

in the Derwent Estuary, but its population collapsed in last decade. The cause of this decline is unknown, but the northern Pacific seastar has been identified as a possible factor.

Introduced species

A number of introduced species have been identified in the Derwent Estuary, some of which have or may potentially have serious impacts on the ecology of the estuary; others may affect human health and public amenity as well. Some of these are listed in Table 7 below:

Table 7 Introduced species in the Derwent Estuary

Common Name	Species Name	Where Found
Northern Pacific Seastar	<i>Asterias amurensis</i>	middle and lower reaches
New Zealand seastar	<i>Patiriella regularis</i>	middle and lower reaches
New Zealand bivalve	<i>Venerupis largillierii</i>	middle and lower reaches
New Zealand screw shell	<i>Maoricolpus roseus</i>	middle and lower reaches
Pacific oyster	<i>Crassostrea gigas</i>	D'Entrecasteaux Channel
Japanese seaweed	<i>Undaria pinnatifida</i>	Tinderbox Marine Reserve
Rice grass	<i>Spartina angelica</i>	upper/mid Derwent
Toxic dinoflagellate	<i>Gymnodium catenatum</i>	middle and lower reaches

The most serious threat to indigenous vertebrate and invertebrate species in the Derwent Estuary is probably the result of introduced species, particularly the northern Pacific Seastar (*Asterias amurensis*). This species is thought to have been introduced via ballast water in the early 1980s. Surveys of *Asterias amurensis* in southeastern Tasmania in 1993/94, revealed that highest densities were found in the Derwent Estuary, particularly in the vicinity of Macquarie Wharf. In 1997, an estimated 27.7 million northern Pacific Seastars were thought to inhabit the estuary. These predators, which eat essentially anything containing protein and have very high fecundity, have dramatically reduced the numbers and species of benthic fauna in the Derwent (Australian Nature Conservation Organisation, 1996; pers. comm. L. Turner, Tasmanian Museum).

In addition to *Asterias amurensis*, massive numbers of the New Zealand seastar *Patiriella regularis* have colonised the Derwent Estuary, particularly near the Hobart wharves. These were probably introduced with New Zealand oysters early this century, and have almost completely replaced all indigenous *Patiriella* species in the Derwent. A New Zealand bivalve (*Venerupis largillierii*) is also found in large numbers, as is the New Zealand screw shell (*Maoricolpus roseus*), particularly near the mouth of the estuary (pers. comm. L. Turner, Tasmanian Museum).

3 Uses of the Derwent Estuary

3.1 Population centre

The first human occupation of the Derwent area is unknown, but aborigines are thought to have arrived in Tasmania over 35,000 years ago. Two aboriginal tribes inhabited the region surrounding the Derwent Estuary: the Oyster Bay Tribe on the Eastern Shore and the South East Tribe on the Western Shore. Both tribes were hunter-gathers and used the Derwent as a source of food, with shellfish as a major element of their diet (Ryan, 1996).

In 1793, Captain Willaumez of the d'Entrecasteaux/Kermadec expedition entered and surveyed the river, naming it 'Riviere du Nord'. One year later, Commodore John Hayes explored the river further and renamed it Derwent, a Celtic word meaning 'clear water'. Risdon Cove was selected as Tasmania's first European settlement in 1803, however, due to unfavourable conditions, the settlement was moved to Sullivans Cove in 1804, where it prospered and grew into the City of Hobart (ABS, 1995; Hepper, Marriott and Associates, 1985).

The Derwent Estuary is now the largest population centre in Tasmania, with a population of approximately 190,000. The majority live along the eastern and western shores of the middle estuary, in the metropolitan areas of Hobart, Glenorchy and Clarence, with smaller population centres at Taroona, Blackmans Bay, Kingston, Bridgewater, Brighton and New Norfolk. Six separate councils border on the estuary (see Table 8 and Figure 15); five of these comprise the Hobart Metropolitan Councils Association (HMCA).

Table 8 Local government areas - populations

Local Government Area	1994 Population	Proportion of State (%)
Brighton*	12,425	2.6
Clarence*	49,840	10.6
Glenorchy*	43,986	9.3
Hobart*	47,629	10.1
Kingborough*	26,994	5.7
New Norfolk	10,310	2.2
<i>Total</i>	<i>191,184</i>	<i>40.5</i>

* HMCA councils

(ABS, 1995)

3.2 Recreation

The Derwent Estuary is widely used for recreation both on and off the water. Most primary contact sports such as swimming, diving and windsurfing are restricted to the lower estuary. Secondary contact sports, including large and small boat sailing, motor-boating, paddling and rowing, are popular throughout the estuary. The Derwent is also a focus for foreshore recreation, with numerous parks, picnic areas and sports grounds.

Most sandy beaches, suitable for swimming, are situated south of the Tasman Bridge. Swimming from docks and rafts is also popular in the river at New Norfolk. The Derwent's main beaches are indicated in Figure 16; of these, Nutgrove, Kingston and Blackmans Bay beaches are the most intensively used western shore beaches, while Bellerive and Howrah beaches are more intensively used on the eastern shore. A number of beaches, particularly those further up-river, have elevated faecal indicator bacteria levels (see Section 6.4 for details). Windsurfers frequent Ralphs Bay and diving is popular towards the mouth of the estuary, particularly at the Tinderbox Marine Reserve. Water-skiing is also practised in the river near New Norfolk and at other sites around the estuary.

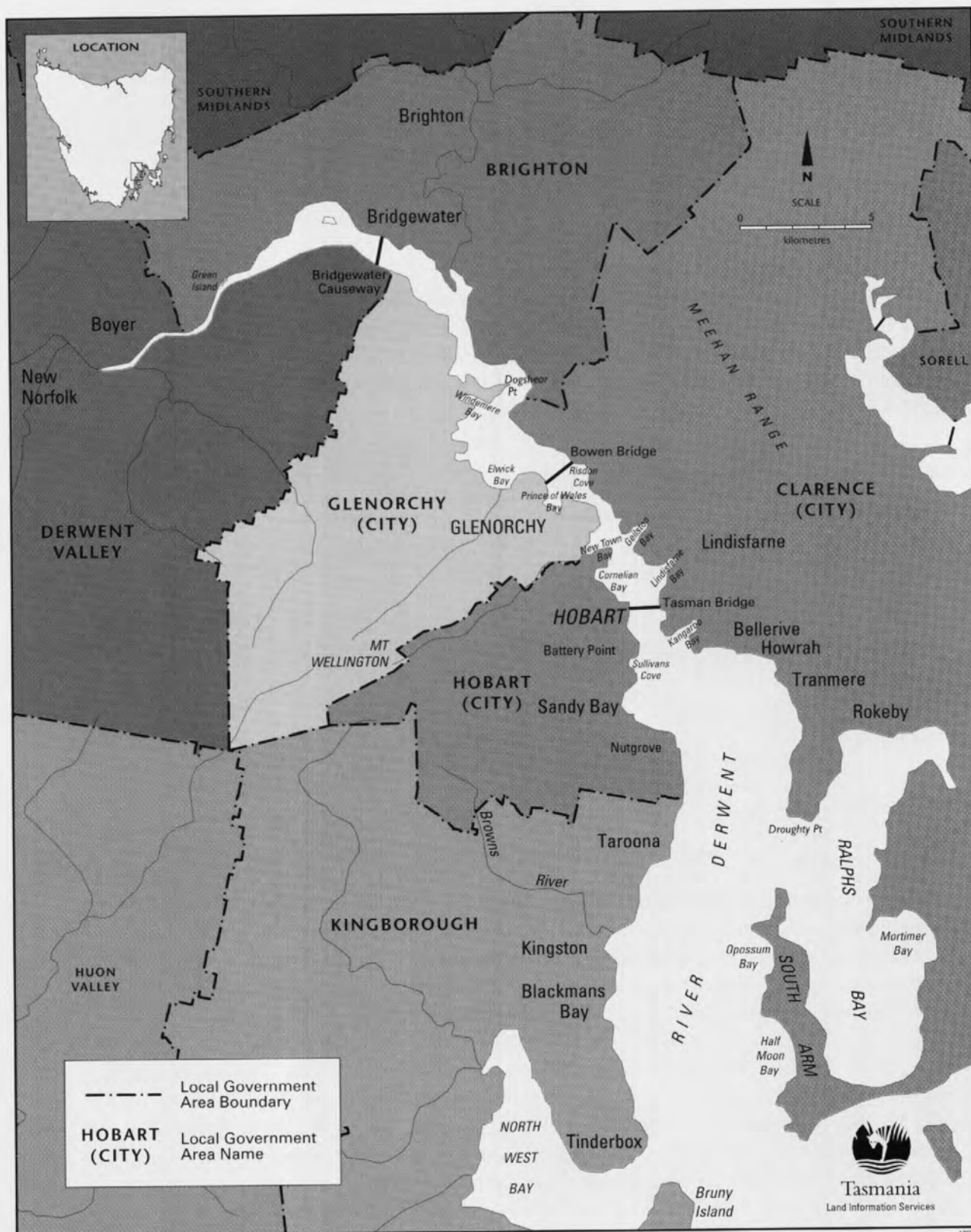


Figure 15 Local government areas

Recreational boating is very popular in the Derwent. Large and small boat sailing takes place in the middle and lower reaches of the estuary. In 1995/96, there were 12,352 registered pleasure vessels in southern Tasmania; the majority of these are based in the Derwent. Nine yacht clubs, two private marinas and numerous small craft anchorages provide slips, mooring and other facilities at sheltered sites throughout the middle and lower reaches of the estuary. Club races for boats of all classes are held on most weekends, and several regattas (Hobart, Sandy Bay and Bellerive) are held on long weekends in the summer. Larger boating events include the internationally renowned annual Sydney-to-Hobart Race, the Australian Wooden Boat Show (held every 2 years) and the Three Peaks Race. On average, the Sydney-to-Hobart Race attracts 140 to 150 vessels. The 50th Sydney-to-Hobart, held in 1994, attracted 370 yachts and more than 4000 participants. This single event was conservatively valued at \$100 million (ABS, 1995). As well as attracting national and international competitors, these events promote the Derwent as a central focus for local sporting clubs and the general community.

There are nine rowing clubs distributed throughout the Derwent at the sites indicated in Figure 16. Four of these are based at New Town Bay. Kayaking and canoeing are also popular, particularly in the river above New Norfolk. Motorboat racing is practised in some parts of the Derwent, particularly in its upper reaches, just downstream of New Norfolk.

Foreshore recreation occurs at numerous sites around the Derwent: these include parks, picnic areas, playgrounds, playing fields, golf courses and other sporting grounds, walking and bicycle tracks. Some of the more notable sites on the western shore include the Kingston Golf Course, Alum Cliffs Track, Nutgrove recreation area, Cenotaph, Queens Domain and Royal Botanical Gardens, Bike Path, Claremont Golf Course and Elwick Race Course. On the eastern shore, popular recreation sites include Geilston Bay Park, the Rosny foreshore and State Recreation Area, Bellerive and Wentworth Parks and South Arm.

3.3 Conservation areas

There are 10 major conservation areas situated along the Derwent Estuary between New Norfolk and the mouth of the estuary, as listed in Table 9 below. Eight of these are land-based; the remaining two (Derwent River Wildlife Sanctuary and Tinderbox Marine Reserve) are predominantly inter- or sub-tidal. The Derwent River Wildlife Sanctuary, established in 1941, is the largest conservation area in the estuary (1568 ha) and occupies most of the wetlands and mudflats below the high water mark between New Norfolk and Dogshear Point. In some areas, adjacent coastal reserves have been created, extending 30 m above the high water mark. No management plan has been developed for this reserve (ANM, 1995).

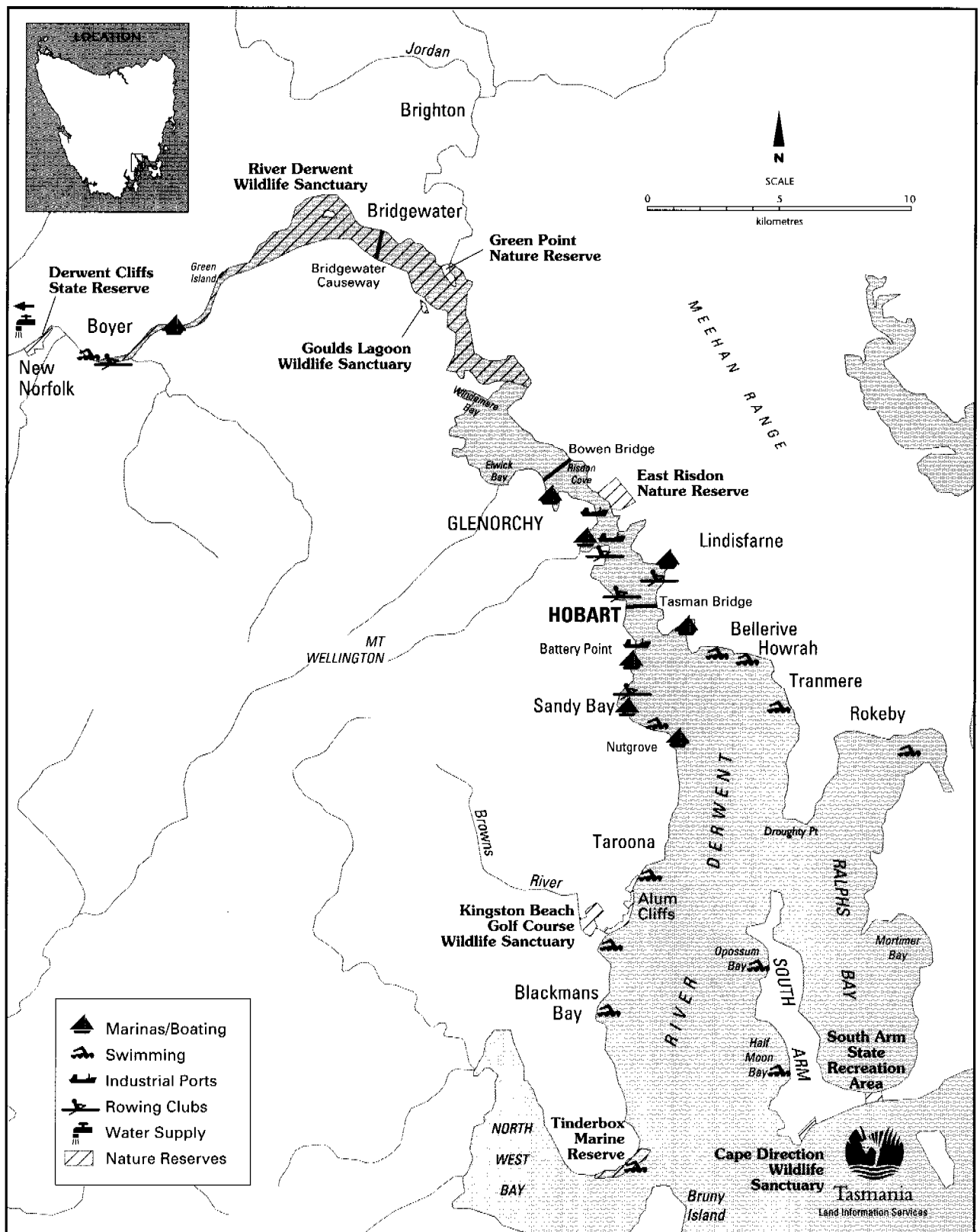


Figure 16 Uses of the Derwent Estuary

Table 9 Conservation areas around the Derwent Estuary

Name	Location	Area (ha)	Date Effective	Comments
Derwent Cliffs SR	Upper Derwent	5	9/1/52	scenic
Derwent River WS	Upper Derwent	1568	27/2/41	river, marsh; includes private lands; boundaries ill-defined
Green Point NR	East Shore	22	3/5/78	research station - old proposal
East Risdon NR	East Shore	88	17/3/71	rare eucalypts
South Arm SRA	East Shore	122	6/11/80	beaches and dunes
Cape Direction WS	East Shore	5	2/9/48	muttonbird rookery
Goulds Lagoon WS	West Shore	8	20/5/38	waterfowl; private land
Alum Cliffs SR	West Shore			scenic walking track
Kingston Golfcourse WS	West Shore	61	26/11/42	dry sclerophyll forest
Tinderbox MNR	West Shore	53	18/9/91	marine habitat

SR = State Reserve; NR = Nature Reserve; WS = Wildlife Sanctuary; SRA = State Recreation Area; MNR = Marine Nature Reserve

3.4 Heritage

The shores of the Derwent Estuary contain a very high density of aboriginal sites, predominantly shell middens and quarries. Sites with important European heritage values include Risdon Cove, Sullivans Cove/Battery Point, Royal Botanical Gardens, Government House, Mount Nelson Signal Station, Mulgrave and Alexandra Batteries, Kangaroo Bluff Historic Site and the Iron Pot Light.

3.5 Fishing

Fishing is second only to walking as a sport or physical recreational activity for Tasmanians. An estimated 30,900 Tasmanians fish regularly and 80% of these fish in salt water. A wide variety of species are landed: finfish account for 85% of the recreational catch, followed by crayfish (5%), squid (3%), abalone (2%), and others (scallops, crabs, mussels, octopus). In 1991/92, the total recreational catch was estimated at 1200 t (as compared to commercial catch of 37,500 t). Recreational fishing is also popular among visitors. In 1992, an estimated 7% of all visitors fished during their trip to Tasmania (27,500 people); 16,000 of these fished in salt water. Annual expenditures by recreational anglers are estimated at \$50 million (ABS, 1995).

The Derwent Estuary supports an extensive recreational fishing industry throughout its length. In the upper estuary, the most important local fishery is for sea trout (*Salmo trutta*) and black bream (*Acanthopagrus butcheri*). Approximately 1500 anglers fish for sea trout in the Derwent Estuary, primarily in the region between New Norfolk and Bridgewater. Fishing for other species is also popular, and it is estimated that approximately 4000 anglers fish the Derwent in any year (Davies *et al.*, 1988). Winter (1995) counted an average of 213 people fishing in the Derwent at any one time, based on aerial surveys.

Tasmania's commercial fishing catch was valued at \$122 million in 1993/94 and aquaculture at \$75 million. Abalone (\$58 million) and southern rock lobster (\$41 million) are the most commercially valuable species. Estuarine finfish species are not generally sought after, but commercially important coastal and nearshore demersal species include Australian salmon, garfish, Jack mackerel, shark, dory, flathead, snoek and tuna. The shark fishery has been

heavily exploited in recent years, and some coastal waters (including the Derwent) have been classified as shark nurseries and closed to commercial fishing (ABS, 1995).

There is little or no commercial fishing in the Derwent Estuary itself, however, 53 commercial fishing vessels were registered in Hobart in 1995/6 and an additional 63 fishing vessels visited and used the port facilities. There are presently no shellfish or finfish farming operations in the Derwent, nor should shellfish collected from most areas (including Ralphs Bay) be consumed, because of high concentrations of zinc and other heavy metals (see Section 6.7). Whitebait was commercially fished in the estuary until 1974 (Davies *et al.*, 1988) and an oyster farm operated briefly in Ralphs Bay in the early 1970s.

3.6 Tourism

Tourism is one of Tasmania's most important industries; it is estimated that tourism directly and indirectly accounts for 9.1% of the State's employment and 6.9% of Gross State Product. In 1996 an estimated 473,000 visitors came to Tasmania, spending on average \$1,200 each, for a total of \$567.7 million dollars (Tasmanian Visitor Survey 1996). Visiting historic sites was the most popular activity, followed by visits to craft shops, markets, antique shops, gardens and museums. In total, 31% of visitors participated in boating-related activities (river cruises, sailing, boating and canoeing).

The Derwent Estuary is an important tourism resource. World class sporting and cultural events on or around the estuary are a major drawcard for Tasmania, attracting national and international attention. The Sydney-Hobart Yacht Race, Three Peaks Race, Taste of Tasmania Summer Festival, Australian Wooden Boat Festival and the upcoming anniversary Tall Ships Race (1998) are all good examples of these. Cruise ships and visiting naval vessels are also important contributors to the local economy. During the summer of 1997, for example, Hobart received 7 cruise ships bringing approximately 5,000 international visitors and their associated expenditure to the riverfront. Naval vessels also brought in more than 10,000 visiting sailors and revenues estimated at \$20 million (G. Denny, Marine Board of Hobart, pers. comm.).

Hobart is the most visited place in Tasmania (78% of all visitors). The centrality of the Derwent Estuary to the image of the city is unquestioned. In addition, many of the tourist sites around the Derwent represent some of the most popular tourist locations in Tasmania, including Sullivans Cove/Salamanca Place (35% of visitors), Royal Botanical Gardens (17% of visitors), the Casino (up to 28% of visitors) and Mount Wellington (26% of visitors). Other points of interest include Battery Point, various river cruises and the Tasmanian Museum and other art galleries. (C. Hankin, pers. comm, Dept of Tourism)

3.7 Marine transportation and shipping

The Derwent has been described as one of world's best harbours: it is easily navigated with few rocks, reefs or other hazards, has a stable and well-defined channel, a small tidal range and minor to moderate tidal currents. Furthermore, the Derwent has few sedimentation problems which impede navigation, rarely requires dredging, and has many good anchorages with shelter from prevailing winds.

Shipping and other marine transportation operations in the Derwent are jointly managed by the Hobart Port Corporation and the marine and Safety Authority of Tasmania. The Port of Hobart is the third busiest port in Tasmania (after Burnie and Launceston) and handled 1.7

million tons of freight in 1995/96. Imports accounted for about 1 million tons - mostly zinc ore and concentrates, petroleum products, phosphate rock and general cargo. Exports accounted for the remaining 700,000 tons - mostly sulphuric acid, zinc and zinc alloys, newsprint and general cargo. See Table 10 for details. In addition, as estimated 400,000 tonnes of jarosite from Pasminco Hobart has been shipped from the Derwent each year and discharged at sea, about 100 km south of Hobart. This practice will cease at the end of 1997. Port revenues in southern Tasmania were valued at 11.5 million dollars (gross) in 1995/1996 (G. Denny, MBH, pers. Comm.).

Table 10 Ten largest imports and exports to/from the Derwent Estuary (1995/1996)

Import (mass tonnes, in thousands)			Export (mass tonnes, in thousands)	
1	Zinc ore/concentrates	483	Sulphuric acid	246
2	Petroleum products	337	Zinc and zinc alloys	169
3	Phosphate rock	79	Newsprint	96
4	General cargo	73	General cargo	64
5	Caustic soda	29	Fertiliser	26
6	Liquid petroleum gas	29	SLR Lead concentrate	23
7	Wheat	18	Superphosphate	15
8	Woodpulp	17	Zinc residue	11
9	Glass bottles	8	Glassware	8
10	Vehicles	6	Glass bottles	7

(Marine Board of Hobart, 1996)

During 1995/96 Hobart was visited by 472 large ships (>35 m), including 10 cruise ships, 18 naval vessels and approximately 60 fishing vessels. Several Antarctic icebreakers and other large research vessels are based in Hobart, including the *Aurora Australis*, *Southern Surveyor* and *Astrolabe*. A small commuter ferry runs between Rosny and Hobart.

3.8 Water supply and wastewater discharges

The Derwent River and its tributaries are an important source of municipal and industrial water supplies. The majority of Hobart's municipal water supply is taken from the Derwent River just above New Norfolk and purified at the Bryn Estyn Water Treatment Plant prior to distribution. This plant treats and distributes around 40 to 60 ML/day in winter and up to 120 ML/day in summer. ANM-Boycr and Pasminco-EZ also use large quantities of Derwent water for manufacturing: ANM uses an average of 61 ML/day of fresh water, while Pasminco Hobart uses approximately 130 ML/day of estuarine water.

Thirteen sewage treatment plants and two large industrial plants discharge effluent directly to the estuary. The estuary also receives urban runoff from 5 to 10 major urban rivulets and over 270 direct outfall pipes. See Chapter 6 for details.

3.9 Research and education

The Hobart area is an important centre for research and education, particularly for marine and Antarctic studies. The following research and education centres are located in the area:

- CSIRO Division of Marine Research (Hobart)
- DPIF Sea Fisheries Research Labs (Taroona)
- University of Tasmania, including the Antarctic Cooperative Research Centre (Sandy Bay)
- Australian Antarctic Division (Kingston)