercial activities.

Eighty nine per cent of respondents to a State biotechnology survey indicated that they have markets outside Tasmania and more than 57% of respondents exported their products and services outside Australia.

Tasmanian public research institutions that reported biotechnology research and development included:

- University of Tasmania
- Tasmanian Aquaculture and Fisheries Institute – developing a variety of new aquaculture species and anti-fouling paint
- CRC for Antarctic and Southern Ocean Studies – research into cold adapted enzymes, human pharmaceuticals and polyunsaturated fatty acids
- CRC for Aquaculture – main area of research expertise includes nutrition, feed development, hatchery technology, genetics, reproduction, environmental management, vaccine development, immunology, fish physiology, disease diagnosis, health maintenance, food technology and grow-out technologies
- CSIRO Marine Research – biotechnology research
- Australian Maritime College – disease vectors in seahorses, food safety and handling, and environmental remediation.

Source: DSD 2001.

Regional links

Collection and recollection of biological samples are made in the area where the organisms occur naturally. However, once species are lodged in collection, and information about them is in electronically accessible databases, researchers need go no further than to the collections, which are often in major cities.

The House of Representatives' Standing Committee on Primary Industries and Regional Services suggested that the major use for Regional areas in bio-industrial development would be in mass producing raw material and carrying out preliminary extractions (CoA 2001). This conclusion was supported by a submission to the committee by the Australian Institute of Marine Science, stating that (AIMS 2001):

> If fermentation/harvest/aquaculture modes of production currently being investigated are found to be economic (even with synthetic post harvest manipulations) the options for substantial regional developments are enormous.

Management arrangements

Access and ownership are the key legislative considerations with respect to biotechnology and bioprospecting in the Region.

The Commonwealth and State/Territory governments share jurisdiction over coastal and marine areas in Australia. States have legislative jurisdiction (under the Commonwealth *Coastal Waters (State Powers) Act 1980* over land, sea and seabed generally out to three nautical miles, but this is subject to any rights or title held by the Commonwealth or another party over property in those waters or that seabed. The Commonwealth Government has jurisdiction over any coastal land it owns and over marine waters generally from three to 200 nautical miles and over the seabed from three nautical miles to the outer limit of the continental shelf.

Commonwealth waters

The Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) establishes the legislative authority for regulations to control access to biological resources in Commonwealth areas.

The Australian Government has released draft amendments to the Environment Protection and Biodiversity Conservation Amendment Regulations 2001 for public comment. These regulations will establish a legal framework to control access to, and use of, the genetic resources of native species in Commonwealth areas.

The legislative changes are designed to:

- safeguard the environment
- promote the sustainable use of biological resources
- ensure the Australian community shares in the benefits derived from the discovery of commercial uses of genetic and biochemical material derived from Australian native organisms
- provide certainty to industry and researchers
- protect and value the special knowledge of Indigenous people
- be consistent with the Convention on Biological Diversity.

State waters

Unlike the Commonwealth, there is no single piece of legislation governing bio-prospecting activities in State/Territory waters. In the absence of such overarching legislation, States/Territories rely on marine legislation including fisheries, living marine resources, wildlife, flora and fauna and aquaculture to regulate bio-prospecting in coastal and inland waters.

Commercial fishing

This chapter provides a brief overview of commercial fisheries in the South-east Marine Region. It is recommended that readers also access the publications outlined below for further information:

- maps showing the locations of catches in each of the Commonwealth and State fisheries in the Region are contained in the BRS *Marine Matters: Atlas of Marine Activities and Coastal Communities in Australia's South East Region*. The Atlas also provides a brief overview of each fishery, descriptions of gear types and social characteristics of the coastal communities of the Region.
- an in-depth economic analysis of Commonwealth fisheries in the Region is provided by Gooday et al. (2001) *Economic value of commercial fishing in Australia's south east*.
- the Bureau of Rural Sciences (BRS) also provides an annual independent analysis of Commonwealth-managed fish stocks in its fishery status reports.

Information on the fisheries in the Region may also be obtained from the relevant State fisheries agency or from the Australian Fisheries Management Authority (AFMA) for the Commonwealth fisheries.

Regional activity

History of commercial fisheries within the Region

The commercial use of the Region's fisheries began soon after Bass and Flinders explored Bass Strait in 1797, although Indigenous fishing and trade had been taking place for millennia. At first, commercial interests concentrated upon the vast abundance of whales and seals in the Region. East Boyd, on Twofold Bay near Eden, is even regarded to be the site of Australia's first industrial complex (Colwell 1969). Whaling was also an important activity around south-eastern Tasmania, Encounter Bay in South Australia and western Victoria.

As more and more Europeans settled in the area, small fisheries developed around the bays and inlets. But it was not until after World War II, with the introduction of new technology such as sonic sounders, radar, hydraulic winches and high capacity diesel engines, that the fishers of the Region were able to fish consistently away from the coast in deeper waters further from their home ports (BRS 2002).

Current activity

At present there are 32 open ocean fisheries within the Region (Larcombe et al. 2002). In 1999, the fisheries of the South-east Marine Region produced around 14% of Australia's total wild fisheries production by value and 21% by volume (ABARE 2001, BRS 2002).

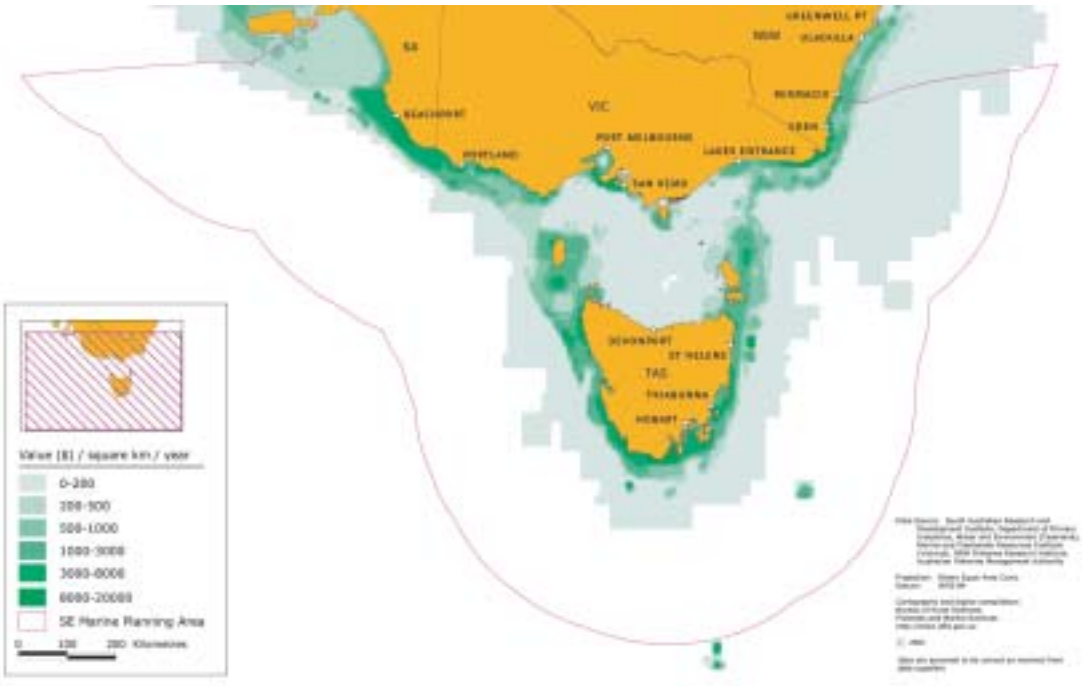
The Region contains some of the world's most highly prized seafoods, including abalone and rock lobster. As well, commercial fishing is an important component of the Region's coastal economies. Activities such as repair yards, dockhandling, transportation, boat construction, fish processing and commercial trade and the supply of marine gear – such as nets and rigging – add significantly to regional employment and economic activity.

Within the Region there are 12 fisheries wholly or partly managed by the Commonwealth and around 30 fisheries wholly or partly managed by the State governments. As a general rule, fisheries managed by the Commonwealth are those that exist within Commonwealth waters (beyond three nautical miles from the coast or territorial sea baseline), with the States responsible for fisheries within coastal and internal waters. In practice, however, fisheries management arrangements are more complex.

Map 7 shows the location of commercial fishing in the Region by value.

Most of the commercial fishing in the Region, by volume, occurs within Commonwealth waters along the continental shelf and the upper continental slope. Fisheries in State waters, such as rock lobster and abalone, are concentrated off the far east coast and western Victoria, southern and western Tasmania and off southeastern South Australia.

Map 7: ***Location and value of commercial fish catches in the Region.*** *Source: Larcombe et al. 2002.*



Commonwealth fisheries of the Region

The Commonwealth fisheries within the Region are the:

- Bass Strait Central Zone Scallop Fishery
- South East Trawl Fishery
- South East Non-trawl Fishery
- Southern Shark Fishery
- Southern Squid Jig Fishery
- Jack Mackerel Fishery
- Eastern Tuna and Billfish Fishery
- South Tasman Rise Fishery
- Macquarie Island Fishery.

The combination of the South East Trawl and South East Non-trawl Fisheries is referred to as the South East Fishery.

In addition, parts of the Southern Tuna and Billfish Fishery, the Southern Bluefin Tuna Fishery and the Great Australian Bight Trawl Fishery exist within the South-east Marine Region. In the case of these fisheries, however, only minimal catches are now taken in the Region. Of these, only the Southern Bluefin Tuna Fishery is further mentioned in this section due to its previous, and possible future, importance within the Region.

Table 2 details the main species caught, fishing methods used, number of licences, total catch and gross value of production for the Region's Commonwealth managed fisheries.

Table 2:
Commonwealth fisheries of the South-east Marine Region 1999/2000.

Fishery	Species caught	Main fishing method	Number of endorsements/ licences	Total catch (tonnes)	Gross value of production
Bass Strait Central Zone Scallop	Scallop	Dredge	154 concession (fishery closed 1999-2000)	763 (1998-99)	$1.726 million
Jack Mackerel	Greenback, yellowtail, Peruvian jack mackerel	Purse seine, midwater trawl	71 permits	Not available for reasons of confidentiality	Not available for reasons of confidentiality
South East Trawl	Mixed fish species particularly orange roughy, ling, blue grenadier, flathead and redfish	Otter trawl and Danish seine	110 boats, 118 class A permits	30 515	$72.248 million
South East Non-trawl	Mixed fish species particularly pink ling, blue eye trevalla, blue warehou	Demersal gillnet, demersal longline, dropline, trotline, trap, purse seine	120 boats, 149 permits	1231	$5.561 million
Southern Shark	Gummy and school shark, other shark	Demersal gillnet, demersal line	168 permits	2726	$13.832 million
Southern Squid Jig	Arrow or Gould's squid	Jig	85 permits	366	$0.443 million
South Tasman Rise	Orange roughy and oreo dory	Demersal trawl	14 permits (Australian vessels only)	346	$0.835 million
Macquarie Island	Patagonian toothfish	Bottom trawl	1 permit	Not available for reasons of confidentiality	Not available for reasons of confidentiality
Southern Bluefin Tuna*	Southern bluefin tuna	Purse seine, longline, trolling, pole and line	120 boat nominations	5263	$56.515 million
Eastern Tuna And Billfish*	Yellowfin, bigeye, skipjack, albacore tuna, billfish species	Pelagic longline, purse seine, pole, trolling, rod and reel, handline	317 permits	10 028	$64.534 million

Source: Modified from Gooday et al. 2001.

**Totals are for the whole fisheries not just the portion of the fishery active within the South-east Marine Region.*

State-managed fisheries of the Region

The Region includes the waters off four Australian States: New South Wales, Victoria, South Australia and Tasmania. The entire waters off Victoria and Tasmania are included in the Region and only part of New South Wales and South Australia.

State fisheries within the Region include:

- abalone
- rock lobster
- inshore and reef scalefish
- giant crab
- scallop
- internal water fisheries including eels (such as occurs within Westernport Bay in Victoria and various estuary fisheries in New South Wales).

In addition, there exist small commercial dive fisheries such as the Tasmanian commercial dive fishery, the target species of which are sea urchins, periwinkles, sea cucumbers and native flat oysters. Other small fisheries include beach cast, seagrass and kelp in southeastern South Australia and King Island, the harvest of the introduced species *Undaria pinnatifida* (or Japanese seaweed) off eastern Tasmania and a developmental jellyfish fishery in some of the bays of Victoria.

Fisheries in each State are managed under separate management arrangements, but there is usually scientific and management cooperation across the States where species resources are shared.

Management arrangements

The Offshore Constitutional Settlement (OCS) governs Commonwealth, States and Territorial waters. In general, the States and Territories have legislative jurisdiction in coastal and internal waters out to three nautical miles, with the Commonwealth retaining legislative jurisdiction from 3-200 nautical miles out to the edge of the Exclusive Economic Zone (EEZ). The OCS also provides for specific arrangements to vary this general rule. For example, an arrangement can be made allowing a fishery to be managed in all waters of the EEZ (excluding internal waters) by either the Commonwealth or State or via a Joint Authority (Commonwealth-State). The capacity exists under the OCS to allow fisheries management to reflect fishing practices, the continuity of fish stocks in both Commonwealth and State waters (including where more than one State is involved), or where foreign fishing vessels are involved. For a full discussion on the OCS refer to the report *Ocean Management – the legal framework*.

Table 3 summarises the current OCS arrangements for fisheries within the South-east Marine Region.

Table 3:
Current OCS arrangements for major fisheries within the South-east Marine Region.

Fishery	NSW	VIC	TAS	SA
South East Trawl	Status quo no arrangements in place	C'wealth	C'wealth / State	C'wealth
South East Non-trawl	State to 80 nautical miles for line and trap, no arrangement in place for purse seine	C'wealth	C'wealth / State	C'wealth
Southern Shark	Status quo no arrangement in place	C'wealth	C'wealth	C'wealth
Eastern Tuna and Billfish	Status quo no arrangement in place	C'wealth	C'wealth	C'wealth
Southern Bluefin Tuna	Status quo no arrangement in place	C'wealth	C'wealth	C'wealth
Southern Tuna and Billfish	C'wealth	C'wealth	C'wealth	C'wealth
Bass Strait Scallop	N/A	C'wealth / State	C'wealth / State	N/A
Southern Squid	Status quo no arrangement in place	C'wealth	C'wealth	C'wealth
Jack Mackerel	Status quo no arrangement in place	Status quo no arrangement in place	Joint Authority	C'wealth
Rock lobster	State	State	State	State
Abalone	State	State	State	State
Giant crab	Status quo no arrangement in place	State	State	State
Macquarie Island	N/A	N/A	Status quo no arrangement in place	N/A

Source: Modified from Gooday et al. 2001.

Commonwealth managed fisheries

The principal legislation for the management of Commonwealth fisheries are the *Fisheries Management Act 1991* (FMA) and the *Fisheries Administration Act 1991* (FAA). The FMA specifies the objectives that must be pursued by the Minister responsible for fisheries. Primary objectives include implementing fisheries management which:

- is cost effective
- is consistent with the principals of ecologically sustainable development (ESD)
- achieves the optimum utilisation of the living resources of the Australian Fishing Zone
- maximises economic efficiency
- is accountable to both the fishing community and the wider Australian community.

As well, the FMA specifies that, as far a practicable, management must not be inconsistent with the preservation, conservation and protection of all species of whales.

The FAA creates a statutory authority model for fisheries management whereby day-to-day management of fisheries are carried out by the Australian Fisheries Management Authority (AFMA). The responsibility for broader fisheries policy, international negotiations and strategic issues continues to rest with the Commonwealth Department of Agriculture, Fisheries and Forestry – Australia (AFFA).

Australian Fisheries Management Authority

The Australian Fisheries Management Authority (AFMA) undertakes day-to-day management of Commonwealth fisheries. AFMA is a Statutory Authority established under the *Fisheries Administration Act 1991* (Cth).

AFMA is funded jointly by industry and the Commonwealth Government. This funding model recognises both the private and public benefits that result from fisheries management.

AFMA is responsible for, among other things:

- making and implementing decisions consistent with both the *Fisheries Administration Act 1991* (Cth) and the *Fisheries Management Act 1991* (Cth)
- ensuring management is approached in partnership with the fishing community and other stakeholders, such as conservation groups
- collecting licence fees and management levies
- regularly assessing the biological and economic status of fisheries under its control.

Source: AFMA 2001.

The primary method for the management of Commonwealth fisheries, as dictated by the FMA is through management plans. Management plans set out, amongst other things:

- the objectives of the management plan
- measures by which the objectives of the management plan are to achieved
- performance criteria by which the measures taken may be assessed.

Management plans are in force for an indefinite period, though there is provision for management plans to be amended or revoked by AFMA.

Currently within the Region, three management plans are in place for the:

- South East Trawl Fishery
- Southern Bluefin Tuna Fishery
- Great Australian Bight Trawl Fishery – part of which crosses into the western part of the Region.

All other Commonwealth managed fisheries in the Region including the South East Non-trawl, Southern Shark and Bass Strait Central Zone Scallop are at present being managed under interim management arrangements until management plans are finalised. Some of the other smaller fisheries are to remain under interim arrangements for the foreseeable future.

Nature of fishing rights

Management plans specify the nature of the right held by fishers within a fishery. There are basically two forms of access rights defined by the FMA – statutory fishing rights (SFRs) and fishing permits.

SFRs are only provided under a management plan and are granted for the period of the plan. They are a right to fish for a resource, not a right to the resource. This is an important distinction as it allows fishery managers to change maximum allowable catches (if a maximum allowable catch regime is in place) within a fishery without having to undertake changes to management plans. This distinction also reflects the ownership of fish resources, which are considered as a common resource owned by all Australians and managed on behalf of the Australian community.

SFRs can take many forms including a right to use certain equipment, to take a particular quantity or species of fish or to use a particular boat type within a fishery. The nature of the actual right within any one fishery will depend upon a number of factors including the history of the fishery, gear used and the biology of the species. More than one type of SFR can be granted for a fishery. In the South East Trawl Fishery, for example, there are both boat and species-based SFRs.

Unlike SFRs, fishing permits do not formally convey a right to fish. On granting a fishing permit (which may cover a time period of up to five years but are generally only granted for twelve months) the Government specifies conditions which must be met in order for the permit holder to retain their permit. Conditions may relate to:

- species and quantity of fish that may be taken
- rate at which fish may be taken
- methods or equipment that may be used to take or process fish.

Both SFRs and fishing permits are generally freely tradeable as long as the obligations of the current holders have been met and the prescribed fees have been paid. However, the basic difference between a SFR and a fishing permit is that an SFR gives a secure right to holders – much the same as a private property right. Thus, for instance, holders may be able to borrow against a SFR.

Nature of management within the Region

The preferred form of SFR for Commonwealth fisheries are those granted under an output control management system. Traditionally, most fisheries have been managed by an input control management system. The main differences between an output and an input control system are that:

- **output controls** are management controls directly limiting the fish catch or landings. They rely on setting a total allowable catch (TAC) for species or species groups. Percentages of the TAC may then be allocated to SFR holders under a system of individual transferable quotas (ITQs)
- **input controls** are management controls over the type or amount of fishing. These controls include gear restrictions such as amount and configuration of nets, number of hooks, seasonal and area closures and boat sizes.

For current management methods within the Commonwealth fisheries of the Region see Table 4.

Table 4:
Management methods within the South-east Marine Region Commonwealth managed fisheries 1999-2000.

Fishery	Management methods
South East Trawl	Combination of output (TACs and ITQs) and input controls
South East Non-trawl	Combination of output (TACs and ITQs) and input controls
Southern Shark	Combination of output (TACs and ITQs) and input controls
Eastern Tuna and Billfish	Input controls
Southern Bluefin Tuna	Output (TAC and ITQs) controls
Bass Strait Central Zone Scallop	Combination of output (check status) and input controls
Southern Squid	Input controls
Jack Mackerel	Combination of output (TACs only) and input controls

The main benefit of an output control system is that it gives fishers a right to take a certain percentage of the catch – an ITQ. This right can be thought of as a private property right with all associated rights, such as the right to buy, sell, trade or borrow against the right. ITQs are generally allocated either for a single species or group of related species within the global catch limit – the TAC. A TAC can also be set for a bycatch species to maintain catches, to allocate the resource to another fishery or sector, or to keep catches within ecologically sustainable limits. The TAC is, as a general rule, set annually based upon both biological and economic assessments. An in-depth analysis of ITQs and their social impacts in the South East Trawl Fishery can be found in Aslin et al. (2001).

The benefits of an ITQ system include the fact that the holder of an ITQ is guaranteed a percentage of the yearly quota. As a result, ITQ holders can concentrate on taking their share of the catch without having to over-invest in more expensive technologies purely in order to beat competitors to the fish. Another advantage is that if the fishery is characterised by over-capacity in the fleet, then rationalising the fleet can be achieved within the fishery itself (through trading quota).

However, problems associated with ITQs include that:

- management of the system is costly due to monitoring and enforcement requirements and thus may not be cost effective for smaller fisheries
- setting a TAC presupposes sufficient knowledge of the resource (in order to set the TAC at a sustainable level)
- the setting of catch limits may result in lower value fish of the target species being discarded (so called 'high-grading')
- management of fisheries under an ITQ system, particularly during the introduction of such a system, may have social, regional and/or equity ramifications.

Many of these issue have long been recognised, for instance (Crutchfield 1982, p. 19):

> It is fairly obvious that if the ITQs scheme is to have any effect in reducing excess capacity in a fishery it will do so with ruthless effectiveness – that is, the price of the shares will be bid up rapidly to the point where substantial numbers of marginal fisherman will be forced out of the fishery rather abruptly. While this has obvious advantages from the standpoint of efficiency alone, it may raise serious social and equity problems... There might also be enforcement problems. If the fishery normally funnels through a few centralised ports, monitoring should not be overly difficult. But since both buyers and sellers would have the incentive and opportunity to understate the individual fisherman's catch, the possibility of widespread violation might be an important barrier if fish are marketed through many small landing ports.

In reality, most fisheries even if managed under output controls (ITQs and TACs), normally retain input controls as well. This is because output controls do not take account of all the effects of fishing on ecosystems, or even all the effects of fishing on the targeted fish stocks. For example, setting a limit on catch takes no account of the need to not take fish below a certain size or during certain seasons – thus allowing them to breed and contribute to the population. Nor can output controls manage impacts such as habitat disturbance. Input controls are retained to manage these issues. Input controls can also be used to help manage some of the social and regional issues referred to above.

Monitoring and enforcement

All Commonwealth fisheries are subject to monitoring and enforcement arrangements by AFMA in accordance with provisions within the FMA. All fisheries have a logbook system in place which details catch (species, weight, number) and effort (location, gear, time spent fishing).

Fishers are also required to report on bycatch issues and any interactions with threatened species. Some fisheries, particularly those subject to ITQ management, also have catch landing records where fishers and processors are required to complete accurate records of landings.

In meeting its obligations under the FMA, much of the day-to-day fisheries monitoring and enforcement is performed by AFMA in conjunction with other relevant Commonwealth and State agencies.

State management

All States manage their fisheries using a statutory base. Generally, the statutory base not only details management methods but also the State agency responsible for administering the Act. In Tasmania, the Department of Primary Industries, Water and Environment (DPIWE) manages and regulates the extraction of wild fish under the *Living Marine Resources Act 1995* (Tas) In South Australia, the Department of Primary Industries and Resources – South Australia (PIRSA) is responsible for the *Fisheries Act 1982* (SA). In Victoria, the Department of Natural Resources and the Environment (DNRE) is responsible for administering the *Fisheries Act 1995* (Vic) and NSW Fisheries manages fisheries in that State under the *Fisheries Management Act 1994* (NSW).

The major State fisheries – abalone and rock lobster – are either managed under a system of ITQs or, ITQs are under consideration as the key management tool. Most of the other fisheries including those in development, have TACs in place. Input controls are also in place across all fisheries to manage habitat disturbance, bycatch, and other issues.

All jurisdictions have performance management systems which assess a fisheries' performance against a number of criteria generally designed to capture both environmental and socio-economic considerations. A number of performance indicators are used to monitor the effectiveness of management arrangements against, for example:

- exploitation and catch rates, mean weight of catch and return on investment in South Australia
- catch per unit effort, total annual catch, fleet size and recreational catch in Tasmania.

Economic dimensions

Production volumes and values

As of 1999, total fisheries production from the South-east Marine Region, in both Commonwealth and State waters was approximately 46 000 tonnes of fish (including molluscs and crustaceans) worth around $321 million – made up of $253 million from State waters and $63 million from Commonwealth waters (BRS 2002). By volume this total was made up of around 34 000 tonnes from Commonwealth waters and around 12 000 tonnes from State waters (BRS 2002). In addition, production value is not evenly spread across the Region's fisheries. For instance, just two fisheries, the abalone fishery and the rock lobster fishery, were worth over $241 million in 1999 – 73% of the Region's total earnings in that year (BRS 2002).

As can be seen from Figure 6, in the five years to 1999, total catch has declined – from around 53 000 tonnes in 1995 to 46 000 tonnes in 1999. However, the value of the catch has increased – from around $272 million in 1995 to $321 million in 1999 (BRS 2002).

Individual fisheries of the Region exhibit much greater variability than can be surmised from the aggregate Regional total. In Tasmania, production volumes across all the State's fisheries have dropped from 6550 tonnes in 1995 to 5241 tonnes in 1999. However, landed value has increased from $94 million to about $130 million for the same period (BRS 2002). The State's abalone fishery continues to be the most important in terms of value with over $81 million worth of fish caught in 1999. The rock lobster fishery is the second most important fishery at over $45 million (BRS 2002).

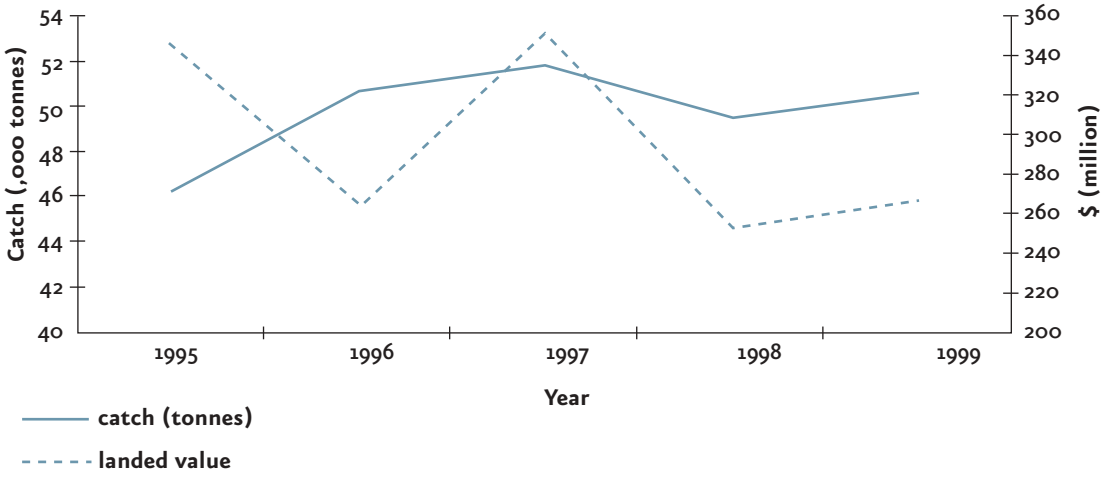
In 1995-1996, the South Australian rock lobster fishery recorded catches of 1694 tonnes worth approximately $44.6 million. By 1999-2000 the catch had only increased by 1.3% (to 1717 tonnes), but the value had increased by 14.8% (to $51.2 million) (Econsearch 2001).

In general, State fisheries have experienced strong growth over the period – from $194 million in 1995 to $253 million in 1999. Commonwealth fisheries dropped in value from around $78 million in 1995 to just over $68 million in 1999 (BRS 2002). There are numerous reasons for this decrease including the:

- general movement of the Eastern Tuna and Billfish Fishery from NSW to southern Queensland
- overfishing of species such as school shark, orange roughy and scallops, leading to reduced catches.

The reduced returns in these fisheries have more than offset increases in value of some of the remaining Commonwealth fisheries.

Figure 6: *Aggregate value and volumes for the Region's fisheries (Commonwealth and State) 1995-1999.*



Source: BRS (2002).

Market and demand analysis

There is currently little information on the final destination of the Region's catch. The information that does currently exist is generally concentrated on the high-value species such as rock lobster or abalone or is the product of one-off studies. The information available, summarised below, is for some of the principal species in the Region:

- **southern rock lobster** – the southern rock lobster is a premium product commanding a premium price on both local and interstate markets. However, price is still perceived to be an important determinant of volume sold (Fisheries Western Australia 2000). While local markets dominated until the 1940's the advent of mass refrigerated transport meant that the major markets shifted overseas – particularly to America. Over the last few decades, as the price of rock lobsters increased, it became economic to freight them live by air. Now over 95% of the catch from South Australia is exported directly to Asia (SARDI 2000) and similar proportions are likely to be exported from other States (either direct or via interstate agents)

- **abalone** – the vast majority, close to 100%, of the Region's abalone catch is exported overseas. The majority goes to Asia with around 5% to Europe. Exports have traditionally been in the form of canned products or frozen un-bled in 19kg blocks. More recently the trend has shifted to exporting live product to Asia

- **scallops** – traditionally the main markets for scallops have been France, Hong Kong, the USA and the domestic market, with the majority exported to France. The main domestic markets are local restaurants, fish retailers and the Melbourne and Sydney Fish Markets (DPIWE 2000). Due to the recent collapse in the Region's scallop fisheries, Australia has turned from a net exporter to a net importer of scallops

- **South East Trawl and non-trawl species** – species caught by these fisheries are mainly destined for the Australian market of the eastern seaboard. In 1995-96, 37.6% of the catch was sold in NSW, 42.8% was sold in Victoria and 19.5% in Tasmania (ABARE 1997). Most of that sold in NSW went to the Sydney Fish Markets from ports outside the Region such as Wollongong, Ulladulla and Bermagui. The nature of the catch in the fishery (a fresh, chilled product) has dictated that the market be primarily domestic. More recently, overseas markets such as Europe and the United States are being accessed for some species, particularly following the introduction of larger, factory trawlers which can package and freeze product on board

- **sharks** – shark (or flake) has been sold predominantly on the domestic market and has been a favourite fish shop species for many years, particularly in Victoria

- **giant crab** – like lobster, giant crabs are mainly exported live to Asia

- **squid** – the majority of squid is sold on the domestic market, either for human consumption or as bait

- **jack mackerel** – the main markets are for domestic fishmeal production, bait and livestock feed. There is limited human consumption of the fish

- **southern bluefin tuna** – the main market is Japan.

Market demand considerations

In 1988, ABARE commissioned a study that illustrates the market demand considerations for some of the fisheries of the Region. This study sought to establish a relationship between South East Fishery species (a fishery mainly supplying the market on Australia's eastern seaboard) and the price received in response to a number of factors including:

- number of buyers
- type of buyers
- day of week
- seasonal impacts
- total weight
- quality
- substitute and complimentary species.

It was found that the prices received for several major species were relatively unaffected by catch volumes. For instance, a sustained increase of 10% in the catch of ling would result in only a 1% fall in market price. However, quality did appear to be a factor in the sale price of certain species (ABARE 1997).

The importance of market demand conditions cannot be understated. For instance, management decisions may affect volumes or quality, which in turn may affect prices received and as a result may affect the economic health of a fishery. As well, market demand conditions may also affect the behaviour of fishers. For instance, as there is at present no market for small redfish these are discarded at sea. An analysis of demand conditions is of importance to anyone seeking to maximise the benefits received from Australia's fisheries.

Employment

While it is difficult to ascertain total direct employment within the Region's fisheries, the BRS has calculated (using 1996 ABS Census data) that less than 1% of the labour force in the Region is directly employed in commercial fishing activities (Coakes et al. 2001). However, due to the Regional nature of employment in commercial fishing this aggregate does, to some extent, mask variability in employment statistics at the regional level. In eastern Tasmania, Flinders and King Islands and Robe (in South Australia), employment rates from commercial fishing are between 6-9%. Rates of employment from commercial fishing in towns considered to be major fishing ports are even higher. For example in Strahan, Triabunna, Port Welshpool and San Remo, employment rates in commercial fishing are between 10 and 15% of the labour force (Coakes et al. 2001).

While it is difficult to gain reliable figures on total employment within each of the commercial fisheries of the Region, there does exist some data at the individual fishery level. For instance, within the South East Trawl Fishery it is estimated that there are 465 full time employees, 58 part time employees and 161 casuals employees as of 2001 (Coakes et al. 2001).

Direct employment within commercial fisheries are only part of the employment story. Many jobs also exist in associated industries such as fish processing and boat building. For instance, it has been estimated that for each job created within the South Australian rock lobster fishery, a further seven to eight jobs in associated industries are also created (EconSearch 2001). For further information on this refer to the section titled *Regional importance*.

Economic status of the Region's fisheries

It might be easy to suggest that the fisheries of Australia's South-east Marine Region are worth the value of the catch sold – some $327 million in 1999 (BRS 2002). However, just analysing gross returns does not give a true picture of the economic status of the Region's fisheries. As Gooday et al. (2001, p.6) state:

> Gross value of production (or gross revenue) figures have sometimes been suggested as useful indicators of the economic performance of fisheries. While gross revenue figures have the advantage of being readily available for most fisheries, they are poor indicators... gross revenue figures do not include any information about the costs of fishing and managing the resource...
>
> The gross value of production of a fishery will increase due to an increase in the price of fish, the quantity of fish sold, or both. An increase in the gross value of production does not imply that the community is better off from these increased sales and/or prices. This will also be influenced by movements in the cost of fishing. Fishing costs include those incurred for fuel, crew, gear and so on as part of the fishing operation. They may also include environmental costs and the costs of management. Any increase in fishing costs would offset some or all of an increase in the gross value of production. If the costs of fishing rose sufficiently, increases in the gross value of fishing could be completely outweighed, with the effect that the community is worse off from the changes.

To gain a true understanding of the economic status of the Region's fisheries, an analysis must include all of the above costs, including those not recovered from the industry – where appropriate. Within the Commonwealth managed fisheries of the Region, ABARE (2001) has calculated the net economic return, which takes into account both gross income and costs (see Table 5).

Table 5:
Net returns to select Commonwealth fisheries[c] 1998-99.

Fishery	Revenue ($m)	Operating costs ($m)	Return to capital ($m)	Management costs ($m)	Profit ($m)
South East Trawl[a]	66.0	55.4	5.2	2.9	2.5
South East Non-trawl[b]	15.7	13.6	1.2	2.1	-1.2
Jack Mackerel	1.0	Not available	Not available	Not available	0.27
Bass Strait Scallop	1.9	1.7	0.4	0.5	-0.7
Southern Squid Jig	2.0	2.1	0.9	0.1	-1.1
Total	86.6				-0.23

a – figures reported are for 1997-98.
b – Includes figures from the Southern shark fishery.
c – totals are for the whole fisheries not just the portion of the fishery active within the South-east Marine Region.
Source: Gooday et al 2001.

Commonwealth fisheries

As illustrated in Table 5, Commonwealth fisheries in the Region actually operate at a loss. While some fishers managed to make a small profit, profit returned to inputs remains low by economy wide standards. For instance, in 1997-98 the South East Trawl Fishery returned only 3.8% of total revenue. However, this is better than the negative returns received within some of the other fisheries. For example, fishers active in the Southern Squid Jig Fishery, the Bass Strait Scallop Fishery and the South East Non-trawl Fishery made a combined loss of around $3 million in 1998/99.

State fisheries

While some analysis has been undertaken for some of the Commonwealth fisheries in the area (see above), for fisheries under State control there "is only limited information available" (Gooday et al., 2001, p.18). For instance, South Australia is the only state to regularly report on the economic status of its fisheries as part of its obligations under the South Australian *Fisheries Act 1982*. Other States either report sporadically or not at all. As a result, only partial data is available for certain fisheries.

South Australia has perhaps the most in-depth analysis of the cost of running an average boat within the fishery. From an average gross income per boat in 1999-2000 of around $287, 000, over $181, 000 goes towards cash costs (eg labour, fuel, bait) and just under $28, 000 covers depreciation on equipment used. As a result the average earning per boat before tax is around $78, 000. Given that the capital costs to enter the fishery are on average in the order of $1.9 million per boat (boat plus gear plus licence cost), earnings represent a rate of return, before tax, of around 4% (EconSearch 2001).

Stock status

Commonwealth fisheries

The economic performance of a fishery is also affected by the status of the stock(s) being targeted. If a fishery is making large returns on the basis of over-harvesting, the fishery could not be regarded as economically sustainable. At some point, catch rates would fall and profits/revenues would drop to a point where commercial fishing was no longer viable. This has occurred in numerous fisheries around the world.

The Bureau of Rural Sciences has completed an assessment of the status of the targeted species in the Region, by fishery (see Table 6). Note that this analysis does not include the status of bycatch species (non-target species usually discarded at sea), which may be important feed stocks for some of the targeted species of the Region.

Table 6:
Status of the main Commonwealth fisheries in the Region (1999).

Fishery	Status
South East Fishery (key species)	One (eastern gemfish) overfished Five probably fully fished with sustainable catches One probably fully fished with declining catches One (blue grenadier) underfished Nine uncertain
Jack Mackerel	Uncertain
Bass Strait Scallop	Overfished
Southern Squid Jig	Uncertain-– probably underfished
South Tasman Rise	Uncertain
Southern Shark	School shark –overfished
	Gummy shark– fully fished

Source: (BRS 2000).

Some of the Commonwealth-managed species in the Region are in a period of consolidation and restructure after historical overfishing. This overfishing came about partly due to lack of knowledge of the distribution, abundance and biology of the stocks, but also due to inadequate management arrangements resulting in unsustainable catches. It has also been suggested that, unless carefully managed, the movement in management from input to output controls can create an incentive to overfish. This is because catch allocations, in the form of ITQs are frequently based on catch history. The higher the catch history the greater the ITQ allocation.

State fisheries

The States manage a number of fisheries within State and Commonwealth waters. For one fishery within the Region – the Southern Rock Lobster Fishery – the stocks throughout much of the Region appears to be improving after many years of decline. In Tasmania it appears that the legal size biomass has experienced an 8% improvement between 1993 and 1999 and in the South Australian Southern Zone Lobster Fishery, lobster abundance in 1997 was 17% above 1992 levels.

In Victoria, the most recent analysis of the rock lobster stock found that it had stabilised at around 16.5% of the virgin unfished biomass with fishing effort still too high to guarantee an increase in its biomass (Hobday et al. 1998). A recent report has estimated that a reduction in commercial effort of between 24 and 31.5%, on average along the Victorian coast, was necessary to maximise the yield (Hobday et al. 1998).

Multiple licence holdings

Many fishers in the Region operate in more than one fishery. This allows fishers to adjust to management changes and seasonal variations in stock abundance by redirecting fishing effort from one fishery to another if they have the capacity to do so (Gooday et al. 2001). Before the introduction of the *Fisheries Management Act 1991* (Cth), fishers held a Commonwealth Fishing Boat Licence (CFBL) which enabled them to target any Commonwealth-controlled species except those species under management arrangements. These arrangements allowed for diversification of fishing operations and ready entry into newly emerging fisheries. State governments also encouraged diversified fishing operations in order to support regional coastal economies. This was a stated aim for the retention of State fishery management arrangements under the OCS. Many commercial fishers still have entitlements across a number of fisheries.

Table 7:
Multiple entitlement holdings by active boats within Commonwealth fisheries of the South-east Marine Region.

	South East Trawl	South East Non-trawl	Southern Shark	Eastern Tuna and Billfish	Southern Bluefin Tuna	Bass Strait Central Zone Scallop	Southern Squid	Jack Mackerel
South East Trawl	101	2	1	2	1	8	0	1
South East Non-trawl	2	66	39	4	1	9	4	1
Southern Shark	1	39	87	2	0	9	3	0
Eastern Tuna and Billfish*	2	4	2	156	39	5	1	1
Southern Bluefin Tuna*	1	1	0	39	49	1	0	0
Bass Strait Central Zone Scallop	8	9	9	5	1	41	20	1
Southern Squid	0	4	3	1	0	20	29	0
Jack Mackerel	1	1	0	1	0	1	0	5

* Most of the current effort from these fisheries is outside the Region but the entitlements allow fishing in the Region.
Source: AFMA 2001.

Multiple licence holding across Commonwealth fisheries

Between January and August 2000, there were 400 boats active in the Commonwealth fisheries of the Region. Many of these boats have multiple licence endorsements across fisheries (see Table 7).

An example of possible effort re-direction under changing management is provided by the Southern Bluefin Tuna (SBT) Fishery. As can be seen from Table 7, 39 participants within the SBT Fishery also hold licences within the Eastern Tuna and Billfish Fishery (managed under input controls). Currently management controls within this fishery do not constrain effort. As a result, any changes to limit effort or catch within the SBT fishery result in increased effort within the Eastern Tuna and Billfish Fishery. A similar situation exists between the Southern Squid and Bass Strait Central Zone Scallop Fisheries where there are 20 boats holding entitlements in both fisheries.

Multiple licence holdings between Commonwealth and State fisheries

Many fishers also hold licences across both Commonwealth and State fisheries. This is because many Commonwealth and State fisheries occur in similar waters, using similar gear which allows fishers to land multiple species. They can also shift between Commonwealth and State fisheries on a seasonal basis. For example, within the Commonwealth managed Southern Shark Fishery over half of the 110 licence holders also hold a licence within Tasmanian State fisheries (AFMA 2001). Table 8 outlines licence holdings between the Southern Shark Fishery and Tasmanian State-managed fisheries. Despite lack of data, it also appears likely that southern shark fishers also hold multiple licences for Victorian and South Australian State fisheries (AFMA 2001).

Table 8:
Number of vessels with both the Southern Shark Fishery and Tasmanian state fishing licence 1999-2000.

Tasmanian licence types	Number of vessels
Rock lobster	30
Giant crab	13
Scallop	16
Scalefish (all types)	42
Beach seine (all types)	4
General trawl	2
Wrasse	2
Australian salmon	1

Source: Modified from AFMA 2001.

As a result of these multiple Commonwealth/State licence holdings, it is possible that the recent change to the management of the Southern Shark Fishery from input to output controls could lead to increased effort within State fisheries. For instance, many State fisheries do not have a maximum total allowable catch limit to constrain effort.

AFMA has recognised that the dual licence issue is symptomatic of a broader management problem.

The potential to fully integrate fisheries where overlap exists, and to overcome problems of bycatch and management inefficiencies has already been proposed by fisheries managers (AFMA 2001).

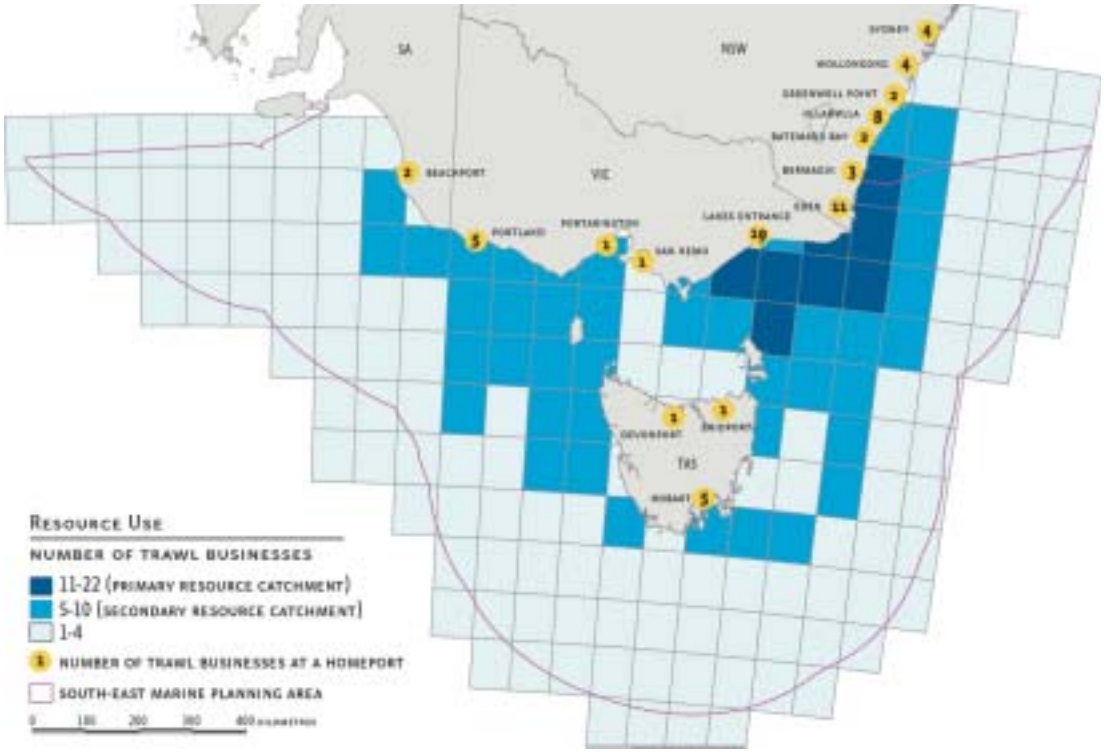
Regional importance

Any analysis of the Regional importance of the fishing industry is limited by the availability of regionally-focussed data. However, data available on two of the Region's fisheries does provide some insight:

South East Trawl Fishery

As of 2001, there were 107 trawl boats active in the South East Trawl Fishery, the major Commonwealth fishery across the Region. Map 8, identifies the location of home ports for the businesses that manage these boats. The majority (59%) of these businesses are located within the Region, outside of major population centres. They are thus important contributors to regional employment and economic activity.

Map 8:
South East Trawl Fishery – Location of Home Ports. *Source BRS 2002.*



Lakes Entrance is an example of a small coastal town where fishing activities are important, directly providing around 8% of employment within the town (Coakes et al. 2001).

The fishing industry provides employment not only on commercial fishing boats but also provides flow on employment for (Coakes et al. 2001):

- management of commercial fishing and ports
- transport
- engineering
- boat maintenance
- machinery and equipment supplies.

For the South East Trawl Fishery, businesses were found to spend between 21 and 35% of their annual income on costs associated with employment. Average expenditure on business goods and services was 29% of annual income (Coakes et al. 2001).

The importance of the South East Trawl Fishery to Lakes Entrance, Victoria

In 2001, 3000 tonnes of catch from the South East Trawl Fishery was landed in Lakes Entrance worth approximately $6.4 million.

Of the 93 persons directly employed in the fishery operating out of Lakes Entrance, over 90% were resident within the town. Over 41% of the total fishery income (some $2.6 million) returned to labour.

Around $2.5 million, or 28.9% of the fishing operators' gross income, was spent in Lakes Entrance on goods and services.

Source: Coakes et al. 2001.

South Australian Rock Lobster Fishery

The rock lobster fisheries of the Region are of great importance to regional economies. Not only do these fisheries create direct employment opportunities but they also create flow on employment and economic activity. For instance, it has been estimated that for each fisher active within the South Australian Southern Zone Rock Lobster Fishery, a further seven to eight jobs are created (EconSearch 2001). This is because employment is generated from supplying of fuel, boat building, insurance, processing, transport and exporting activities.

It has also been estimated that the South Australian Southern Zone Rock Lobster Fishery generated direct business income of $51.2 million in 1999-2000. As well, flow-ons to other sectors added $54.3 million locally and $37.9 million in the rest of the State. As a result, the fishery generated $143.3 million in business turnover within South Australia (EconSearch 2001). The total impact of the South Australia Southern Zone Rock Lobster Fishery is shown in Table 9.

Table 9:
Economic impacts of the SA Southern Zone Rock Lobster Fishery (1999/00).

Affect	Turnover ($m)		Employment		Household Income ($m)		Value Added ($m)	
	Local	SA	Local	SA	Local	SA	Local	SA
Direct	51.2	51.2	707	707	20.1	20.1	39.5	39.5
Indirect	54.3	92.2	476	689	12.0	19.9	28.3	46.3
Total	105.5	143.4	1183	1396	32.1	40.0	67.8	85.8
Total per Tonne	$61, 000	$83, 000	0.69	0.81	$19, 000	$23, 000	$39, 000	$50, 000

Source: Adapted from EconSearch 2001.

Conservation

Conservation is the protection, maintenance, management, ecologically sustainable use, restoration and enhancement of the natural environment (DEST 1992a). The Australian Committee for the International Union for the Conservation of Nature and Natural Resources (IUCN) expands this definition to include the understanding and enjoyment of Australia's natural and cultural heritage (AHC 1994).

For completeness, conservation is included as a 'use' in this report. As a 'use', conservation measures include marine protected areas, listing of species under environmental legislation or the application of sectorial measures to protect the environment. However, it is emphasised that:

- environmental considerations are also accounted for in other South-east Marine Region assessment reports
- the South-east Regional Marine Plan takes a holistic view of 'conservation' by couching all management recommendations within the context of ecosystem-based management and on the basis of ecologically sustainable development principles.

This section focuses on three aspects of conservation in the South-east Marine Region – marine protected areas (MPAs), threatened species and an overview of conservation measures across sectors using the Region. Non-Indigenous marine cultural heritage is covered in the *Marine heritage* section of this report and Indigenous cultural heritage is covered in the report *Sea Country – an Indigenous perspective*.

Background

Ecologically sustainable development (ESD) is a significant principle affecting management of the marine environment and marine living resources. Defined as:

… using, conserving and enhancing the communities' resources so that ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased (EA 1992).

Australia has ratified several international conventions and is committed to the protection of marine biodiversity, ecological integrity, and the sustainable use of marine resources. At a national level, the principle Commonwealth legislation relating to environmental matters is the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). An in-depth discussion on national and international oceans management regimes are discussed in the report *Oceans management – the legal framework*. A brief outline is provided below.

The EPBC Act identifies six matters of national environmental significance (NES) including World Heritage properties; wetlands of international importance (Ramsar Convention); nationally threatened species; ecological communities; nuclear actions; and Commonwealth marine areas. The objectives of the Act are many and varied and include to:

- provide for the protection of the environment
- promote ecologically sustainable development
- promote the conservation of bio-diversity
- promote a co-operative approach to the protection and management of the environment
- assist in the co-operative implementation of Australian international environmental responsibilities
- recognise the role of Indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity
- promote the use of Indigenous people's knowledge of biodiversity.

The EPBC Act also provides for environmental assessment of and approvals for actions that trigger any matters of national environmental significance.

At a policy level there has been an accelerated program of marine protection. The commitment to marine protection is reinforced through *Australia's Oceans Policy* which aims to adopt an integrated approach to the conservation of marine diversity within a multiple-use planning framework that encompasses ecologically sustainable ocean use for Australian marine waters.

In addition, each of the States in the Region has developed State-based policies to protect coastal, estuarine and marine environments. Regional coastal strategies and action plans are currently being prepared to provide a Region-wide approach to integrated coastal planning.

The exceptional species diversity, endemism, habitat types and ecosystems make this Region globally significant and an integral part of the Australian landscape and include temperate, cold temperate and sub-antarctic waters. To maintain the ecological health of the Region, a range of National and State mechanisms have been put into place to meet conservation objectives and maintain biological integrity including:

- species conservation of marine biota
- regulation and management of marine resource use
- active implementation of ecologically sustainable development
- reduction and management of pollution
- management of the impacts of marine infrastructure developments
- further development of marine protected areas and other marine managed areas
- active community participation in the decision making process.

Marine protected areas (MPAs)

MPAs have been recognised nationally and internationally as being important for marine conservation and management since the early 1960s (Kriwoken & Haward 1991). As such, they are recognised by the World Wide Fund for Nature (WWF), the IUCN and UNCEP to be an effective means for protecting marine biodiversity, resources, and the ecosystems of which they are a part.

However, while the oceans comprise 70% of the earth's surface, less than 1% of the marine environment is within protected areas, compared with 9% of the land surface (World Commission on Protected Areas 2001). These figures are reflected in Australia. Cresswell & Thomas (1997) identify that approximately 58.6 million hectares of terrestrial areas are protected (about 7.6% of the Australian mainland), and approximately 38.9 million hectares is conserved in marine protected areas – about 3.5% of Australia's EEZ.

Through *Australia's Oceans Policy* the Commonwealth Government is committed to accelerate the declaration and management of MPAs in Commonwealth waters. The Government recognises that the National Representative System of Marine Protected Areas (NRSMPA) forms part of an integrated strategy to conserve and manage the waters within Australia's marine bioregions.

Within the Region, Commonwealth MPAs have already been established at Macquarie Island and the Tasmanian Seamounts. The Commonwealth is currently assessing the conservation values of an additional two areas in the Region. The location of marine and coastal protected areas within the Region is shown in Map 9. Details of each of these protected areas are provided in Table 10.

Map 9:

Marine and coastal protected areas in the Region. *Source Larcombe et al. 2002.*

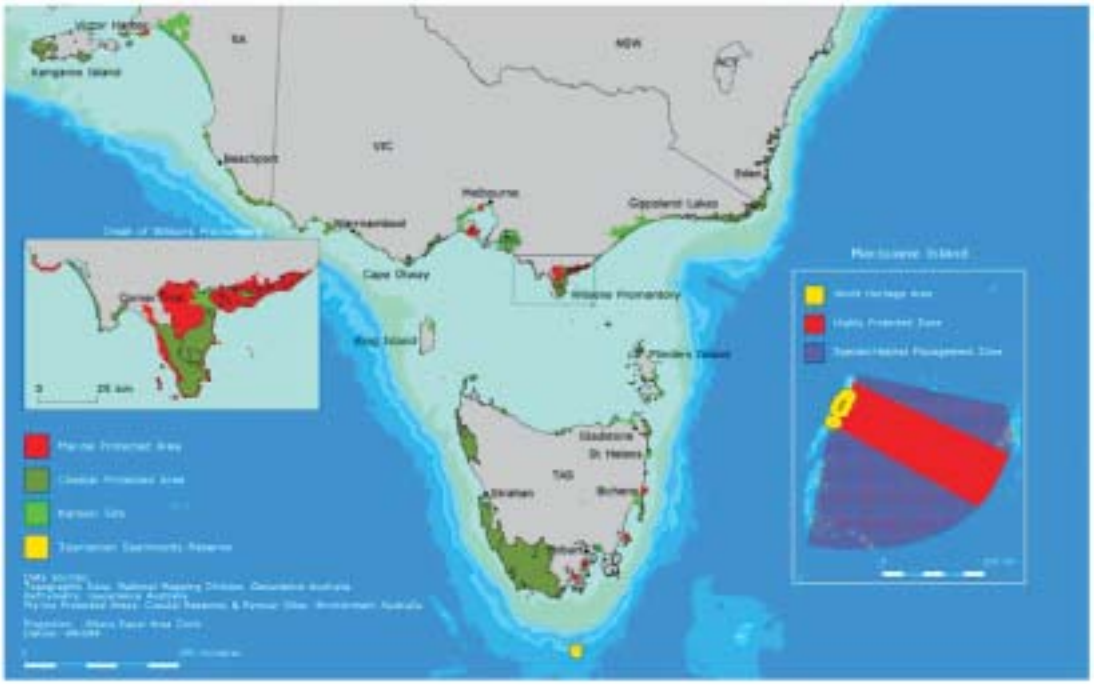


Table 10: *Marine protected areas in the South-east Marine Region.*

Jurisdiction	Marine Protected Area	Location
Commonwealth	Tasmanian Seamounts Reserve	170 km south of Tasmania in Australia's EEZ
Commonwealth and Tasmania	Macquarie Island Marine Park and Nature Reserve	1500 km southeast of Tasmania along the southeast quadrant of Macquarie Island out to the EEZ
New South Wales	Davidson Whaling Station Historic Site	35 km southeast of Eden
	Mimosa Rocks National Park	22 km northeast of Bega
	Wilsons Promontory Marine Park and Marine Reserve	Adjoins the Wilsons Promontory National Park around the southern tip of Wilsons Promontory in South Gippsland
Victoria	Shallow Inlet Marine and Coastal Park	Near Sandy Point in the Nooramunga area in South Gippsland
	Corner Inlet Marine and Coastal Park	Near Port Franklin in the Nooramunga area in South Gippsland
	Nooramunga Marine and Coastal Park	Between Port Welshpool and Port Albert in South Gippsland
	Bunurong Marine Park	6 km southwest of Inverloch in Venus Bay
	Point Cook Marine Reserve	15 km southwest of Port Melbourne in Port Phillip Bay
	Port Phillip Heads Marine Park	The area at the southern entrance of Port Phillip Bay (including the shipping channel) encompassing the existing Harold Holt Marine Park (Swan Bay, Mud Islands, Popes Eye, Point Lonsdale, Point Nepean) and narrow coastal strips immediately outside the Heads.
Tasmania	Maria Island National Park	One kilometre offshore from the northeastern point of Fossil Bay to Return Point on Maria Island
	Ninepin Point Marine Reserve	All waters within a 500 m radius of the point itself in the D'Entrecasteaux Channel
South Australia	Governor Island Marine Reserve	400 m seaward of Governor Island off Bicheno
	Tinderbox Marine Reserve	700 m southwest of Tinderbox Bay in the D'Entrecasteaux Channel
	Coorong National Park	The Coorong
	West Island Aquatic Reserve	500 m off Victor Harbour in Encounter Bay

Area	Status/Objectives of the Reserve	IUCN Category
37 000 ha	Marine Reserve established in 1999 under the *National Parks and Wildlife Conservation Act 1975* (replaced by the EPBC Act 1999)	Ia VI
16.2 million ha (incl 12,785 State Nature Reserve)	Marine Park established in 1999 under the Commonwealth *National Parks and Wildlife Conservation Act 1975* (replaced by the EPBC Act 1999)	Ia IV
27 ha	Not listed as an MPA in ANZECC 1998, however, it was established as a protected area in 1986	Not listed
5667 ha	National Park was established 1973	II
10 000 ha	Marine Park established in 1986 under the *Crown (Lands) Reserves Act 1978* as a Schedule 4 Park or Reserve	II VI
2000 ha (includes a minor land component)	Marine Park established in 1986 under the *Crown (Lands) Reserves Act 1978* as a Schedule 4 Park or Reserve	VI
18 000 ha (includes a minor land component)	Marine Park established in 1986 under the *Crown (Lands) Reserves Act 1978* as a Schedule 4 Park or Reserve; *contains a wetland of international importance (Ramsar Convention)	Not available
15 000 ha (includes a minor land component)	Marine Park established in 1986 under the *Crown (Lands) Reserves Act 1978* as a Schedule 4 Park or Reserve; *contains a wetland of international importance (Ramsar Convention)	VI
1660 ha	Marine Park established in 1991 under the *Crown (Lands) Reserves Act 1978* as a Schedule 4 Park or Reserve	VI
120 ha	Marine Reserve established in 1982 under the *Fisheries Act 1968*	VI
17 453 ha	The Harold Holt Marine Reserve (3500 ha) was established in 1979 under the *Fisheries Act 1968* at the entrance of Port Phillip Bay. * Port Phillip Bay (western shoreline) and Bellarine Peninsula contain wetlands of international importance (Ramsar Convention)	Not available
1500 ha	This National Park was established jointly under the *National Parks and Wildlife Act 1970* and the *Living Marine Resources Management Act 1995 (Tas)* in 1991	II
60 ha	This Marine Nature Reserve was established jointly under the *National Parks and Wildlife Act 1970* and the *Living Marine Resources Management Act 1995* (Tas) in 1991	IV
60 ha	This Marine Nature Reserve was established jointly under the *National Parks and Wildlife Act 1970* and the *Living Marine Resources Management Act 1995* (Tas) in 1991	IV
53 ha	This Marine Nature Reserve was established jointly under the *National Parks and Wildlife Act 1970* and the *Living Marine Resources Management Act 1995* (Tas) in 1991	IV
10 018 ha	Conservation Park established under the National Parks and Wildlife Act check; *contains a wetland of International Importance (Ramsar Convention)	Not classified yet
34 ha	This Aquatic Reserve was established in under the *State Fisheries Act 1982* in 1971	II

Management arrangements

Before 1999, Commonwealth MPAs were established and managed under the *National Parks and Wildlife Conservation Act 1975* (Cth). In July 2000 the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) replaced this Act, and the process of establishing and managing MPAs now falls under this legislation. New Commonwealth MPAs can be proclaimed in Commonwealth waters (generally those waters from three nautical miles out to the boundary of the EEZ at 200 nautical miles).

Each MPA declaration involves both Commonwealth and State governments as key players. Within some jurisdictions, local government may be involved in MPA planning and management. Management plans are developed for each proposed MPA, with specific aims and management intentions or objectives described. Management plans are developed through processes of public participation, and performance indicators are determined through this process.

Activities permitted in marine protected areas

There are no targets for MPAs to cover a certain percentage of Australia's waters, nor are there any targets for allocation of MPAs to a particular IUCN category (EA 2001d). To assist in the adequate protection of biodiversity a mix of MPAs, from highly protected to multiple use, may be assigned to achieve a range of management outcomes. The EPBC Act requires all MPAs to have a management plan and specifies certain actions that can only be carried out in accordance with a management plan, including actions affecting native species and actions for commercial purposes and mining operations.

What is allowable in a marine protected area depends on the purpose for which the area was set aside and how it is managed (EA 2001d). Sections 354 and 355 of the EPBC Act prohibit certain actions in MPAs unless authorised by a management plan. These include actions affecting native species, heritage, actions for commercial purposes and mining operations. In some cases, virtually all human activity is excluded, or fishing and removal of sea life may not be permitted. In other cases recreational and commercial activities such as fishing, tourism or exploration may occur providing the natural attributes of the MPA are not disturbed. Other areas have seasonal restrictions on activities, for example seasonal changes to shipping routes to reduce impacts on migrating whales.

Table 11:
IUCN categories and suggested allowable activities.

Activity	Strict nature Reserve	Wilderness Area	National Park	Habitat/ Species Area	Managed Resource Area
	IUCN 1a	IUCN 1b	IUCN II	IUCN IV	IUCN VI
Mining	✗	✗	✗	✗	✔
Commercial fishing	✗	✗	✗	✔	✔
Harvesting	✗	✗	✗	✔	✔
Charter fishing	✗	✗	✔	✔	✔
Recreational fishing	✗	✗	✔	✔	✔
Research monitoring	✔	✔	✔	✔	✔
Commercial tourism	✔	✔	✔	✔	✔
Commercial filming	✔	✔	✔	✔	✔

Source: EA 2001.

Note: The IUCN categories specifed in this table are not a commentary on management effectiveness and should be interpreted with flexibility at national and regional levels.

Conserving the environment remains the main objective in these multiple-use areas. Table 11 summaries the Commonwealth's view on how the relevant reserve management principles should be given effect to in regulating activities in MPAs. To date, IUCN categories III (natural monument) and V (protected landscape/seascape) have not been applied to any of Australia's MPAs and it is considered unlikely that any future Commonwealth MPAs would meet the criteria for these categories (EA 2001d).

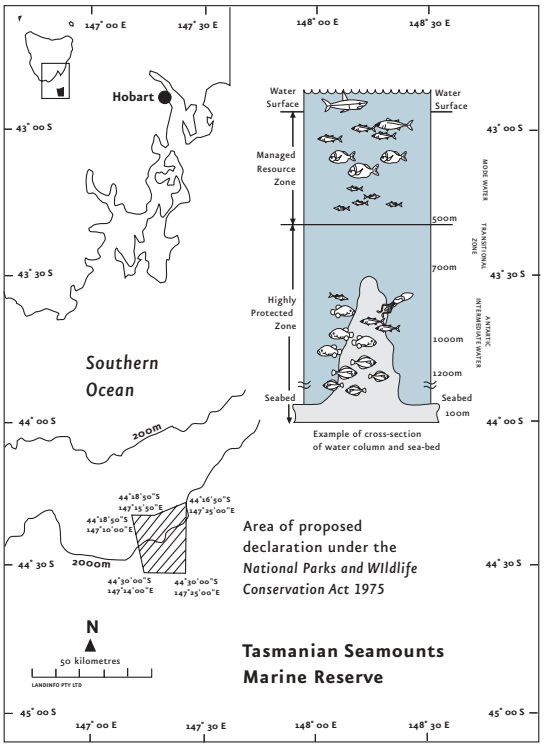
Regional offshore marine protected areas

Tasmanian Seamounts Marine Reserve

Following voluntary closure of the region by the South East Trawl Fishery operators, the Commonwealth Government, under the *National Parks and Wildlife Conservation Act 1975* (Cth), declared the Tasmanian Seamounts Marine Reserve on 16 May 1999 in recognition of their unique habitats and wildlife.

The Reserve is located 170 km south of Hobart and covers 37 000 ha (Figure 7). The proclamation of the Reserve was to protect the unique and vulnerable benthic communities of the seamounts from human-induced disturbance, and to add a representative sample of this unique seamount area to the NRSMPA.

Figure 7: *Tasmanian Seamounts Reserve.* *Source: EA.*



Given that the 70 Tasmanian seamounts and their associated biota are considered "fairly homogenous", the 15 seamounts contained within the Reserve provide a representative sample (EA 2001e).

The management plan for the Marine Reserve was released in 2001.

There are approximately 70 seamounts situated in close proximity to one another. These cone shaped remnants of extinct volcanoes are between 200-500 m high and several km across their base. They rise sharply from the sea floor at depths of 1000-2000 m beneath the sea surface and peak at depths between 660 m to 1940 m (Koslow & Gowlett-Holmes 1998). This field of seamounts is a distinctive geological feature not known elsewhere on the continental margin of Australia. They support a distinct benthic (bottom dwelling) community of animals, many of which are native to the Tasmanian seamounts and they do not occur anywhere else on earth. Research has found high proportions of species (24-43%) and at least eight genera are new to science. The species in the area appear to be representative of the seamount fauna of the seamount area.

The Reserve is divided into two vertically stratified zones. These zones include a Managed Resource Zone from the surface to a depth of 500 m and a Highly Protected Zone from a depth of 500 m below sea level to 100 mes below the seabed. Discussion on this stratification is provided in the multiple-use study at the end of this report.

Macquarie Island Marine Park

The Macquarie Island Marine Park was declared in 1999 to protect the unique and vulnerable marine ecosystems of the Macquarie Island Region, particularly:

- the migratory, feeding and breeding ranges of marine mammals and seabirds
- a number of threatened species that depend on the area
- the unique benthic habitat.

The Park is divided into two management zones. These zones include a Highly Protected Zone of 5.8 million ha (the world's largest) where fishing, petroleum and mineral exploration is prohibited; and a Species/Habitat Management Zone of 10.4 million ha on the northern and southern portions of the Park that allows for scientific research as the primary activity. The management plan for this Park was finalised in September 2001.

For more detail refer to the report *Resources – Macquarie Island's picture*.

Areas under conservation assessment

Two other areas under conservation assessment fall within the South-east Marine Region: the blue whale aggregation site on the shelf break extending between Port MacDonnell and Warrnambool, and the Bass Straight Sponge Beds in the Victorian deeper reef areas of Bass Straight (>20 m). These assessments are expected to take up to 12 months and will identify the conservation values of the areas, threatening processes impacting on these values, and issues for consideration in a potential reserve design.

A decision on whether or not to declare these areas as MPA's may be based on the outcomes of the South-east regional marine planning process, depending on the timing of the planning process.

Australian Whale Sanctuary

Under the EPBC Act, all Commonwealth waters form the Australian Whale Sanctuary. The Sanctuary has been established to give formal recognition of the high level of protection and management afforded to cetaceans (whales, dolphins and porpoises) within Australian waters.

Within the Whale Sanctuary it is an offence to kill, injure, take, trade, keep, move, interfere with or treat a cetacean, except under certain circumstances. Exceptions include situations where:

- the action is authorised by a permit (although permits cannot be issued to kill whales or to take them for live displays)
- the action is provided for in, and undertaken in accordance with, a recovery plan for the species
- there is an emergency involving either a serious threat to human life or property
- the action is reasonably necessary to relieve, or prevent, suffering of the animal.

Australia is also committed to achieving a permanent international ban on commercial whaling and establishing a global whale sanctuary. To establish the sanctuary, Australia is seeking international support from the IWC given its moratorium on commercial whaling in 1986. As part of this objective, Australia is actively pursuing the establishment of a South Pacific Whale Sanctuary with New Zealand and French Polynesia (EA 2001b). This Sanctuary would compliment the exiting Southern Ocean and Indian Ocean Sanctuaries to ensure that Southern Hemisphere whales (as well as dolphins and other marine mammals) are protected in their South Pacific breeding grounds, as well as the waters of the South-east Marine Region as they migrate to their feeding grounds in the Southern Ocean.

State Marine Protected Areas

The States are contributing to the NRSMPA through the assessment of candidate sites for marine protected areas, management of existing marine parks and other marine reserves, and proposals for additional MPAs.

In NSW, marine protected areas were initially established under the NSW Fisheries and Oyster Farms Act 1935 as Aquatic Reserves and Intertidal Protected Areas. Marine reserve provisions, including a new provision for MPAs, are now included in the NSW *Marine Parks Act 1997*. Under the new Act, MPAs are under the control of a Marine Parks Authority, jointly serviced by the NSW Fisheries and National Parks and Wildlife Services. There are currently three marine parks and 35 national parks or nature reserves dedicated or reserved under the National Parks and Wildlife Act. Eight aquatic reserves have been declared in NSW that are managed by NSW Fisheries. In the South-east Marine Region, less than 10% of the Twofold Shelf IMCRA bioregion is protected within a MPA (ANZECC 1999).

In South Australia, the Department for Environment, Heritage and Aboriginal Affairs and the Department of Primary Industries and Resources both have the ability to create MPAs with existing legislation and they may

be declared under the SA *National Parks and Wildlife Act 1972* or SA *State Fisheries Act 1982*. In addition, marine areas may be protected under the *Historic Shipwrecks Act 1981* (SA) for the purpose of protecting shipwrecks. South Australia has only the Coorong National Park situated in the South-east Marine Region. Less than 0.01% of waters in the South-east Marine Region are protected by South Australian MPAs, and no protection is provided in the Otway IMCRA bioregion that extends into Victorian and Tasmanian waters (Baker 2000). However, the South Australian Government is in the process of considering candidate areas for multiple-use marine parks, including no-take zones, across the State. As part of this initiative, the Government has recently announced a pilot Marine Protected Area in the Backstairs Passage to the Murray Mouth during 2002.

Tasmania has declared five marine reserves under the *National Parks and Wildlife Act 1970* (Tas). The fish within these reserves are protected under the *Living Marine Resources Act 1995* (Tas). Over 3% of State waters are categorised as Marine Nature Reserves and Marine National Parks (ANZECC 1999). In addition, progress is being made on investigating a marine reserve within Port Davey. The Tasmanian Government released the *Tasmanian Marine Protected Area Strategy* in 2001 to establish and manage these areas, contribute to long term ecological viability of marine and estuarine systems, maintain ecological processes and systems, and protect Tasmania's biodiversity (DPIWE 2001). Less than 10% of the Bruny, Freycinet and, extending up into Victorian waters, Flinders IMCRA bioregions are protected within MPAs (ANZECC 1999).

The Victorian Environment Conservation Council (ECC), under the *Environment Conservation Council Act 1997* (Vic), has powers to undertake studies and to make recommendations to the Minister with regard to environmental protection of Victorian waters. Any recommendations must be implemented under the *Reference Areas Act 1978* (VIC), *National Parks Act 1975* (VIC), *Fisheries Act 1995* (VIC) or the *Crown Lands (Reserves) Act 1978* (VIC). Victoria currently has 13 MPAs, although the ECC has recommended a review of all marine protected areas and has recommended a holistic system comprising of 12 marine parks and 10 marine sanctuaries, five Marine Conservation Areas and 15 Marine Special Management Areas for inclusion in the NRSMPA. If they are established, these protected areas will increase the area of highly protected conservation reserves from 0.05% to 5.2% of Victoria's marine environment (NRE 2001). At present, 10 to less than 50% of the Victorian embayments and between 0 to 10% of the Central Victoria IMCRA bioregions are protected within MPAs (ANZECC 1999).

Ramsar Wetlands

In 1971 representatives of 18 countries, including Australia, met in Ramsar, Iran, and agreed on the Convention on Wetlands of International Importance (the Ramsar Convention). This Convention recognises the value of wetlands, particularly as waterbird habitat, and aims to protect these areas. Under Article 1.1 a wetland is defined as:

> ... areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres (EA 2001a).

In Australia, the Ramsar Convention is implemented under the EPBC Act and State and Territory legislation. This is achieved primarily under the auspices of the Natural Resource Management Council which replaced ANZECC in 2001. Marine and coastal zone wetlands may include rare or unique wetlands, and was replaced by biodiversity, rare plants or animals, waterfowl, native fish species or critical habitats.

Australia has designated more than 56 wetlands under Ramsar and 18 of these wetlands are located on or near the coast in the South-east Marine Region (see Table 12), including the recently recognised Edithvale-Seaford Wetlands in Melbourne. In addition, 698 wetlands have qualified as being nationally significant (EA 2001a).

These wetlands include:

- marine waters – permanent shallow waters less than 6 m deep at low tide
- sub-tidal aquatic beds including kelp beds and seagrasses
- coral reefs
- rocky marine shores including rocky offshore islands and sea cliffs
- sand, shingle or pebble beaches including sandbars, spits and sandy inlets.

Table 12:
Ramsar classified wetlands in the South-east Marine Region.

Name	Location	Area (ha)	Placed on List	Ramsar Criteria
Northwestern Corner of Lake Crescent	TAS	470	1982	2
Pittwater-Orielton Lagoon	TAS	2920	1982	2, 3
Moulting Lagoon	TAS	4580	1982	1, 2, 3
Flood Plain Lower Ringarooma River	TAS	4160	1982	2
Apsley Marshes	TAS	940	1982	2
Jocks Lagoon	TAS	70	1982	2
East-Coast Cape Barren Island Lagoon	TAS	4230	1982	2
Logan Lagoon Conservation Area	TAS	2320	1982	1, 2, 3
Little Waterhouse Lagoon	TAS	90	1982	1, 2
Lavinia Nature Reserve	TAS	6904		2
Corner Inlet	VIC	51 500	1982	1, 2, 3
Port Phillip Bay (Western Shoreline) & Bellarine Peninsula	VIC	7000	1982	1, 2, 3
Edithvale-Seaford	VIC	261	2001	1, 2
Sea Elephant Conservation Area	VIC	1730	1982	
Gippsland Lakes	VIC	43 046	1982	1, 3
Western Port	VIC	52 325	1982	1, 3
Western District Lakes	VIC	30 182	1982	1, 3
Bool and Hacks Lagoon	SA	3200	1985	1, 2, 3
Coorong and Lake's Alexandra and Albert	SA	140 500	1985	1, 2, 3, 4, 5, 6

Source: ECC 1999, NRE 2001.

Threatened marine species

The Australian marine environment is home to a wide diversity of flora and fauna. The fish and fauna of temperate Australia consists of around 5500 to 6000 species, about 85% of which are endemic to southeast Australia. Many marine animals (whales, dolphins, seals, and sea lions) also either visit or live within the Region. The South-east Marine Region is also home to numerous migratory seabirds with more than 20 species breeding in the Region and many more foraging or migrating through the Region. Many of these species are considered to be of conservation significance and are protected under either Commonwealth or State legislation.

Threatened species and ecological communities are those native species or ecological communities whose survival has been assessed as being under threat (Natural Heritage Trust 2001). Although no marine ecological communities are currently listed under Commonwealth legislation, a number of species that live in, or visit the Region, are listed as 'threatened' or of conservation significance. For example, albatrosses and giant petrels, which inhabit or pass through the Region, are listed as being under threat for a range of reasons and all whales and dolphins are also protected under Commonwealth legislation.

The report *Ecosystems – nature's diversity* lists 120 species of conservation significance (listed under either Commonwealth or State legislation) which occur within the Region and provides ecological profiles for these species. The Commonwealth legislation underpinning the management of threatened species within the Region can be found in the report *Oceans management – the legal framework*.

International recognition

A number of species that breed or pass through the South-east Marine Region are under local or global threat according to Commonwealth/State legislation and/or IUCN Red List Criteria.

What is the IUCN Red List of endangered species?

The 2000 IUCN Red List is the world's most comprehensive inventory of the global conservation status of plant and animal species. It uses a set of criteria to evaluate the extinction risk of thousands of species and subspecies. These criteria are relevant to all species and all regions of the world. With its strong scientific base, the IUCN Red List is recognised as the most authoritative guide to the status of biological diversity.

The overall aim of the Red List is to convey the urgency and scale of conservation problems to the public and policy makers, and to motivate the global community to try to reduce species extinctions.

Australia can also nominate species threatened with extinction under the *Convention on International Trade in Endangered Species of Wild Fauna and Flora 1973* (CITES). A State Party first nominates species that are then accepted by the Conference of Parties, as such the species listed are mainly those that do not have major commercial value. While CITES has been applied to a wide range of species, a large number of high value commercial migratory marine fish, including southern bluefin tuna and a number of shark species, have not been listed despite these species meeting the criteria for protection under this Convention (Cox et al. 1999).

Commonwealth threatened species conservation

The Commonwealth's approach to protecting biodiversity and conserving threatened species has been built around identifying key threatened species, processes and critical habitats; preparing recovery, threat abatement, and wildlife conservation plans; developing conservation agreements; the issuing of conservation orders; and the development of a system of marine protected areas.

Threatened species and ecological communities are protected at the national level under the EPBC Act 1999. When the Act was launched the national list of threatened species, ecological communities and threatening processes consisted of only those previously listed under the repealed *Endangered Species Protection Act 1992*. Under the EPBC Act the new categories of

'critically endangered', 'conservation dependent' and 'extinct in the wild' have been added to the initial categories of 'endangered', 'vulnerable' and 'extinct'. For ecological communities, the categories have expanded to include 'critically endangered' and 'vulnerable'.

The Commonwealth has established the Endangered Species Program with the goal of protecting and conserving Australia's native species and ecological communities. A feature of the program is that it identifies the need for addressing key threatening processes. Under the EPBC Act the nomination of a listed key threatening process is one which "threatens, or may threaten, the survival, abundance or evolutionary development of a native species or ecological community". The Commonwealth currently lists 11 key threatening processes. Some of these threatening processes occurring within the Region include:

- loss of climatic habitat caused by anthropogenic emissions of greenhouse gases
- land clearance
- incidental catch (or bycatch) of seabirds during oceanic longline fishing operations
- incidental catch (or bycatch) of non-targeted catch including by-product, discards and other species interacting with fishing gear
- introduction of exotic organisms into Australian marine waters.

Marine debris has also been nominated as a key threatening process. This nomination quotes a number of examples of entanglement in, and ingestion of marine debris, by marine wildlife. It calls for the development of a National Threat Abatement Plan (AFMA 2001b).

Threat abatement plans

The assessment of a key threatening process is the first step to addressing the impact of a particular threat under Commonwealth law. Once a threatening process is listed under the EPBC Act a threat abatement plan can be put into place if it is proven to be "a feasible, effective and efficient way" to abate the threatening process.

Threat abatement plans provide for the research, management, and action necessary to reduce the impact of a listed key threatening process on a threatened species or ecological community. Implementing a threat abatement plan should assist the long-term survival in the wild of the threatened species or ecological community. For example, after pelagic longlining was listed in 1996 as a key threatening process under the repealed *Endangered Species Protection Act 1992* (Cth), it was then obligatory to develop a threat abatement plan. This plan was released in 1998 and is the only threat abatement plan relevant to the South-east Marine Region.

Threat abatement plan for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations

The incidental catch (or bycatch) of seabirds during oceanic longline fishing operations is listed as a key threatening process under the EPBC Act 1999. A threat abatement plan was prepared to reduce sea-bird bycatch and to meet the requirements of the Act (EA 1998b). The Plan was developed in consultation with the pelagic longline fishing industry, non-government conservation groups, scientists and governmental authorities.

The objective of this Plan is to reduce seabird bycatch in all fishing areas, seasons or fisheries to below 0.05 seabirds per thousand hooks, based on current fishing levels (EA 1998b). This represents a reduction of up to 90% of seabird bycatch within the Australian Fishing Zone. The plan:

- prescribes appropriate modifications to fishing practices or equipment
- provides for development of new mitigation measures
- educates fishers and the public
- collects information necessary to improve knowledge of seabird-longline fishery interactions.

The ultimate aim of this plan is to achieve a zero bycatch of seabirds, especially threatened albatross and petrel species, in longline fisheries. However, the plan recognises that using currently available mitigation methods, it is not possible to achieve this goal in the short term.

Recovery plans

Recovery plans aim to maximise the long-term survival in the wild of threatened species or ecological communities. They set out the research and management actions necessary to stop the decline of, and support the recovery of, those species and communities. The Minister for the Environment and Heritage may make and implement recovery plans for threatened species (other than conservation dependent species) and threatened ecological communities listed under the EPBC Act. A Commonwealth agency must not take any action that contravenes a recovery plan once they have been adapted. They remain in force until the species has been removed from the threatened species list. The Commonwealth has developed six draft recovery plans relevant to the South-east Marine Region for:

- blue whales
- southern right whales
- marine turtles
- great white sharks
- grey nurse sharks
- albatrosses and giant petrels.

Action plans and wildlife conservation plans

Since the start of the Endangered Species Program in 1989, the Commonwealth has produced action plans and wildlife conservation plans. These strategic documents review the status of a defined group of related organisms (eg birds and fish). They review the conservation status of major Australian taxonomic groups against IUCN categories, identify threats and recommend actions to minimise those threats. Action plans assist government and non-government organisations to establish national priorities for threatened species conservation. An action plan for marine fish is currently in preparation as are conservation overviews for marine invertebrates and algae.

Action plans aimed at protecting species in the South-east Marine Region are for Australian cetaceans, seals and birds. Wildlife conservation plans within the South-east Marine Region are for Macquarie Island and the Southern Ocean.

Permits

A person may apply to the Minister for a permit to be issued under the EPBC Act. Such a permit is required for killing, injuring, taking or trading a member of a listed threatened species or community in a Commonwealth area. A permit may not be obtained for killing, injuring, taking or trading a listed threatened species that is a cetacean.

Such permits are not issued unless the Minister is satisfied of several considerations, for example, that the specified action will not contribute significantly to the conservation of the listed threatened species or listed threatened ecological community.

Listed marine species that may be found in the South-east Marine Region are:

- seals – eared and 'true'
- marine turtles
- seahorses, sea-dragons and pipefish (including the ghost pipefish)
- birds that naturally occur in Commonwealth marine areas.

Environmental assessment

Several Commonwealth and State legislative mechanisms require an environmental assessment before begining projects, developments, or activities in environmental areas. These are discussed under the heading *Sectoral measures*.

Sectoral measures

Conservation measures across other sectors are driven by three broad areas:

- environmental assessment and protection under environmental legislation
- resource agency specific measures
- industry driven initiatives.

In addition, legislation, policy development and implementation and initiatives by industry are all influenced by changes in public attitude.

Although different sectors in the Region incorporate ecologically sustainable development (ESD) principles into industry strategies and codes of conducts, they hold varying standpoints regarding the purpose of conservation. For example, different sectors hold a number of views with regard to the purpose, strategy, location and effectiveness of MPAs.

The fishing industry is concerned that a national representative system of marine protected areas (NRSMPA) will restrict their access to resources (Baker 2000).

The petroleum industry holds similar concerns about restricting access to resources, particularly as the classification system used for marine protected areas as laid down by the International Union for the Conservation of Nature (IUCN) treats petroleum and mineral extraction identically (category of mining) implying they have similar effects. It also treats mining as the most restricted industry (only one category out of seven permits mining). Accordingly, there is no provision for banning other industries while allowing petroleum extraction. The petroleum industry regards this treatment as not supported by the scientific evidence of the relative environmental impacts of petroleum extraction compared to other industries.

Conservationists are concerned that multiple-use MPAs will not provide adequate protection of marine ecosystems and biota if extractive industries are permitted (Killingbeck 2001). Indigenous peoples are concerned that the bioregional focus of the NRSMPA may ignore human interests in, and use of, marine environments (Roberts & Tanna 1999). They argue that this system makes no provision for Indigenous people to access and use marine resources in those areas.

Commonwealth fisheries

International initiatives

The entry into force of the United Nations Convention on the Law of the Sea (LOSC), to which Australia is a Party, obligates the Commonwealth Government to manage the conservation and use of living resources within the Exclusive Economic Zone (EEZ). Under the LOSC, each country is responsible for the sustainable management of fisheries within their 200 nautical mile EEZ. Australia's obligations under the LOSC have demonstrated the need to develop more strategic approaches to environmental management if fishing is to be ecologically sustainable.

The UN *Convention for the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks* implements provisions of the LOSC relating to the conservation and the enforcement of regulations of highly migratory and straddling fish stocks. This Convention came into force in December 2001 and has direct implications for the management of Australia's tuna fisheries and the South Tasman Rise Trawl Fishery for orange roughy and oreo dories.

The Food and Agriculture Organisation (of the United Nations) has developed a voluntary Code of Conduct for Responsible Fishing 1995 that is directed both globally and regionally. The Code establishes principles for responsible fishing and fisheries taking into account all their relevant "biological, technological, economic, social, environmental and commercial aspects" (Tsamenyi & McIlgorm 1999). Practical implications for this code include maintaining biodiversity, implementing a precautionary approach and facilitating sustained recovery of depleted resources.

The Marine Stewardship Council (MSC), an independent, global, non-profit organisation based in London, offers a range of eco-labelling initiatives and promotes marine conservation by developing responsible, environmentally, socially beneficial and economically viable fishing practises by harnessing market forces and consumer power in favour of sustainable fisheries. No fisheries in the Region have yet had MSC certification.

Commonwealth initiatives

The *Fisheries Administration Act 1991* (Cth) and the *Fisheries Management Act 1991* (Cth) are the primary pieces of legislation for the Commonwealth administration and management of fisheries. Both apply the precautionary principle with an increased focus on ecosystem rather than a species-based approach. AFMA aims to manage for sustainable fisheries for the benefit of all users and interest groups both now and in the future (AFMA 2001a). This requires that fishing does not threaten biological diversity and the environment can sustain the activities being carried out. In support of this direction, target and by-product species are managed through formal arrangements such as fishery-specific management plans. The Commonwealth also encourages research into environmentally friendly fishing practices, and technological improvements to fishing gear and methods (CoA 2000).

In 1992 the Bureau of Rural Sciences began producing annual Fishery Status Reports for Commonwealth-managed fish stocks. These reports form part of an independent assessment of the performance of Commonwealth fisheries management under AFMA. They are based on the most recent assessments carried out by a range of research agencies, including State agencies, CSIRO and other stakeholders. The individual reports incorporate an evaluation of Commonwealth fisheries management as it is a role of government to assess the Authority's performance on behalf of the owners of the resource – the public.

An issue of increasing concern for fisheries has been the take of non-target species in fishing (both commercial and recreational) – an issue known as bycatch. To address this issue, a cooperative approach between governments was developed between the Commonwealth and the States. The resulting *National Policy on Fisheries Bycatch 2000* has the objective of ensuring that fisheries are ecologically sustainable, at least with respect to bycatch (CoA 2000). This policy defines bycatch as:

- that part of a fisher's catch which is returned to the sea either because it has no commercial value or regulations preclude it being retained
- that part of the catch that does not reach the deck of the fishing vessel but is affected by interaction with the fishing gear.

The policy also recognises that bycatch issues are often across jurisdictions and fisheries and therefore close cooperation between stakeholders is required if bycatch can be pursued to ensure ecologically sustainable fisheries.

The Commonwealth Bycatch Policy addresses the issues in the *National Bycatch Policy* from a Commonwealth perspective. This policy sets up the requirement for Bycatch Action Plans to be developed for each major Commonwealth fishery by 2001. Under these plans and in some cases before the plan's existence, fisheries' protection measures are being achieved through bycatch reduction, improved protection for vulnerable/threatened species and minimising adverse impacts of fishing on the marine environment (CoA 2000). Bycatch action plans for fisheries in the Region include those for the South East Trawl Fishery, Southern Shark/South East Non-Trawl Fisheries, Bass Strait Central Zone Scallop Fishery, Southern Squid Jig Fishery, Sub-Antarctic Fisheries and the Tuna Fisheries.

Some of the conservation measures in place for Commonwealth fisheries are requirements under environmental legislation. Such measures may subsequently be put in place under general fisheries regulation or management arrangements. For instance, the incidental catch of seabirds during oceanic longline fishing operations was recognised as a key threatening process on Schedule 3 of the repealed *Endangered Species Protection Act 1982* (now listed under the EPBC Act). Measures in the threat abatement plan to address this incidental catch have been translated into fisheries management arrangements across Commonwealth oceanic longline fisheries.

Other environment measures specific to the EPBC Act include:

- Commonwealth-managed fisheries are obliged to undergo strategic assessment under Part 10 of the EPBC Act 1999 (although State fisheries can also undergo the same assessment if the relevant State Minister requests it)
- all fisheries with an export component must undergo assessment under Part 13A of the EPBC Act 1999 to determine whether the fishery is ecologically sustainable and therefore whether the species taken in the fishery are exempt from the export controls of the Act (with review of that exemption in five years), or are under the export controls of the Act (either with exports permitted for up to three years or exports prohibited)
- any fisheries having or likely to have an impact on threatened species, migratory species, cetaceans or listed marine species (as specified in the Act) require either assessment, or individual operators must obtain a permit under Part 13.

To satisfy the Commonwealth Government requirements under the EPBC Act for a demonstrably ecologically sustainable fishery, the fishery (or fisheries if a species is caught in more than one fishery) must operate under a management regime that meets the following principles (EA 2001c):

- **Principle 1** – a fishery must be conducted in a manner that does not lead to over-fishing, or for those stocks that are overfished, the fishery must be conducted such that there is a high degree of probability the stock(s) will recover.
- **Principle 2** – fishing operations should be managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem.[2]

The requirement for the strategic assessment of Commonwealth fisheries and the guidelines by which ecological assessment is to be undertaken is discussed more fully in the report *Oceans management – the legal framework*.

Fishing industry initiatives

The fishing industry itself acknowledges that the right to use the marine resource for commercial purposes carries with it obligations to do so in a responsible manner. The primary vehicle for industry self-regulation of environmental issues is through codes of conduct or similar codes.

One code introduced for the South-east Marine Region was the Code of Conduct for Responsible Fishing developed for the South East Trawl Fishery. The code was developed by the South East Trawl Fishing Industry Association (SETFIA 2000) to ensure the sustainability of fish resources. The code provides a strategy for:

> responsible fishing and fishing activities, taking into account all their relevant biological, technological, social, economic, environmental and commercial aspects.

The South East Non-Trawl Association (SENTA) has also subsequently developed a Code of Conduct for Responsible Fishing for the South East Non-Trawl Fishery with the objectives of encouraging collaboration between the industry and other stakeholders having an interest in the conservation and management of fish resources. This Code has been developed in response to the global fishing industry and international environmental instruments. The industry has also produced a handbook for fishers in non-trawl industries to provide a practical guide on how to reduce bycatch and solve bycatch problems.

The Southern Shark Fishery is currently drafting its own Code of Conduct and the Australian Seafood Industry Council (ASIC) has developed A Code of Conduct for a Responsible Seafood Industry (CCRSI). The code sets out standards of behaviour to ensure the effective conservation of marine ecosystems and biodiversity, and the management and development of living aquatic resources (ASIC 1998). This Council represents commercial fishing, aquaculture and aspects of the post harvest sectors of the Australian Seafood Industry on national issues.

[2] The issues addressed under the principle are those that define components of ecosystem integrity.

Recreational fishing

Government

Recognition by recreational fishing associations and industry of the need for more sustainable fishing practises led to the Commonwealth Government's 1994 *National Recreational Fishing Policy*. The Policy aims to provide a framework for the future development of recreational and sport fishing whilst maintaining fish stocks for present and future generations. These aims are being achieved through the development of partnerships between all stakeholders to conserve, restore and enhance the values of the industry (NRFWG1994).

Day-to-day management of recreational and charter fishing is undertaken by State Governments. The management measures for recreational fishing, include bag possession limits, size limits, gear restrictions, seasonal closures and area closures.

All have some conservation management component, either for the target species, bycatch species or the supporting environment. These measures are implemented by all of the State Governments across the Region (Table 13).

The Fisheries Action Program is a component of the Natural Heritage Trust and aims to help rebuild Australia's fisheries, both commercial and recreational, to more productive and sustainable levels. The Program seeks to encourage community participation in, and awareness of, fisheries issues. The program aims to achieve an 'appreciable difference' in four key areas. Two of these areas specifically relate to conservation measures:

- environment – biodiversity conservation and improved long-term protection and management of environmental resources
- sustainable production – maintenance of and improvement to the sustainable productive capacity of the environmental and natural resource base of Australia.

Recreational fishing clubs and others who participate in recreational fishing have taken part in the program in order to improve the environment in which they fish.

Table 13:
Recreational fishing management strategies.

Jurisdiction	Management Strategy	Agency or Association
Commonwealth	*National Recreational Fishing Policy 1994*	Commonwealth of Australia
	National Code of Practice for Recreational and Sport Fishers	Recfish Australia
	RecFish National Environmental Strategy (2001)	Recfish Australia
	Sport, Conservation and Integrity: Code Of Ethics	Australian National Sportfishing Association
	Angling Rules and Equipment Regulation: Ethical practices for salt and freshwater species	Game Fishing Association of Australia
South Australia	A Management Strategy for the Sustainable Development of Recreational Fishing in South Australia 2001	South Australian Primary Industry and Resources
	Code of Practice for Recreational Fishers	South Australian Primary Industry and Resources
	Recreational Fishing Guide 2001	South Australian Primary Industry and Resources
Tasmania	A Code on Sea Fishing for the Future (1995)	Department of Primary Industries, Water and Environment
	Net Smarter: A guide to responsible, safe and sustainable recreational netting practises (2000)	Department of Primary Industries, Water and Environment
Victoria	Recreational Fishing Guide (includes some non-regulatory information)	Department of Natural Resources and Environment

Recreational fishing associations initiatives

Both national and state recreational fishing bodies have developed environmental strategies and codes of practice for fisheries and marine areas. For example, RecFish Australia has developed a National Code of Practice for Recreational and Sport Fishing and agreed upon a national standard for recreational fishing.

The National Code of Practice for Recreational and Sport Fishing

The National Code of Practice for Recreational and Sport Fishing 2001 is a voluntary agreement among Recfish Australia's fourteen national and state fishing member associations. These associations represent a diverse range of recreational and sport fishing practices including inland and saltwater fishing, rock and game fishing, and diving.

The Code of Practice addresses four main areas of fishing responsibility:

- looking after fisheries – by taking no more than what is needed, understanding and observing all fishing regulations, reporting illegal activities and supporting activities that restore and enhance fisheries and fish habitats
- protecting the environment – by preventing pollution and protecting wildlife by removing rubbish, avoiding damage to sensitive sites, using established roads and tracks, reporting environmental damage, and avoiding interactions with threatened species or their habitat
- treating fish humanely – by quickly and correctly returning unwanted or illegal catch to the water, and using only legal tackle
- respecting the rights of others - by practicing courtesy towards all those using coastal waters, obtaining permission from landholders and traditional owners, and caring for personal safety and the safety of others.

Source: Recfish Australia 2001.

Similar codes of practice exist at the national and state recreational fishing body level. For instance, both the Game Fishing Association of Australia and the Australian National Sportfishing Association have codes of practice. In addition, State governments also have codes of practice in place to compliment regulations. Examples are the Tasmanian Government's Code of Conduct for Responsible Fishing and the South Australian Government's Code of Practice for Recreational Fishers.

Offshore petroleum

International obligations

The offshore petroleum industry must comply with international laws and treaties such as the guidelines developed under *International Convention for the Prevention of Pollution from Ships* (MARPOL) 1973/78, LOSC and the London Convention of 1972. The International Maritime Organisation's Intervention Convention affirms the right of Australia to take measures on the high seas to prevent, mitigate or eliminate danger to its coastline from a maritime casualty. In addition, the *International Convention on Oil Pollution Preparedness, Response and Cooperation* (OPRC) 1990 provides a global framework for international cooperation in combating major incidents or threats of marine pollution. A protocol to this convention (HNS Protocol) covers marine pollution by hazardous and noxious substances including oil spills. In addition, petroleum activities need to consider Australia's obligations under the Ramsar, JAMBA and CAMBA Conventions with regard to the protection of migratory birds and their environments.

Commonwealth initiatives

Offshore petroleum legislation is implemented by Australian Governments to regulate activities associated with exploration and production. This legislation aims to provide a regulatory framework for the exploration and extraction of petroleum resources in a safe and environmentally responsible manner. State Governments own and administer petroleum rights over land and coastal waters to three nautical miles. The

Commonwealth has jurisdiction for the regulation of offshore petroleum activities beyond State coastal waters. The key law for management of offshore activities is the *Petroleum (Submerged Lands) Act 1967* (Cth) and its associated regulations and guidelines. In particular, the Petroleum (Submerged Lands) (Management of Environment) regulations 1999 manage the day-to-day environmental requirements of the industry to ensure the conservation of the resources of the sea and sea-bed whilst allowing petroleum activities to take place. Key objectives of the regulations include adopting best practice environment protection standards and ensuring operations are carried out in a way that is consistent with ESD principles.

Controls are placed on all aspects of offshore operations, and licences that define limits are required for various discharges. Strict limits are imposed on discharges to the air and marine waters. The management of environmental impacts in offshore petroleum exploration is primarily delivered through Environmental Management Plans under Section 9 of the Petroleum (Submerged Lands) (Management of Environment) Regulations 1999.

The objective of these Regulations (as specified in Clause 3 of the Regulations) is to ensure that any petroleum activity in an adjacent area is carried out in a way that is consistent with the principles of ecologically sustainable development. The environmental plan should incorporate appropriate environmental performance objectives, standards and contingency plans, implementation strategies, and a risk analysis, as well as measurement criteria for determining whether the objectives and standards, contingency plans are met. In addition, the plan should be presented in an objective form based on co-regulation between government regulators and offshore petroleum industry operators (DISR1999).

There is also the provision under the *Petroleum (Submerged Lands) Act 1967* (Cth) to place conditions on permits. These conditions are specific to individual permits. In some cases these conditions relate to environmental conditions.

Examples of permits

Seismic exploration

Strike Oil, operators of the Vic/P44 exploration permit have tailored their collection of geophysical data through seismic exploration activities to avoid the blue and southern right whale feeding and breeding periods off the Warrnambool/Port Campbell coast. As a consequence, exploration should proceed without disturbance to blue whales that are feeding before commencing migration, and southern right whale cows can give birth and rear young off Logan's Beach at Warrnambool, which is a major tourist attraction.

Exploration drilling

Exploration in the Otway Basin offshore from Port Campbell by Woodside Energy on behalf of the joint venture operators of exploration permits Vic/P43 and T/30P has been specifically designed to avoid impacts on whales. A whale observation program has been put in place to ensure that any drilling will not take place while pygmy blue whales are believed to be in the area of the drilling locations. An environmental research program by the joint venture partners in the Otway Basin is studying the distribution and abundance of blue whales and krill in the eastern Otway area, as well as background ambient noise and noise levels during drilling and other marine operations, such as shipping.

Source: Woodside Australian Energy 2001.

In addition, some offshore petroleum exploration can trigger significance criteria associated with areas of national environmental significance listed in the EPBC Act 1999, including Commonwealth marine areas, threatened species and ecological communities, and migratory birds. While the EPBC Act may prevent an action occurring or require the placement of conditions on it, the Act does not replace the need for a cleared action to have an environment plan approved under the Petroleum (Submerged Land) (Management of Environment) Regulations before it can proceed.

Concerns over the interactions between seismic surveys and marine mammals has led to the development of the Guidelines on the Application of the Environment Protection and Biodiversity Conservation Act to Interactions between Offshore Seismic Operations and Larger Cetaceans. These guidelines were developed to assist offshore seismic operators address some of their obligations under the EPBC Act relevant to interactions with whales or large cetaceans. The guidelines have been developed with input from the scientific community, conservation groups concerned with large whales and the petroleum industry [the Australian Petroleum Production and Exploration Association (APPEA) and the Australasia Chapter of the International Association of Geophysical Contractors (IAGC)].

The Australian Petroleum Production and Exploration Association Environmental Policy

APPEA represents the interests of most key companies involved in oil and gas exploration and production in Australia. The Association supports ecologically sustainable development and recognises excellent environmental performance. It aims at achieving a "legislative, administrative, economic and social framework which efficiently and effectively facilitates safe, environmentally responsible, socially responsible and profitable oil and gas exploration, development and production" (APPEA 2001). Conserving biological diversity, maintaining ecological processes and systems and promoting ecologically sustainable development are among the core objectives of APPEA and the petroleum industry. As such, the Association has developed an Environmental Policy and a Code of Environmental Practise (APPEA 1996) with the aim of achieving responsible development of petroleum resources from offshore areas.

The Australian Petroleum Production and Exploration Association (APPEA) has over 50 full members including BHP Petroleum Pty Ltd, Esso Australia Ltd and Santos Ltd. The Association actively supports member companies to:

- comply, at a minimum, with applicable laws, regulations, standards and guideline for the protection of the environment and in their absence adopt the best practicable means to prevent or minimise adverse environmental impacts
- work and consult with appropriate government agencies drafting policies laws, regulations or procedures to protect the environment
- ensure that adequate waste management practices are carried out based on the prevention, minimisation, recycling, treatment and disposal of wastes
- provide adequate training to enable employees and contractors to adopt environmentally responsible work practices and to be aware of their stewardship responsibilities
- promote research to conserve resources, minimise wastes, improve understanding of risks and impacts and to cost effectively minimise these to improve environmental protection
- develop emergency plans and procedures so that incidents can be responded to in a timely and effective manner
- develop and maintain management systems to identify, control and monitor risks and compliance with government regulations and industry guidelines
- monitor environmental effects and assess environmental performance at all stages of exploration, development, production and rehabilitation
- communicate openly with government, non-government bodies and the public in a timely manner on environmental issues which relate to the industry's operations.

Source: APPEA 1997.

Industry initiatives

Dealing with risk is an important component of environmental management in the offshore petroleum industry. Of particular focus is the potential environmental impact of oil spills and the use of acoustic devices used in offshore seismic survey work. International and national research organisations and the petroleum industry have completed a number of studies into the environmental impacts of offshore petroleum activities, particularly in relation to marine mammals, penguins and birds.

In addition, offshore petroleum companies support best practice environmental management, comply to international standards including the ISO 14000 series and contribute to a wide range of environmental programs. For example, BHP Billiton's Charter (2001) states that the company has "an overriding commitment to safety, environmental responsibility and sustainable development". In an effort to improve its environmental performance BHP (now BHP Billiton) openly acknowledges in the *Environment and Community Report 2000* (BHP 2000a , p.1) that:

> Some aspects of our past performance have not always matched our values. We take the social and environmental consequences of our actions seriously, and are making progress by reacting in a positive and progressive way.

Shipping

International obligations

As a global industry, shipping has a consistent set of international regulations to govern its behaviour and as a means of demonstrating that ships are fit for the purposes of ocean travel, the carriage of goods and passengers. Many rules and procedures are elaborated in international treaties to which Australia is a Party. The most important of these are the LOSC, the London Convention of 1972, and the many treaties, codes and rules made by the International Maritime Organisation (IMO) and the International Labour Organisation.

Broadly, the LOSC provides primary responsibility for the regulation of ships to rest with the flag State (the country in which the ship is registered), particularly where the vessel is operating on the high seas. Flag States are also obliged to adopt laws for the prevention of pollution from ships that are consistent with international rules and standards. In addition, when foreign ships are in Australian waters, they are also required to comply with national and state laws. Despite this Convention's global application, it has been criticised as having no mechanism to ensure that contracting Parties fulfil their obligation or to sanction them if they do not.

Due to the international nature of the shipping industry, action to improve maritime safety and prevent marine pollution is more effective if carried out multilaterally rather than by individual countries acting unilaterally and without coordination. Accordingly, the United Nations established the International Maritime Organisation (IMO) in 1948 to coordinate maritime matters throughout the world. The IMO was the first international body devoted exclusively to maritime matters.

The fundamental roles of the IMO (comprising of 158 Member States including Australia) are the safety of life and property at sea and the protection of the marine environment. Most of the IMO's work is undertaken by a number of committees and subcommittees. Since 1959 the IMO has promoted the adoption of some thirty conventions and protocols, and adopted more than 700 codes and recommendations concerning maritime safety, the prevention of pollution and related matters (AMSA 2001b). In particular, the International *Convention for the Prevention of Pollution from Ships 1973*, as modified by MARPOL 73/78, covers accidental and operational oil pollution as well as pollution by chemicals, goods in packaged form, sewage, garbage and air pollution. The Convention has five technical annexes each dealing with a different type of pollutant, such as oil, noxious liquid substances, harmful packaged substances, sewage and garbage. Further information on these annexes is found in the report *Oceans management – the legal framework*.

The IMO produces a number of manuals and guidelines to address environmental threats including manuals on oil pollution, chemical pollution and port reception facilities; and guidelines for the development of shipboard oil pollution emergency plans (particularly for ships over 400 gross tonnes) and clean ballast tanks. In addition, the introduction of the *International Safety Management Code for the Safe Operation of Ships and for Pollution Prevention* (the ISM Code) as a new Chapter of the SOLAS Convention aims to ensure compliance with mandatory rules and regulations.

The ICS (2000, p.132) identifies that "environmental groups have become significantly more influential in recent decades, at both governmental and non-governmental levels". The shipping industry has received specific attention in the areas of oil and chemical spills, waste disposal, water and air pollution, antifouling and the introduction of invasive marine pests through ships' ballast waters and hull fouling. Bodies or forums such as the Commission on Sustainable Development and Regional programs such as the South Pacific Regional Environment Program (SPREP) and the Asia Pacific Economic Co-operation Marine Conservation Working Group (APEC-MRCWG) are now developing agendas to address shipping related environmental concerns. The Food and Agriculture Organisation (FAO) are also examining ship registration and regulation matters in an effort to overcome illegal fishing.

Commonwealth initiatives

In Australia, the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) gives effect to the core provisions of the MARPOL Convention. Technical requirements, such as certification and construction of vessels, are legislated under the *Navigation Act 1912* (Cth).

In 1996, the Australian and New Zealand Environment and Conservation Council (ANZECC) released its strategy to protect the marine environment – *Working Together to Reduce Impacts from Shipping Operations*. The objective of the strategy is to promote best practice maritime waste management, reduce pollution from shipping and to communicate effectively with the shipping and boating industry about marine environmental protection. Other key issues raised in the public consultation process included completing environmental impact assessments for all offshore activities posing environmental threats (eg contaminated ballast waters, marine debris), and the need for additional and targeted research and the development of appropriate regulation and shipping standards (ANZECC 1996).

In an effort to provide information and resources to all stakeholders in the shipping and boating industry, the education and outreach component of the Action Plan produced an information register entitled *Reducing the Impacts from Shipping Operations on the Marine Environment* (MESA 1997). ANZECC has also conducted a review of Australian marine debris, which identified that a high percentage of debris is sourced from land-based activities or inshore fishing, boating and shipping activities (Maunsell 1996). This report identified that a large proportion of Tasmania's debris is derived from ocean sources.

In addition, ANZECC identified Marine Environment High Risk Areas (MEHRAs) if they have sufficiently high socio-environmetal value and are vulnerable to shipping and boating (ANZECC 1998). It is intended to register MEHRAs in Australia and New Zealand in an effort to communicate these areas to national and international shipping. For example, shipping routes to the ports of Melbourne and Geelong, and associated channels are adjacent to the Port Phillip Heads Marine Park. These areas are under the jurisdiction of the Victorian Channels Authority and they may be routinely modified in order to maintain safe navigable water. Other nominated MEHRAs in the South-east Marine Region are:

- Twofold Bay to Mallacoota
- Wilsons Promontory to Port Albert
- Bass Strait, Furneaux Group
- Robin's Passage, King and Hunter Island.

The shipping industry actively promotes environmentally sustainable practices. In Australia, it is highly regulated by a number of Commonwealth and State agencies. For example, at the Commonwealth level the Department of Transport and Regional Services promotes environmentally sustainable shipping outcomes that are also consistent with Australia's international obligations. In addition, the Australian Maritime Safety Authority (AMSA) regulates Australia's shipping fleet and manages the nation's international maritime obligations (AMSA 2001a). AMSA's aim is to achieve best practice in the provision of maritime safety, search and rescue for vessels and aircraft, and the protection of the marine environment from ship sourced pollution.

To achieve these goals, AMSA provides advice and information on a wide range of shipping issues to assist the industry in complying with MARPOL 73/78 and Australian laws and regulations. In addition, AMSA is responsible for overseeing the standard of ships entering Australian waters and the Authority is the managing agency for the National Plan to Combat Pollution of the Sea by Oil and Other Noxious and Hazardous Substances.

To exercise control over foreign owned ships, AMSA surveyors conduct Port State Control (PSC) inspections in Australian ports in accordance with international guidelines sets out by the IMO and ILO. In addition, Australian flag vessels engaged on interstate and overseas voyages are surveyed for the issue of appropriate statutory certificates by AMSA, or by authorised classification societies on behalf of AMSA. These inspections and surveys are undertaken to ensure that all ships comply with the relevant provisions of the IMO instruments and codes, including MARPOL 73/78, and with the provisions of the *Navigation Act 1912* (Cth). Should a ship be found to not comply with appropriate requirements, AMSA detains the ship until satisfactory repairs are carried out or remedial action taken (AMSA 2001b). During 2000 there were 2926 inspections of foreign flagged vessels of which 125 detentions were made.

AMSA (1998) have also developed the *National Plan to Combat Pollution of the Sea by Oil and Other Noxious and Hazardous Substances* which has been operating since 1973. This National Plan brings together the combined response resources of the Commonwealth, State and Territory Governments, and the oil, shipping and exploration industries to provide a level of preparedness to marine environmental threats including oil and chemical spills (AMSA 1999). As part of this plan, the *National Marine Oil Spill Contingency Plan* aims to protect the marine environment from oil pollution or, when this is not possible, to minimise such effects. Australia is also in the process of developing a multi agency Oil Spill Response Incident Control System (OSRICS) and AMSA's OILSPILL database currently contains over 4900 records. Between January 1991 to December 1999 inclusive, there were 2628 oil discharge sighting and oil spills reported in Australia and the National Plan was involved in 184 of these incidents (AMSA 2001a). In addition, the Australian Marine Oil Spill Centre (AMOSC), a subsidiary of the AIP, is an integral part of this National Plan, housing the major central stockpile of oil spill response equipment.

As part of the National Plan, Jones et al. (2000) has recently produced a risk assessment of oil and chemical spills of Australian ports and waters for AMSA. The report divides the Australian coast into 31 regions with seven of these being in the South-east Marine Region. Shipping levels, environmental resource data and meteorological data were sourced and analysed to determine risk profiles for each region and key areas of relatively high risk. In the South-east Marine Region, high-risk areas include coastal shipping in the southeast of NSW; major ports in Melbourne, Geelong, Launceston and Devonport; and Bass Straight offshore facilities. Overall, port risks dominate, followed by ship risks.

Spills resulting from collisions or groundings account for over 90% of major spills. However, as the cargo oil lost from tankers declines, the relative significance of bunker spills from other types of shipping is increasing. Over the past 15 years, 28% of major oil spill incidents have involved loss of ships' fuels from ships other than tankers (DOTARS 2000, p.15). The grounding of the *Iron Baron* off Tasmania in 1995, and subsequent spill of bunker fuel into the marine environment highlights the risks associated with oils spills in the Region.

For smaller spills of less than seven tonnes, the primary causes of ship-related spills are in loading or discharging of cargoes (71% of all ship sourced spills) or bunkering (12%). Responsibility for spills of this type is generally attributable to equipment failure, the human factor or conditions prevailing at the time (DOTARS 2000, p.15).

***Iron Baron* Case Study**

The *Iron Baron*, a 37557 dwt BHP chartered bulk carrier (built in 1985) grounded on Hebe Reef at the approach to the Tamar River, Northern Tasmania at 1930 hours (7.30pm) Eastern Standard Time (EST) on Monday 10 July 1995.

The vessel had departed from NSW's Port Kembla on Saturday 8 July 1995, with a 24 000 tonne cargo of manganese ore that had been loaded at Groote Island. The vessel was bound for the BHP owned TEMCO facility at Bell Bay, which is located some 12 kms inside the Tamar River estuary and within the Port of Launceston. Weather conditions prevailing at the time were northwesterly winds of 20-25 knots with two metre seas.

Shortly after the grounding, it was confirmed bunker fuel oil had escaped, which was later estimated at around 300 tonnes. The ship's crew were safely evacuated, whilst National Plan response arrangements were initiated. Weather conditions deteriorated and with the prevailing tidal conditions, oil impacted shorelines in the vicinity of Low Head. There was significant impact on wildlife, particularly little penguins.

Whilst work continued to refloat the casualty, clean-up of affected shorelines was under way. A large wildlife collection, treatment and rehabilitation program was established at the pilot station complex at Low Head, north of George Town.

The ship was refloated on Sunday 16 July 1995, and the vessel moved to an anchorage, some two miles offshore. The Port of Launceston Authority imposed a number of conditions to be met in relation to port safety and environmental protection, before the vessel could enter port.

There was further oil released from under the ship following the refloating, some of which was successfully collected at sea whilst some impacted Bakers Beach and the Rubicon River estuary in the vicinity of Port Sorell. Several Bass Strait near-shore islands were impacted at some locations. These islands were also the scene for a concentrated wildlife collection effort.

Underwater inspections and onboard assessments confirmed major structural damage had occurred and with the ship's condition reported to be deteriorating, and adverse weather predicted, BHP as the ship owner, decided to dump the vessel. The Commonwealth Environment Protection Agency approved a disposal site some 53 miles east of Flinders Island. After towing to the dumping area, the *Iron Baron* sank around 1930 hours (7.30pm), Sunday 30 July 1995.

Source: AMSA 2001c.

Introduced marine species

The Federal Government has developed the *Introduced Marine Pests Program* as a key platform in the response to introduction of exotic marine pests such as the Northern Pacific seastars and Japanese kelp. The program's overall goal is to support actions that will ultimately lead to the control and local eradication of introduced marine species. The Program also provides advice and funds to help combat marine species outbreaks.

In partnership with the Commonwealth, AQIS (as the lead Agency) has set in place the *Australian Ballast Water Management Strategy* and released the Australian Ballast Water Guidelines (1999) to inform ships entering Australian waters of this country's requirements in relation to the control of ballast water and sediment discharge. The guidelines take a precautionary approach and direct ships to avoid the uptake of potentially harmful aquatic organisms and pathogens before entering Australian waters; routinely clean ballast tanks in mid-ocean or under controlled arrangements in dry dock; and under no circumstances release sediment from tanks or holds (AQIS 1999). In addition, AQIS also provides barrier controls to prevent the importation of animal products that could threaten Australian fisheries.

From 1 July 2001, the Commonwealth has introduced strict new rules for the management of ballast water by international trading ships. Ballast water must be exchanged at sea (or equivalent on-board treatment systems), or a risk assessment of all ballast water intended for discharge in Australian waters must be undertaken before release. For high-risk ballast water, as assessed by the strategic ballast water decision support system, the approved management options will include (DOTARS 2001):

- full exchange at sea (or equivalent on-board treatment systems)
- non discharge of high risk ballast water in Australian ports or waters
- tank to tank transfer to prevent discharge of high-risk ballast water.

Shipping industry initiatives

The shipping industry itself promotes safe and environmentally sensitive operations at the international and national level. For example, the Green Award is an international, independent incentive-based system for safe and environmentally friendly shipping (Green Award Foundation 1999). The Award was started in 1994 in The Netherlands based on a quality assurance system that encompasses the technical qualities of ships, crews and management. Shipping companies receive financial benefits from quality operations in the form of rebates, or reduced port fees, tariffs and payable ship dues. In 2001, the scheme was extended to bulk carriers and already Australia and some other bulk exporting companies are seeking to use the award as an instrument of foreign trade. At the national level, the non-profit organisation Australian Marine Environment Protection Association (AUSMEPA) actively builds partnerships for cleaner seas through an education strategy. This strategy focuses on the importance of, and need to, protect the marine environment, and it provides an opportunity for the shipping industry to demonstrate their commitment to environmental protection.

Tourism and recreation

International obligations

The International Union for the Conservation of Nature (IUCN) recommends that tourism be sustainable in terms of meeting environmental, visitor and host community needs. As such, the IUCN suggests that ecologically sustainable tourism should attempt to move visitors' experiences beyond passive enjoyment to an active role that "promotes positive environmental ethics and fosters preferred behaviour" (Ceballos-Lascurain 1996, p.28). In addition, the International Council on Monuments and Sites (ICOMOS) (2000) concedes that tourists can threaten the values of those places they visit. In response to this concern the Charter provides guidance for the sustainable management of the tourism industry. ICOMOS argues that "tourism should bring benefits to host communities and provide an important means for them to care for and maintain their heritage and cultural practises". To meet this objective, ICOMOS (2000) advises that host communities and visitors experience natural and cultural values first hand; conflicting values should be sustainably managed for present and future generations; each visitor's experience should be meaningful and enjoyable; communities and Indigenous people should be involved in tourism conservation planning; and tourist programs should protect and enhance natural and cultural heritage.

The Global Code of Ethic for Tourism is a blueprint for ensuring the sustainability of the tourism sector and for minimising its negative impacts. It was adopted in Chile during 1999 by the World Tourism Organisation (WTO) General Assembly. It is in keeping with the rationale of reconciling environmental protection, economic development and the fight against poverty in a sustainable manner, as formulated at the United Nations "Earth Summit" in 1992 and expressed in Agenda 21.

Commonwealth initiatives

The Commonwealth is committed to the development of an internationally competitive, sustainable tourism industry (DISR 2001b). The Commonwealth recognises the need for sustainable tourism and that tourism activities should be consistent with the basic ESD principles of social and inter-generational equity, the protection of biological systems and the preservation of communities. The key goals and characteristics of sustainable tourism as described in the Commonwealth 1991 ESD Working Group Report on Tourism are detailed in Table 14.

In 1983, Hector Ceballos-Lascurian was one of the first to define ecotourism as travel to relatively undisturbed environmentally sensitive areas with the specific objective of studying, admiring, and enjoying the scenery and its wild plants, as well as any existing cultural manifestations (DOT 1994). Blangy & Wood (2002, p.32) define ecotourism as responsible travel to natural areas that conserves the environment and sustains the well-being of the local people. Australia has incorporated these two definitions in the 1994 *National Ecotourism Strategy* (DoT 1994, p.17) which refers to ecotourism as:

> nature-based tourism that involves education and interpretation of the natural environment that is managed to be ecologically sustainable for natural and cultural areas, and local communities.

In addition, the Strategy also recognises the potential of ecotourism as a learning medium and it recommends that operators provide an appropriate level of environmental and cultural interpretation.

The 1997 report *Coastal Tourism: A Manual for Sustainable Development* is based on the philosophy of ecologically sustainable development and aims to protect the "coastal tourism industry's primary asset – the coast" (EA 1997, p.viii). The manual outlines environmental, social and economic criteria for consideration when planning, constructing or operating tourism ventures.

The Commonwealth has since developed a *National Action Plan, Tourism: A Ticket to the 21st Century* that seeks to provide direction for tourism policy formulation and industry planning. The Action Plan is supported by a range of other Commonwealth initiatives including the Tourism Council Australia's 1998 *Code for Sustainable Tourism Practice*.

In addition, the Australian Heritage Commission and the CRC for Sustainable Tourism has developed the guide *Successful Tourism at Heritage Places* (2001) to assist tourism operators, heritage managers and comminutes to derive benefit from and appropriately manage heritage places.

Table 14:
Goals and characteristics of sustainable tourism.

Goals	• To preserve material and non-material well-being of communities
	• To preserve intergenerational equity and to protect biological resources
	• To ensure the cultural integrity and social cohesion of communities
Characteristics	• Tourism which is concerned with the quality of the experience
	• Tourism which has social equity and community involvement
	• Tourism that operates within resource limits – including minimisation of impacts and energy use and the use of effective waste management/recycling techniques
	• Tourism which maintains the full range of recreational, educational, and cultural opportunities within and across generations
	• Tourism based upon activities or design that reflect the Region's character
	• Tourism that allows visitor understanding and which encourages the visitor to be concerned about, and protective of, the host community and environment
	• Tourism that does not compromise the sustainability of other activities
	• Tourism which is integrated into local, regional, and national plans

Source: Adapted from Moscardo 1999.

Industry initiatives

There are many examples of successful industry initiatives aimed at conserving the Region whilst providing a range of products and services that are tailored to meet visitor expectations.

The Ecotourism Association of Australia (EAA) was formed in 1991 as a non-profit organisation and is the peak body for the ecotourism industry. The Association has over 500 members including ecotourism operators; tourism planners; protected area managers; academics; tourism, environmental, interpretation and training consultants; and local and regional tourism associations. The Association's vision is to (Ecotourism Association of Australia 2001):

> ... be leaders in assisting ecotourism and other committed tourism operations to become environmentally sustainable, economically viable, and socially and culturally responsible.

The Association has adopted a number of approaches to achieve this vision including developing and adopting sustainable practices; increasing professionalism within the industry; streamlining policies and processes that may complicate operations in protected areas; assisting operators to improve interpretation; contributing to conservation solutions and projects; involving local communities; and marketing the principles of sustainability to increase awareness across the tourism industry.

A number of accreditation programs have also been established in Australia to provide customers with assurance that tourist experiences are ecologically sustainable.

Nature and Ecotourism Accreditation Program

The Nature and Ecotourism Accreditation Program (NEAP) was originally launched as the National Ecotourism Accreditation Program in 1996. The program is a world first and it was developed by the Ecotourism Association of Australia (EAA), the Australian Tourism Operators Network (ATON) and the Tourism Council of Australia (TCA) with funding from the Office of National Tourism. It was developed by industry for industry to address the needs of ecotourism and nature-based tourism operators in Australia. Ecotourism and nature-based tourism accreditation provides industry, protected area managers and consumers with an assurance that an accredited product is backed by a commitment to best practice environmental management, conservation of our natural resources and the provision of quality experiences.

Under NEAP, ecotourism is defined as "ecologically sustainable tourism with a primary focus on experiencing natural areas that fosters environmental and cultural understanding, appreciation and conservation".

Source: Ecotourism Association of Australia 2001.

Industry also contributes directly to the protection and conservation of the Region. Support includes corporate contributions to conservation initiatives, premierships, technical assistance, educations programs, publicity and direct staff involvement. Codes of Conduct, similar to those developed for commercial and recreational fishing, have also been developed in the tourism and recreation sectors. The Tasmanian Sea Canoeing Club, for example, is in the process of developing a Code of Conduct for sea kayaking.

Defence and surveillance

The Australian Defence Force (ADF) has developed an Environment Management System (EMS) to enable Defence to demonstrate due diligence and effective environmental management. The EMS has adopted the Defence Environment Policy Statement as a cornerstone of its environmental management strategy. This policy positions the ADF as a leader in environmental stewardship to ensure that military activities are compatible with ESD principles, the maintenance of healthy ecosystems, and the conservation of natural and cultural environments (DoD 1998). The ADF is required to carry out Environmental Impact Assessments and Management Plans for all activities that may result in significant environmental impact. The Royal Australian Navy is committed to the preservation of the marine environment by controlling discharge of waste and pollution to sea.

Australia entered into a Trilateral Environmental Security Cooperation in 1994 to expand the close defence relationships between Australia, Canada and the US. The Trilateral includes cooperation in defence environmental matters. Australia has the lead on three specific issues: environmental impact analysis, range management and joint activities. Other issues considered under this Trilateral arrangement include global climate change, fisheries and marine protection, non-native invasive species management and environmental disaster response.

Minerals

Government

The Commonwealth's *Offshore Minerals Act 1994* enforces environmental provisions for the offshore minerals industry. Individual State Governments also have additional, non-legislative provisions in place for offshore mining operations. For instance, offshore mining operations in the waters adjacent to Tasmania must be undertaken in line with the Mineral Exploration Code of Practice (MRT 1999). Although written principally for onshore mineral exploration, the Code is also applicable for offshore exploration and production. Under the Code, licence conditions under which exploration work may proceed are decided on a site-by-site basis, usually after consultation with other Government departments, such as those with responsibility for the environment, heritage, transport and Indigenous interests.

Industry initiatives

The Minerals Council of Australia has developed the Australian Mineral Industry Code for Environmental Management (AMC 2000). Although primarily aimed at land-based activities the principles embodied in the Code also apply to offshore mining operations. These principles are:

- accepting environmental responsibility for all our actions
- strengthening our relationship with the community
- integrating environment management into the way we work
- minimising the environmental impacts of our activities
- encouraging responsible production and use of our products
- continually improving our environmental performance
- communicating our environmental performance.

Examples of the manner in which the Code is to be implemented by mining companies is that signatories to the Code produce annual public environment reports. Companies will annually assess their progress against the Code using the Code Implementation Survey. These surveys are then submitted to the Minerals Council.

The Minerals council itself also has an External Environmental Advisory Group (EEAG) which provides the Minerals Council Environment Committee information on issues of interest and concern to the community regarding the environment and related social performance of the Australian minerals industry. It should be noted that there is currently only one active offshore minerals exploration permit, and therefore the Code has limited application in the offshore environment at this stage.

Ocean disposal

The need for an international convention to control the disposal of wastes at sea was recognised in 1971 at the first meeting of the preparatory committee for the United Nations Conference on the Human Environment. As a result of the views expressed at this meeting, the 1972 *Convention on the Prevention of Marine Pollution by Disposal of Wastes and Other Matter* was, designed to prohibit and limit marine pollution. Since 1975 the London Convention has controlled ocean disposal internationally. Rules on ocean disposal are given a minimum standard internationally, but have been supplemented and strengthened by a number of regional agreements or by national legislation.

The *Environment Protection (Sea Dumping) Act 1981* regulates the disposal of wastes and other matter in Australian waters.

Currently, the decision to issue a disposal permit depends on the likely environmental impact of any contaminants in the dredged material and the environmental sensitivity of the proposed disposal site. New dredge spoil guidelines are being produced to define levels of contaminants above which disposal will not normally be allowed. Environmental and monitoring reports are now required for nearly all disposal activities.

Submarine cables

Submarine cables in Commonwealth waters are managed under the *Sea Installations Act 1987* (Cth). Under section 23 of the Act, it is a condition of a permit that either the use of or work on an installation will not interfere with navigation, fishing or the conservation of the resources of the sea or seabed. In addition, if an installation is damaged or it is in such a condition that it constitutes or is likely to constitute a threat to safety or the environment, the owner of the installation may be required to undertake repairs to mitigate the threat [s.54].

The installation of major submarine cables, such as that proposed for Basslink, is required to undergo environmental impact assessment under both Commonwealth (EPBC Act) and State legislation.

Biotechnology

The EPBC Act establishes the legislative authority for regulations to control access to biological resources in Commonwealth areas. A legal framework to control access to, and use of, the genetic resources of native species in Commonwealth areas was established in recent amendments to the Environment Protection and Biodiversity Conservation Regulations 2000 Access Permits and Benefit-Sharing Arrangements. The proposed legislative changes will, amongst other things, safeguard the environment and promote the sustainable use of biological resources.

Biotechnology Australia and the Commonwealth Biotechnology Ministerial Council were established in 1999 to coordinate government biotechnology activity. They developed the National Biotechnology Strategy that was released in July 2001 with a vision to capture the benefits of biotechnology for the Australian community, industry and the environment. The vision is supported by goals, including (Biotechnology Australia 2000, p. iv):

> to ensure that in research into and in applications of biotechnology, human health and the environment are safeguarded, in particular through a rigorous, efficient and transparent system of regulation for gene technology research and for genetically modified organisms and products.

Ports

Government

Legislation and regulations concerning port-related conservation management focus on the monitoring and control of oil pollution and ballast water, minimisation of the impact of dredging activities, and emergency response management. Provisions relating to shipping mentioned earlier also apply to ships while in port waters. In particular, provisions from the International Maritime Organization (IMO) affect how ports are operated. For instance, in November 1997 the IMO formulated a Code of Practice for the Safe Loading and Unloading of Bulk Carriers (BLU Code)

as a means of enhancing the safe operation of bulk carriers in port. This Code has been recommended by the Commonwealth Government to apply in Australian ports. The IMO Code of Safe Practice for Solid Bulk Cargoes (BC Code) has been in place in Australia for many years. This code is mandatory with penalties prescribed for non-observance.

State Government agencies have also implemented various codes directed at safe handling and conservation practices in ports. The Victorian Channels Authority, in consultation with the Environment Protection Authority and Australian Quarantine Inspection Service, has established the Code of Practice for Hull Cleaning which applies in the port waters of Geelong and Melbourne and is applicable to all commercial vessels greater than 200 gross tons.

In 2001, the Commonwealth Government, through the Marine Waste Reception Facilities Program under the Coasts and Clean Seas Initiative, provided over $645, 000 in funding for projects aiming to prevent toxic wastes from boats entering ports, marinas and boat harbours around the country. Within the Region, funding was provided to the Gippsland Ports Committee of Management to install a bilge water pump-out facility at Lakes Entrance (EA 2001).

Industry initiatives

Individual port corporations have also addressed environmental issues, generally through environmental management systems or equivalent strategies. The Melbourne Port Corporation (MPC) has produced a 'Whole of Port' Environmental Management Plan (EMP) to ensure the ecological sustainable development of the port. In January 2002, the Port of Devonport is due to release its Port Operations Environmental Management System (POEMS) which covers all aspects of the Port's operations and other outside environmental influences.

Aquaculture

Government

AQUAPLAN, Australia's national strategic plan for aquatic animal health, was developed jointly by State, Territory and Commonwealth Governments and private industry sectors. AQUAPLAN is implemented by the Fish Health Management Committee. It consists of eight programs, including the protection of Australia's aquatic animal health status and methods and protocols to manage emergency aquatic disease outbreaks.

Day-to-day management of aquaculture in the South-east Marine Region is undertaken by State governments. State governments have both legislation and guidelines in place which address conservation issues. The Victorian Government has released the Best Practice Environment Management Guidelines for Salmonid Farming in Victoria. The South Australian Government has also recently introduced legislation for the aquaculture industry which should provide greater certainty for the industry and the environment.

Industry initiatives

The Code of Conduct for Australian Aquaculture was initiated by the Australian Aquaculture Forum, consisting of peak aquaculture industry bodies. The Code sets out principles which aim to maintain ecological and economic sustainability for the aquaculture industry:

- ecologically sustainable development
- economic viability
- long-term protection of the environment to ensure availability of suitable sites for aquaculture operations
- compliance with, and auditing of adherence to, regulations and the code of conduct
- resource sharing and consideration of other users of the environment
- research and development to support the achievement of the above five priorities.

The Australian Seafood Industry Council's Code of Conduct for a Responsible Seafood Industry includes issues relating to conservation and aquaculture. In particular the Code states that aquaculturalists and fish farmers will encourage the development and operation of aquaculture in a manner and at a rate in accordance with ecologically sustainable development principles (ASIC 1998).

Alternative energy

The installation of major alternative energy establishments, such as offshore or onshore wind farms, is required to undergo environmental impact assessment under both Commonwealth (EPBC Act) and State legislation. An example of such an assessment relates to the proposed Hydro Tasmania's Woolnorth Wind Farm development in northwest Tasmania and its possible effects on orange-bellied parrot migration (Hydro Tasmania 2000).

Defence

The primary objective of Australia's Defence Force is to prevent or defeat attacks on Australia. Our geography and reliance on the sea for trade are reflected in the Government's adoption of a maritime strategy as a cornerstone of the nation's defence. Australia's Maritime Strategy combines the capabilities of the three services to maximise combat power – the Army, the Navy and the Air Force.

The total Defence departmental appropriation for 2000-2001 was $12.2 billion or 1.8% of Gross Domestic Product. Total defence funding from all sources for 2000-2001 was $19.4 billion, including a capital use charge of $4.6 billion and the cost of superannuation for former military personnel of $1.7 billion (ABS 2001).

Background

Australia faces significant security challenges due to its vast coastline, large maritime jurisdictional area and distance from maritime allies. Australia shares maritime borders with Indonesia, East Timor, Papua New Guinea, New Zealand, the French Territories and the Solomon Islands.

With island territories extending from the tropics to the hazardous Antarctic waters of the Southern Ocean, the Australia Defence Force responsibilities range well beyond the immediate South-east Marine Region, covering an area of some 16 million square kilometres. In total, the Navy patrols a jurisdictional area of almost 10% of the world's total surface area, requiring ships with high endurance and excellent sea-keeping qualities.

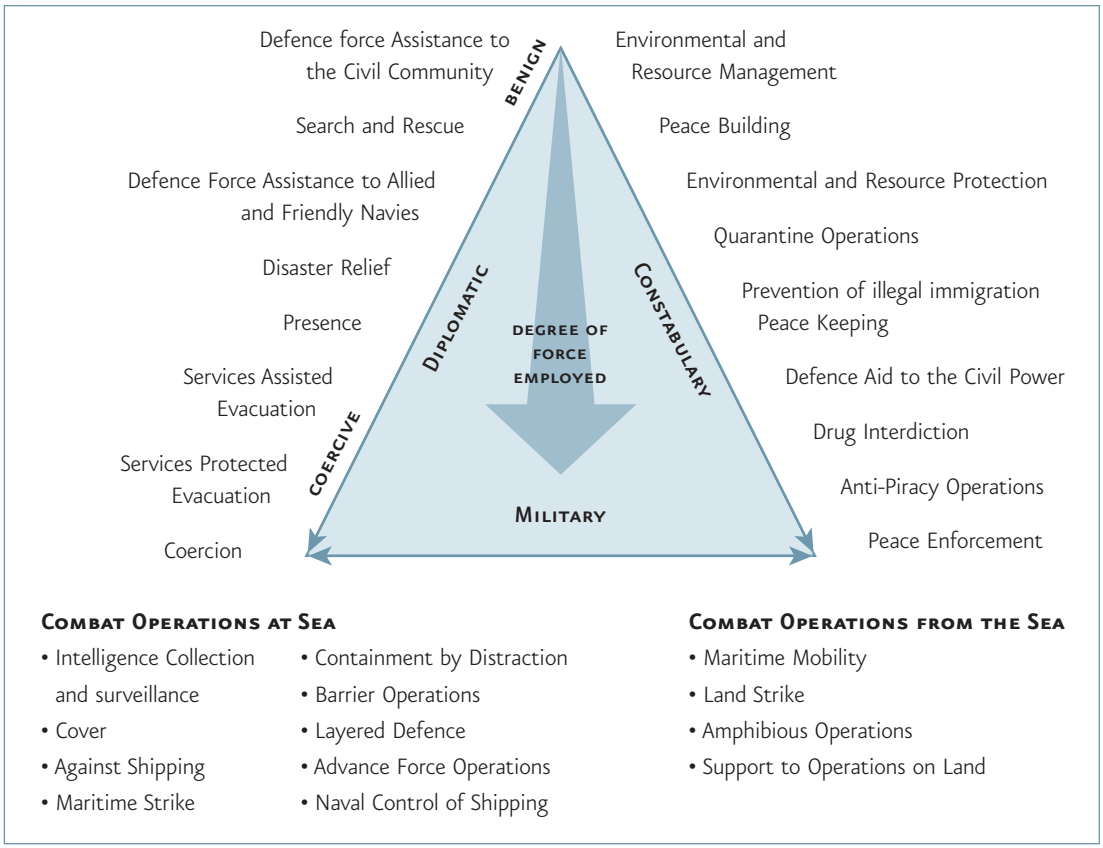
Trade in the global marketplace is vital to Australia both now and into the future. Globalisation has meant that Australia's economy is becoming more integrated with other nations and less self-sufficient. Sea transport accounts for 99% by volume and 72% by value of Australia's international merchandise trade (DoTARS 2000) making Australia the world's 5th largest user of shipping routes (DoD 2001). Access to world markets relies on merchant shipping enjoying freedom of navigation.

The Royal Australian Navy and the Royal Australian Air Force patrol Australia's ocean areas and the adjacent high seas. Through bilateral and multilateral agreements, and in accordance with international rights, they also operate and patrol widely throughout south-east Asia and the south-west Pacific.

With the exception of a relatively small number of Australian Customs Service vessels, the Royal Australian Navy provides the total surface response effort within Australia's marine jurisdictional area. The Australian Defence Force also works closely with other Government authorities in the Region such as the departments responsible for Fisheries and Immigration, Customs Service, Federal Police and the Australian Quarantine Inspection Service. Together these organisations protect Australia from contraband, unlawful entry, unlicensed fishing and the introduction of exotic diseases and plant and animal species.

The span of the Australian Defence Force operations can be summarised into three broad categories – military, constabulary and diplomatic (see Figure 8). However, most of these activities do not occur in the waters of the South-east Marine Region at this point as activities are focussed in Australia's northern latitudes.

Figure 8:
The span of maritime operations. *Source: Australia's Navy for the 21st Century, 2001.*



Regional activity

Australian Defence Force activities in the Region include:

- transit of naval vessels
- training exercises
- ship building and repairs
- hydrographic survey work
- surveillance and enforcement
- search and rescue.

There are currently no Royal Australian Navy vessels based in the South-east Marine Region but the Region is host to one commissioned establishment (HMAS Cerberus, Crib Point, Victoria) and two non-commissioned establishments (the East Coast Armaments complex, Port Wilson, Victoria and the Naval Headquarters, Hobart, Tasmania,). HMAS Cerberus is Australia's largest Naval Training Base.

Transit of naval vessels

While none of the Royal Australian Navy's vessels are permanently based in the Region, it is a key transit route between Fleet Bases East (Garden Island Sydney) and West (HMAS Stirling, Western Australia).

The Region is also a transit route and a port of rest for international defence forces. The Region contains two important international ports for overseas navies – Hobart and Melbourne. Since 1996, there have been 858 visits to Australian ports by international defence vessels. Ports of the South-east Marine Region accounted for 63 of these visits.

Under the United Nations Convention on the Law of the Sea, Australia has sovereignty out to 12 nautical miles from the territorial sea baseline. This means that international defence forces passing through the beyond 12 nautical miles of the territorial sea baseline are free to conduct exercises without Australia's knowledge or permission.

Training / firing ranges

The Region encompasses annually gazetted areas for Defence activities and exercises. In addition, ad hoc training exercises considered to pose no public or environmental risk are conducted routinely during navy vessel transit.

The majority of the training areas in the Region were gazetted following World War II. Their location is a function of such variables as proximity to Australian Defence Force bases and the nature of the training required. The boundaries of the gazetted areas have been designed to minimise safety risks associated with exercises. Australian Defence Force exercises in a gazetted area may take place over several weeks at a time with actual firing of live ammunition and testing of expensive equipment limited due to cost.

The location of gazetted training areas in the Region include:

- at Western Port, the navy may conduct gunnery practices and military flying from Monday to Friday, between the hours of 2300 and 0545. In addition, at Hanns Inlet, the Navy has continuous use of an area for radar flares. The Navy also uses Cape Schanck for gunnery, military flying and naval activity, with vertical limits and restricted hours of operations
- in Port Phillip Bay the Navy and the Air Force conduct exercises
- some terrestrial Army training areas have safety templates for firing and explosives training that extend seawards – on Swan Island, Victoria and Stony Head, Tasmania
- land establishments abutting the area are principally for munnitions storage (Twofold Bay, Eden – currently under construction), training (HMAS Cerberus, Victoria), and military exercises (Stony Head, Tasmania)
- an area around Pyramid Rock was in the past used as a bombing range. Due to unexploded ordnance the Australian Hydrographic Office continues to advise on dangers in the area (AHO 2002). In addition, defence exercise areas off southeastern Kangaroo Island were used for radar tracking and firing exercises. These areas were revoked in 1998.

Map 10 details gazetted training areas of the Region as of 2001.

Map 10:
Gazetted training areas 2001. *Source: Larcombe et al. 2002.*

Ship building

The Region hosts one major defence ship-building facility at Williamstown in Victoria. Construction of modules for the $6 billion ANZAC frigates occurs in three locations: Williamstown in Victoria; Newcastle in NSW; and Whangari in New Zealand. The final assembly occurs in Williamstown.

ANZAC class – frigates, Australia

The ANZAC Ship Project is a collaborative project between the Australian and New Zealand Governments for the development and construction of 10 new ANZAC Class guided missile frigates – eight for the Royal Australian Navy (RAN) and two for the Royal New Zealand Navy (RNZN).

Tenix won the ANZAC Ship Project contract in 1989. The 17-year, fixed price contract is currently worth approximately $A6 billion. It is the largest and arguably most successful defence contract ever awarded in Australia. Tenix's management of the contract has earned it international recognition and a number of prestigious engineering and quality awards.

The ANZAC Ship Project is providing the Royal Australian and Royal New Zealand navies with sophisticated world class vessels specifically developed for their operational and strategic needs.

The project is also providing long term benefits for the economies of Australia and New Zealand, involving more than 1300 companies utilising 73% local content.

Source: TENIX 2001.

Hydrographic survey

The Royal Australian Navy is responsible for the national task of charting and surveying Australia's waters. Navigational safety in Australia's waters therefore depends heavily on the Navy's efforts.

The Australian Hydrographic Service is part of the Royal Australian Navy. It is responsible for providing Australia's national charting service under the terms of the UN Safety of Life at Sea (SOLAS) Convention and the Commonwealth's Navigation Act. This role requires the coordination and determination of policy and standards, which covers both hydrographic surveying and charting, as well as contributing to the coordination, exchange and standards related to geo-spatial data in general.

The Australian Hydrographic Service is also responsible for providing direct support to the Australian Defence Force for the provision of hydrographic, charting, oceanographic and meteorological services. National responsibilities and commitments include:

- publishing and maintaining the national chart series (nearly 400 navigational charts)
- publishing the Australian National Tide Tables
- developing an Australian series of *Sailing Directions* and other nautical publications
- compiling and maintaining the Australian hydrographic data collection
- providing a fortnightly *Notices to Mariners* service to facilitate changes and additions to charts and publications
- determining the priority for national hydrographic survey requirements through liaison with:
  - the Department of Defence
  - the Australian Maritime Safety Authority
  - key scientific organisations
  - State maritime agencies.

Surveillance and enforcement

The Australian Defence Force is a major contributor to Australia's national surveillance effort. Responding to incursions into our maritime jurisdictional areas and the provision of platforms to support action against illegal foreign fishing are important defence tasks. Coastwatch closely coordinates the Australian Defence Force surveillance and policing effort. Its efforts also support other agencies such as those responsible for customs, immigration, quarantine and fisheries.

Search and rescue

The Australian Defence Force assists Australia in fulfilling its search and rescue responsibilities for an area one tenth of the world's surface.

Economic dimensions

Over the last 10 years, the Australian defence industry has built up considerable design and construction, project management and systems integration expertise in the maritime sector. Australia has three prime contractors (Australian Defence Industries, Australian Submarine Corporation and Tenix), and over 700 sub-contractors supply a range of equipment and services. Major players in the maritime sector include: CompAir Australia, GEC Marconi, CelciusTech Australia, Thomson Marconi Sonar, British Aerospace Australia, ADI Systems Group, Compaq Systems, CSC Australia, Vision Systems, Australian Marine Technologies, MTU Australia, and Siemens Australia. Major projects undertaken include the:

- $1 billion Huon Class Mine Hunter Project by Australian Defence Industries
- $5 billion Collins Class Submarine Project by Australian Submarine Corporation
- $6 billion ANZAC Frigate Project by Tenix Defence Systems.

Employment

A breakdown of Australian Defence Force personnel is not available for the Region. Table 15 details the Australian Defence Force Personnel Statistics as at June 2000 for NSW, Victoria, South Australia and Tasmania.

Studies of the impact of defence procurement in South Australia showed a multiplier effect of 1.145. By comparison the multipliers for tourism were 1.192 and 1.126 for the motor vehicle industry. On average, for each defence job in regional Australia, a further job is created and for each defence dollar spent a further 40 cents is added to the local economy.

Source: DoD 2000.

Linkages

Over 1400 Australian companies supply the Australian Department of Defence with a range of goods and services. Australia has a total defence budget of around $12 billion per annum and Defence Acquisition and Logistics expenditure accounts for over 20% of this total. The Department of Defence is currently managing some 200 major acquisition projects with an estimated cost of some $43 billion. In 1997-1998, the Australian defence industry exported a total of $28.5 million in defence and defence related goods, and $302 million in exports of other technology. In 1997, the top 20 Australian Defence companies had a combined turnover in excess of $2.5 billion and employed almost 30 000 people (Austrade 2001).

Table 15:
Australian Defence Force, Reserve and civilian personnel by location of employment [1]

	NSW	Vic	SA	Tas	Total
Permanent Forces [2][3]					
Navy[4]	6055	1502	61	12	7630
Army	4994	3179	553	105	8831
Air Force	4892	1576	1595	9	8072
Sub Total	15 941	6257	2209	126	24 533
Civilians/Sub Total	3260	3611	1819	124	9174
Total	**19 201**	**9868**	**4028**	**250**	**33 347**
Reserves [5]					
Navy	432	95	44	53	624
Army	4979	3253	1533	783	10548
Air Force	483	326	245	0	1054
Sub Total	5894	3674	1822	836	12 226
Grand Total	**25 095**	**13 542**	**5850**	**1086**	**45 573**

1 - Figures in this table show actual staff numbers as at 30 June 2000 and are not the average funded strengths.
2 - Permanent forces include all paid and unpaid members.
3 - Personnel are shown in the location they are administered from.
4 - Personnel serving in ships are included against the State or Territory in which the ship is home ported.
5 - Figures are reserves with training obligations.

Management arrangements

In 2000, the Federal Government released *Defence 2000 – Our Future Defence Force*. This paper both announced and explained Australia's strategic defence policy over the next decade, as well as outlining the Government's plan for the development of our armed forces. This was matched by a commitment to provide the funds required.

Legislation

There is a substantial body of Commonwealth legislation, which governs the operation of the Australian Defence Force including:

- *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*
- *War Service Estates Act 1942*
- *Williamstown Dockyard Employees Act 1987*.

In addition, legislation such as the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the *Navigation Act 1912* is binding on defence except in relation to matters of national security. As well, naval officers are appropriately empowered under various Federal Acts such as the Fisheries Act, Customs Act, Immigration Act and the Quarantine Act.

International treaty and security arrangements

Under the obligations contained within a number of international agreements, the Australian Defence Force is required to provide support for a variety of government agencies including those responsible for:

- search and rescue – conducted under the auspices of 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.

Emerging industries

While there is a myriad of emerging industries such as aquaculture and tourism that could be of increasing importance within the South-east Marine Region, this section concentrates on those emerging industries based on producing renewable energy. New developments within the Region associated with current uses are covered elsewhere in this report.

Background

Clean renewable energy resources are becoming increasingly attractive, not just for environmental reasons but also because hydrocarbon resources are finite and are likely to become increasingly expensive.

A number of renewable energy resources are being explored around the world. Those applicable within the Region include wave power, wind power and biomass.

Wave power

Wave power offers considerable potential, particularly in areas exposed to large swells such as on Tasmania's west coast or along the Victorian coastline. Unlike other renewable energy sources, wave power has the potential to offer a continuous energy supply to the electricity grid.

Ocean Power Technologies Australia is proposing to launch a series of buoys off the coast of Portland, Victoria, to harness the power of the ocean's waves.

The buoys would be submerged more than a metre below the water's surface. Inside each buoy, cylinders move around a piston-like structure as the buoy follows the rise and fall of the waves which drives a generator attached to the ocean floor. Computers would constantly monitor the system's performance, disconnecting the system when unusually large waves threaten, and reconnecting when the waves return to normal. The system is expected to generate up to 10 megawatts of electricity – enough to power about 10 000 homes. The project is due to be launched in 2002, although the project has recently been delayed and other sites are now under consideration.

Wind power

Wind energy, like wave and tidal power, is an important renewable energy resource. Wind energy is an indirect form of solar energy, with between 1-2% of the solar radiation that reaches the Earth converted into wind energy. This is due to the unequal heating of different parts of the Earth's surface, which causes cooler, dense air to circulate to replace warmer, lighter air (see Figure 9).

Currently there are a number of well-established technologies available that efficiently generate electricity from the wind. Nearly all of these are land-based, but there is an incentive to shift generation offshore for a number of reasons including:

- consistently higher wind speeds are encountered offshore (Cook et al. 1992)
- environmental complaints relating to such factors as noise and loss in visual amenity may be minimised.

Offshore wind farms are in commercial use in parts of Europe and are currently proposed for the United Kingdom.

Wind-based power generation within the Region occurs on coastal land. The three main generators are the:

- Codrington wind farm, south of Port Fairy, Victoria, which was completed in mid 2001
- King Island wind generator commissioned on the 23 January 1998
- Breamlea wind generator, near Bells Beach, Victoria.

In addition, a wind energy project proposed in Victoria involves Cape Bridgewater, Cape Nelson, Cape Sir William Grant and Yanbuk.

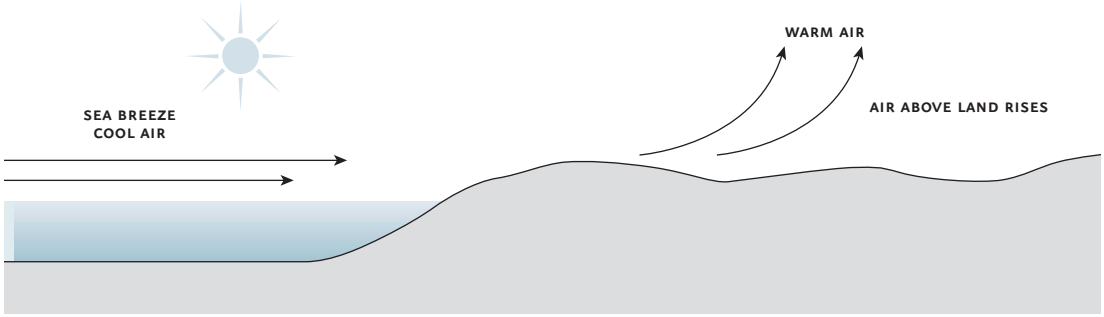
Biomass

Biomass energy is derived from plant and animal material (such as wood from forests), residues from agricultural and forestry processes, and industrial, human or animal wastes.

The energy value of biomass, derived originally from solar energy via photosynthesis, can be released by chemical processes. For example, biomass can be used directly (eg burning wood for heating and cooking) or indirectly by converting it into a liquid or gaseous fuel (eg ethanol from sugar crops or biogas from animal waste). The efficiency of the conversion process and the calorific value of biofuel determine how much of the actual energy can be practically utilised.

There is a wide range of animal wastes that can be used as sources of biomass energy, the most common are manures from pigs, chickens and cattle. Recently the gases from a cargo of rotten fish has been used in biomass plants in Denmark. However, the most likely sources of biomass within the Region may include by-catch or seaweed.

Figure 9: *Wind formation by local heating and cooling.*



Fish as biofuel: Norway's experience with rotting fish

The rotting remains from a sunken cargo ship carrying 3300 tonnes of frozen fish off Norway's western coast were shipped to Denmark where the cargo was used as biofuel.

The cargo ship, owned by Norway's Nomadic Shipping had become a serious environmental problem as the fish started to pollute the sea and air in the local area.

Once raised the rotting fish gas was used to power six different biofuel plants, with the residues used as compost.

Source: PlanetarK 2001.

Economic dimensions

As of 1999, fossil fuels accounted for nearly 94% of Australia's total energy supply (IEA 2001). As a result, Australia is far more dependant upon fossil fuels than any other OECD country. For example, Australia's reliance on coal is double the OECD average (IEA 2001).

There are a number of reasons why renewable energy sources have had limited application to date in Australia (IEA 2001):

- an abundance of low cost fossil fuels
- the geographic dispersal of the Australian population
- limited hydro-electric resources.

In addition, there are a number of other factors at play, including that, in general, most financially-viable, large- scale, power-generating technologies are fossil fuel based. The relatively large price difference between energy from fossil fuels and renewable energy sources is a major factor in Australia's reliance upon fossil fuels. Policy responses to reduce greenhouse gas emissions to mitigate climate change may help to alter the relative economic attractiveness of fossil fuels and renewable energy sources, but it is as yet too early to say.

The Codrington wind farm and the Portland wind energy project are forecast to save an estimated 988 000 tonnes of greenhouse gas equivalent per annum when compared to generating this energy from a coal-fired power station (Pacific Hydro 2000). As well, the wind turbine on King Island currently saves islanders $500, 000 per year in imported energy (Sterling Wind 1998).

Management arrangements

The *Commonwealth Renewable Energy (Electricity) Act 2000* establishes the framework for renewable energy targets. Under the Mandated Renewable Energy Target (MRET), wholesale electricity dealers will be required to source an additional 9500 GwH per annum of their electricity from renewable sources. This is to be achieved progressively over the period 2001 to 2010 and maintained until 2020. This requirement is designed to help slow the increase in greenhouse gas emissions and accelerate the commercialisation of renewable energy technologies. It will also complement energy market reforms presently being implemented.

A Renewable Energy Regulator has been appointed to oversee the implementation of the mandatory renewable energy target. Determinations made by the Renewable Energy Regulator will further detail arrangements under the scheme.

Government-industry policies

The National Greenhouse Strategy has been developed by the Commonwealth State and Territory Governments with important contributions made by the Australian Local Government Association, industry and the community. The Strategy reflects a comprehensive approach to tackling greenhouse gas issues and is supported through a number of key programs:

- Renewable Energy Equity Fund – provides venture capital to small innovative companies that are developing renewable energy technologies
- Renewable Energy Commercialisation Program – provides grants to assist the commercialisation of renewable energy technologies
- Renewable Energy Showcase – offers one-off competitive grants to demonstrate the very best of Australia's technologies
- Renewable Energy Technology Internet Site – promotes the renewable energy industry and provision of information on government assistance
- Renewable Remote Power Generation Program (RRPGP) – provides financial support to increase the use of renewable energy generation in remote parts of Australia that presently rely on diesel for electricity generation.

Further information on the National Greenhouse Strategy and supporting programs is available from the Australian Greenhouse Office.

Marine heritage

The oceans of the South-east Marine Region have significant natural, cultural and maritime heritage value. Heritage places are the inheritance of all Australians passed through generations and include natural, Indigenous and historical values. Heritage places include: coastlines; islands and reefs; Indigenous clan estates and coastal middens; shipwrecks; lighthouses; customs houses; coastal fortifications; and penal settlements such as Port Arthur, Sarah Island (Macquarie Harbour) and Maria Island. For the purposes of this assessment, marine heritage focuses solely on non-Indigenous heritage. Indigenous heritage is discussed in the assessment report *Sea Country – the Indigenous perspective*.

Background

Heritage places are those which are "associated with human history, and which are of value to our society for cultural reasons" (Pearson & Sullivan 1995). For the purposes of the State of the Environment reporting, the heritage environment was defined as having three elements: places, objects and intangible factors (EA 1997). The management of heritage places is "concerned with what things will be retained from the past, and with how they will be used in the present and future" (Lipe 1984). Pearson & Sullivan (1995) list the values of some key elements of Australian heritage including places that:

- are irreplaceable, but potentially sustainable and of national and economic value
- are treasured as unique testimonies to an enduring past
- can improve the quality of life
- provide emotional, symbolic or physical links with the past
- show high artistic or creative achievements
- are of value for research
- offer recreation and community use, opportunities or economic potential.

Definition of cultural and natural heritage

The World Heritage Convention, to which Australia is a party, defines cultural and natural heritage as follows:

Article 1

For the purposes of this Convention, the following shall be considered as cultural heritage:

- monuments: architectural works, works of monumental sculpture and painting, elements or structures of an archaeological nature
- inscriptions, cave dwellings and combinations of features, which are of outstanding universal value from the point of view of history, art or science
- groups of buildings: groups of separate or connected buildings which, because of their architecture, their homogeneity or their place in the landscape, are of outstanding universal value from the point of view of history, art or science
- sites: works of man or the combined works of nature and man, and areas including archaeological sites which are of outstanding universal value from the historical, aesthetic, ethnological or anthropological point of view.

Article 2

For the purposes of this Convention, the following shall be considered as natural heritage:

- natural features consisting of physical and biological formations or groups of such formations, which are of outstanding universal value from the aesthetic or scientific point of view
- geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation
- natural sites or precisely delineated natural areas of outstanding universal value from the point of view of science, conservation or natural beauty.

Source: UNESCO 2000.

Heritage places in the South-east Marine Region

The South-east Marine Region has a rich, yet only partially documented and appreciated, maritime heritage. This includes early settlement sites along the coast, a wide variety of shipwrecks, navigational aids and sites of Aboriginal significance. Conservation and interpretation of this heritage helps us to understand and appreciate our culture and history. Map 11 shows the location of known shipwrecks in the Region plus other significant marine cultural heritage sites such as customs houses, coastal fortifications, and lighthouses listed on the National Estate.

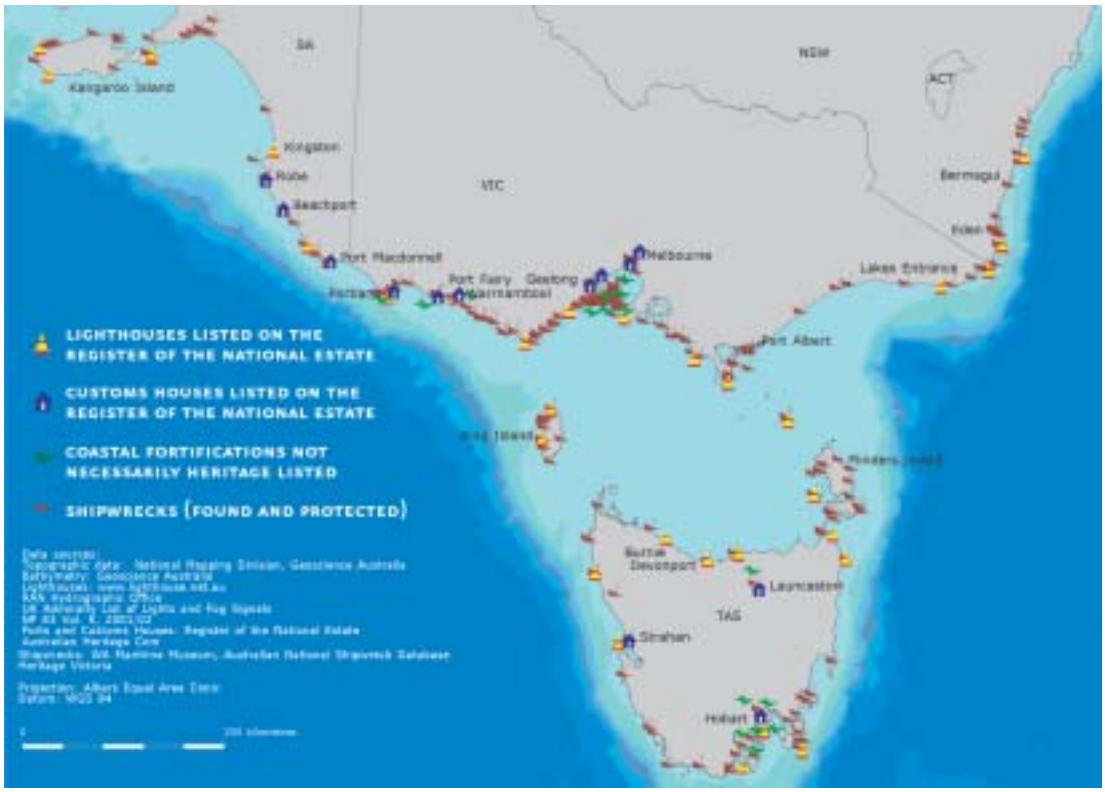
Underwater cultural heritage

Underwater cultural heritage includes any historic relic or structure that lies beneath the sea or inland waters. Underwater cultural heritage includes shipwrecks, port facilities, submerged remains of jetties, deposits of bottles or other artefacts.

Many different types of sunken vessels are located in the Region. These range from wooden sailing ships and passenger ships to fishing and early sealing and whaling vessels. There is increasing interest in locating and listing submerged aircraft and flying boats.

All shipwrecks are protected under the *Historic Shipwrecks Act 1976* (Cth) and in complementary State legislation. Shipwrecks are often referred to as 'museums without walls'. They have great aesthetic appeal to divers and are of archaeological value to researchers and society in general (EA 1997, p.7). More than 6500 shipwrecks lie just beyond Australia's shores (EA 2001). Over 1000 of these wrecks are located in the South-east Marine Region (Larcombe et al. 2002).

Map 11:
Marine cultural heritage sites within the South-east Marine Region. *Source: Larcombe et al. 2002.*



Notable shipwrecks in the Region

***Clonmel* 1841**

One of the earliest steamers to work in Australia, and the earliest located steamship wreck in Australia, is that of the paddle-steamer *Clonmel* wrecked on an unchartered sandbar east of Wilsons Promontory on 3 January 1841 (Heritage Victoria 1996). Built in Birkenhead, England, in 1836 the *Clonmel* was a wooden schooner-rigged paddle-streamer measuring 154.8 feet x 21.5 feet x 16.6 feet.

The *Clonmel* lies on the east bank of the Port Phillip bar, close to the entrance. A 50 m protected zone has been placed around the site which restricts diving, fishing and boating activities. The steamship lies in 4-7 m of water and the tip of the boiler and funnel are visible at low tide.

Sydney Cove

The Indian-built *Sydney Cove* is the eighth oldest wreck located in Australian waters. It was lost between Rum Island and Preservation Island on the southwestern edge of the Furneaux Group on 9 February 1797 en-route from Calcutta to Port Jackson. After being heavily salvaged immediately following its wrecking, it lay undisturbed for over 170 years before its rediscovery in 1977.

***Cataraqui* – Australia's worst civil disaster**

After nearly four months at sea transporting 367 passengers, 42 crew and a cargo of slate from Liverpool to Melbourne, the *Cataraqui* struck bad weather in Bass Strait and was forced onto rocks off the southwestern coast of King Island on 4 August 1845. Due to the treacherous conditions only nine passengers and crew made it to land. Little today remains of the ship but information markers positioned near the graves of passengers and crew, and on a point overlooking the wreck site, bear testament to the loss of life.

Source: DELM 1998.

Interpretive maritime trails

Some 25% of Australia's 6000 documented shipwreck sites have been located, and approximately 2.5% of these have been interpreted through shipwreck trails (Strachan 1995). These trails are popular and have established better liaison between Government heritage agencies and the local community. Community access to shipwreck heritage is an important program goal in most States and features prominently in the priorities of the National Shipwrecks Program.

Shipwreck trails in Region

Great Ocean Road Historic Shipwrecks Trail

Visitors touring along the Great Ocean Road on Victoria's coastline can learn about the Region's maritime history through interpretive signs. The trail was launched in 1990 to highlight the importance of maritime activity to Victoria's development.

Southern Ocean Shipwreck Trail

This trail extends from the Victorian border to the mouth of the Murray River in South Australia. Along this coastline 89 vessels have been wrecked with 259 lives lost (Government of South Australia 2001). The region includes Cape Northumberland, the site of South Australia's worst maritime tragedy, that of the *Admella*, in which 89 passengers and crew lost their lives in 1859.

Other notable shipwrecks include the *Geltwood*, a 1056 tonne sailing ship wrecked in 1876 with the loss of 31 lives; the *Maria*, a small sailing vessel wrecked off the Coorong in 1840, with all passengers and crew killed while attempting to reach Encounter Bay; the *Phaeton*, an American sailing vessel lost while bringing Chinese immigrants into Robe in 1857.

Some historic shipwrecks lie within protected or no-entry zones. These zones vary in size but may cover an area up to a radius of 800 metres around a wreck site, and may be declared where circumstances place the wreck at particular risk of interference. These declarations prohibit all entry into these zones in the absence of a permit and in particular no diving,

trawling or mooring is allowed. There are currently 13 protected zones in Australian waters and they are generally located in in-shore areas. For example, protected zones have been declared for eight particularly fragile historic shipwrecks off the Victorian coast. Seven of these protected zones are in Port Phillip Bay and one is near Port Albert on the east coast. These are all, with the exceptions of the *William Salthouse* (1841) and the *Hurricane* (1868), off-limits to diving, fishing and boating.

The Australasian Institute for Marine Archaeology (AIMA) has developed the AIMA Code of Ethics to provide direction to those seeking to work on, or disturb maritime heritage (AIMA 1993). The Guidelines for the Management of Australia's Shipwrecks were developed by the Commonwealth Government in partnership with AIMA to mitigate human pressures on wrecks including: fishing, dredging, coastal development, commercial salvage, and recreational souveniring (AIMA 1994).

Built heritage

Built heritage along the coastal strip of the South-east Marine Region includes lighthouses, custom houses, coastal fortifications and former sealing and whaling stations.

Currently there are 49 lighthouses classified as 'major lighthouses' in the Region, that is, those lighthouses with a light range greater than 15 nautical miles (Larcombe et al. 2002).

Some significant lighthouses of the Region

Iron Pot Lighthouse

The Iron Pot Lighthouse was the first lighthouse built in Tasmania and is the second oldest lighthouse in Australia. It consists of the oldest original tower in Australia and was the first lighthouse to utilise a locally made optic. It is also believed to be the first lighthouse in Australia to be converted to solar power.

Deal Island Lighthouse

The Deal Island Lighthouse in Bass Strait was first turned on in 1848. It was built jointly by the New South Wales, Victorian and Tasmanian Governments. Its height of 305 m above sea level makes it not only the highest light in Australia, but also in the Southern Hemisphere.

Cape Schanck Lighthouse

The Cape Schanck Lighthouse was constructed in 1859 as part of the second campaign of ocean (as opposed to harbour) lighthouse building in Victoria which also produced lights at Wilsons Promontory and Gabo Island. Cape Schanck, along with other Victorian ocean lighthouses, was handed over to the Commonwealth after Federation. All the transferred lighthouses, now automated, were returned to Victoria in 1995.

The lighthouse is historically, architecturally, scientifically, socially and archaeological important. The buildings are a complex of lighthouse and lightkeepers' quarters which have been in continuous operation since 1859. Its substantially intact original buildings are some of the oldest groups of lighthouse buildings in Australia. Like the Wilson's Promontory Lighthouse, this complex is a manifestation of the increasing importance of Bass Strait as a shipping route in the 1850s and was a direct result of inter-colonial cooperation before Federation. In addition, the lighthouse is an important example of nineteenth century lighthouse technology, particularly the lens array which was manufactured by the famous lighthouse manufacturer Chance Bros of Birmingham. This array was the first of its type imported into Victoria.

Wilsons Promontory Lighthouse

The Wilsons Promontory Lighthouse was constructed in 1859 and the remaining buildings include the rock faced granite tower, head lightkeeper's quarters and associated stone walls. During World War II the site was also used as a radar station and the remains can be seen to this day.

The lighthouse is of historical, architectural and archaeological significance. It is historically important as a key component in a series of navigational aids, which served to make safe the passage of Bass Strait. Architecturally, it is an important example of the lighthouse design work of Charles Maplestone, the architect for all Victorian lighthouses between 1856 and 1861.

Maatsuyker Island Lighthouse

The Maatsuyker Island Lighthouse was constructed around 1890 and is Australia's southernmost lighthouse. The lighthouse is located on Maatsuyker Island 10km offshore from southern Tasmania. The Maatsuyker Island complex is a group of relatively intact late Victorian buildings and an intact lighthouse in an isolated and dramatic setting. The lighthouse was until recently manned by keepers, and it remains a beacon that guides seafarers to safety through some of the worst storms of the Roaring Forties. A midden found on the island is thought to be around 570 years old and represents the largest Aboriginal sealer's midden yet found in Australia.

Source: Lighthouse Computer Training & Development 1999, Heritage Victoria 2001, Chester 1995, MAST 2001.

Old sealing and whaling stations or camps in the Region include whaling stations at Fishery Cove, Encounter Bay and Rivoli Bay in South Australia; Eden in NSW; Portland in Victoria; Adventure Bay and the Derwent River in Tasmania. Sealers also frequented areas on Kangaroo Island and Guichen Bay in South Australia, across the Bass Strait islands and along the coastlines of Victoria and Tasmania.

The importance of sealing in the history of Macquarie Island is discussed in the assessment report, *Resources – Macquarie Island's picture*.

Management arrangements

The management and legislation that protects, conserves and regulates activities relating to shipwrecks in Australian waters exists at the international, national and state level.

At the international level, the ICOMOS *Charter on the Protection and Management of Underwater Cultural Heritage* (the Sofia Charter) was ratified in 1996 and is primarily designed to protect and conserve underwater cultural heritage. Under the Sofia Charter underwater cultural heritage is considered as archaeological heritage that is either in, or removed from, an underwater environment.

In addition to the Sofia Charter, Australia has agreements with a number of countries relating to marine cultural heritage. These obligations are examined in the assessment report, *Ocean management – the legal framework*.

A number of other ICOMOS Charters also guide heritage management in Australia. In particular, the Australian Branch of ICOMOS published the influential Australia ICOMOS *Charter for the Conservation of Places of Cultural Significance* (known as the Burra Charter) in 1979. The Charter is effectively a code of professional heritage practice that sets down guidelines for conserving places of cultural significance.

The *Australian Natural Heritage Charter* was adopted in 1996 to assist in the decision-making on conservation of heritage (Australian Committee for IUCN 1996). The Charter is intended to achieve a uniform approach to conserving places of natural significance and states that (AHC 1996, p.3):

> Natural heritage incorporates a spectrum of values, ranging from existence value at one end through to socially-based values at the other. The fundamental concept of natural heritage, which most clearly differentiates it from cultural heritage, is that of dynamic ecological processes, on-going natural evolution, and the ability of ecosystems to be self perpetuating. At the cultural end of the spectrum, clear separation of cultural and natural values can be difficult, and more than one layer of values may apply to the same place.

The *National Strategy for Australia's Heritage Places* recognises our responsibility to past and future generations where the Australian community protects, conserves, promotes and manages its heritage through cooperation and respect between all communities and governments (AHC 1999). In addition, this strategy recognises that Australia's heritage should be managed in accordance to evolving traditions, customs and laws while acknowledging that Indigenous people are custodians of their heritage. *Australia's Oceans Policy* complements the National Heritage Places Strategy and states that "our oceans are national heritage assets in community ownership" (EA 1998a, p.25). The Policy aims to identify, conserve, promote and hand to future generations the natural and cultural heritage of Australia's marine areas. It supports cooperation between all stakeholders in the marine environment, stewardship and the identification of heritage values to ensure that they are conserved.

Overview of Australian heritage legislation

Australia protects its important heritage places through a variety of mechanisms. The main Commonwealth legislations in this regard, the *Australian Heritage Commission Act 1975* and the *Historic Shipwrecks Act 1976*, are discussed in the assessment report, *Ocean management – the legal framework*.

Decisions affecting most heritage places are carried out under State and local government environmental, heritage and planning laws. Listing in the Register, set up under the *Australian Heritage Commission Act 1975*, gives heritage places some protection through the imposition of obligations on Commonwealth agencies.

Legislation to introduce a new Commonwealth heritage regime has been introduced to the Senate. The Bills propose amendments to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to identify, conserve and protect places of national heritage significance; and provide for the management of Commonwealth heritage places. Under the Bills it is proposed to change heritage-listing arrangements. This will include the creation of two new heritage lists, a National Heritage List of places of outstanding heritage significance for the nation, and a Commonwealth Heritage List of places owned or managed by the Commonwealth. It is also proposed that an independent expert body, the Australian Heritage Council, would be created to assess places for possible national or Commonwealth place listing.

Under the Bills, places listed will be protected under existing provisions within the EPBC Act. In essence, this means that no-one may take an unapproved action that is likely to have a significant impact on the heritage values of a listed national or Commonwealth heritage place. The Bills also provide for: a planning process to manage heritage places; reporting on the state of places; and funding assistance for heritage conservation (AHC 2001).

Protecting natural heritage places relies primarily on a variety of environment protection, nature conservation, land-use and planning laws. State and Territory governments have their own legislation to protect heritage, usually covering only historic places and sites, and there are generally separate arrangements for identifying and protecting 'natural' places and those important to Aboriginal and Torres Strait Islanders (AHC 2001). While each State has legislation complementary to the Commonwealth's to protect historic shipwrecks in its waters, the day-to-day management of most shipwrecks is the responsibility of the relevant State government.

In NSW, the *Heritage Amendment Act 1998* clarifies the shared responsibility for heritage management between local government authorities responsible for items of local significance, and the NSW Heritage Council. Historic heritage protection is provided in South Australia by the *Heritage Act 1993*. In Tasmania, historic places are protected by the *Historic Cultural Heritage Act 1995*. This Act has established the Heritage Council and the Tasmanian Heritage Register. The *Heritage Act 1995* provides legislative protection for Victorian heritage places. In addition, in Victoria, it appears that local government authorities have been increasingly active in using planning powers to protect heritage places.

Indigenous uses

The assessment report *Sea Country – an Indigenous perspective* discusses Indigenous people's uses of, and aspirations for, the South-east Marine Region. This report provides a brief summary of prominent uses by Indigenous people within the Region.

The continuing importance of coastal zone resources to Aboriginal people in southern Australia is summarised in the following extract from the Tasmanian Aboriginal Centre's submission to the 1993 Coastal Zone Inquiry (RAC 1993):

> The coastline is dotted with Aboriginal sites that have been there for many thousands of years..... The coastline gives us sources of fish foods, plant foods, and cultural activities. It is as meaningful today in our lives as it was thousands of years ago...

Harding & Rawlinson (1996) identify the following traditional uses of marine and coastal areas:

- place-related subsistence (including barter and exchange within local Indigenous communities)
- maintaining Indigenous culture, including spiritual beliefs, ceremonial practices and traditional fishing and hunting skills.

These traditional uses are important components of Indigenous use within the Region. In fact, most parts of coastal Australia are of continuing cultural and spiritual significance to Aboriginal people, who engage in subsistence hunting, fishing and gathering. Hunting and fishing for traditional foods provides a important part of the diet, forming an almost invisible non-cash part of the economy in both remote and urban coastal regions.

Fishing is an important part of Aboriginal culture and Indigenous fishing uses a variety of methods and equipment including hand gathering, lines, rods and reels, nets, traps and spears. Indigenous fishing targets a range of species of fish, shellfish, crabs and worms that are used for food, medicine or bait. Target species off southern NSW include mullet, flathead, whiting, tailor, bream, blackfish, crabs, lobsters, oysters, cockles, whelks, abalone and beach worms. Abalone, crab and lobster harvesting are also recognised as an important part of the Aboriginal fisheries.

In Victoria, many Indigenous people continue to fish for eel using traps and other fishing methods. In Tasmania, Indigenous people harvest lobsters, abalone, oysters, mussels and numerous species of fish, including rays, for food. Kelp and mariner shells are also used to make shell necklaces.

Aboriginal people in southeastern South Australia have engaged in fishing and shellfish collecting on a regular, sometimes daily basis. In the Coorong area and at Raukan (Point Maclay) Indigenous people engage in line fishing in the sea lakes behind the foredunes and collect sand pippis (shellfish) from the beach.

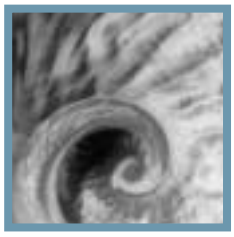
Native title claims

In the South-east Marine Region eight claims have been lodged covering a sea area of roughly 60 000 square kilometres. Six of these claims have satisfied the conditions of the registration test and are lodged on the Register of Native Title Claims. Further information on these claims can be found in both the assessment report *Sea Country – an Indigenous perspective* and the Larcombe et al. (2002) report *Marine Matters: Atlas of Marine Activity & Coastal Communities in Australia's South-East Marine Region*.

Indigenous Land Use Agreement (ILUA)

One ILUA exists within the South-east Marine Region, near Port Campbell in Victoria (see the *Petroleum, Indigenous and Tourism Multiple Use Study* in Chapter 7). An ILUA is a voluntary agreement between native title groups and other people about the use and management of land and waters (Larcombe et al. 2002) and was created by a 1998 amendments to the Native Title Act (NTA). This amendment incorporated provisions for flexible, voluntary agreements between native title and other parties and, as such, should hold some appeal for those wishing to negotiate land use agreements.

An ILUA needs to be registered with the National Native Title Tribunal, or similar body, and allows for wide consideration of, and consultation with, Indigenous people and all others with rights and interests in the land/area. ILUA's provide for practical resolution of land use and management issues and specify relationships between Indigenous and other



parties including legal guarantee for actions. The role of ILUA's is becoming increasingly important not only in terms of good business sense, but in light of the wider implications of recent legal decisions that recognise the existence of native title at sea – such as in the Croker Island case.

Indigenous Protected Areas (IPAs)

Four coastal and island Indigenous Protected Areas (IPAs) have been recently established in Tasmania:

- Mt Chappel and Badger Islands Indigenous Protected Areas located in the Furneaux Island Group off the north coast of Tasmania
- Oyster and Risdon Coves Indigenous Protected Areas near Hobart in southern Tasmania.

IPAs are established on Indigenous-owned and managed land that is included as part of Australia's National Reserve System of protected areas. Regaining management responsibility for these island and coastal Regions potentially provides Tasmania's Indigenous communities with an opportunity for their greater involvement in managing marine areas within the South-east Marine Region.

Marine research and education

Australia's marine environments are huge, remarkably diverse and resource rich. The sustainable use of our oceans is dependent upon scientific research and education facilitating our understanding of the complexity of the ocean's biota and the inter-relationship with ocean users (for example fisheries and petroleum).

The improved management of the oceans is contingent upon the effective use of research to educate ocean users, policy makers and the general public. The marine research and education sector is the key enabling sector for achieving the sustainable use of Australia's oceans. This sector is made up of public and private institutions/establishments and formal and informal education mediums.

The sector is unique in that unlike the majority of ocean 'users' it is overwhelmingly dominated by government ownership and funding – estimated to be around 93% of all funding to the 'sector' in 1993 (HOMA 1993). This is largely because the Australian governments are trustees of the ocean for the Australian people and the majority of marine research and education has a 'public good' aspect that is not commercially attractive to the private sector.

To account for the prospect of commercial innovation and discoveries emerging from government research, a number of government research and education bodies have commercial arms to develop and market new products.

Background

Marine research and education has the potential to improve our understanding and management of Australia's marine jurisdiction, supporting our sovereignty claims under the United Nations Convention on the Law of the Sea, and providing a vital input to marine industry development in the sustainable exploitation of our resources. It can also add to the understanding of marine species, ecosytems and environments, thereby contributing to their conservation.

Communicating research findings to target audiences is a basic requirement for effective marine resource and marine industry management. For example, science based research is necessary to provide knowledge of such things as ecosystems, particular fisheries information (including biology, stock population dynamics, effects of fishing) and ultimately the sustainable yields for resource management. It also provides valuable information on the biodiversity of the marine environment (IC 1992).

Marine research encompasses three types of activities:

- basic research – experimental and theoretical work undertaken primarily to acquire new knowledge without a specific application in view
- applied research – original work undertaken to acquire new knowledge with a specific application in view
- experimental development – systematic work using existing knowledge gained from research or practical experience to create new or improved products and processes.

Marine research in Australia is aimed at both pure research and experimental development. For instance, agencies such as the CSIRO, the Fisheries Research and Development Corporation and Geoscience Australia carry out research that aims to benefit both the public and the private sector. Where private benefits are identified, agencies have set in place funding arrangements to reflect the benefits flowing from research.

Education (both formal and informal) is the key link between marine research and target audiences. The vehicle for delivering the message depends on the complexity of the issue and the target audience. Traditionally, formal institutions such as government funded universities and specialist colleges have trained marine industry stakeholders and public sector policy makers. At the other end of the spectrum, but of no less importance, are the less formal marine educational centres and non-government community based organisations. These concentrate on informing the public on marine issues, primarily to increase the community's knowledge and appreciation for the marine environment, and for the social and environmental benefits that flows from such knowledge.

Marine research and education are not always mutually exclusive. For instance, universities, while predominantly engaged in education, also engage in research and development. Similarly, marine research organisations may also have a role as educators. As well, marine management agencies such as the Commonwealth and State fisheries agencies also engage in both research and education. Organisations may also cooperate across these areas to achieve mutually-desired outcomes. As well, some agencies outside the Region may undertake either research or education within the Region – such as the Australian Fisheries Management Authority and the Bureau of Rural Sciences – both based in Canberra.

Community networks

In 1991, the Australian Government recognised the community's concern for the marine environment by establishing Ocean Rescue 2000 – a decade-long marine conservation program. As part of this program, the Marine and Coastal Community Network was established in 1993 to assist community involvement in caring for our oceans and coasts. The Network is a non-government, community-based organisation. Through the Network individuals and community groups can contact others who share their interests or are working on similar environmental issues. Their aim is to bring organisations, government agencies and industry together to develop a more cooperative and coordinated approach to marine resources management. The Network has regional coordinators based in all States and Territories.

Source: MCCN 2001.

Regional activity

Marine research

The Region is home to CSIRO Marine Research, Australia's largest marine research organisation, and the Australian Antarctic Division. These Commonwealth-funded agencies conduct research into the resources and dynamics of the diverse marine ecosystems in the Region.

Other organisations include:

- Cooperative Research Centres
- Geoscience Australia
- Australian Quarantine and Inspection Service
- Bureau of Meteorology
- Fisheries Research and Development Organisation.

Coastal research in the Region is also carried out by a variety of State Government agencies including:

- Marine and Freshwater Resource Institute at Queenscliff, Victoria
- Department of Primary Industries, Water and the Environment, Tasmania
- South Australian Research and Development Institute.

As well, tertiary institutions in the Region including the University of Tasmania, University of Melbourne, Monash University, University of Latrobe and Deakin University as well as the Australian Maritime College, carry out ecological and applied industry research in coastal waters (Larcombe et al. 2002).

Marine education (formal)

The Australian Maritime College in Launceston, Tasmania, is an example of a specialised marine education facility, providing high-quality education and training for the maritime sector and government. Other formal education facilities in the Region include universities in Tasmania and Victoria that offer courses and research opportunities in areas such as:

- marine biology and ecology
- aquaculture
- maritime transport and marine engineering
- marine resource management
- related areas such as law, economics and the social sciences.

Marine education (informal)

Marine educational centres concentrate on providing education to the public on marine issues primarily for the social and environmental benefits that will flow from such knowledge within the wider community. As such, centres are generally run as not-for-profit facilities or facilities provided by the public sector. For instance, in Victoria, MAFRI runs the Marine Discovery Centre. This centre aims to assist "people of all ages to discover the wonders of southern Australia's marine environment" (MDC 2001). As well, in Tasmania, the Department of Education runs the Marine Discovery Centre at Woodbridge in Southern Tasmania.

Economic dimensions

The main funding sources for research organisations are direct Commonwealth and State appropriations, the Fisheries Research and Development Corporation and various funds administered by Government agencies such as the Australian Fisheries Management Authority, the Department of Agriculture Fisheries and Forestry and, more recently, the National Oceans Office.

Research accounts for about half of the total outlay on management of Commonwealth fisheries. In 1988-89 this amounted to over 6% of the gross value of commercial fisheries production.

Management arrangements

There are no specific legislative requirements for the management of the marine research and education sector in Australia. The sector operates within the existing national legislative arrangements. However, to recognise the critical importance of the sector, the Commonwealth, State and Territory governments have sought to influence its development through policy mechanisms.

Commonwealth policy mechanisms

Through policies including *Australia's Ocean's Policy*, the *Marine Industry Development Strategy* and the *Marine Science and Technology Plan*, the Commonwealth Government recognises the importance of marine research and education in developing an integrated, multi-dimensional approach to ocean management. This emerging policy framework is influenced by both the marine research and education sectors and will in turn influence their future direction. This is likely to result in stronger links between scientists, industry and environmental managers in setting priorities and goals for marine science.

Offshore Minerals

The commercial potential of Australia's offshore mineral resources is largely unexplored and undeveloped. Since 1990, there have been 65 applications for offshore exploration licences in Commonwealth waters and 10 applications for offshore mining licences. Only one exploration permit (Tas-MEL-2), covering Ringarooma Bay in northeast Tasmania, remains active and there are no current mining licences. To date there have been no commercial discoveries in Australian waters (Pemberton, 2001; Sait, 2001).

The low level of offshore mineral exploration and development activity can be attributed to a number of factors, including Australia's relatively accessible and proven onshore mineral reserves, and the perceived increased cost and risk associated with offshore exploration and development.

For these reasons, its is likely that future offshore exploration and mining will initially be focussed in near-shore shallow coastal waters in search of readily-accessible construction materials (such as sand, gravel and limestone), other materials such as heavy mineral sands and diamonds, and other placer deposits.

Future exploration for other deposit types, such as base metals in hard rock in near-shore shallow water environments, will in part be dictated by advances in exploration techniques as well as the economics of exploitation in offshore environments. The main deep-sea mineral deposits that may be of long term commercial mining interest are metal-rich ferromanganese crusts and nodules. The main metals of economic interest in such deposits are cobalt, copper, nickel and possibly gold.

Background

The information available on Australia's offshore mineral potential comes from limited exploration by private companies and from reconnaissance undertaken by Geoscience Australia. Mineral commodities that have the potential to occur as economically viable deposits within the Australian Exclusive Zones include:

- construction materials – generally near-shore deposits of sand and gravel
- placer minerals – deposits are found near shore and include diamonds, gold and tin
- manganese nodules – deposits principally of manganese, nickel, cobalt and copper that occur in the deeper waters of the EEZ, as well as ferromanganese oxide crusts (sometimes called cobalt rich crusts)
- phosphorites – deposits are found on the continental shelf margins and seamounts
- offshore extension of onshore mineralisation – near-shore deposits identified by extrapolating onshore geological information.

Mineral classifications

Marine mineral deposits can generally be classified into:

- placer deposits – cassiterite (tin), gold, diamonds and mineral sands
- aggregates – marine sand, gravel and phosphate
- metalliferous nodules, crusts and muds – manganese nodules.

These deposits are found at different depths, in varying environments and at differing volumes, presenting many challenges for their extraction (Figure 10).

Placer deposits

Placer deposits are formed as a consequence of the specific gravity and resistance of certain minerals to weathering. As a result of these properties, placer minerals are concentrated in locations such as present-day or old river channels and beaches (Figure 11) (Cook & Taylor 1997).

Most commercial placer mining operations take place on beaches, including in the inter-tidal zone, but improved exploration methods and mining techniques now allow for mining to about 600 m depth.

Figure 10: *Location of marine mineral resources.* *Source: Cook and Taylor, 1997, p.1.*

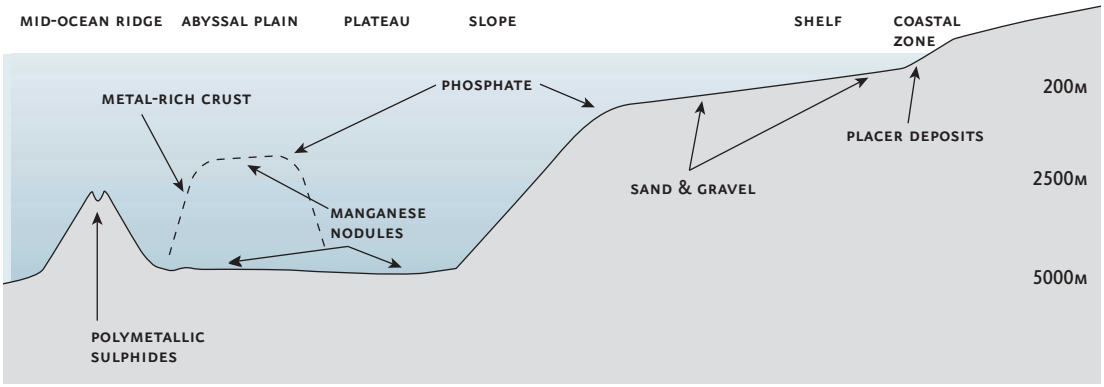
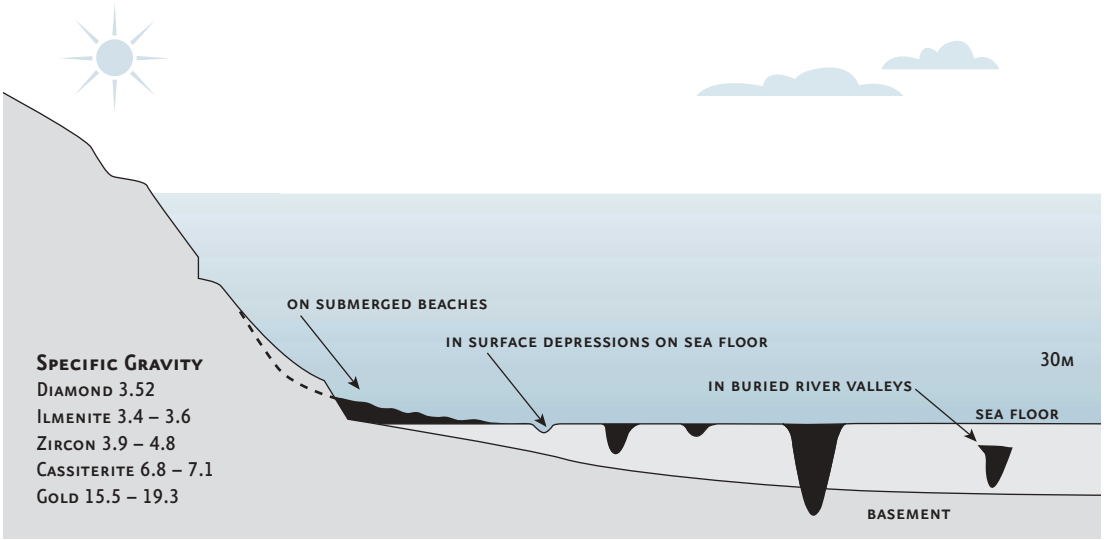


Figure 11: *Environments of offshore placer mineral occurrence.* *Source: Cook and Taylor, 1997, p.2. (Modified from Cronan, 1992).*



Aggregates

Aggregates, such as marine sands, gravel and phosphate, are a high-volume, low-value commodity. Nevertheless, after hydrocarbons, they are probably the most important group of marine minerals globally in terms of income generation (Cook & Taylor 1997). Marine sands and gravel are generally extracted from relatively shallow waters whereas phosphate deposits are found at greater depths on the continental margins, and to a lesser extent on plateaus and seamounts. Phosphate deposits are in the form of phosphatic nodules. There are no commercial offshore phosphate extraction activities currently in existence. (Falconer 1989).

Metalliferous nodules, crusts and muds

Much of the economic interest in the deep ocean has focussed on manganese deposits found in the abyssal zone of many of the world's oceans, as well as elevated areas such as seamounts and mid-ocean ridges. They are also found in a variety of other locations such as within active volcanic areas and submerged calderas, including mid-oceanic hydrothermal systems called 'black smokers' and 'white smokers' (Cook & Taylor 1997). Metalliferous deposits can be found as either nodules or pavements/crusts. Both nodules and crusts may be high in magnesium, iron, nickel, copper and/or cobalt (Cronan 1992).

Exploration techniques

Offshore mineral exploration techniques include geophysical methods such as sonar, seismic reflection and magnetic gravity measurements. These are normally carried out from surface vessels without physical contact with the seafloor. Geological methods physically sample the seabed using techniques such as surface grabs, dredging, shallow coring and deep drilling. Finally, geochemical methods analyse constituents of seabed sediments and rocks for trace or ore bodies.

Current offshore mining technology

The four basic methods of mining offshore deposits on the continental shelf are scraping, excavating, fluidising and tunnelling beneath the seafloor.

Scraping methods include:

- dragline dredge – a single dredge bucket operated by cables from a surface vessel recovers material. The bucket descends to the seafloor and scrapes material from the surface of a deposit. The filled bucket is then raised to the surface and the material dumped into a barge for transportation to shore
- trailing suction dredge – a pump draws a slurry of bottom water and sediment containing the ore into a riser (or pipe) leading to a surface vessel. As sediment accumulates in the surface vessel water decants overboard.

Excavation methods include clamshell bucket dredge, bucket ladder dredge, buckwheel suction dredge, suction dredge, cutterhead suction dredge, air lifts, hydro-jet dredge, dry mining, drilling and blasting. The two primary methods are:

- clamshell bucket dredge – a split bucket operated by cables descends to the seafloor and is mechanically actuated to bite into the seabed and remove material. The filled clamshell is raised to the surface and the material is dumped into a barge for transportation to shore. This method is best suited to excavation of large size granular material where accuracy of positioning is not important
- bucket ladder dredge – consists of a chain of loosely connected buckets mounted over a heavy digging arm (or ladder) attached to a surface vessel. This method is most efficient for excavation of deposits containing boulders, clay and weathered bedrocks. Its use offshore has been limited to dredging of alluvial gold and tin and it is frequently used for clearing harbours. Bucket ladder dredges are limited to a depth of 45 m but rarely operate at depths over 20 m. Only a few of these dredges have been built for offshore mining in the last 20 years, and it is likely that they will be superseded by the bucket wheel suction dredge.

Fluidising-methods include:

- slurries – certain types of deposits may be mined as a fluid slurry through drill holes penetrating the seabed. Sub-seabed areas were mined this way in Japan's shallow offshore waters in 1974
- solutions – hard-rock deposits that are amenable to hydrometallurgical treatment.

Tunnelling beneath the sea floor involves entry to a deposit either from shore or from natural or artificial islands in shallow waters. The deposits are then mined by conventional underground techniques. In certain cases, sub-sea deposits of bedded coal, potash and ironstone, as well as veins of lead, copper and tin, have been mined by conventional land-based underground methods.

Regional activity

There has been limited exploration for minerals in the South-east Marine Region since the 1960's. Exploration licences have been granted for cassiterite off northern Tasmania, Flinders Island and Great Oyster Bay. The areas of interest include the alluvial deposits offshore from known onshore tin resources. Other placers that have been subject to exploration licences in the Region include zircon, ilmenite, monazite and titanium off King Island and zircon and tin in Great Oyster Bay. Exploration licences were also granted for phosphate nodules off western and southern Tasmania. No commercial exploitation followed this exploration activity.

The single current exploration licence for offshore minerals in the South-east Marine Region is for cassiterite that occurs at Ringarooma Bay off north-east Tasmania. (Map 12).

Metalliferous deposits

The most comprehensive study of metalliferous deposits in the South-east Marine Region was conducted by Exon (1997). He reported unusually thick ferromanganese crusts, up to 20 cm thick, on rocky outcrops off western Tasmania and on the South Tasman Rise in water depths of 1500-4500 metres. Those from within the oxygen-minimum zone (below 2000 m) average 0.8% cobalt, which compares very favourably with other locations in the world that are highly prospective (eg Marshall Islands). However, the highest cobalt content is from crusts only 2-4 cm thick, as compared to a suggested cut-off thickness of 4 cm. Exon (1997) recommended that further prospecting for cobalt-rich crusts should concentrate on outcrops in water depths of 1000-2000 m on the eastern South Tasman Rise and southern Tasmanian margin (Hill et al. 2001).

Economic dimensions

The question of whether or not an offshore mineral deposit can be commercially exploited is subject to a range of issues including location (distance from the shore or port and depth etc), grade, price, environmental impact, extraction technology and other competing uses for the area – such as conservation. To date the offshore mineral deposits in the South-east Marine Region have not been commercially viable. In the context of increased world consumption of mineral resources and emerging technologies, it is likely that offshore areas will become increasingly attractive for exploration and development activity in the future.

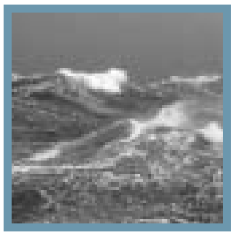
Management arrangements

Commonwealth waters

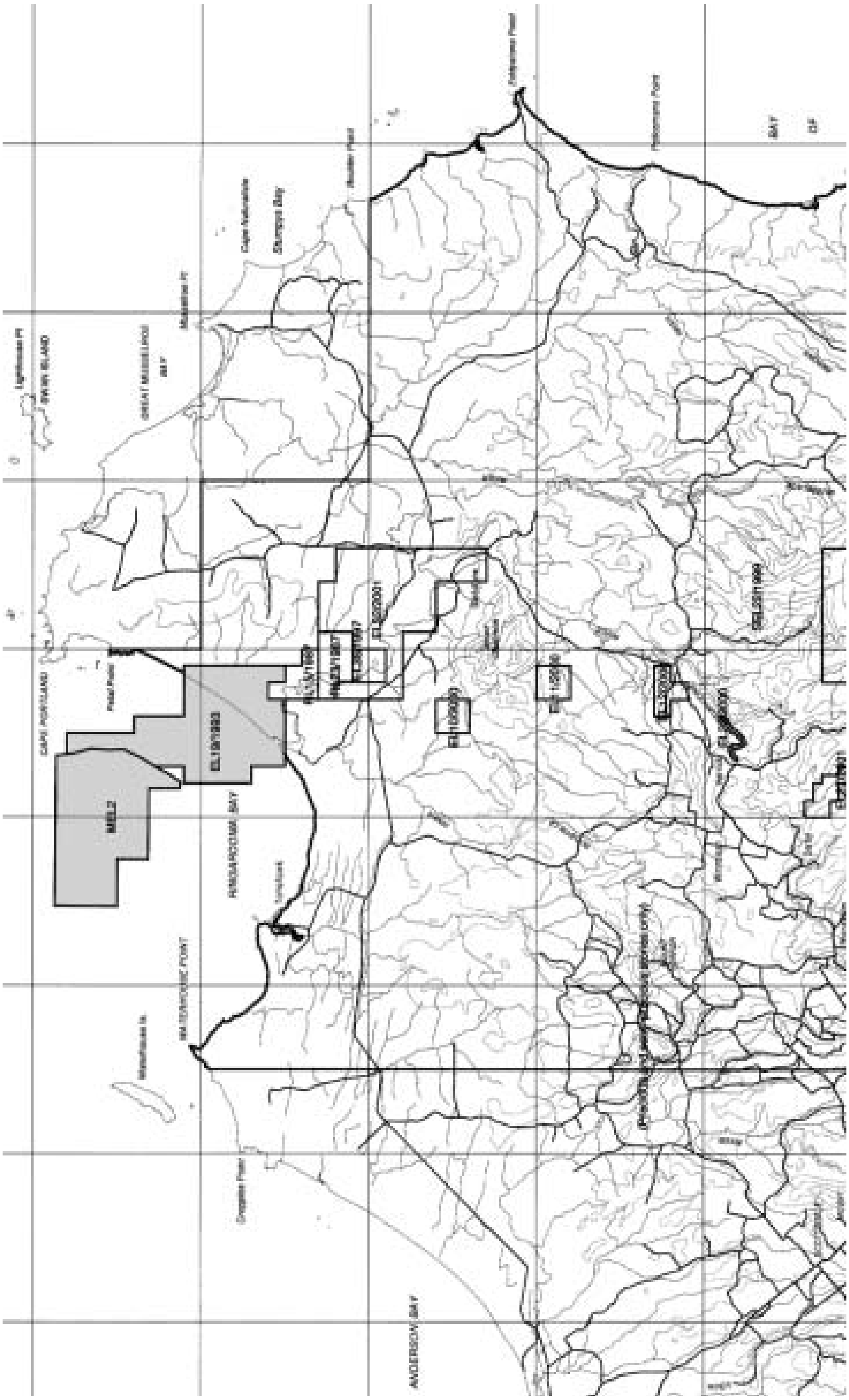
The Commonwealth *Offshore Minerals Act 1994* (the Act) replaced the *Minerals (Submerged Lands) Act 1981* and began operations on 1 March 1994. The Act provides the legal framework for the exploration for, and the production of, minerals other than petroleum on Australia's continental shelf that is under Commonwealth jurisdiction (beyond the coastal waters of the States/Territory). There are also six associated Acts which provide for the payment of royalties, fees for registration, exploration, retention, mining and works licences. These separate Acts are required for constitutional reasons. The total Commonwealth legislative package relating to offshore minerals is contained within the assessment report *Oceans management – the legal framework*.

Offshore Minerals Act 1994

Section 44 of the Act prohibits offshore exploration and mining companies from interfering with the rights of other users and uses of the sea, such as navigation, fishing, conservation, other lawful operations and native title, to a greater extent than is necessary for the reasonable exercise of the rights and performance of duties.



Map 12: *Offshore mineral licence areas in the South-east Marine Region.* Source: *Minerals Tasmania 2001.*



Administration

The administration of the Commonwealth legislation is shared between the Commonwealth and States and Northern Territory governments. Each jurisdiction administers the Act for and on behalf of the Commonwealth over the offshore area adjacent to it. The Act operates through two institutions – the Designated Authority and the Joint Authority. There is a separate Designated Authority (DA) and Joint Authority (JA) for each State and the Northern Territory.

The Designated Authority for each State and the Northern Territory is the relevant Minister responsible for that jurisdictions adjacent offshore area. The Designated Authority is responsible for the normal day-to-day administration of the Commonwealth legislation.

The Joint Authority consists of the Commonwealth Minister and the relevant State or Territory Minister. The Joint Authority is responsible for major decisions relating to licences, such as grants and refusals. In the event of a disagreement the views of the Commonwealth Minister prevail.

An important feature of the offshore licensing system is that the Joint Authority always acts through the corresponding Designated Authority with the Designated Authority always carrying out the Joint Authority's decisions. Applicants and licence holders always deal with the Designated Authority and do not deal directly with the Joint Authority, although the Joint Authority is the ultimate decision-maker. The Designated Authority operates through the department responsible for mining in the relevant State or Territory.

State and Northern Territory legislation

The States and the Northern Territory are in the process of drafting their respective complementary offshore minerals legislation using the Commonwealth Act as a model. This legislation will apply to the mineral resources of the seabed within the first three nautical miles of the territorial sea.

Pending the enactment of their offshore minerals legislation, the States and the Northern Territory may approve exploration for, and the exploitation of, offshore minerals under their respective onshore mining legislation. A number of exploration licences have been granted but no mining has been carried out to date.

Ocean waste disposal

The oceans are the recipients of a cocktail of by-products from land-based production and consumption activities. Heavy metals are released in industrial production processes and bacteria and other biological carriers come from human and animal wastes. Population increases along Australia's shorelines and the corresponding industrial development has resulted in a rapid increase in sewage outflow into rivers, estuaries and oceans. Land use and storm water systems influence the nutrient load of rivers as well as the turbidity and sedimentation in coastal environments (Plunkett 2001a). The dumping of ships and chemicals in Australia's offshore areas impacts upon the marine environment in the local area and may have wider environmental implications.

Traditionally, ocean disposal and outflows have been based on the belief that tides, currents and the sheer volume of the world's oceans (covering 70% of the Earth's surface) would ensure that materials disposed of would be quickly and harmlessly dispersed.

However, as early as the 1920's public concern at waste washing ashore at Melbourne and Sydney beaches saw ocean disposal become a political issue, and the Federal Government introduced the *Beaches, Fishing Grounds and Sea Routes Protection Act 1932*. This legislation was enacted some forty years before there were any international moves to control ocean disposal (Plunkett 2001a).

Background

For the purposes of this assessment, ocean waste disposal is considered to derive from two main sources:

- land-based sources
- dumping at sea.

It is important to consider land-based sources of marine pollution as around 80% of contamination in the marine environment (SOEAC 1996). Contaminates come from a number of sources including: stormwater run-off; pipes and drains; rivers and urban catchments; and the atmosphere. Table 16 details the main pollutants and their sources.

Ocean disposal encompasses the dumping of a myriad of society's waste at sea. Types of materials dumped in Australia's waters include (EA 2001b):

- ammunition
- dredge spoils
- human bodies
- chemical and industrial waste
- obsolete equipment including boats
- materials for artificial reefs
- food scraps
- treated water.

Table 16:
Marine land-based pollutants and their sources.

POLLUTANTS	SOURCES
Nutrients	Soil erosion, fertiliser run-off, industrial and urban sewage discharge, animal production
Suspended solids	Forest clearing, overgrazing, agriculture
Organochlorins	Pesticides, herbicides, industrial chemicals
Organophosphates	Pesticides
Metals (Cu, Pb, Cd, Zn, Hg)	Discharge leachates, tailings, smelters, mining operations
Pathogens	Stormwater
Litter	Stormwater

Source: Plunket 2001a.

Activity in Australia

As a signatory to the London Convention 1972, the Australian Federal Government enacted the *Environment Protection (Sea Dumping) Act 1981*, which came into force on 6 March 1984 to regulate ocean dumping in Australian waters.

The Australian Department of Environment and Heritage administers this Act. Since coming into force a total of 191 dumping permits and 41 variations (alterations to conditions imposed in a previously-issued permit) have been issued for dumping in Australian Commonwealth waters. Table 17 provides a detailed breakdown of permits issued.

Table 17:
Type and number of permits and variations issued by the Federal Government in Australia.

Type of material dumped	Number of permits issued	Variations* of a permit
Ammunition	2	0
Dredge spoil	103	33
Human bodies	15	0
Jarosite	10	0
Chemicals and industrial waste	5	0
Obsolete equipment including boats	27	5
Materials for artificial reefs	26	3
Food scraps	1	
Treated water	2	
TOTAL	**191**	**41**

Source: Environment Australia 2001b.

Below is a discussion on some of the types of materials dumped in Australia's waters.

Ammunition

The defence forces voluntarily comply with existing legislation despite being exempt from requiring a permit to dispose of waste at sea under section 7 of the *Environment Protection (Sea Dumping) Act 1981*.

Until the early 1970s, obsolete ammunition and equipment was regularly dumped by or on behalf of the navy, airforce and army. This was because the options for ammunition disposal were limited as disposal on land had inherent dangers and destruction was difficult and costly.

Disposals including the dumping of obsolete warplanes off Sydney occurred frequently at the end of World War II to eliminate old war stocks. Exact disposal figures are difficult to locate, although it is known that by the early 1970s some 23 000 tonnes of ammunition had been dumped by the Department of Supply (suppliers for the forces) off the north Queensland coast.

The Royal Australian Navy appears to have originally dumped at depths greater than 549 m (300 fathoms), but switched to depths greater than 915 m (500 fathoms) after trawlers working at the 300 fathoms limit snared ammunition in their nets.

Other disposals are known to have occurred at lesser depths (183 m or 100 fathoms), including the post-World War II disposals off Sydney. Most ammunition disposal seems to have stopped in 1973. Two small disposals in 1981 and two disposals off Flinders Island (1989 and 1992 respectively) have occurred since 1973 (Plunkett, 2000).

As well as disposing of munitions and other equipment, there are historical exercise areas for gunfire and torpedo practice around Australia including Hervey Bay, Jervis Bay, Fremantle, Port Hobart, Port Phillip and Port Jackson. Spent munition from these and current exercises is scattered across the seabed in these locations.

Chemical and industrial waste

In the past, choices for disposing of industrial waste and spent chemicals were limited to landfill, ocean disposal or incineration. Ocean disposal was preferred, as landfill usually posed environmental hazards close to population centres and precluded some future uses of the land. Ocean disposal was also comparatively cheap.

Records of chemical disposals before March 1984 are limited. The earliest recorded disposal where the amount dumped, the date and the location of disposal is known, was made in 1939 for p-nitrochlorobenzene. Most of the known chemical disposals occurred from the mid 1960s to early 1980s.

In the early days of dumping, most of the disposal sites for chemicals and other materials were concentrated at sites near major ports where the material were loaded for disposal. Some of the drums of chemicals have posed, and could still pose, a problem for trawling vessels or for sea mining. For instance, on 18 April 1973 a fishing vessel trawling in 115 fathoms, 15 to 18 miles east of Sydney, snared twelve 44-gallon drums. The contents of the drums, vinyl chloride tar (contaminated hydrocarbons), covered the deck of the boat and the fish catch. In 1983 a vessel trawling east of Brisbane trawled a 1 tonne cylinder of mustard gas – part of the chemical warfare agents dumped in Australian waters at the end of World War Two (Plunkett 2001b).

Chemical and industrial waste covered under the *Environment Protection (Sea Dumping) Act 1981* includes 'black liquor' (a waste product in the paper-making industry) and spent caustic soda. Three permits for black liquor have been issued in Australia for a total of 65 000 tonnes, the last being on 13 January 1986 for 30 000 tonnes. Two permits for spent caustic soda have been issued for a total of 4800 tonnes, the last being on 23 December 1986 for 2800 tonnes. Dumping chemical and industrial waste is no longer permitted under the 1972 London Convention (Plunkett 2001b).

Current Commonwealth and State government policies that ban ocean disposal of hazardous substances and encourage waste avoidance, cleaner production and environment management technologies, have improved environment protection for both the sea and the land.

Ocean disposal of vessels

Hundreds of obsolete vessels have been disposed of at sea or abandoned off Australia (Parsons & Plunkett 1995), including vessels scuttled in the designated 'graveyard' sites of the *Beaches, Fishing Grounds and Sea Routes Protection Act 1932*. This Act contains 14 official sites.

Although some of the 'graveyard' sites see little use, the sites off Sydney Heads (New South Wales), near Rottnest Island (Western Australia) and near Barwon Heads (Victoria) have been heavily used. The availability of shipping registers and the work of maritime archaeologists in each State means that our knowledge of ship disposal for this century is relatively comprehensive.

Disposing of old vessels in deep water is now discouraged and is only permitted if this is the only practical means of disposal.

Artificial reefs

Artificial reefs are usually intentionally placed for numerous reasons associated with enhanced recreational opportunities such as fishing, diving and even surfing. This is in addition to the disposal of unwanted material and artificial structures built for coastal protection, or port and marina facilities such as breakwaters and groynes.

Most of the wrecks in the Region have been sunk through accident. Discussion about these shipwrecks can be found in the heritage section of this report.

From the mid-1960s at least 63 boats have been dumped to create artificial reefs in Australian waters.

Foods scraps and treated water

This relates to the disposal of waste from Australia's external territories. For example, from the start of Australia's expeditions in the mid-1950s, solid waste generated at the Antarctic stations was usually deposited at tip sites on land. Occasionally in winter, when sea ice conditions allowed, waste materials were taken from the stations and left on the sea ice where they would eventually disperse into the sea. This practice declined with the introduction of high temperature incinerators but some non-combustible wastes were disposed of in this way until 1985.

The disposal on the sea ice of organic waste (food scraps) and ash ceased at Casey in 1986 and at Mawson and Davis in 1987. There are no records of the volume, composition or location of materials disposed of in this way. All solid waste is now incinerated on site or brought back to Australia in accordance with legislation implementing the *Protocol on Environmental Protection to the Antarctica Treaty* (the Madrid Protocol).

Small quantities of waste are also generated aboard Antarctic vessels. Some Antarctic vessels dumped waste north of 60°S before 1988. Since 1988 only macerated food scraps (excluding poultry products) have been dumped. With the current supply boat, all waste is either burnt or returned to Australia. In February 1988 remnants of a few 200 litre drums and some debris from a derelict research station at Atlas Cove was jettisoned off a boat near Heard Island (EA 2001d).

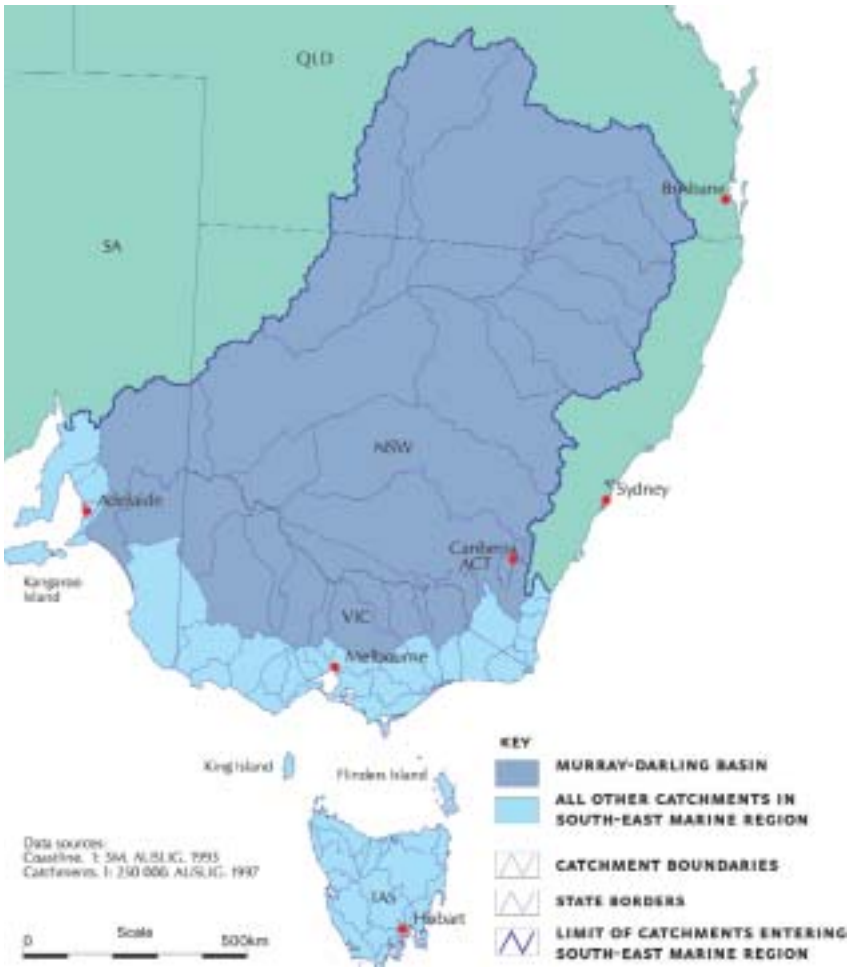
Regional activity

Land-based sources

Map 13 shows one possible source of pollutants entering the South-east Marine Region. It shows the extent of the catchments that feed the rivers flowing into the Region. Consequently, pollutants from as far away as thousands of kilometres can impose a pollutant load into the Region. In all, land-based changes over an area of some 1.3 million km^2 could impact on the Region.

Pollution impacts on the Region's marine environment in a myriad of ways. For instance, excess nutrients can affect near shore environments such as reefs and seagrass meadows. Loss of habitat may directly affect uses of the Region through diminishing nursery areas for commercially important species or loss of visual amenity which may lead to reduced tourism or recreational activity (Plunkett 2001a). In addition, stormwater, sewage outflows and particulates enter the Region from a myriad of sources such as cities and settlements.

Map 13: *Catchment areas of the South-east Marine Region.*



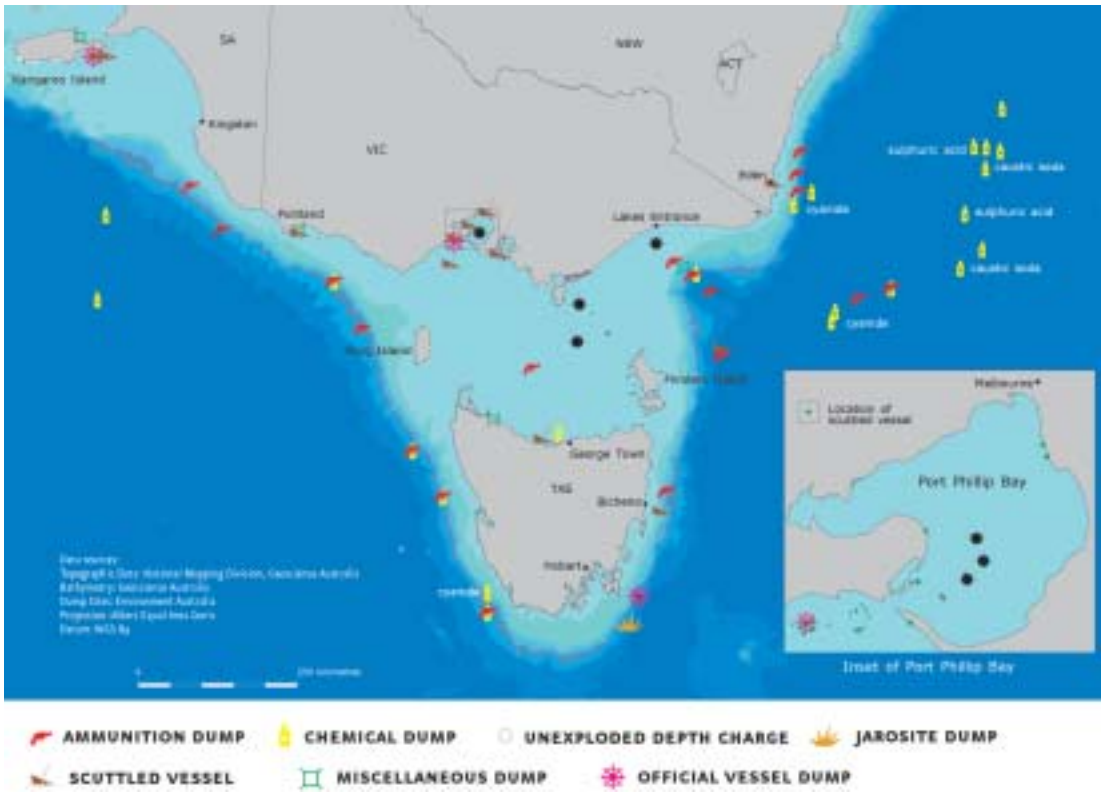
Dumping at sea

For an overview of ocean dumping sites (past & present) in the South-east Marine Region refer to Map 14.

As can be seen from Map 14, many different types of materials have been dumped in the South-east Marine Region including:

- chemicals and industrial waste
- ammunition
- scuttled vessels.

Map 14:
Ocean dumping sites (past and present) in the South-east Marine Region. *Source: Larcombe et al. 2002.*



Chemicals and industrial waste

Throughout the 1970's, iron calcine derived from roasting of iron pyrite was disposed of twice daily off George Town on the north coast of Tasmania in waters only 50 metres deep. At about this time thousands of gallons of waste cyanide were dumped off the west coast of Tasmania, the south coast of Victoria and the east coast of New South Wales, much of it in relatively shallow water less than 1500 m deep. Further offshore, in waters around 4000 m deep, thousands of tonnes of spent caustic soda and sulphuric acid were dumped during the late 1970's and early 1980's. Dumping of about 6 million tonnes of jarosite also occurred from Pasminco's zinc smelter in Hobart from 1966 to 1997. Table 18 details total recorded dumpings in the Region's Commonwealth waters.

Ocean disposal of jarosite

Jarosite is a residue from the roasting and hydrometallurgical treatment of zinc concentrates. Jarosite waste is a fine-grained, high-moisture content material consisting largely of ammonium jarosite (continuing iron, ammonium and sulfate), gypsum and calcine residue. Jarosite also contains heavy metals, including zinc, mercury, lead, cadmium, copper and arsenic, which are by-products of the refining process.

Ocean disposal of jarosite waste was first considered by the Electrolytic Zinc Co. (EZ) in 1958-1960. The Hobart Tug and Lighterage Company investigated the disposal proposal for EZ and received permission from the Hobart Marine Board to use a site in Storm Bay, five miles beyond the Derwent Light. It was proposed to use two hopper barges owned by EZ and a tug owned by HT & LC. This scheme was dropped and studies were carried out from 1960-1965 to find a more economic process. During this time, it was always assumed waste would be dumped at sea.

In 1972 a request was made for a permit to the Director of Mines for ocean disposal. The State Government approved in principle at sea disposal of residues and advised EZ that navigation safety aspects required clearing with the Commonwealth Department of Shipping and Transport. The State Government in October 1972 and the Commonwealth Government in June 1973 granted permission for ocean disposal of jarosite. Both Governments placed conditions on the permits, which included:

- an annual tonnage not exceeding 200 000 tonnes to be disposed of at sea in an area of five miles radius from the geographical position Latitude 43° 38'S, Longitude 148° 18 'E (being beyond the edge of the Continental Shelf) where the depth of water is around 2000 metres
- a weekly return of all disposal operations with an analysis of the dumped materials to be made to the Department of Transport
- log books of the disposal vessel be available to the relevant Department
- whenever required a nominated Commonwealth officer would be carried on the disposal vessel
- on a dry weight basis, the waste shall not contain in excess of 8% total zinc, 3% water-soluble zinc, 0.07% total cadmium, 0.02% soluble cadmium, 2% total lead, 0.0003% total mercury.

On average 170 000 tonnes of jarosite was disposed of annually the concentration of these elements and the physical properties of the waste may have varied as a result of changes in the refining process.

In 1990 the London Convention passed a resolution to end ocean disposal of industrial waste by December 1995. A new gypsum plant was built in 1993 to produce a product from the gypsum streams that had previously been disposed of with jarosite in the ocean. In October 1995 a Special Permit was issued under the *Commonwealth Environment Protection (Sea Dumping) Act 1981* allowing for the ocean disposal of jarosite wastes for the period 1 November 1995 to 31 December 1997. The ocean disposal program however was terminated by EZ in late October 1997. In its final year of disposing of jarosite at sea the *MV Anson* made 255 voyages, disposing of a total for the year of 111 200 dry tonnes of jarosite.

Source: PA Management Consultants 1974, Thompson & Brett & AGC, 1998

Table 18:
Summary of total recorded dumpings by category in the Region's Commonwealth waters.

MATERIAL	STATE	TOTAL QUANTITY
CAUSTIC SODA	NSW	6174 tonnes
CYANIDE	NSW	1584 gallons, 17 drums, 3276 kg
BLACK LIQUOR	NSW	2650 tonnes
SODIUM AZIDE	NSW	375 gallons
SPENT SULPHURIC ALKYLATION ACID	NSW	6000 tonnes
PESTICIDES	SA	180 gallons
JAROSITE	TAS	approx 6 million tonnes
IRON CALCINE	TAS	1 199 569 tonnes
IRON PYRITE	TAS	15 000 tonnes
CYANIDE	TAS	8 drums
CYANIDE	VIC	5324 gallons
CYANIDE	VIC	10 drums
CYANIDE	VIC	15 tonnes
PYROTECHNICS	VIC	1 ton
PYROTECHNICS	VIC	90 gallons
CHEMICALS	VIC	20 gallons
BLACK LIQUOR	VIC	27 815 tonnes
POISONOUS MATERIAL	VIC	70 gallons
FLARES	VIC	95 gallons

Source: EA 2001a.

Ammunition

Obsolete munitions equipment was dumped regularly until the early 1970's with a peak in dumping at the end of World War Two to eliminate old war stocks. In 1989 and 1992 two disposals of obsolete munitions occurred off Flinders Island (Plunkett, 2000). In addition spent ordinance from defence training operations occurs in areas such as Port Phillip Bay. It is reported that several unexploded depth charges are littering central and eastern Bass Strait.

Scuttled ships

Hundreds of obsolete vessels have been disposed of at sea or abandoned off Australia (Parsons & Plunkett 1995), including vessels scuttled in the designated 'graveyard' sites of the *Beaches, Fishing Grounds and Sea Routes Protection Act 1932*. This Act contains 14 official sites of which three exist within the Region – off Hobart, in Port Phillip Bay and off Kangaroo Island (Larcombe et al. 2002).

Ships scuttled in the Region include a 74 m bucket dredge sunk in ocean waters at 20 m depth off Phillip Island, Victoria, in 1976 (Pollard 1989) and the *Nella Dan*, which ran aground and was damaged beyond repair at Macquarie Island. As well, a large number of vessels are located near the entrance to Port Phillip Bay in Victoria.

Coastal ocean disposal

State governments have permitted an unknown number of disposals within coastal waters (State jurisdiction). These dumpings principally comprise dredge spoils and artificial reefs.

Economic dimensions

Sea dumping and ocean disposal encompasses a number of activities. The pollution outflows from a sewage treatment plant, the scuttling at sea of a ship, or the dumping of dredging spoils occur primarily in the open ocean. Other activities that indirectly result in the disposal of waste at sea include the nutrient or chemical run-off that may occur from farms and factories entering the water table or local stream which eventually finds its way into the ocean. Likewise the rubbish dumped in the street or particles from car exhausts that settle on roads and buildings can be carried by rain into the ocean.

Given this wide definition of sea dumping there is a number of economic reasons as to why it occurs. In general, the waste amelioration capacities of the ocean is considered the most economic or financial method, or indeed the most expedient method. While other choices could be made, these choices are generally too expensive relative to the environmental gain, not technically feasible or people are unaware of alternatives methods or either disposal or waste minimisation. These are all economic choices.

For example, the practicality of stemming the flow of pollutants, such as the nutrient run-off from farms into the oceans may prove difficult. Any strict controls may make agriculture, or at least traditional agriculture, non-viable across a large percentage of prime agricultural land.

Management arrangements

Commonwealth waters

Australia currently regulates the deliberate loading, dumping and incineration of waste at sea under the *Environment Protection (Sea Dumping) Act 1981* and the *Environment Protection (Sea Dumping) Amendment Act 1986*. These apply to all vessels, aircraft or platforms in Australian waters and to all Australian vessels or aircraft in any part of the sea. This allows Australia to fulfil its international responsibilities under the London Convention. They are administered by Environment Australia and/or the Great Barrier Reef Marine Park Authority (if dumping is to take place within the Great Barrier Reef Marine Park).

Under the Acts, Australian waters include those waters from the low water mark out to the 200 nautical mile limit of the Exclusive Economic Zone, excluding seas within the limits of a State or the Northern Territory (eg gulfs in South Australia, Port Phillip Bay, Darwin Harbour and Sydney Harbour).

Operational discharges from ships, such as sewage and galley scraps, are regulated by the Protection of the Sea legislation, which is administered by the Australian Maritime Safety Authority (AMSA).

Permits from Environment Australia are required for all sea dumping operations. A special permit is required for materials that must be dumped with special care. A general permit is required for other material. Currently, about twenty permits are issued in Australia per year, mainly for the dumping of uncontaminated dredge spoil.

In deciding whether to grant a permit, consideration must be given to the requirements of the London Convention and other relevant conventions and treaties.

Some materials, such as those produced for biological and chemical warfare and radioactive material, cannot be dumped in Australian waters under any circumstances.

Specific management arrangements for the disposal of various materials and waste products are detailed below.

Disposal of dredged or excavation material at sea

Disposing of dredged or excavated material at sea requires a permit under the *Environment Protection (Sea Dumping) Act 1981*. The purpose of the application is to determine the need for disposal and the potential environmental impacts. The application must clearly describe the material to be disposed, its origin, quantity and physical and chemical composition, its dry toxicity characteristics, how it will be transported and the disposal method. Alternative management strategies, including no disposal and waste minimisation options, are addressed. The reasons why sea disposal is the preferred alternative must be provided.

Human burial at sea

Application for a permit for burial at sea is required under the *Environment Protection (Sea Dumping) Act 1981*. Fifteen permits for sea burial of human bodies had been issued from 1984 to February 1997. Guidelines for burial at sea follow those specified for disposal of ships at sea and include appropriate ballast provisions and site selection (eg away from fishing).

Artificial reefs

Artificial reefs in Commonwealth waters are regulated under the *Environment Protection (Sea Dumping) Act 1981*. A Commonwealth permit is required to create an artificial reef. Penalties for dumping materials to create an artificial reef without a permit can attract fines of up to $250, 000. Additional permits may also be required under relevant State legislation. Permits are necessary to ensure that appropriate sites are selected, the materials are suitable and prepared properly, and that artificial reefs do not pose a danger to navigation, fishers or divers. Once the permit is issued the artificial reef is then chartered on maritime maps (EA 2001d).

Coastal waters

Under section 9 of the *Environment Protection (Sea Dumping) Act 1981*, known as the Rollback Provision, States can legislate to control sea dumping in their adjacent three nautical miles of sea if the legislation conforms with Federal law and the London Convention. This is a consequence of the 1979 Offshore Constitutional Settlement, an agreement between the Federal Government and State Governments allowing the States full sovereignty over the first three nautical miles from their coast. The Commonwealth Act does not apply to dumping in waters within the limits of a State such as bays, gulfs and rivers.

International control of ocean disposal

The need for an international convention to control the disposal of land based wastes at sea was recognised in 1971 at the first meeting of the preparatory committee for the United Nations Conference on the Human Environment. Discussion at this meeting highlighted the need to prohibit and limit marine pollution.

The London 'Dumping Convention' was finalised in 1972 and since 1975 has governed ocean disposal internationally. Rules on ocean disposal are given a minimum standard internationally but have been supplemented and strengthened by a number of regional agreements or by national legislation (Boyle 2000). The London Convention supports the terms of the Law of the Sea Convention and is similar in its goals to MARPOL 73-78 (MARPOL – International Convention for the Prevention of Pollution at Sea 1973).

In 1993, Parties to the Convention (ratified by Australia in 1985) started a detailed review of the London Convention, leading to the adoption of a few crucial amendments. These amendments consolidated in a legally binding manner the prohibition to dump all radioactive wastes/materials and industrial wastes, and incineration at sea of industrial wastes and sewage sludge. In 1996, this review was completed with the adoption of the 1996 Protocol to the London Convention 1972, which, when entered into force, replaces the London Convention.

Oil and gas

This chapter provides a brief overview of the petroleum industry in the South-east Marine Region. It is recommended that readers also access the the BRS *Atlas of Marine Activities and Coastal Communities in Australia's South East Region* which contains maps showing offshore petroleum titles, oil and gas wells, seismic survey locations and a general discussion on the industry.

Further information on the petroleum industry in the Region may also be obtained from the relevant State agencies or from the Commonwealth Department of Industry, Tourism and Resources.

Background

The petroleum industry is a significant contributor to net national wealth. Annually, the industry earns about $8 billion, which compares to coal ($8.3 billion), alumina ($3.5 billion), wool ($3 billion), wheat ($3.5 billion) and iron and steel ($5.1 billion). The industry also contributes about $2 billion to Commonwealth government revenue in the form of resource and income tax.

In April 2001, the Australian Petroleum Production and Exploration Association (APPEA) estimated that the petroleum industry directly employed about 13 000 people and invested about $2 billion in exploration and development activities (APPEA 2001). Within the Region, initial estimates point to over 3000 people being directly employed within the industry with many further thousands of associated jobs.

The Australian petroleum industry supplies on average 70-80% of domestic demand for liquid fuels (in November 2001, Australia was 95% self sufficient – but this is unusually high), and accounts for 54% of Australia's total energy requirements.

Petroleum discoveries have been reported in Australia since early settlement. However, significant commercial discoveries have only been made in the last 30 years. The overwhelming majority of discovered reserves are found in Commonwealth waters (ie three nautical miles from the Territorial Sea baseline to 200 nautical miles – the Exclusive Economic Zone). The areas of highest production are the North West Shelf adjacent to Western Australia, the Timor Sea adjacent to the Northern Territory, and Bass Strait adjacent to Victoria and Tasmania.

Eighty five per cent of Australia's oil and gas is found in the oceans that surround our continent.

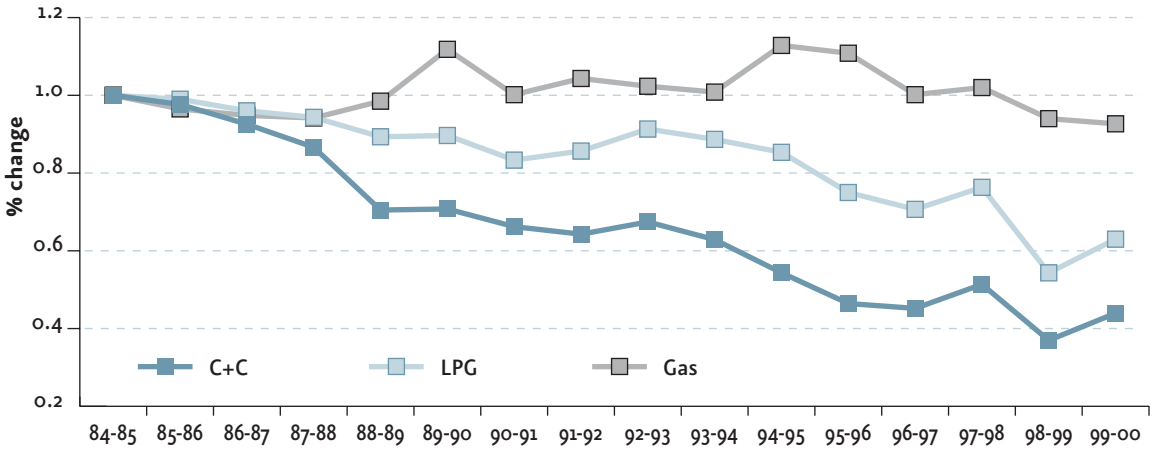
Regional activity

There has been exploration activity in various parts of the Region since the late 1950s in four major basins: Gippsland, Otway, Sorrel, and Bass. However, only the Gipplsand Basin is currently productive.

The Gippsland Basin, of which the major fields of Barracouta and Marlin were discovered in the mid-1960s by Esso/Broken Hill Proprietary (BHP), has been Australia's dominant oil producing area for the best part of thirty years. However, in recent decades production has generally been declining due to the resource becoming depleted. Today, oil production from Australia's western and northern offshore oil fields has now surpassed the level of production from the Gippsland Basin.

Infill drilling and development activities since 1996 initially curbed the decline in liquid production in the basin and subsequent developments increased the rate of oil production. However, the decline in production continues. Figure 12 details the proportionate decline in Gippsland production since 1982.

Figure 12: *Proportional change in Gippsland production since 1982.*



C+C = crude and condensate

Source: DISR 2001.

However, despite this decline the Gippsland Basin is still a major producer in terms of Australia's total production. For instance, in 2000 the Basin produced 25% of Australia's total crude oil and condensate output, 43% of Australia's total Liquefied Petroleum Gas (LPG) output and 43% of Australia's Natural Gas output (APPEA 2001a).

In Bass Strait today there are 22 production facilities producing from 17 fields, connected by a 500 km network of submarine pipelines that carry oil and gas to Longford, Victoria for processing. At Longford there are three gas plants and a crude stabilisation plant (Map 15).

Map 15:
Petroleum fields and infrastructure. *Source: Larcombe et al. 2002.*

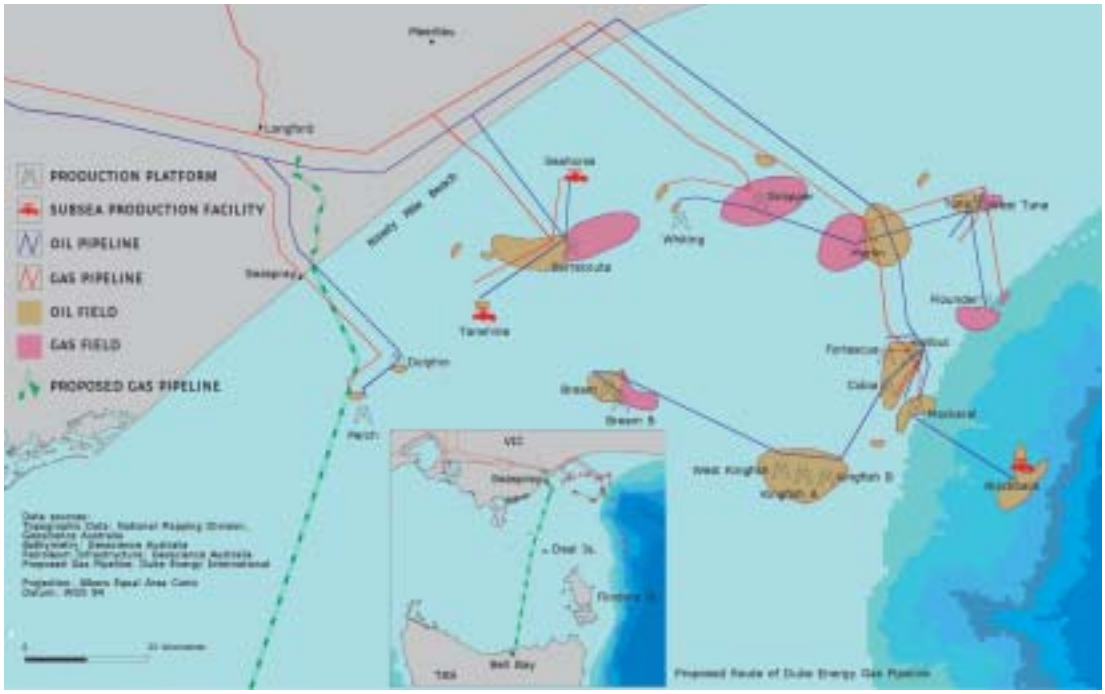


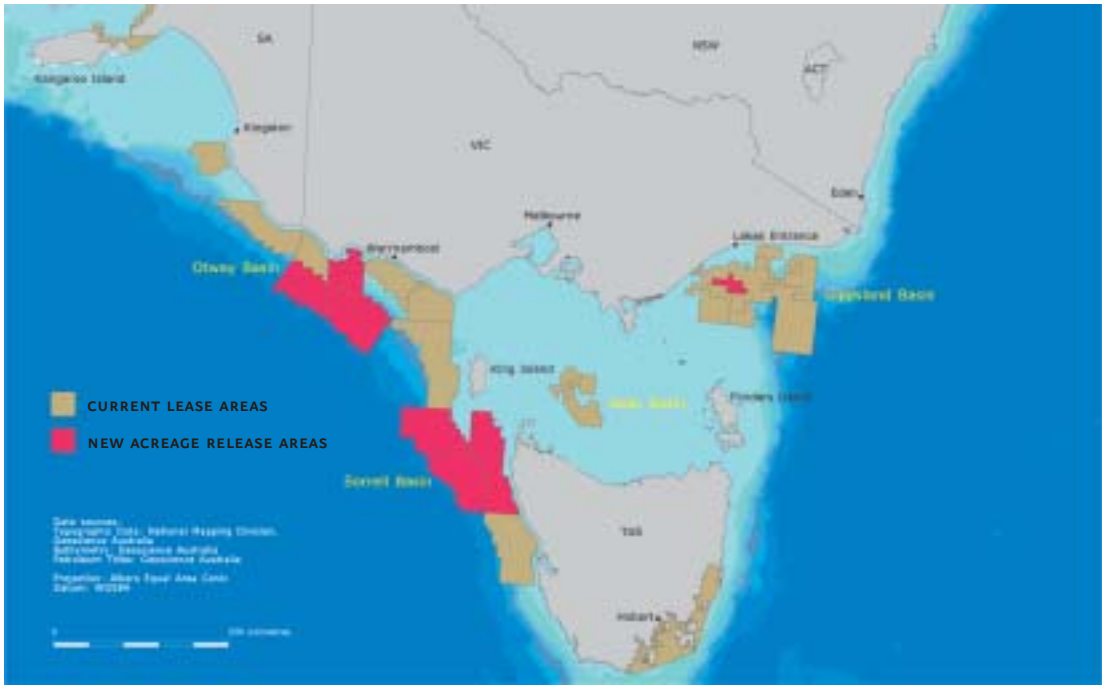
Table 19 provides additional detail on the offshore production facilities in the Region, including the Patricia Baleen Gas Field which is due for its first gas delivery in September 2002 (Rigzone 2001).

Table 19:
Offshore production facilities in the Region.

Facility	Type	Field	Water Depth (m.)	Type	Start Date	Expected Stop Date
Barracouta	Fixed Platform	Barracouta	46.0	oil & gas	1969	> 2019
Bream A	Fixed Platform	Bream	59.0	oil & gas	1988	> 2019
Bream B	Concrete Gravity Structure	Bream	61.0	oil & gas	Dec. 1996	c. 2025
Cobia	Fixed Platform	Cobia	78.0	oil	1983	2018
Dolphin	Steel Gravity Monotower	Dolphin	38.0	oil	1989	2018
Flounder	Fixed Platform	Flounder	93.0	oil	1984	> 2019
West Fortescue	Subsea Completion	Fortescue	na	na	na	na
Fortescue	Fixed Platform	Fortescue	69.0	oil & gas	1983	2019
Halibut	Fixed Platform	Halibut	72.5	oil	1970	> 2019
Kingfish A	Fixed Platform	Kingfish	77.1	oil	1971	> 2019
Kingfish B	Fixed Platform	Kingfish	77.7	oil	1971	> 2019
West Kingfish	Fixed Platform	West Kingfish	76.2	oil	1982	> 2019
Mackerel	Fixed Platform	Mackerel	92.7	oil	1977	> 2019
Marlin	Fixed Platform	Marlin	58.5	oil & gas	1969	> 2019
Perch	Steel Gravity Monotower	Perch	42.0	oil	1989	2018
Seahorse	Subsea Completion	Seahorse		oil		
Snapper	Fixed Platform	Snapper	54.9	oil & gas	1981	> 2019
Tarwhine	Subsea Completion	Tarwhine	43.0	oil	May 1990	>2015
Tuna	Fixed Platform	Tuna	58.8	oil & gas	1979	> 2019
West Tuna	Concrete Gravity Structure	Tuna	61.0	oil & gas	Jan. 1997	c. 2020
Whiting	Fixed Platform	Whiting	54.0	oil	1989	2012
Blackback	Subsea wells (3 completions)	Blackback	400	oil	Jan 1999	
Patricia Baleen	Subsea Completion	Patricia Baleen	50-60	gas	2002	2010

Source: NRE 2001, DITR Pers. Comm.

Map 16:
Offshore petroleum titles. *Source: Larcombe et al. 2002.*



Since production in Bass Strait began in 1966, about 3.5 billion barrels of oil and condensate (85% of proven reserves) and five trillion cubic feet of gas (about 50%) has been produced (Esso-Mobil 2001). In June 2000 remaining proven reserves were estimated at 688 million barrels of oil and condensate and 4381 billion cubic feet of natural gas.

As at 13 August 2001, there were 16 exploration permits, 14 retention leases, 19 production licences and over 30 pipeline licences in the Region (see Table 20).

Table 20:
Permits, leases and licences within the South-east Marine Region.

Adjacent State	Exploration Permits	Retention Leases	Production Licences	Pipeline Licences
Eastern South Australia	2 (+1 in State waters)	-	-	-
Tasmania	3	1	-	-
Southern NSW	-	-	-	-
Victoria	8 (+ 1 in State waters)	10 (+ 1 in State waters)	19	27 (6 in State waters)
Total	**15**	**12**	**19**	**33**

Source: DSR 2001.

Factors controlling the production of petroleum

Factors controlling the production of petroleum are varied and may be classified as geological, regulatory, environmental, cultural and economic (Radke et al. 1997):

- geological – the geological setting favourable to petroleum generation and accumulation is fundamental to petroleum production. Petroleum accumulation requires an organic-rich source rock, a porous reservoir rock, a seal of non-porous rock bounding the reservoir and a trap (a feature that causes migrating fluids to accumulate within the reservoir). In addition, the right combination of heat, pressure and time is necessary to 'cook' the organic material in the source rock 'kitchen' and generate petroleum. The most prospective geological settings are found in Mesozoic and Tertiary sedimentary basins of Australia, particularly in offshore areas.
- regulatory – all Australian petroleum is the property of the Crown and ownership of land does not carry with it any rights to explore for, or produce minerals or petroleum from that land. Offshore, the Crown's position is expressed in terms of sovereignty and sovereign rights rather than ownership. Consequently, both onshore and offshore interests in petroleum require a special grant from the Crown based on the petroleum legislation relevant to the jurisdiction.
- environmental and cultural – petroleum exploration and production activities are conducted under the provisions of government legislation that protect the environment. Special provisions may need to be made to protect environmentally sensitive areas and areas of high conservation, commercial or recreational value.
- economic – factors that have the greatest impact on hydrocarbon exploration and development include oil pricing, government taxation and market access. Proximity to the infrastructure and facilities of developed fields also plays a part, as do technical requirements, such as the cost of deep-water compared with shallow-water production, or compliance with environmental requirements.

Economic dimensions

The petroleum industry is, by its nature, a costly one to both enter and maintain. Not only does industry have to pay for lease areas and exploration permits, but the infrastructure necessary for production is extremely costly. In addition the lead times between expenditure and recovery of costs may take many years.

Costs associated with the industry include:

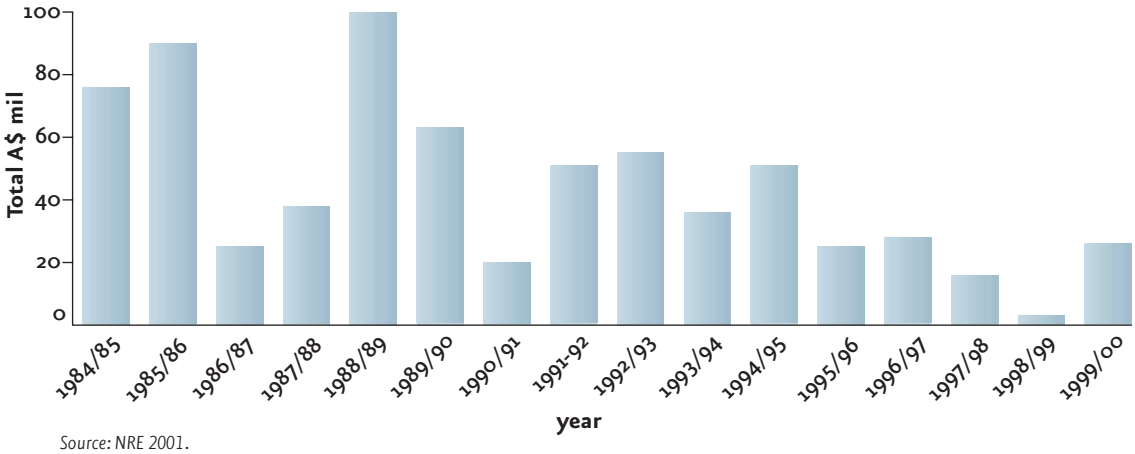
- exploration and development
- infrastructure.

Offshore petroleum exploration and development is extremely complex and costly, due to such factors as water and drilling depths, vessel availability, as well as climatic conditions. For example, work program quotes for offshore exploration drilling in the Gippsland basin range from $3 million and $34 million per well and for the Otway Basin between $8 million and $10.25 million per well (DISR 2001). The petroleum industry spent an estimated $34 million on exploration and development activities in 1999-2000 in the Region, including expenditure on:

- 798 square kilometres of seismic exploration
- three exploration wells totalling a drilling depth of 4951 metres
- nine development wells totalling a depth of 25 894 metres.

Over the last decade, annual petroleum exploration expenditure has fluctuated significantly with a peak of about $100 million in 1988-99 and a low of $3 million ten years later (1998-99). These fluctuations are strongly linked to international movements in oil prices and exchange rates. Figure 13 details petroleum expenditure in the Region for the periods 1984-1985 and 1999-2000.

Figure 13: *Petroleum offshore exploration expenditure 1984/85 to 1999/2000.*



Source: NRE 2001.

Seismic surveys

The exploration for petroleum reserves has been greatly enhanced by advances in technologies. In particular, seismic surveys provide valuable data on the depth, and types of rocks found on the seabed. Today a very sophisticated seismic process is often used to provide three-dimensional (3D) images.

The surveys assist in pinpointing areas with the potential for production. However, there are many factors to consider before a discovery is taken into production. These include how much oil and/or gas a reservoir contains and how much it will cost to extract it.

A network of pipelines to transport oil and gas onshore links the Bass Strait petroleum production facilities. This pipeline network extends across jurisdictions from Commonwealth waters to Victorian Coastal waters. The construction of the pipeline across Bass Strait, which commenced in early 2002, also means that Tasmania will be connected into the Victorian gas network.

Value of production

For the 1999-2000 financial reporting year, the average daily production of Bass Strait was 199 977 barrels of oil. At $50 per barrel this production was valued at $3.6 billion. For the same reporting period, 538 million cubic feet of gas was produced daily. At $2.50 per GJ this production was valued at $490 million (NRE 2001).

Recent developments

In August 2001, the Victorian Minister for Energy and Resources the Hon Candy Broad MP announced that investment in oil and gas exploration (onshore and offshore) had doubled to $75 million over the 2000-2001 financial year.

Offshore in the Otway Basin, Origin Energy and Woodside Petroleum along with partners CalEnergy and Benaris, made two major discoveries with reserves estimated to be in the order of 900 PJ of gas. This compares to the remaining developed reserves in the Gippsland Basin of about 4500 PJ.

Esso/BHP have proposed a record 3500 square kilometre 3D seismic survey over the Northern Gippsland Basin fields as part of a new exploration campaign.

In addition, Esso/BHP have announced that they are evaluating a variety of major infrastructure options to develop more of Gippsland's gas fields. The most immediate of these will involve a 51 km gas pipeline from the Bream platform.

Source: DPC 2001.

Markets

Oil and gas are important sources of energy in the Australian economy. Since Australia produces more light crude oil and gas than is required for domestic consumption, a significant proportion is exported. The domestic refining industry imports heavy crude oil since it is not produced in sufficient quantities to satisfy domestic demand. Ethane and LPG are also produced as inputs to the domestic petrochemical industry.

Australian oil production is sold wherever it can find a buyer. As a global commodity there are no constraints on where it can be marketed. Normally the critical factors are price, quality, cargo size and delivery date. A large proportion of Australia's crude oil is sold on the oil spot markets.

In its natural state, gas cannot be easily stored or transported by tanker. Its production, therefore, is largely dependent on having a tied market. The production rate from a field is dictated by the rate at which the power stations or distribution networks at the end of the pipeline draw from the line. There may be more than one pipeline feeding those distribution networks. Gas producing companies, therefore, usually seek long-term contracts, generally 15 or 20 years and often with take-or-pay terms, to guarantee the volume of the offtake.

Gas produced from Bass Strait has ready access to the heavily populated markets of the east coast of Australia. As a consequence, all natural gas produced from Bass Strait is sold domestically. Almost all Bass Strait crude oil is also sold domestically, with some exported in a refined state. LPG is exported but the majority is sold domestically.

In addition to supplying 90% of Victoria's demand, Bass Strait natural gas is sold in NSW via Duke Energy's Eastern Gas Pipeline. Based on current demand there are sufficient proven natural gas reserves in Bass Strait to meet Victoria's gas needs for the next 25 years.

Investment

A total investment in excess of $12 billion has been made on property, plant and equipment by the Esso/BHP joint venture since exploration started in Bass Strait in 1964. The Patricia Baleen project, development which commenced in 2001, is the first non-Esso/BHP development in Bass Strait. Development costs for the project are estimated at about $100 million (Rigzone 2001).

Employment

Until recently ESSO was the sole employer within Bass Strait with respect to petroleum. At present, Esso directly employs about 1600 staff. This comprises 300 offshore petroleum workers, the majority of whom live in Sale. Others are located in the townships of Stratford, Maffra, Traralgon and Bairnsdale. The offshore workforce is supported by 500-600 Melbourne based staff and engineers. The Longford onshore production facility employs a further permanent staff of 250. An additional 500 staff are dedicated to reconstruction work at the Longford facility.

Longford is the site of the heliport that services offshore areas and two supply vessels operate from the Barry Beach Marine Terminal near Port Welshpool where approximately 34 people are employed.

Balance of trade

In 1999-2000, over 10 million mass tonnes of oil and petroleum products, over one million mass tonnes of Liquefied Petroleum Gas (LPG) and seven million mass tonnes of Liquefied Natural Gas (LNG) were exported. For the same period over one million mass tonnes of oil and petroleum products were imported (AAPMA 2001). Tables 21 and 22 detail trade in oil and gas for 1999-2000.

Table 21:
Trade in oil and gas for 1999-2000.

	Exports	Imports
Crude Oil	$5.3bn	$6.3bn
LNG	$1.9bn	-
Products	$1.2bn	$1.3bn
LPG	$0.6bn	$0.1bn
Total	**$9.0bn**	**$7.7bn**

Source: APPEA 2001a.

Table 22:
Regional oil and petroleum exports (mass tonnes).

Toll Western Port	3 492 000
Toll Geelong Port	2 833 579
Melbourne Port Corp	1 804 281
Total	**8 129 860**

Source: AAPMA 2001.

The oil and gas industry affects both the current and capital accounts of the balance of trade. For example, during the development phase of oil and gas projects, specialist capital equipment is required which is, in general, sourced internationally. Nevertheless, the Australian Petroleum Production and Exploration Association has reported that well in excess of 50% of capital goods required for the development of oil and gas projects are purchased from Australian suppliers.

Links

The Australian petroleum industry is multifaceted and includes Australian and international petroleum companies and their support industries such as:

- seismic exploration
- drilling
- petroleum operators
- support vessels
- helicopter transport
- construction
- catering.

Not only does the industry impact upon associated businesses but it also has a marked positive effect on the Australian economy. For instance, a 1996 study by the Australian Bureau of Resource Sciences found that a $1 million increase in the output of the oil and gas industry increased real gross domestic product by between $1.8 million and $2.4 million. This implied an output multiplier of 1.8 to 2.4. Under this model a 20% rise in production would lead to a 0.4-0.5% gross domestic product increase and a 0.2-0.4% increase in national employment (APPEA 2001b).

At the regional level, the petroleum industry has a profound economic impact on the Victorian economy, including downstream processing activities (electricity generation, petrochemicals, smelting etc), and contributes about $29 billion to Victoria's economy and provides some 92 000 jobs (NRE 2001).

The offshore Gippsland petroleum province has provided more than two thirds of Australia's cumulative oil production to date with major petrochemical facilities in the Melbourne area being established. There are significant flow-on employment and supply benefits. Oil and gas remains the most valuable commodity produced in Victoria.

Management arrangements

Following the 1979 Offshore Constitutional Settlement, responsibility for offshore petroleum mining is shared between the States, the Northern Territory and the Commonwealth. This settlement substantially reordered the previous arrangements implemented in 1967.

The principal legislation covering offshore petroleum mining is:

- for State or Territory waters, the relevant State or Territory Petroleum (Submerged Lands) Act
- for Commonwealth administered adjacent area waters (outside the three mile nautical limit), the Commonwealth's *Petroleum (Submerged Lands) Act 1967* (PSLA).

State and Territory legislation mirrors the Commonwealth's, so that the same provisions apply in all jurisdictions.

The PSLA generally sets out provisions dealing with a range of matters such as:

- the respective roles of the Commonwealth, States and the Northern Territory in the Joint Authority and the Designate Authority
- the obligations of permit and license applicants and the rights and obligations of title holders, with respect to exploration for, and recovery of petroleum
- the approvals required for certain activities
- reporting obligations of permit and license holders, the Designated Authority and Joint Authority enforcement and inspectorial activities
- exemptions
- penalties.

The Act sets out subordinate legislation making powers to enable requirements of a more technical type to be covered by directions and regulations. Sections 9 and 11 of the PSLA extend the State and Territory legal systems offshore in so far as they do not conflict with Commonwealth legislation. This ensures a seamless jurisdictional coverage extending from onshore to offshore. For the Bass Strait operations Victorian law is applied offshore.

For instance, offshore pipelines conveying naturally occurring hydrocarbons in a gaseous, liquid or solid state within three nautical miles of the Victorian coast are administered under the Victorian *Petroleum (Submerged Lands) Act 1982*. Offshore pipelines within Commonwealth waters adjacent to Victoria, are administered under the Commonwealth *Petroleum (Submerged Lands) Act 1967*.

Administrative framework

To ensure administrative consistency between State, Territory and Commonwealth jurisdictions, the Offshore Petroleum Agreement and the PSLA provide the State and Territory Ministers or Designated Authority (ie the State/Territory Minister responsible for petroleum matters) with the power to administer the Commonwealth Act on a day to day basis.

Under these arrangements, the Commonwealth fulfils an overall policy setting function and consults with the States and Northern Territory on major petroleum operational and policy matters through a Commonwealth-State/Territory Joint Authority (JA).

Ports and Marinas

Ports and marinas are at the interface between land and sea. Commercial ports facilitate Australia's exports and imports by providing a place for ships to berth and for goods and commodities to be stored and sorted. They also provide home ports for the Region's fishing fleet and the numerous leisure crafts needing secure anchorages for repair and re-provisioning.

Background

The ports industry is essential to facilitate efficient flows of trade for the benefit of the Australian economy. Their importance is highlighted by the fact that approximately 99% of Australia's trade is carried by ship. As outlined by the BTE (2000, p.1):

> Australia's ports are an integral part of the national transport system and trade activities. They handle most of Australia's international merchandise trade and large quantities of bulk commodities within Australia. Ports also have a major role in the movement of cargo and passengers between Tasmania and the mainland. For many cargoes, shipping provides the only practicable means of transport in terms of capacity and cost... Ports are therefore essential for the operation of the Australian economy.

In 2000-2001, 578 million tonnes of products were moved through Australian ports. This was made up of 103 million tonnes of imports and 474 million tonnes of exports (AAPMA 2001). In 2000-2001 a total of 25 003 port calls into major ports were made by commercial ships undertaking intra – and interstate trade and exporting or importing to overseas destinations (AAPMA 2001).

The ports of the Region accounted for 23% of Australia's total exports from ports and 5% by volume – a total of over $23 billion and 25 400 million tonnes respectively. They also accounted for around 37% of imports by value and 25% by volume – over $30 billion and 13 million tonnes respectively (BTE 2001).

Regional activity

Within the South-east Marine Region there are nine principal commercial ports currently in operation:

- Victoria – at Melbourne, Portland, Hastings/Westernport, Geelong
- Tasmania – at Burnie, Devonport, Launceston, Hobart
- New South Wales – at Eden.

Commodity movements within the Region are dominated by the Port of Melbourne which in 1998-99 handled international cargo to the value of $36, 409 million (BTE 2001).

Port of Melbourne

Over 40 shipping lines regularly visit the Port of Melbourne, providing access to over 300 ports around the world. It is the largest and busiest container port in Australia, handling around 37 % of the nation's container trade.

The Port of Melbourne currently ranks 35th on the registered container ports in the world, handling more than double the volume of Fremantle, Adelaide and Brisbane combined. It facilitates $60 billion in trade each year and contributes over $5 billion annually to Victoria's economy.

Sixty-seven per cent of Melbourne's imports and 85 % of exports are in the form of containerised cargo. The port also handles a substantial volume of bulk and general cargo.

Source: Melbourne Ports Corporation 2001.

In addition to these principal ports there are numerous other smaller ports along the coast of the Region including:

- South Australia – Port MacDonnell, Robe, South End, Beachport and Kingston
- Victoria – Port Fairy, Warrnambool, Queenscliff, Port Campbell, Apollo Bay, Lorne, Port Welshpool, Port Albert, Lakes Entrance and Mallacoota
- Tasmania – Bridport, St. Helens, Bicheno, Triabunna, Dover, Strahan and Stanley
- New South Wales – Merimbula.

The ports also service intra- and interstate trade. In 2000-2001 coastal cargo throughput in the Region was equal to around 21 million tonnes – representing 42% of total Australia coastal throughput. Important goods and commodities on this coastal trade include:

- petroleum and petroleum products
- iron and steel
- edible products and preparations
- metalliferous ores and metal scraps.

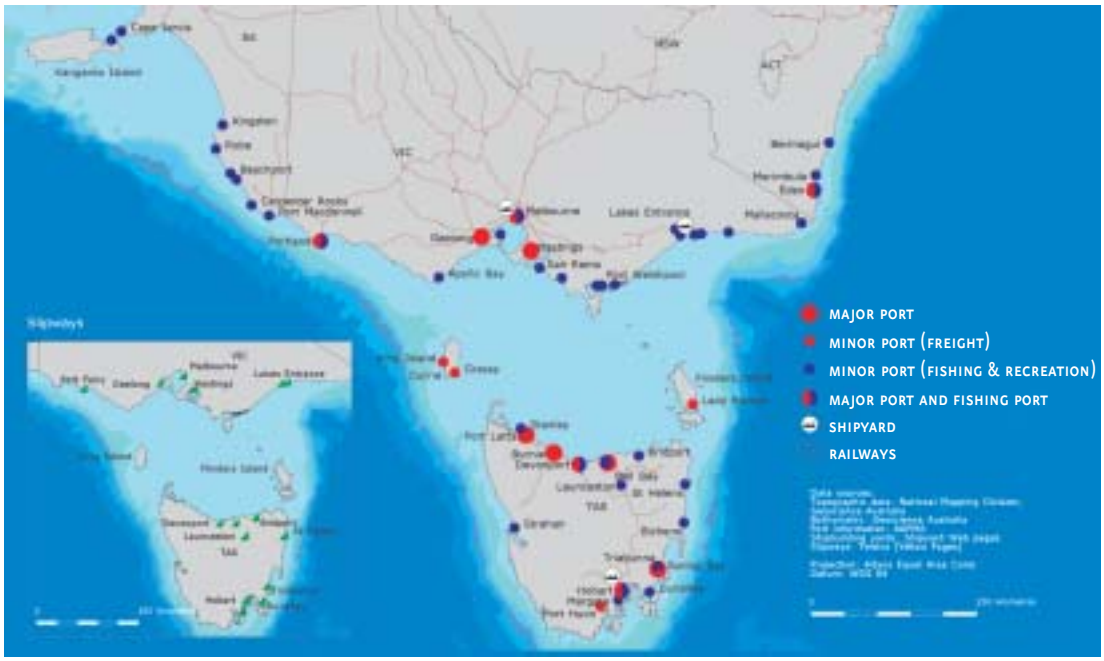
The role of ports in the Region

The major ports of the Region are important for berthing large international and regional trading ships. Smaller ports perform different functions for small coastal towns or settlements, ranging from serving fishing vessels to providing a safe harbour during storms or for vessels in distress. For example, Port MacDonnell, South End and Dover are important rock lobster ports. Lakes Entrance is a key port in the South East Trawl Fishery and for scallops. Port Fairy and Port Albert support boats in the Southern Shark Fishery. Some ports, such as Bicheno, Strahan and Merimbula are also servicing a growing number of tourist and recreational vessels (Map 17).

The Region's ports can be broadly defined within several different categories (IC 1993)

- integrated – servicing general cargo, container cargo, bulk cargo, recreational and passenger vessels – examples are Burnie and Melbourne
- regional – ports dominated by a core group of bulk commodities supplemented by a mix of general and/or container cargo and tourist, recreation and maintenance facilities – examples are Geelong, Launceston, Devonport, Hastings and Hobart
- dedicated – ports with one or two bulk commodity operations in export-orientated industries such as coal, mineral ores or woodchips – examples of dedicated ports within the Region are the ports of Portland and Eden
- community – small ports servicing the domestic and business needs of small communities in outlying areas and often including small boat harbours – examples are Apollo Bay, Port Fairy, Warrnambool, Lorne Point and Queenscliff.

Map 17:
Ports in the South-east Marine Region. *Source: Larcombe et al. 2002.*

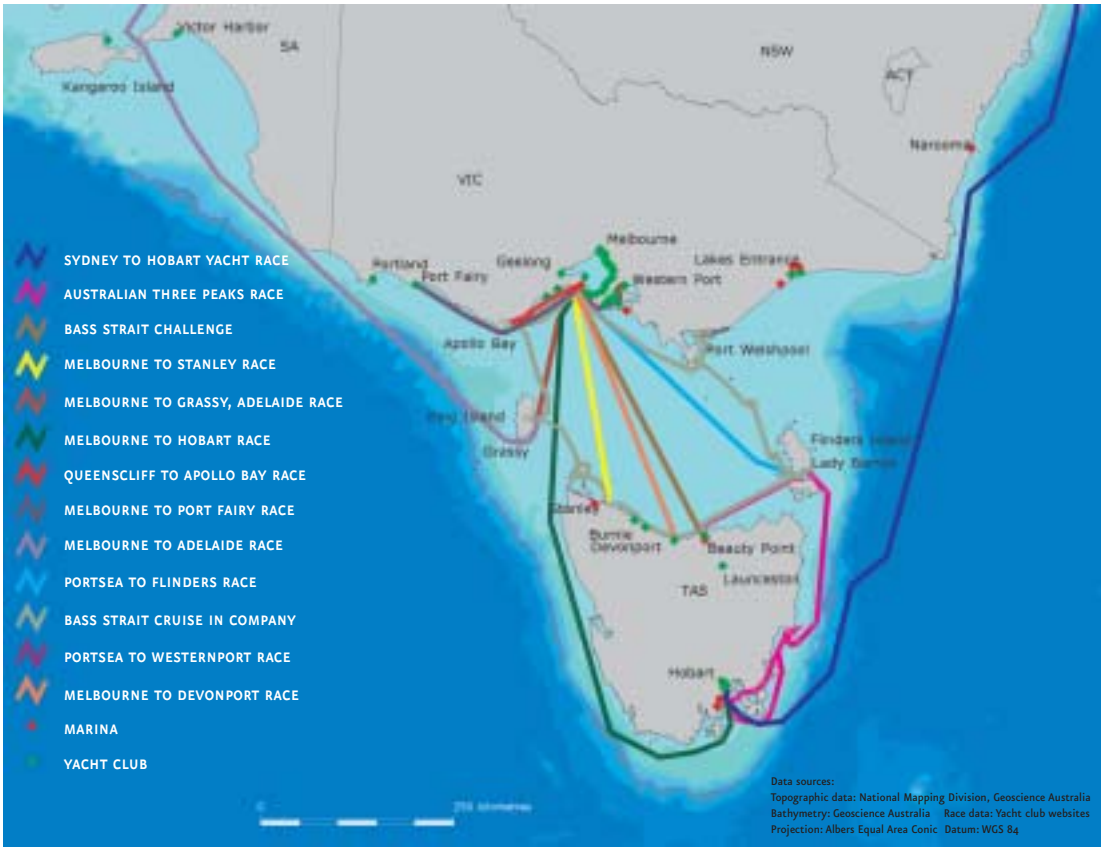


There are also many marinas throughout the Region that offer dockage, shelter and other services for small craft. These are usually connected with a yacht club, though not always. In general, yacht clubs and marinas are usually located in urban areas where access to the sea is convenient (Map 18).

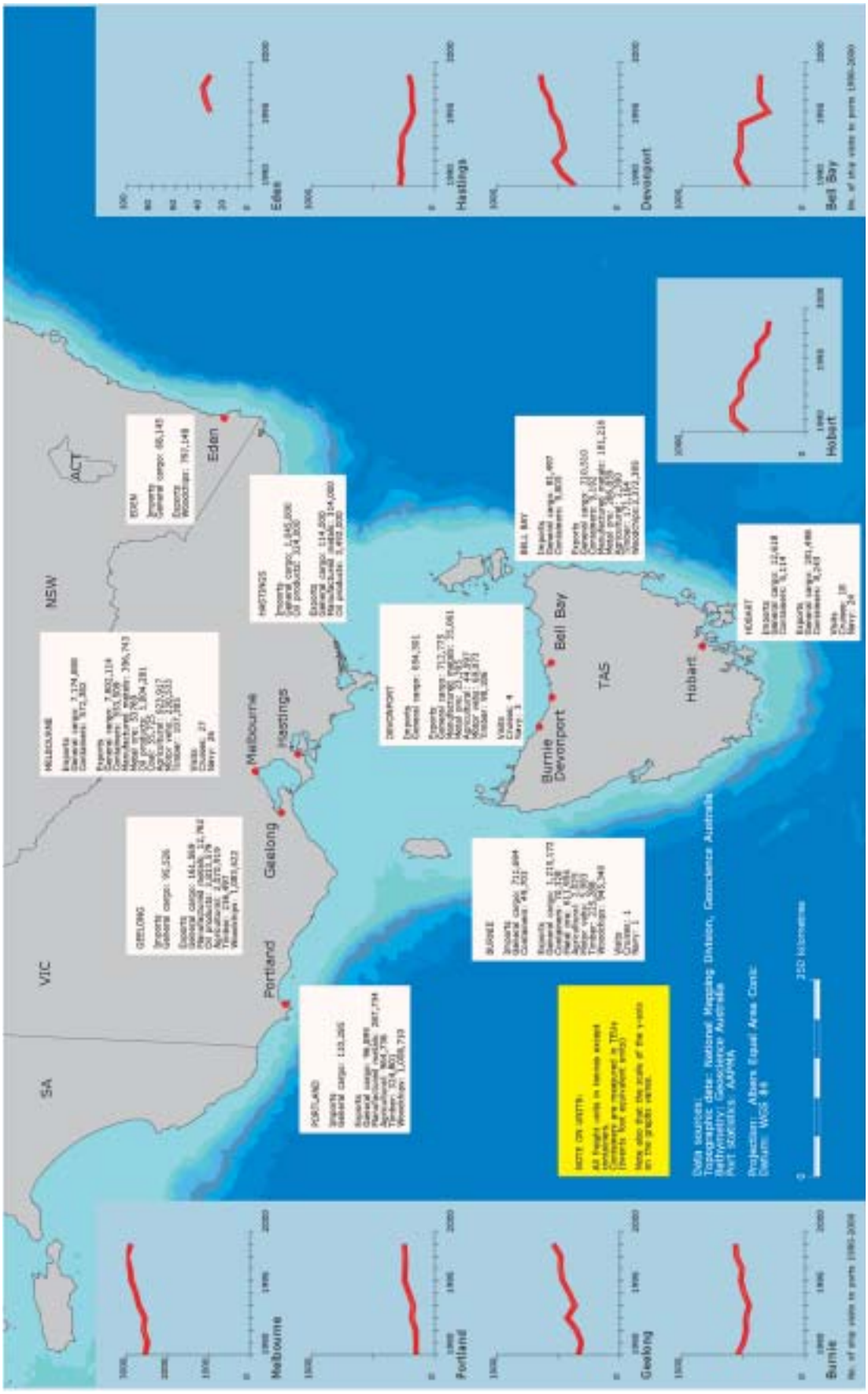
Economic dimensions

While Melbourne ranks tenth for the volume handled by the top 10 ports in Australia it ranks first in terms of value of goods handled (BTE 2001). This reflects the fact that the port generally facilitates trade in high valued manufactured goods rather than bulk commodities such as coal or iron ore. However, ports such as Portland, Geelong and Eden, reflecting the hinterlands they service, exist to facilitate exports in bulk commodities such as grain, woodchips and wood products, petroleum products, and aluminium. Other ports such as Burnie, Devonport and Launceston cater for mixed

Map 18: ***Yacht clubs, marinas and races in the South-east Marine Region.*** *Source: Larcombe et al. 2002.*



Map 19: *Major port statistics (1999-2000).* *Source: Larcombe et al. 2002.*



cargo reflecting Tasmania's dependence on shipping for the majority of its exports and imports – around 99.6% of Tasmania's intra-state and international trade goods flow through the State's ports (DoT 2001).

Some ports, such as Portland and Eden are also important for their role in supporting the fishing industry within the Region. Eden is one of the largest fishing ports in the Region, catering for the vessels in the South East Trawl, Eastern Tuna and Billfish and other fisheries.

Volume and value

The ports of the Region accounted for 23% of Australia's total exports by value and 5% by volume – a total of $23.256 million and 25.479 million tonnes respectively. The ports also accounted for 36.65% of Australia imports by value and 25.07% by volume – $30.417 billion and 13.571 million tonnes respectively (BTE 2001). As a trading nation, both exports and imports make a significant contribution to the Australian economy. For instance, exports contributed around 23% of Australia's GDP in 2000-01 (ABS 2001).

Markets and demand

Imports and exports are forecast to continue to grow as Australia becomes increasingly integrated into the world trading market. For instance, for the Port of Melbourne, a growth rate of over 6% in container trade is forecast for the foreseeable future. As well, automotive trade out of Melbourne has been growing at 7.9% on average per year for the last 10 years with volumes expected to increase in the future. Between 1993-1994 and 1999-2000 overseas imports into Melbourne grew from 9.9 million tonnes to 17.75 million tonnes – a growth in volume of 79.3% in six years. Exports through the port also grew during these years with exports increasing from 8.1 million tonnes to 12.9 million tonnes – a growth in exports of 59% in six years (Melbourne Ports Corporation 2001).

Ship calls to major ports of the Region are continuing to grow for the majority of ports (Map 19). While some ports have experienced a decrease in ship visits – Hobart, Launceston, Hastings – this reflects a shift in cargo movements to other ports rather than a decreased reliance on ports and shipping services.

Employment

Preliminary calculations suggest that the ports of the Region generate over 3000 jobs directly and many more indirectly. This figure points to employment of approximately:

- 2000 in Victoria
- 280 in the proportion of New South Wales in the Region
- 120 in the proportion of South Australia in the Region
- around 600 in Tasmania.

Regional importance

As with Australia as a whole, ports within the Region play an essential role in the movements of cargoes. Activities within ports generate jobs and income for local communities. As a trading nation Australia relies on the flows of exports and imports facilitated by ports. The production of exports provides jobs and income throughout Australia and imports allow increased choice and essential inputs for local producers (such as machinery). As well coastal cargoes, moved within Australia, are important for local communities (BTE 2000).

As stated above, the port industry generates direct employment of around 3000 persons within the Region. As well, an initial analysis of available data suggests that the Region's ports were responsible for nearly $400 million in value adding.

A recent study undertaken for the Port of Devonport in Tasmania provides an example of the regional importance of ports.

Port of Devonport

The operation of the Port of Devonport generated a total of over $290 million in output in 1999-2000 for the Tasmanian economy.

The value added attributable to the operation of the port was $180 million. This was equivalent to approximately 1.8% of gross state product, which provides a measure of the overall level of economic activity in Tasmania.

Household income generated by the operation of the port totalled almost $32 million. Employment was estimated at over 2400 jobs (full-time equivalent, which represented 1.4% of total Tasmanian employment.

There were 639 ship visits to the Port of Devonport by commercial cargo vessels in 1999-2000. The results of the analysis for the seaport segment indicate that, on average, each ship call at the Port of Devonport contributed to the Tasmanian economy:

- $430, 000 of output
- $270, 000 of value added
- $140, 000 of household income
- 3.5 full-time equivalent jobs for one year.

Source: EconSearch 2001.

The Port of Melbourne contributes $5.8 billion to the Victorian economy annually by facilitating direct and indirect activity (Melbourne Port Corporation 2001).

The importance of port activity and services is further demonstrated by the fact that that 99.6% of Tasmania's interstate and international trade travels by ship (DoT 2001).

Management arrangements

Within the Region, and Australia in general, the responsibility for establishing and regulating ports lies with the State governments. However, decisions of governments at all levels have an impact on port operations.

For instance, through the Australian Maritime Safety Authority (AMSA), the Commonwealth regulates ship safety and provides navigational aids. In addition, the Australian Customs Service (ACS) and the Australian Quarantine and Inspection Service (AQIS) play a role in regulating and controlling imported goods. As well, the Commonwealth plays a limited role in funding the provisions of the land-based infrastructure necessary for port operations.

Port corporations are responsible for facilitating the smooth and efficient movement of trade (both imports and exports) for the benefit of the Australian economy. It is a multi-faceted role that involves the planning and provision of adequate port facilities, infrastructure and necessary services such as pilotage, towage and navigational aids, as well as multi-modal facilities to meet the sea/land transport interfaces. State governments influence port operations through port corporations and play a role in providing necessary infrastructure to link ports to land transport.

The powers of port corporations are set out in the relevant State legislation. These powers will vary but generally encapsulate two main areas:

- planning, coordination and facilitation – developing the port, such as taking control of land, planning additional berths, arranging dredging. They may also coordinate users such as shippers, terminal operators and shipping lines
- regulation – setting and/or policing rules regarding matters such as safety and navigation, environmental regulations and licensing port operators including pilotage and towage services.

Port corporations also ensure that safety regulations are met regarding cargo handling equipment, dangerous goods and livestock.

The regulation of port activities in Australia is generally carried out by independent departments or agencies rather than by the port corporations themselves. The separation of regulatory and operational responsibilities is justified on the grounds of avoiding potential conflicts of interest – such as competitive neutrality considerations – that may arise if regulating activities in which the port authority is involved (PC 1998).

Recreational Fishing

Definition

Recreational fishing is defined as the taking of fish and other living marine resources for non-commercial purposes. It therefore includes activities ranging from the inter-tidal gathering of bait and shellfish to offshore gamefishing for marlin, tuna and shark. Pepperell (2001) offers the following definition of recreational fishing for non-commercial reasons:

- fishing for finfish with hook and line
- fishing for cephalopods (squid, calamari) with hook and line
- fishing for finfish using net and traps
- fishing for crustaceans with nets, traps or hook and line
- spearfishing, both diving and wading
- gathering invertebrates for food or use as bait.

Regional activity

Some of the most popular locations for recreational fishing in the Region are:

- New South Wales – Twofold Bay, Eden, Wonboyn
- Victoria – Mallacoota, Gippsland Lakes, Corner Inlet, Western Port Bay, Port Phillip Bay, Portland Bay
- Tasmania – Tamar River, Great Oyster Bay, D'Entrecasteaux Channel, Storm Bay, Derwent River, Huon Channel
- South Australia – The Coorong, Victor Harbor.

Within these areas, recreational fishing activity tends to be seasonal, concentrated on the summer months where the days are longer and warmer and visitor numbers are greater. In many cases fishing is dictated by the seasonal movement and availability of target species.

Research suggested that between 25 and 35% of Australians aged over 14 years undertake recreational fishing activities at least once a year (McIlgorm & Pepperell 1999), with the figure approaching 50% for younger people.

Surveys also show that between 37 and 42% of country residents go fishing compared to capital city residents. Based upon surveys to date and the present Australian population size, recreational anglers undertake approximately 50 million fishing days per annum (McIlgorm & Pepperell 1999).

For the States bordering the Region, the most recent reliable data for the number of people engaging in recreational fishing at least once a year is:

- Victoria – around 916 000 (1987)
- South Australia – around 360 000 (1997)
- Tasmania – around 107 000 (1983)
- New South Wales – around 1 508 000 (1995).

Of those fishing in Victoria, a significant percentage fished within just two locations, Port Phillip Bay and Western Port Bay. Within these bays in 1991, between 200 000 and 210 000 recreational fishers fished a total of 3.3 million fishing days – between 15 and 17 fishing days per person per year (Dragun 1991).

Recreational fishing locations of the Region

Recreational fishing occurs within a number of habitat types, with the main habitat types for recreational fishing (McIlgorm & Pepperell 1999) being:

- estuaries
- ocean beaches
- offshore demersal (sea floor)
- offshore pelagic (water column).

Estuaries

Important estuarine species in the South-east Marine Region are flathead (tiger and sand), black bream, whiting (King George and other species), garfish, squid (calamari and Gould's), mullet and luderick.

Most estuarine fishing is undertaken by rod and reel. However, recreational fishing in estuaries also takes place by hand gathering, cast netting (eg whitebait) or by gillnet (Tasmania only).

Ocean beaches

The exposed nature of many of the beaches around the Region leads to the development of features such as gutters and holes, which attract and hold fish. Fishermen target these features by rod and reel (surf fishing) for species such as Australian salmon, tailor and mullet. Popular surf fishing locations in the Region include beaches near Merimbula and Eden (New South Wales), Ninety Mile Beach (Victoria), St Helens and Hobart (Tasmania) and Goolwa and Victor Harbor (South Australia)

Rocky headlands

Natural rocky headlands and artificial rocky breakwalls provide habitat for many species which are targeted by recreational fishermen. Where these headlands and breakwalls abut deep water they may provide game fishing platforms for large surface swimming (pelagic) species such as tuna, kingfish, shark and even marlin. Green Cape, south of Eden, is a renowned land-based game fishing platform for yellowfin tuna and yellowtail kingfish. Other headlands and breakwalls off Victoria (eg Cape Otway, Mornington Peninsula), southeast South Australia and Tasmania yield species such as snapper, sweep, pike, parrot fish and Australian salmon.

Offshore demersal

Offshore demersal fishing generally targets deep-water reef species, usually within 20 nautical miles of the coast (McIlgorm & Pepperell 1999), using rod and reel or handlines with weighted lines to reach the bottom. Fishing takes place from larger recreational boats or commercially chartered boats. Popular species targeted are snapper, striped trumpeter, banded morwong and flathead (found on sandy substrates). Further offshore, species such as blue-eye trevalla may be targeted. In more inshore waters diving for abalone and lobster and setting traps for lobster are popular. Offshore demersal fishing takes place in many locations in the Region, particularly out from the coastal towns along southern New South Wales, western Victoria, south-eastern South Australia and eastern Tasmania.

Offshore surface

Offshore fishing for surface (pelagic) species such as tuna, shark and marlin takes place in numerous locations around the South-east Marine Region. Much of the offshore surface fishing is from commercially chartered boats. Principal target species in the Region are southern bluefin tuna, yellowfin tuna, albacore, sharks and striped marlin. Fishing is primarily by rod and reel, either from a moving boat with lures or bait (trolling) or from a stationary boat (bait). Major offshore surface fishing locations are off Eden (NSW) and St. Helens and the Tasman Peninsula (Tasmania).

Important recreational species of the Region

There are many important recreational species in the Region. Table 23 details some of the species caught by recreational fishers in the area by predominant habitat type.

A recent study in Victoria (NRE 2001) provides some indication of recreational fisher preferences:

- 46% fished for flathead
- 35% fished for whiting
- 30% fished for snapper
- 22% fished for bream
- 14% fished for Australia salmon
- 12% fished for trevally.

The importance of these species varies across the Region both spatially and temporarily (seasonally). Species such as tuna, squid, Australian salmon and blue warehou are all targeted by anglers when seasonally available. Availability is dependent on numerous factors including seasonal feeding, migrations and spawning aggregations.

Table 23:
Recreational fishing species of the Region by habitat type.

Species	Estuarine	Beach	Headland	Offshore demersal	Offshore surface
Rock lobster			✔	✔	
Abalone			✔	✔	
Crabs	✔			✔	
Cockles / pippis	✔	✔			
Mussels	✔				
Squid	✔				✔
Southern bluefin tuna					✔
Yellowfin tuna			✔		✔
Albacore					✔
Striped marlin					✔
Australian salmon	✔	✔	✔		
Tiger flathead	✔			✔	
Black bream	✔				
Blue warehou	✔			✔	
Striped trumpeter				✔	
Blue-eye trevalla				✔	
Flounder	✔			✔	
Snapper			✔	✔	
Garfish	✔			✔	
Whiting	✔			✔	
Tailor		✔	✔		
Yellowtail kingfish			✔		✔
Silver trevally	✔			✔	
Long-finned pike	✔			✔	
Luderick	✔		✔		
Barracouta	✔		✔		✔
Jack mackerel			✔		✔
Banded morwong				✔	
Tommy ruff	✔				
Mullet	✔	✔			
Shark	✔		✔	✔	✔

Economic dimensions

Production volumes and values

Accurate data on the size of the recreational catch within Australia and the Region is currently unavailable. The Commonwealth Department of Agriculture, Fisheries and Forestry is currently undertaking a National Recreational and Indigenous Fishing Survey to provide comprehensive information.

Data on catches in particular locations gives some indication of the extent of catches for some of the species in the area:

- in 1991, it was estimated that for Port Phillip and Westernport Bays 11 600 tonnes of fish was caught by recreational fishers (Dragun 1991)
- in the shallower waters of the east coast of Tasmania (less than 10 fathoms) over 78% of the total catch of lobsters (both by recreational fishers and commercial fishers) is estimated to be taken by recreational fishers (TAFI 1999).

While it is possible, but difficult, to estimate production volumes within the sector, estimating production values for recreational fishing is fraught with difficulty. This is because it is not clear how the industry should be valued. For instance, should it be based upon the price of commercial fish proxied from the cost of fishing, or estimated using the myriad of other values derived from the activity such as contributing to a healthy lifestyle or some other measure of wellbeing?

While some studies have calculated the cost of fishing for a kilogram of fish, for instance $200 per kilogram in Victoria, this still does not allow a study of production values in a similar way to say a commercial activity such as oil and gas or commercial fisheries. The reason for this is that while one can calculate the input costs (such as boats, fuel and time) and use these costs as a proxy for the 'market price' for a kilogram of recreational fish, some of this expenditure is not directly related to the fish as such but to the activity itself. For instance, some fishers, while appreciating the feed of fish that they have caught, may value more the actual trip away or the freedom which such trips allow.

Market and demand analysis

In a similar sense to production volumes and value, there does not exist a market with associated demands in a similar sense to a commercial activity. However, demand within recreational fishers could be thought of as being represented by the number of recreational fishers active within the Region – some 3.5 million.

Employment

Once again, the analysis of employment generated by recreational fishing is different to commercial activities, as a general rule. For instance, people who partake in recreational fishing are not employed but their activities do create employment. Certain sectors such as charter boat operators, fishing guides and equipment hire businesses can be considered as directly employed by the sector. As of 2001, there were 139 charter boat operators active in the Region (Larcombe et al. 2002). Most other employment, however, is indirectly related such as accommodation and bait providores and boat and tackle manufacturers. For further discussion on this see below.

Regional importance

There are myriad industries that depend upon and service the recreational fishing sector including the industries for (Pepperell 2001):

- fishing tackle
- boating
- bait
- marine equipment and service (motors, engines, electronics, accessories, insurance)
- marinas
- recreational fishing media
- charters
- fishing guides
- accommodation
- other regional businesses (food and petrol outlets for example).

These sectors are import to the Region's economy. For example, In South Australia over $1 billion is invested in recreational fishing boats and tackle (Sunfish 2001). Table 24 indicates the sectors benefiting from nearly $1, 037 million spent by recreational fishers in Victoria in 1997 (Unkles 1997).

Table 24:
Victorian recreational fishing expenditure as a proportion of expenditure items.

Expenditure items	per cent of recorded expenditure
Fishing tackle, bait	0.7
Travel, accommodation, fuel, food and drink, hire fees	3.8
Fishing equipment and specialised clothing	12.0
Boats, cars and related expenditure	83.4

Source: Modified from Unkles 1997.

In Victoria, over 26% of total expenditure occurs away from Melbourne – the major population centre of the Region. For the Melbourne area, a large proportion of recreational fishing activity occurs within Port Phillip and Westernport Bays, including areas that are non-metropolitan. Total gross expenditure by recreational fishers fishing in either Port Phillip Bay and Westernport Bay was estimated at $387.5 million in 1991 (Dragun 1991). Table 25 details gross expenditure on marine recreational fishing in Victoria in 1996.

The flow on effects of recreational fishing into the wider economy are outlined in Table 26.

Table 26:
Recreational fishing: contribution to Victorian State and regional economies.

Victoria total	
Gross state product ($ million)	1,265
Employment generated ('000 jobs)	27.0
Household disposable income ($ million)	830
Melbourne region	
Gross state product ($ million)	765
Employment generated ('000 jobs)	15.9
Household disposable income ($ million)	496
Southeast region	
Gross state product ($ million)	144
Employment generated ('000 jobs)	3.3
Household disposable income ($ million)	99
Southwest region	
Gross state product ($ million)	106
Employment generated ('000 jobs)	2.4
Household disposable income ($ million)	72

Source: Modified from Unkles 1997.

Management arrangements

The management of recreational fishing primarily seeks to ensure that the resource is harvested sustainably so that harvesting can continue. It is also important for managers to be able to help maximise the fishing experience and to manage cultural and social imperatives.

It is this second consideration that makes management of recreational fishing fundamentally different to management of commercial fisheries. For instance, with commercial fishing the objective of management is to

Table 25:
Gross expenditure on marine recreational fishing in Victoria.

Region	Gross trip related expenditure ($million)	Gross capital expenditure ($million)	Total gross expenditure ($million)	per cent of Victorian expenditure
Melbourne	140.8	465.8	606.6	73.7 per cent
Southeast	40.8	75.6	116.4	14.2 per cent
Southwest	32.0	67.7	99.7	12.1 per cent
Total marine	213.6	609.1	822.7	100 per cent

Source: Modified from Unkles 1997.

ensure that harvest rates are constrained to ensure sustainability of the resource. However, with recreational fishing, management also concentrates upon maximising fishing opportunity – but not necessarily guaranteeing a catch (Pepperell 2001).

Historically, the Commonwealth has limited its jurisdiction to commercial fishing with States assuming responsibility for all recreational fishing. However, managing recreation and charter fishing in Commonwealth waters is presently under review and the Commonwealth may move towards taking more of a stewardship role while the States and Territories take effective responsibility for day-to-day management.

State

The States of the Region manage the majority of recreational fishing activities through a number of means including:

- bag possession limits
- size limit
- gear restrictions
- seasonal closures
- area closures.

As well, most States have licences in place to help mange recreational fishing, such as:

- New South Wales and Victoria – recreational fishing licences are required by most people between the ages of 18 years and retirement for any form of recreational fishing
- Tasmania – recreational fishing licences are required for the taking of abalone, rock lobster and scallops and for the use of nets and dredges
- South Australia – no general recreational fishing licence is required apart from recreational lobster pots.

In line with maximising the fishing experience, some States have set aside recreational-only fishing areas to improve recreational fishing by changing commercial fishing practices or even excluding commercial fishers all together from areas popular with recreational fishers. In Tasmania, parts of the D'Entrecasteaux Channel behind Bruny Island, the Derwent River and Georges Bay are reserved for recreational fishing. In New South Wales recreational fishing areas are under consideration along the entire coastline. More then 200 nominations for recreational fishing areas off southern New South Wales from Narooma to the Victoria were received from the public for the area to be declared a recreational-only fishing zone. Recently the New South Wales Fisheries Minister announced the closures of a number of estuarine fisheries from Narooma to the Victorian border to be set aside for recreational fishers.

Commonwealth

While managing recreational fishing is the responsibility of the States, there is some Commonwealth involvement, particularly for certain species important to Commonwealth fisheries. For instance, species targeted by the Tuna and Billfish Fisheries and the South East Trawl Fishery are important to both commercial and recreational fishers.

As a result, there is scope for the Commonwealth to monitor and manage recreational fishing for species under Commonwealth management plans. For example, charter operators who rely upon species managed by the Commonwealth could come under Commonwealth management (Pepperell 2001). The majority of Commonwealth fisheries are still managed through arrangements with the States.

In addition, under the Commonwealth EPBC Act 1999, Commonwealth-managed fisheries are required to undergo strategic assessment by 2005. If a fishery or some component of the fishery is assessed as unsustainable then conditions may be imposed. If the fishery includes recreational catch them this may also be impacted.

The Commonwealth has also released the National Recreational Fishing Policy which introduces five key goals for recreational fishing which are to (NRFWG 1994):

1. ensure quality fishing, and maintain or enhance fish stocks and their habitats, for present and future generations as part of the environmental endowment of all Australians

2. develop partnerships between governments, the recreational fishing community, and associated industries to conserve, restore and enhance the values of recreational fisheries throughout Australia

3. allocate a fair and reasonable share of Australian fish resources to recreational fishers, taking into account the needs of other user groups

4. establish an information base at national and regional levels to meet the needs of recreational fisheries management

5. establish a funding base to effectively manage the nation's recreational fisheries.

The National Recreational Fishing Policy also outlines 16 key principles relating to all aspects of recreational fishing ranging from ecosystem protection, stewardship, recreational experience, access and funding.

Shipping and ship/boat building

Maritime transport is vital to Australia's economy. Ships transport nearly all of Australia's exports. As an island nation with a coastline that spans 37 000 km, coastal shipping is fundamentally important to Australia. Australia is the fifth largest user of shipping services in terms of tonnes per kilometre with around 99% of our trade carried by ship (BTE 2001).

The shipping industry comprises Australian and internationally flagged vessels and the shore based activity that supports them. Some aspects of shipping are mentioned in other sections of this report with ports in particular being detailed separately.

The Australian shipbuilding industry primarily focuses on producing innovative vessels for the world market with over 95% of production exported.

Background

The importance of shipping to Australia and the Region is demonstrated by the fact that in 2000-2001 Australia exported 496 million tonnes of commodities valued at about $100 billion and imported about 54 million tonnes of commodities valued at $83 billion. The Region accounted for 25 million tonnes of commodity exports valued at about $23 billion. This was 23% of Australia's exports by value and 5% by volume (BTE 2001).

Regional shipping activity

Shipping activity in the Region encompasses:

- cargo shipping
- passenger shipping
- ship/boat building and repair activity.

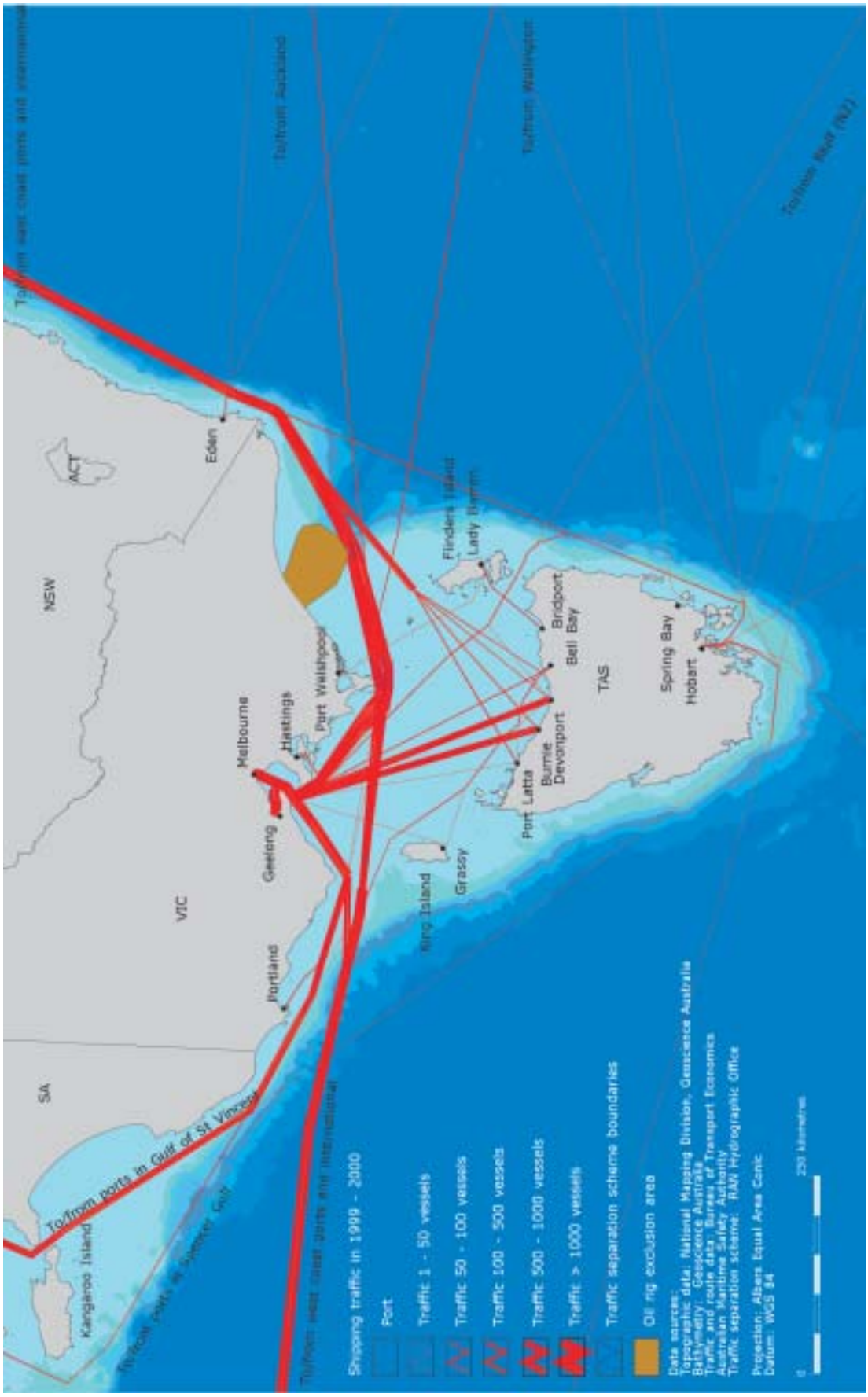
The Region is home to some of Australia's busiest shipping routes: Bass Strait, east-west; and west-east international trading routes. This traffic includes international and coastal cargo trade, passenger services and cargo and vehicular ferry services across Bass Strait. Cargo shipping alone accounted for about 8955 ship movements in the Region in 2000-2001. Map 20 shows shipping routes and traffic within the Region in 1999-2000.

Cargo shipping

Ships travelling from eastern ports in Australia to ports of the Region account for the highest number of movements (1572) with reciprocal movements from ports in the Region to eastern ports the next highest (1337) (BTE 2001). The Australian cargo fleet, which comprises 56 vessels over 1000 deadweight tonnes and 12 minor trading vessels between 150 and 1000 tonnes, transports the overwhelming majority of coastal cargo (Corporate Information 2002).

A number of carriers transport general cargo within the Region. For instance, between Victoria and Tasmania, Brambles Shipping operates a daily cargo service between Burnie and Melbourne and Holyman Shipping operates a similar service six days a week between Devonport and Melbourne. In addition, the Holyman's service goes via Grassy, King Island, one day per week.

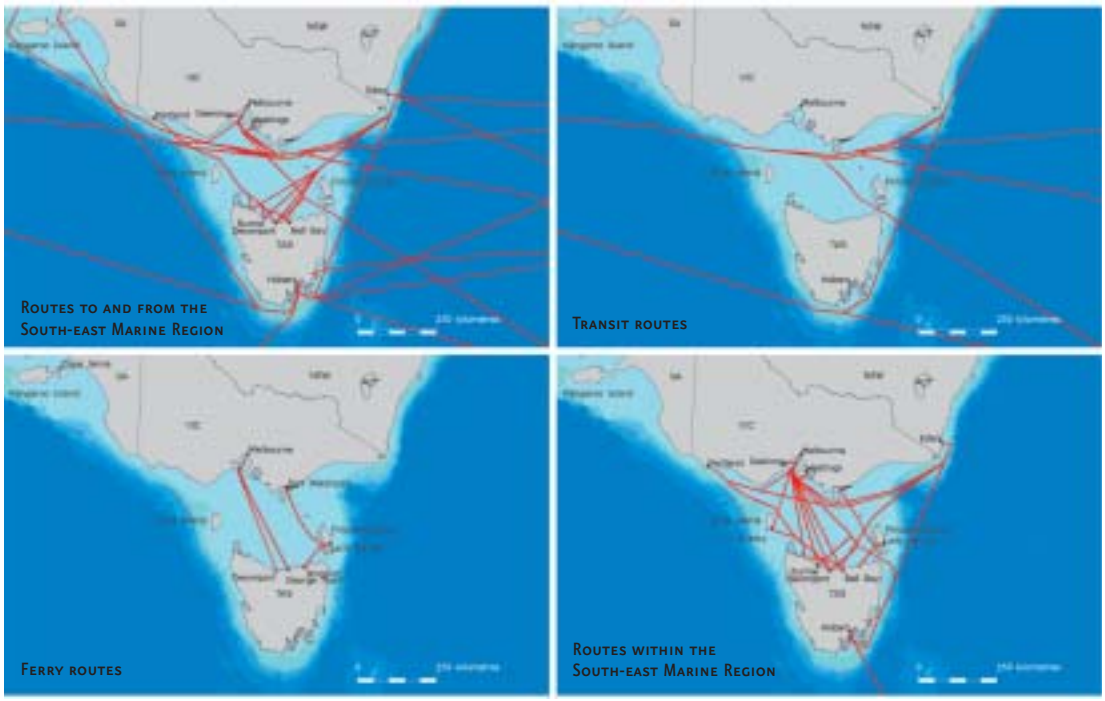
Map 20:
Shipping routes and traffic in the South-east Marine Region. *Source: Larcombe et al. 2002.*



General shipping routes and traffic for 2000-2001 by region of origin and destinations are shown in Map 21.

As can be seen from Map 21, the principal ports of the region are located at Portland, Geelong, Melbourne, Hastings, Port Latta, Burnie, Devonport and Bell Bay.

Map 21:
Shipping routes and traffic 1999-2000, p.132. *Source: Larcombe et al. 2002.*



International trade

Of vessels leaving the Region bound for overseas, the top four export destinations by value for 2000-2001 were (BTE 2001):

- East Asia – $4 billion
- North America – West Coast $2.5 billion
- South East Asia – $2.3 billion
- Middle East Gulf – $2.2 billion.

For vessels entering the Region from overseas, the top four sources of imports by value for 1999-2000 are:

- Asia – $15 billion
- Europe – $6.1 billion
- North America – $6 billion
- Pacific – $1.5 billion.

Passenger services

The principal commercial passenger service in the Region (excluding cruise lines) is the TT-Line Ferry service between Melbourne (Victoria), Devonport (Tasmania) and George Town (Tasmania). The ferry route is shown in Map 20.

The TT-Line is owned and operated by the Tasmanian government. In 1999-2000 the TT-Line carried 329 867 passengers across Bass Strait on 455 crossings (TT Line 2001). TT-Line operates 2 vessels:

- the Spirit of Tasmania – a 31 000 tonne vessel that can carry 1300 passengers, 350 cars, and 70 standard shipping containers, sailing between Melbourne and Devonport year round.
- the Devil Cat – a high-speed 91 metre Catamaran that can carry 740 passengers and 200 cars, operating from mid-December to early April between Melbourne and George Town each year.

Other passenger routes are between Bridport in northern Tasmania and Lady Barron in Tasmania and Port Welshpool in Victoria. There are a number of local ferry services such as between Kettering and Bruny Island in Tasmania, between Cape Jervis and Penneshaw on Kangaroo Island and to the islands in Western Port.

Shipping as an enabler of regional tourism

Tourism is a major industry in the Region and is particularly important for Tasmania. The TT-Line in conjunction with Federal Government's subsidies is a major enabler of the Tasmanian tourism industry.

Tasmania has experienced a rapid increase in visitor numbers and over the last decade tourism growth has been estimated at 4% each year. In 1999-2000 there were 531 700 visitors to Tasmania who spent about $551.8 million. This was up from the previous 12 months with 524 000 and $551.8 million in expenditure.

A study by the Centre for Regional Economic Analysis at the University of Tasmania found that in 1998 total travel expenditure in Tasmania was $900 million, generating employment for an estimated 18 300 people, 10.3% of total employment in the state.

Source: BTE 2001, Tourism Tasmania 2001.

Ship/boat building and repair

There are a large number of small shipyards spread throughout the Region and three major shipyards:

- INCAT in Hobart, building large wave-piercing catamarans
- Tenix Defence systems in Williamstown is building the ANZAC frigates ordered by the Royal Australian Navy. The only drydock in the Region is at Tenix shipyard in Williamstown, VIctoria
- Commercial Catamarans at Lakes Entrance, Victoria build medium-sized catamarans, mostly for commercial fishing.

As can be seen, ship production in the Region concentrates upon specialist boat production. Australia, and the Region, ceased production of large ships of conventional design over 20 years ago.

In addition, the shipping industry requires a viable, well-equipped and highly skilled repair industry to operate effectively and efficiently. The Australian

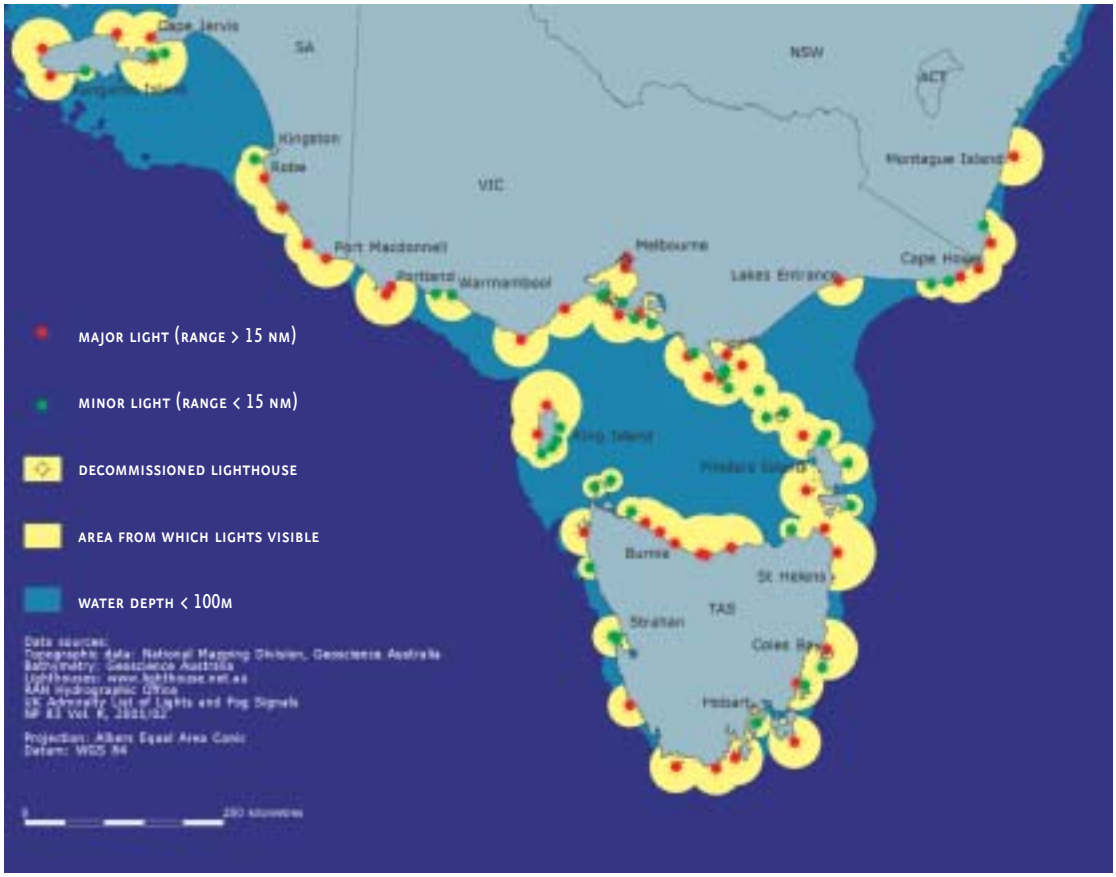
shipping repair industry ranges from multi-million dollar dry dock repair and maintenance facilities to basic dockside repairs.

As a rule, major refits and repairs of large vessels are restricted to dry-dock facilities of which only one exists in the Region – in Melbourne. For smaller vessels and minor repairs, docks, ship lifts and slipways are utilised and are spread throughout the Region. In addition all ports have companies specialising in carrying out running repairs on ships. For an overview of major and minor ports, slipways and shipyards of the Region see Map 17.

Lighthouses

In addition to services to shipping outlined above aids to navigation, including lighthouses, are essential for the safe passage of ships. The distribution of lighthouses and the area covered by their lights is shown in Map 22.

Map 22:
Lighthouses in the Region. *Source: Larcombe et al. 2002.*



Economic dimensions

Employment

Employment is generated both by those directly involved in the construction, maintenance and operation of ships, on board and ashore, and by a wide range of service providers, including:

- port corporations
- port terminal operators
- stevedores
- freight forwarders
- marine architects
- surveyors
- legal advisers
- customs shipping and travel agents
- tourism operators
- inter-modal transport industries
- other shipping related freight industries
- technology infrastructure providers.

Preliminary calculations suggest that in 2001 the shipping industry generated direct employment of over 2000 jobs within the Region and value adding of about $130 million.

Ferries

The TT-Line operating between Melbourne and Devonport employs 425 ship and shore based staff. In addition it provides significant indirect employment in a range of industries including engineering, tourism and hospitality, stevedoring, freight and purveying. It is independently estimated that the TT-Line annually contributes more than $160 million to Tasmania's economy through increased tourist and company expenditure on goods and services in the State (TT Line 2001).

Initial figures indicate that the Region's ship/boat building industry generates direct employment of over 3000 within the Region with value adding of over $150 million.

Regional importance

The maritime industry in general and the shipping industry in particular are important contributors to the Australian economy. It is estimated that direct employment and first order linkages account for about $14 billion or 3.2% of Australia's Gross Domestic Product and direct employment of about 71 000 people (AMN 2001). However, little data exists at present to allow a breakdown of the links at the regional level.

Management arrangements

Australian regulatory framework

Jurisdictional responsibility for shipping is divided between the Commonwealth and the States/Northern Territory under the Constitution. It is agreed in the Shipping and Navigation Agreement under the Offshore Constitutional Settlement. The agreement provides for sharing of powers based on the voyage being undertaken rather than a ship's location at any particular time or whether or not it is engaged in commerce.

State and Northern Territory marine safety regulations generally apply to the relevant ships operating within coastal and inland waters. In some cases the law is expressed as applying to any ship connected with the relevant State and to any ship operating in State waters.

Commonwealth waters

The *Navigation Act 1912* (Cth) provides the legislative base for much of the Commonwealth's responsibilities for maritime issues. These include (DOTARS 2000):

- ship safety
- the coastal trade
- employment of seafarers
- shipboard aspects of the protection of marine environment wrecks and salvage operations
- passengers (eg number of passengers, discipline and sanitary matters)
- tonnage measurement of ships
- a range of administrative measures relating to ships and seafarers.

Sectors affected by the Act include:

- fishing and tourism operators whose ships voyage overseas
- the offshore oil and gas industry
- ship design, building and maintenance industries
- suppliers of shipping equipment and supplies
- ship classification societies and surveyors
- coastal pilots
- marine salvage companies
- people and businesses with an interest in product transported by ships, eg exporters.

The Australian Maritime Safety Authority (AMSA established under the Commonwealth *AMSA Act 1990*) and the Commonwealth Department of Transport and Regional Services are the key bodies responsible for administering/regulating the *Navigation Act 1912* (Cth) in Commonwealth waters.

AMSA's primary responsibilities include maritime safety, protection of the marine environment and search and rescue operations. AMSA is responsible, on behalf of the Commonwealth Government, for enforcing operational standards for ships in Australian waters to promote sea-worthiness, safety and pollution prevention. It participates in the development and implementation of national and international maritime safety and environment protection standards. It provides the national network of aids to navigation and coordinates search and rescue operations for the maritime and aviation sectors in Australia's internationally agreed search and rescue region through Australian Search and Rescue (AusSAR). It also manages the National Plan of Action to Combat Pollution of the Sea by Oil and Other Noxious Substances.

Australia's international obligations

Australia's power to regulate shipping within the Exclusive Economic Zone is subject to provisions contained within the United Nations Convention on the Law of the Sea (LOSC). This convention defines the internationally agreed responsibilities and jurisdictions of Flag States, Coastal States and Port States, and provides the framework for more detailed technical conventions and agreements under the International Maritime Organization (IMO) and International Labour Organization (DOTARS 2000). The LOSC also defines the navigational rights of ships in territorial waters and on the high seas and their obligations concerning ship safety and marine environment protection.

Australia meets its international maritime safety and seafarers obligations through the *Navigation Act 1912*. Most of the detailed regulations concerning shipping are implemented through Marine Orders made under s425 of the Act (DOTARS 2000).

International Maritime Organisation

Because the shipping industry is international, action to improve maritime safety and prevent marine pollution is more effective at an international level rather than by individual countries acting unilaterally or without coordinating with others.

A conference held by the United Nations in 1948 established the International Maritime Organisation (IMO) as the first international body devoted exclusively to maritime matters. Most of the IMO's work is undertaken in a number of committees and subcommittees. Of particular relevance to pollution from ships is the Marine Environment Protection Committee (MEPC) established in 1973. Since 1959 the IMO has promoted the adoption of some thirty conventions and protocols, and adopted more than 700 codes and recommendations concerning maritime safety, the prevention of pollution and related matters (AMSA 2001).

Port State Control

In international law every ship is to be registered (flagged) with a country. It is the primary responsibility of the Flag State to regulate its flagged ship for safety and operations. However, only some of the flagged States discharge these obligations. The method that has developed internationally for the control of the quality of the ships and personnel is taken by the States into whose ports the ships trade, known as 'port state control'. For Australian ports this is undertaken by the Australian Maritime Safety Authority.

The power of the Port State to inspect these ships is contained in international conventions and also in the sovereign right of the Port State to set down the conditions under which ships will enter its ports. This is in contrast with more limited rights relating to ships that merely pass through territorial seas or other zones (innocent or transit passage). Australian Maritime Safety Authority officers board ships in port and inspect their safety and other aspects of seaworthiness. Ships that fail to comply are the subjects of a report and if the deficiency is serious enough the ship is detained until the ship complies with international requirements. The Australian Maritime Safety Authority reports regularly on the inspections, detentions and other non-compliance aspects.

Restrictions and cautions

A number of permanent and ad hoc restrictions apply to ship operations in the Region. These notifications are updated regularly by the Australian Hydrographic Service. Examples include:

- the Bass Strait Separation Scheme (designed for the protection of installations in the Bass Strait area and for the safety of shipping) approved by the International Maritime Organisation (IMO).
- petroleum safety zones (500 metre radius) from petroleum facilities
- areas to be avoided by ships of more than 200 gross tonnage
- military activities.

Details on the scope of Commonwealth legislation impacting on the shipping industry are contained within the report *Oceans management – the legal framework*.

Submarine cable and energy transmission lines

Background

Submarine cables in the Region are limited to the sub-sea floor of Bass Strait between Tasmania and the Australian mainland. In Bass Strait there is currently, *in situ*, one operational submarine cable (a fibre optic communication cable) as well as several obsolete telegraph and telephone cables.

There is also a substantial petroleum pipeline network for conveying petroleum products from offshore production facilities within Bass Strait to the Longford gas plant. Further details are available in the section titled *Oil and gas*.

Two energy transmission lines (electricity and natural gas) and one additional fibre optic cable are planned for the Region. Map 23 details current and proposed submarine cables of the Region.

Regional activity

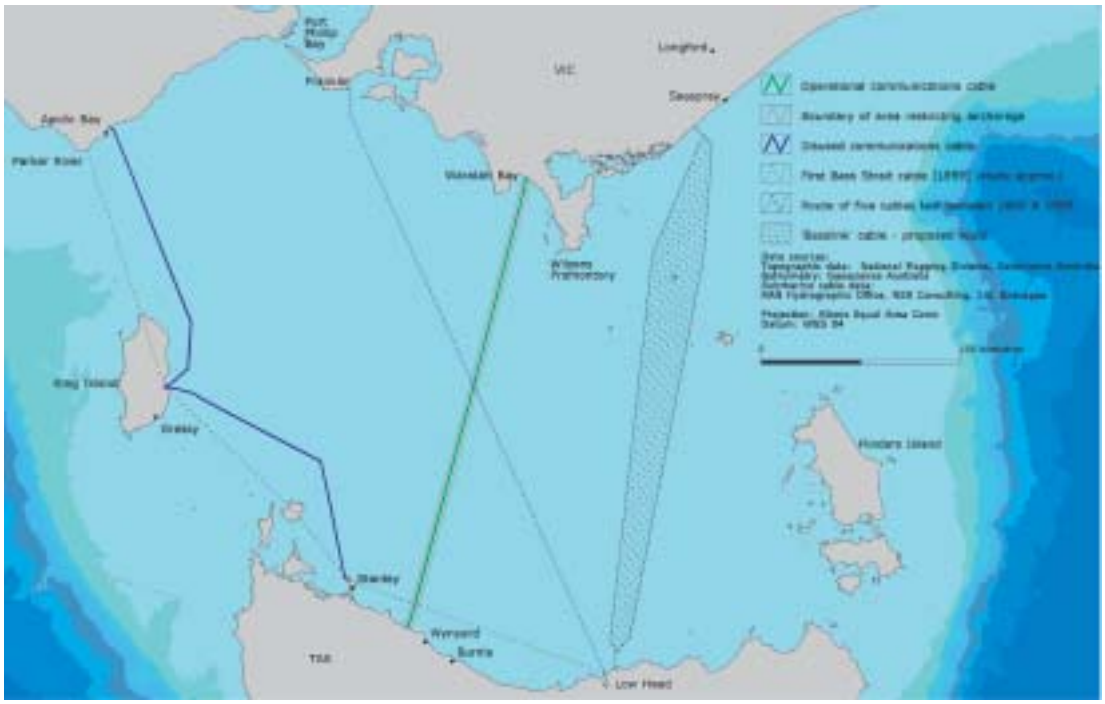
Communication cables

From its earliest history, establishing permanent communication lines has been a priority of successive governments.

A total of seven telegraph/telephone cables were laid in the period 1859 to 1936 and some cables remain *in situ* (Larcombe et al. 2002).

- 1859 – cable from Parker River, Cape Otway – King Island – three Hummock Island – Circular Head – Low Head
- 1869 – from Flinders direct to Low Head
- 1885 – from Flinders direct to Low Head (approx six miles to the east of the 1869 route)
- 1889 – from Flinders direct to Low Head (a replacement cable – the 1869 cable was recovered)
- 1909 – from Flinders direct to Low Head. Twin cables owned by the Post Office (recovered and redeployed to the North of Australia during the World War II)
- 1936 – from Apollo Bay (Victoria) to Perkins Bay (Stanley) via Naracoopa (King Island).

Map 23:
Communication cables in the South-east Marine Region. *Source: Larcombe et al. 2002.*



The last telegraph/telephone cable laid was in 1936. This was taken out of service in 1967.

The original telegraph/telephone cables have been superseded by technological developments including radio, satellite, microwave and fibre-optic cable. The only active communication line between Tasmania and the mainland is a Telstra fibre optic cable installed in 1995.

The cable is a section of an inter-capital optical fibre route buried 0.6 m below the surface straddling Bass Strait between Sandy Point Victoria and Boat Harbour Tasmania. It is approximately 60 mm in diameter, has a bitumus outer covering over a wire armouring, and has a design life of 40 years. Map 23 shows the route across Bass Strait.

Telstra plans a second fibre optical cable. While the project is still at the conceptual stage and no firm plans are available, one proposal is to bundle the new cable in with the proposed Tasmanian natural gas pipeline (discussed below).

Energy transmission lines

With the exception of the Bass Strait petroleum pipelines, there are no energy transmission lines *in situ* in the Region. However, permanent electricity and natural gas transmission lines between Tasmania and Victoria are in advanced stages of planning:

- electricity – Basslink
- natural gas – Tasmanian Natural Gas Project.

Electricity – Basslink

Basslink is the proposed $500 million 400 kV direct current, monopole electricity inter-connector between Tasmania and Victoria.

Natural Gas – Tasmanian Natural Gas Project

The Tasmania Natural Gas Project will bring natural gas to Tasmania for the first time. Duke Energy International's natural gas transmission pipeline project features a 744 km sub-sea and underground pipeline that will transport natural gas from Victoria across Bass Strait to Hobart in Tasmania's south and Port Latta on Tasmania's northwest coast.

The planned pipeline will be laid in three parts: stage one 338km (350 mm diameter), stage two 240 km (150 mm diameter), stage three 166 km (200 mm diameter). The project includes the refitting of northern Tasmania's Bell Bay Power Station as a gas fired facility. The project has a design life of 40 years. Pipe laying began in December 2001 and gas is expected to flow between Victoria and Tasmania by July 2002.

While the seafloor of Bass Strait is generally sufficiently flat to make seabed preparation largely unnecessary, some seabed levelling will occur using a plough or jet. Burial may be required in sandy sediments in shallow water and at the landfall, with the majority of the pipe resting on or partly embedded in the seabed, depending on the local conditions. In the soft sediments found in most parts of these waters, natural processes are expected to bury the pipeline over time.

Economic dimensions

The construction of energy transmission infrastructure directly stimulates economic activity in the construction phase as well as promoting competition and alternative energy sources.

Basslink electricity transmission line

The proposed Basslink project will assist in meeting Tasmania's demand for electricity and allow Tasmania to participate in the national electricity market. It will also provide Victoria with a more flexible and cost-effective response to meeting peak electricity load demands, and larger reserves of electricity supply capacity, leading to a more reliable electricity system (NRS Environmental consultants 2001).

The *Basslink Draft Integrated Impact Assessment Statement* estimates that:

- Basslink would generate the employment equivalent of 360 full-time person years in Tasmania, with real gross State product projected to be approximately $32 million higher than would otherwise be the case
- Victorian employment is projected to be 559 full-time person years higher with real gross state product approximately $50 million higher.

In addition, as a result of the link, national employment is projected to increase by 2720 and National Real Gross Domestic Product by $250 million. This is made up of:

- Tasmania – 485 extra positions and $60 million higher real gross product
- Victoria – 1545 extra positions and $155 million higher real gross product
- rest of Australia – 690 extra positions and $35 million higher real gross product.

Tasmanian Natural Gas Transmission pipeline

There are a number of direct benefits expected to flow from the construction of the $430 million Duke energy gas pipeline, including:

- the construction phase, which will involve approximately 900 contract and subcontract jobs in pipe manufacture and placement
- an estimated further $150 million, which will be invested by reticulation companies in the infrastructure needed to deliver gas to commercial and domestic customers in population centres.

The project is expected to have an immediate positive effect on the Tasmanian economy by providing employment and purchase of services during construction, particularly those towns along the pipeline route. Long-term benefits are expected to flow to the Tasmanian economy through the natural gas infrastructure. A new competitive energy source in Tasmania is expected to stimulate new investment by the industrial, commercial and residential sectors, creating further direct and indirect employment opportunities.

The project is also expected to stimulate capital upgrades by industry to reduce operating costs and increase production efficiency. Opportunities for value adding, through further downstream processing of raw materials, may also arise in the food, pulp, paper and mineral processing industries.

Management arrangements

Cables

The *Submarine Cable and Pipelines Protection Act 1963* (Cth) (Cables and Pipelines Act) gives effect to Australia's international treaty obligations. It requires that Australia "take the necessary legislative measures to provide that the breaking or injury by a ship flying a flag or by a person subject to its jurisdiction of a submarine cable beneath the high seas or the exclusive economic zone shall be a punishable offence". The Act does not apply in the territorial sea or in protected zones around submarine cables. The Act also only applies to Australian ships.

Basslink

The proposed Basslink project will cross Commonwealth, Victorian and Tasmanian jurisdictions. The three governments have established a single environmental assessment process for the project and have established a working group to advise on the most appropriate legislative regime for the project.

Tasmanian Natural Gas Project

The Tasmanian Natural Gas Project crosses the legislative jurisdictions of Tasmania, Victoria and the Commonwealth. As a result, the project requires

separate planning, environmental and other approvals from all three jurisdictions. The three governments have agreed to a coordinated environmental assessment process for stage 1 (from Longford Victoria to the Bell Bay Power Station in Tasmania). This process is to be run in accordance with the principles contained in the Inter-governmental Agreement on the Environment (1992) and the Basis for a National Agreement on Environment Assessment (1997).

Surveillance

Australia conducts surveillance and enforcement operations over a coastline of approximately 37 000 km. Australia has the 3rd largest maritime zone in the world – an area of nearly 12 million square kilometres. Within this zone Australia has either sovereignty or sovereign resource rights and responsibility on behalf of both the Australian and international communities for the protection and preservation of the marine environment.

Background

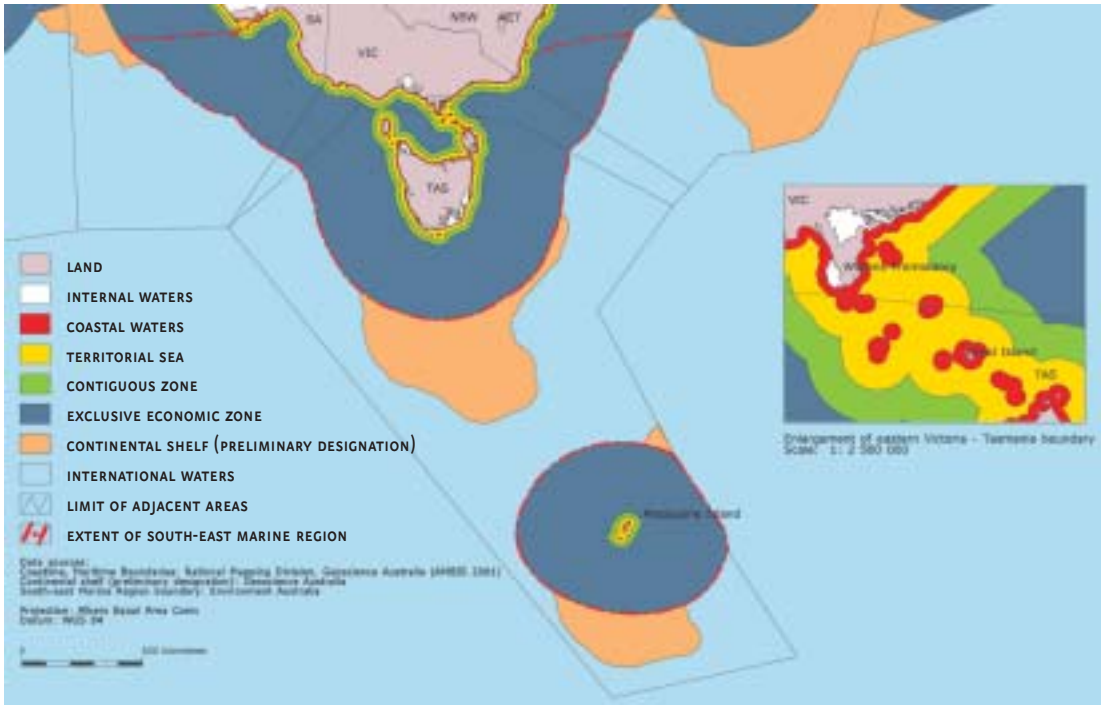
Australia has responsibility over an area exceeding some two million square kilometres in the Region. This is approximately double the combined land area of New South Wales, Victoria and Tasmania (see Map 24).

An effective surveillance and enforcement strategy is essential in the light of developments such as:

- adopting the United Nations Convention on the Law of the Sea
- creating Australia's Exclusive Economic Zone
- increased illegal movements of goods, drugs, migrants, plants and animals into and out of Australia
- an increasing number of offshore oil and gas installations
- illegal fishing.

Civil surveillance in Australia began in the late 1960s using Royal Australian Air Force (RAAF) and Royal Australian Navy (RAN) aircraft to patrol the newly-declared 12 nautical mile fishing zone. RAN patrol boats assisted with the surveillance and acted as a response force.

Map 24:
Jurisdictional and administrative boundaries off southeastern Australia. *Source: Larcombe et al. 2002.*



During the early to mid 1970s a number of issues began to focus the Government's attention on Australia's civil surveillance needs:

- between 1973 and 1974, the activity of foreign fishing vessels significantly increased in Australian waters with foreign traditional fishers making regular landings in the Kimberley coast area, leading to a quarantine risk
- in April 1976, the first Vietnamese 'boat people' arrived in Darwin
- in August 1977, the Government announced its intention to declare a 200 nautical mile Australian Fishing Zone (AFZ) around Australia.

A 1987 review by the Australian Government recommended that the administration and funding of the civil surveillance program be streamlined by bringing together policy, operational control, contract administration and funding in one autonomous agency. The term 'Coastwatch' was coined in August 1988. Subsequently Coastwatch was established as a Division of Australian Customs.

While the principal Australian surveillance body is Coastwatch, the Australian Defence Force is the principal enforcement, search and rescue body (Bateman 1995). Coastwatch coordinates Australia's maritime surveillance and response program using contract aircraft and sea-going vessels of the Customs Marine Fleet. The Australian Defence Force contributes to tasks including enforcement of exclusive economic zone arrangements and other maritime agreements, drug interdiction and anti-contraband operations, people smuggling, anti-piracy operations and maritime counter-terrorism.

The activities of Coastwatch are determined by the surveillance and response needs of the various government agencies that form its client base including the:

- Commonwealth Department of Agriculture, Fisheries and Forestry – Australia (AFFA), Australian Fisheries Management Authority (AFMA) and the Australian Quarantine Inspection Service (AQIS)
- Department of Immigration and Multicultural Affairs (DIMA)
- Department of Environment and Heritage – including the Great Barrier Reef Marine Park Authority (GBRMPA)
- Department of Transport and Regional Services (DOTARS)
- Australian Maritime Safety Authority (AMSA).
- Attorney General's Department and Australian Federal Police (AFP)
- Australian Customs Service.

Coastwatch uses client-generated threat assessments and surveillance requests to plan flying through areas that have the best chance of achieving an operational result. These areas change over time and are continually reassessed by Coastwatch operational planners, in consultation with client agencies, so that all new or emerging threats can be adequately addressed.

Aircraft operations are governed by a series of factors that limit the short and long-term rate of effort. Aircrew numbers and aircraft availability act as constraints on the short-term effort rate, while funding ultimately constrains the long-term rate. Each aircraft operation is planned to gain the maximum possible benefits for the least cost. The optimal economy of surveillance effort is generally achieved through multi-tasking of aircraft. For example, in the normal course of events, an aircraft conducting a fisheries surveillance task would also undertake surveillance tasks for all other agencies with interests in the area being covered.

Regional activity

Key clients in the Region are the Australian Fisheries Management Authority (AFMA) and Environment Australia. Less significant clients in the area are the Australian Customs Service (ACS) and the Australian Quarantine and Inspection Service (AQIS). Coastwatch also has responsibilities for surveillance and response in the subantarctic and antarctic regions.

Coastwatch does not currently consider the Region an area of high or emerging threats. There are currently no Coastwatch assets based in the Region and patrolling aircraft would generally be deployed from Cairns. With the exception of emergency repairs or minor servicing, Coastwatch assets are not maintained in the Region.

Surveillance Results

There have been no significant incidents other than fisheries infringement in the Region during the past five years. There were no apprehensions or arrests resulting from aerial surveillance in the area during that period. Surveillance flights conducted by Coastwatch aircraft for each of the past two years are summarised in Table 27. Only part of a flight may have been within the Region and the region or destination airfield may be outside the boundaries of the 'box'. The majority of identified sightings are Australian Fishing Vessels (AFV), Foreign Fishing Vessels (FFV), cargo vessels (MER) and yachts (YHT).

Table 27
Surveillance flights conducted by Coastwatch aircraft 2000/01.

Year	No of Flights	Total Flight time	No. of Vessels Sighted – by Category				
			AFV	FFV	MER	YHT	Other Vessel
2000	17	102	23	21	24	13	6
Jan-Nov 2001	16	82	88	8	31	7	10

Source: Coastwatch 2001.

Economic dimensions

Direct expenditure by Coastwatch for the financial year 2000-01 was $66.17 million. This figure does not include the cost of Royal Australian Navy (RAN) Fremantle Class Patrol Boats, Royal Australian Air Force (RAFF) P3C Orion aircraft or the cost of the Customs Marine Fleet. In 1999-2000 costs incurred by the Australian Defence Forces to carry out their surveillance and enforcement duties was about $130 million (Coastwatch 2001).

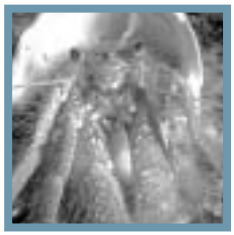
The Coastwatch aircraft fleet comprises 15 fixed-wing aircraft and two helicopters, all of which are based north of 18°South. Only the Dash 8 aircraft ever operates in the Region. The annual flying budget for the five Dash 8 aircraft is 8000 hours. At most, 250 hours (< 1.5% of total hours) would be programmed off-shore in the Region. Cost is around $66 million = $1,320,000 per year.

The RAAF provides 250 hours of P3C Orion time per year. These aircraft are based at Edinburgh, South Australia. Approximately one-third of their time would be programmed deep off-shore in the area southeast of Adelaide extending to Macquarie Island. Cost: 80 hours at ~ $44, 000 per hour = $3 500 000 per annum.

Coastwatch can and does charter light aircraft to conduct visual surveillance for client agencies (eg whale surveys for Environment Australia). Total annual usage in the area would rarely exceed 20 hours. Cost: 20 hours at ~ $1, 000 per hour = $20, 000 per annum.

Employment

Coastwatch employs 62 staff nationally in offices located in Canberra, Cairns, Thursday Island, Darwin and Broome. There are no Coastwatch staff or contract staff located in the Region.



Management arrangements

The legal framework for Australian civil maritime and enforcement activities is based on Australia's claims to maritime areas under international law. It covers Australia's baselines, territorial sea, contiguous zone, exclusive economic and fishing zone and continental shelf. Australia is a party to the four Geneva Conventions that entered into force between 1962 and 1966 (Bergin 1995):

- Territorial Sea and Contiguous Zone
- High Seas
- Continental Shelf
- Fishing and conservation of the living resources of the High Seas.

Within the Region, Coastwatch is coordinated out of Canberra from the National Coastwatch national operations centre.

Tourism and offshore charter

Tourism is one of the largest world industries, expected to generate US $9.2 trillion of economic activity (total demand) and over 260 million jobs worldwide by 2011 (WTTC 2001).

In 1999, Australian tourism was valued at just under $60 billion, comprising around $45 billion spent by Australians on domestic tourism and about $17 billion spent by international tourists. In 1997-1998 the Australian tourist industry employed 513 000 people representing around 6% of total employment (DITR 2002).

The Australian tourism industry has grown rapidly. This growth is expected to continue with the Tourism Forecasting Council (2001) predicting that international visitors to Australia will increase from 4.9 million in 2000 to 9.4 million in 2010.

Background

Initial calculations indicate that nationally, the direct value of marine tourism was in the region of $9.1 billion in 2000-2001 with marine tourism directly employing around 210 000 people with the indirect value added of around $23 billion and indirect employment of 497 000 – making it and the petroleum industry the two most valuable marine-based industries in Australia.

Utilising the above data, marine tourism generated over $2.6 billion in value added within the Region in 2000-01. In addition it created over 60 000 full time jobs.

Tourism can take many forms. The industry is extremely dynamic, reflecting the scope of human recreational activity. It encompasses most short-term travel away from the normal place of work and residence, including travel for business and pleasure. The World Tourism Organisation (WTO 2000) defines tourism as:

> persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes not related to the exercise of an activity remunerated from within the place visited.

This definition identifies tourism as trips between two or more countries or two or more domestic locations. It also includes travel for business, health, education, religious and other reasons. In an economic context, its effects are to directly generate economic activity and stimulate increased activity throughout the wider economy.

While the impact of tourism is widespread, it is particularly pronounced for transport, accommodation, food and restaurants, entertainment and specialist built facilities and services.

Australia's environment is a major attraction for international visitors. Nature-based and heritage tourism is an important element of Australia's tourism industry. For example:

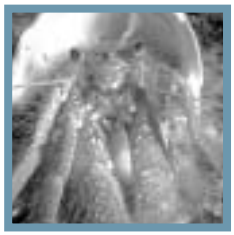
- almost half, or nearly two million international visitors visited a national park or participated in a bush or rainforest walk while in Australia in 1999 (SATC 2001).
- a South Australian Tourism Commission survey of the activity of international visitors found that 45% of respondents identified nature related factors as influential in their decision to visit Australia.
- a domestic visitor activity survey conducted by the Bureau of Tourism Research found that 58% of respondents participated in ecotourism while visiting the south coast of New South Wales (Tourism New South Wales 2001).

Table 28 details sample results of a survey asking international visitors to rank their preferred activities (out of a total of 29 identified activities) while visiting Australia. In all cases nature-based tourism ranked highly.

Table 28:
Preferred activities by international tourists.

Activity out of 29	England		Japan		Singapore		Indonesia		Germany	
Preferred Activity	**Rank**	**%**	**Rank**	**%**	**Rank**	**%**	**Rank**	**%**	**Rank**	**%**
See Natural Wonders	1	86	1	60	2	40	1	69	1	73
Wildlife in Natural Surroundings	4	77	2	48	4	32	5	41	4	64
Visit a National Park	2	81	3	39	8	24	4	42	5	58
Go Swimming	3	78	11	15	12	15	11	19	6	56
Walk on a beach	5	70	4	34	6	26	2	49	7	55
Understanding Natural Environment	12	46	7	22	9	22	6	36	13	39
Go Bushwalking or Hiking	18	27	9	17	14	13	3	45	15	24
Go Snorkelling	14	38	14	8	13	14	13	16	15	24
Go Scuba Diving	13	39	10	16	10	17	17	10	17	21
Go Sailing	18	25	13	13	10	17	15	13	18	15
Go Surfing	17	28	16	8	11	16	18	9	21	12
Go Fishing	23	17	8	20	11	16	13	16	24	7

Source: SATC 2001.



Regional activity

Caution needs to be taken in interpreting tourism activity data because of the extremely broad scope of data collected on the industry and the difficulty in attributing absolute numbers to such a wide range of activities.

Marine and coastal tourism is a thriving industry in the Region. Activities range from offshore fishing and yacht racing to more passive leisure activities such as a stroll along the beach. The charter boat industry provides an important adjunct to the tourism industry, catering to the needs of tourists and others, providing access to fishing, diving, whale-watching and other forms of recreation.

Victoria

The Lakes and Wilderness Region in Victoria's far eastern corner has the State's most compact range of spectacular coastal and alpine natural environments. The area is characterised by a vast wealth of natural attractions, including the extensive Gippsland Lakes and rivers system, the unspoilt coastal wilderness of Croajingolong National Park, the legendary Snowy River and the spectacular high country scenery along the Great Alpine Road.

In 1999, the Region attracted 573 000 overnight visitors (59% from Melbourne) and 418 000 day trips. Total expenditure from overnight visitors was about $160 million. Key activities by overnight visitors include:

- walking/sightseeing (38%)
- dining out at restaurants (36%)
- visiting friends and relatives (31%)
- going to the beach (30%)
- fishing (21%).

Tourism in the Region and adjacent coastal waters and lands involves both domestic and international tourists. The Region is diverse with visitors participating in a wide range of activities including:

- diving
- charter boating
- recreational boating
- whale/dolphin watching
- cruise ship visitations
- yacht racing
- going to the beach/surfing/coastal sightseeing/swimming
- penguin watching
- fishing (addressed under *Recreational fishing*).

Diving

A survey at the 1996 Scuba Expo in Sydney found that Tasmania was the most popular Australian destination for recreational diving behind Queensland, New South Wales and Western Australia.

There are an estimated 300 000 regular divers in Australia some 50 000 divers being accredited each year by the four main dive training agencies. Dive tourism is worth close to $600 million to the Australian economy.

In 1999-2000 3400 visitors participated in scuba diving. Approximately half of all scuba diving visitors were domestic (53%) and half were international (47%).

Charter boating

Around 135 boats are registered in the Region's charter boat industry (Larcombe et al. 2002): 80 in Victoria, 16 in New South Wales, 28 in Tasmania, and 10 in South Australia.

The vessels are used predominantly for recreational fishing and for scenery tours, including increasingly popular whale-watching.

Whale- and dolphin-watching

The recent increase in whale numbers has created a whale- and dolphin-watching industry in the Region for species including:

- New South Wales – humpback whales, bottlenose dolphins
- Victoria – southern right whales, bottlenose dolphins
- Tasmania – southern right whales, humpback whales, bottlenose dolphins
- South Australia – southern right whales, bottlenose dolphins, and common dolphins.

In 1998 the International Fund for Animal Welfare estimated that direct expenditure in the Australian whale-watching industry was about US$12 million and total expenditure of about US$46 million. This was up from 1994 when direct expenditure was US$4.5 million and total expenditure about $45 million. Total expenditure is the sum of direct and indirect expenditure on associated accommodation, food and other services (Hoyt 2000).

Cruise ships

The number of cruise ships visiting Australia is small by world standards. For example, in 2000 there were over six million passengers in the USA sector of the cruise industry (Shipping World and Shipbuilder 2001). However, like most areas of the cruise ship industry, there are signs of strong growth.

In 1998, there were 198 port visits by 38 cruise ships in Australia, up from 140 visits by 25 vessels in 1995-1996. Of these, only a few visited the Region where they called at the ports of Melbourne and Hobart. Stays in port are normally very short, usually less than 24 hours. In 1999, 25 international cruise ships visited Tasmania carrying 17 730 visitors. This was up from the previous 12 months when 19 ships visited, carrying 11 890 passengers (Tourism Tasmania 1999). Cruise ship visits in the Region are seasonal, running from late spring to early autumn.

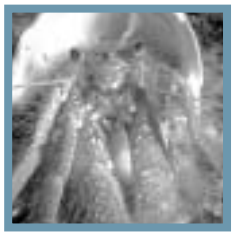
Yacht racing

There are about 12 major yacht races held within the Region, notably the Sydney to Hobart yacht race. While the direct economic impact of these races is relatively small, they are associated with increases in regional tourism.

The major yacht races held in the area are:

- Australian Three Peaks race
- Bass Strait Challenge
- Melbourne to Stanley Race
- Melbourne to Grassy Race
- Melbourne to Hobart Race
- Queenscliff to Apollo Bay Race
- Melbourne to Port Fairy Race
- Melbourne to Adelaide Race
- Portsea to Flinders Race
- Sydney to Hobart Race
- Portsea to Westernport Race
- Melbourne to Devonport Race.

Map 18 (p.110) details yacht races that occur within the South-east Marine Region.



1999 World Sailing Championship economic impact assessment

The 1999 World Sailing Championships was staged at various locations around Port Phillip Bay (Victoria) during January 1999. The events attracted 1696 competitors, including 1133 international participants.

Based on the results of a comprehensive participant survey and other information provided by event organisers, an economic assessment has revealed that:

- approximately $5.5 million of additional expenditure in the State of Victoria was attributed to the 1999 World Sailing Championships, resulting in a total economic impact to the State of about $9.9 million
- flow-on economic benefits should be derived given that a significant number of competitors indicated that they would return to Melbourne as part of the pre-Sydney 2000 training and or/or to compete in future regattas staged in Melbourne
- intangible benefits including an increase in exposure and export for the domestic ship chandlery industry arises from the conference held immediately subsequent to the championships.

Source: Ernst & Young 1999.

Recreational activities

The Region is characterised by a diverse coastline comprising beautiful white sandy beaches to sheer rocky cliffs. The adventure magazine *Outdoor* recently named wine Glass Bay, Tasmania as one of the top ten beaches in the world. Bells Beach, Victoria is recognised as a world-class surf beach. Coastal waters are used for recreational activities including sailing and sea canoeing. According to the President of the Tasmanian Sea Canoeing Club, more than 1000 people in Tasmania regularly use sea kayaks to visit offshore islands and secluded beaches.

Penguin watching

Penguin watching is popular at specific locations across the Region. These include the Penguin Reserve at Phillip Island in Victoria, northern and eastern Tasmania and Bruny Island off southeastern Tasmania. An independent analysis by management consultants KPMG estimated that the Penguin Reserve at Phillip Island was responsible for about $100 million a year in gross economic benefit to the State of Victoria, creating employment for more than 1000 people (DPC 1996).

Economic dimensions

Current data suggests that tourism associated with marine environments generated direct employment of over 60 000 within the Region and direct value adding of around $2.6 billion in 2000/01.

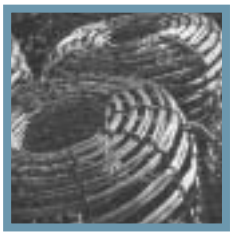
Management arrangements

There is no overarching legislation for the tourism industry in either Commonwealth or State jurisdictions, apart from Acts setting up Government tourism bodies such as Tourism Tasmania. However, there is a range of non-tourism specific legislation that applies to participants in the industry.

Specific Commonwealth and State/Territory environment legislation regulates access to and provides measures to protect the Australian environment and heritage sites. The *Environment Protection and Biodiversity Conservation Act 1999* is the key Commonwealth environment legislation. The Act covers all forms of marine cultural heritage such as lighthouses, jetty's wharfs and the remains of Indigenous occupation.

The Commonwealth *Historic Shipwrecks Act 1976* automatically protects all shipwrecks that are over 75 years of age located in Commonwealth waters. Younger shipwrecks can be protected if they are found to be significant after investigation and evaluation. This legislation is administered on the Commonwealth's behalf by State/Territory governments.

To ensure world class operating practices and promote Australia as a centre of tourism excellence, the Australian tourism industry, in conjunction with Commonwealth, State and Territory governments, has developed specific codes of practice, principles and guidelines to guide the industry's development and operation.



Non-market economic values

This chapter summarises work undertaken for the National Oceans Office by Hassell and Associates. A copy of the full report is available at www.oceans.gov.au. The views expressed in this report are those of the authors and not necessarily those of the Commonwealth of Australia. The Commonwealth does not accept responsibility for any advice or information in relation to this material.

Introduction

The South-east Marine Region provides a range of goods and services to the community. For some of these, such as fish and petroleum, prices are valued directly through the market by the price consumers are prepared to pay, although market prices do not always reflect the true value.

Some uses are viewed in market terms, even though a market for their goods and services doesn't really exist – defence, surveillance and the provision of navigational aides are examples.

Some goods and services do not have a market value or have a value to society that cannot be adequately expressed in market terms. Some of these are crucial to the maintenance of a healthy society and its economy.

> The services of ecological systems and the natural capital stocks that produce them are critical to the functioning of the Earth's life-support system. They contribute to human welfare, both directly and indirectly, and therefore represent part of the total economic value of the planet (Costanza et al. 1997).

Examples include ecosystem functions that ultimately provide us with highly valued commercial food species, the waste assimilative capacities of natural environments, the role of the ocean in climate regulation and the provision of recreational and aesthetic opportunities.

Environmental goods and services then, tend to have both market and non-market values. When considering their value it is useful to consider both the market and non-market values in a total economic value framework. Total economic value allows interested parties to conceptualise the values of an environmental service within the wider values of society. Without explicit recognition of these values society risks making sub-optimal decisions and overusing some resources (Pearce et al.1991).

The application of such a framework would ideally assist in gaining a full appreciation of the value to the society of the South-east Marine Region.

Total economic value framework

The total economic value of an environmental resource includes:

- direct use values – values arising from the physical use of environmental resources. These may include commercial or market activities such as commercial fishing, guided fishing trips, boat tours, etc, as well as non-commercial or non-market activities such as recreation (James & Gillespie 1997; DEST et al. 1995)
- non-direct use values – those values not derived directly from commercial activities and not associated directly with recreational activities. For example, the value of clean air derived from ocean processes, aesthetics associated with seascapes and pollution amelioration capabilities of well functioning ecosystems.

These values can be further divided into a number of other categories (see Table 29).

Figure 14 details the major components of total economic value.

Table 29:
Components of total economic value.

Total economic value	=	Direct use value	
	+	Non-direct use values	
		Ecological function value	The value of the ecological services and functions provided by an environmental resource. The concept attempts to capture indirect ecological values derived from the links connecting species through a variety of food chain and nutrient cycles (Young 1992). Ecological function values may include waste assimilation functions and life support functions, such as the provision of clean air, water and other resources (James and Gillespie 1997)
		Options value	The benefit of maintaining the right to use resources without necessarily doing so. It may include future use by existing individuals or by future generations. It also incorporates the concept of 'quazi-option values' which are those derived from the opportunity to obtain better information by delaying a decision that could result in irreversible environmental damage
		Vicarious use value	The knowledge that others may be enjoying the use of a natural environment for recreational, commercial or other activities
		Bequest value	The maintenance of environmental attributes for the benefit of future generations
		Existence value	The satisfaction that the community derives from simply knowing that certain things exist (including because of ethical concerns), for example, rare species or special ecosystems (James and Gillespie 1997).These values are presented diagrammatically in Figure 14

Source: Young (1992); DEST et al. (1995).

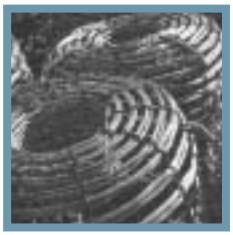
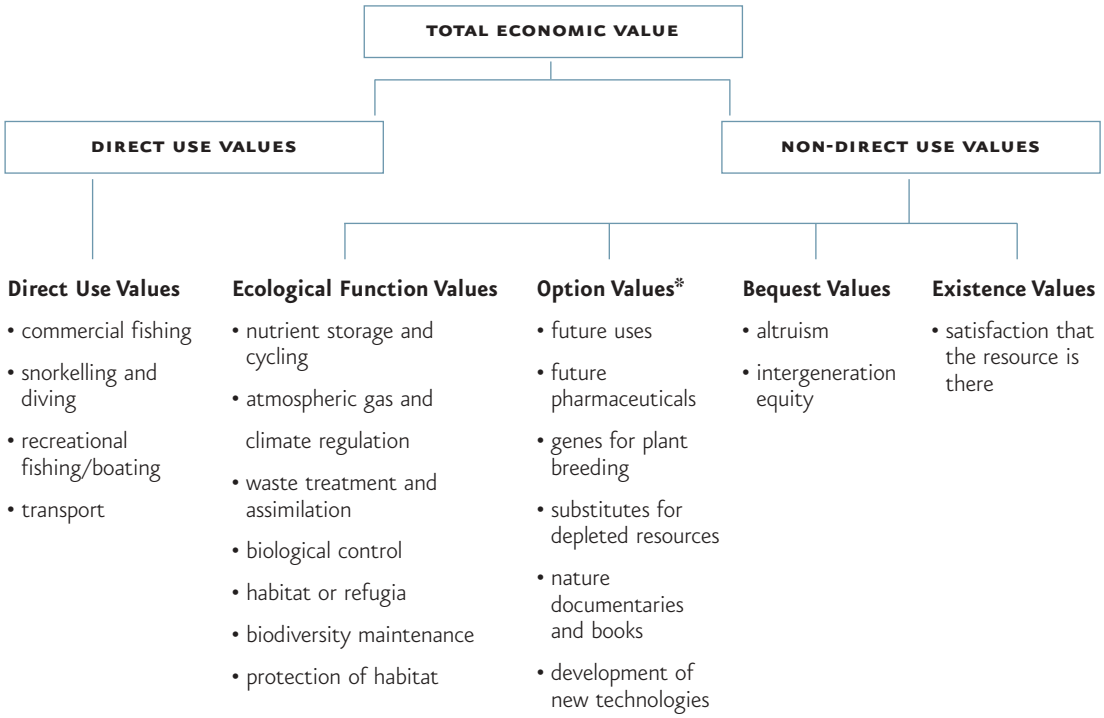


Figure 14: *Major components of total economic value.*



*Includes option, quasi-options and vicarious values.

Source: Adapted from Young (1992); DEST et al. (1995).

Using a common unit to compare different options and their consequences can assist the decision making process, particularly when trade-offs between competing outcomes must be negotiated. The most frequently used unit is monetary values.

A number of authors have attempted to estimate the value of ecosystem services in a monetary sense. Costanza et al. (1997) estimated the average global value of 17 ecosystem services across 16 biomes. Overall, the estimated value of global ecosystem services was US$16-54 trillion with marine systems contributing approximately 63%. Table 30 details the financial value of a range of marine environmental services.

Table 30:
Financial values of marine ecosystem services.

Ecosystem service	Annual value (US$)
Nutrient storage and cycling	4 trillion
Atmospheric gas and climate regulation	1.2 trillion
Waste treatment and assimilation (from coral reefs, tidal marshes and manghroves)	1.1 trillion
Biological control of populations (including pest species)	0.3 trillion

Source: Costanza et al. 1997.

There are a number of techniques that can be used to ascribe monetary values to non-market environmental goods and services. These can be broadly categorised as market-based techniques, surrogate market techniques, hypothetical market or survey techniques and benefit transfer methods. All of these approaches have their limitations and some economists question the usefulness of ascribing monetary values to non-marked valued environmental services. The difficulties tend to increase as the links between the environmental service provided and a marketable commodity or service becomes more tenuous.

Non-direct use values of marine areas

The productive capacity of the marine environment is substantial, with oceans estimated to provide more than 35% of the planet's primary production (Lalli & Parsons 1993). The Region contributes to this capacity, producing a range of environmental goods and services from which holders of fishing rights, the tourism industry, people seeking recreation and researchers derive value from direct use. However, there is also a range of services that can be classified as non-use values.

Ecological function values

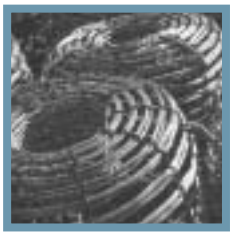
Well-functioning ecosystems provide services that have an ecological function value. These benefits or services are usually derived by supporting and protecting other economic activities, for example, waste assimilation or nutrient cycling (Spurgeon 1992).

The ecosystem services provided by the marine environment are also valuable to people for the purposes of survival, material gain and for enjoyment, through recreation and leisure activities. Humans also fundamentally rely on natural ecosystems for life-support functions such as producing clean air and providing climate regulation, as well as its resources, such as water (James & Gillespie 1997). Ecosystem services are also inter-dependent – a change in the factors affecting one is likely to have ramifications for the provision of others.

Nutrient storage and cycling

The marine food chain depends on the concentrations of nutrients available in the marine environment. The water resource and its inhabitants recycle atmospheric and marine nutrients through microalgae or phytoplankton. They take up nutrients and make them available to a wide range of other organisms through the food chain (Polunin 1983; DEST 1993). The level of nutrient in turn regulates the abundance of phytoplankton.

The most productive waters of the world are found in areas of upwelling, which bring nutrients accumulated in the seabed and deeper waters to the surface (Kingsford 1995). The physical structures of the seabed and the Subtropical Convergence south of Tasmania, where warmer subtropical waters mix with more nutrient-rich subantarctic waters, are important drivers of marine productivity.



Atmospheric gas and climate regulation

The marine environment plays a significant role in regulating the earth's climate. Circulating ocean water has a considerable affect on onshore climates, affecting the atmosphere's temperature, moisture content, stability, rainfall and winds (Linacre & Geerts 1997) and therefore, the productivity of terrestrial systems.

The oceans are also a critical factor in regulating the composition of atmospheric gases suitable for humans, animals and plants. Oceans are involved in maintaining oxygen and carbon dioxide levels, and are critically important sinks for carbon dioxide.

Photosynthesis by microalgae, phytoplankton and macroalgae also plays a key role in maintaining the composition of the atmosphere. Phytoplankton absorbs carbon dioxide and releases oxygen during photosynthesis. This global support role of the cycling of gases is said to be larger than that of tropical rainforests (Kingsford 1995). Macroalgae, such as the kelp forests of the South-east Marine Region, also make an important contribution to climate regulation services, absorbing significant quantities of carbon through photosynthesis. The total amount of carbon produced per day per area in kelp forests is comparable to that recorded in terrestrial grasslands (Kingsford 1995).

Waste reception, treatment and assimilation

Estuaries, reefs, open oceans and the seafloor provide an ecosystem service of waste treatment and assimilation. This is particularly the case for the assimilation of non-point source discharges such as the bilge of ships, effluent from pulp mills, organic waste from offshore aquaculture and waste heat from electricity generating plants (Tisdell 1985; de Groot 1992; DEST 1993).

Biological control

The balance of organisms in the marine environment is controlled through a complex interrelationship of many factors including the control of predator/prey relationships. The marine environment habitat contributes to this relationship, providing hiding places from predators, which helps regulate population and species interactions of fish communities, as has been demonstrated for coral reefs, rock reefs, seagrass beds and kelp beds (Heck & Orth 1980; Ebeling & Hixon 1991).

Biological support

A variety of habitats are represented in the South-east Marine Region, including kelp forests, soft sediment substrata, caves, crevices, boulders, the open ocean, continental slopes, seamounts and submerged rocky reefs. They provide surfaces for feeding, shelter and points of anchor, and support a range of species important to the commercial fishing, tourism and education industries.

Habitats may be grouped according to whether they are physical structures, structures formed by organisms or the open ocean itself. The area defined as the Macquarie Island Marine Park is a significant example of biological support in the South-east Marine Region. Macquarie Island and its surrounding territorial waters out to 12 nautical miles, was listed as a World Heritage Area in 1997 due to its outstanding geological and aesthetic values. Macquarie Island is home to a large variety of wildlife including Elephant and Fur Seals; Royal, King, Gentoo and Rockhopper penguins; and 16 other types of seabird. The Royal Penguin is only found on Macquarie Island (EA 1999). More information on Macquarie Island is contained in the report *Resources – Macquarie Island's picture*.

Biodiversity maintenance

Biodiversity is the principal form of non-direct use value (Young 1992). The diversity, distribution, and interdependence of life are crucial to its survival, giving greater resilience to ecosystems and organisms and subsequently the health of dependent systems (DEST 1993).

The interdependence of species is characterised by each species forming part of the food chain or web of nutrient transfers. Human beings ultimately are dependent on food chain or nutrient transfer pathways for their well-being, survival and enjoyment (Crawford et al. 2000).

Although Australia's off shore waters are generally considered to have low productivity, there are areas of the South-east Marine Region with exceptional species richness, particularly where there is convergence

and strong currents producing high concentrations of nutrients and micro-organisms. Examples include the benthic habitats off East Gippsland and the Tasmanian Seamounts.

Protection of terrestrial and other marine habitats

Underwater structures, such as rocky and coral reefs, provide protection values through reducing the impact of wave and water current energy on shorelines. It could be argued that aquaculture, located in bays or estuaries, are also afforded protection value by the shoreline structures reducing the impact of storms, wind, and wave action.

Option values

Spurgeon (1992, p. 534) describes options values as being "equivalent to an insurance premium guaranteeing the supply of something in the future which may otherwise become unavailable". This includes the potential value of increased information in the future. The documentation of Indigenous people's use of plants, for example, has been the source of new pharmaceuticals and foods (DEST 1993). As such, an important option value is the possibility of discovering new biological resource with important genetic or pharmaceutical characteristics, as well as developing new applications of existing knowledge. To ensure these options are available, the maintenance of biodiversity is essential.

Existence values

Existence values, while similar to option values, relate to the community deriving satisfaction from knowing things exist, such as a rare ecosystem or species (James & Gillespie 1997). Individual existence values may exist even if people do not visit the site in question. For example, a person living in a Melbourne may be willing to pay for the conservation of a natural area that they may never visit, such as the Tasmanian Seamounts at 1970 m depth.

Examples of existence values include social (including spiritual values, cultural, artistic and heritage values), protection (such as a reserve being a safe haven), historical and intrinsic values:

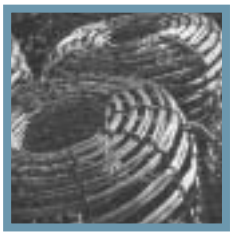
- **social value** – human cultures evolve with their environments. Different cultures within the same society may derive different types of significance from the same environments or locations, including their flora and fauna
- **protection values** – the South-east Marine Region provides sanctuary to whales and seals, with the entire Region part of the Australian Whale Sanctuary. Blue whales, which are listed as an endangered species, feed and travel through the Region. The Tasmanian Seamounts Marine Reserve and other areas also provide protection to a range of species and habitats. The community may value the protection such areas provide to endangered animals
- **historical value** – Macquarie Island Marine Park has an historical value as it is a significant example of the major stages in the earth's evolutionary history
- **intrinsic value** – many people recognise the 'intrinsic' value of species and ecosystems, = independent of any direct or indirect use to humans. While it is subjective and cannot be valued monetarily (Spurgeon 1992), the declaration of reserves or sanctuaries providing safe havens, may demonstrate that humans believe animals have a right to safety or protection
- **vicarious use values** – vicarious use values are gained by people who do not visit an area, but who derive pleasure from knowing that others may be enjoying use of a natural environment for recreational or educational purposes (James & Gillespie 1997).

Aesthetic values

Aesthethic values are those derived from the experience of an environment or the cultural of natural attributes contained within it.

Bequest values

Bequest values refer to the maintenance of environmental characteristics for the benefit of future generations (James & Gillespie 1997). It may include option, existence and vicarious use values for future generations, for example potential pharmaceutical benefits. A number of literature review studies have not found valuations estimating separate bequest values for marine protected areas. However, bequest values are generally captured in research studies on the willingness to pay for goods and services, which cover all non-use values.



Conclusion

Environmental goods and services tend to have both market and non-market values. It is possible to provide crude monetary estimates of some non-market values of environmental goods and services. However, the difficulties in attributing such a monetary value tend to increase as the links between the environmental service provided and marketable goods or services become more tenuous. While these techniques are problematic, they indicate that the scale of non-market values is significant. As such, any loss or decrease in environmental goods and services is likely to have major economic (as well as social and environmental) consequences.

There are significant issues associated with attributing monetary values to a range of non-market environmental goods and services, including concerns over the appropriateness of doing so. Current economic tools are helping us gain a deeper appreciation of the contribution non-market environmental values make to human well-being. However, they are an inadequate basis for decision making where complex trade-offs between competing natural resource uses and environmental uses must be considered.

There is very little data available on the economic contribution made by non-direct use values in the South-east Marine Region. Nevertheless, in order to maximise overall community benefit, both market and non-market values must be considered when making decisions.

Pressures

This chapter summarises work undertaken for the National Oceans Office by DCafe. A copy of the full report is available at www.oceans.gov.au. The views expressed in this report are those of the authors and not necessarily those of the Commonwealth of Australia. The Commonwealth does not accept responsibility for any advice or information in relation to this material.

Introduction

All users of the South-east Marine Region apply, to varying extents, pressures on the environment and the services it provides. Equally, a range of factors including economic and market conditions, changes in lifestyle preferences, legal and institutional requirements and the environment itself, apply pressures on uses within the Region.

This chapter does not provide a definitive list of all pressures affecting uses in the Region. Instead it provides an overview of the types of influences affecting the day-to-day or long-term use of the Region.

Pressures can be categorised as:

- economic and market-based – those affecting users including through changes in demand for products, changes in costs of inputs, etc
- lifestyle – those brought about through changes in peoples' preferences or attitudes
- resource use – impacts of resource use on the environment and the provision of environmental services
- institutional – those arising from legal, regulatory or other institutional requirements, including resource management arrangements
- environmental change – those arising from changes in the environment either through natural cyclical change, natural disaster or evolutionary change
- cross-cutting – those which either arise when one use affects a number of others or where a particular issue, for example native title, has potential implications across a range of uses.

These categories are not mutually exclusive, but are often interrelated. A hypothetical example is used here to help explain the interrelation. High interest rates may mean a fisher is unable to purchase new fishing technology as required to comply with revised bycatch management arrangements. This is despite the new arrangements being applied in response to concerns regarding the impact of bycatch rates on the sustainability of the fishery.

Economic and market pressures

Nearly all uses of the Region, particularly those engaged in extractive uses, are subject to economic and market pressures. For instance, changes in the world trade price of certain fish may cause changes in fisher behaviour such as increased competition for access to the resource, or increased investment in the application of available technologies. Changes in the world price of crude oil, either through exchange rate movements or changes in the world price, may change the extraction rate or the economic variability of some ventures.

The demand for shipping and associated port services is linked to both local and overseas economic conditions. The depreciation of the Australian dollar relative to our major trading partners' currencies "has been a major factor in the increasing demand for Australian products" (DCafe 2001) by overseas buyers. Local demand for products serviced by coastal and international shipping has also been strong due to a "relatively buoyant Australian economy" (DCafe 2001). The current value of the Australian dollar has also been a factor in the growth of both international and domestic tourism.

Changes in consumer preferences or demographics also affect consumer behaviour. For instance, population growth and changes in the age profile of the Australian population are leading to increased consumption of fish. As well, these same changes are leading to an increase in tourism numbers (DCafe 2001, p.17):

> The coming retirement of the 'baby boomers' and the general high income and health of this group .... is likely to result in an increase in the demand for recreational and leisure services.

Other economic and market pressures are not so obvious (DCafe 2001, p.20):

> Increasing wealth and increasing population size will increase pressures on the generation of waste.

Lifestyle pressures

Changes in the lifestyle of the Australian population are leading to changes in how the Region is used. For instance, for the oil industry (DCafe 2001, p. 10):

> Increasing expectancy and relative affordability to be able to control household temperatures creates an increasing demand for energy. Increased car ownership, including greater multiple car ownership within a single family, and increased willingness to travel adds to fuel demand.

This increased demand may be a factor in future decisions on exploration activity in the Region.

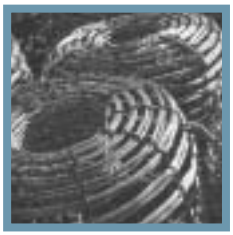
The growth in disposable income and willingness to experience different leisure activities is contributing to the growing importance of tourism and recreation to the Region's economy, including an increase in the number of cruise ship visits. The ongoing movement of Australians to coastal locations is adding pressure on coastal environments, including nurseries for important commercial and recreational fish species.

Resource use pressures

Resource use from far inland through to the rural coastal margin of the Region all produce pressures on the Region's environment. In particular, urban sewage, stormwater and run-off from both extensive and intensive agricultural industries affect the Region.

The earliest industries in the Region were based on the exploitation of whales and seals. The large decrease in population sizes is likely to have had profound ecological consequences.

Past fishing practices have resulted in over-exploitation of some fish stocks such as school shark, scallops and eastern gemfish, and localised commercial extinctions.



Advances in technology have affected the species and ecosystem function of the marine environment. Indeed, as technology continues to progress, new pressures will emerge. For example, advances in deep-sea mining and petroleum production will open up new areas for exploration.

Inadequate management arrangements for ballast water in the past has been responsible for the introduction of a number of introduced marine species into the Region, the ecological consequences of which are not yet fully understood.

Institutional pressures

Most of the key industries in the Region are governed by specific legislation at either the Commonwealth or State levels, and frequently both levels.

Australia also has international obligations under a range of Conventions including the United Nations *Convention on the Law of the Sea*, the *Convention for the Prevention of Pollution from Ships*, the London Dumping Convention, the Convention on Biological Diversity and many others. These affect how Australia designs and implements the ocean management arrangements. Further, the final outcomes of negotiations on the Kyoto Protocol may have ramifications for the relative cost and demand for fossil fuels, and as such, future oil and gas production and exploration investment in Bass Strait and elsewhere in the Region.

Australia's fisheries management arrangements have been steadily moving towards a greater reliance on 'output mechanisms' using Individual Transferable Quotas and Total Allowable Catches (TAC). TACs are based on what is thought to be the sustainable level of catch for a fishery, which in turn is dependent on the adequacy of our understanding of fish biology and ecosystem functions. New arrangements for assessing the sustainability of fisheries have been introduced under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). These may affect current management arrangements.

Arrangements for identifying and managing marine protected areas is likely to continue to be a key issue for established industries and for communities both bordering on and more distant to the Region.

Environmental change pressures

Throughout history environmental change has affected how humanity has both lived and utilised the natural world. For instance, El Niño events (a natural process driven by disruptions in the ocean-atmosphere system in the tropical Pacific) may mean increased rainfall in the Americas and droughts in Australia. This in turn can lead to increased fire risk and a change in the types of crops able to be planted. Changes in sea surface temperatures caused by the same event mean that the range of certain fish populations may increase or decrease.

Therefore, environment change pressure can be both positive and negative. For example, changes in ocean circulation may mean that fish aggregate closer to land thus reducing the cost and effort to catch them. Those same changes however, may drastically affect the reproductive success of certain species which may lead to a drop in species' numbers or localised or complete extinction.

Cross-cutting pressures

Commercial, recreational and Indigenous fishers may at times all target the same species. In addition to creating challenges for fish stock management, competition between fishing sectors has social and economic implications at the community level. Aquacultural production also impacts on commercial and recreational fisheries, especially in the case of the Southern Bluefin Tuna Fishery where the growing out of tuna in sea cages off Port Lincoln now accounts for 90% of the annual quota.

Developments in fishing technology may affect fisheries including reducing bycatch, decreasing the cost per unit of catch, increasing the catch capacity of fishers, and the development of new fisheries.

Native title claims, and future developments in interpreting native title law, may affect a range of uses and associated decision making processes, especially in coastal waters.

Commercial shipping, fishing boats, yachts and other recreational vessels all use the marine environment. Collisions between freighters and fishing boats and yachts are not uncommon.

Weather and our capacity to predict it affects most uses of the Region. The affect of global warming on weather patterns in the Region is unknown.

The long term affects of such activities as sea dumping are not known at present.

Conclusion

Users of the South-east Marine Region are subject to, and contribute to, a range of pressures. Some of these, including stormwater and agricultural run-off, fishing, and coastal development, can be greatly influenced by decisions taken by government and users themselves. Others are influenced only marginally, if at all, by government and user decisions. These include pressures flowing from the world economy, changes in lifestyle or changes in the world climate or long-term weather patterns.

As planning issues emerge during the next development stage of the South-east Regional Marine Plan, the range of pressures pertinent to them will be examined in detail.

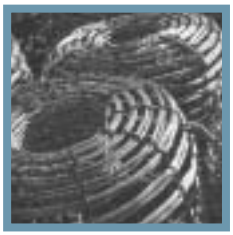
Future uses and opportunities

This chapter provides an overview of the potential future direction and opportunities for uses of the Region. It does not identify those areas or sites within the Region that may offer future prospectivity, production or conservation needs. Nor does it cover Indigenous people's future uses and aspirations, in particular, sea rights and commercial opportunities. These are covered in the report *Sea Country – an Indigenous perspective*.

All of the current uses within the South-east Marine Region occur because the Commonwealth and State Governments, acting on behalf of the community, have determined that these uses can exist in order to provide social or economic benefits to the Region. However, history shows that the government of the day may repeal the right to use ocean resources. For example, previous uses such as sealing and whaling, the dumping at sea of toxic chemicals and the dumping of rubbish from ships are no longer permitted.

It is important therefore to discuss future uses and opportunities in light of current government policies to determine whether expansion of any one particular use is encouraged or otherwise. It is also important to note that future uses and opportunities will, in some part, be influenced by the regional marine planning process and other management developments. The trends provided in this chapter cannot predict changes to policy – whether at the international, National, State or even local level – that may have an affect on future uses within the Region.

Growth in marine industries of 8% per annum has been recorded in recent years. The annual value of Australia's marine industries has been estimated at between $50 billion and $85 billion by the year 2020 – a major increase from the estimated $30 billion in the mid-1990s (DISR 1997). Although this growth is projected across the entire Australian marine area it is probable that a percentage of this growth will occur in the South-east Marine Region. It is also likely that this growth will occur across a broad spectrum of the uses in the Region, though the reasons behind that projected growth and the nature of the growth will be quite different.



Managing future uses

Australia's Oceans Policy is the principal overriding policy for the Commonwealth management of Australia's oceans. It sets the framework for the current and future multiple-use management of Australia's oceans.

One of the broad goals of *Australia's Oceans Policy* is "to promote ecologically sustainable economic development and job creation". The growth of such activities, however, is balanced by the need to ensure the sustainability of an activity and ecosystems and other activities impacted by that activity.

In seeking to provide the basis by which economic activity may be promoted, *Australia's Oceans Policy* states that through regional marine planning the Government will provide increased certainty, long-term security and new opportunities for economic growth that will reinforce industry progress within the sectors (EA 1998). The growth and development of marine related industries in a sustainable manner is encouraged and supported by the Commonwealth Government.

Alternative energies

Clean renewable resources are becoming increasingly attractive, mainly for environmental reasons but also because hydrocarbon resources are finite and may, at some stage in the future, become too valuable to be burned merely as fuel. The Commonwealth Government, through the National Greenhouse Strategy and other programs, supports research and development into the harnessing of renewable energy.

A number of marginal renewable energy resources are being exploited both around the world and within the South-east Marine Region. Most of the emerging energy establishments in the Region are either small or developmental. They aim to supply clean energy to small or mid-size townships around the coast. However, the likelihood is that as technology continues to improve one or more of tidal, wave or ocean thermal energy will develop into a cost effective and renewable energy source for many coastal communities. The most likely of these to develop further in the foreseeable future is wind energy.

Unlike wave and tidal power establishments, wind power in the Region is currently land based. In other parts of the world wind power technology has moved offshore, especially in Denmark and other northern European nations. For instance, according to The Danish Governments' Action Plan for Energy, *Energy 21*, 4000 MW of offshore wind power should be installed before 2030. With another 1500 MW installed onshore, Denmark will then be able to cover more than 50% of its total electricity consumption through wind energy (Danish Wind Industry Association 2001).

In April 2001 the British Government cleared the way for a £1.6 billion investment in offshore wind power – its first large scale attempt to capture offshore wind. The aim is for 540 wind turbine towers (sets of blades) in groups of 30 spinning more than 100 metres above the waves between 1.5 and 10 kms offshore, supplying 1% of Britain's energy needs by 2004-2005. According to the British Wind Energy Association, the wind blowing across the seas around Britain could supply the island's electricity needs three times over, and could easily be producing 10% of its needs by 2010 (Callus 2001).

These examples highlight that the technology for harvesting offshore wind power exists. The climatic conditions are probably favourable in many parts of the South-east Marine Region for this power source to be harvested, especially the west and south coasts of Tasmania. However, it may be many years before such large-scale offshore wind technology reaches Australia and the Region, especially as relatively affordable gas supplies to most of the Region are projected well into the future. Small-scale renewable energy projects though are likely to continue to be cost effective alternatives for isolated communities (eg King Island) or may be built to supply other remote areas reliant upon the expensive shipment of diesel fuel (including perhaps Macquarie Island).

There are also opportunities for the development of hydrogen as a major fuel source for the future. Currently, about 99% of the world's hydrogen is extracted from fossil fuels – most of this by treating natural gas with steam. In the long run, hydrogen will be derived from renewable energy through electrolysis-using electricity from the sun, wind, and other sources to split water into hydrogen and oxygen, thereby eliminating the use of fossil fuels altogether (Worldwatch Institute 2001).

Aquaculture

Australia's Oceans Policy identifies aquaculture as having great potential to develop further export markets for high value products and contribute to regional development opportunities (EA 1998).

Development work in the aquaculture of finfish, freshwater crayfish, mussels and algae is taking place in a number of areas around Australia. Research is continuing into the hatchery rearing of species such as abalone, scallops, giant clams, and flat and pearl oysters. Aquacultural ventures which are either investigating production methods or about to start small-scale production in the Region include flounder, seahorses, eels, striped trumpeter, southern rock lobster and black bream (TAFI 1999).

To date, aquaculture farms have been established primarily in sheltered bays and estuaries across the Region. To cater and plan for the development of aquaculture in these areas the State governments have moved to zone areas for aquaculture use, such as along the far south coast of South Australia. However, the scope for further development of aquaculture in these areas is finite due to the lack of suitable sites and resource use pressures. For example, the Environment Conservation Council in Victoria identified that increased access to marine waters has been difficult to obtain and this is perceived as a major impediment to further development of aquaculture in the marine environment (ECC 2000). Regardless, there is an already growing number of individual onshore aquaculture establishments, farming species such as abalone and even seahorses, in the Region.

Movement of aquaculture farms from estuaries to both onshore and offshore areas is being encouraged in the Region, in line with trends around the world. For instance, South Australia is considering the concept of onshore aquaculture industrial parks. Although still a concept, the parks would act as 'business incubators' allowing operators to move from small experimental operations to larger ones with greater ease and at lower cost (ABC 2001c).

Another example is Destiny Abalone off the west coast of South Australia, who are planning to grow up to three million green lip abalone on a six and a half thousand tonne vessel. The plan is to use the vessel to take the abalone into waters that are suitable to the venture. In particular, during summer when the water temperature increases the vessel can be moved offshore to cooler water to halt potential virus problems (ABC 2001d). With the continuing interest in aquaculture ventures in the Region, plus the issues associated with aquaculture related diseases, lack of suitable inshore sites and local eutrophication, the options to move farms offshore will be increasingly considered. For example, Tasmanian salmon farmers may look to Norway where the first floating salmon farming plant meant for deep sea usage was opened in February 2001 (Falch 2001).

Rock lobster

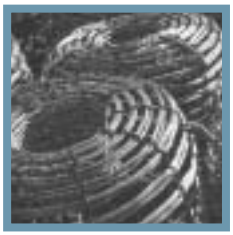
One development that may show potential for aquaculture farming is the southern rock lobster. There are two main methods currently being investigated – the ongrowing of wild caught juveniles and the growth of rock lobsters from the egg.

With the on-growing of juvenile lobsters, young lobsters are caught at sea in special collectors. They are then held in cages and are fed on a natural diet of fish and mussels. Recent studies indicate that juveniles have the potential to achieve weight gains of around 20% – representing a 60% return on investment.

Rock lobster can also potentially be raised to maturity from the egg. However, rock lobsters have a complicated lifecycle with 11 distinct morphological stages, and to date only small numbers have been successfully raised in Japan and New Zealand.

At present seven permits have been issued in Tasmania allowing rock lobster faming trials to go ahead.

Source: Van Barneveld 2000.



In addition, species such as snapper, yellowtail kingfish and striped trumpeter, which naturally occur in coastal waters, are being considered as potential aquaculture species and may be more suited to aquaculture farms offshore. This is already the case in NSW where the NSW Government recently approved a 30 hectare snapper farm at Port Stephens following a two year trial of the operation. The farm is located three kilometres (about 1.6 nautical miles) offshore and is expected to produce 500 tonnes of fish a year and create up to about 40 jobs (ABC 2001d).

On Flinders Island, Aquaculture Tasmania is presently gearing up to produce the world's first commercial scale round pearls from green lip abalone. Abalone, scallop and mussel farms are also seen as potential growth areas for the island (ABC 2001b). Adjoining the Region in the far west, an industry focus group has been formed to develop aquaculture on Kangaroo Island. Products being investigated include marron and abalone.

The growth in aquaculture, like most other resource-based industries is heavily dependent upon market access. A failure in the market, due to factors such as a major economic depression, increased tariffs or even health scares, could lead to a marked downturn in the industry. For instance, just over a year ago, shares in Norwegian salmon companies were regarded as precious, while today they are regarded as high risk, due to problems in selling the salmon on the European Union market above the minimum import price. Shares in these companies have dropped 87% in 12 months and billions of dollars have disappeared from the value of the companies involved (Engo 2001). There are also concerns over the implications of the current world glut of salmon on the local salmon aquaculture industry with export prices dropping by 20% (ABC 2002).

Biotechnology and other emerging industries

Marine biotechnology is currently thriving in Australia, which reflects the great diversity of organisms in Australasian waters and the large range of compounds present within those organisms. Within the Region the principal activity is the bioprospecting of chemicals from marine biota. The Commonwealth Government's *Australian Biotechnology 2000: A National Strategy* supports the biotechnology sector. The Strategy seeks to encourage advancements in biotechnology research and development that contribute building internationally competitive and environmentally sustainable agriculture and food sectors. Although bioprospecting within the Region is likely to increase due to its relatively high level of endemism, the nature of the industry dictates that the overall extraction of resources from the Region will be relatively minor and strictly controlled.

Other emerging industries include plans around the world to rein in global warming by either physically depositing carbon dioxide into the ocean or by enhancing the ocean's ability to absorb carbon dioxide. For instance, there has been recent international research into fertilising the ocean with iron salts to enhance phytoplankton growth, which will then absorb carbon dioxide from the atmosphere. It is reported that carbon dioxide can be removed by this process for about $2 a tonne compared to $30-$100 per tonne currently paid by industry (Knapp 2001).

Commercial fishing

Unlike petroleum, there is no controlled release of potential fisheries areas in the South-east Marine Region. Current fisheries management boundaries in the Region generally extend across areas far greater than the current areas of effort as shown in the BRS Atlas of the Region. Commercial fishermen can generally operate in any of the waters covered by the fishery in which they have a right. There may however be areas of exclusion such as near petroleum platforms or in marine protected areas.

The Australian Fisheries Management Authority (AFMA) has released a policy entitled *Exploration of (New) Fish Resources* (AFMA 1999). This policy outlines the process commercial fishers must follow should they wish to explore new areas where there is no current fishery. The policy lists several factors that must to be taken into account in granting limited access to those new resources. It does not, however, address the issue of exploratory fishing within the boundaries of an existing fishery.

When considering the future potential and opportunities of commercial fishing within the Region, a number of issues that could be considered include:

- status and extent of the resource being targeted (eg is the resource large enough to be commercially viable to target and how will it respond to fishing pressure?)
- impact of the harvest on the ecosystem (eg could the harvest have an unacceptable impact upon threatened species or the habitat?)
- location of the resource from fishing ports (eg is it too far away for either vessels to physically get to or to make it not cost effective targeting?)
- ability of the resource to be taken (eg is it too deep, too thinly spaced or is there gear currently available that is able to extract the resource?)
- willingness of fishermen to catch the resource (eg is catching the resource worth the effort or is it not cost effective given the water depth or the weather conditions in the time of year that the resource is available?)
- market for the resource (eg once caught can the resource be sold at a price and volume to warrant catching more?)
- government(s) regulations in place (eg is the resource allowed to be taken and is the gear proposed allowed to be used?).

In many cases a combination of these issues are relevant.

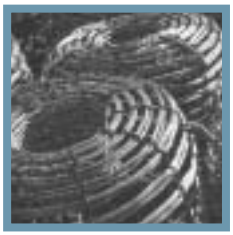
The future of many commercial fisheries in the Region and, indeed around the world, is highly dependent on ensuring the sustainable harvest of those fisheries from all sectors. AFMA, in its *Strategic Research Plan* notes the complexity of ensuring that a harvest is sustainable:

> In attempting to ensure the sustainable harvest, the catches and operations of commercial and recreational fishers are but one factor influencing fish stocks; other important factors include the biology of the fish, crucial environmental conditions (such as rainfall, water temperatures, currents and nutrients), predator-prey relationships, the dynamics of the food chain, natural mortality and the effects of habitat destruction and land-based pollution. Many of these influences, particularly environmental influences, may change without warning and are difficult to predict or measure (AFMA 1999).

The list of issues is therefore both extensive and made even more challenging by the fact that fisheries resources, unlike sheep or cattle, at best can only be estimated. There is always doubt over the exact status and extent of any resource. The challenges are multiplied when the ecological effects of harvesting a resource must also be taken into account.

This is illustrated in the most recent status report of Commonwealth fisheries undertaken by the Bureau of Rural Sciences (BRS 2002). BRS found that 11 target species in Commonwealth fisheries were classified as overfished, 11 as fully fished and a further 35 classified as 'uncertain', despite the highly regulated and generally regarded best-managed fisheries in the world. The overfished species include many in the South-east Marine Region such as blue warehou (*Seriolella brama*), eastern gemfish (*Rexea solandri*), orange roughy (*Hoplostethus atlanticus*) [in the western, southern and eastern management zones of the South East Trawl Fishery], redfish (*Centroberyx affinis*), southern bluefin tuna (*Thunnus maccoyii*) and school shark (*Galeorhinus galeus*).

Fully fished species within the Region include blue grenadier (*Macruronus novaezelandiae*) and flathead (*Neoplatycephalus* and *Platycepalus* spp.), with other species being locally fully fished in parts of the Region. The major State commercial species – green-lip abalone (*Haliotis laevigata*), black-lip abalone (*Haliotis rubra*) and southern rock lobster (*Jasus edwardsii*) – also appear to have little room for expansion above current catch levels.



The future opportunities for the increased targeting of these species would appear very limited, at least in the near future. Most are on long term recovery plans with relatively low total allowable catches (TACs) in order to assist the recovery.

As most of the major commercial fish species in the Region are at least 'fully fished' there are only minor chances of expanding without the discovery of new populations of these species, especially if a species is restricted to habitats on the continental shelf. There may be a chance of discovering new populations for some of the deep-water species as additional research and mapping of the Region continues. In some cases, the discovery of a new population may just result in the enhancement of the recovery program in place to restore the stock across the Region. At best there may be a limited extension in the areas currently fished in the South East Trawl Fishery into a few new deep water areas where newly discovered underwater features (such as seamounts) create a productive environment.

It is unlikely in most cases, however, that a fishery will extend to cover additional grounds. This may be due to numerous factors including that:

- species may be so sparse at the limits of its range that it is not commercially feasible to target it
- gear employed to target a species may not be feasible in certain depths or environments (eg trawl over reef areas)
- species may not be catchable in all parts of its range (eg in certain parts of its range it may only exist in a juvenile stage making it unmarketable or be subject to catch restrictions such as size limits).

On the other hand, a fishery may expand to cover more grounds when the market price for a species increases to the extent where additional effort is warranted or where modifications in gear allows access to new areas.

Notwithstanding the above, major opportunities for growth in fisheries production are generally seen to be the rapidly developing aquaculture sector, value-adding of lower-value species and making better use of bycatch.

As most of the major Commonwealth and State fisheries are managed under a system of output controls, catches are strictly controlled and cannot legally exceed set limits, unless approved by the regulating authority (see section *Overview of Uses – Commercial fisheries)*. The level of the TAC therefore plays a significant role in determining the future level and spread of effort in a fishery. Setting a low TAC will normally result in a low level of effort in the fishery and may also result in concentrating effort in areas of proven catches, areas close by home ports or into shorter periods of the year (eg spawning periods where species congregate).

Virtually all State and Commonwealth commercial fisheries are also managed under limited entry restrictions, either on their own or in combination with output controls. The most basic input control is limited entry. This means that no additional licences or permits are issued for any fishery and so any extension of effort will be from entitlement holders in a fishery. This is clearly illustrated in the Region with the South East Trawl and South East Non-trawl Fisheries. In combination, under current management arrangements, these fisheries effectively cover the taking of all species by all methods in Commonwealth waters of the South-east Marine Region, except where species have previously been identified as part of another fishery or are under State jurisdiction through an Offshore Constitutional Settlement (OCS) arrangement.

There have been recent instances in the Region where a fishery has expanded to species that were previously taken only as a bycatch and, as a result of this expansion, a new fishery has been declared to specifically manage the take of that species. For instance, giant crabs (*Pseudocarcinus gigas)* were previously a bycatch of the southern rock lobster fishery. A sector of the southern rock lobster fleet began targeting giant crabs in the Region. A fishery based on targeting giant crabs now exists and new licences have been granted by State Governments off their respective States. These licences generally came from southern rock lobster licence holders who diversified into the fishery. Another example is the taking of blue warehou *(Seriolella brama)* by gillnets. This species was initially a bycatch when targeting school and gummy shark but increased targeting of this species led to the species now being managed as part of the South East Non-trawl Fishery.
The fishing of blue warehou in the South-east Marine Region is covered in the next chapter.

An example of a species which may develop into a new fishery in the South-east Marine Region in the foreseeable future is Rays bream *(Brama brama)*. The Eastern Tuna and Billfish Fishery off eastern Australia, which covers all pelagic species under Commonwealth jurisdiction, excluding southern bluefin tuna, is managed under input controls. The gear used to target Rays bream is relatively different in configuration to that currently used in the fishery, making specific management arrangements, and potentially a new fishery, for that species a possibility.

Existing Australian longline fisheries are tightly regulated. Any new fishery developed must minimise interactions between established fisheries, the bycatch of target species, and to have the gear substantively different from the pelagic longline method used by the Eastern Tuna and Billfish Fishery, which is managed under input (gear) controls.

Rays bream

This species was a significant bycatch of Japanese longline operations off southern and eastern Tasmania when targeting southern bluefin tuna, though the Japanese generally discarded Rays bream. Only small amounts have been traditionally taken by domestic fishermen.

Rays bream is tragetted off Spain by fishermen using longlines with about to 10-12000 hooks, and catches of 350-550 fish per 1000 hooks were obtained (Last & Baron 1994). Rays bream, like other Pomfrets, have high quality white flesh, and if landed in quantity, handled properly and with proper marketing, could form the basis of a valuable new Australian fishery.

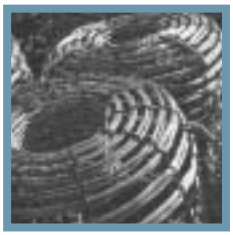
Comparatively little is known of the species abundance and distribution within Australian waters. Australian observers placed on the Japanese tuna longliners report that Rays bream appear to be associated with the 11°C - 13°C surface water temperatures.

The Australian Maritime College, through funding by the FRDC, recently completed a study to improve targeting of Rays bream. The study examined basic gear arrangements, hook sizes, baits and fishing depth needed to further management and commercial development. Ten commercial fishermen were provided with trial 2.5 km, 1000 hook test longline systems which were to be used on a voluntary basis. Only one trial set was completed with inconclusive results achieved. In the end the industry trial failed due to the high cost and risk of undertaking any long-term fishing trials.

It is also feasible that the targeting of southern bluefin tuna off southern and eastern Tasmania by Japanese longline vessels, and for a short period of time domestic longeline vessels, may return. With the exclusion of Japanese fishing vessels from Australian waters in the mid-1990s and the move by Australian fishers to the farming of southern bluefin tuna in Port Lincoln, pelagic longlining for southern bluefin tuna in the Region has virtually ceased. Hypothetically speaking, pelagic longlining for southern bluefin tuna could return to the waters of the Region if a long-term recovery plan for the species was successful or the Australian Government allowed Japanese longline effort back in its waters. This could be further enhanced if artificial spawning and raising of the species also proves successful.

Other fisheries, such as the State and Commonwealth squid and mackerel species (Jack mackerel, blue mackerel etc) have the potential to expand with value adding of the landed catch. Though varying attempts have been made in the past with little success, other opportunities may arise. For example, a recent report notes that Japanese food scientists are developing a way to use squid to make pizza bases (Ananova 2001). If squid pizza crusts became popular in Japan or even Australia, the demand for squid may increase to the point where there is greater effort dedicated to the Southern Squid Fishery.

The nature of fisheries management is changing to more fully address ecologically sustainable management, a prerequisite to attain ecologically sustainable development (ESD) objectives. All Commonwealth fisheries and State fisheries with an export component are now required to be assessed by Environment Australia under its Guidelines for the Ecologically Sustainable Management of Fisheries. These guidelines were based upon similar criteria developed by The



Marine Stewardship Council (MSC) for the assessment of the ecological sustainability of fisheries. Fisheries accredited by the MSC benefit by market promotion of the sustainable nature of the fishery.

AFMA has recently initiated a more integrated and ecosystem-based approach for the major southern fisheries under its jurisdiction. AFMA is currently reviewing management arrangements off southern Australia (called the Southern Region by AFMA) to identify management options to better pursue its legislative objectives in the future. AFMA is proposing that a management plan covering all demersal and mid-water trawl fisheries in southern Australia is the most appropriate way to ensure that ecologically sustainable development is pursued. This plan will provide a single set of management objectives, strategies and performance indicators across all four fisheries:

- South East Trawl Fishery
- South East Non-trawl Fishery
- Southern Shark Fishery
- Great Australian Bight Trawl Fishery.

The main features of this option for future management include:

- the existing management arrangements for each fishery are to be 'rolled' into a single plan of management
- reporting will cover all waters, all methods and species, and will take account of the cumulative impacts of the fisheries on fish stocks and the marine environment
- secure access rights, in the form of boat and quota rights, will be granted to all sectors.

Issues to be resolved include costs, avoidance of cross-sectoral subsidisation of levies and complementary management arrangements for the Victorian Inshore Trawl Sector of the South East Trawl Fishery.

The plan should lead to long-term sustainability of the resources and security for the commercial fishing industry in the South-east Marine Region.

Whether this initiative extends to other Commonwealth fisheries or to State fisheries within the Region is not yet known.

Conservation

The Commonwealth Government is committed to the establishment of the National Representative System of Marine Protected Areas (NRSMPA). This was reaffirmed in *Australia's Oceans Policy* which also commits the Government to accelerate the development of the NRSMPA both for conservation purposes and to give regional security through industry access to ocean resources (EA 1998). A better understanding of the marine ecosystem is necessary to identify areas that could be considered for representative marine protected areas under the NRSMPA. This identification process is being assisted by a national bioregionalisation of Australia's oceans. The interim bioregionalisation for the South-east Marine Region is the first step towards a national bioregionalisation (see the report *Ecosystems – nature's diversity*). The National Oceans Office, in cooperation with other Government and research agencies is undertaking this body of work.

State Governments have also endorsed the NRSMPA as an important tool in the conservation of regional marine resources. These Governments are contributing to the NRSMPA within the Region through the assessment of candidate sites for marine protected areas, management of existing marine parks and other marine reserves, and proposals for additional marine protected areas (MPAs).

Australia has moved into a new era of environmental management with the coming into force of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) on 16 July 2000. The Act requires all Commonwealth fisheries to be strategically assessed as ecologically sustainable under the EPBC Act by July 2005. This assessment is based on the new Guidelines for the Ecologically Sustainable Management of Fisheries. These Guidelines are also the basis for the assessment of Commonwealth and State fisheries seeking export permits under the *Wildlife Protection (Regulation of Exports and Imports) Act 1982* (Cth). These Guidelines have set a new higher benchmark for the ecological management of commercial fisheries.

The Act also requires other activities started after the Act came in to force to be assessed. The assessment determines whether activities will affect matters of national environmental significance, including Commonwealth marine areas, Ramsar wetlands and threatened species and ecological communities. Environment Australia completes the assessments. For example, new petroleum exploration and production activities that began after the introduction of the EPBC Act come under the auspices of the Act.

As more information becomes available about the marine environment and the species that it supports, it is likely that more species and ecological communities will be identified as needing specific conservation measures to be set up by State and / or Commonwealth Governments. More marine species in the Region may be subject to recovery plans or specific management measures under either environmental or resource management legislation. These requirements may temper some activities which may otherwise have exerted undue pressure on the sustainability of species.

Defence and surveillance

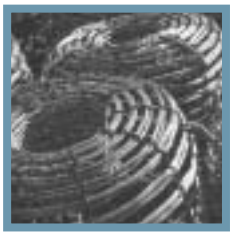
Australia's naval force is experiencing rapid changes in technologies as a result of a number of well-established international trends:

- the proliferation of high-capability anti-ship missiles such as Harpoon, Exocet and their Russian equivalents. The number of types of platform that can launch these missiles has also increased to include not just ships but submarines and several types of aircraft. Supersonic anti-ship missiles are expected to enter service in several countries in the Asia-Pacific Region over this period and the capability to target ships at long range will improve (DoD 2000)
- the expansion of submarine capability in the Asia-Pacific Region, including Australia's Collins class submarines, and the improvement in the strike capabilities with the introduction of more capable aircraft. These new aircraft are, in some cases, supported by air-to-air refuelling, and are able to be fitted with longer-range, stand-off weapons (DoD 2000)
- Coastwatch is investigating new and emerging technologies that may be used to provide high level service to clients. Coastwatch has a clear mandate to investigate new and alternative forms of technology that would prove more effective. For instance, trials of commercial satellite information gathering have been conducted, although the cost remains prohibitive. Unmanned aerial vehicles may prove to be a cost effective alternative for some of the unmanned aircraft tasks. High frequency surface wave radar is also being investigated for its promise to provide continual long-range / wide-area tracking of vessels. Many other forms of technology remain under consideration.

As these new technologies are introduced there is also a need for training exercises. As such, the continued need for exercise, including formal exercise areas in the Region, will probably continue.

Naval infrastructure developments in the South-east Marine Region over the coming few years have been identified in the Navy Green Book. There are currently two developments proposed:

- **naval ammunitioning facilities, Eden $40m:** construction of an explosive ordnance licensed wharf to provide for navy ammunitioning activities in close proximity to the Sydney Fleet Base and east Australian exercise area – the scope of work includes a wharf capable of berthing *HMAS Success* and a separate temporary storage/transit depot (DoD 2001)
- **Aeronautical and Marine Research Laboratory, Fishermen's Bend, Vic, $54m:** construct facilities at Fishermen's Bend to facilitate relocation from existing site at Maribyrnong – the scope of work includes working accommodation and research/testing facilities depot (DoD 2001).



The South-east Marine Region should at least maintain its level of defence force activity into the next few years because of current world tensions and the need to protect Australian interests such as shipping, petroleum infrastructure and coastal developments, and defence forces duties associated with search and rescue and surveillance.

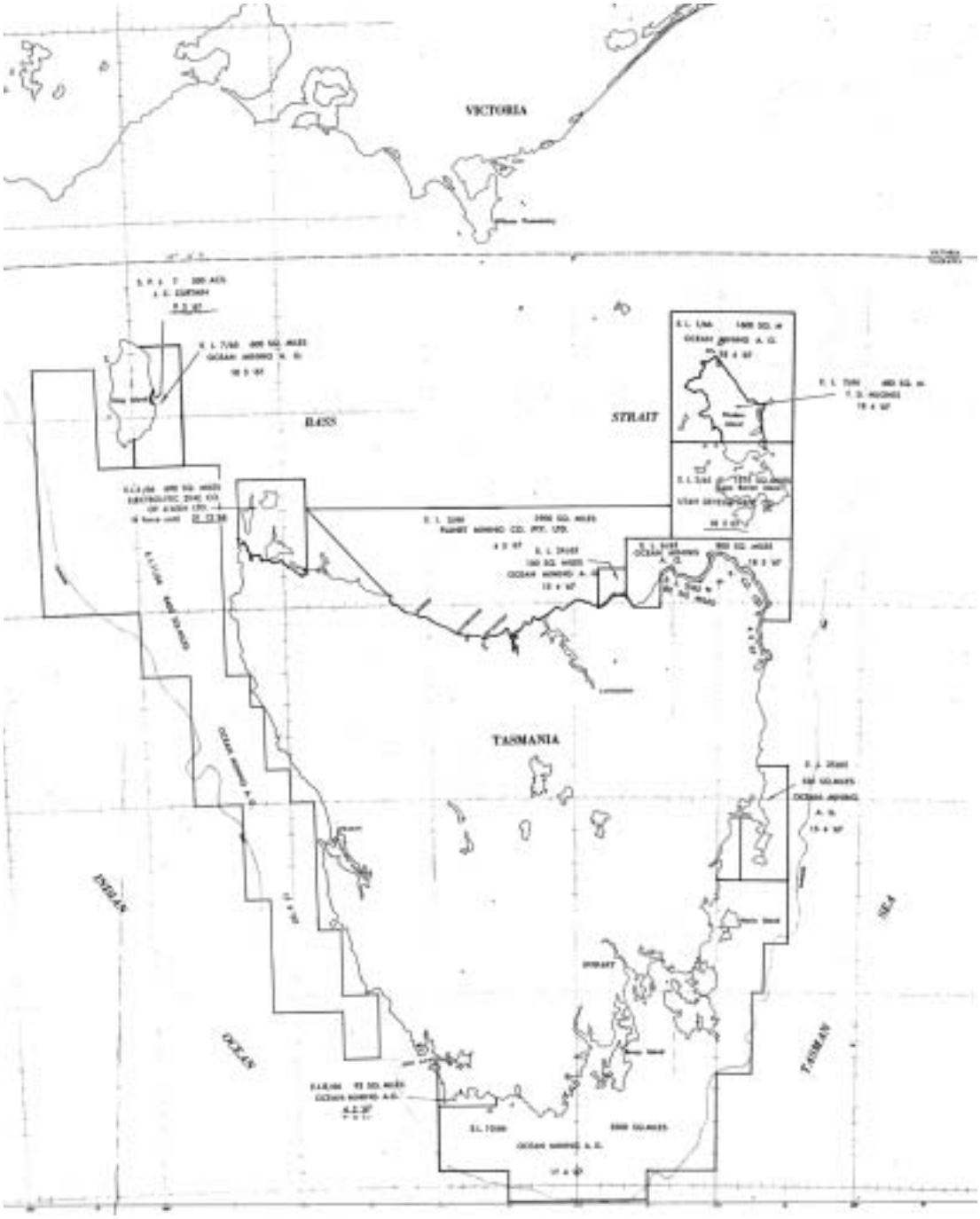
The current national surveillance issues – those of illegal immigrants and illegal drugs and quarantine – have not been and are unlikely to be, major issues for the South-east Marine Region. Such activity is more likely to continue as a major issue off northern Australia. However, the predicted increase in shipping activity and volumes of cargo will pose its own onshore surveillance issues and create greater threats for illegal drugs and increase the requirements for the monitoring of pollution from ships. Illegal fishing is also likely to at least be a potential issue along the outer edges of the Region until effective high seas management and real-time monitoring of flag-of-convenience vessels is in place.

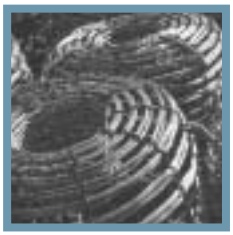
Surveillance requirements, both formal (through Coastwatch and the Navy) and informal (from commercial fishing vessels and merchant ships) will continue to be required, though it is unlikely that a marked increase in surveillance activity will be needed across the Region. This may change, though, if international tensions increase or if the price of a species increases dramatically, leading to increased incentives for illegal fishing both from domestic and foreign vessels.

Minerals

Mineral industry interests in the Region are mainly concerned with the long term future potential of commercial mineral deposits (Stoddart 2000). Current mineral exploration in the Region is limited to one exploration lease for cassiterite (tin) in Ringarooma Bay off northeast Tasmania and, as yet, the long term production potential of this lease appears unproven. However, there has been interest shown and exploration leases granted in the past, reaching their hey-day in the 1960's. They ranged from placer deposits of zircon, ilmenite, monazite and titanium off King Island, tin in Great Oyster Bay off the east coast of Tasmania, and phosphate nodules off western and southern Tasmania (Map 25). There was also recent interest in offshore diamond mining off Kangaroo Island, although exploration leases were never taken up due to other terrestrial interests.

Map 25:
Offshore minerals licence areas off Tasmania 1966. *Source: Mineral Resources Tasmania.*





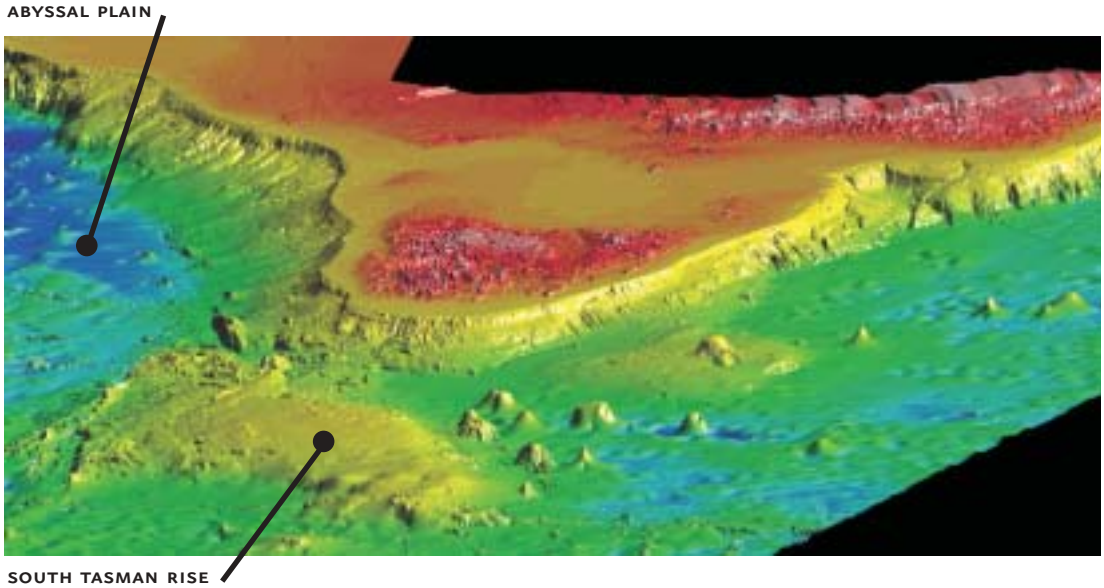
Although these leases never reached the stage of production they indicate where future opportunities may lie given improved market conditions in the future. Geoscience Australia also speculates that there may be potential for gold and perhaps heavy mineral sands off southern New South Wales (Hill et al. 2001).

The main deep-sea mineral deposits that may be of long-term commercial mining interest appear to be the metal-rich ferromanganese crusts and nodules. The main metals of economic interest in such deposits are cobalt, copper and nickel. Manganese nodule fields are common on the abyssal plains off Tasmania and the South Tasman Rise, and also found to occur in deep water near the South Tasman Rise (shallowest recovery was 2400 m). Though apparently abundant, the nodules from both the South Tasman Rise and adjacent abyssal areas are of low metal grade (averaging 0.14% Copper, 0.26% Nickel, 0.20% Cobalt) and are presently not of economic interest (Hill et al. 2001). Figure 15 shows the abyssal plains of the South-east Marine Region.

The continuing downward trend in world metal prices is one reason why manganese nodules (and particularly the cobalt, copper and nickel in them) have not been commercially exploited. There is no reason to believe that there will be any marked increase in metal prices in the foreseeable future, in part because mining companies have been so successful in finding and exploiting large low-grade onshore deposits (Cook & Taylor 1997).

However, crusts located within 1500-2000 m water depth average higher cobalt contents (0.79%). This is comparable with those high-grade crusts from the Marshall Islands, indicating that these shallow-water crusts may have long-term economic potential. But the shallow-water crusts so far sampled by Geoscience Australia cruises (*L'Atalante and Rig Seismic*) are only

Figure 15:
Abyssal plain of the South-east Marine Region. *Source: Hill et al. 2001.*



2-4 cm thick – approximately the cut-off grade for economic potential (Exon 1997). There is the possibility, however, that thicker crusts of similar higher grade exist in nearby areas within the Region. Exon (1997), for example, recommends that further prospecting for cobalt-rich crusts should concentrate on outcrops in water depths of 1000-2000 m on the eastern South Tasman Rise and southern Tasmanian margin (Hill et al. 2001).

Mining these resources is difficult and expensive. The technology required is in its infancy and despite research by some of the world's most wealthy nations (USA, Japan and Germany) has not progressed beyond development.

It is possible, though, that individual companies will continue to show an interest in exploring the mineral potential of the Region and further exploration leases will therefore be granted to allow this to occur. There appears to be many possibilities open for mineral exploration across a wide range of areas and resources in the Region. However, unlike the controlled exploration lease program for petroleum where areas are planned in advance and put out to bidding, the location of the future mineral exploration leases is likely to be less planned and will probably be highly dependent upon the interests and expertise of the individual companies and the changing world demand for mineral resources.

Environmental concerns will continue to have a considerable impact on the future course and scale of offshore mining activity, particularly in options on what is considered an acceptable activity. However, there are other socio-economic factors to consider, particularly the projected rise in world population and the overall rise in living standards. Either of these trends will inevitably result in greater mineral resource use that is unlikely to be balanced by increased recycling or material substitution. In the case of phosphate, one of the major food minerals, there is no scope for recycling of phosphatic fertiliser or for substitution (Cook & Taylor 1997).

Ocean disposal

Ocean disposal will continue in the Region in line with international agreements and the *Environment Protection (Sea Dumping) Act 1981* (Cth). Unlike the past, however, current ocean disposal is highly regulated, especially with respect to potential environmental impacts. Most approvals granted are now largely for the disposal of dredge spoil or the construction of artificial reefs. Such events are likely to remain in the majority in the next few years, though rare events may occur, like the controlled sinking of stricken ships such as the *Iron Baron* off eastern Flinders Island. The demand for the dumping of dredge spoil may even increase with the pressures on ports to cater for larger vessels and the growing number of recreational boats seeking continued and safe access to the ocean.

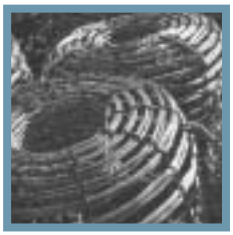
The interest in the construction of artificial reefs for recreational fishing, diving and even surfing will most likely continue. For example, in Tasmania an ex-navy vessel is being sunk to enhance recreational diving and an artificial sandbar is being built near Hobart to increase surfing opportunities in the area.

Despite the support for these types of disposal, they are coming under increasing environmental scrutiny with respect to their impacts on the ecosystem.

Petroleum

The question of whether or not an offshore petroleum or mineral deposit can be commercially exploited is subject to a range of issues including location (distance from shore/port, depth etc), grade, price, environmental impact, extraction technology and Government policy. To date petroleum accumulations have been exploited in the offshore Gippsland Basin in eastern Bass Strait. But new Bass Strait discoveries to the west in the offshore Otway Basin, and an earlier find off Tasmania, are expected to add to gas supply competition in the eastern States' markets in the near future.

Unlike fisheries, petroleum and mineral resources are not renewable. All petroleum wells and mineral deposits have a definitive lifespan and are being depleted from the first moment of production. For trends of production over the last two decades see Figure 13 (p.104). Depending on the size of the reserve or deposit, the lifespan can be for many decades or more. However the amount of proven commercial resource can be maintained and even expanded through the release of new exploration acreage; innovation in



exploration and exploitation technologies; and reductions in cost of and increases in prices for resources. Accordingly, petroleum and mineral industries can operate sustainably.

There are 22 petroleum production facilities currently operating in Bass Strait, all of which are in the Gippsland Basin. The earliest forecasted end date for any of these wells is 2012 for Whiting, with most having at least a further 20 year lifespan.

Exploration

There is also significant exploration activity in the Gippsland Basin and new reserves continue to be found, such as those at West Tuna, which began operating in 1997, Blackback in 1999 and the Patricia Baleen gas field under development and due to deliver its first gas in September 2002 (Rigzone 2002). Given the presence of commercial oil and gas fields, there is expected to be continuing interest from the petroleum industry in new exploration acreage releases in the area. As a result of acreage releases in 1999 and 2000, four new exploration permits have been awarded in the offshore Gippsland Basin since May 2000. The work programs in these permits include seismic surveying and the drilling of exploration wells with total indicative expenditure over the six year permit terms of more than $A158 m.

There is also strong interest in exploration in the Otway Basin. Although there has been exploration activity in the area for more than 30 years, interest has been heightened by recent major discoveries including the successful Geographe-1 and Thylacine-1 wells drilled by Woodside and Origin Energy. There are also other exploration permits in the area with seismic and well commitments (eg StrikeOil NL, Origin Energy and Woodside Petroleum). Further releases of acreage are planned.

Exploration activity is also continuing in permit areas in the Bass and Sorell Basins. A permit held over the Strahan Sub-basin off west Tasmania, includes the locality of the Cape Sorell-I well, which had oil shows. In addition, acreage is currently available for bidding by potential explorers in the Sorell Basin. Further releases in the Bass Basin are likely in the near future. For an overview of current lease areas see Map 16 (p.102), in the *Oil and Gas* section of this report.

In addition, the Commonwealth Government's Regional Minerals Program has allocated over $4 million to studies that will add to the geological knowledge of the Sorell Basin, off northwest Tasmania. This includes work such as sequence stratigraphic and biostratigraphic reviews of the Bass Basin to enhance the petroleum prospectivity of sedimentary basins in Bass Strait and off the west coast (DISR 2001). As such, the Sorell Basin is clearly seen by both Government and industry as a prospective future petroleum production area.

The exploration for both petroleum and minerals, and as such new discoveries, can only occur within exploration permit areas. So further discoveries will only take place within the areas of current permits, plus other areas opened up for bidding in the acreage release program. The Australian Offshore Petroleum Strategy, released in April 1999, provides the framework for the efficient exploration of Australia's continental shelf over a 5-10 year timeframe. The Strategy aims to create more certainty in the acreage release process and give industry more lead-time in considering areas for future release. In determining the acreage release program the following factors are considered:

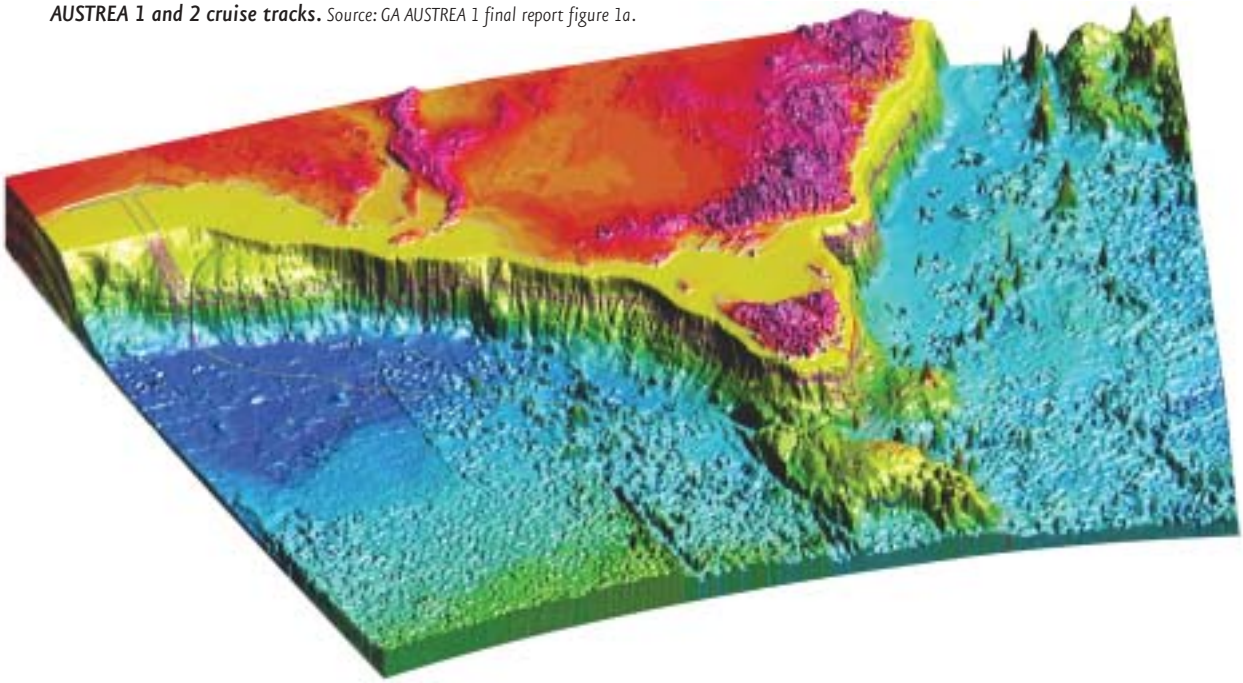
- a regular release pattern of one release a year, each with two closing dates (so areas will be available for consideration by explorers for either approximately six or 11 months)
- nomination of areas up to 18 months in advance of release to enable companies to plan ahead, form study groups, and to encourage pre-release commercial studies, seismic surveying and data reprocessing
- each release will include a broad selection of mature, sub-mature, immature and frontier areas available for exploration to meet the diversity of corporate exploration strategies
- areas released will include blocks in which companies have expressed an interest or carried out non-exclusive surveying
- areas are subject to environmental assessment before being released and permits awarded, and conditions may be imposed.

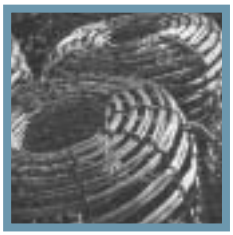
Exploration for petroleum will continue in the Region due to its proven and prospective resources and its proximity to markets in the eastern States, making it ideally located to supply oil and gas from any new discoveries. Much of the Region is still under-explored and its potential for further petroleum discoveries is relatively unknown at this time. There may also be considerable additional petroleum in accumulations that would – if discovered – be regarded as uneconomic to produce using existing technology (DISR 2001).

What exploration has been undertaken in the deeper water areas of the Region has been undertaken by Geoscience Australia [formerly the Australian Geological Survey Organisation (AGSO)]. Between December 1999 and February 2000, AGSO completed two major seabed swath-mapping and geophysical surveys (AUSTREA-1 and AUSTREA-2) off southeast Australia and on the Macquarie Ridge for the National Oceans Office and Environment Australia. Together, these surveys swath-mapped about 260 000 km of seabed and collected about 21 000 km of geophysical profile data, including 15 000 km of reflection seismic data.

The AUSTREA seismic lines crossed a number of poorly explored parts of the Tasmanian margin (Figure 16). The profiles provided new data and confirmed the presence of significant sediment thickness (greater than 1.5km). As such at least some petroleum potential has been identified in the Port Davey and Sandy Cape Sub-basins of the Sorell Basin, and also off southern Tasmania, east Tasmania (rift basin off Freycinet peninsula) and north-east of Cape Barren Island (Hill et al. 2001).

Figure 16:
AUSTREA 1 and 2 cruise tracks. *Source: GA AUSTREA 1 final report figure 1a.*





Parts of the claimable continental shelf beyond the Exclusive Economic Zone may also have significant potential for petroleum exploration. For instance, the AUSTREA 1 survey found that the South Tasman Rise contains deep wrench basins with up to 6 km of sedimentary section, but they lie in deep water on the flanks of this continental block, and so their productivity is reduced. Potential gas hydrates were also identified on and adjacent to the South Tasman Rise. Bottom-simulating reflectors have been identified in seismic profiles within small sedimentary basins on the South Tasman Rise and also beneath the L'Atalante Depression. They suggest the presence of considerable volumes of free methane gas and methane in the form of crystalline hydrates. Though no economic way of extracting the methane from such deposits has yet to be devised, they nevertheless represent a potential resource, though very long term at present (Hill et al. 2001).

The Australian Offshore Petroleum Strategy (DISR 1999) states that from 2001 there will be increasing emphasis on deep water areas and it is anticipated that the gazettal of frontier or remote frontier areas with petroleum potential will include the South Tasman Rise between 2001-2005. Research and exploration is extending and will continue to extend into deeper waters of the South-east Marine Region. This is also the case for production where, for instance, in 1999 sub-sea production began from the Blackback field in about 400 m of water. This compares to the next deepest well at Flounder of 93 m. Globally, petroleum production technology has advanced to the point where production in waters of 1500 m depth is considered achievable, with even deeper production in the near future.

Deep, ultradeep and frontier

Some claim that what the petroleum industry was calling deep water three years ago – about 450 m – should no longer be treated as such, since it is fairly standard for an oil company with today's field development technology at its fingertips.

So logically, what was being called ultradeep just three years ago – 900 m – is also now much less intimidating. The number of projects globally producing at these ultradeep depths is growing fast as confidence and reliability of floating production and related subsea techniques continues to grow.

As a result, industry now see 1500 m as the new ultradeep mark. Most industry-standard production equipment is generally designed for use up to this depth already, although anything deeper is still considered frontier design territory. Few doubt, however, that even 2500 m of water will be possible for production purposes within the next five years, if not sooner.

Source: Thomas 2000.

Infrastructure

As more wells are brought into production, particularly in the shallower waters of Bass Strait and in the Otway Basin there will be a corresponding increase in the number of pipelines to transport the oil or gas brought to the surface. Whether a pipeline is used will depend on whether the product is oil or gas, the depth and nature of the seabed and an assessment of the economic feasibility and environmental impacts of constructing a pipeline. In addition, further pipelines are possible from current facilities. For instance, BHP has recently received approval to build a fourth Bass Strait gas pipeline from the company's Bream oilfield to its Longford production facility in Gippsland. Construction of the 46 km pipeline began in December 2001 and is expected to cost $200 million (ABC 2001a).

The main new pipeline being constructed in the Region is the Duke Energy gas pipeline across Bass Strait – construction commenced in December 2001. The Tasmanian (Duke Energy) Natural Gas Project will bring

Gippsland Basin natural gas from Victoria to Tasmania via a subsea pipeline, develop onshore gas supply pipelines and undertake the conversion of Bell Bay Power Station to take natural gas as feedstock. The project has a design life of 40 years with gas flowing from July 2002. For details on the Duke Energy pipeline route see insert to Map 15 (p.100) in the section *Oil and Gas*.

Recreational fishing

Recreational fishing is about being with friends, relaxing, 'getting away from it all', appreciating the natural environment and catching a feed of fish. This has been the case for generations and will almost certainly continue for many generations to come if fish stocks and the environment that supports those stocks are effectively managed.

Unlike the past, recreational fishing is becoming increasingly managed to increase the chances of everybody catching a fish, to minimise the environmental disturbance from fishing and to maintain fish stocks. Increasingly, the overall catch of some species by the recreational and commercial sectors is becoming unsustainable as commercial fishing becomes more effective at targeting stocks and the number and effectiveness of recreational anglers increase. Species such as blue warehou, southern rock lobster and abalone are under increasing pressure from all sectors with overall catch limits sometimes applied to only part of the commercial sector. The challenge for governments is to limit the recreational sector's overall take of such species to ensure the long term sustainability of the species while still providing the recreational experience. As the numbers of recreational fishers increases with the overall population increase, increased leisure time and the move to coastal areas, the pressure from this sector on some species will continue to increase. This will see management changes such as lower bag limits, increased minimum sizes and further gear restrictions to restrain overall catches.

As new boats and fishing technology improve the range of recreational fishing opportunities, so new species are becoming targets for recreational fishers. The productive upper continental slope and offshore reef waters in the Region, long targeted by commercial fishermen are becoming favoured offshore recreational fishing grounds for species such as blue-eye trevalla and snapper.

As Australia becomes increasingly multicultural it is possible that the range of species targeted by recreational fishers may change as families seek to catch their own fish previously supplied by the commercial sector. Some species that this could have applied to, such as seahorses and sea-dragons and pipefish, cannot be taken.

Currently an estimated 30 000 interstate and international visitors do some sea fishing off Tasmania each year. With the general increase in tourism expected well into the future the numbers of tourists undertaking recreational fishing is likely to increase across the Region. These visitors will also most likely continue to use offshore charter industry services for their recreational fishing experience.

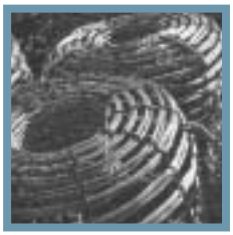
Research and education

The Commonwealth's direction for marine science in Australia is set out in *Australia's Marine Science and Technology Plan 1999* (DISR 1999a). The Plan reflects three major, long-term priorities for marine science, technology and engineering:

- understanding the marine environment
- using and caring for the marine environment
- infrastructure for understanding and utilising the marine environment.

The major Commonwealth and State research organisations in the South-east Marine Region that continue to play important roles in the future research of the Region are:

- Geoscience Australia
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- South Australian Research and Development Institute (SARDI)
- Victorian Marine and Freshwater Research Institute (MAFRI)
- Tasmanian Aquaculture and Fisheries Institute (TAFI).



The research carried out by these agencies has started to change over the past decade or so, moving from a focus on stock or resource-based assessment to research addressing environmental and ecosystem questions.

The advent of regional marine planning, ecosystem-based management and greater environmental scrutiny of resource use has seen an increase in the demand for research to advise management decisions in this area. Research organisations and educational institutions are forming multi-disciplinary research centres in order to address the multi-disciplinary nature of ecosystem issues, and to seek cost benefits in shared research and expertise.

One major focus of research and monitoring is to improve our knowledge of large-scale climatic changes, including global warming. Information from this research is important when assessing the long-term future uses and opportunities in the South-east Marine Region. For example, rises in water temperature may alter fish movements and species compositions, potentially displacing whole fishing fleets. Similar rises may lead to a loss of production or even the collapse of some aquaculture ventures reliant upon cooler waters to engender sufficient growth rates in fish held. On the other hand, changes in water temperature and oceanographic processes may open up new opportunities, some of which have probably never before been considered feasible in the Region. The effects of global warming on the Region are still conjecture but management and industry needs to continue monitoring the oceans to remain adaptive in their approach.

Shipping and ports

Shipping has to date been essential to Australian trade, and will not be replaced by alternative forms of transport in the foreseeable future. Bulk and containerised cargoes (which make up the majority of all commercial shipping) simply cannot be cost effectively freighted around the globe by any other means.

Within the South-east Marine Region, transport infrastructure is focussed on some of Australia's major ports such as the Port of Melbourne, Toll Geelong Port and Devonport. With a potential continued demand for shipping in the Region, shipping will continue to be a major user of the South-east Marine Region for many years to come.

Across the globe commercial shipping vessels are getting bigger as operators seek greater economies of scale. Since 1995 the largest containership in the world has increased by 42% in size and there is an imminent move to a new maximum vessel size of about 9000 – 10 000 TEUs (twenty-foot equivalent units) (Damas 2001).

The bigger vessels may have significantly deeper drafts – drafts considerably greater than can be offered at many major ports. In the longer term, ports in the South-east Marine Region may have to deepen existing channels by dredging (at a costly price) to accommodate these ships (VCA 2001).

Most major ports in the world have already announced development plans that include dredging deeper access channels and berths to accommodate the increase in ship size. Bridge clearance and navigation approaches may also need to be considered. Port infrastructure may also need upgrading to handle the larger volumes of cargo landed at one time and to cope with the changing demands on machinery (for example, cranes will have to have longer and/or higher reach).

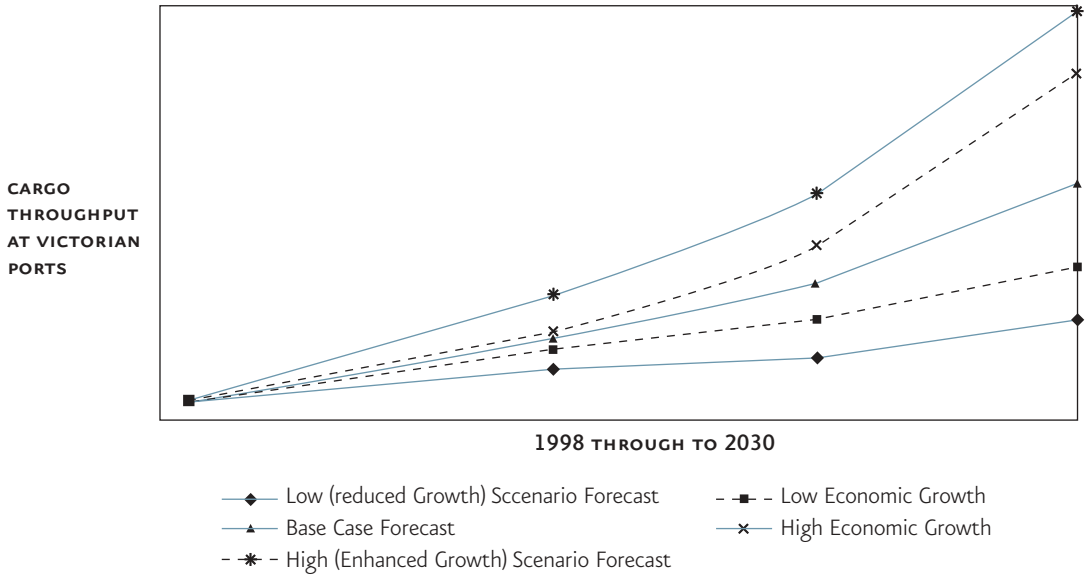
The Victorian Channels Authority is the agency responsible for the management of the movement of commercial shipping, and the provision and maintenance of commercial navigation channels and

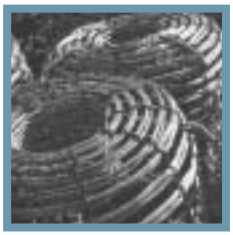
aids in the major Victorian ports. The Authority is looking at ways of reducing the amount of dredging. One means of doing this, known as a real time or dynamic under keel clearance system, is to identify periods when tide and swell conditions are most favourable for ships to travel safely at maximum loads. In addition, this system identifies those sections of channel that may still need to be deepened, significantly minimising dredging costs. The estimated costs to dredge the Port Phillip channel is around $200 million (VCA 2001).

Projections for future trade at Victorian ports from 1998 to 2030 by the Victorian Ports Strategic Study showed that growth in cargo through Victorian ports was likely to grow even with a low economic growth forecast (Figure 17).

It is unlikely, however, that this growth will be felt evenly across the Region with the potential for trade becoming even more focussed on key ports such as Melbourne and Devonport. There is currently debate over whether facilities in the Port of Melbourne are suitable to handle this proposed increase in the volume of cargo. However, Patrick and P&O's Swanson Dock facilities are projected to handle more than twice their current cargo throughput (Crisp 2001). At least one new commercial deep-water port, at Barry Beach in South Gippsland, Victoria, is planned for the Region. Esso BHP Billiton has signed over land at Barry Beach to developer Ancon Australia, which hopes to build a commercial deepwater port on the site. The first stage of the Barry Point development will cost $15 m and should enable the handling of ships up to 10 000 tonnes.

Figure 17:
All Victoria ports – future trade forecast scenarios. *Source: Victorian Ports Strategic Study.*





The port will be for bulk sea transport, such as timber products, possibly dairy products and perhaps even cargo for Energy Brix (Lloyds 2002).

As the number and volume of international shipping in the Region increases there will also be increased demands for shipping support services such as container manufacturers, classification societies, freight forwarders, customs agents, and harbour towage. Some of these demands are likely to be handled by multinational agencies located outside the Region but some may continue to be serviced by agencies and support industries in the Region, particularly those located in the principal ports.

Other significant developments in the industry include:

- **high-speed technology** – the expansion of the number of vessels that are capable of very high speeds include hovercraft, passenger/vehicle catamarans and high speed container vessels. This development has increased the importance of the safe speed at sea as excessive speed is one of the main contributory factors in collisions between vessels at sea (Kavanagh 2001). Shipping in general is becoming increasingly safe with the compulsory introduction of multi-hulled tankers, better weather and sea-state forecasting, electronic navigational equipment and the push for improved training and welfare of crew

- **petroleum infrastructure** – the likely development of petroleum infrastructure in the Otway Basin following the discovery of major gas reserves, may reduce the number of areas commercial ships are able to access. Whether developments in the Otway Basin reach a similar size as those in the Gippsland Basin, where ships are excluded in areas, is yet to be seen. As such, it may be many years before a determination will need to be made. The current exclusion area surrounding the Gippsland Basin infrastructure will remain in place for at least the next 20-30 years, given the projected reserves of the wells and the time required for the decommissioning of expended wells.

- **conservation** – governments around the world are becoming more conscious of the need to manage environmental impacts of activities and shipping is not divorced from this trend. Although the global nature of shipping means these measures need to be implemented from an international perspective, there are particular measures that may be of relevance to the South-east Marine Region. These may include interactions with marine mammals (both directly through collisions and indirectly through, for example, noise pollution), and the possible designation of environmentally sensitive areas to shipping along the lines proposed by the Australian and New Zealand Environment and Conservation Council (ANZECC 1996). This report's *Conservation* section provides a broader discussion of this issue.

Submarine cables

Basslink is the proposed undersea electricity link across Bass Strait connecting the Tasmanian and Victorian electricity markets. Basslink will assist in meeting Tasmania's growing demand for electricity, allow Victoria to meet peak energy demands and allow Tasmania to join and participate in the National Electricity Market . At this point in time there appears general support for an electricity connection between the mainland and Tasmania. However, serious concerns are being expressed, particularly by the fishing and petroleum sectors, over the proposed technology for the cable. Further information about the Basslink proposal is provided earlier in this report.

As noted earlier, the original telegraph/telephone cables laid across Bass Strait from 1859 and 1936 have been superseded by alternate communication methods including radio, satellite, microwave and fibre-optic. The only active communication line between Tasmania and the mainland is the Telstra fibre optic cable installed in 1995, with a design life of 40 years. Telstra is currently in an advanced stage of planning a second optical cable. They plan to run this cable alongside the Basslink cable, laying it at the same time.

Tourism and recreation

Growth in the tourism industry has been such that by 2010 it is expected to generate US $9.3 trillion of economic activity (total demand) and 207 million jobs worldwide by 2011 – one in every 11.2 jobs (WTTC 2001).

The increase in tourism to date throughout Australia has been due to numerous factors, including increased disposable income, leisure time, population, life expectancy, mobility, number of childless couples, increased age before first child and advertising of tourism opportunities.

In addition, the relative fall in the Australian dollar compared to the major world economies, has made overseas travel for Australians relatively expensive, whilst making Australia a more favourable destination for overseas visitors. These trends are likely to continue, increasing the demand for tourism opportunities in the Region.

Governments at all levels recognise the economic benefits of encouraging tourism to their areas. In Australia this is highlighted with the recent government spending to offset the recent slowdown in tourism throughout Australia due to the collapse of Ansett Airlines and the international terrorism crisis. For instance the Tasmanian Government recently announced a $200, 000 intrastate campaign which has been funded through the State Government's $2 million tourism assistance package, initiated to offset some of the effects of the above events (TDPC 2001). The Victorian Government also announced a $10 million rescue package (Media release: 30/10/01) and the Commonwealth Government announced a $15 million relief funding for small to medium tourism businesses that were directly affected by the Ansett Airline collapse (ATC 2001). To counteract the slump in international tourism people are also being encouraged to visit more of their own State and country, with advertising around the country to encourage such travel.

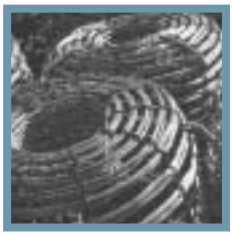
The growing tourism market has led to an increased number of tourism ventures that relate directly to the marine environment. In the South-east Marine Region these include the seahorse farm in Beauty Point, the Tasmanian Wooden Boat Festival, local regattas, the Melbourne Aquarium, maritime museums, penguin spotting and charter boat operations involved in watching marine mammals and offshore charter fishing. In some cases these ventures have led to increased prosperity for coastal communities in the Region, such as Bicheno off eastern Tasmania. Public interest in marine cultural history has led to many once dilapidated buildings and port areas being restored and many have become popular tourist destinations. It is likely that these trends will continue into the future both Australia-wide and in the Region.

Cruise ships

International tourism in the Region includes visits by cruise ships. These visits are planned well in advance with the itinerary of cruise ships visiting ports (including exact arrival and departure times) lodged as much as 2-3 years ahead. The current Victorian Cruise Shipping Strategy sets out a program to ensure the continuing development of the industry in Victoria and to maximise the industry's growth potential and related economic benefits which flow from increasing cruise ship visits (DOI 2002). For instance, the Strategy includes investigating and upgrading Station Pier in Melbourne to accommodate new generation cruise ships, upgrading berths for use by visiting navy ships and cruise vessels, and identifying alternative cruise ship berthing arrangements. The Victorian Cruise Shipping Strategy for the period 2001-03 is currently being developed.

Similar to the trends in commercial shipping, cruise ships are increasing in size and offering more and more for the tourism dollar. Most of the growth has been aimed at the mass market. In some parts of the world this has been accompanied by the growth in the number of mystery cruises and voyages to nowhere. Three days in port with three days at sea is steadily becoming the norm for many cruises, though this is not yet the case in the South-east Marine Region where short port stays are still scheduled into 2003.

There has, however, been interest in expanding the infrastructure in some areas to attract cruise ships to ports other than Melbourne and Hobart, such as recent interest in Geelong and on Phillip Island (DOI 2002). These may lead to major redevelopments of port infrastructure in these areas and enhanced tourist opportunities.



Yacht racing

The Sydney to Hobart and the Melbourne to Hobart open ocean yacht races are part of Australian culture and their shifting within, yet alone removal from, the sporting calendar could not be envisaged by many Australians. However, following the ill-fated Sydney to Hobart race a few years ago, dramatically increased insurance premiums are already influencing the size and composition of the fleets. The increased insurance premiums may have a greater effect on some of the smaller race events in the Region, though they will most likely continue. The economic benefits and regional exposure from major events will continue to attract sponsorship.

Although there are no 'fixed' courses for oceanic yacht races the general routes and direction of these events are relatively firm and the current racing routes should be a relatively accurate portrayal of oceanic yacht racing in the Region for years to come.

Recreation

Many once sleepy coastal towns are becoming popular holiday, retirement and 'seachange' areas. This trend has been going on for a number of years. It is evident in the population change in the Region between 1991-1996, at least for some centres such as St Helens, Robe and Lakes Entrance, though most growth is still located on the fringes of the major metropolitan centres (Larcombe et al. 2002). The increased flow to coastal areas is leading to greater demand for facilities and infrastructure which both opens up the areas to further development and places increasing pressures on the local marine and coastal environments.

Recreational boating is increasing as a lifestyle choice and is likely to continue due to the relatively high levels of disposable income. Recreational boats are also becoming larger and faster, enabling travel further offshore. For some people, the dream of cruising around the coastline in a personal yacht is becoming a more practical reality. Yachts travelling around the world will continue to call into the Region, bringing in both income and quarantine issues such as introduced marine pests.

The recreational use of beaches and other coastal environments will continue to increase in line with population growth and the movements to coastal areas. People undertaking popular activities such as surfing, swimming, snorkelling and diving, will be seeking continuing access to these areas and a clean and healthy environment in which to enjoy the recreational experience.

The South-east Marine Region lends itself to the recent international growth in extreme sports. This may go to the extent of open ocean surfing in the massive swells of the Southern Ocean, as has already happened off California (O'Hanlon 2001). Other offshore recreational activities of a less extreme nature include offshore kayaking. This activity is also increasing in popularity but is likely to remain close to the coastline, except for the occasional Bass Strait crossing.

Conclusion

Although the South-east Marine Region has a relatively long history of use there are clearly many uses that have the potential for further development. These developments will be moulded by regional pressures (eg population growth), domestically (eg Government policy and demand) and through international pressures (eg increased commercial shipping sizes). Some activities, such as petroleum exploration and production, will continue to flourish for many years to come and move into new frontier areas as information, technology and markets allow. On the other hand, other activities, such as many major commercial fisheries, are in a period of consolidation with many species under management arrangements to recover stocks to sustainable levels. In such cases, industry growth may be over the longer rather than shorter term. The uses, and users, in the Region are likely to become more numerous, complex and extensive in the future, and management challenges may correspondingly increase.

Governments across the Region now ensure that activities under their jurisdiction are conducted in an ecologically sustainable manner. Of equal consideration is the need to ensure that people continue to have access to and enjoy the experience of the coast and ocean, and that industry is able to continue to access the values of the marine environment.

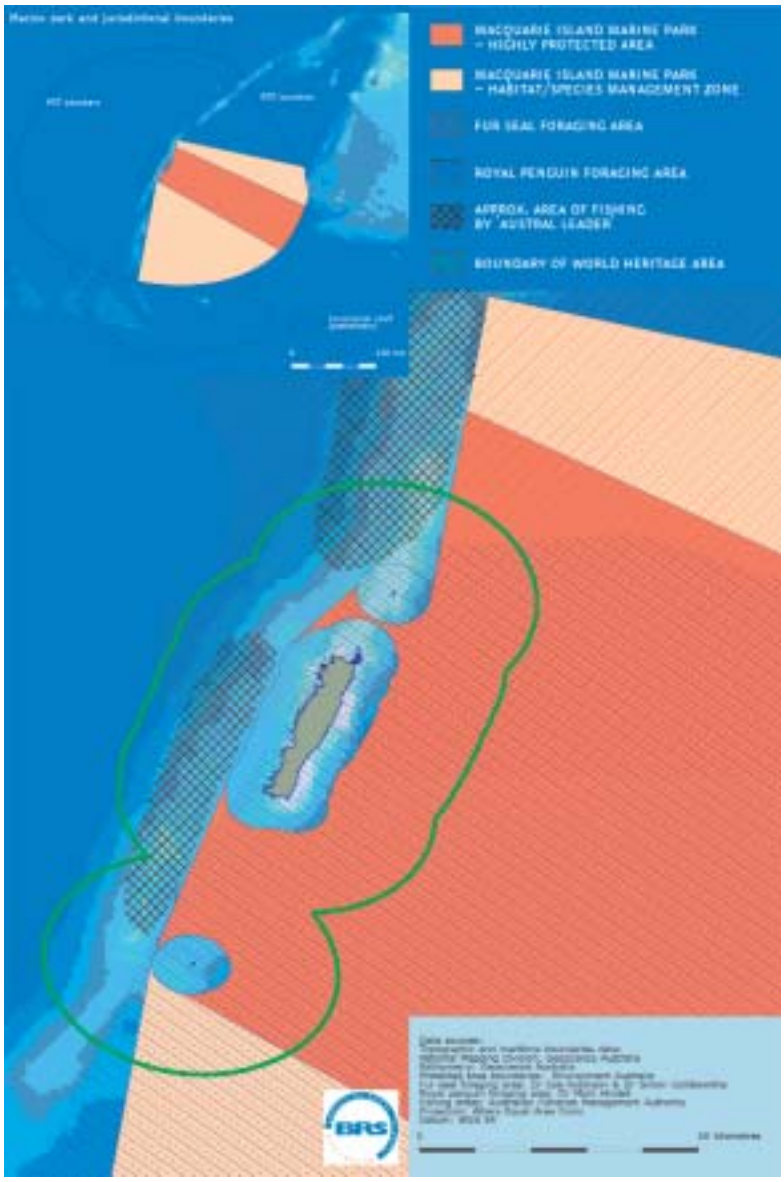
Multiple use studies

This chapter includes ten studies that illustrate the complexity and scope of how multiple uses in the Region interact and how these interactions are managed. They do not provide a complete picture of all of the uses within each of the Large Marine Domains in the Region, rather they examine particular interactions across uses occurring in a specific area.

- **Macquarie Island:** examining the links between the commercial trawl fishery for the Patagonian toothfish and species of high conservation value living on Macquarie Island, such as elephant seals and royal penguins.
- **South Tasman Rise:** examining the only ongoing use in the South Tasman Rise Large Marine Domain – the South Tasman Rise Trawl Fishery. Recent research, however, indicates the potential for petroleum production, and even mineral extraction in the long term. This study examines the fishery and what may occur in the future.
- **Tasmanian Seamounts Marine Reserve and commercial fishing:** examining the one offshore marine protected area in the South-eastern Large Marine Domain. The reserve was recently declared following ground-breaking research and cooperation between the fishing industry, Environment Australia and the CSIRO. This study outlines the conservation measures in place – from complete protection in the deeper waters to management of the pelagic longline fishery in the upper waters and measures in place to ensure that the fishery is sustainable.
- **Danish seine fishing and petroleum infrastructure off Lakes Entrance:** examining how two industries with a long history in the waters off Lakes Entrance are able to co-exist in the same area without compromising either safety requirements for petroleum production platforms or catches in the Danish seine fishery.
- **Shipping and Port Phillip Heads:** examining the the most complex shipping location in the South-east Marine Region. Port Phillip Heads is the entrance to two of the principal ports in the Region representing a high volume of activity – the Port of Melbourne and Toll Geelong Port. The study examines how the multitude of shipping types – from large tankers to yacht racers – are managed.
- **Nature-based marine tourism and the Governor Island Marine Nature Reserve:** examining the close relationship between the Governor Island Marine Nature Reserve and the development of Bicheno on the east coast of Tasmania as an important nature-based marine tourist destination.
- **Defence activities and mineral exploration off south-eastern Kangaroo Island:** examining a 'might-have-been' off Kangaroo Island in South Australia where there was interest in offshore diamond exploration alongside a defence exercise area.
- **Giant crab and South East Trawl Fisheries off western Tasmania:** examining two fisheries off western Tasmania – one passive (trapping for giant crab) and one active (trawling for finfish). Such a combination of fisheries has historically been characterised by gear conflict, including not so subtle conflict resolution measures on wharves or at sea. The study describes the process by which such issues are now effectively resolved.
- **Offshore petroleum coexistence with tourism, conservation and Indigenous people:** illustrating the measures in place for the new Minerva gas project off Port Campbell in Victoria, which is designed to minimise impacts on conservation, cultural and tourism values of the spectacular Port Campbell National Park.
- **Blue warehou:** examining blue warehou, a species that is fished across the Region – both commercially and recreationally. It examines the multitude of measures in place by both State and Commonwealth agencies for the management of the species.

Macquarie Island Domain Case Study

Map 26: *Macquarie Island Marine Park and jurisdictional boundaries.*



Macquarie Island is located some 20 nautical miles north of the Antarctic Polar Frontal Zone (of Antarctic Convergence), 1500 km southeast of Tasmania and 1300 km north of the Antarctic continent. The island forms part of the State of Tasmania and is managed by the Tasmanian Parks and Wildlife Service as a State Reserve. It is also an International Biosphere Reserve and the Island and surrounding waters out to 12 nautical miles were listed as a World Heritage Area in December 1997 on the basis of its unique and vulnerable marine ecosystems and its unique geological characteristics.

Commercial fishing is the only extractive use within the Macquarie Island Large Marine Domain and is undertaken on a limited entry basis by a single boat, the *Austral Leader*. The Macquarie Island Fishery covers all fishing in Commonwealth waters from the three nautical mile boundary out to 200 nautical miles and comes under Commonwealth jurisdiction. Fishing in Commonwealth waters is managed by the Australian Fisheries Management Authority (AFMA) under the *Fisheries Management Act 1991* (Cth).

In mid-1999 the AFMA developed and implemented the *Macquarie Island Fishery Interim Management Policy* for the period October 1999 to June 2001. This Policy permitted access by a single boat using the trawl method. The Policy has been extended by the AFMA Board for a further 18 months to December 2002.

The current target species of the fishery is the Patagonian toothfish (*Dissostichus eleginoides*). Toothfish are found on the shelf and upper slope areas at depths of 300 m to more than 2000 m and fished at depths between 600 – 1000 m (AFMA 1999). Fishing for Patagonian toothfish has generally taken place to the west and north of Macquarie Island.

The bycatch recorded to date from all grounds includes fish as well as rocks, corals and other benthic organisms (AFMA 2000a).

The Macquarie Island Marine Park makes up around one-third of the Exclusive Economic Zone (EEZ) around Macquarie Island and its associated islets (Map 26). The Marine Park was proclaimed on 27 October 1999 to protect the unique and vulnerable marine ecosystems of the Macquarie Island Region, particularly:

- the migratory, feeding and breeding ranges of marine mammals and seabirds and a number of threatened species that depend on the area
- the unique benthic habitat.

The Macquarie Island Marine Park covers an area of approximately 16.2 million hectares (ha) and includes the world's largest Marine Highly Protected Zone. It is divided into two management zones:

- a Highly Protected Zone of 5.8 million ha where fishing, petroleum and mineral exploration is prohibited
- a Species/Habitat Management Zone of 10.4 million ha on the northern and southern portions of the Park that allows for scientific research as the primary activity. Limited commercial fishing may be allowed in certain circumstances.

Petroleum and mineral production is prohibited throughout the Park.

The Park is managed by the Commonwealth Government under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Management is guided by the Macquarie Island Marine Park Management Plan, which was finalised in September 2001.

As with other islands of the Southern Ocean, Macquarie Island is notable for its overall low biological diversity, but high numbers of some species. The Macquarie Island Region provides habitat for, amongst others, antarctic and subantarctic fur seals, the southern elephant seal, several species of penguins, a number of albatross species, and many benthic and pelagic species such as fish and krill. The Region is, however, unusual in its biological composition relative to other areas in the Southern Ocean. A number of its species are listed as threatened under the EPBC Act and/or the Tasmanian *Threatened Species Protection Act 1995* or the *IUCN Red List Criteria* (Table 31).

Table 31:
Threatened species.

Common Name	Scientific Name	Status
Royal penguin	*Eudyptes schlegeli*	Redlisted in IUCN and listed as vulnerable according to IUCN criteria
Southern elephant seal	*Mirounga leonina*	Listed as vulnerable according to IUCN criteria and listed as threatened under section 178 of the EPBC Act, 1999
Antarctic fur seal	*Arctocephalus gazella*	Conservation dependent according to IUCN criteria

Source: Modified from EA 2001a.

Concerns have been expressed over the possible trophic interactions between the fishery and threatened species. These concerns led to a study funded jointly by the Fishery Research and Development Corporation (FRDC), CSIRO Marine Research, the Australian Antarctic Division and Austral Fisheries Pty. Ltd. The overall objective of the project was to:

- understand population and fishery biology of the Patagonian toothfish and its interactions with other ecologically important species
- provide scientific advice for ecologically sustainable development of the fishery.

A number of bycatch species, particularly the pelagic myctophid fish *Electrona subaspera*, provide the primary diet for a variety of marine mammals, in particular the fur seals *Arctocephalus gazella* and *A. tropicalis* (Goldsworthy et al. 1997) and royal penguins *Eudyptes schlegeli* (Hull et al. 1997).

The otoliths or ear bones of the fish *Electrona subaspera* were identified in between 83.5% to 96.6% of seal scats collected in a study on diet and diving behaviour of fur seals at Macquarie Island. Foraging was concentrated to the west and north of Macquarie Island with very little activity south of the Island. The distance travelled to foraging sites from Macquarie Island ranged between 94 and 386 km (Goldsworthy et al. 1997).

A further study suggests that elephant seals forage in areas quite close to Macquarie Island – foraging both to the south of the Antarctic Polar Front and north of the Antarctic Polar Front (Hindell et al. 1991).

The foraging activity of the royal penguin, a species endemic to Macquarie Island, occurs offshore to the southeast of Macquarie Island at a minimum distance of 68 km. The penguins forage predominantly in pelagic water 4000 to 5000 m deep within the Polar Frontal Zone. Euphausiids (krill), myctophid fish and some cephalopods dominate the diet of royal penguins (Hull et al. 1997).

The total annual biomass consumed by seabirds, seals, toothfish and the toothfish fishery within the Macquarie Island EEZ has been estimated to be 419 774 tonnes comprised of 61% pelagic fish (mostly myctophids), 28% pelagic crustaceans (mostly euphauside) and 7% cephalopods (Goldsworthy et al. 2001).

In recent years, marine wildlife and fisheries interactions have attracted global attention because of the large numbers of seabirds and seals reported dying in large-scale commercial fishing operations around the world. The very high mortality of seabirds has been reported from longline fisheries where seabirds dive for baited hooks, get caught and drown. Seals and other mammals seem to avoid longliners but tend to get caught in trawl nets.

To monitor the death or injury of animals in the Macquarie Island Fishery, observers were present on every voyage from 1997 to 2000 and monitored about 60% of shots and hauls for seabird and seal interactions with the gear (Williams et al. 2001). Three species, the black browed albatross, the great albatross and giant petrel are known to interact with fishing gear, although these interactions have been minor (AFMA 2000a and AFFA 2001a). The death of a seal from injuries sustained when landing on a research vessel during stormy weather has also been observed, though the observers were unable to determine either the time or cause of death (AFFA 2001a). The fishery has fewer interactions with seabirds than elsewhere primarily because longlining is not used.

Food web links between toothfish, the fishery, seals and sea birds are found to be weak. A combined diet analysis and consumption model estimates that seabirds (mostly penguins) consume 88% of food resources in terms of prey biomass around Macquarie Island, followed by toothfish (8%), seals (3%) and other seabirds (<1%) (Williams et al. 2001).

The seal and seabird communities around Macquarie Island prey primarily on pelagic fish (myctophids) and pelagic crustaceans (94% of prey biomass), neither of which form important prey of toothfish[4] or are a target or bycatch[5] of the commercial fishery.

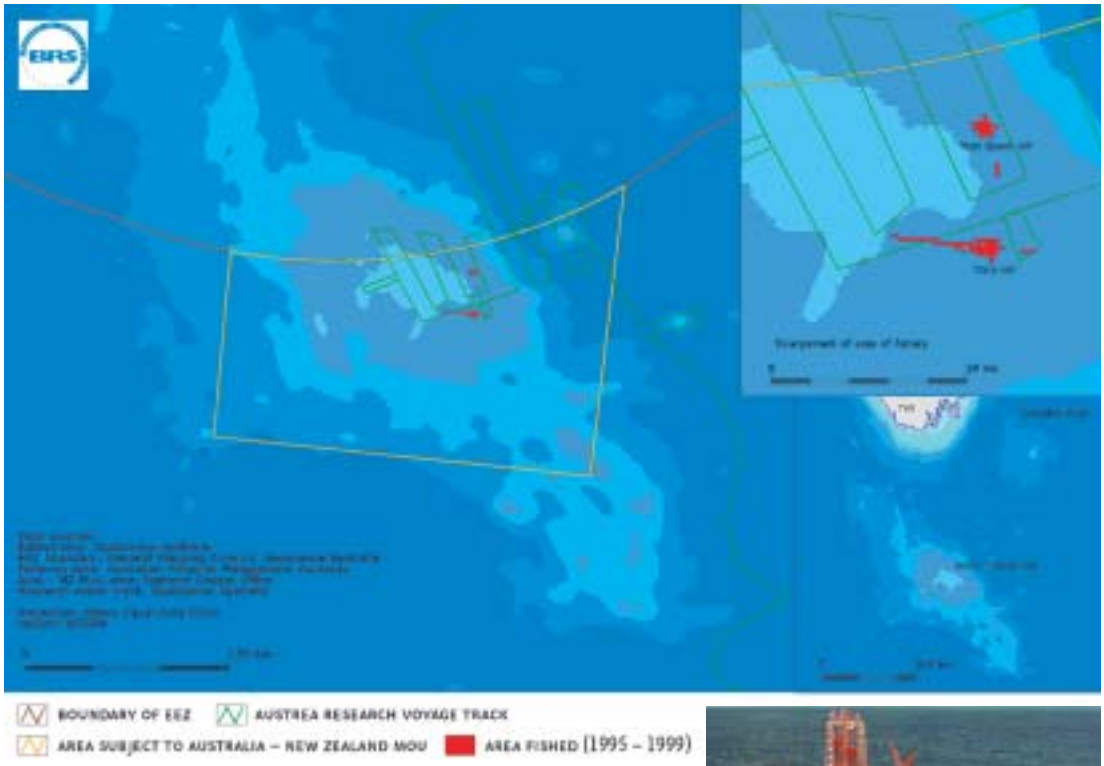
Although the toothfish fishery is unlikely to compete for the prey of seals and seabirds, the development of new fisheries in the future may unless these interactions are addressed. During the 1980s, approximately 75 000 tonnes of the myctophid (*E. carlsbergi)* were taken from the southwestern Atlantic, and processed into meal and oil (Kock 1992).

Global interest in this fishery has increased in recent years. The rapid development of intensive aquaculture fisheries around the world has meant that the demand for fish-meal has been increasing, and as such it is possible that this fishery may expand to other areas in the Southern Ocean in the future. The estimated annual consumption of *E. carlsbergi* in the Macquarie Island EEZ is about 66 000 tonnes, most of which is consumed by king penguins. If such a fishery were to be developed around Macquarie Island, it would compete directly with seabirds and seals and would need to be carefully managed (Goldsworthy et al. 2001).

[4] The toothfish prey includes fish (58.1%), cephalopods (31.6%), crustaceans (10.3%) (Goldsworthy et al. 2001).

[5] Bycatch includes non-target species fish, jellyfish, corals/sponges, crustaceans including crabs, cephalopods, echinoderms and other invertebrates (Williams et al. 1997).

Map 27: ***South Tasman Rise.*** *Source: Larcombe et al. 2002.*



Current and future uses on the South Tasman Rise

The South Tasman Rise Large Marine Domain covers the area of the deep water continental rise straddling Australia's Exclusive Economic Zone (EEZ) to the south of Tasmania. It includes both an area inside the EEZ under Australian jurisdiction and an area on the high seas. The area on the high seas is subject to a claim by Australia as an area of extended continental shelf under Article 76 of the United Nations Convention on the Law of the Sea (LOSC).

Uses in the South Tasman Rise large marine domain are essentially restricted to commercial fishing for demersal finfish species. The only other uses to date in the area are research cruises for fisheries and, more recently, mapping the claimable continental shelf and geophysical attributes of the area. There is virtually no shipping over the area though it is close to the transit route between Hobart and Macquarie Island for supply and research vessels.

The only domestic commercial fishing vessels to have recorded any effort in the area were those fishing as part of the South East Trawl Fishery and, more recently, vessels in the recently declared South Tasman Rise Fishery. Catches were recorded in the area as early as 1988 (Lyle 1994) and into the early 1990's during the orange roughy "boom" days. These catches were generally relatively small and consisted mainly of oreo dories (BRS 2000).

However, in September 1997, significant aggregations of orange roughy were discovered and the fishery rapidly increased to the extent that Australian vessels had landed 1668 tonnes by the end of 1997. As the bulk of these fish were taken outside the Australian fishing zone (AFZ), the fishery also attracted vessels from the New Zealand deepwater trawl fleet. The New

Zealand fleet took 430 tonnes during the same year. From January 1 to March 1998 the Australian catch was 2052 tonnes.

Throughout the fishery, catches of orange roughy have centred on two, small seamount features, both outside the AFZ – the Main Spawn Hill and Dory Hill (Clark & Tilzey 2001). In recent years orange roughy have only been caught in quantities on the Main Spawn Hill, despite widespread effort in all years (Clark & Tilzey 2001). Only one large catch, in 1997, has been reported inside the AFZ to date in the fishery.

The increased interest in trawling for orange roughy in the area led to the declaration by the AFMA of the South Tasman Rise Trawl Fishery in March 1998. This Fishery covers an area of the high seas adjacent to the EEZ. Catches from the fishery are mainly exported to the United States, though some are sold domestically.

The area of the fishery is also the subject of a Memorandum of Understanding (MOU) signed in February 2000 by the New Zealand and Australian Ministers responsible for fisheries. The MOU sets up overall catch limits, catch sharing provisions and operating conditions for vessels from both countries, including a pay back provision for overfishing by New Zealand fishers under the original MOU which took effect on 1 March 1998. The overall catch limit set for the fishery was 2400 tonnes, of which Australia is allocated 75% or 1800 tonnes. Declining catch rates suggest there is limited potential for future expansion of the fishery.

Although commercial trawling is the only current activity in the area of the South Tasman Rise, a recent survey by Geoscience Australia (formerly the Australian Geological Survey Organisation [AGSO]) – referred to as the AUSTREA-2 survey – has identified possible future commercial opportunities for both petroleum production and minerals extraction.

Emerging opportunities

The AUSTREA-2 survey, on board the research vessel L'Atalante, had numerous objectives with respect to the South Tasman Rise including:

- the study of the geological framework for the South Tasman Rise to document critical information required to define the outer limit of Australia's Continental Shelf under Article 76 of LOSC
- to provide an understanding of potential economic values (Hill et al. 2001).

The survey found that the South Tasman Rise contains deep basins with up to 6 km of sedimentary section, but they lie in deep water on the flanks of the rise so their productivity is reduced (Figure 15, p.159). Nevertheless, Geoscience Australia believes that because drilling and development technology has kept up with the global trend to explore deeper and deeper fields, acreage will probably be released on the South Tasman Rise in the next few years (Hill et al. 2001).

Potential gas resources have also been identified on and adjacent to the South Tasman Rise (Stagg et al. 2000). Potential areas were identified in seismic profiles within small sedimentary basins on the South Tasman Rise. Considerable volumes of free methane gas and methane in the form of crystalline hydrates may be present in

these areas. Though no economic way of extracting methane from such deposits has been devised, they nevertheless represent a potential resource, though very long term at present (Hill et al. 2001).

Exon (1997) found that manganese nodule fields are common on the abyssal plains off Tasmania and the South Tasman Rise, and also occur in deep water adjacent to the South Tasman Rise (shallowest recovery was 2400 m). The nodules dredged from here were commonly from areas of rocky outcrop, and were mostly smooth and very large (5-10 cm diameter). Though apparently abundant, the nodules from both the South Tasman Rise and adjacent abyssal areas were of low metal grade (averaging 0.14% copper, 0.26% nickel, 0.20% cobalt) and are presently not of economic interest (Exon 1997).

Following encouraging results from the AUSTREA-2 survey, Geoscience Australia is currently undertaking a study of existing information of the South Tasman Rise to provide an understanding of geological processes and potential economic values to underpin future promotion of areas for petroleum exploration. Results from this study may lead to petroleum, and less likely minerals, exploration in the area. This is further backed up by the *Australian Offshore Petroleum Strategy 1999*. The Strategy states that from 2001 there will be an increased emphasis on deep water areas and it is anticipated that the gazettal of frontier or remote frontier areas with petroleum potential will include the South Tasman Rise between 2001-2005.

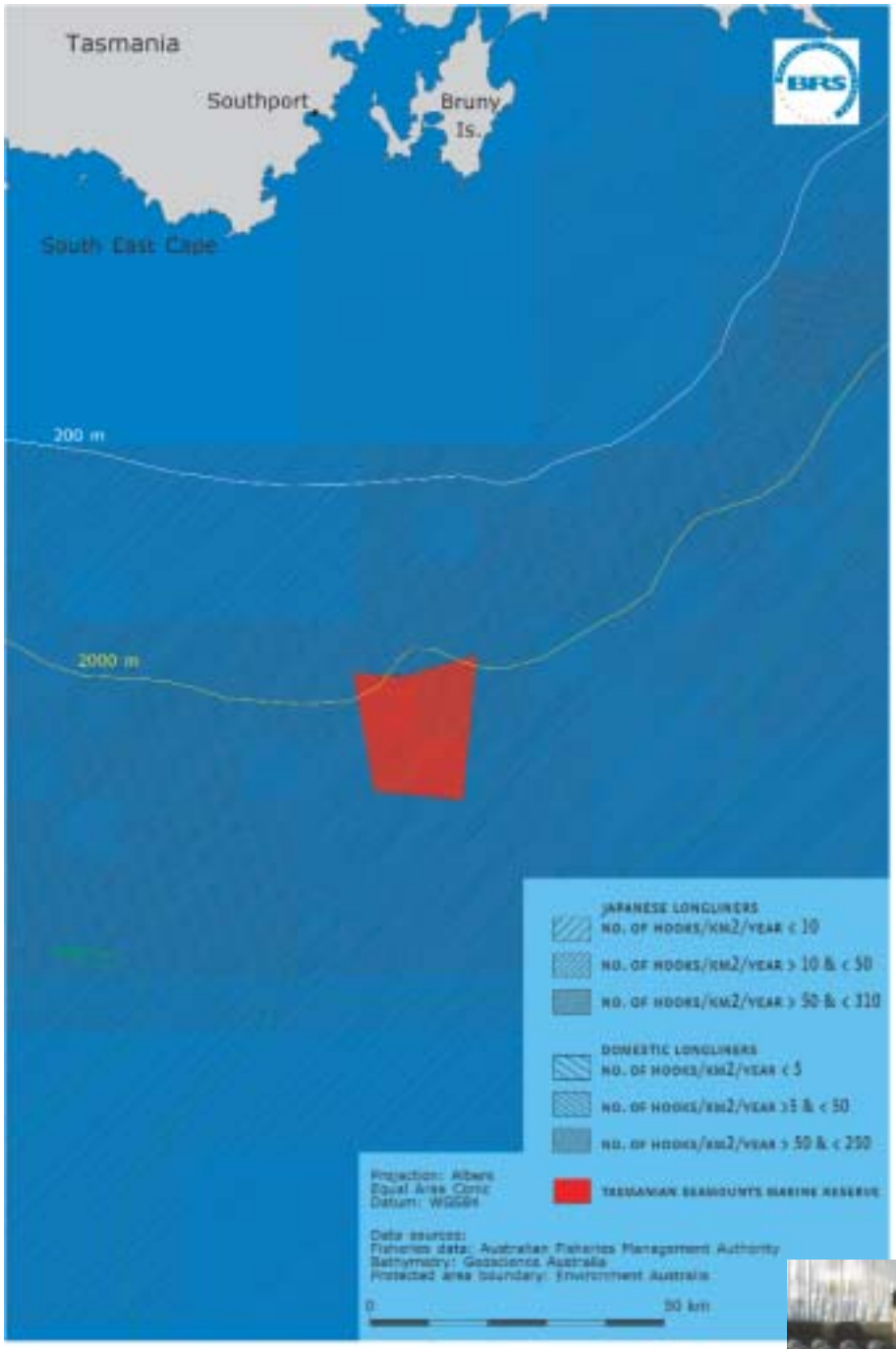
However, any exploration in the area will only proceed following the granting of a permit. Petroleum related activities are only allowed if there is no interference with another activity (such as fishing, navigation, conservation of resources and the sea bed) beyond that which is necessary (Section 124 of the PSL Act 1967).

Whether the level of interference on other activities is disruptive is determined through discussions with the other users. In the case of the demersal trawl fishery on the South Tasman Rise, discussions would be held between officers representing the Designated Authority for the management of petroleum off Tasmania, the exploration lease holder(s), the AFMA and the South Tasman Rise Australian Trawl Association. Similar discussions would also be held if minerals exploration was proposed for the area. The discussion might focus on timing of exploration activity, how it corresponds to the peak fishing times and the effects of the exploration activities (eg seismic surveys, dredges) on the fish aggregations being targeted by the trawl fleet and the broader ecosystem that supports those aggregations.

Tasmanian Seamounts Marine Reserve and commercial fishing

Map 28:

Tasmanian Seamounts Marine Reserve. *Source: Larcombe et al. 2002.*



On 16 May 1999 the Commonwealth Government proclaimed the Tasmanian Seamounts Marine Reserve. The Reserve is located some 170 km south of Hobart and covers an area of 37 000 ha (EA 2001a).

The Reserve protects the unique and vulnerable benthic communities of the seamounts from human-induced disturbance, and adds a representative sample of this unique seamount Region to the National Representative System of Marine Protected Areas (EA 2001a).

When assessing the Tasmanian Seamounts Region, Environment Australia recognised that the Region was exposed to real and potential pressures from human impacts, though some of these were identified as being low. The pressures included commercial pelagic and demersal fisheries (including impacts of trawling in areas within or adjacent to the Reserve) and mineral exploration and development. Table 32 lists those pressures identified by Environment Australia before the Reserve's declaration that may have impacted on the Region's environment and the level of risk the pressure could have had on the marine environment. These pressures are now managed within the Reserve under the Tasmanian Seamounts Marine Reserve Management Plan.

Table 32:
Potential and existing pressures onthe Tasmanian Seamounts Reserve. *Source: Environment Australia 2001a.*

	Adverse impacts on values	
Pressures	**Benthic ecosystem – 500 m below sea level to 100 m below seabed**	**Pelagic ecosystem – sea surface to 500 m below sea level**
Trawling in Reserve	Removal of benthic flora and fauna. Damage to slow-growing corals. Reduction in mobility of species among seamounts. Sediment drift. Reduction in size and abundance of fish.	Reduction in size and abundance of fish. Pollution from boats.
Risk	High	Medium
Trawling adjacent to the Reserve	Accidental or deliberate encroachment. Reduction in mobility of species among seamounts. Sediment drift. Reduction in size and abundance of fish.	Accidental or deliberate encroachment.
Risk	High	Low
Fishing for pelagic species	Disturbance to predator/prey relationship. Reduction in size and abundance of fish.	Disturbance to predator/prey relationship. Pollution from boats. Reduction in size and abundance of fish.
Risk	Low	Low
Bycatch from pelagic fishing	NA	Sea bird by catch.
Risk		Medium
Petroleum, mineral exploration and development	Removal of benthic flora and fauna. Damage to slow-growing corals. Pollution associated with mining operations. Interference with benthic communities from seismic testing.	Pollution associated with mining operations. Pollution from associated shipping including fuel, oil spills and litter.
Risk	Low	Low
Research	Damage to habitat. Removal of species.	Pollution from boats.
Risk	Low	Low
Tourism and recreation	NA (No diving technology currently exists to access the seamounts)	Pollution from associated shipping, fuel, oil spills and litter.
Risk		Low
Commercial shipping	NA (There is very little commercial shipping in the area of the Marine Reserve)	Pollution from shipping, fuel, oil spills and litter.
Risk		Low

The benthic communities of the Tasmanian seamounts were assessed by CSIRO as being highly vulnerable to trawling activities which include scraping and ploughing of the substrate, sediment re-suspension, destruction of the benthos, and loss of biodiversity (Koslow & Gowlett-Holmes 1998). However, the deeper Tasmanian seamounts, peaking at depths of 1150-1700 m beneath the sea surface had not been targeted by the trawl fleet, partly due to the relative lack of fish aggregations at those depths and the limitations of current gear technology. In addition, before CSIRO's survey of the Region, the South East Trawl Fishing Industry Association agreed to a voluntary closure of the area from trawling. The seamounts were therefore in pristine condition during the CSIRO survey (Koslow & Gowlett-Holmes 1998) and have remained so since.

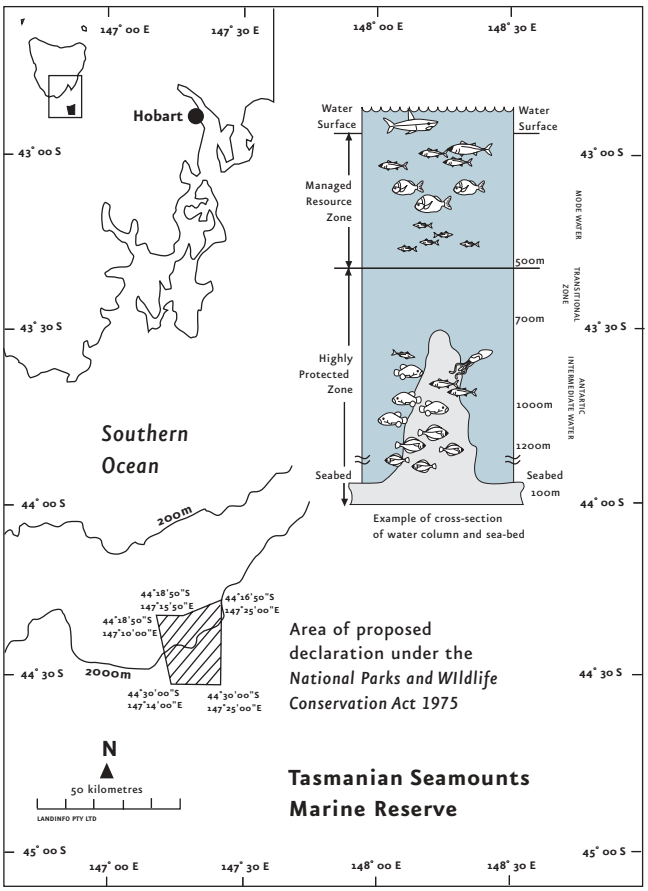
The Reserve is divided into two vertically stratified management zones (Figure 18):

- a Managed Resource Zone (IUCN Category VI [Managed Resource Protected Area] exists from the surface to a depth of 500 m. The aim of this zone is to ensure the long term protection and maintenance of biological diversity while providing access to commercial fishing using non-trawling methods (ie tuna longline industry).
- from 500 m below sea level to 100 m below the seabed is managed to protect benthic ecosystem integrity within a Highly Protected Zone (category Ia). No fishing, petroleum or mineral exploration is permitted in this zone.

The vertical zoning system acts on advice from the CSIRO which found that:

> ...effective management of a southern Tasmanian seamount MPA clearly should be based on an IUCN Category I reserve below 500 m. However, the available evidence indicates that fishing within the upper 500 m is unlikely to have a significant impact on the seamount-associated community, so a Category VI reserve may be maintained for the upper waters without adversely affecting the conservation value of the deepwater seamount reserve (EA 2001b).

Figure 18:
Tasmanian Seamount Marine Park Zoning. *Source: EA.*

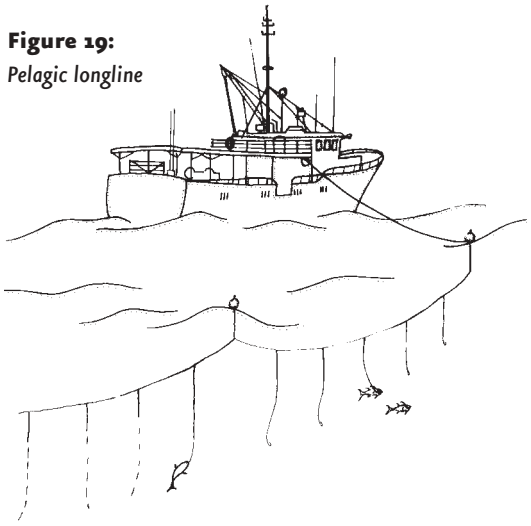


Commercial fishing has been the main human use in the seamounts region off southern Tasmania and as such, presented the greatest potential pressure on the seamounts. These fisheries nominally include two tuna fisheries (Southern Bluefin Tuna Fishery, and Eastern Tuna and Billfish Fishery), the South East Trawl Fishery and numerous other fisheries, including the Commonwealth South East Non-trawl, Southern Squid and Southern Shark Fisheries and the Tasmanian Southern Rock Lobster and Giant Crab Fisheries. However, most of these fisheries have never recorded effort in the area as the depth of the water makes the area unsuitable for most commercially targeted species. Commercial species found in the Region include orange roughy (*Hoplostethus atlanticus*) and oreos (*Pseudocyttus maculatus* and *Allocyttus niger*) in the deeper waters, and tuna and associated species in the upper (pelagic) water column.

Of these, the one commercial fishery which has been active in the Region in the past is the pelagic longline fishery targeting southern bluefin tuna (*Thunnus maccoyii*).

Pelagic longlining involves the setting of a single mainline of up to 130 km in length, suspended horizontally by buoy lines. Between 600 and 3000 branch lines are usually attached to the mainline at regular intervals. The branch lines are usually 25-50 m long and terminate with a hook baited with squid, pilchards, small mackerel, or similar species. Fish are caught at different depths depending on the line's position and the amount of slack in the mainline between floats, but fishing generally occurs above 300 m in depth (Larcombe et al. 2002). In addition, this method is mainly used to target broadbill swordfish in the Tasmanian seamounts Region (Figure 19).

Figure 19:
Pelagic longline



Japanese longliners fished off southern and eastern Tasmania for southern bluefin tuna between the 1960s and January 1997. It is a highly sought after fish in the Japanese market and restaurants. An individual fish may be worth many thousands of dollars. From 1979 access was governed by an annual Bilateral Access Agreement between the governments of Australia and Japan, though Japanese vessels have been excluded from fishing within areas within the Australian fishing zone since January 1997. Australian longline vessels took up targeting southern bluefin tuna off Tasmania at about this time though the fishery failed to develop due to the limited total allowable catch available and the concentration of that catch quota in the tuna farms in Port Lincoln.

There is currently no pelagic longlining in the waters of the Tasmanian Seamounts Marine Reserve, although it is possible that the Southern Bluefin Tuna Fishery may extend back into the area. There is also potential for other pelagic fisheries to develop, such as Rays bream or squid.

If pelagic longlining re-occurred in the waters of the Reserve it will be subject to its own conservation measures. Although longlining is an effective fishing method, it is not highly selective. It is one of the greatest potential threats to some seabirds (EA 2001). In addition, lost and broken lines can entangle fish, marine mammals, birds and vessels, and discarded bands from bait boxes 'collar' marine mammals. The discharge of fish offal may also result in other impacts, including population increases in some seabird populations and dependency upon this food source (AFFA 2001b).

In recognition of the impacts on seabirds, pelagic longlining was listed by the Commonwealth in 1996 as a key threatening process under the *Endangered Species Protection Act 1992* (replaced by the EPBC Act 1999). The nomination was based on the high bycatch of seabirds, especially albatrosses, on tuna longline hooks in the southern AFZ (AFFA 2001a). Threatening processes associated with longlining have since been addressed under the *Threat Abatement Plan for the Incidental Catch (or Bycatch) of Seabirds During Oceanic Longline Fishing Operations* (EA 2001).

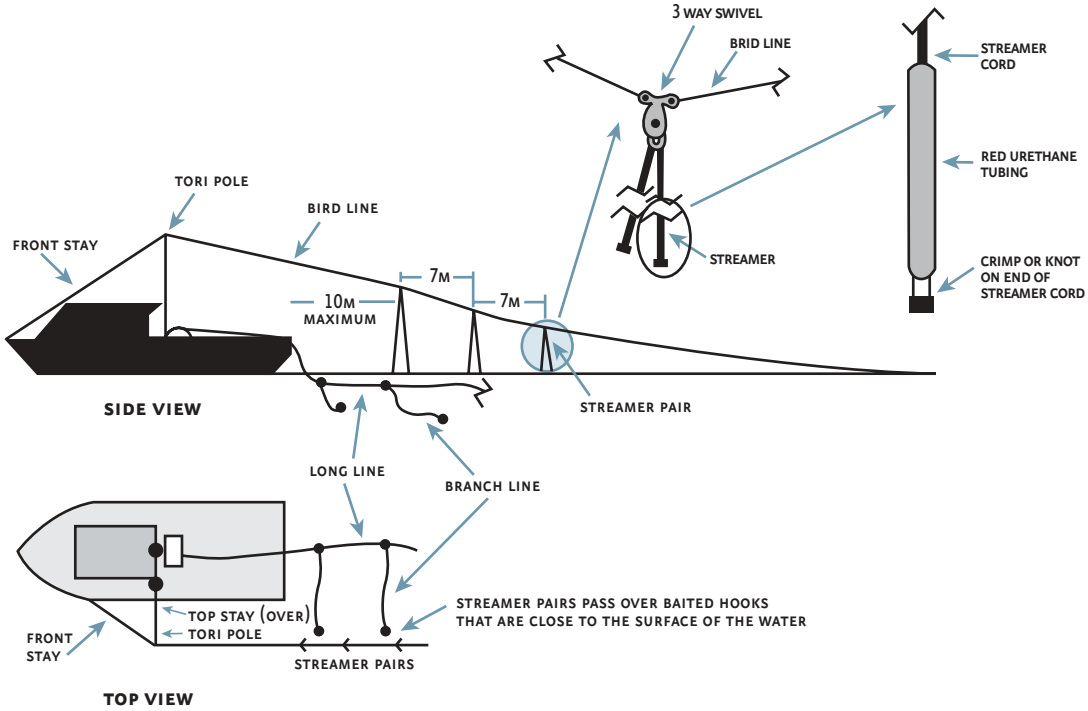
The objective of the Threat Abatement Plan is to reduce seabird bycatch in all fishing areas, seasons or fisheries to below 0.05 seabirds per thousand hooks, based on current fishing levels (EA 2001a). This represents a reduction of up to 90% of seabird bycatch. The Plan:

- prescribes appropriate modifications to fishing practices or equipment, including night setting of gear, flying streamers on 'tori lines' to scare birds off baits (Figure 20) and the thawing of baits prior to use
- provides for development of new mitigation measures
- educates fishers and the public
- collects information necessary to improve knowledge of seabird-longline fishery interactions.

The ultimate long-term aim of this Plan is to achieve a zero bycatch of seabirds, especially threatened albatross and petrel species.

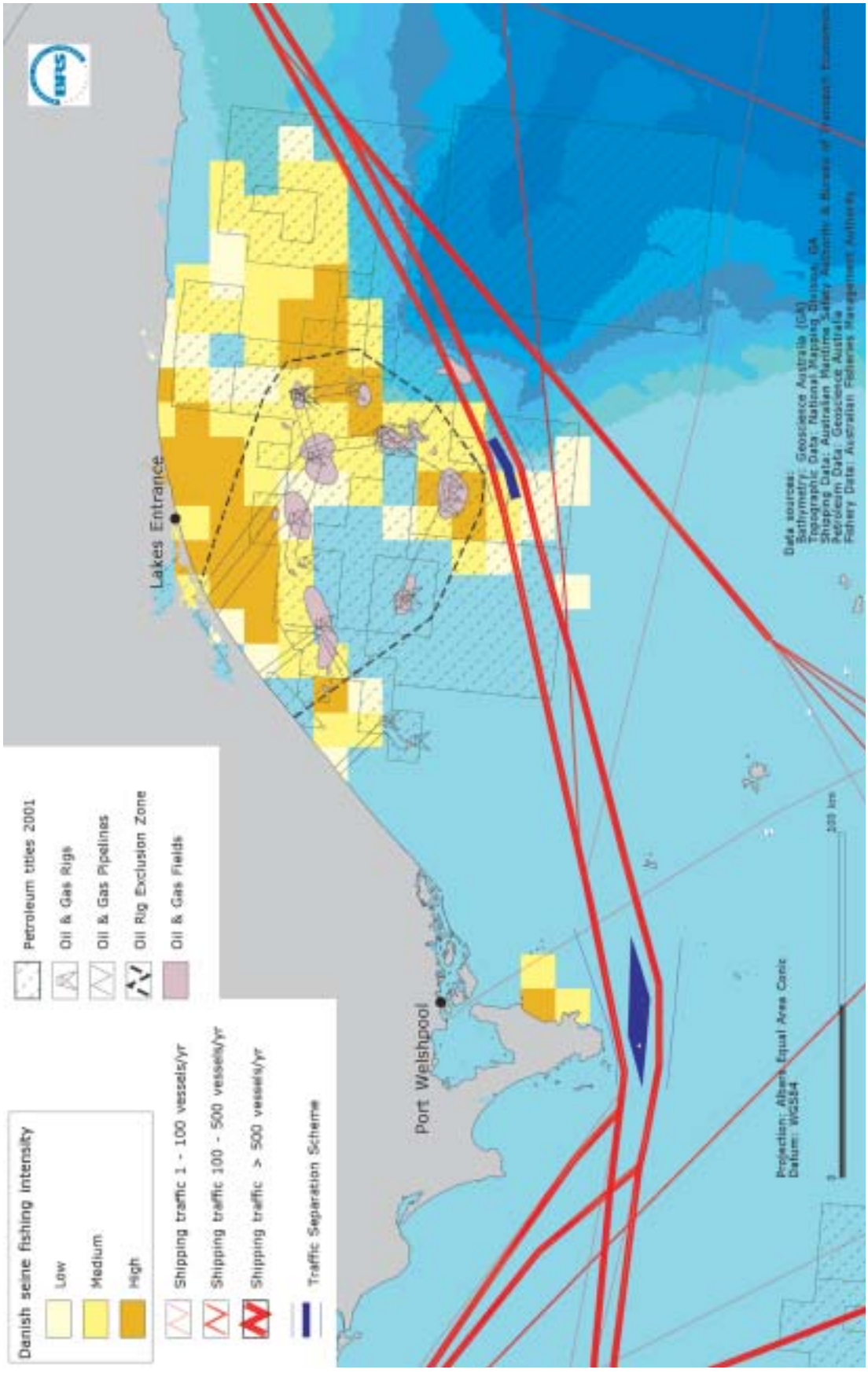
In addition, AFMA has recently released a Bycatch Action Plan under the *Commonwealth Policy on Fisheries Bycatch* for the tuna fisheries (AFMA 2001). This Plan applies to all tuna fisheries and was developed in consultation with stakeholders, particularly environment/conservation groups, scientists, fisheries managers and the fishing industry. It covers only the incidental catch of seabirds but also other bycatch species such as sharks. Commercial fishers also have their own incentives for conservation measures – every bird hooked potentially represents one less multi-thousand dollar fish. Fishers are also increasingly aware of the importance of maintaining the long-term sustainability of a fishery by maintaining the ecosystem processes.

Figure 20:
Tori line configuration for tuna longline vessels. *Source AFMA.*



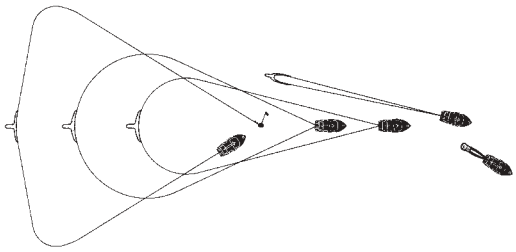
Danish seine fishing and petroleum infrastructure in Bass Strait

Map 29:



Danish seine fishing gear is used by Australian commercial fishermen on the continental shelf in an area off Lakes Entrance, eastern Victoria. The net (a cross between a trawl net and a seine net in shape) is operated from the vessel and used for bottom fishing. The line and net are laid out in a pear shape, and then hauled back to the stationary or slowly steaming vessel in a similar fashion to bottom trawl (Figure 21) (Larcombe et al. 2002). Retrieval of the net generally uses a combination of the forward movement of the vessel to close the net and the hauling of the ropes using a powered winch. Hauling is slow initially to herd the fish, then speeds up to tire the fish and finally to concentrate them in the bag of the net. The gear is only able to work over sand, mud or similar seabed types and cannot be used over rocky bottoms or reefs.

Figure 21:
Danish Seine fishing method.



The Danish seine sector originated in NSW and moved from Eden to the previously unexploited grounds of Lakes Entrance in the 1950s (BRS 2000), over a decade before the first oil production facilities were established in the Region. Tiger flathead (*Neoplatycephalus richardsoni)* was the main target species at Lakes Entrance but eastern school whiting were also taken.

A Japanese export market for eastern school whiting (*Sillago flindersi)* was established in the early 1970s significantly increasing catches of whiting (Tilzey 1994). Danish seining is still used primarily to target tiger flathead and eastern school whiting which occur at depths of less than 200 m and 100 m respectively. Seine catches and catch rates in the Bass Strait for tiger flathead are significantly higher in summer reflecting both seasonal fluctuations in flathead abundance and seasonal switches between flathead and eastern school whiting as the preferred target species (Smith & Wayte 1999).

Danish seine fishing in the South-east Marine Region is now part of the Commonwealth South East Trawl Fishery. Both tiger flathead and eastern school whiting are managed under the individual transferable quota management system where entitlement holders are allocated a percentage of a total allowable catch for each species. In 1999, boats utilising the Danish Seine fishing method caught 2200 tonnes of fish worth approximatley $3.7 million (Larcombe et al. 2002).

The main Danish seine fishing grounds occupy the same area as the Gippsland Basin petroleum producing facilities. There are 22 petroleum production facilities currently operating in Bass Strait. These facilities consist of production platforms, pipelines and navigation markers. Production platforms are generally fixed (eg Barracouta, Bream A, Halibut and Mackerel), though there are some steel gravity (Dolphin and Perch) and concrete gravity structures (Bream B and West Tuna) as well as subsea wells (Seahorse, Tarwhine and Blackback).

The first major oil and gas fields in the South-east Marine Region were discovered in the mid-1960's by Esso/Broken Hill Proprietary (BHP) in the Barracouta and Marlin fields of the Gippsland Basin. There has been continuous oil and gas production in the area since then, making the Gippsland Basin Australia's dominant oil producing area for the best part of thirty years.

Although production has generally been declining for the past couple of decades exploration still occurs in the area and most wells are anticipated to continue production until about 2018-2020.

In order to protect the valuable petroleum installations from collision by ships and prevent possible serious loss of life and damage to the environment from such a collision, there is a strict safety zone of a 500 m radius around each establishment. Safety zones are declared

under Section 119 (Safety zones) of the *Petroleum (Submerged Lands) Act 1967* (Cth). Vessels are prohibited from entering or remaining in a safety zone without appropriate approval, including the Danish seine fishing vessels.

Fines of up to $100, 000 may be imposed for navigation within a safety zone (AHO 2002). Vessels are encouraged to keep at least 2.5 miles clear of these installations. The vessel master must give due allowance to prevailing weather conditions and the possibility of engine, steering or mechanical failures (AHO 2002).

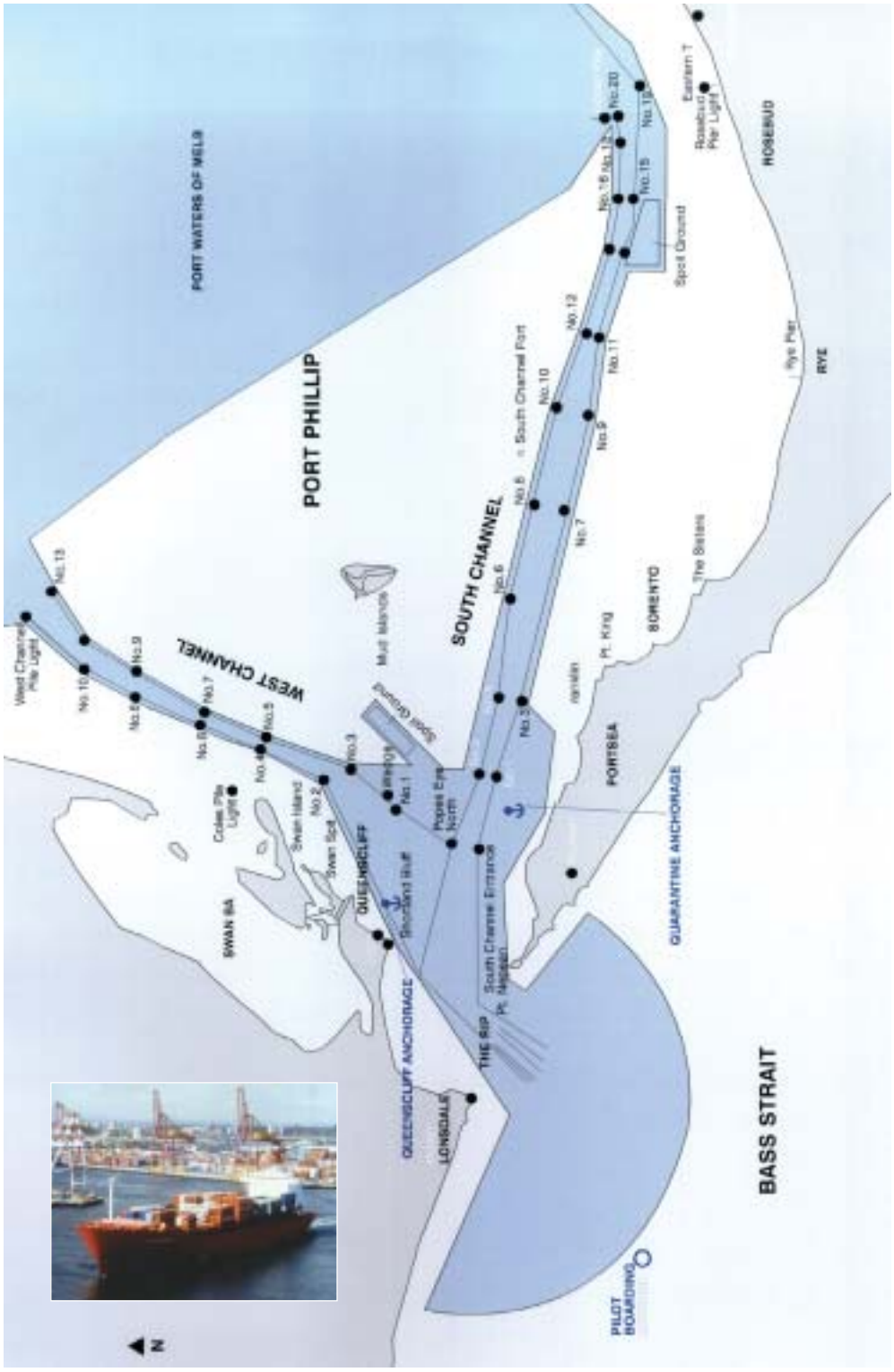
Production platforms are within a ring of large anchor buoys which may exceed one mile in diameter. In addition, the positions of all oil producing platforms are shown on appropriate charts produced by the Australian Hydrographic Office. The position of exploration rigs, which change their location from time to time, are provided in *Auscoast Warnings* and in the *Australian Notices to Mariners*. Boat operators are required to ensure that their charts and navigational warning information is up to date at all times.

Vessels over 200 gross tonnage – which include all large commercial ships – must avoid a designated area around the Gippsland Basin oil platforms and are routed past it by the traffic separation scheme. This 'area to be avoided' surrounds all of the Gippsland Basin petroleum facilities. These large commercial shipping vessels are routed past the area to be avoided by the traffic separation scheme. Although in place to protect the petroleum facilities, these arrangements also provide a safe haven for Danish seine operations in the area off Lakes Entrance.

The operations of the Lakes Entrance Danish seine commercial fishing fleet and the petroleum industry in the area of the Gippsland Basin demonstrates how potentially conflicting resource use industries can co-exist, as they have done for almost 40 years. The safety zones around the petroleum platforms in total occupy only a small area of the entire basin, leaving plenty of productive fishing grounds for the Danish seine fleet. In addition, there are formal communication links available to advise of any changes or additions to petroleum activities in the area to ensure the continued safe coexistence of the two activities.

High volume and high risk shipping traffic area – Port Phillip Heads

Map 30:
Shipping channels in Port Phillip Bay. *Source: Victorian Channels Authority.*



Port Phillip Heads is the narrow entrance to Port Phillip Bay in Victoria. The heads and waters within Port Phillip Bay see the greatest concentration of commercial shipping activity in the Region. Ships going through the heads include bulk cargo ships, container ships, tankers, ferries, cruise ships, racing yachts and recreational fishing boats. The area is also of conservation interest, containing the Port Phillip Heads Marine Park.

The amount of shipping movement and high potential risk of a major accident has necessitated a stringent management regime in the area to control shipping movements and to provide clear responsibilities to the masters of ships.

Port Phillip Bay contains two of the major ports in the South-east Marine Region – the Port of Melbourne and TollGeelong Port. The Port of Melbourne is the largest and busiest container port in Australia with 37% of the nation's container trade (1.3 million TEU annually). About sixty billion dollars worth of trade each year goes through the port. The port itself contributes in excess of $5 billion to Victoria's economy annually (Melbourne Port Corporation 2001). In excess of 40 shipping lines visit the Port of Melbourne, providing access to over 300 ports around the world (Seafreight 2001). The Port of Melbourne operates 24 hours a day, 365 days a year.

In the financial year 1999-2000, over 6800 commercial ships transited Port Phillip Heads – or approximately 19 vessels per day (Larcombe et al. 2002). Added to these are the multitude of commercial and recreational fishing, sailing and sightseeing vessels that transit the heads or sail on waters either side of the heads. A ferry between Queenscliff and Sorrento links either side of Port Phillip.

The majority of bulk cargo ships, container ships and tankers are piloted through Port Phillip Heads and along the navigation channels within Port Phillip. For vessels entering Port Phillip, pilots are placed on board at the boarding ground – some three miles off the heads for bulk cargo and container ships and five miles off the heads for tankers – and remain with the vessel until it has docked. Similarly, for outgoing vessels the pilot remains on board until it has cleared Port Phillip Heads.

The Victorian Channels Authority (VCA) is responsible for the management of the movement of commercial shipping, and the provision and maintenance of commercial navigation channels and navigation aids in the port waters of Port Phillip Bay, including Melbourne and Geelong (Map 30) (VCA 2001). Provisions in place by the VCA to ensure safe movement within shipping channels in the Bay include:

- a vessel of less than 20 m in length or a sailing vessel must not impede the passage of a vessel which can safely navigate only within a narrow channel or fairway[6]
- a vessel engaged in fishing must not impede the passage of any other vessel navigating within a narrow channel or fairway
- vessels are required to proceed at a safe speed so that they can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions
- a vessel must not cross a narrow channel or fairway if such crossing impedes the passage of a vessel which can safely navigate only within such a channel or fairway
- a vessel should avoid anchoring in a narrow channel.

Large vessels constrained by their draught[7] are required to navigate with particular caution with full regard to their condition. It may take a modern, large oil tanker of 240 000 deadweight tonnes more than 20 minutes and up to about 4.8 km (three miles) to stop from the moment that the engines are put astern (Kavanagh 2001), though this size vessel does not as yet visit Port Phillip.

Harbour Master Directions play a major role in assisting navigation and ensuring shipping safety within Port Phillip Bay and through Port Phillip Heads. This includes ensuring that the heads are closed to all other traffic when a large ship is navigating them, and maintaining radio and signal contact with vessels.

Commercial fishing boats, yachts and recreational vessels often keep close company and can form a

[6] "Channel" or "fairway" means that part of the body of water within the port waters of Geelong and Melbourne of sufficient depth to be used by vessels of commerce for navigation.

[7] The term "vessel constrained by her draught" means a power-driven vessel which because of her draught in relation to the available depth of water is severely restricted in her ability to deviate from the course it is following.

hazard to larger vessels. There are 28 yacht clubs and four marinas in Port Phillip, with ten or more yacht races passing through Port Phillip Heads during any twelve-month period (Larcombe et al. 2002). The Southern Squid Jig Fishery also operates just out from the heads and innumerable recreational craft frequent the area, especially on weekends.

Large vessels have limited manoeuvring options available to them (Kavanagh 2001) with specific codes of conduct in place for a range of activities, from recreational through to the conduct and participation in regattas, contests or races. The Harbour Master may approve or change these codes of conducts, and may suspend or cancel events in the interest of safety and commercial operations.

Applications to run a sailing event in Port Phillip Bay need to be lodged with the Harbour Master not less than one week before the event for which approval is being sought. The application must contain, amongst other things, the course and waypoints for the event; the proposed start and finish dates and times; the approximate number of boats expected to take part and the size and type of boats expected to take part.

The Victorian Channels Authority has put in place appropriate risk management processes and cost effective measures which recognise the need for multiple-use access and the expectations of users, the special needs of large commercial ships and the potential for collisions. Over the past couple of years there have been no major shipping incidents in the Port Phillip Heads area.

Nature-based tourism

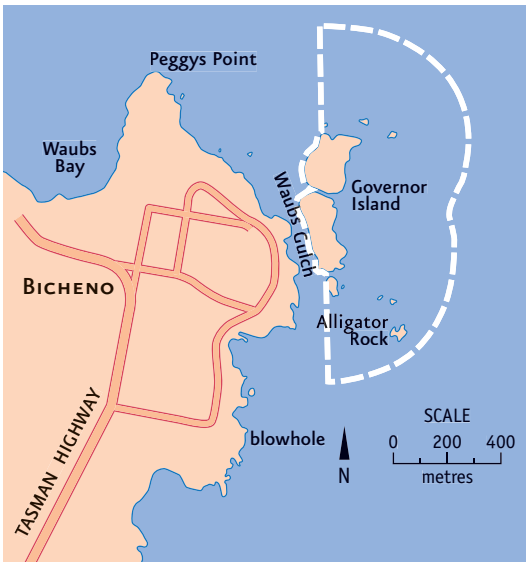
Bicheno is a small regional town located on Tasmania's East Coast approximately 195 kilometres north from Hobart. The town is one of Tasmania's most popular and important holiday locations combining the mild east coast climate, spectacular coastal vistas and a range of coastal and marine visitor attractions.

At the turn of the 1800s sealers and whalers used Waubs Boat Harbour, as Bicheno was then known, as a shelter for their boats. The town was later settled as a coal mining port in 1854 with the coal being pulled by horses along a five kilometre tramway from the Denison River mines. Today, Bicheno is still a relatively important fishing centre, the home of many lobster and abalone fishing boats.

The local economy of Bicheno has increased with tourism (particularly dive tourism) since the establishment of the Governor Island Marine Nature Reserve (Baker 2000).

The Governor Island Marine Reserve was declared in 1991 for its recreational, aesthetic and biodiversity values and it forms part of Tasmania's system of marine protected areas (Map 31). It has been assigned the overall IUCN category IV – Habitat/Species Management Area – managed mainly for conservation objectives. Management is a joint intervention between the Tasmanian Parks and Wildlife Service and the Marine Resources Section of the Tasmanian Department of Primary Industry, Water and Environment.

Map 31:
Bicheno and Governor Island Marine Reserve. *Source: DPIWE.*



The Reserve is 50 hectares in size and approximately 1.5 kilometres long. It includes the island itself, Alligator Rock and all waters 400 m eastward from the shoreline of Governor Island. The Island is an important sea-bird rookery and one of Tasmania's largest breeding populations of crested terns nest there (TPWS 2002). Sheer rock walls, deep fissures and caves are found underwater and these provide an important habitat for an unusually diverse range of marine communities. Spectacular displays of mobile and sedimentary invertebrates are found in the area and numerous fish species are abundant including zebra fish, boarfish, red gurnard, perch, parrot fish, leatherjacket, banded morwong, marble fish and globe fish. The rocky reef drops steeply into deep water in an area with strong currents. In these waters, sea snakes and turtles arrive from the tropics following the warm East Coast Current. The Reserve and surrounding waters are of scientific interest and provide first-class diving. Productive fishing for reef fin-fish occurs in the adjacent areas outside the Reserve.

Bicheno's emerging nature-based tourism industry

Bicheno forms part of the journey along Tasmania's By the Sea tourist route where the Governor Island Marine Nature Reserve, Bicheno Sealife Centre, adventure tours, penguin watching, diving, fishing and seafood are all marketed as attractions in the area. The locally operated visitor centre is now one of the most popular in the State.

One fisher who has moved from fishing into tourism is Phillip Gough (Rigney 2001). As a Bicheno fisherman Phillip harvested crayfish, sharks and then scale fish including orange roughy. Rigney (2001 P.58) reports that Phillip then moved into the live fish trade when "the big boats came in without catch restrictions, harvesting the orange roughy almost out of existence". At the time, banded morwong and parrotfish were not considered delicacies. However, in the past 20 years these fish have become increasingly popular and they are flown out live from Australia to Asian restaurants. Today, Phillip uses his local knowledge of the sea to introduce visitors to the unique marine life in and around the Governor Island Marine Nature Reserve. His Glass Bottom Boat marine guiding business has operated for the past five years and illustrates how one person has benefited from innovative sustainable development by redirecting his industry focus from fishing to tourism in order to meet the demands of an environmentally conscious consumer market. Bicheno is increasingly focusing its tourism effort into promoting nature-based tourism experiences.

Regional examples

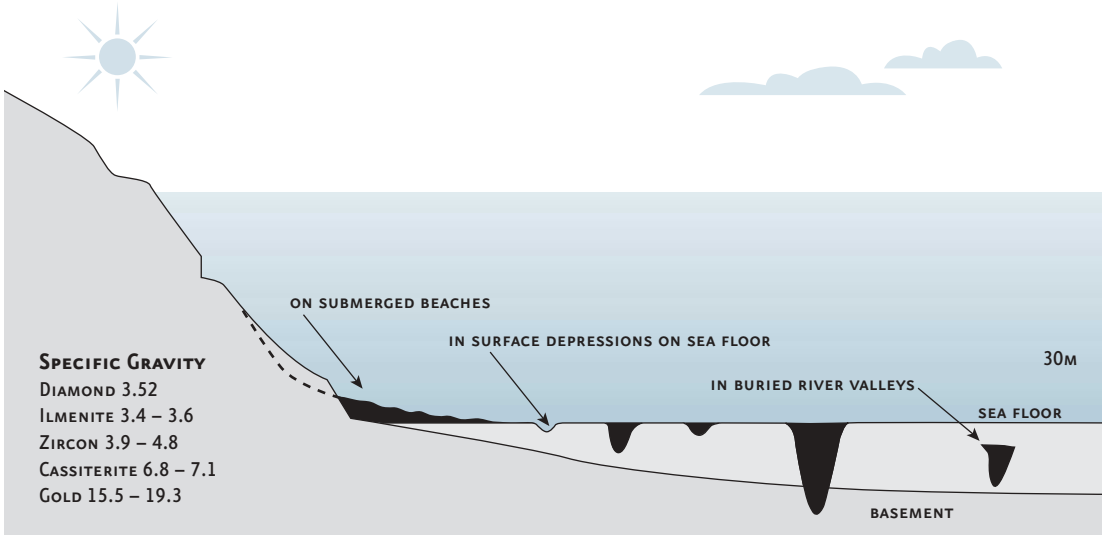
The Tinderbox Nature Reserve, an underwater interpretive nature trail in Tasmania is another example of nature-based tourism, offering an 'experimental' education program that fosters stewardship of the marine environment.

Likewise, the Annulus (Popes Eye) Marine Reserve in Victoria, an artificial blue stone reef MPA covered in sponges, ascidians, soft corals, bryozoans, sea fans and many fish species, has become one of the most popular snorkelling and diving sites near Melbourne. It is estimated that this Reserve along with the surrounding Port Phillip Heads Marine Park attracts 80% of Victorian charter boat diving, with a combined recreational and commercial dive value in the millions per year (Baker 2000). Many smaller MPAs, including sanctuaries and shipwrecks, also provide a valuable contribution to tourism. MPAs also offer benefits for education and are environments of scientific interest.

Defence activities and mineral exploration off south-eastern Kangaroo Island

Mineral exploration begins with seismic surveys to locate geological features that may host potential productive sediments (Sait 1997). Minerals such as diamonds, gold and tin form in deposits of gravel or similar material as a consequence of the specific gravity and the resistance to weathering. Known as placers, these minerals tend to be concentrated in present or former river channels and beaches (Figure 22) (Cook & Taylor 1997).

Figure 22:
Environments of offshore placer mineral occurrence. *Source: Cook and Taylor, 1997, p.2. (Modified from Cronan, 1992)*



Marine placers are usually mined using dredges though there are five basic components of offshore placer mining equipment to consider:

- method for digging or excavating – this will largely depend on the type, extent and thickness of the deposit
- method of lifting – influenced very much by the water depths and the required production
- type of dredging platform – influenced by the selection of excavation method and the anticipated weather conditions
- the treatment plant – directly dependent on the nature of the deposit and the sales specifications
- disposal of waste materials and products from the dredge (Sait 1997).

Most commercial placer mining operations take place on the beach, including the intertidal zone. However, improved exploration methods and mining techniques now allow for mining to about 600 m depth. Successful offshore diamond mining operations exist off the west coast of South Africa and Namibia. In addition, offshore diamond exploration has taken place in the Joseph Bonaparte Gulf off north-western Australia.

The peak legislation for the mining of offshore minerals in Commonwealth waters is the *Offshore Minerals Act 1994* (Cth). Exploration licences under the Act are granted for an initial term of four years, though they

may be renewed for a further specified period upon application. A licence entitles the holder to explore for, and take samples of, minerals in the specified licence area. Exploration licences are generally mineral specific and authorise any activity that is directly related to exploring for minerals, including bathymetric and seismic surveys, core drilling and grab sampling.

In September 1996 Carnegie Minerals NL applied for minerals exploration licences to explore for diamond deposits off south-eastern Kangaroo Island. The area of interest coincided with the exercise areas R296A and R296B, administered by the Department of Defence. These areas were used for radar tracking and firing exercises for the experience and retention of skills (Map 32).

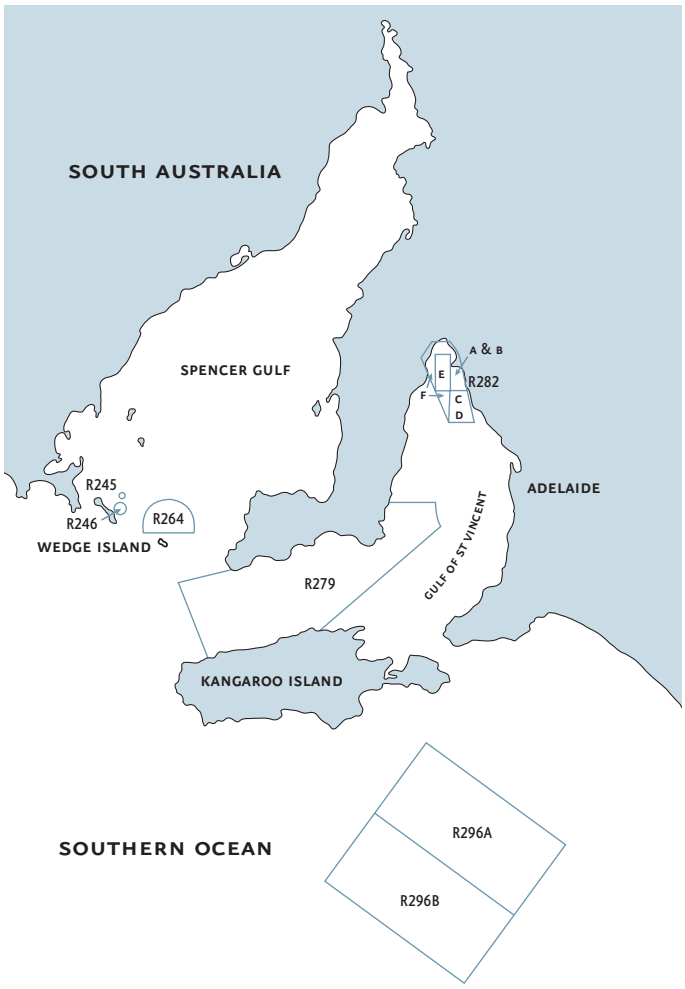
The Department of Defence was notified of the company's interest in exploring for offshore diamonds. The Department reviewed the area and indicated that it had no objections to the issuing of the mineral exploration licences being issued. However, it sought a caveat on the licence requiring the company to notify Air Force Headquarters at least 30 days before commencing exploration operations in the area.

Naval Maritime Headquarters also requested that when exploring in waters deeper than 27 m that it be notified of the proposed location and timing of the exploration.

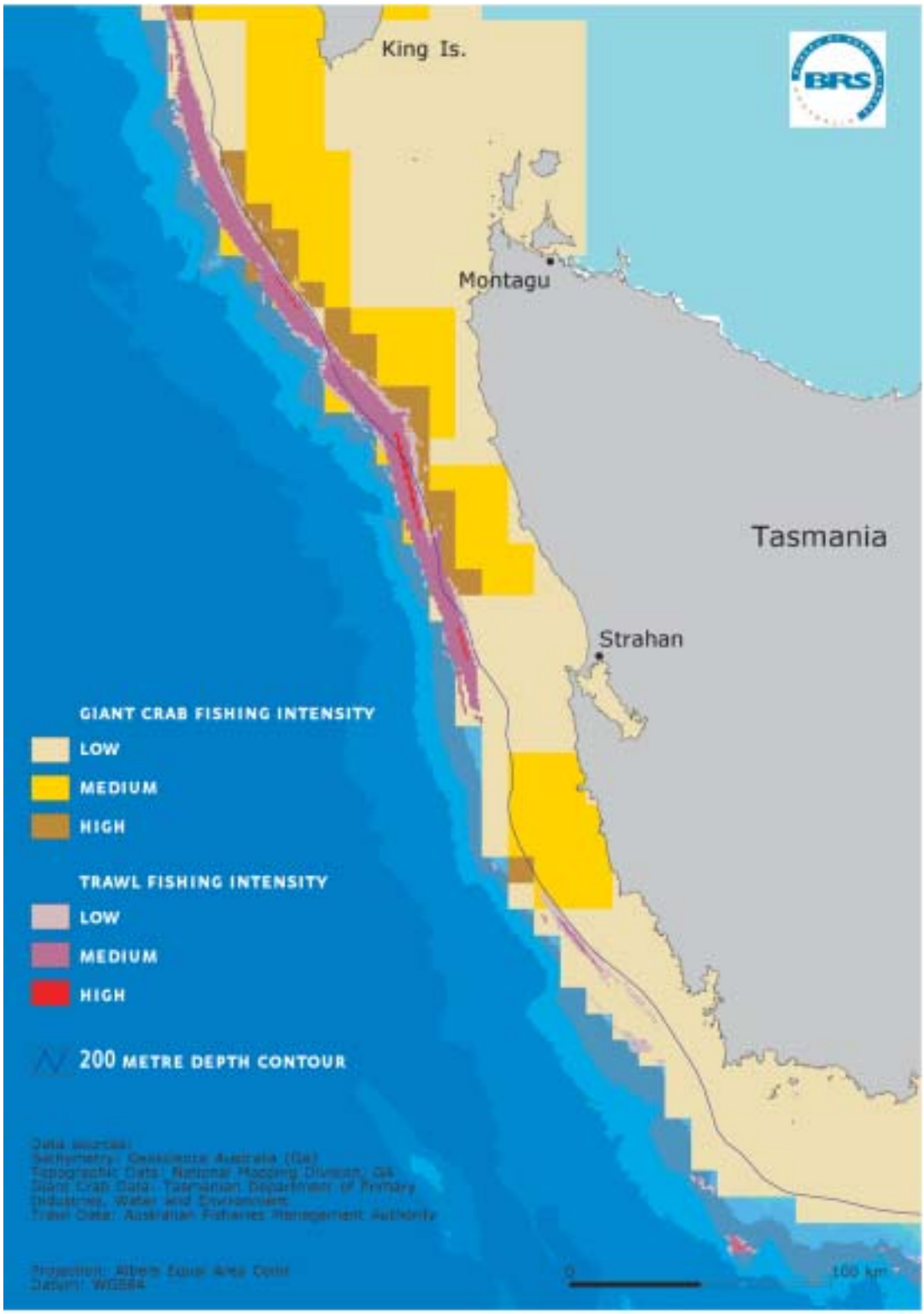
The Department of Defence also indicated that should mining prove to be commercially viable, it would need to move its training areas. This would involve negotiations between Defence and other Federal and State authorities.

As it turned out, the company withdrew all seven licence applications in August 1997, stating that it wanted to concentrate on its onshore activities. The Defence exercise area R296 (A and B) was also revoked in 1998.

Map 32:
Previous defence exercise area. *Source: Australia's Hydrography Office.*



Map 33:

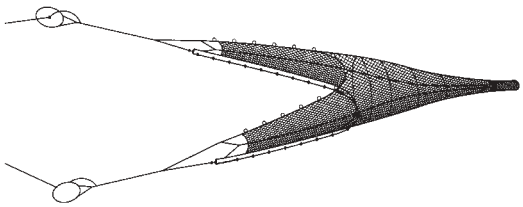

King Is.
Montagu
Tasmania
Strahan
GIANT CRAB FISHING INTENSITY
LOW
MEDIUM
HIGH
TRAWL FISHING INTENSITY
LOW
MEDIUM
HIGH
200 METRE DEPTH CONTOUR

Giant crab and South East Trawl Fisheries off western Tasmania

The South-east Marine Region includes the majority of the waters of the Commonwealth South East Trawl Fishery. The South East Trawl Fishery covers scallop, squid, gillnet, dropline and pelagic longline fishing. The fishery provides an important source of food, employment, trade and economic well-being for coastal communities and the wider Australian population. In 1999 the fishery catch in the area of the South East Marine Region was about 23 000 tonnes worth about $45 million (Larcombe et al. 2002). More than 100 species are taken by the fishery, though 17 species or species groups provide the bulk of the catch .

Demersal (bottom) trawls (Figure 23) work along the seabed in water depths in excess of 1500 m, but are generally used above 1000 m. The trawl boards, sweeps, lower bridle and ground gear are in contact with the seabed. The net is held open horizontally by trawl (otter) boards. These boards are hydrodynamically designed to spread the sweeps, bridles and wing nets as the gear is dragged along the seabed. These in turn herd the fish towards the net. The fish then swim ahead of the net until they tire and fall back into the net proper and are retained in the codend. The length of bridle and the buoyancy of plastic floats attached to the headline provide the net's vertical opening. A similar configuration is used for mid-water trawling.

Figure 23: *Demersal trawl.*



The major trawl grounds in the South-east Marine Region are reasonably well defined in terms of their proximity to the edge of the continental shelf. One of the main areas is off western Tasmania north of Strahan. Boats fishing in these waters target the winter spawning run of blue grenadier (*Macruronus novaezelandiae*). Trawling in this area targets larger mature fish than other sectors of the fishery. The area has also relatively productive trawl grounds for spotted warehou (*Seriolella punctata*) and other species are taken as a bycatch. Blue grenadier is now primarily taken by large factory trawlers, filleted, frozen, boxed and then exported to Europe and the United States.

These same waters are also productive areas for the Tasmanian Giant Crab (*Pseudocarcinus gigas*) Fishery. The fishery is comparatively small with a total allowable catch of 100 tonnes in Tasmanian jurisdictional waters. However, it is of comparatively high value, with the landed valued estimated to be between $2.5 and $3.5 million at first point of sale (DPIWE 2001b). Giant crabs occur from shallow coastal waters to depths in excess of 400 m. Most fishing occurs between 300-400m on the upper part of the continental slope (Larcombe et al. 2002). Giant crabs are caught using traps with a line to a surface float. Once set they stay in the same position until retrieved by a mechanical line hauler.

The Giant Crab Fishery in Tasmania began in 1992. Before then giant crabs were taken as a bycatch of the rock lobster, shark and trawl fisheries. The virgin stock has since been fished down and the fishery is now fully exploited. In the short life of the fishery it has moved from effectively open access to limited entry and then to individual transferable quotas. Jurisdictional responsibility has also transferred from the Commonwealth to Tasmania. The Tasmanian Giant Crab Fishery is managed as a single zone covering all waters off Tasmania.

In Tasmania, production peaked in 1994 at about 260 tonnes and catches have generally declined since then. The current total allowable catch (TAC) of 100 tonnes is thought to be sustainable at least in the short term (DPIWE 2001b).

The giant crab industry comprises 95 fishing licences and 1035 quota units. Currently there are about 20 vessels participating in the fishery. The remaining 75 licences lease their quota to the 20 vessels fishing in the fishery, though 90% of the catch is taken by only 10 vessels (DPIWE 2001b), primarily fishing off Tasmania's west coast. Significant catches of giant crab also occur off Portland and Cape Otway in Victoria and east of Flinders Island. About half of the catch is exported live to overseas markets principally in Hong Kong and China. The other half is sold in the restaurants of Sydney and Melbourne.

The differing gear used for the crab and trawl fisheries may result in conflict where the gears clash. For example, trawl operators may steam through an area where pots have been set and snag the lines attaching

the pots to the surface marker buoy or the pots themselves. In the past such incidents would have been resolved either on the water or more frequently on the wharf with little attention to polite language. Fights and vandalism of gear were known to occur.

Today, disputes over gear conflict are now handled in a peaceful and constructive manner through proper negotiation in industry forums with the assistance of dedicated industry associations.

Professional associations and industry groups now represent commercial fishers in most sectors. The Tasmanian Rock Lobster Fishermen's Association (TRLFA) represents the giant crab industry at all levels. The industry's views are presented to Government through a statutory advisory committee structure, including the Crustacean Fisheries Advisory Committee (CFAC), which has representatives from DPIWE Marine Resources, Industry, Fisheries Scientists and the Marine Police. The TRLFA is also closely affiliated with the Tasmanian Fishing Industry Council (TFIC), which is the peak commercial fishing body in Tasmania. TFIC's objectives include:

- uniting all sections of the fishing industry in Tasmania for their common benefit
- to present the views of a cohesive Tasmanian fishing industry at a Commonwealth level
- promoting efforts within the industry for the solving of common problems (TFIC 2001).

TFIC provides for effective communication between commercial fishermen, marine farmers and fish processors and makes representations on their behalf to the Tasmanian and Commonwealth Governments (Lister 2001).

Similarly, all operators in the trawl sector of the South East Fishery are represented by the South East Trawl Fishing Industry Association (SETFIA). SETFIA has developed a voluntary Code of Conduct for Responsible Fishing in the South East Trawl Fishery (SETFIA 2000). The Code sets out a strategy for responsible fishing and fisheries activities, taking into account all their relevant biological, technological, social, economic, environmental and commercial aspects. The Code recommends resolving disputes in a timely, peaceful and cooperative manner. In addition, the Code recommends that when target fishing, trawl duration should be kept to a minimum. It also reinforces the need to fish with due regard to the safety of fishers, the IMO International Regulations for Preventing Collisions at Sea, as well as its provisions for the organisation of marine traffic, protection of the environment and the prevention of damage to or loss of fishing gear.

Offshore Petroleum coexistence with tourism, conservation and Indigenous peoples

The waters off the Victorian coastline support a large tourist industry and incorporate natural, social and cultural heritage values. The Port Campbell National Park, containing the 12 Apostles (one of Australia's tourism icons) along a spectacular coastline, is the most popular tourist attraction outside Melbourne. Over two million people visit the Great Ocean Road annually (Corangamite Shire 2001). Tourism is vital to the economy of the area.

Port Campbell National Park

The Port Campbell National Park was proclaimed on 5 May 1964. The Park extends some 17 km eastwards and 48 km westwards along the coast from township of Port Campbell. The Park is assigned the IUCN Category II (National Parks) of the United Nation's List of National Parks and is managed primarily for ecosystem conservation and appropriate recreation. Sections of Port Campbell National Park are also listed on the Register of the National Estate, recognising the area's outstanding natural and cultural values, and its importance as part of Australia's heritage. The park provides for a wide variety of tourism experiences, including lookouts, boardwalks and interpretation facilities overlooking the spectacular coastal scenery.

Gas field development

BHP Billiton's Minerva gas field development is located in the southwest of Victoria near Port Campbell. The field will supply gas to a new fertiliser plant to be located near Geelong. The Minerva Project is a joint venture between BHP Billiton (90%) and Santos (BOL) Ltd (10%). An environmental impact assessment was undertaken in consultation with the community, government and other stakeholders.

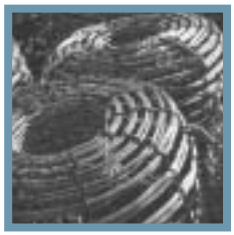
The project consists of two offshore gas extraction wells located 60 m underwater and approximately 11 km offshore. Pipelines connect the wells to an onshore gas processing plant that will treat the gas before it is sent to Geelong. Consultations between BHP Billiton and the community, government and other stakeholders have resulted in the Minerva project being designed with special regard to visual amenity, environmental sensitivity and cultural and tourism values of the area.

The field itself is to be developed with a sub-sea structure rather than other methods, such as the fixed petroleum platforms, that could have been visible from the shore.

The gas pipelines will travel 10 km underwater, cross the shore at Two Mile Bay, then continue a further 4.5 km inland to the gas plant (BHP 2000). Two Mile Bay is one of seven Special Protection Areas in the Park and is significant for its geology, wetlands, small mammal diversity and Aboriginal middens (Parks Victoria 1998).

The pipelines will be built across the shoreline of the Port Campbell National Park using the horizontal drilling technique to minimise environmental impacts and disturbance to sites of cultural and heritage significance in the park. The horizontal drilling technique will avoid impacts on the dune system, which is known to contain a shell midden, and the physical beauty of the Two Mile Bay Special Protection Area.

Discussions held between BHP Billiton, the Framlingham Aboriginal Trust, the Kirrae Whurrong Native Title Group and the Victorian Government led the way for Victoria's first Indigenous Land Use Agreement to allow BHP Billiton to construct the pipeline (NNTT 1999).



Commercial fish species targeted by different sectors

Blue warehou *(Seriolella brama)* are found in the continental shelf and upper slope waters throughout south-eastern Australia. The species is also found in New Zealand waters. Adults are caught in depths to 500 m, although most commercial catches occur from 50 to 300 m. Its diet consists of jellyfish and small invertebrates (DPIWE 2001a).

Blue warehou is currently considered to be a single stock for fisheries assessment and management purposes. It is a highly mobile species with a broad distribution of breeding locations (DPIWE 2001a). Juveniles and sub-adults form large schools and migrate through certain areas of the Region during summer and autumn, especially along the north and southeast coasts of Tasmania (DPIWE 2001a) and western Victoria.

The species is known by many names throughout the Region. Some of the more common local names include sea bream, snotty trevalla, snotties[8] and Tassie trevally, or combinations of nearly all of the above. It is a targeted fish throughout the Region by Commonwealth licensed commercial fishermen using both trawl and gillnet, Tasmanian State licensed fishermen using gillnets, and Victorian and Tasmanian anglers using rod and reel and gillnet (Tasmania only). An unknown, but small catch of blue warehou is probably also taken in the NSW State-licensed fish trawl fishery. The species is also taken as a bycatch by Commonwealth shark fishers and by State fishers targeting other inshore fish species.

Blue warehou are reported to grow between 65 cm (BRS 1999) to 76 cm (DPIWE 2001a) and over 7 kg in weight (at about 10 years old). They are a rapidly growing fish reaching around 25 cm length in their first year. Spawning occurs in western Bass Strait in winter and spring, and there is some evidence that they become mature from about 32 cm in length (DPIWE 2001a), which they reach at about 3-4 years of age (BRS 1999).

The Global TAC for blue warehou

The trawl fishery for blue warehou in all waters of the South-east Marine Region, excluding coastal waters off southern NSW, is managed as part of the Commonwealth South East Trawl Fishery. Blue warehou is one of a multitude of fish taken by the trawl fishery, though it is one of 16 species or species groups, under quota management, including the setting of a total allowable catch (TAC). A TAC is also in place for the take of blue warehou by the Commonwealth Non-trawl Fishery where blue warehou is targeted by gillnets.

To manage the total take of blue warehou across the trawl and non-trawl sectors the Australian Fisheries Management Authority (AFMA) has introduced a 'global TAC' of 750 tonnes for 2001. This is allocated between the two sectors – 307.5 tonnes for the trawl sector and 442.5 tonnes for the non-trawl sector (AFMA 2000b). This is well below 1999 TAC of 1750 tonnes[9].

In 2000, 71 trawl operators and 21 non-trawl operators recorded catching blue warehou out of 81 and 34 permanent quota holders respectively. However, the number of quota holders increased to 100 for trawl and 35 for non-trawl due to seasonal leases of quota within the sectors (Spence 2001). As of 1 January 2001 seasonal leasing of quota between the Commonwealth trawl and non-trawl sectors is permitted[10] which technically allows either sector to take the full quota.

The Tasmanian blue warehou fishery

In South Australia and Victoria an Offshore Constitutional Settlement arrangement provides for the Commonwealth jursidiction of blue warehou inside three nautical miles. Such an arrangement does not exist in Tasmania and as such the State manages its own commercial fishery targeting blue warehou and other species. This fishery, the Tasmanian Scalefish Fishery, only occurs in the coastal waters around the State. Catches of blue warehou in the Fishery are primarily by gillnet and have varied between 119 and 360 tonnes over the past decade or so. However, catches during 2000 were only 95 tonnes (BRS 2000). There are currently 431 licences (2000/2001 season) (DPIWE 2001c), though not all have gillnet entitlements.

[8] These fish have a mucous film covering their bodies (hence the name 'snotties'). It has been speculated that this slime may be an adaptation to protect against the stinging cells of jellyfish which juveniles shelter under, and adults later feed upon.

[9] The 1999 TAC rose to 2107t with the inclusion of 'carryover' of uncaught quota from the previous year. The equivalent 'carryover' quota for 2001 is 1117t (474t trawl, 643t non-trawl), approximately double the catch achieved in 2000 (BRS 1999).

[10] At this stage permanent transfer between the two sectors is not possible due to the different nature of the access rights between the fisheries (AFMA 2000a).

Recreational fishers

Blue warehou is a popular recreational fish in north-western Tasmania, particularly from wharves such as at Stanley. Recreational fishermen catch sub-adult blue warehou in large bays and estuaries. They are normally caught during the colder months of the year on rod and reel using baits of prawn, rock lobster or fish flesh. In Tasmanian waters recreational fishermen also use gillnets[11] to catch warehou (BRS 2000).

The overall Tasmanian recreational fishery catch of blue warehou is unknown but the gillnet component of the catch was recently recorded as 116.3 tonnes.

In Tasmania there is a minimum size limit for blue warehou of 250 mm which applies to both commercial and recreational fishermen. In addition, there is a daily bag limit for recreational fishermen off Stanley wharf of 20 fish per person and a possession limit[12] of 30 per person. There are also restrictions on mesh size, net length and depth[13] and closed areas when using gillnets (BRS 2000). Due to the increase in the number of gillnets by almost 25% since 1995 (when licences were first issued and thus data recorded) there was growing concern about the sustainability of local populations of some species. This has led to proposals that the number of graball nets allowed per person should be reduced from two to one from 1 November 2002. In addition, the minimum mesh size for graball nets is proposed to increase from 100 to 108 mm from the same date for both recreational and commercial fishing.

In Victoria there is no minimum length size for blue warehou but there is a bag / possession limit of 20 fish per person (NRE 2001). The overall recreational catch of blue warehou in Victorian waters is unknown. There are no bag limits for blue warehou off either South Australia or NSW, though the numbers taken are probably very small.

Blue warehou as bycatch

Following the most recent series of Offshore Constitutional Settlement negotiations between the Commonwealth and South Australian and Victorian Governments, State licensed fishers who do not hold Commonwealth fishing entitlements are permitted a bycatch of blue warehou as part of their normal State fishing operations. The allowance of 100 kg of blue warehou per trip is to cover for the incidental (non-targeted) catch of blue warehou without these fishers needing to hold Commonwealth entitlements (including quota) for the occasional fish taken, or to discard the fish. As at 30 June 2000 there were 522 licences in the Victorian Ocean Fisheries Fishery and 436 licences in the South Australian Marine Scalefish Fishery, though only a small number of the South Australian fishers operate within the area of the South-east Marine Region.

In Tasmania, 315 licensed rock lobster fishermen are entitled to use up to 200 hooks and 150 metres of gillnet in waters off Tasmania to take species other than rock lobster. Blue warehou, however, are rarely taken as part of this entitlement.

Off southern NSW, an unknown number of blue warehou may be taken in coastal waters (within three nautical miles) by up to 50 State licensed fishers in the Fish Trawl Fishery and by methods other than trawling[14] out to 80 nautical miles. Trip limits to compliment the South East Trawl Fishery management arrangements are in place.

Commonwealth Southern Shark Fishery entitlement holders are allowed to take blue warehou as a bycatch but must take less than 100 kg per trip. However, if they also hold a South East Non-trawl or Trawl Fishery entitlement, all catches of blue warehou need to be covered by quota. During 2000, there were 24 southern shark gillnet operators who recorded taking blue warehou.

[11] From a Tasmanian Government management perspective, gillnets include graball and mullet nets.
[12] Possession limits apply to everywhere, including the car and the home freezer.
[13] Commercial fishers are permitted a net depth of up to 50 meshes (though there are some variations to this to cater for nets with smaller mesh sizes etc). Recreational fishermen are permitted up to 33 meshes.
[14] Noting that gillnets are banned off NSW.

Different gear allowing different catches

In April 2000 there were 39 gillnet concessions in the South East Non-trawl Fishery. The mesh size for gillnets used in the Fishery corresponds to those in the Southern Shark Fishery and limits operators to a mesh size between 150 and 165 mm. This compares to the 100-140 mm (new 108 mm minimum size proposed) minimum mesh size restriction for Tasmanian gillnets. The South East Trawl Fishery also has a mesh size restriction in place, with operators restricted to a minimum mesh size of 90 mm. These variations in mesh size allow a wide spread of age groups to be taken across the Region.

A global catch control process

In July 1996, the Standing Committee on Fisheries, consisting of the heads of State, Territory and Commonwealth fisheries agencies, supported the development of a global catch control process for species managed by more than one jurisdiction. A global catch control will set a sustainable catch limit across all jurisdictions and sectors. Each jurisdiction would then manage its sector(s) to ensure that its component of the global catch was not exceeded. Although the Standing Committee agreed to the trialing of a global catch control process for two species (blue warehou and pilchards), no trial was subsequently undertaken and the concept of a global catch control has not been advanced.

The 1999 catch of blue warehou by the Commonwealth trawl and non-trawl sectors was 643 tonnes (355t trawl, 288t non-trawl), worth $1.8 million. The 2000 catch declined to 516 tonnes (434t trawl, 82t non-trawl) with agreement that the resource had declined since the early 1990's (BRS 2000)

Although the Commonwealth has reduced its TAC across the trawl and non-trawl fisheries for blue warehou there are no limits on the Tasmanian State fishery catch and there are many State and Commonwealth licensed fishers who can take blue warehou as a bycatch of their operations. Recreational catches are also managed in a way to share the resource (eg limit of 20 on the Staley Wharf) rather than limiting the overall take for species conservation purposes.

Blue warehou was assessed in the Bureau of Rural Sciences (BRS) Fishery Status Report 2000 as being currently overfished with declining catches. 'Overfished' is defined as a fish stock for which levels of fishing or catches are excessive, or which still reflect the effects of prior excessive fishing. In the former case, yields may be higher in the long term if the fishing level is reduced in the short term. A classification of 'overfished' may continue after reduction of fishing levels while the stock rebuilds to a desired level or until resumption of fishing is acceptable (BRS 2002). This assessment changed from the 1999 status report for blue warehou of fully fished, where current catches of a fish stock are close to optimum sustainable levels.

The South East Fishery Assessment Group, the main scientific advisory group for the South East Fishery, has recognised the problem of needing information across all sectors of the fishery in order to provide effective advice to management. It has stressed that some of its high priority research areas with respect to basic data needs and collection for blue warehou were:

- collecting independent scientific annual data across all sectors and areas
- approaching Tasmania for annual size and age-composition information from the inshore fishery
- obtaining estimates of the total recreational catch (Smith & Wayte 2000).

Without this information, and effective cooperative management by Commonwealth and State Governments across all jurisdictions in the Region, the risk of blue warehou catches across the Region will decline even further.

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National Oceans Office

Level 1, 80 Elizabeth St, Hobart

GPO Box 2139, Hobart, Tas, Australia 7001

Tel: +61 3 6221 5000 Fax: +61 3 6221 5050

www.oceans.gov.au

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