

APPENDIX F

APPENDIX F1. PROFILES OF THREATENED SPECIES

a) Fisheries Management Act 1994

i) Endangered species

Green sawfish (*Pristis zijsron*)

The following information was taken from the NSW Fisheries Scientific Committee's website (www.fsc.nsw.gov.au), which provides profiles of species listed in the FM Act. Green sawfish have been recorded in the tropical Indo-West Pacific from eastern Australia and Papua New Guinea through to western India, with a disjunct population off Mozambique and eastern South Africa. In Australia, the species occurs mainly in the tropics from Broome to southern Queensland, with individuals found as far south as Sydney and a single record from Glenelg, South Australia. In NSW, specimens have been collected from Byron Bay in the north to Parramatta River in the south, plus an unofficial record from Jervis Bay. The species is thought to grow to approximately 7.3 m in length and has been reliably recorded at 5 m, with males maturing by 4.3 m. This is a species with low fecundity and it is thought that they may have up to 20 young. They feed on fishes and benthic invertebrates, using the saw as a club to stun schooling fishes such as mullet, and as a shovel to uncover benthic animals (Allen 1989). Green sawfish have suffered a serious population decline in NSW. Prior to 1972, the species was regularly found in the shallow waters at the mouths of the Tweed, Clarence and Richmond Rivers and on outside ocean beaches such as Yamba. The last specimen from the Sydney region was taken in 1926. The causes of this decline are thought likely to include:

- bycatch in shallow water prawn trawling, and other netting methods in shallow water, as they would rarely have been returned to the water alive
- targeted harvest for flesh, fins and saws. The fins command a high price in the shark fin trade and the saws are used in traditional medicine and were sold as curios
- habitat degradation.

Sawfish are also listed as vulnerable under the EPBC Act.

Grey nurse shark (*Carcharias taurus*)

Grey nurse sharks are found around the world in inshore waters, primarily in sub-tropical and temperate regions around the main continental landmasses, with the exception of the eastern coast of North and South America and Antarctica. Known key sites for grey nurse sharks or major aggregations of the species in NSW can be found at reefs off Port Stephens, Seal Rocks, Forster, Laurieton, Batemans Bay and South West Rocks. Relatively little is known about the migratory habits of Australian grey nurse sharks. There is evidence from Australian data that suggests migrational movement, probably in response to water temperatures, up and down the coast. At certain times of the year, grey nurse sharks aggregate according to sex. Males are predominant in southern Queensland during July to October, while a high proportion of sharks off central NSW at the same time of year is composed of females. Grey nurse sharks are often observed just above the seabed in or near deep sandy-bottomed gutters or rocky caves, in the vicinity of inshore rocky reefs and islands, generally between 15 m and 25 m. They have also been recorded in the surf zone, around coral reefs, and to

depths of around 200 metres on the continental shelf. The diet of the adult grey nurse shark consists of a wide range of fish, other sharks, squids, crabs and lobsters, and some observations also suggest that schools of grey nurse sharks can feed cooperatively by concentrating schooling prey before feeding on them (Environment Australia, 2000a).

In Australia, two populations are thought to exist, one on the east coast and one on the west. The east coast population has been recorded from as far north as Mackay and extends south around the greater part of the southern half of the continent. On the west coast, the population extends as far north as the North West Shelf. They are still found within this general historical range, but the east coast population is thought to have declined considerably. During the 1960s and 1970s, spearfishers took large numbers of grey nurse sharks and reduced the population to a low level. Setlining by commercial fishers also continues to take a small number each year, and the beach meshing program was also responsible for catching large numbers of grey nurse sharks up until 1975. Despite protection since 1984 in NSW waters, the species has not shown an increase in population size. Current research (quarterly surveys from November 1998) indicates a much lower adult population size than when the species was recommended to be listed as a vulnerable species in NSW (early 1999), and the status of juvenile numbers in the sampled population is uncertain (www.fsc.nsw.gov.au, 1999). These factors were also largely responsible for its listing as a vulnerable species under the EPBC Act.

ii) Vulnerable species

Black cod (*Epinephelus daemeli*)

Black cod are found on estuarine and inshore reefs and deeper offshore reefs in temperate and subtropical waters of the southeastern Pacific. In Australia, they are found from Queensland to Kangaroo Island, although they are rare and probably only represented by non-breeding migrants in more southern areas. Hence, they are found along the entire NSW coastline, which is also the centre of the species' Australian mainland distribution (Heemstra and Randall 1993; Pogonoski *et al.*, In prep). Their maximum size is 1 - 2 metres in length, but are commonly only found up to 0.8 m (Hutchins and Swainston 1986). Smaller fish are females, which change sex to become male at around 1 m in length (Pollard unpublished). They are an aggressive, highly territorial species, and are usually found in association with caves, ledges or large underwater structures such as bridge pylons that they may occupy for life (Gill and Reader 1992; Henrisson and Smith 1994). Their numbers are reported to have declined significantly as a result of spearfishing pressure in the 1970s (Pogonoski *et al.*, In prep.). Lincoln Smith *et al.* (1989) reported that 137 black cod were caught in spearfishing competitions in NSW in 1976 alone. Their territorial and curious nature, combined with their slow movement, is thought to have made them an easy target and a prize catch by both line and spearfishers, although they are no longer thought to be targeted by either group of fishers. Commercial fishers still report occasional captures, particularly from deeper offshore reefs. Historical, anecdotal evidence suggests that a decline in abundance in the Sydney region occurred around 1900 when coastal towns became populous and fishing and shipping pressures increased (Roughley, 1916). Their slow growth and territoriality probably also prevents rapid recovery from decreases in population. Despite protection in NSW waters since 1983, there is no evidence of an increase in their abundance.

Great white shark (*Carcharodon carcharias*)

White sharks are found worldwide in temperate, coastal waters but are rare in tropical waters. In Australia, they have been recorded from southern Queensland to northwestern Western Australia. There are no reliable estimates of the number of white sharks in Australian waters, but it is thought

that the numbers of fish are decreasing (Environment Australia, 2000b). Based on data sets from the region between Port Stephens and Wollongong, great whites appear to have suffered a population decline in NSW, with a reported decreases in annual catches in beach meshing from 1950s to 1990s, and less compelling evidence of decline from game-fishing landings (www.fsc.nsw.gov.au, 1998).

In many places around the world the white shark is a protected species. This happened first in South Africa in 1992, then in Namibia, the Maldives, and in Florida and California. This species is now protected in all Australian states and territorial waters. It is believed that a white shark of 5 - 6m in length is likely to be 15 - 25 years old, and the most commonly encountered white sharks are between 3 - 4 m in length. Females mature at 4.5 - 5 m in length and males at probably less than 4 m, and as the fish matures, its diet changes. Fishes to about 2 metres normally eat squid and other fishes such as stingrays and other sharks. Adults eat seals, sea lions, dolphins and dead whales, although some will continue to eat fishes such as snapper. They have also been known to eat elephant seals, sea otters, turtles and sea birds. They are also listed as vulnerable under the EPBC Act.

iii) Protected species - Section 19 (totally protected)

Estuary cod (*Epinephelus coioides*)

Estuary cod are found in Africa, India, Singapore, Hong Kong, Taiwan, Philippines, and Reunion, Mauritius and Andaman Islands. In Australian waters, they are most common in Queensland, Northern Territory and Western Australian waters. In NSW, they are found on estuarine and inshore reefs from about Sydney northwards (Heemstra and Randall, 1993; Pogonoski *et al.*, In prep.). They are reasonably territorial, but have been found in a wide variety of estuarine and marine habitats but are most common in lower estuaries and around protected silty reef habitats. Adults are usually found along the bases of small drop-offs, or in caves or shipwrecks (Pogonoski *et al.*, In prep.). Estuary cod grow to about 1 metre in length (Kuitert, 1993), and although they were probably never abundant in NSW estuaries, are considered vulnerable to a variety of fishing pressures including demand for the live fish trade (Pogonoski *et al.*, In prep.). Consequently, they are totally protected in NSW waters.

Queensland groper (*Epinephelus lanceolatus*)

The Queensland groper is fairly similar to the estuary cod, and has a similar range and habitat preference within NSW (Pogonoski *et al.*, In prep.). They do, however, grow to a much larger size of up to 3 metres (Kuitert, 1993). Queensland groper is totally protected within NSW waters for similar reasons to those applicable to the estuary cod.

Weedy seadragon (*Phyllopteryx taeniolatus*)

Seadragons are a member of the family Syngnathidae, which also includes seahorses and pipefishes. An unusual feature of this family of small fishes is that the male broods the young, which leave the brood pouch at a relatively advanced stage (Kuitert, 1993). Weedy seadragons are found on estuarine and inshore reefs along the NSW coastline north to about Port Stephens (Hutchins and Swainston, 1986). Their preferred habitat appears to be the interface between kelp beds and sand (Kuitert, 1993). Their maximum size is about 45 cm (Kuitert, 1993). The species is quite common in its preferred habitat and population numbers are not thought to have declined (Pogonoski *et al.*, In prep.), however, due to its vulnerability to over-collecting for the aquarium trade, it is totally protected within NSW waters.

iv) Protected species - Section 20 (protected from commercial fishing)

Blue groper (*Achoerodus viridis*)

The blue groper is a marine fish that inhabit inshore rocky reefs along the entire NSW coastline (Kuitert, 1993). Their young recruit to sheltered habitats that provide physical structure, including estuarine seagrass beds (Gillanders, 1999). Larger juveniles are common around sheltered rocky reefs within the lower reaches of marine-dominated estuaries, and appear to gradually move out to inshore reefs as they grow (Gillanders, 1999). They are a popular angling species, attaining at least 1.2 metres in length (Kuitert, 1993). Populations appeared to decline sharply in the 1960s because of fishing pressure, and although significant recovery has occurred in recent years, the species remains protected from spearfishing and commercial exploitation within NSW in view of its curious behaviour and popularity with SCUBA divers (Smith *et al.*, 1996).

b) Threatened Species Conservation Act 1995

Unless otherwise specifically referenced, the following species profiles were obtained from the website of the NSW National Parks and Wildlife Service, at www.npws.nsw.gov.au/2001. The profiles for marine turtles and dolphins were obtained from the website of Environment Australia, at www.environment.gov.au, respectively.

i) Endangered species

Birds

Beach stone-curlew (*Esacus magnirostris*)

Beach stone-curlews are exclusively coastal and have been recorded around the north coast of Australia and associated islands from Onslow in Western Australia to the Nambucca River in NSW, and rarely southwards to Forster (Marchant and Higgins, 1993). They have largely disappeared from the southeastern part of its former range and are now rarely recorded on ocean beaches in NSW. They prefer open, undisturbed beaches, islands, reefs and estuarine intertidal sandflats and mudflats with mangroves nearby. They also frequent river mouths, offshore sandbars associated with coral atolls, reefs and rock platforms and coastal lagoons. They forage at low tide in search of crabs and other marine invertebrates. Threats to the species include loss of habitat due to residential and industrial development, human disturbance through beach-combing, boating and 4WD vehicles, predation by raptors, cats and dogs, nest destruction by pigs or high tides, and nest desertion.

Gould's petrel (*Pterodroma leucoptera leucoptera*)

Gould's petrel is a member of the gadfly group of petrels. All members of the group are pelagic, soaring erratically on narrow wings and feed on surface fish, squid and krill. The non-breeding range and feeding areas are unknown, but it is thought to forage predominantly within the Tasman Sea. Gould's petrel breed primarily on Cabbage Tree Island and to a lesser extent on Boondelbah Island, offshore from the entrance to Port Stephens. Adult birds begin arriving on Cabbage Tree Island from mid to late September, and the fledglings depart the island from late March to early May, and are thought to then remain at sea for several years. Threats to the species include: nesting habitat degradation by rabbits; the subsequent proliferation of bird-lime trees, the sticky fruits of which entangle the birds; and predation by currawongs and ravens. A recovery plan and program has been implemented and seen a reduction of these threats and corresponding increase in population

numbers and survival. The recovery plan also recommends that Cabbage Tree Island be declared Critical Habitat under the TSC Act (NPWS, 2000c).

Hooded plover (*Thinornis rubricollis*)

Hooded plover occur on sandy beaches and inland saltlakes of southeastern and southwestern Australia. They are endemic to southern Australia and are found along the coast from Jarvis Bay to the western Eyre Peninsula in South Australia, along the coast of Tasmania, the Bass Strait Islands and from 30°S on the Western Australia coast to the western edge of the Great Australian Bight. Occasional strays are recorded as far north as Sydney, but the most important sites for the species are on the south coast. Sussex Inlet, particularly on Bhewerre and Cudmirrah Beaches, is thought to support the highest density of hooded plovers, followed by the coastline between Lake Conjola and Lake Tabourie (Carter, 1995). A survey in 1988 suggested the NSW population might be as low as 62 individuals of a total population of approximately 5000 (Marchant and Higgins, 1993). Hooded plover are found most often on long stretches of sandy shore, backed by tussock or dunes covered in creeping plants with nearby inland lakes. Preferred habitat has a wide wave-wash zone with beachcast seaweed for feeding, backed by sparsely vegetated sand dunes for shelter and nesting. Their diet includes polychaete worms, molluscs, crustaceans, insects, waterplants and seeds. Threats to the species include artificially high populations of silver gulls around human settlements leading to increased predation, predation by foxes and raptors, loss of habitat due to development for housing and recreation, human disturbance during the summer breeding season, particularly four-wheel driving along sand dunes and beaches, and destruction of nests by stock.

Little tern (*Sterna albifrons*)

Little terns are migratory or partly migratory seabirds. They occur from Shark Bay in Western Australia, around northern and eastern Australia, to the east coast of Tasmania and around to the Gulf of St Vincent in South Australia. In NSW, a second population of the subspecies *sinensis* predominantly occurs, which is migratory, breeding in the spring and summer along the entire east coast from Tasmania to northern Queensland. The other population of the subspecies breeds in Asia and migrates to Australia in summer, masking the size of the threatened, eastern Australian population. Little terns have been recorded nesting at 70 sites along the NSW coast, but at only 31 since 1987 and 11 in 1998/99. Since 1995, the largest, most successful colonies have been at Sawtell, Harrington, Botany Bay, Lake Wollumboola and more recently Farquhar Inlet (formerly known as Old Bar) (NPWS, 2000b). In NSW, the species is strictly coastal. Most of the nesting sites are sand-spits, sand islands or beaches within or adjacent to the mouths of rivers, creeks and coastal lakes. Nesting also occurs at some sites on ocean beaches well away from estuaries, but often with a large coastal lake nearby. Little terns in NSW feed predominantly, perhaps exclusively, on fish less than 10 cm long and often generally referred to as whitebait. They include perchlets (*Ambassis* spp.), surfsardines (*Iso rhotophilus*) and sprats (Clupeidae), but may also include juvenile mullet, gudgeons, tailor and whiting. Most feeding occurs inside or at the mouths of estuaries and up to 500 m offshore. There are numerous threats to the species, and human disturbance has been identified as a major, and often the most important factor leading to poor breeding success and abandonment of nest sites. Human disturbance can range from the extreme of 4WD and trail-bike use through to walking or simply sitting or fishing on the beach, all of which may keep the terns off nests. Others include adverse weather conditions, nesting at locations prone to flooding, predation by foxes, dogs, cats, rats and a variety of birds, coastal development, availability of food, damage to estuarine habitats and pollution (NPWS, 2000b). It is also listed as endangered under the EPBC Act.

Wandering albatross (*Diomedea exulans*)

Wandering albatross are circumpolar in distribution, occurring over pelagic waters of the Southern Ocean, including around South America, New Zealand, Australia, South Africa and Antarctica. In the Australasian region, they occur inshore, offshore and in pelagic waters, regularly feeding in sheltered harbours and straits, and have been recorded as gathering at sewage outfalls. They feed mostly on cephalopods and fish by scavenging, seizing food from the surface, shallow plunging or pursuit plunging, and do most of their hunting at night. They have also been recorded following schools of dolphins, southern right whales (*Balaena glacialis*), pilot whales (*Globiocephala* spp.) and southern right whale dolphins (*Lissodelphis peronii*). They breed on subantarctic and Antarctic Islands in the Indian Ocean, Atlantic Ocean and seas south of New Zealand. They nest on coastal or inland ridges, slopes, plateaus and plains, often on marshy ground, and prefer open or patchy vegetation for easy access, near exposed ridges or hillocks for take-off. In NSW, they are most abundant from mid-June to mid-September. Historical threats to the species include accidental and deliberate killings at commercial fishing grounds adjacent to breeding islands, egg collecting and end nest predation. Current threats are thought to be primarily long-line fishing operations and possibly trawling (Marchant and Higgins, 1993).

Marine mammals

Blue whale (*Balaenoptera musculus*)

Blue whales are distributed worldwide in oceanic waters, but are not necessarily restricted to deeper waters. They undergo extensive migrations between warm water (low latitude) breeding grounds and cold water (high latitude) feeding grounds, although the exact breeding ground locations are unknown. Feeding is restricted to colder, i.e. Antarctic waters, almost exclusively on *Euphausia superba*, and they are generally characterised as swallows or gulpers. The migration paths are also widespread and do not necessarily follow coastlines or oceanographic features. In the Southern Hemisphere, they are generally found between 20°S and 60 – 70°S, and have been recorded from all Australian states, particularly Western Australia. Past threats include over-hunting in commercial whaling operations, leading to a drastic reduction in population numbers to only a small remnant of original, e.g. in southern hemisphere from approximately 200,000 to perhaps fewer than 1,000. Current threats are thought to include direct disturbance from:

- seismic operations
- collision with large vessels
- entanglement in fishing gear
- defence operations
- pollution, including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea, leading to accumulation of toxic substances in body tissues.

Blue whales are also classified as endangered under the EPBC Act.

ii) Endangered populations

Little penguins (*Eudyptula minor*) at Manly, Sydney Harbour

Little penguins, only found in Australia and New Zealand, once ranged from Swan River in Western Australia through Tasmania and up to Moreton Bay in Queensland, and may still occasionally venture that far. They are relatively common in the waters of southern Australia, breeding mainly on offshore islands. They generally breed from south of Port Stephens in NSW, including the Sydney region, along the coast through Victoria, South Australia, Tasmania and as far as Fremantle in Western Australia. In 1986, it was estimated that the total breeding population in eighteen known colonies in NSW consisted of 17,000 pairs, most at the large colonies on Montague, Tollgate and Brush Islands. It is now believed to be closer to 49,000 birds at 22 known sites, however, the population in North Harbour/Manly is the only population known to breed on mainland NSW, and consists of only approximately 50 breeding pairs.

Little penguin nesting habitat normally consists of burrows built in sand dunes, rockpiles, sea caves, and occasionally under buildings. At Manly, a range of nest types are utilised, including under rocks on the foreshore, rock falls under seaside houses, garages, under stairs, in wood piles and under overhanging vegetation. Male penguins return to their colonies between June and August to reconstruct or dig new burrows and to attract females. About 3 months later, fledglings leave the nest and only return annually to moult until they are about 3 - 4 years old, when they return to breed.

Little penguins appear to be opportunistic feeders, foraging in relatively shallow waters. Their diet consists mainly of small schooling fish, like anchovies (*Engraulis australis*), pilchards (*Sardinops neopilchardus*), squid (Order Teuthida) and to a lesser extent, krill (Euphausiids). The population of penguins on Lion Island, in the Hawkesbury River, is also known to feed on blue sprats (*Spratelloides robustus*), small-mouthed hardyheads (*Atherinosoma microstoma*) and Ogilby's hardyheads (*Atherinomorus ogilbyi*).

The major threat to the Manly population is the loss of suitable habitat. Past development has greatly reduced available habitat in the area. Disturbance of little penguins and their habitat is also a major threat to the population. Predators such as dogs, cats, and foxes are known to take penguins from shallow burrows and as they move between the water and their nesting habitat. Commercial fishing has also been listed in the threat abatement plan as a threatening process, although there is currently no data to support the claim and fishing is not listed in the Act as a Key Threatening Process. Fishing, primarily hauling in this area, provides competition for food resources, disturbance due to noise outside burrows and may obstruct penguins from returning to their nests (NPWS, 2000a).

iii) Vulnerable species

Reptiles

Green turtle (*Chelonia mydas*)

Green turtles occur worldwide and are found in tropical and subtropical waters. They inhabit seagrass beds and coral reefs with a good cover of seaweed. Adult turtles are herbivores, feeding on seaweeds and seagrasses, whereas immature turtles feed on jellyfish, small molluscs, crustaceans and sponges. Green turtles grow to an average of about 1 metre and are sexually mature generally between 91.5–122.5 cm CCL. They may migrate up to 3000 km from feeding grounds in Indonesia, Papua New Guinea, New Caledonia, Fiji, Queensland, Northern Territory and Western Australia to breed and

nest in southern and northern Great Barrier Reef, northwest Northern Territory, Gulf of Carpentaria, Western Australia, Coral Sea and Ashmore Reef. Nesting generally occurs from late November to January and earlier in the Northern Territory from July to December. They recruit from the pelagic phase as immature turtles (CCL = 40-50 cm) to inhabit subtidal and intertidal coral and rocky reefs and seagrass meadows of the continental shelf. While they are most abundant within 1000 km of their nesting beaches, they live year round in coastal waters from central Western Australia, through Northern Territory and Queensland to central New South Wales, continuing to feed in waters as cool as 15°C. Green turtles are also listed as vulnerable under EPBC Act.

Leatherback turtle (*Dermochelys coriacea*)

Leatherback turtles are the largest of the marine turtles, with shells averaging 1.6 metres in length and with a total weight of up to 500 kg. They are so named because of their leathery shell, which is black with lighter spots and has five ridges. They inhabit tropical and warmer temperate waters, feeding on jellyfish and other soft bodied invertebrates. Unlike other marine turtles, leatherbacks spend almost their entire life feeding within the water column and are generally regarded as an oceanic species. Leatherback turtles do not nest in Australia in any numbers. Only a small population of leatherback turtles has been found breeding and nesting in eastern Australia, mainly from December to January. In Queensland, 1-3 females per year nest on Wreck Rock and adjacent beaches, and sporadic nesting occurs at other widely scattered sites in Queensland, New South Wales and the Northern Territory. In Western Australia, there are 2-6 sightings off the mid-west coast per year. The major breeding and nesting sites in the Asia/Pacific occur in Indonesia, Malaysia, Papua New Guinea and the Solomon Islands. They are listed as vulnerable under EPBC Act.

Loggerhead turtle (*Caretta caretta*)

Loggerhead turtles are found worldwide, inhabiting tropical and warmer temperate waters such as coral reefs, bays and estuaries. While they are most abundant within 1000 km of their nesting beaches, they live year round in coastal waters from southern Western Australia, through the Northern Territory and Queensland to southern New South Wales. The southern Great Barrier Reef and adjacent mainland near Bundaberg is the breeding centre of the eastern Australian population. Breeding is centred on Dirk Hartog Island (Shark Bay), Muiron Islands, Ningaloo and the North West Cape area for the western population. Loggerhead turtles eat shellfish, crabs, sea urchins and jellyfish. They reach sexual maturity at about 30 years or more and grow to an average of 1 metre in size. Loggerhead turtles migrate from feeding grounds in the Northern Territory, New South Wales and Queensland to the above nesting sites on the eastern and western Australian coastlines. Mating occurs from late October to early December, followed by nesting from late October to early March. They recruit from the pelagic phase as immature turtles (CCL = 70-80 cm, >10 years) to inhabit subtidal and intertidal coral and rocky reefs and seagrass meadows as well as deeper soft-bottomed habitats of the continental shelf. They are listed as endangered under EPBC Act.

Birds

Black-browed albatross (*Diomedea melanophris*)

Black-browed albatross are circumpolar in distribution, occurring over pelagic waters of the Southern Ocean, including around South America, New Zealand, Australia, South Africa and Antarctica. In Australia, they occur along the east coast from Stradbroke Island in Queensland, along the entire south coast of the continent to Western Australia. They regularly migrate to waters off the continental shelf from May to November and are regularly recorded off the coast of NSW during this

time. Black-browed albatross feed on fish, crustaceans, cephalopods and offal, and often forages in flocks with other seabirds. Prey are usually seized from the surface while swimming or landing, as well as by submerging themselves to capture prey underwater and by scavenging behind fishing vessels. The latter technique, particularly related to long-line vessels, is one of the processes threatening the species, along with disturbance to nesting colonies by introduced predators.

Black-tailed godwit (*Limosa limosa*)

Godwits are migratory wading birds that breed in Mongolia and Siberia, and visit Australia during the summer, arriving in August and leaving in March. They are most common between Weipa and Darwin, but is also found in small numbers along much of the Queensland coast south of Cairns, south of Derby in Western Australia, the southeast of South Australia, and mainly around Port Phillip Bay in Victoria. In NSW, they have been regularly recorded only on Kooragang Island (Hunter River), with scattered sightings from both coastal and inland areas. Inland records, particularly within the Murray-Darling Basin, indicate that a regular inland passage is used. Godwits are primarily found along the coast on sand spits, lagoons and mudflats, and inland on mudflats of lakes and swamps. They have also been recorded in meadows and sewage treatment works. Their diet includes a variety of invertebrates such as insects and larvae, earthworms, crustaceans, molluscs, spiders, spawn and tadpoles of frogs and fish eggs. Threats to the species include hydrological changes to inland lakes and tourism or agricultural developments reducing coastal and inland habitat areas.

Black-winged petrel (*Pterodroma nigripennis*)

Black-winged petrels are marine, pelagic seabirds of the subtropical and tropical southwest and central Pacific Ocean. They frequent the north Tasman Sea and areas extending eastwards into the central southern Pacific Ocean. Within Australia, the species has been sighted in scattered areas along the southern Queensland and NSW coastline. In NSW, they have been observed ashore at Muttonbird Island, Byron Bay, Lord Howe Island, Norfolk Island, Newcastle, Cronulla, Batemans Bay, Solitary Island, Wollongong and Eden. They are thought to feed on squid and prawns, which they catch seizing from the surface or shallow diving. While at sea, it is usually solitary, although it does form loose groups of up to 20 when feeding. They also nest in colonies on subtropical and tropical islands and inlets in the southwestern Pacific Ocean. Breeding grounds are usually on vegetated coastal slopes or rugged terrain inland. Nests are generally located on higher ground in burrows or rock crevices, with the entrance hidden by scrub, tussocks and grasses. Threats to the species include predation by cats, rats, pigs and goats.

Broad-billed sandpiper (*Limicola falcinellus* subsp. *sibirica*)

This subspecies of sandpiper are migratory wading birds that breed in north and northeastern Soviet Union, and visit India, southeast Asia and Australia during the summer. In Australia, they are most common along the northern coasts, particularly the northwest, with occasional birds seen on the southern coasts and very few inland. In NSW, the main site for the species is the Hunter River, with records along the coast south to Shoalhaven River. They are known to favour estuarine sand- and mudflats, particularly areas of soft mud on the seaward side of mangroves, saltmarshes and reefs as feeding and roosting habitat. They have also been recorded in shallow freshwater lagoons and sewerage treatment works. Their diet includes insects, worms, crustaceans, molluscs and seeds. Threats to the species include hydrological changes to inland lakes (for individuals that remain in Australia over winter) and development of coastal estuaries, mudflats and saltmarshes.

Fleshy-footed shearwater (*Puffinus carneipes*)

The flesh-footed shearwater is a pelagic, trans-equatorial migrant, widely distributed across the southern Indian Ocean and southeastern Pacific Ocean in the breeding season. They are a breeding and non-breeding visitor to the coastal and pelagic waters of southern Australia, where they are locally common in all months of the year. Breeding is from late August to December. Offshore of northeastern NSW, the species is predominantly recorded from September to May, with breeding birds foraging around Lord Howe Island from August to May. Nests are made in burrows on gentle to steep slopes, with moderate vegetation and adjacent elevated areas for take-off. They feed on fish and squid by seizing prey from the surface, as well as surface plunging and pursuit diving to 4 m. They also scavenge for food. They have been recorded taking offal from behind fishing boats and running among gulls to seize offal from beaches. They feed during the day, flying out to sea before sunrise and returning in the late afternoon. Threats to the species include native and introduced predators, disturbance of nesting sites by humans, and historical killing for food, feathers and oil.

Great knot (*Calidris tenuirostris*)

Knots are migratory wading birds that breed in Siberia and migrate to Australia in large numbers from late August, leaving in March and April. Some individuals may stay over winter. They occur throughout Australia, including the coastal islands of Tasmania, but is most common and abundant in the north, and uncommon to rare further south. In NSW, they have been recorded in scattered sites along the coast to about Narooma, and are primarily found within sheltered, coastal habitats containing large intertidal sand- and mudflats, including in inlets, bays, harbours, estuaries and lagoons. They have also been recorded on exposed reefs or rock platforms. Their diet includes bivalve molluscs, gastropods, polychaete worms and crustaceans. Threats to the species include hydrological changes to inland lakes (for those that remain over winter) and tourism or agricultural developments reducing coastal and inland habitat areas.

Greater sand plover (*Charadrius leschenaultii*)

Sand plovers are migratory wading birds that breed in central Asia and migrate to Australia in summer. The species is commonly recorded on the west coast, but is apparently rare on the east coast. In NSW, they have been recorded in coastal areas from the northern rivers region south to Shoalhaven Heads, with the majority of birds recorded in the Clarence and Richmond Rivers. They forage on intertidal sand- and mudflats in estuaries, and roost during high tide on sandy beaches or rocky shores. They have also been recorded on inshore reefs, rock platforms, and small rocky islands and sand cays on coral reefs. Their diet includes insects, molluscs and crustaceans. Threats to the species include hydrological changes to the Clarence and Richmond Rivers and tourism or agricultural developments reducing coastal and inland habitat areas.

Grey ternlet (*Procelsterna cerulea*)

The grey ternlet occurs through much of the tropical Pacific Ocean from Australia east to Hawaii and San Felix and San Ambrosio Islands off the east coast of Chile. In Australia, the species occurs off the east coast between the Tropic of Capricorn and Bass Strait and is occasionally beachcast during stormy weather. Individuals are usually recorded off the east coast soon after breeding season between December and March, and it is thought that some individuals may disperse to the east coast of Australia from breeding grounds on Lord Howe and Norfolk Islands. They feed during the day on small crustaceans, fish and squid by fluttering above the water surface before dropping down to seize their prey. They feed inshore and occasionally offshore of the tropical and subtropical islands on

which they breed and roost. Threats to the species include intensive fishing operations in feeding grounds, cyclonic weather and urban development on Lord Howe and Norfolk Islands.

Kermadec petrel (*Pterodroma neglecta*)

Kermadec petrels are marine, pelagic seabirds that occur in subtropical seas between 20 and 35°S. Breeding colonies are located in the South Pacific Ocean, 25-35°S, from Lord Howe Island to Juan Fernandez Island. Non-breeding petrels migrate trans-equatorially, with individuals recorded as far north as 28°N in the central Pacific Ocean and 21°N in the eastern Pacific Ocean. The species is usually present around Kermadec Island throughout the year and is a vagrant to the east coast of Australia. Only sporadic records exist for the NSW coastline: Kingscliff in 1974; Tuggerah Beach in 1976; Steamers Beach (Jervis Bay) in 1976; and an unconfirmed record from Wollongong in 1990. Very little is known about the diet of Kermadec petrels, but specimens have contained squid and crustaceans, which they are thought to capture by seizing from the surface and dipping. Threats to the species include predation by cats, coatis and rats; harvesting by humans; and destruction of nest sites by goats and rabbits.

Lesser sand plover (*Charadrius mongolus*)

Lesser sand plovers are migratory wading birds that breed in eastern Siberia, southern Mongolia, western China and the Himalayas and migrate to the coasts of eastern and southern Africa, the Middle East, India, Southeast Asia and Australia in summer. The species occurs around the entire coastline of Australia but is most abundant in the Gulf of Carpentaria and along the east coast of Queensland and northern NSW. They are rarely recorded south of Shoalhaven River. They favour beaches, sandflats, mudflats and mangroves within estuaries, and roost during high tide on sandy beaches or rocky shores. In NSW, important sites for them include Port Stephens, Harrington Inlet and the Clarence and Richmond Rivers. Their diet includes crustaceans, molluscs, insects and polychaete worms. Threats to the species include hydrological changes to the Clarence and Richmond Rivers and tourism or agricultural developments reducing coastal and inland habitat areas.

Little shearwater (*Puffinus assimilis*)

The circumpolar range extends from the Atlantic Ocean, generally between 40°N and the Atlantic Convergence, to the Pacific and southern Indian Oceans. The species ranges in seas off southwestern and southeastern Australia, the Kermadec Islands and far southeastern New Zealand, from Bounty to Antipodes and Auckland Islands. In NSW, the little shearwater has been recorded along the coast and in breeding colonies on Lord Howe Island. They nest in burrows located amongst tussock grasslands, shrublands, and woodlands and under mats of succulents (e.g. *Atriplex* spp., *Carpobrotus* spp.). They feed primarily on squid, krill and small fish by plunge diving, surface seizing and pattering across the surface with wings raised above the back. They have also been observed feeding with dolphins. Threats to the species include loss of nesting habitat due to development of resorts and erosion of dunes, disturbance by humans of nesting islands, and predation by rats, cats and dogs.

Osprey (*Pandion haliaetus*)

Ospreys have a disjunct distribution around the Australian coastline, occurring in the north from Broome in WA to the south coast of NSW, in the south from Kangaroo Island to the Great Australian Bight, and from Esperance to Cape Keraudren in the west (Marchant and Higgins, 1993). In NSW, the osprey occurs primarily along the coast, south to about Womboyn Lake and is found in

greater numbers in the north of the state (Marchant and Higgins, 1993). They require extensive areas of clear, open water for fishing, often ranging up into freshwaters of larger rivers. They are found on offshore islands, littoral habitats, terrestrial wetlands and coastal lands of tropical and temperate Australia (Marchant and Higgins, 1993). They nest in prominent positions near the ocean or large waterbodies, on rocky headlands, stacks, cliffs, palm trees, in tall dead trees, and on artificial platforms (Marchant and Higgins, 1993). More recently, particularly on the north coast of NSW, ospreys have been nesting on electrical supply poles as they provide the type of vantage points of their former natural habitat. The NPWS and NorthPower have been working together to customise these poles to avoid electrocution and to provide stable nesting platforms. They feed mostly on fish, clutching them from the surface of the water or diving to less than 1 m, and are able to eat toxic (Diodontidae, Tetraodontidae) and spiny fishes (Balistidae and Acanthuridae). They also feed on terrestrial vertebrates, seabirds and crustaceans (Marchant and Higgins, 1993). Osprey are tolerant of human activity, often nesting within or adjacent to urban areas, but over clearing and degradation of water quality are likely to have an adverse impact on their nesting and feeding habitat (Marchant and Higgins, 1993).

Pied oystercatcher (*Haematopus longirostris*)

The pied oystercatcher is distributed along the entire Australian coastline and offshore islands, with most key sites located in the southeast. These include The Coorong in SA, Derwent River in Tasmania and Corner Inlet in Victoria (Marchant and Higgins, 1993). They roost and forage on sandy beaches, mudflats, sandbanks and rocky shores, and occasionally roost in mangroves. They also forage on oyster leases, but are more common at the low water mark on beaches where they probe soft substrata for molluscs, worms and crabs and sometimes take small fish from shallow water. They nest on sandy beaches, sandbars and along estuaries, immediately above the high water mark, as well as on sand dunes or saltmarshes and mudflats (Marchant and Higgins, 1993). Threats to the species include alteration of habitat, human disturbance, destruction of nests and predation by foxes.

Providence petrel (*Pterodroma solandri*)

The providence petrel has a pelagic distribution, particularly during the non-breeding season. The species is mainly subtropical in the southwest Pacific Ocean, including the Tasman Sea, however some birds migrate to the north Pacific and Bering Seas. During the breeding season, the species can be found in the waters off the eastern Australian coast. They are also observed in the non-breeding season, although it is generally rare or absent from December to February. In NSW, the species occurs along the entire coast, however, it has been recorded most often off the north coast, with Lord Howe Island a popular breeding site for the species. On Lord Howe Island, the species nests in burrows or rock crevices on forested, upper slopes and summits of mountains. They feed on fish, squid, crustaceans and offal, and favoured feeding grounds are located within the Tasman Sea and along the edge of the continental shelf off the east coast of Australia. They have also been recorded feeding near humpback whales and near fishing boats. Threats to the species include predation by cats, nest and habitat disturbance by pigs and goats, and settlers of offshore islands ate them.

Sanderling (*Calidris alba*)

Sanderlings are an uncommon to locally common migrant from Siberia and other breeding grounds within the Arctic. They generally spend the summer in coastal areas of northern and eastern Australia and some individuals remain over winter. Sanderling prefer open sandy beaches exposed to open sea-swell, exposed sand bars and spits, and are also found in coastal areas on low beaches of firm

sand, near reefs and inlets, along tidal mudflats and bare coastal lagoons. In NSW, important sites for them include Harrington Inlet and Old Bar at the mouth of Manning River. They forage at the edge of the water in the wave-washed zone and sometimes among rotting kelp, as well as at the edges of shallow pools on sandspits and mudflats. Their diet consists of insects and their larvae, crustaceans, jellyfish, fish, spiders, worms, plants and seeds, and larger molluscs and crustaceans are also taken as carrion. Threats to the species include hydrological changes to estuaries and similar waterbodies that may modify or remove habitat, and tourism or agricultural developments reducing coastal and inland habitat areas.

Shy albatross (*Diomedea cauta*)

The shy albatross is circumpolar in distribution, occurring widely in the southern oceans around South America, New Zealand, Australia and South Africa. Islands off Australia and New Zealand provide breeding habitat, which takes place between September and December on rocky islets with little vegetation and soil. Nests are usually located on the sheltered sides of islands and consist of a mound of mud, bones, plant matter and rocks. They feed on fish, squid, crustaceans and offal by a variety of techniques, including seizing prey from the surface while swimming or landing on top of it, diving, and scavenging behind fishing vessels. Scavenging, particularly behind long-line vessels, is one of the threats to the species, along with disturbance by introduced predators, pollution and historical feather collection.

Sooty oystercatcher (*Haematopus fuliginosus*)

Sooty oystercatchers are endemic to Australia and are widespread along the east, west and south coasts, with scattered records from northern Australia. There are thought to be only small numbers of birds in NSW distributed evenly along the coast (Marchant and Higgins, 1993), although the coastline between Lake Conjola and Lake Tabourie is thought to support more than 1% of the Australian population (Carter, 1995). They are a strictly marine coastal species, preferring rocky intertidal shorelines with a minimal cover of foliose algae, coral reefs or sandy beaches near intertidal mudflats. They also occasionally forage on oyster leases, but are more common on intertidal rock platforms where they feed on molluscs, crustaceans, ascidians, echinoderms and small fish. When feeding on beaches, they take worms, larvae of seaweed flies and sandhoppers. They nest on offshore islands and rock stacks, often close to rocky coasts, and sometimes on remote headlands, promontories or steep beaches (Marchant and Higgins, 1993).

Sooty tern (*Sterna fuscata*)

Sooty terns have been observed within the tropical and subtropical waters and islands of the Indian, Pacific and Atlantic Oceans. In Australia, individuals are widespread in the tropics and occasional sightings occur along the west and east coasts, from Perth in Western Australia to Bermagui on the south coast of NSW, although they are more common off the north coast. Breeding colonies of up to 1,000,000 pairs have been recorded on Lord Howe Island, where they nest on coral cays, atolls, sandbars, rock stacks, cliffs or offshore islets. They are active during day and night, mainly feeding on fish, squid, crustaceans and hydrozoans taken from the surface. Food may also be scavenged from aerial pursuits of other birds and by hawking for cicadas over forests. Threats to the species include: disturbance of breeding colonies; egg collecting; predation of eggs and chicks by cats, rats and other birds; and ticks.

Terek sandpiper (*Xenus cinereus*)

The Terek sandpiper is a non-breeding migratory visitor to Australia's west, north and east coasts. In NSW, the species has been recorded from the Northern Rivers region south to Lake Wollumboola. The two main sites are the Hunter and Richmond Rivers, with the Hunter identified as nationally and internationally important for the species. They prefer muddy beaches near mangroves, coastal mudflats, lagoons, creeks and estuaries, but have been observed on rocky pools and coral reefs and occasionally up to 10 km inland around brackish pools. Their diet consists of polychaete worms, crustaceans, small shellfish, beetles, waterbugs, and the adults and larvae of various flies. Threats to the species include hydrological changes to estuaries that may modify or remove habitat, tourism or agricultural developments reducing coastal and inland habitat areas, urban and industrial development, and disturbance by recreational activities.

White tern (*Gygis alba*)

White terns occur transglobally throughout tropical and sub-tropical oceans and islands. Individuals may occasionally visit the east coast of Australia between Cape York Peninsula and Sydney, generally only coming ashore as a result of stormy weather. Within NSW, they are regularly recorded off the coast at Ballina and occasionally off Sydney and Wollongong. They are present on Lord Howe Island from September to June, dispersing when the winter gale arrives. White terns are diurnal, although dusk and dawn are probably important feeding times. Individuals feed both inshore and offshore, generally dipping their bill to catch prey at or near the surface and can catch five or six fish in succession before returning to trees to eat them. Their diet generally consists of fish and other small aquatic animals. Threats to the species include stochastic events impacting upon small colonies; strong winds dislodging eggs from branches; predation by cats, kestrels, owls and currawongs; and the introduced black ant.

Marine mammals

Humpback whale (*Megaptera novaeangliae*)

Humpbacks have a worldwide distribution, but spend the summer months feeding in pelagic waters of Antarctica, generally between 60–70°S. In winter and spring, they migrate to warmer breeding grounds, 15–20°S, and are recorded in coastal waters off all states of except for the Northern Territory. There is distinct Northern and Southern Hemisphere populations based on temporal migration separation, and there are thought to be at least six Southern Hemisphere populations. Two of these populations are recorded off Australia's coastline, one off the west coast and the other off the east coast. There is thought to be a sex ratio bias towards males in east coast migration, and a possibility that not all females migrate north each year. Key localities within Australian waters include: Cape Naturaliste/Geographe Bay, north of Rottnest Island, Shark Bay, North West Cape, off Dampier Archipelago and coastal islands off Kimberley in Western Australia; southern coast, off Coffs Harbour and Cape Byron in New South Wales; Stradbroke Island, Hervey Bay, and islands in Great Barrier Reef, especially Whitsunday Passage area off Queensland. The exact locations of breeding grounds are unknown, although breeding occurs in central Great Barrier Reef area and there is probably a wide range of opportunity for breeding over several degrees of latitude on both the east and west coasts. Humpbacks feed mainly in Antarctic waters almost exclusively on krill (*Euphausia superba*). Elsewhere they feed on small shoaling fish and occasionally benthic organisms, and there is some evidence of feeding on fish and plankton swarms in warmer waters, e.g. off Eden and on larval *Munida gregaria* during their southern migration off New Zealand. Catches in the subtropics off

northwest Western Australia and eastern Australia showed almost no evidence of local feeding. They feed by variety of methods, generally determined by their location. In the Southern Hemisphere, they feed by swallowing large volumes of prey and water or by disturbing the water, creating a washing machine effect. In the Northern Hemisphere, they feed by lunging and bubble feeding, which involves production of a bubble net formed by exhalation under water, concentrating prey. Humpbacks were heavily exploited by commercial operations until about 1970, and estimates suggest the population may have been reduced to 5% of its initial size by 1963. Despite international protection since then, recovery seems to have been delayed until mid-1970s, possibly mainly through continued illegal catches until about 1970. Current threats are thought to include direct disturbance on migration path and in breeding areas by:

- whale watching and research vessels/aircraft, pleasure craft, swimmers and divers;
- coastal seismic operations
- defence operations
- collision with large vessels
- entanglement in fishing gear/shark nets
- pollution, including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea, leading to accumulation of toxic substances in body tissues, although this is likely to be minimal given that it rarely feeds in low latitudes (Bannister *et al.*, 1996).

Humpback whales are also classified as vulnerable under the EPBC Act.

Indo-Pacific humpbacked dolphin (*Sousa chinensis*)

Occurs in southern China, through the Indo–Malay Archipelago to northern and northeastern Australia, where it is most regularly recorded in Western Australia (north of 24°S), Northern Territory and Queensland, with occasional strandings reported in New South Wales (mostly north of 29°S). They are primarily a coastal species, occurring in estuaries and rivers of tropical and subtropical climates. They occur close to the coast, in less than 20 m depth, although aerial surveys in the Great Barrier Reef region may have located them in waters between the outer reef and the mainland, further from shore than has been previously reported in the literature. Key localities for the species in Australia include Moreton Bay, Tin Can Inlet and Great Sandy Strait in Queensland. Their diet consists of a variety of species of fish, some cephalopods and crustaceans. They have been known to feed in association with prawn trawlers in Moreton Bay, and presumably elsewhere throughout their range in Australia. There is no reliable data on mortality rates or on abundance. In Moreton Bay, 36% of dolphins show evidence of shark attack, suggesting mortality from sharks may be significant. In South Africa, many animals also have very high levels of organochlorines, probably sufficiently high to kill a female's first calf, and it is possible that similar high pollutant loads occur in dolphins of Moreton Bay, but no data are available at present. Threats to the species are thought to include habitat destruction and degradation, noise pollution, harassment or disturbance (particularly close to major cities as in Moreton Bay), incidental capture in shark nets and trawl-nets, illegal killing, and overfishing of prey species. They are also prone to live capture for display purposes, in Queensland (permits granted for up to 12 per year at present) and northern NSW. Other potential threats include pollution and mass mortalities induced by pathogens.

Long-snouted spinner dolphin (*Stenella longirostris*)

Spinner dolphins are found in tropical, subtropical and occasionally temperate waters of both the northern and southern hemispheres from the Indian, Pacific and Atlantic Oceans. In Australia, they have been recorded from Western Australia (as far south as Bunbury), Northern Territory, Queensland and New South Wales. They are primarily pelagic but can be neritic in some regions. They commonly associate during feeding with tuna, pan-tropical spotted dolphin and sea birds under certain oceanographic conditions, i.e. well defined, shallow, 100 m deep pelagic habitats in restricted areas. Along the west coast of Australia, its presence in southern localities may be associated with the Leeuwin Current. They feed on mesopelagic fish, mostly myctophids, squids and shrimps at depths greater than 250 m, although they have also been known to feed on reef-living and benthic organisms. They are known to congregate in groups of over 1000 animals, but generally group size is less than 250 and there is some segregation by age and sex. Very few strandings have been recorded in Australia. Predators are sharks and possibly killer whales, false killer whales, pygmy killer whales and pilot whales. High levels of mercury (natural contamination) and DDT, dieldrin and PCB have been recorded for *S. longirostris* from outside Australian waters. Parasitism is believed to be a major factor in the natural mortality of this dolphin. In eastern tropical Pacific Ocean, numbers declined to about 44% of their former number as a result of incidental catch in purse seine nets. Purse seines and gillnetting in the Arafura and Timor seas were historically major threats to the species. More current threats include: Taiwan's gillnet shark fishery, which operates just outside Australian waters and is a serious problem for incidental catches of small cetaceans; illegal catches within Australian EEZ; occasionally reported as incidental captures in shark nets in Queensland; the Philippines gillnet fishery; small cetacean fishery in the Solomon Islands; and Thai shrimp trawls. Potential threats are thought to include entanglement in driftnets set outside the Australian EEZ and in lost or discarded netting, and pollution leading to accumulation of toxic substances in body tissues (Bannister *et al.*, 1996). Long-snouted spinner dolphins are classified as 'insufficiently known' under the EPBC Act.

Sei whale (*Balaenoptera borealis*)

Sei whales are distributed worldwide in oceanic waters, undertaking long migrations between warm water breeding grounds and colder water feeding grounds. In the Southern Hemisphere, they do not migrate as far south as other baleen whales except Bryde's whales. They also prefer deeper water than their close relative, Bryde's whale, and are not often found near coasts. They are infrequently recorded in Australian waters, with scattered records from Western Australia, eastern Great Australian Bight, Tasmania and Queensland, and some sighting records may be confused with Bryde's whales. Sei whales feed mainly on pelagic copepods (*Calanus* spp.), and occasionally euphausiids and amphipods. They feed by skimming, which entails swimming through plankton swarms with open mouths, but can also feed by gulping. They can be found in large concentrations on feeding grounds, otherwise generally in small groups of up to about six. Historically, in the Southern Hemisphere, they were only caught in large numbers as numbers of blue and fin whales declined, particularly from the 1960s, but stocks soon reduced until their protection in 1977. Current threats are thought to include direct disturbance by:

- seismic operations
- collision with large vessels
- entanglement in fishing gear

- pollution, including increasing amounts of plastic debris at sea, oil spills, and dumping of industrial wastes into waterways and the sea, leading to accumulation of toxic substances in body tissues (Bannister *et al.*, 1996).

Sei whales are also classified as vulnerable under the EPBC Act.

Southern right whale (*Eubalaena australis*)

Southern right whales are circumpolar and only found in the southern hemisphere between approximately 30° and 60°S. They move from pelagic waters of higher latitudes where feeding occurs in summer, to warmer, lower latitudes for breeding in winter, when they approach close to the coast. In Australia, they are distributed around the southern coastline from Perth, WA to Sydney, NSW, including Tasmania. Their range is possibly extending, with recent sightings from Shark Bay and North West Cape, WA and north of Sydney to Cape Byron, NSW. Adult females are sighted most frequently close to coast, coming inshore to give birth on a mainly three-year cycle. Little is known about the diet of southern rights, but observations, lack of suitable prey and whaling data imply that they do not feed near the coast in winter, with calving females effectively fasting for at least four months. Prey is thought to be mainly pelagic larval crustaceans, particularly *Munida gregaria* and copepods. They are taken primarily during summer in the open ocean, south of about 40°S. Threats to the species are thought to include historical gross exploitation at least into the late 1960s, and despite international protection, is likely to have prevented significant recovery until recently. More recent threats are thought to include direct disturbance, particularly in near-shore concentration/calving areas, from:

- whale watching and research vessels/aircraft, pleasure craft, swimmers and divers
- low-flying aircraft
- coastal industrial activity, e.g. seismic, drilling, sandmining and shipping operations
- defence operations
- collision with large vessels, particularly on shipping routes on eastern seaboard, in Bass Strait and across the Great Australian Bight
- entanglement in fishing gear.

Potential threats are thought to include increased whale watching pressure, industrial activity and pollution levels, and these may all be compounded by an increase in right whale numbers. The latter will also affect availability of suitable coastal calving habitat (Bannister *et al.*, 1996). Southern right whales are also classified as vulnerable under the EPBC Act.

APPENDIX F2. THE EIGHT PART TEST

The various pieces of legislation under which this assessment is being done require the determination of whether there is likely to be a significant effect of the Ocean Hauling Fishery on any threatened species, populations or ecological communities or their habitats. This requires consideration of the matters listed in s5A of the EP&A Act, generally referred to as the Eight Part Test and itemised in italics below. If the test reveals that a significant impact is likely then a Species Impact Statement (SIS) will be required, or the FMS may be modified such that a significant effect is unlikely. Further, a SIS would have to be prepared if the strategy incorporated land or water that was declared as critical habitat.

a) Part 1 — Life cycle of threatened species

In the case of a life cycle of threatened species, whether the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.

The Ocean Hauling Fishery is highly unlikely to place any species, at a State or regional level, at risk of extinction by interrupting their life cycle. In other words, the fishery does not impact on species such that they can neither breed, feed, roost, migrate nor otherwise disperse.

b) Part 2 — Endangered population.

In the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.

The endangered population of little penguins in North Harbour Aquatic Reserve is the only endangered population that could be affected by the fishery, however, it is unlikely to be directly affected by the methods in the Ocean Hauling Fishery. The capture of bait species in nearshore coastal waters, however, would provide competition for food resources, particularly during breeding when they are thought to have shorter foraging ranges.

Dayton *et al.* (1995) highlighted the problem of catching aggregated prey, particularly baitfish, and were concerned that it could be a significant, but unstudied problem in Australia. A study in Port Phillip Bay, Victoria, suggested that adult little penguins had died from starvation because fishing had depleted stocks of anchovies and pilchards (Harrigan, 1992). A later study reported that weather patterns, particularly related to the El Nino – Southern Oscillation phenomenon, caused dramatic shifts in baitfish recruitment, schooling behaviour, abundances and distributions, such that penguins were probably unable to catch sufficient food, irrespective of fishing practices (Hoedt *et al.*, 1995).

There is potential that during periods of low abundance, fishers may take a significant proportion of the available fish, severely limiting the resources available to the penguins, but it is unknown whether or not this occurs or the degree to which it is likely to compromise the population. Monitoring fluctuating catch levels, as detailed in the recovery plan for the endangered population of little penguins at Manly, may not necessarily provide any information about the impact of fishing unless there is some indication of the stock levels of baitfish and the feeding requirements of the penguins. Chapter E (Volume 2) suggests that adequate stock assessments of baitfish are not yet available, although they are proposed under the draft FMS. The NPWS is currently researching the feeding requirements and feeding ranges of the little penguin population. The combination of such

research may provide some indication of the effects of this fishery, and the Estuary General Fishery, on the little penguin population at Manly.

With the exception of the fatalities due to attacks largely by domestic animals, the population has been relatively stable at Manly, and it is thought that increasing the available nesting area could increase the number of birds. This would suggest that, in the absence of more reliable information about the effects of the Ocean Hauling Fishery on baitfish stocks, the fishery is unlikely to significantly compromise the little penguin population.

c) Part 3 — Regional distribution of habitat.

In relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.

The literature review for this assessment found little or no data about the effects of the fishery on habitats of sandy beaches, reefs or islands in which the fishery takes place.

The threatened species of fish considered in this assessment are marine species that primarily inhabit rocky reef, as well as a couple of species that utilise sandy beaches, particularly when they contain deep gutters or reefs. Given the extent of this type of habitat along the coast, and the limited scope for the techniques used in the fishery to affect this type of habitat, the fishery is considered unlikely to modify or remove a significant area of rocky reef. The fishery is unlikely to significantly modify the habitats of sandy beaches and the draft FMS proposes to significantly reduce the area that can be fished, reducing the potential extent of any impacts.

The fishery would not modify or remove a significant area of habitat for turtles, whales or dolphins.

The little penguin population at Manly, by definition, is likely to have a significant area of known habitat affected by the fishery, but this is unlikely to occur to the extent that it modifies or removes any habitat.

Of the other birds, primary areas of habitat for most species are found within or adjacent to estuaries, with occasional use of sandy beaches. Little terns, hooded plovers, pied oystercatchers, sooty oystercatchers and beach stone-curlews are some species that would regularly use sandy beaches of the open coast. The prime breeding sites of little tern have been identified by NPWS and strategies put in place to minimise harm or disturbance. Those measures, and those proposed in the draft FMS, should ensure that the fishery does not modify a significant area of their preferred habitat.

There is currently very little known about the distribution and abundance of hooded plover, but studies would suggest that it is extremely limited in both extent and number. The coastal beaches between St Georges Head and Brush Island, particularly Cudmirrah Beach on the South Coast appear to be the most important sites for this species. Cudmirrah Beach is closed to the fishery, preventing the modification of a significant area of habitat for the species.

Pied and sooty oystercatchers are widely distributed along the NSW coast, and at this stage there is no information about significant areas of habitat for these species. The use of sandy beaches and rocky shores by both of these species makes them susceptible to direct or indirect effects due to the fishery, but the methods are highly unlikely to result in the modification or removal of habitat for these species.

Very little is known about the distribution of beach stone-curlews, but they are thought to prefer extensive areas of open beaches and are generally restricted to beaches north of Nambucca Heads. The fishery could cause temporary disturbance of the species, but is unlikely to result in the modification or removal of any of its preferred habitat.

d) Part 4 — Isolated habitat.

Whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

The Ocean Hauling Fishery will not isolate any areas of habitats, nor will it fragment them such that they could become progressively isolated. Further, the connectivity of marine systems is such that reproductive isolation is almost impossible, especially in terms of the techniques used in the fishery.

The penguin population at North Harbour has not become isolated because of commercial fishing, nor is it causing an incremental isolation. Expanding urban development and a natural geographic formation are largely responsible for the isolation of the population. The fishery is also unlikely to prevent any possible further expansion of the area utilised by the population.

e) Part 5 — Critical habitat

Whether critical habitat will be affected.

Critical habitats have not been defined for any of the species considered in this assessment. Irrespective of this, a precautionary approach would suggest that the habitats occupied by the little penguin population are critical to their survival, and this is demonstrated in a recent proposal by the recovery team for the population to list parts of North Harbour as Critical Habitat (NPWS, 2001). As stated above, however, the fishery is unlikely to modify or remove the habitats, or restrict their distribution. As such, there will be few or no effects on those habitats. Should the proposal be approved and the area be gazetted as Critical Habitat, activities in the area will be part of a separate review process, information for which was being gathered at the time of this report.

f) Part 6 — Adequate representation in conservation areas.

Whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region.

It is important to note that very little is known about the distribution of most of the threatened species of fish. Furthermore, this part of the test (and most of it for that matter) is designed to examine whether affecting a small area of habitat (usually terrestrial) or small number of a species might be offset by their occurrence in protected areas. Very little is known about the biodiversity of our marine protected areas, and even less of threatened species, so it is impossible to assess whether the species or their habitats are adequately represented in conservation reserves or the like.

Numerous conservation reserves along the coast provide habitats for the various threatened species considered in this assessment. The endangered population of little penguins occurs in an Aquatic Reserve and representative habitats of most of the other species occur adjacent to National Parks, Nature Reserves or areas closed to commercial fishing. Estuary cod, black cod and Queensland groper are known to occur in Solitary Islands Marine Park, Julian Rocks Aquatic Reserve and Cook

Islands Aquatic Reserve. Weedy seadragons are known to occur in Fly Point Aquatic Reserve and Jervis Bay Marine Park.

g) Part 7 — Threatening processes.

Whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.

There are currently no declared threatening processes under the FM Act, nor is commercial fishing listed as a threatening process under the TSC Act. Further, the activities undertaken in this proposal are considered highly unlikely to exacerbate existing threatening processes under the TSC Act.

The recovery plan for little penguins at North Harbour does recognise commercial fishing as a threatening process to the colony, and as such this assessment accepts that there is potential for it to constitute a threatening process under the TSC Act in future. At this stage, the fishery does not appear to be adversely affecting two or more threatened species, one of the criteria necessary for an activity to be declared a threatening process.

The only processes related to fishing under the EPBC Act are the incidental catch (bycatch) of sea turtle during coastal otter-trawling operations within Australian waters north of 28° South, and the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations. Neither of these techniques applies to the Ocean Hauling Fishery.

h) Part 8 — Limit of known distribution.

Whether any threatened species, population or ecological community is at the limit of its known distribution.

The endangered population of little penguins at North Harbour must be at the limit of its distribution. The proposal will not reduce or affect the ability of the population to expand its range. Other birds whose distribution limits are likely to occur in NSW include beach stone-curlew, hooded plover, Gould's petrel, broad-billed sandpiper, fleshy-footed shearwater, great knot, grey ternlet, providence petrel, wandering albatross, shy albatross, sooty tern and white tern.

Green sawfish are more common in the north of eastern Australia, and the north coast region probably represents the southern limits for these species. Other species of fish that are thought to be at the limit of their distribution within NSW include eastern blue devil, elegant wrasse, estuary cod, Queensland groper and weedy seadragon.

i) Conclusion

This assessment has considered the eight factors under s5A of the EP&A Act in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities or their habitats. The assessment was based on a review of biological information derived from the various agencies responsible for those species, from published literature and from personal communications. The assessment has found that the proposal will not have a significant effect on any threatened species, populations or ecological communities or their habitats, and as such a Species Impact Statement is not required for the Ocean Hauling Fishery.