Review of the Conservation Status of Australia's Smaller Whales and Dolphins

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1. Introduction and background

The Action Plan for Australian Cetaceans developed by John Bannister, Catherine Kemper and Robert Warneke, and published in September 1996, provided a significant and positive contribution towards Australia's capacity to manage and conserve the great diversity of whales and dolphins recorded in Australian waters. Its scope was broad, ranging from the conservation status of Australian cetaceans and conservation research to key habitats and processes threatening cetacean taxa, and the need to address future priorities for conservation.

The importance of *The Action Plan for Australian Cetaceans* is twofold. It provided the first detailed assessment of biological and distributional information available for all 43 cetacean species then recognised in Australian waters. In addition, it focussed also on the importance of developing a national overview of the priorities for the conservation of all Australian cetaceans, while developing a basis for promoting and monitoring research and management activity, with an emphasis on endangered and vulnerable taxa.

The present report has been prepared in response to a request by the Threatened Species Scientific Committee for a progress report describing the current status of the smaller Australian cetacean species, and the conservation initiatives pertaining to them. This follows a commitment by the Commonwealth Government in the coalition's 2001 environment election statement 'A Better Environment' that the Government would ask the Threatened Species Scientific Committee to review the conservation status of priority small cetaceans.

In all, 35 species are defined in this report as small cetaceans. One species, *Tursiops aduncus*, has been added to the Australian list since the publication of *The Action Plan for Australian Cetaceans*. These dolphins are now recognised as distinct from *T. truncatus*. The species is common along the shores of the Indian Ocean, mainland Australia, and China (Wang *et al* 2000; Hale *et al.* 2000). Eight species of baleen whales and the Sperm Whale also occur in Australian waters; however, the International Whaling Commission caters to a large degree for these species in the Commission's annual deliberations, and in consequence they have not been considered further in this report.

Three species of small whales and dolphins were identified in *The Action Plan for Australian Cetaceans* as priority species, and listed in the category Insufficiently known, in view of their particular biological interest and concern for their conservation status (p.3 in Bannister *et al.* 1996). They are the Irrawaddy (Snubfin) Dolphin, *Orcaella brevirostris / O. heinsohni*; the Long-snouted Spinner Dolphin, *Stenella longirostris*; and the Indo-Pacific Humpbacked Dolphin, *Sousa chinensis*. These are described in detail below, in relation to the threats that they face, in terms of the conservation objectives identified for each, and those conservation actions already initiated, or required. Irrawaddy (Snubfin) and Indo-Pacific Humpbacked Dolphins share similar environments along Australia's northern shores, providing potential opportunities for researchers to form one or more groups, and to share resources and equipment. The remaining 32 species are described in Appendix 2.

2. Methodology, including Conservation Status

The review follows much of the approach and content of *The Action Plan for Australian Cetaceans for Australian Cetaceans* to ensure ready comparison with the present report, including the identification of key habitats, threatening processes, research directed at, or relevant to conservation strategies and issues. A brief description for each of the 35 species was developed for this review, incorporating new information derived from the literature (prime sources: Zoological Record online; Cambridge Scientific Abstracts) as well as unpublished data from a range of sources.

A first draft of the report was forwarded to a number of people with an interest in small cetaceans, to which 14 of 28 people responded; 12 of these provided information of value to the review. In all, 17 members of the National Whale Recovery Group responded, four of who provided information useful to the review. These two groups overlapped by five members, three of whom were not able to participate (overseas). A table summarising the content of submissions is provided in Appendix 3.

As indicated by Bannister *et al*. (1996) the selection of categories that define levels of threat applicable to cetaceans is problematic, for quantitative measures developed primarily for terrestrial animals are often more difficult to apply to marine mammals. The most recent approaches, developed over a period of some 10 years by the IUCN (2001) require adequate estimates of population numbers, range size and distribution or estimates of population reduction to determine conservation status. Such data are frequently lacking for most cetaceans, including Australia's smaller species. Obtaining the required data, even for a few species, will form an essential and primary component of future research on small cetaceans. Some initial suggestions on approaches to obtaining the required data are discussed in section **6**; further input from members of the cetacean scientific community will be requested and collated to form a workable structure for such data collection.

The categories selected by Bannister *et al.* (1996) were those defined by the IUCN at that time, namely: **Extinct**; **Endangered**; **Vulnerable**; and **Insufficiently known**. The categories defined under Australia's *Environment Protection and Biodiversity Conservation Act 1999* are, in order of diminishing threat: **Extinct**; **Extinct in the Wild; Critically endangered**; **Endangered**; **Vulnerable**; and **Conservation Dependent**. In 2001, the IUCN introduced a new assessment process, in which the categories were revised; these differ from those of the EPBC Act only in the inclusion of the **Conservation Dependent** category in the latter. The IUCN categories are now, in order of diminishing threat: **Extinct**; **Extinct in the Wild**; **Critically Endangered**; **Endangered**; **Vulnerable**; **Near Threatened**; and **Least Concern** (IUCN Redlist; IUCN 2001). The term **Insufficiently known**, as used by Bannister *et al.* (1996) provides for species that are suspected, but not definitely known, to fit into extinct, endangered or vulnerable categories, primarily as a result of lack of information. Its current equivalent in IUCN terms, namely, **Data Deficient** (IUCN 2001), has been added, where appropriate, to the species descriptions.

An additional category, with three levels, was developed by Bannister *et al.* (1996): **No category assigned, (a) because of insufficient information (NCA(a)); No category assigned, (b), but possibly secure (NCA(b)); No category assigned, but probably secure (NCA(c)).** These last three categories were relevant to almost all small Australian

cetaceans (Bannister *et al.* 1996). A summary of the categories assigned to each non-priority species is provided under section **4**.

In accordance with the recommendations of the IUCN (2001), the assessment of the degree of threat to a particular species is primarily based on the degree of reduction in population size (defined as the number of mature individuals), and/or reduction in geographic range. Details of the several criteria adopted by the IUCN and available for the process of assessment may be found on the Internet at http://www.iucn.org/themes/ssc/redlists/RLcats2001booklet.html.
The dependence on population numbers and geographical range for this assessment process highlights the importance of obtaining such data for all species as a matter of urgency. This issue is addressed further under section **6**.

No flagship taxa have been identified. However, it is pertinent to note that two of the three taxa accorded this status in *The Action Plan for Australian Cetaceans* in 1996 (*Sousa chinensis* and *Orcaella brevirostris*) are priority species, and therefore under scrutiny. Now that the Indo-Pacific Bottlenose Dolphin, *Tursiops aduncus*, is recognised both as a full species (Ross 1977; Hale *et al.* 2000; Wang 1999; Wang *et al.* 2000, 2001) and as one of the dominant cetacean species of eastern Australian coastal waters (Möller, L.M. and Beheregaray 2001), it embodies the attributes previously accorded to *T. truncatus* as a flagship species. In contrast, *T. truncatus*, which appears to inhabit offshore waters in this region, now ranks as a poorly known species.

3. Species Descriptions - Priority Species – General description.
Refer to Appendix 1 for detail

Background

The authors of *The Action Plan for Australian Cetaceans* accorded priority status to four species. Three of these are small cetacean species: the Indo-Pacific Humpbacked Dolphin, *Sousa chinensis*; the Irrawaddy Dolphin, *Orcaella brevirostris*; and the Long-snouted Spinner Dolphin, *Stenella longirostris*. The fourth species was the Sperm Whale, excluded here as a large whale. All four species were classified as Insufficiently known.

The priority status has been retained for the present for several reasons. Although studies of Indo-Pacific Humpbacked Dolphin and Irrawaddy Dolphins are underway, progress on both population size and distribution will require further work. The taxonomy of *Sousa* is still under discussion at a global level, although changes at species level are not anticipated for Australian populations. The taxonomic status of *Orcaella* species in Australia has recently been challenged with a new species described to replace the Irrawaddy dolphin, *O. brevirostris* as the Australian Snubfin dolphin, *Orcaella heinsohni* (Beasley, I., Robertson, K. M., and Arnold, P. 2005).

Both species live in small groups in shallow coastal waters, where they are particularly susceptible to anthropogenic influence, especially capture in nets. Evidence indicates that Indo-Pacific Humpbacked Dolphins are philopatric, suggesting that the loss of females from such small groups through anthropogenic means could reduce the viability of a group in the long term and might initiate its decline. [Philopatry describes the attachment of an animal or group of animals to a particular area; Gr. = love of the land; evident in several species of odontocetes, and the Gray Whale]. The presence of philopatry in Australian *Orcaella* species has yet to be confirmed (G. Parra, personal communication).

The Long-snouted Spinner Dolphin was accorded priority status in response to the high rate of incidental capture in the Taiwanese gill-net fishery for sharks, in which some 4900 dolphins were killed between 1981 and 1985.

Subsequent to the banning of this gill-net fishery and cancellation of the Taiwanese license, netting or harpooning of dolphins, largely for bait, continued illegally for some years in Australian waters. However, such activity has all but disappeared based on information from the Australian Fisheries Management Authority (Mike Yates, personal communication; May 2003).

Comprehensive research programs were recommended for *Sousa chinensis* and *Orcaella* species (as *Orcaella brevirostris*) and a less intensive research program was described for the Long-snouted Spinner Dolphin (Bannister *et al.* 1996). The continuation of these recommended research objectives, as identified in *The Action Plan for Australian Cetaceans*, will be instrumental in enhancing the conservation of these species.

The descriptions for the three priority species are similar in content to those of other species, but differ in their length, through the expansion of some points to clarify issues; and a preliminary and brief assessment of the extent to which the Conservation Objectives described by Bannister *et al.* (1996) for these species has been addressed.

4. Synopsis for Other Small Species

In addition to the three priority species, the synopses for each of the remaining 32 species of small cetacean presently recognised in Australian waters have been updated with new information and perspectives on biology, distribution and management related issues. These synopses are presented in Appendix 2. No conservation category has been assigned to any of these species.

Eighteen species are ranked as not having sufficient information to provide a firm basis on which to infer a significant threat, past or present = (NCA(a)). These include: Spectacled Porpoise; Rough-toothed Dolphin; Dusky Dolphin; Risso's Dolphin; Indo-Pacific Bottlenose Dolphin; Pantropical Spotted Dolphin; Striped Dolphin; Fraser's Dolphin; Southern Right Whale Dolphin; Pygmy Killer Whale; Shepherd's Beaked Whale; Longman's Beaked Whale; Blainville's Beaked Whale; Hector's Beaked Whale; Andrew's Beaked Whale; True's Beaked Whale; Gingko-toothed Beaked Whale and the Dwarf Sperm Whale.

The Indo-Pacific Bottlenose Dolphin, *Tursiops aduncus*, has recently been recognised as a full species, subsequent to a genetic evaluation of delphinid species. This species occurs widely around Australia in large groups, and appears to be secure. *Tursiops truncatus*, previously the taxon to which all bottlenose dolphins were allocated, has been re-evaluated and rates as a poorly known species in Australian waters (rated K, with the three priority species); the inshore bottlenose dolphin, *Tursiops aduncus*, now appears to be the most significant species numerically along Australian shores (Hale *et al.* 2000).

Fourteen species are ranked as having no category assigned, where there is no firm basis on which to infer a significant threat, but there are general indications of wide distribution and abundance = (NCA(b)). These include: Hourglass Dolphin; Bottle Nose Dolphin; Common Dolphin; Melon-headed Whale; False Killer Whale; Killer Whale; Long-finned Pilot Whale; Short-Finned Pilot Whale; Arnoux's Beaked Whale; Gray's Beaked Whale; Strap-toothed Beaked Whale; Cuvier's Beaked Whale; Southern Bottlenose Whale; and the Pygmy Sperm Whale.

None of the species are ranked (NCA(c)) - no category assigned, but likely to be secure. A summary of the conservation status of all species is provided in Table 1.

Several species are noteworthy for the considerable development in our knowledge since *The Action Plan for Australian Cetaceans* was published six years ago. The first Spectacled Porpoise, *Phocoena dioptrica*, was recorded for continental Australia in 1997 (Evans *et al.* 2001). Other changes of note have been: the growing acceptance that *Tursiops aduncus* is a valid species. This species is probably the best-known cetacean in Australia, as the highlight of Monkey Mia, Shark Bay, and many other bays around Australia. The presence of Dusky Dolphins in Australian waters has been confirmed, with most records for Tasmania, and additional records for South Australia and Victoria (Gill *et al*. 2000).

Longman's Beaked Whale, *Indopacetus pacificus*, has long been considered the rarest beaked whale in the world, based on two skulls only, from Queensland and Somalia. Genetic material extracted from the skull of the holotype and five additional specimens have been identified; further, the colour pattern of one specimen provided a clue to the real

identity of the "Tropical Bottlenose Whale", now considered almost certainly to be *Indopacetus pacificus*. It is apparently reasonably common from Somalia to South America in tropical waters (Dalebout *et al.* 2003).

5. Overview of threatening processes affecting small cetaceans

The threatening processes that impact on Australia's small cetaceans are described briefly for each species in the relevant description. This section provides information on some impacts affecting small cetaceans that are not included elsewhere or for which more information is now available. Also it examines those species that share particular impacts, to assess whether they provide insight into those species more at risk than others, and hence require higher priority in mitigation measures.

5.1 Impact of marine mariculture on small cetaceans

The impact of marine aquaculture facilities on small cetaceans is generally negative (Kemper *et al.*2003), based on an assessment of such facilities in S.E. Tasmania; Port Lincoln, South Australia and Shark Bay, Western Australia. Such interactions include fatal entanglements, illegal killing, non-fatal entanglements, and evidence of habitat disturbance in farms producing pearls, mussels and salmonid fishes, involving *Tursiops truncatus*, *T. aduncus* and *D. delphis.* Between 1998-2000, four *D. delphis* and five *T. truncatus* were killed when entangled in salmonid farms in south-eastern Tasmania. Kemper and Gibbs (2001) reported on a minimum of 29 dolphins (*T. aduncus* and *D. delphis*) entangled and killed at southern blue-fin tuna feedlots between 1994 and 2000. Stomach contents indicated that they were attracted to the presence of prey fish around the farms. Methods for mitigating entanglements include well-tensioned mesh; minimising wastage of food; removal of dead caged fish immediately; immediate repair of damaged nets, and closure of anti-predator nets. Finfish farms also utilise two primary food species of importance to these species of dolphins – jack mackeral *Trachurus declivis* and pilchard, *Sardinops neopilchardus*, thereby potentially reducing food supplies for these and other piscivorous mammals, such as fur seals.

Kemper *et al.* (2003) noted that positive interactions between cetaceans and aquaculture facilities housing finfish have not been identified, although they are more difficult to quantify. The additional nutrients available to wild fish around such facilities is counter-balanced by the potential for algal blooms and impact on the benthic environment and fauna. Despite mitigation approaches, in their view such interactions should be considered inevitable. Kemper *et al.* (2003) cite some studies outlining how to minimise interaction between marine mammals and aquaculture facilities. Options are few, however, and include Acoustic Harassment Devices (ADHs), which produce sounds of an intensity likely to impair hearing, and may also affect non-target species in the area. The authors stress the necessity of stringent environmental impact assessment before additional facilities are planned and permitted.

5.2 Impact of ecotourism on cetaceans

The public demand for access to close-up or tactile experiences with whales and dolphins has increased enormously, and continues to do so (Bejder and Samuels 2003). Swimming with wild whales and dolphins is widespread across the world, occurring in 19 countries and involving 15 delphinid species; the beluga; the dense-beaked whale, three species of balaenopterids and the sperm whale (Samuels *et al.* 2003).

Such activities have enabled several million humans to observe and touch, swim with or feed wild whales and dolphins in an industry worth a commensurate amount of money. However, such encounters may be prolonged, and repetitive, potentially with negative results. Counter-productive activity includes disruption to socialising and breeding behaviour, feeding or choice in direction of travel. Research indicates that some tourist activities produce short-term changes in the behaviour of cetaceans involved in interactions, but the degree of impact is often difficult to evaluate, in part because such effects may be cumulative in their effect. Further, the subtlety of the immediate effects on a cetacean makes interpretation difficult, and Bejder and Samuels (2003) encourage research in this field, with a focus on a fuller understanding of the impacts of such tourism on cetaceans.

Lone, sociable dolphins typically make first contact with humans (Samuels *et al.* 2003); their habituation to humans takes time, but places them at risk of injury or death. Food provisioning forms the main focus for encounters with dolphins, and evidence suggests that provision of food requires control to minimise the risk to wild dolphins. These authors identified only one location where habituated dolphins interacted with humans. Unhabituated dolphins are involved in most swim-with programs. Research indicates that the behaviour of targeted dolphins changes during swim-with activities, in response to approaches by swimmers, providing insight into the impact of cetacean-focused tourism. Samuels *et al.* (2003) suggest a precautionary approach in interacting with wild cetaceans.

5.3 Increasing environmental sound levels in the oceans

Acoustic noise in the oceans is increasing as a result of a range of impacts on the environment, including more boat traffic, dredging, seismic surveys associated with oil and gas exploration, ocean experiments and military activities. Overall increase in sound levels can have a range of impacts on cetaceans, including physical damage to body tissue, gross damage to the ears, and a permanent shift in hearing threshold; masking of communication with conspecifics, and assessment of environmental cues; behavioural changes, chronic stress, with a range of consequences; and social disruption (Simmonds, Dolman and Weilgart 2003).

All species are potentially affected by acoustic disturbance. The Australian Government has implemented Guidelines On The Application of the ***Environment Protection and Biodiversity Conservation Act*** to Interactions Between Offshore Seismic Operations and Larger Cetaceans for the oil and gas exploration industry to minimise impacts on cetaceans during this activity. At higher levels of sound, such as are used in the testing of Active Sonar systems, physical damage or a permanent shift in hearing may occur. The consequences of such damage to hearing is starvation and death for odontocetes, once their echolocation is impeded or destroyed.

Research on the impacts of such systems on small cetaceans, with particular attention on beaked whales, family Ziphiidae is being conducted in the Northern Hemisphere. These deep-diving whales are subdued in their surfacing behaviour, and often go undetected. They prefer deep-water habitats, such as seamounts and canyons formed in the deeper levels of the continental slope. Recent stranding events in the Canary Islands and in the Bahamas as a probable result of the use of mid frequency sonar demonstrated the effects such equipment in certain areas have for these whales. Research in the United States has suggested there is a correlation in time and space between some mass stranding events and the operation of certain types of sonar equipment in particular circumstances. Such events were evident in the stranding of 17 toothed whales in the Bahamas in 2003, associated with use of mid-frequency sonar systems.

5.4 Entanglement of marine mammals

In addition to direct capture, marine mammals are potentially subject to entanglement in debris from fisheries operations. The debris is derived from a range of materials, coming mostly from trawl or gill nets, rope, twine and fishing line. It ranges in size from a simple loop to whole nets. The South Australian Museum recorded fatal entanglements of Common Dolphins in lines attached to crayfish pots, and two Common Dolphins and one bottlenose dolphin killed in monofilament gill-nets and shark nets (Shaughnessy *et al.* 2003). The impact of debris on entanglement of small cetaceans is largely unknown, as most animals are likely to die unnoticed at sea. Species involved in Australian waters include bottlenose dolphins and Common Dolphins (Jones 1995; Bannister *et al.* 1996; Shaughnessy 1999).

5.5 Fisheries by-catch in Australian waters

The frequency and often the identity, of small cetaceans involved in by-catch is uncertain. Bottlenose Dolphins and Common Dolphins are those caught most frequently in fisheries overseas. Shaughnessy *et al.* 2003 notes that most incidents involve single animals, but occasionally mortality involves significant numbers, such as the death of 33 common and bottlenose dolphins in a purse seine fishery for Australian herring in Bremer Bay, Western Australia. Several species of small cetaceans have been used for bait in crayfish pots (Bannister *et al.* 1996).

The depredation by Killer Whales and other small toothed whales of tuna and bill-fish caught on long-lines off eastern Australia and near Norfolk Island (Shaughnessy *et al.* 2003) places a different perspective on interaction between fishers and whales.

5.6 Actions taken by fishing industries to reduce by-catch of marine mammals

By-catch action plans for several fisheries managed by the Australian Fisheries Management Authority were launched in May 2001 and reside on the AFMA website. The fisheries include the South East Non-trawl Fisheries. Protected species, including cetaceans, are considered to be at low risk in the South-East Trawl Fisheries. The species considered to be at risk (dolphins, great white sharks and sea lions) are included as a result of broader community perception rather than specific interactions within the two fisheries. Leadbitter (1999) has described a number of mitigating measures to counter potential threats in these fisheries. He promoted the use of

pingers to warn cetaceans away from fishing gear and provision of escape panels for cetaceans in purse seine nets. Methods of handling animals brought aboard vessels, including cetaceans, and other issues such as not discarding unwanted fish, are described by Leadbitter *et al.* (1998)

5.7 Overview of other threats

The range of potential threats is broad. Based on those identified by Bannister *et al.* (1996), the following comments reflect potential outcomes for further threats in relation to the species likely to experience them.

Entanglement - All 35 species of small cetaceans are at risk of entanglement in a range of netting, including anti-shark nets, set nets, discarded netting, and drift nets set illegally. Actions to alleviate risks include education, compliance and monitoring.

Habitat Degradation - Three species with a narrow habitat niche, such as *Sousa chinensis*, *Orcaella brevirostris/ O. heinsohni* and *Tursiops aduncus*, are susceptible to habitat degradation. Actions to alleviate impacts include protection of coastal vegetation, sustainable coastal development and usage and riverine inputs.

Direct Killing - Deliberate killing for bait, vandalism, human consumption etc. Three species have been known to be affected in this manner: *Tursiops aduncus*, *Delphinus delphis* and *Orcinus orca* are killed deliberately and illegally for sport, crayfish bait or as a perceived competitor in fisheries. Under the EPBC Act it is illegal to kill a cetacean in Commonwealth waters. All States and the Northern Territory have similar provisions in their legislation.

Ship strike – Small inshore dolphins are most vulnerable to fast-moving, high-powered vessels such as launches, ferries and jet skis. The outcome is likely to be death, either instantaneous or eventual, due to injury, infection, lack of ability to feed etc. With the ever-increasing use of coastal habitat by the human population, this threat requires continual eduction of the water-going public and management of areas of concern through the introduction of restricted speed zones.

Oil Spills - The limited data available suggest that cetaceans are not harmed directly by oil spills, even of the order of that arising from the wreck of the *Exxon Valdez*. However if philopatric, inshore species such as *Tursiops aduncus* and *Sousa chinensis* are displaced from their feeding areas, they may face competition for food and space with adjacent groups.

Potential For Epizootic Events - The potential loss of a considerable proportion of one or more species is a possibility. The first step in counteracting such an event in terrestrial animals has been established in the form of the Australian Wildlife Health Network (AWHN), which commenced operations on 1 July 2002. Integration of the marine ecosystem into the network would provide an effective conduit for notification of and response to such an event.

Global Warming - The long-term impacts of global warming has the potential to affect all cetaceans in habitat changes, prey availability and changes in sea levels.

Persistent organic pollutants - Because the oceans act as a sink to collect and distribute pollutants from and to wide areas, marine mammals, through their diet, are susceptible to the accumulation of PCBs and other pollutants. Their physiology is not adept at degrading such contaminants, and as they are a long-lived group, the potential for accumulation over time of life-threatening levels is high. PCBs have the potential to particularly affect localised populations that feed in restricted areas that receive industrial run-off or by-products released into rivers or the ocean. Research that monitors marine mammals as indicators of the health of our environment is important.

Diminished Genetic Diversity – This is mainly a concern in populations that suffer severe depletion with limited opportunity for interbreeding with other populations. Studies underway on localised groups of in-shore bottlenose dolphins is indicating that there is limited exchange between bays at least along the eastern Australian coast and this may have an effect on genetic diversity. It is also an indication that localised populations may not be replaced if the resident group dies out. Loss of genetic diversity is not believed to be a problem for pelagic small cetacean populations.

Food Availability – The impact of increasing pressure by humans on diminishing fish and squid fisheries is an issue for many species and presents the most direct threat to coastal/inshore odontocetes.

5.8 Overview of Conservation Objectives

The conservation objectives determined by Bannister *et al.* (1996) cover a range of topics that are ultimately important in the conservation of each species. These group readily into sections and individual projects, along the following lines.

- establish and improve knowledge of distribution for all species especially those inhabiting the coast;
- establish and monitor population size for all species;
- determine the habitat requirements and their physical structure for each species;
- ensure that all relevant materials are collected from stranded and other animals for museum collections.
- determine morphological and physiological parameters (growth rates; senescence; age determination)
- determine reproductive parameters, including gestation period, generation time, age at sexual maturity; calving rate; senescence, etc.
- investigate genetic relationships, ranging from genera to potential subspecies;
- determine diet, including seasonal change, over the distribution of the species;
- material for assessing status of heavy metals and pollutants from biopsies or carcases;
- assess the potential impact of overfishing finfish and/or cephalopods on each species;
- assess the effects of current ecotourism and possible future effects on cetaceans involved; fund research to further knowledge in this field;
- assess level of incidental catch by monitoring relevant fishing industries and other operations, e.g. aquaculture;
- take opportunities to assess impact of debris at sea;
- nominate important locations for protection;
- employ an ecosystem management approach, especially in relation to fishing;

- assess the impacts of detrimental acoustic effects in important cetacean habitats;
- improve stranding networks; and
- develop photo identification catalogues to provide information on population size.

6. General Research and Approaches for the Future

6.1 Recommendations

Recommendation 1. Irrawaddy (Snubfin) and Indo-Pacific Humpbacked Dolphins

To determine the distribution and population size for Irrawaddy (Snubfin) Dolphins and Indo-Pacific Humpbacked Dolphins in northern Australian waters. Studies on taxonomy, pollution and genetic determination of population structure should also be considered. Information should also be gathered on the level and type of incidental take in fisheries.

Rationale

- Irrawaddy **(**Snubfin**)** and Indo-Pacific Humpbacked Dolphins are high priority species that occur close inshore along Australia's northern shores; although the overall distribution of these species is known, very few population data are known for any region. Northern Australia provides the greater part of habitat suitable for both species, and probably most of these two species in Australian waters. The Australian population of *Orcaella* has been described as a new species (*O. heinsohni*) separate from their Asian counterparts.

- In keeping with their priority status, it is proposed that the first voyage to determine population size and distribution should focus on these two species, and any others in the region.

- Given the similarity in their habitats and distribution, it would be appropriate for researchers on these species to team up for the assessment of distribution and status of the two species. Remote communities may assist by informing the team about local populations of dolphins.

- Use of a quiet vessel, such as a yacht may prove most effective, or a vessel able to support a quiet launch. Techniques for assessing numbers of *Sousa* acoustically have been developed recently (Van Parijs *et al.* 2000). While offering the potential for determining numbers even when water clarity is minimal, further evaluation of the technique may be appropriate. Aerial survey may also assist in identifying areas with high numbers of these species.

- Regional assessments for these species, and re-classification of status, would be appropriate where there is concern about local decline in populations.

- Research on the calls of *Orcaella* in Australian waters is important, to assess the potential for assessing localised population size using call rates.

- POPUPS may prove useful for acoustic monitoring of elusive species, such as Irrawaddy **(**Snubfin**)** dolphins, and could provide additional data at night-time or in more remote areas.

Recommendation 2. **Spinner Dolphin**

To determine the distribution, population size and taxonomy of the Long-snouted Spinner Dolphin, *Stenella longirostris,* in northern Australian waters.

Rationale

- The Spinner Dolphin was accorded priority status in response to the high rate of incidental capture in the Taiwanese gill-net fishery for sharks in the early 1980s. The level of threat to the Timor Sea populations is still uncertain, although evidence provided by the Australian Fisheries Management Authority suggests that such threats have all but disappeared in this region. (Mike Yates, Australian Fisheries Management Authority).

- Spinner dolphins in the Great Barrier Reef are very small, and close in size to the Dwarf Spinner dolphins of Thailand. The relationship between Spinner Dolphins in the Great Barrier Reef region and other forms of Spinner Dolphin requires elucidation.

Recommendation 3. Bottlenose Dolphin

A. To determine the taxonomy and distribution, of the Indo-Pacific Bottlenose Dolphin, *Tursiops aduncus* and the Bottlenose Dolphin, *Tursiops truncatus.*

Rationale

- It is important to be able to distinguish *T.aduncus* species from *T. truncatus*. Priority should therefore be given to studies on the osteology and external morphology of the two species throughout Australian waters.

B. To determine the population size and conservation status, of the Indo-Pacific Bottlenose Dolphin, *Tursiops aduncus* and the Bottlenose Dolphin, *Tursiops truncatus.*

Rationale

- The Indo-Pacific Bottlenose Dolphin offers great potential for the first complete population assessment for any Australian small cetacean species. This inshore species occurs around much of the Australian coast, including possibly some of northern Tasmania.

- The species is well suited to assessment by a series of shore-based surveys, along Australia's coastline. Being philopatric, mixing between adjoining groups is minimal, and this species effectively comprises a series of small, self-contained entities along the coast. Some populations have been studied in depth in several localities, including Monkey Mia, Stradbroke Island, Shark Bay, Cockburn Sound,

Perth, Port Stephens, Jervis Bay, Port Phillip Bay, Port Adelaide, and southern coastal Victoria.

- Management of this species is likely to become increasingly important. It bears the brunt of human impacts on the coastal environment, including habitat degradation and consequent diminishment of local food resources. Burgeoning coastal development and associated issues, including boat traffic, will all impact on this species. Completion of such a survey, coupled with local assessments of potential impacts, would be a very valuable contribution to the conservation of this species, and an important acknowledgement that such surveys are practical and achievable.

Recommendation 4. **Biological sampling**

To investigate and determine the primary biological parameters for species of Australian small cetaceans.

Rationale

- Substantial knowledge of the biology of small cetacean species is essential to understand those aspects of cetacean life that are important and relevant to conservation. Full knowledge of life history parameters, in particular, are pivotal in this process, and underscore the urgency for determining useful working values for these parameters for all Australian species.

- An essential component in this process is to ensure that all biological material of value in determining reproductive status and activity, growth, diet, age, level of parasitism and other biological parameters is collected from all possible sources including strandings and by-catch, and deposited in an appropriate natural history museum involved.

- Explore opportunities to further our biological knowledge by comparing and combining samples from selected species in Australian institutes, such as reproductive materials, thereby increasing sample sizes and improving the strength and interpretative potential of results.

- Assess the levels of heavy metals and pollutants from carcases or biopsies, and determine the presence and degree of change, if any, in levels of pollutants in small cetaceans, compared to a decade or two ago. Pollutant samples can be analysed by the Australian Government Analytical Laboratories, Canberra, or by laboratories in several universities and the CSIRO.

- Funding for the collection and analysis of samples relevant to life history studies is essential, owing to the low level of funding available to museums to support such work. Some measure of the amount of material available for processing, prior to the proposed strandings workshop, would assist in determining the level of financial support required.

Recommendation 5. **Genetic sampling**

To collect, as an integral part of any survey, biopsy samples from all possible species and populations. This would provide material for a range of genetic studies already underway in Australian waters to determine genetic structure within Australian populations and degree of relationship with other populations further afield.

Rationale

- Biopsy samples can provide insight into genetic relationships between individuals, groups and other populations, population size, sex, association with other individuals, movement patterns, hormonal status; and an indications of feeding ecology, based on analysis of stable isotope ratios in fatty tissue.

- A range of techniques, used in association with genetic work, provide capacity to predict and model the status of populations. They include population viability analysis, sensitivity analysis and other methods pertinent to assessing and managing disjunct populations as discrete management units.

Recommendation 6. Killer whales

To assess the forms of killer whales present in Australian waters.

Rationale

- Three forms of killer whale have been reported in the Antarctic (Pitman and Ensor 2003). An assessment of which forms are present in Australian waters should be carried out using existing photographic material to start. Estimates of minimum numbers from individually identified whales may also be possible.

Recommendation 7. Prey Identification

That a Prey Identification Service is established and funded to enable the identification of prey items in small cetaceans.

Rationale

The few dietary studies made for Australian marine mammals have focussed largely on the analysis of dietary composition. The collection and analysis of prey remnants in the stomach of small cetaceans provides the most effective means of assessing diets and their components. The predominant items requiring identification are cephalopod beaks and fish otoliths, as most small cetaceans feed primarily on fishes and cephalopods.

- The capacity to identify a broad range of prey, including remnants of smaller species in an individual stomach provides opportunities for insight into trophic pathways. Such assessments will become increasingly important as pressure on fish and cephalopod stocks increases.

- Reference collections are vital for such services to be effective. Excellent reference collections for cephalopods are well established at Museum Victoria, Melbourne. Otolith collections, however, are less complete, with the exception of Southern

Ocean species, which are well represented at the Australian Antarctic Division. Smaller collections are present in the South Australian Museum and Museum Victoria. Expansion of these collections would be most valuable, increasing the range of species, and extending the depth of data on otolith length/ prey mass relationships. Some funding to support such a service could accrue from fees for identification services.

- Prey identification services have proved very effective in Europe and South Africa, and would be a valuable resource for a range of marine ecological studies in Australia.

Recommendation 8. Beaked whales

To establish study sites over selected large canyons on the Australian coast to estimate numbers and distribution of resident beaked whales.

Rationale

Beaked whales can be surveyed at sea at the same time as other small cetaceans. However, these whales surface very briefly and dive for long periods, making identification difficult and often sporadic. Research on beaked whales is important, as they constitute one-third of all small cetacean species in the Australian region. Very little is known of their numbers, or biology and even less concerning their conservation status.

Shipboard surveys of beaked whales (*Mesoplodon* spp. and *Ziphius cavirostris*) from 1991-1998 along the shelf edge and Gulf Stream waters off the northeast United States showed that these species frequent similar shelf-edge habitats (Waring *et al.* 2001). Beaked whales were present mostly along the colder shelf edge, and associated significantly with canyon habitats. It is likely that such habitats are utilised by beaked whales along much of Australia's extensive coastline, particularly along the more southern shores, as well as numerous seamounts in the Coral Sea, and the Tasman Sea between New Caledonia and Tasmania, such those forming the Lord Howe Marine Park.

North Atlantic Bottlenose Whales frequent a large canyon off Nova Scotia, and research by Hal Whitehead and associates has shown that at least 133 of these whales are effectively resident in/over this canyon for much of the year. This expression of philopatry suggests that other populations of beaked whales may do the same. Work in the Bahamas by Colin Macleod on Blainville's Beaked Whale indicates that some animals are resident, and research in the Cook Island by Nan Hauser provides similar evidence.

It is recommended that a select number of canyons is visited in small vessels at least monthly, over a period of a year, to assess whether beaked whales are present in the area, to identify all species and photograph all beaked whales in the area to determine whether animals are resident. Once a number of individuals have been sighted and recorded, it is recommended that biopsies are taken to determine a range of parameters, including sex, hormonal status, evidence of lipids that may give clues to diet, and so forth, as a starting point for research on these whales.

Canyons should be selected largely for ease of access, and availability of vessels. The large canyon off Wollongong, and the Perth Canyon off Rottnest Island seem good candidates for testing purposes, as they are visited monthly by vessels catering for seabird observers.

Any such project should be reassessed after a year. If the study proves promising, it is suggested that longer-term projects are established in association with local universities, to continue research in collaboration with other marine mammalogists.

Recommendation 9. Distribution, population size, habitat

To determine the distribution, population size and nature of the habitat, for each of 33 species of small cetaceans in Australian waters, excluding Irrawaddy and Indo-Pacific Humpbacked Dolphins.

Rationale

The first two Conservation Objectives listed above under section 5.8 - namely knowledge of distribution and knowledge of population data for each species – comprise the most important components of this project, on which the assessment conservation status of 35 species of cetaceans depends.

Our current capacity to assess the conservation status of Australian of small cetaceans is very limited, primarily by our lack of good-quality information on distribution and population data for virtually all Australian small cetaceans. The emphasis on these aspects reflects the importance of these key elements in establishing the conservation status of species using IUCN criteria, which equate to those under the EPBC Act.

The importance of collecting such information is recognised under section 173 in the EPBC Act, in which it states as a requirement that: “The Minister must prepare surveys that identify, and state the extent of range of cetaceans present in Commonwealth marine areas” and that “A Commonwealth marine area must be covered by a survey…… within 10 years after the commencement of this Act, or (b) within 10 years after the area becomes a Commonwealth marine area.” The Act came into force in 1999, implying that these surveys are required to be completed within the next 6-7 years.

The initiative developed here outlines approaches to obtaining these data. With the exception of a very few inshore species that can be accessed in small coastal vessels, our ability to observe and assess density and numbers of small cetaceans in oceanic waters is dependant upon access to ocean-going vessels for appropriate periods, lasting several days to weeks.

It is proposed that complete circumnavigation of Australia’s coastline is required over time; with the survey for small cetaceans focussed on the region between the shoreline and the outer edge of the continental shelf (approximately 50 nm offshore). Effective surveys will require a zig-zag course to be made across the continental shelf, to maximise at all times the number of sightings and range of species observed.

The process of determining population estimates and distribution for all Australian small cetacean species also provides a unique opportunity to document other important aspects of the lives of small cetaceans, especially the characteristics and usage of habitat for each species. Much of this information can be collected readily, as a component of the overall survey, using standard ship's equipment, and satellite data, sampling with epipelagic plankton nets and a temperature probe; useful parameters to evaluate habitat include water depth; depth of the thermocline (?15ºC isotherm), gradient of the sea floor, surface temperature and salinity, and its variability, surface chlorophyll concentration and epipelagic zooplankton biomass, such as is described by Davis *et. al*. (1998), Griffin (1997) and Mignucci-Giannoni (1998).

The program will cover the entire coastline of Australia in a series of voyages over the 6-7 year period, which provides for overlap to assess the influences of seasonal change on cetacean distributions. As overall time spent on survey is a key factor in the success of this venture, efforts will be made to utilise a wide range of ships of opportunity throughout the project. Organisations and ships conducting marine research will also provide potential opportunities for such survey work, such as AIMS and the Australian Maritime College, CSIRO vessels, hydrographic vessels, and vessels involved in seismic work.

The program will require a small, full-time survey team to manage and oversee the project, and provide feedback on activities and progress. Particular emphasis will be placed on data quality and storage. The team would also advise on the most effective voyage track for maximising data collection on cetacean habitat across the continental shelf. We recommend that this survey be fully funded for a period of 3 years to enable the program to meet the requirements of the EPBC Act, with an obligation to publish the results after a 2-year period for analysis. Three full-time employees would be appropriate to manage the program, assisted by a series of trained observers under contract for specific periods. These observers would be located in a range of locations around Australia, providing flexibility for joining a ship of opportunity if necessary.

A national register of trained and experienced cetacean observers around Australia will be developed to ensure effective placement of observers on ships at all opportunities. Training resources and workshops will ensure that observers are well equipped to maximise the opportunities to identify and count cetaceans at sea accurately. It is envisaged that small teams of observers would, for periods appropriate to the length of the voyage, undertake the bulk of the observation and recording of data. Techniques for assessing numbers of cetaceans are relatively well-established, and well-supported by readily available software, such as *Introduction to Distance Sampling. Estimating abundance of biological populations* (Buckland *et al.* 2001)

Sightings data will be assembled in a single database to provide an effective national sightings database, including storage and retrieval of pertinent images of cetaceans at sea. Data will be processed and stored on board ship, and downloaded to the database on completion of the voyage. It is proposed that data are stored in a central location, linked to other complementary datasets, and accessed via a protocol, Ozcam, the zoological protocol equivalent to that enabling access to the Virtual Herbarium.

At present, only daytime observations and counts only are practical. However, current improvements in acoustic monitoring and the ability to identify species by their calls,

suggest that combined visual and acoustic surveys are likely in the future, thereby improving the quality and rate of data collection, especially at night. (see Mellinger and Barlow (2003) at: http://www.pmel.noaa.gov/vents/acoustics/pdfs/AcousticAssessmentWorkshopReport.pdf

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8. Personal Communications

Arnold, P. (November 2002). The marine population of *Orcaella* in Australian waters has been identified as a new taxon, and is presently being described by Peter Arnold and colleagues (Peter Arnold, Museum of Tropical Queensland, Townsville, personal communication to Graham Ross).

Dobbs, K. (November, 2002). Little information is available on the distribution, numbers or habits of spinner dolphins in the Great Barrier Reef (Kirstin Dobbs, personal communication to Graham Ross).

Dunstan, A. and Arnold, P. (2003). Small spinner dolphins have been observed on regular, possibly daily migrations from lagoonal areas at dusk, via particular channels, such as Cormorant Pass, to the open ocean (Andy Dunstan and Peter Arnold, personal communication to Graham Ross may 2003).

Gales, N. (March, 2003). A group of four beaked whales, as yet unidentified, observed over the Perth Canyon, off Rottnest Island, suggest the potential for further research opportunities on these poorly known species, by focussing on topographical features such as canyons, which appear to be favoured by members of this family (Nick Gales, personal communication to Graham Ross).

Hembree, D. (deceased). Unpublished notes on diet data collected in early 1980s from an *Orcaella* sp. caught in a net in the Arafura Sea, with three *Johnius* sp. (Sciaenidae) present in the stomach; unpublished notes from research on the Arafura Sea fishery for sharks, including data on diet of Spinner Dolphins caught in the Timor Sea fishery (Graham Ross, personal communication, January 2003).

Kemper, C. (November 2002). An extensive morphometric study on over 200 specimens of Australian *Delphinus* by C. Bell, C., Kemper and J. Conran supported evidence from a genetic study that a single variable, short-beaked species, *D. delphis,* occurs in southern

Australia (Catherine Kemper, South Australian Museum, Adelaide, personal communication to Graham Ross).

Parra, G. (December, 2002). Irrawaddy (Snubfin) Dolphins occur in small, localised groups; Philopatric behaviour requires confirmation. If it is present, as in many odontocetes, individuals would be unlikely to move to another group, implying low potential for recovery for a group through immigration, once numbers have been reduced through the loss of one or more members, such as nets set for anti-shark protection (Guido Parra, personal communication to Graham Ross).

Plön, S. (late 1999). Information on biological parameters included in the descriptions for Pygmy and Dwarf Sperm Whales written for the SPRAT database, and subsequent updates of species descriptions (Stephanie Plön, in correspondence with Graham Ross).

Yates, M. (May, 2003). Paragraph based on discussion with Mike Yates on current situation in regard to illegal capture of cetaceans in northern Australian waters: Subsequent to the banning of this gill-net fishery and cancellation of the Taiwanese licence, netting or harpooning of dolphins, largely for bait, continued illegally for some years in Australian waters. However, such activity has all but disappeared; the most recent gill-netter recorded in Australian waters was a large Taiwanese vessel observed in the Cape Wessells area in October 1995 (Mike Yates, Australian Fisheries Management Authority; personal communication 6 May 2003).

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Table 1: Comparison of categories of conservation status

Species	**Bannister *et al.* (1996)**	**IUCN (2003)**	**Ross**
Indo-Pacific Humpbacked Dolphin (S*ousa chinensis*)	K	DD	K
Irrawaddy (Snubfin) Dolphin (*Orcaella brevirostris / O. heinsohni*)	K	DD	K
Long-snouted Spinner Dolphin (*Stenella longirostris*)	K	LR (cd)	K
Spectacled Porpoise (*Phocoena dioptrica*)	NCA (a)	DD	NCA (a)
Rough-toothed Dolphin (*Steno bredanensis*)	NCA (a)	DD	NCA (a)
Dusky Dolphin (*Lagenorhynchus obscurus*)	NCA (a)	DD	NCA (a)
Hourglass Dolphin (*Lagenorhynchus cruciger*)	NCA (b)	LC	NCA (b)
Risso's Dolphin (*Grampus griseus*)	NCA (a)	DD	NCA (a)
Bottlenose Dolphin (*Tursiops truncatus*)*	NCA (a)	DD	NCA (b)
Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*)*		DD	NCA (a)
Pantropical Spotted Dolphin (*Stenella attenuate*)	NCA (a)	LR (cd)	NCA (a)
Striped Dolphin (*Stenella coeruleoalba*)	NCA (a)	LR (cd)	NCA (a)
Common Dolphin (*Delphinus delphis*)	NCA (b)	LC	NCA (b)
Fraser's Dolphin (*Lagenodelphis hosei*)	NCA (a)	DD	NCA (a)
Southern Right Whale Dolphin (*Lissodelphis peronii*)	NCA (a)	DD	NCA (a)
Melon-headed Whale (*Peponocephala electra*)*	NCA (a)	LC	NCA (b)
Pygmy Killer Whale (*Feresa attenuate*)	NCA (a)	DD	NCA (a)
False Killer Whale (*Pseudorca crassidens*)	NCA (b)	LC	NCA (b)
Killer Whale (*Orcinus orca*)*	NCA (c)	LR (cd)	NCA (b)
Long-finned Pilot Whale (*Globicephala melas*)	NCA (b)	LC	NCA (b)
Short-finned Pilot Whale (*Globicephala macrorhynchus*)	NCA (b)	LR (cd)	NCA (b)
Shepherd's Beaked Whale (*Tasmacetus shepherdi*)	NCA (a)	DD	NCA (a)
Arnoux's Beaked Whale (*Berardius arnuxii*)	NCA (b)	LR (cd)	NCA (b)
Longman's Beaked Whale (*Indopacetus pacificus*)	NCA (a)	DD	NCA (a)
Andrew's Beaked Whale (*Mesoplodon bowdoini*)	NCA (a)	DD	NCA (a)
Blainville's Beaked Whale (*Mesoplodon densirostris*)	NCA (a)	DD	NCA (a)
Ginkgo-toothed Beaked Whale (*Mesoplodon ginkgodens*)	NCA (a)	DD	NCA (a)
Gray's Beaked Whale (*Mesoplodon grayi*)	NCA (b)	DD	NCA (b)
Hector's Beaked Whale (*Mesoplodon hectori*)	NCA (a)	DD	NCA (a)
Strap-toothed Beaked Whale (*Mesoplodon layardii*)	NCA (b)	DD	NCA (b)
True's Beaked Whale (*Mesoplodon mirus*)	NCA (a)	DD	NCA (a)
Cuvier's Beaked Whale (*Ziphius cavirostris*)	NCA (b)	DD	NCA (b)
Southern Bottlenose Whale (*Hyperoodon planifrons*)	NCA (b)	LR (cd)	NCA (b)
Pygmy Sperm Whale (*Kogia breviceps*)*	NCA (a)	LC	NCA (b)
Dwarf Sperm Whale (*Kogia sima*)	NCA (a)	LC	NCA (a)

* Species for which there is a recommended change in conservation status

Appendix 1. Descriptions for Priority Species

1 Indo-Pacific Humpbacked Dolphin *(Sousa chinensis)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Sousa chinensis*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as K.

To determine the conservation status of *Sousa* in the Australian region, and meet the objectives of *The Action Plan for Australian Cetaceans*, it will be necessary to survey and estimate population size across the entire range of this species in Australian waters, from 34ºS on the east coast to 25ºS on the west coast. This survey would aim to determine the number of animals and their relationship with other *Sousa*, using photo-identification and acoustic techniques, to establish an estimate for the Australian population. The survey would benefit by incorporating biological material from all deceased animals, and biopsy samples from as many live *Sousa* as possible, to determine through genetic and other studies: the species status, the sex of individuals, their levels of hormones and pesticides; relationships, and degree of philopatry in Australian *Sousa*.

Family Delphinidae. Indo-Pacific Humpbacked Dolphin, *Sousa chinensis* (Osbeck, 1765)
EPBC Act Status: Cetacean; Approved Recovery Plan: none
Conservation Status: *The Action Plan for Australian Cetaceans* status – insufficiently known (K)
IUCN status: Insufficiently known/Data Deficient
CITES Status: Appendix I
Bonn Convention: migratory species
Sousa chinensis: Census of Australian Vertebrate Species 1655, updated 31 Dec. 1998.

Taxonomic status. Described by Osbeck in 1765, from the coast of China. The holotype has been destroyed; a neotype for *Sousa chinensis* has been selected and described by L.J. Porter (2002). The genus comprises five nominal species - *S. teuszi* in West African waters, and four Indo-Pacific species: *S. plumbea*, *S. lentiginosa*; *S. borneensis*, and *S. chinensis*. While recent morphological studies suggest that there may be as few as one species only, with two subspecies, to the east and west of the Bay of Bengal (Ross *et al.* 1995), the results of recent genetic studies by Cockcroft and Smith-Goodwin (2002) contradict a number of conclusions drawn on morphological grounds. Complementary studies on genetic material from much of the range of the genus will provide an invaluable comparison with the results of the morphological studies.

Distribution. Based on the premise of a single species in the genus, Indo-Pacific Humpbacked Dolphins are distributed more or less continuously as local residents along the coast from False Bay, South Africa to the South China Sea, including the Red Sea, Arabian Gulf, the Indian subcontinent, Gulf of Thailand, Malacca Straits and northern Borneo, and the coast of China to the Changjiang River (31° 50'N). At least one animal reached the Mediterranean via the Suez Canal, the first known case of anthropogenic range extension for a marine mammal through habitat modification (Kerem *et al.* 2001). The distribution of Australian *Sousa* extends to 25°S on the west coast, and 34°S on the east coast, aided by from the warm eastern boundary current; similarly those resident in southern South Africa live at 34°S in water temperatures of 15-22°C (Bannister *et al.*

1996). There is evidence of seasonal changes in abundance, as indicated by sighting rates in some populations, for example, in southern Africa, India and China (Parsons 2002).

Conservation objectives. The six conservation objectives are:

To determine distribution and to monitor abundance, especially in key areas;
The distribution of Indo-Pacific Humpbacked Dolphins in Australian waters is understood in broad terms, based largely on the relatively few records of strandings and captures. There are no data on absolute abundance. Fifty individuals have been photo-identified in Moreton Bay; estimates for Moreton Bay in 1984-1986, and 1985-1987 respectively were: 163 animals (95% confidence intervals 108-251), and 119 animals (95% confidence intervals 81-166); preliminary results for Cleveland Bay, in the Central Section of the Great Barrier Reef, suggest a population less than 200 animals (Parra *et al.* 2002). Data from Dugong aerial surveys along the Queensland coast provide minimum estimates of Indo-Pacific Humpbacked Dolphins. These counts are uncorrected for submerged animals. Surveys to determine the abundance of this species between 25°S on the west coast, and 34°S on the east coast, using acoustic techniques, verified against localised photo-identified groups, should provide an estimate of abundance on which the conservation status of this species can be assessed.

To determine possible impact of threats, such as pollutants, incidental capture and habitat degradation;
Levels of pollutants should be determined from all available carcases, together with analysis of skin and blubber biopsies, preferably sampled across the distribution of this species in Australia. Prey species in deceased dolphins could be identified from fish otoliths recovered from stomach contents, and determined against reference collections.

To study habitat requirements to assess impacts of degradation;
Studies on habitat degradation in relation to assess possible impacts on Indo-Pacific Humpbacked Dolphins have not been pursued as yet.

To derive a relationship between aerial survey estimates and absolute abundance to be estimated and monitored;
Aerial surveys were abandoned, as a result of poor detection ability, in favour of acoustic monitoring of *Sousa* sounds (Van Parijs, Smith and Corkeron 2002), which promises to provide a useful relationship between the rate of vocalisation by Indo-Pacific Humpbacked Dolphins in the area and the number of animals present. Photo-identification in local areas would assist in evaluating the numbers of animals present.

To compare genetics and morphology between Australian and other regions to assess taxonomic status of Australian animals;
Genetic studies should be continued, to assess samples from a larger proportion of the Australian distribution, to determine population structure, and review the morphological work towards resolving current inconsistencies.

To establish life history parameters for Australian animals to allow better interpretation of population trends and effects of threats.
In Australian waters, Indo-Pacific Humpbacked Dolphins attain lengths of 262 cm in males and 260 cm in females. Age and lengths of South African animals at physical maturity is 13-14 years, and 2.58-2.74 m; maximum weight recorded is 260 kg (male) and 170 kg

(female); maximum age is more than 40 years and maximum length 2.74 m (Ross *et al.* 1994; Bannister *et al.* 1996). Reproductive data derived from Australian and South African dolphins: length and weight at birth 0.97-1.08 m and ca 14 kg; age and length at weaning not known; age at sexual maturity 10-13 years; mating season, gestation period, and calving interval unknown; calves born in summer; no calving areas known in Australian waters (Bannister *et al.* 1996). Goodwin (1997) indicated that Indo-Pacific Humpbacked Dolphins show strict female philopatry; Atkins and Atkins (2002) were less certain about the state of philopatry in Richards Bay, Natal, but stated that a small proportion of the animals could be considered resident.

Biology. These dolphins inhabit coastal, estuarine, and occasionally riverine species, in tropical and subtropical regions. The species occurs close to the coast, generally in less than 20 m depth. Aerial surveys in the Great Barrier Reef region have located *Sousa* in waters between the outer reef and the mainland, further offshore than has been reported in the literature (Corkeron *et al.* 1997; Marsh 1990). Key localities include Moreton Bay, Queensland and the lower reaches of the Brisbane River and adjacent offshore waters, where a resident population occurs in water less than 10 m in depth, and offshore to 6 km. Tin Can Inlet, Great Sandy Strait, Queensland, features a group which, until recently, approached humans for food. Several groups appear to be resident within Ningaloo Reef, north-western Australia (Bannister *et al.* 1996). Indo-Pacific *Sousa* are not known to be migratory (Ross 2002), although numbers of animals increase seasonally in South Africa. Some seasonal inshore-offshore and longshore movements are recorded for West African *Sousa* (Bannister *et al.* 1996). Teleost fishes, some cephalopods and crustaceans, as well as littoral, estuarine and demersal reef species are eaten. Indo-Pacific Humpbacked Dolphins feed in association with prawn trawlers in Moreton Bay, and presumably elsewhere throughout the species' range in Australia (G. Ross *et al.* 1994; Bannister *et al.* 1996).

Threat Summary. Past and current threats include: presumed habitat destruction and degradation, including noise pollution, harassment, particularly close to major cities (e.g. in Moreton Bay) (Bannister *et al.* 1996); incidental capture through drowning in inshore gill-nets set across rivers, and estuaries to catch barramundi and other fish species. Shark nets set for the protection of swimmers, killed 18 *Sousa* in 1968-2001, 11 of which were from nets at Townsville and Cairns (Parra *et al.* 2002) – despite the low numbers killed per year in such shark nets, they may have a significant impact on social structure of cetaceans such as *Sousa*, given their philopatric nature and small group size; trawl-nets, drift-nets; illegal killing, particularly by people killing for sport, e.g. spearing or shooting (there is no evidence of direct killing of *Sousa* in Australian waters - Parra *et al.* 2002); live capture in Qld (permits granted for up to 12 per year at present) and northern NSW; overfishing of prey species. Potential threats: pollution, particularly from organochlorines, because inshore cetaceans are very vulnerable, especially in agricultural regions; epizootics, marine mammals being very susceptible to pathogen-induced mass mortalities (Bannister *et al.* 1996). Interaction with tourism operators of dolphin-watching and dolphin-feeding activities is increasing, e.g., at Tin Can Bay, south-eastern Queensland, and on boats, with the potential for adverse reactions by the dolphins. Frequencies of whistles produced by Australian Indo-Pacific Humpbacked Dolphins (1.2-16 kHz; Schultz and Corkeron 1994) and broad band clicks (2-22 kHz; van Parijs and Corkeron, 2001) coincide with frequencies emanating often from boat traffic, suggesting that noise pollution may a problem for this species. Determination of the level of philopatry in this species and others that live in small groups is important, as the impact of the loss of reproductive females from such groups is potentially greater than that for species forming large schools.

2 Irrawaddy (Snubfin) Dolphin *(Orcaella brevirostris / O. heinsohni*)

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Orcaella brevirostris / O. heinsohni*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as K.

Establishment of the size of the population and its distribution along the Queensland coast is urgent, as numbers may be diminishing. In this process, it is also recommended that an extensive collection of biopsy samples should be initiated as soon as possible to determine genetically the taxonomic status of the species in Australian waters and its relationship with other populations of *Orcaella*, the sex of individuals, levels of hormones and other substances, such as pesticides; to evaluate levels of relationships between populations, including assessment of the presence of philopatry, and to contribute to an assessment of the population size on the eastern and northern shores of Australia. The similarities with *Sousa* in habitat and distribution strongly suggest that a joint investigation with those studying *Sousa* in this region would be most appropriate.

Family Delphinidae. Irrawaddy (Snubfin) Dolphin, *Orcaella brevirostris / O. heinsohni* Gray 1866.

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e45
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e45
Distribution showing presence in the shelf region (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), north of 18ºS on the west coast and 28ºS on the east coast, in waters 20m deep. The distribution is broadly based on the Species Profile and Threats database account.

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
The Action Plan for Australian Cetaceans status – insufficiently known (K)
Bonn Convention: listed as migratory species.
IUCN status: Insufficiently known/ Data Deficient
CITES Status: Appendix II
Orcaella brevirostris: Census of Australian Vertebrate Species 1636, updated 31 Dec. 1998.

Taxonomic status. Described by Gray 1866 (a redescription of the dolphin described by Owen the previous year). Currently only one species recognised, *Orcaella brevirostris / O. heinsohni*. Phylogenetic status has been confused until recently when both molecular, genetic and morphologic evidence suggested that closest affinities are with delphinids, rather than the externally similar Monodontidae (Arnold and Heinsohn 1996; Grétarsdóttir and Árnason 1992; LeDuc 1997; Lint *et al.* 1990; see also Rice 1998 for discussion). Recent research has shown that the Australia/New Guinea population differs from the Asian populations genetically, morphologically and in their habitat. In his analysis of the cytochrome *b* gene, LeDuc (1999) found that the riverine and coastal marine forms of *Orcaella brevirostris* differed genetically by 5.3%; in addition, Beasley, Arnold and Heinsohn (2002) have demonstrated significant differences in the form of the mesethmoid bones, the nasal ossicles, and the degree of separation of the pterygoid hamuli, of these two forms, based on an analysis of 124 crania collected from both habitats. The authors noted

that the degree of morphological difference in indicative of a major geographic/ecological barrier that has operated for a considerable period. The more derived nature of skulls from Australia/New Guinea implies an origin from the Asian populations (Beasley *et al.* 2002); *Orcaella* in Australia and New Guinea live only in the marine environment. These authors note that the Australian/New Guinean animals are taxonomically distinct from the Asian dolphins at the subspecific level, at least, and probably warrant recognition as a full species. The authors propose additional morphological and genetic work, before naming the taxon formally.

Conservation objectives. The five conservation objectives are:

Determine extent of incidental take and fisheries in northern Australian and nearby waters;
Past threats include Aboriginal hunting, a few *Orcaella* captured for oceanaria in Queensland; current and previous incidental capture in barramundi nets, for which little data on take is available, and capture in nets set to capture sharks for the protection of bathers (Banister *et al.* 1996). In the Townsville area alone, Parra *et al.* (2002) documented 41 Irrawaddy (Snubfin) Dolphins as museum specimens, which were caught in shark nets between 1968 and 1990; this number is almost certainly an underestimate, for another 55 unidentified "dolphins" or "porpoises" were caught in the nets in the same period, some of which are likely to be *Orcaella*. Two dolphins were caught by the Taiwanese net fishery in the early 1980s (D. Hembree, unpublished notes from the Arafura Sea fishery; G. Ross personal communication).

Determine distribution and monitor abundance in Australian waters to assess possible impact of threats, particularly effect of direct and indirect fishing activities;
Coastal, estuarine, and riverine areas are important in other regions of this species' range. Australian *Orcaella* occur only in marine environments. These dolphins live in shallow, tropical and subtropical areas, up to 20 km from shore. No key localities are yet known in Australian waters (Bannister *et al.* 1996). Limited seasonal migration has been recorded in the Mekong R., Kampuchea, and the Irrawaddy R., Myanmar (Burma) (Bannister *et al.* 1996; Stacey and Arnold 1999).

Obtain information on diet re trophic level and impact of fishing industry on food resources;
Little information is available on the diet of Irrawaddy (Snubfin) Dolphins. Stomach contents included bony fishes, cephalopods and crustaceans from demersal, benthic and pelagic habitats (Bannister *et al.* 1996). Three *Johnius* sp. (Sciaenidae) were found in a stomach of a net-caught dolphin in the Arafura Sea (D. Hembree, unpublished notes from Arafura Sea fishery; G. Ross, personal communication). Retrieval of all deceased *Orcaella* carcases is essential to obtain all possible dietary items, including otoliths and other prey items, to determine the likely prey spectrum for Australian *Orcaella*, and the potential impact of humans on prey stocks.

Determine taxonomic relationships within and outside Indo-Pacific region to assess likely impact of threats on possible individual populations;
The marine population of *Orcaella* in Australian waters has been identified as a new taxon, yet to be named formally (P. Arnold, personal communication, November 2002). In the event of formal recognition of a new species, the collation of biological data for this new taxon will be important, including reproductive and growth data, including whole mass and

mass of body parts, age determination from teeth; pesticide and hormone samples, and parasite data.

Minimise possible detrimental effects on population(s), for example, from fishing and other human activities.
Eight Irrawaddy drowned in Queensland shark protection nets in the period 1996-2001; seven of these were from Ellis Beach, an event that seems likely to have deleted most or all of the local population. It is strongly recommended that shark nets be replaced on the Queensland coast with drumlines.

Distribution. *Orcaella brevirostris,* as currently placed taxonomically, occurs along the coast from the Bay of Bengal, through the Indo-Malay Archipelago. It occurs also up rivers in places (to Bhamo, Myanmar in the Irrawaddy River, to the Lao Peoples' Democratic Republic, in the Mekong River, in Mahakam River and Semayang Lake, of east Kalimantan, Indonesia and Lake Murray, Papua New Guinea).

The new species of *Orcaella* is a marine form, reported in Western Australia from north of, and including Broome (18°S), the Northern Territory (Chatto and Warneke 2000), and Queensland, south to the Brisbane River (27°32'S) (Bannister *et al.* 1996; Paterson *et al.* 1998; general distribution from Stacey and Arnold 1999). Minimum estimate for areas surveyed off Northern Territory is 1227 ± 301, but the figures are uncorrected for animals below the surface (Freeland and Bayliss 1989). This estimate has been disputed (Perrin *et al.* 1996, *in* Stacey and Arnold 1999). There are no estimates of population rate of change (Freeland and Bayliss 1989).

Coastal, estuarine and riverine areas are important for *Orcaella* in other regions. Only marine populations are known from Australia, where this species occurs in shallow, tropical and subtropical areas, up to 20 km from shore. No key localities are known in Australian waters (Bannister *et al.* 1996).

Biology. Age or length at physical maturity is not known; maximum weight not known but Australian animals reach 2.1-2.3 m long, and weigh 114 -133 kg; maximum age is 28 years; maximum length is 2.70 m in males and 2.30 m in females (37 Australian dolphins: Arnold, P. personal communication; Bannister *et al.* 1996). Weight and length at birth of a captive animal was 12.3 kg and 0.96 m; weaning occurred at 2 years old. Age at sexual maturity is unknown; length ca 2 m. Calving interval is unknown; mating season is from March to June (at 11°-12°N), and April - June (at 0°-1°S). Gestation lasts 14 months (captive animal) and calves are born in August or September; the period may be extended at low latitudes or there is significant geographical variation: newborns recorded from near Calcutta in June, in Laos from April to May, and in the Townsville region in August. Births in captive Indonesian animals appear to span July to February (extralimital data from Arnold, P., pers. comm.). No calving areas are known in Australian waters, near-term foetus and neonate recorded from Townsville (Bannister *et al.* 1996). Group size in Australian *Orcaella brevirostris / O. heinsohni* is small, ranging from 1 to 14 animals, with an overall group size of 5.4 animals; 26 of 29 sightings were within 10 km of shore, with 3 groups up to 23 km offshore (Parra *et al.* 2002). Parra's observations during aerial surveys suggest that Irrawaddy (Snubfin) Dolphins tend to occur in small, localised populations. Philopatry has yet to be confirmed. If this species is philopatric, the prognosis seems poor for the recovery of groups that have lost one or more members in nets (G. Parra personal communication). A better understanding of whether this species is philopatric or not is

important, as the impact of the loss of reproductive females from such small groups is potentially greater than that for species that live in large schools.

Threats summary. Current threats include incidental capture in nets, and the overfishing of prey species; potential threats include pollution (organochlorines, particularly PCBs) which is potentially serious in view of the species' inshore nature; habitat destruction and degradation, including noise pollution and harassment, particularly close to major cities (such as Cairns) and resort developments; the possibility of large population losses in the event of pathogen-induced mass mortalities (epizootics) to which marine mammals are susceptible (Bannister *et al.* 1996).

3 Long-snouted Spinner Dolphin *(Stenella longirostris)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Stenella longirostris*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as K.

Family Delphinidae. Long-snouted Spinner Dolphin, *Stenella longirostris* (Gray, 1828).

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation Status: *The Action Plan for Australian Cetaceans* status - insufficiently known (K).
IUCN Status: Insufficiently known/ Data Deficient
Bonn Convention: listed as migratory species (Southeast Asian populations).
CITES Status: Appendix II
Stenella longirostris: Census of Australian Vertebrate Species 1620, updated 31 Dec. 1998.

Marine protected areas managed for, or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. Described by Gray in 1828. This species varies greatly geographically, both in size and extensive variation in colour pattern between regions (Rice 1998). Perrin (1990) described three subspecies, *S. l. orientalis*, *S. l. centroamericana* Perrin, 1990, and *S. l. longirostris* (Gray, 1828); the last of these occurs in the Australian region. A fourth, very small subspecies, *S. l. roseiventris* (Wagner, 1846) inhabits shallow water in the Gulf of Thailand, the Timor Sea and the Arafura Sea (Perrin *et al.* 1999). Those from Thailand have been termed "dwarf spinners" previously (Perrin *et al.* 1989). The relationship between this form and Spinner Dolphins in the Great Barrier Reef region requires elucidation, with respect to subspecific status, distribution and lifestyle, including migration, breeding and feeding, and association with particular reefs. The latter are of particular interest, as Perrin *et al.* (1999) noted that specimens from this area were at the lower end of the distribution of body length and skull size, and close to the upper end of the small *S. l. roseiventris*.

Distribution. Long-snouted Spinner Dolphins occur in the Northern and Southern Hemispheres, in the Indian, Pacific and Atlantic oceans. In Australia, there are records from Western Australia, as far south as Bunbury, 33° 19'S; the Northern Territory (including numerous records of these dolphins caught in the Arafura and Timor seas as by-catch in the gill-net fishing industry, during 1981-1985), Queensland and New South Wales (Bannister *et al.* 1996), and the Great Barrier Reef. The distribution map published in Perrin and Gilpatrick (1994) shows the Australian populations in a global perspective.

Conservation objectives. The seven conservation objectives are:

To determine the distribution and monitor abundance in Australian waters;
Spinner dolphins, *Stenella longirostris roseiventris*, occur through the Timor and Arafura seas; the subspecific status of Spinner Dolphins present in Queensland, New South Wales, and those on the west coast as far south as Bunbury 33ºS, is likely to be *S. longirostris longirostris* (Perrin and Gilpatrick 1994). Little information is available on their

distribution, numbers or habits in the Great Barrier Reef (K. Dobbs, personal communication, November 2002). Observations of these animals in the northern Great Barrier Reef indicate that they undertake regular (?daily) migrations from lagoonal areas at dusk, via particular channels, such as Cormorant Pass, to the open ocean (A. Dunstan and P. Arnold, personal communication).

To assess possible impact of threats, especially effect of direct and indirect fishing activities;
Between 1974 and 1986, an estimated 4900 Long-snouted Spinner Dolphins were killed in the Taiwanese fishery gill-net fishery in the Arafura and Timor seas between 9º-13ºS and 126º-138ºE along Australia's northern shores. They comprised 35% of the by-catch of cetaceans in this fishery (Harwood and Hembree 1987).

Subsequent to the banning of this gill-net fishery and cancellation of the Taiwanese license, netting or harpooning of dolphins, largely for bait, continued illegally for some years in Australian waters. However, such activity has all but disappeared; the most recent gill-netter recorded in Australian waters was a large Taiwanese vessel observed in the Cape Wessells area in October 1995 (Mike Yates, Australian Fisheries Management Authority; personal communication 6 May 2003).

To obtain information on diet to determine trophic level and assess possible impact of fishing industry on food resources;
Long-snouted Spinner Dolphins in northern Australia feed on a range of reef-living and benthic organisms, including fish (leatherjackets, ponyfish, small eels, apogonids), sepiids and squids, shrimp and other crustaceans (Harwood and Hembree 1987; D. Hembree, unpublished notes from the Arafura Sea fishery; G. Ross, personal communication). No data are available on the small spinner dolphins inhabiting the outer reefs or channels.

To determine taxonomic relationships within and outside the Indo-Pacific region;
Four subspecies of *Stenella longirostris* have been described, one of which is present in northern Australian waters (*S. l. roseiventris*); *S. l. longirostris* may also be present. The true status of S. *longirostris* in Australian waters will not be known until dedicated surveys are carried out to monitor population density**.**

To assess likely impacts on possible individual populations;
There is insufficient information to determine impacts on individual populations.

To minimise possible detrimental effects on population(s), e.g., from fishing activities;
Withdrawal of the license for Taiwanese vessels to fish in the Australian EEZ appears to have removed the many of the effects on small cetacean populations in the region. The gill-net shark fishery appears to have ceased operation in the region (Mike Yates, Australian Fisheries Management Authority; personal communication 6 May 2003).

To ensure funding provided for monitoring threatened populations in northern Australia. .
Funding is not assured for work on threatened cetacean populations in northern Australia. Genetic determination of the relationship of the small forms of spinners, such as those in Great Barrier Reef region to other forms of spinner dolphins is a priority.

Biology. Spinner dolphins are primarily pelagic but can be neritic in some regions. They occur in tropical, subtropical and occasionally temperate waters. They associate with tuna,

Pantropical Spotted Dolphins and sea birds under certain oceanographic conditions, such as well-defined, shallow, pelagic habitats about 100 m deep, in restricted areas. Along the West coast of Australia, the presence of Spinner Dolphins in southern localities may be associated with the Leeuwin Current. No key localities are known in Australian waters (Bannister *et al.* 1996). They are not known to be migratory.

Over deep oceanic water, Long-snouted Spinner Dolphins feed on pelagic fish, mostly myctophids, and squids and shrimps taken at depths greater than 250 m (Perrin 1998). Stomach contents of animals from northern Australia contained reef-living and benthic organisms. D. Hembree (D. Hembree, unpublished notes from Timor Sea fishery; G. Ross, pers. comm.) noted the following food items and their frequency (e.g., x3 = 3 dolphins) leatherjackets (x7); small eels, including *Gymnothorax* (x4); ponyfish (x3); an apogonid; teleost remains (x3); sepiids (x 4) and squid beaks (x2); shrimp/prawns (x4) and an isopod. Perrin (2002) suggested that the dwarf form from the Gulf of Thailand also could be a bottom-feeder and their small size may be associated with such a habit.

Mature adults range from 129 –235 cm in length and 23-78 kg in weight, depending on the population they belong to (Perrin 2002). Age at physical maturity exceeds 10 years; maximum weight and age are 75 kg and 22 years, respectively; maximum length is 2.35 m in males, and 2.04 m in female (Bannister *et al.* 1996; Perrin and Reilly 1984). Spinner dolphins in northern Australian waters are considerably smaller, with a minimum adult length of 142 cm and a maximum length of 158 cm. Adults weigh 24 to 28.5 kg (mean 36.5 kg – data ex D. Hembree notes). The smallest physically mature animals recorded are a male, 1.36 m long, and a female, 1.29 m long, from the Gulf of Thailand.

This species associates with Pantropical Spotted Dolphin as well as Yellowfin Tuna and sea birds, probably linked to feeding. Known to congregate in groups of over 1000 animals but generally group size is less than 250. There is some segregation by age and sex. Spinner dolphins associate with small to medium-sized whales as well as other dolphins. The species is very acrobatic and seemingly playful, taking its name from its ability to leap and spin longitudinally while in the air. Often rides the bow wave of vessels (Bannister *et al.* 1996; Perrin 1998).

Very few strandings are recorded in Australia. Predators include sharks and possibly Killer Whales, False Killer Whales, Pygmy Killer Whales and Short-finned Pilot Whales (Bannister *et al.* 1996). High levels of mercury are recorded (natural contamination) and DDT, Dieldrin and PCBs have been recorded for *S. longirostris* in waters outside Australia. Parasitism, which affects hearing, is believed to be a major factor in the natural mortality of this dolphin (Bannister *et al.* 1996; Perrin 1998). Length at birth is 0.7-0.8 m; weaning occurs at 1-3 years old. These dolphins mature at 6-9 years old and 1.6-1.9 m in length (males), and at 4-10 years and 1.5-1.9 m in length (females); Northern Australian animals mature at about 1.4 m in length in females, and about 1.5 m long in males; Calving areas are unknown in Australian waters. Elsewhere, the calving interval is 2-3 years (more frequent in depleted populations); the mating and calving seasons not known. Gestation ranges from 9-11 months. These lengths suggest maturity at perhaps 1.4 m long in females, and perhaps about 1.5 m in males.

Threat Summary. Past threats include activities of the Taiwanese gill-net fishing industry in the Arafura and Timor seas during 1981-1985, in which an estimated 4900 Spinner Dolphins were killed, comprising 35% of the by-catch of cetaceans (Harwood and

Hembree 1987). The threat continues as the fishery operates just outside of Australian waters; it is potentially a serious issue for incidental catches of small cetaceans, and is likely to affect populations in Australian waters, as would illegal catches within Australia's Economic Exclusion Zone. Spinner Dolphins are occasionally reported as incidental captures in shark nets in Queensland. The possibility of incidental and direct catches in the region is cause for serious concern (Leatherwood and Reeves 1983; Gilpatrick *et al.* 1987; Perrin and Gilpatrick 1994).

Outside of Australia, the most significant impact has been on populations in the purse-seine netting in the eastern tropical Pacific; population size is still well below original levels despite measures to curtail incidental take. In this region, numbers have declined to about 58-72% (in the form known as Whitebelly Spinners) and 44% (in the form known as Eastern Spinners) of their former numbers of millions of animals, as a result of incidental catch in purse-seine nets (Bannister *et al.* 1996). No population estimates are available for other parts of range but they are generally considered common. In the Philippines, spinner dolphins are the most frequently caught species in the gill-net fishery; a small cetacean fishery takes some Spinner Dolphins in the Solomon Islands, and they are killed incidentally in Thailand by shrimp trawls (Bannister *et al.* 1996). The effect on numbers in both areas is unknown. Perrin (1999) noted that this species is particularly vulnerable because of its size and relative ease of capture; the likelihood of incidental catches forming the basis of a directed fishery, and the associated problem of monitoring and regulating the catch; loss of habitat, and the need for management at national and international level.

Potential threats: Entanglement in drift-nets set outside the Australian Economic Exclusion Zone and in lost or discarded netting; pollution (including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea) leading to bio-accumulation of toxic substances in body tissues (Harwood and Hembree 1987; Bannister *et al.* 1996).

Appendix 2. Descriptions of other small cetacean species

1 Spectacled Porpoise *(Phocoena dioptrica*)

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Phocoena dioptrica*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as NCA(a).

Conservation objectives. As described in *The Action Plan for Australian Cetaceans*: the objectives are to establish basic biological parameters, including seasonal variation (with reference to Argentinian and New Zealand data); investigate genetic relationships including the possibility of discrete populations; assess the degree of biological threat posed by pollutants and other threats; and to improve definition of range more closely in relation to oceanographic parameters.

The limited information available on this species in the Australasian region provides little towards meeting the conservation objectives described in *The Action Plan for Australian Cetaceans*. The five known records in the region are insufficient to establish: basic biological parameters, including seasonal variation (with reference to Argentinian and New Zealand data); investigate genetic relationships including the possibility of discrete populations; assess the degree of biological threat posed by pollutants and other threats; and to improve definition of range more closely in relation to oceanographic parameters.

Family Phocoenidae. Spectacled Porpoise, *Phocoena dioptrica* Lahille, 1912.

EPBC Act Status: Cetacean; Approved Recovery Plan: none [66728].
Bonn Convention: listed migratory species; as *Australophocaena dioptrica*
Conservation Status: *The Action Plan for Australian Cetaceans* status: - no category assigned because of insufficient information (NCA(a))
IUCN status: Insufficiently known.
CITES Status: Appendix II. / Data Deficient

Phocoena dioptrica: Census of Australian Vertebrate Species 1660, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. Lahille described the Spectacled Porpoise as a member of the genus Phocoena on morphological grounds in 1912. In 1985, Barnes erected a new genus, *Australophocaena* for this species, in recognition of similarities between *Phocoena dioptrica* and *Phocoenoides dallii*. In the same year, however, genetic analyses of the cytochrome b gene and the control region of mitochondrial DNA of the Spectacled Porpoise by Rosel *et al.* (1995) found support for the return of species to the genus *Phocoena.* The generic name *Australophocaena* received little support, and the genus *Phocoena* was retained by Bannister *et al.* (1996) and also by Rice (1998). The appropriate formal name for the Spectacled Porpoise accepted here is *Phocoena dioptrica*. No subgroups are recognised.

Distribution. *Phocoena dioptrica* occurs in the Southern Hemisphere, where it is apparently circumpolar in subantarctic latitudes. It inhabits offshore Atlantic coasts of South America, northwards to ca 34°S, and is present at the Falkland Is. and around South Georgia. It is recorded in the Pacific Ocean south of New Zealand, at the Auckland Is., Antipodes Is, Macquarie I. and to the west in open ocean at about 56°S, 175°W; also in the Indian Ocean at Heard and Kerguelen Is. The apparent concentration of records near subantarctic islands possibly reflects observer bias. There is insufficient evidence to assess possible seasonal North-South movements (off South America) or East-West movements at higher latitudes. The first records for continental Australian seas were found in 1997 (Tasmania and South Australia; Evans *et al.* 2001). No information is available on movements in this species. It is unknown whether the few widely scattered Australian records represent animals moving northwards from areas to the south or populations resident in waters close to Australia (Bannister *et al.* 1996). There are no absolute population measures, but the species is apparently common in inshore waters of Tierra del Fuego; elsewhere not known (Bannister *et al.* 1996). This species apparently prefers the subantarctic region (ca 1-8°C) and continental seas in the cold temperate region influenced by cold currents, such as the Falkland Current off Argentina. No key localities are known in Australian waters (Bannister *et al.* 1996).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e66728
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e66728
Distribution showing presence in the oceanic, slope and shelf regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), adjacent to Macquarie, and Heard and McDonald Islands south to 62ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. Very little is known of the diet of *P. dioptrica*, other than it eats fishes and squids (Bannister *et al.* 1996). This overview based mainly on data from Argentina. Physical maturity is attained at ca 2.0 m in males; the maximum weight is about 80 kg, and maximum length is 2.24 m (male), or 2.04 m (female); maximum age is unknown. One of the smallest and least known cetaceans of the Southern Ocean, this little known, unobtrusive species is seen singly and in groups of 2-3, the latter comprising male, female and calf; apparently this species does not school in larger numbers. Strandings and incidental capture in nets occur. Possibly vulnerable to predation by Killer Whales (Bannister *et al.* 1996). Length at birth is about 0.48 m (near term foetus), probably ca 0.70-0.80 m at full term; no data on length or age at weaning; sexual maturity attained at ca 1.85 m (female); areas for which there are no data include: calving interval, mating season, or gestation period; calving season possibly late winter to summer; calving areas (Bannister *et al.* 1996; Evans *et al.* 2001).

Threat summary. Past threats include incidental capture in tangle-nets set for crabs and fishes in Tierra del Fuego, but not now used. Current threats include incidental capture in gill-nets set by artisanal fishermen on the coast of Argentina - the extent is unknown but the fishery is expanding since 1988; possible entanglement in drift-nets and other nets set, lost or discarded in international waters at higher latitudes. Potential threats include: incidental captures in expanding fisheries in the Southern Ocean, especially in areas adjacent to subantarctic islands; disturbance and pollution resulting from coastal and offshore oil and mineral exploration (Argentina); pollution of preferred habitats, leading to accumulation of toxic substances in body tissues (Klinowska 1991); Bannister *et al.* 1996.

2 Rough-toothed Dolphin (*Steno bredanensis)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Steno bredanensis*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as NCA(a).

Conservation objectives. As described in *The Action Plan for Australian Cetaceans*: the objectives are to determine the distribution and monitor abundance in Australian waters to assess possible impact of threats, particularly effect of direct and indirect fishing activities; to obtain information on diet to determine trophic level and assess possible impact of fishing industry on food resources, and; to determine taxonomic relationships within and outside the Indo-Pacific region, to assess likely impacts on possible individual populations.

Family Delphinidae. Rough-toothed Dolphin, *Steno bredanensis* Lesson 1828 [30]

EPBC Act Status: Cetacean; Approved Recovery Plan: none
Conservation Status: *The Action Plan for Australian Cetaceans* status: no category assigned, due to insufficient information (NCA(a));
IUCN Status: Insufficiently known/ Data Deficient
CITES Status: Appendix II
Steno bredanensis: Census of Australian Vertebrate Species 1642, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. Described in 1828 by Lesson as *Delphinus bredanensis*. No subspecies are recognised. Evidence that Atlantic and Indo-Pacific populations may differ is inconclusive, and there are no data on the taxonomic status of the few Australian specimens.

Distribution. Occurs in low latitudes of Atlantic, Indian and Pacific Ocean. Strandings in mid-latitudes outside these regions could be vagrants. In Australia, it is recorded from Barrow Island, Western Australia; Northern Territory, Queensland and southern New South Wales. No population estimates are available. Believed to be uncommon throughout its range but difficulties in identification could mean that abundance is underestimated, and this species may not be as rare in Australian waters as believed (Leatherwood and Reeves 1983; Bannister *et al.* 1996).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e30
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e30
Description: Distribution showing presence in the oceanic and slope regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), north of 35ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. This species is pelagic and possibly neritic; and also oceanic. It occurs in tropical and subtropical waters. Its habitat requirements are unknown. No key localities known in Australian waters. It is not known to be migratory. The few data on feeding include pelagic octopus, squid and reef fish; larger fish may be taken in deep water (Bannister *et al.* 1996). This overview on biological parameters is based on non-Australian information. Age at physical maturity is ca 16 years; maximum weight is about 155 kg; maximum age is about 32 years; maximum length is 2.65 m (male) and 2.55 m (female) (Miyazaki 1980). Groups may comprise up to several hundred individuals but usual group size is 10-20. It occurs with Pilot Whales, Bottlenose Dolphins, Spotted Dolphins and Spinner Dolphins. These dolphins ride bow waves but not as commonly as some other dolphin species. 'Skimming' swimming behaviour has been reported. They stay submerged for longer periods (up to 15 mins) than other dolphins. Possibly feed in groups (Leatherwood and Reeves 1983). Group strandings have occurred on several occasions outside of Australia (Perkins and Miller 1983), and three animals stranded together on Barrow I., Western Australia, in 1971. Japanese specimens had a high incidence of skeletal malformations. Very little is known about their parasites (Bannister *et al.* 1996). Length at birth is about ca 1.0 m. There is no information on age or length at weaning; age and length at sexual maturity is 14 years and 2.25 m in males, and 10 years and 2.20 m in females. Calving interval and season, mating season, and gestation period is unknown. No calving areas are known in Australian waters (Perrin and Reilly 1984; Bannister *et al.* 1996).

Threat Summary: there is no information on past threats; Current threats include: possible direct catches in areas adjacent to Indonesia, so illegal catches within the Australian Economic Exclusion Zone are likely; no information on indirect catches in Australian waters (Harwood and Hembree 1987); direct fisheries captures in Solomon Is. and Papua New Guinea, in small numbers; known incidental catches are pelagic drift-net and gill-net fisheries off Sri Lanka; rarely taken in purse-seine netting operations outside Australia. Potential threats include: entanglement in drift-nets set outside Australian Territorial Waters and in lost or discarded netting; pollution (including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea) leading to bio-accumulation of toxic substances in body tissues (Bannister *et al.* 1996).

3 Dusky Dolphin *(Lagenorhynchus obscurus)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Lagenorhynchus obscurus*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as NCA(a).

Conservation objectives. Determine distribution and abundance in Australian waters to assess possible impact of threats, particularly the effect of direct and indirect fishing activities; obtain information on diet to determine trophic level and assess possible impact of fishing industry on food resources; determine taxonomic relationships within and outside of Indo-Pacific region to assess likely impact of threats on possible individual populations.

Family Delphinidae. Dusky Dolphin, *Lagenorhynchus obscurus* Gray 1828 [43]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation Status: *The Action Plan for Australian Cetaceans* status- no category assigned, because of insufficient information (NCA(a)).
Bonn Convention: listed as migratory species.
IUCN status: Insufficiently known/ Data Deficient

CITES Status: Appendix II
Lagenorhynchus obscurus: Census of Australian Vertebrate Species 1625, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. A well-established species. Validity of the six species in the genus confirmed on morphological grounds by Miyazaki and Shikano (1997). Two named and one unnamed subspecies recognised: *L. o .fitzroyi* (Waterhouse, 1838), coastal South America from Peru to the Falkland Is.; *L. o. obscurus*, S. Africa from Angola to Cape Agulhas, Prince Edward Is., Île Amsterdam; *L. obscurus* subsp. East coast of New Zealand from Whitianga, North I. to Stewart I., Campbell I., Auckland Is. and Chatham Is. (Rice 1998). Subspecific status of Australian specimens is unknown (Gill *et al* 2000). Rice (1998) observed that the Pacific White-sided Dolphin, *L. obliquidens*, from the North Pacific is sufficiently similar to *L. obscurus* to be accorded subspecific status. Erroneous record for Tasmania has been re-identified as *Lissodelphis peronii*.

Distribution. Known from 13 records only, since 1828, across southern Australia from Western Australia to Tasmania (Gill *et al.* 2000). Records include photographs of a stranding in Tasmania; a specimen has yet to be collected as tangible confirmation of this species in Australian waters. Skull from Kerguelen I. Elsewhere occurs only in the Southern Hemisphere from about 55° to 26°S, with extensions well northwards, in association with cold currents. Rare in Australian waters. No information available on population size in Australia; considered abundant elsewhere within its range including New Zealand, but no estimates of population size. (Bannister *et al.* 1996; Gill *et al.* 2000).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ d43
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ d43
Interim distribution showing presence in all of the Australian marine area (based on AMBIS version 1), south of 26ºS. The distribution is broadly based on information derived from Bannister, J.L., Kemper, C.M. and Warnecke, R.M. 1996. The Action Plan for Australian Cetaceans. ANCA.
Distribution map: EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e43
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e43
Distribution showing presence in the oceanic, slope and shelf regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), between 26ºS and 55ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. Dusky Dolphins occur mostly in temperate and subantarctic zones. Primarily inshore but also pelagic at times. Resident inshore for much of year and may seek out colder water (18°C) as inshore temperatures rise in summer. Around New Zealand their distribution is believed to be related to the Subtropical Convergence, with numbers declining north and south of this feature. No key localities known in Australian waters (Bannister *et al.* 1996). The species is not known to be migratory, although there may be small seasonal movements, and individuals may move long distances (see Würsig and Bastida 1986); in Australian waters the very limited data suggest that presence of this species may be linked to ENSO events (Gill *et al.* 2000). Dusky Dolphins feed primarily on schooling fish; especially anchovy, lanternfishes and squid (Bannister *et al.* 1996). This biological overview is based on available non-Australian. information. Birth length, 0.9 m; weaning age estimated at 18 months; maximum age >21 years; maximum length 2.11 m (male), 1.93 m (female) (Perrin and Reilly 1984). Occurs in groups of hundreds in summer and less than 20 in winter. Rests in shallow water. Most aerial behaviour associated with surface feeding; acrobatic displays associated with social behaviour. Known to dive to at least 150 m. Surface feeder, in aggregations with sea birds. Has been seen with Southern Right Whales. Suspected predator is Killer Whale. A mass stranding of six animals has been reported (Bannister *et al.* 1996). Age at sexual maturity varies: 7 years in one male, 18 years in one 1.65 m female. The calving interval is unknown; mating is inferred to occur in summer; calves are born mainly in summer, after a gestation period estimated to be 11 months; no calving areas are known in Australian waters - however, a female stranded in Tasmania while giving birth (Gill *et al.* 2000).

Threat Summary: current threats include pelagic drift-net fishery in Tasman Sea which may involve Dusky Dolphins; taken as part of an uncontrolled gill-net fishery off Peru and fished illegally off Chile. Potential threats include entanglement in drift-nets set outside Australian Economic Exclusion Zone and in lost or discarded netting; pollution (including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea) leading to bio-accumulation of toxic substances in body tissues (Bannister *et al.* 1996).

4 Hourglass Dolphin (*Lagenorhynchus cruciger)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Lagenorhynchus cruciger*, in relation to threats or potential threats it faces, is generally limited. However, the species' wide distribution and abundance suggest that it may be less threatened than those classified as NCA(a) and it is recommended that its status remain classified as NCA(b).

Conservation objectives. Determine distribution and monitor abundance in Australian waters to assess possible impact of incidental catch and climatic changes; determine diet in order to assess impact of present and future fisheries in southern waters; minimise possible detrimental effects on population (s).

Family Delphinidae. Hourglass Dolphin, *Lagenorhynchus cruciger* (Quoy and Gaimard, 1824) [42]

EPBC Act Status: *Cetacean; Approved Recovery Plan: none.*
Conservation Status: *The Action Plan for Australian Cetaceans* status – no category assigned, but possibly secure (NCA(b)); / Data Deficient
IUCN Status: Insufficiently known; / Data Deficient
CITES Status: Appendix II.
Lagenorhynchus cruciger: Census of Australian Vertebrate Species 1627, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic Status. Described by Quoy and Gaimard (1824) as *Delphinus cruciger*. It is a well-established species. The validity of the six species in the genus was confirmed on morphological grounds by Miyazaki and Shikano (1997). No subspecies have been described (Bannister *et al.* 1996; Rice 1998).

Distribution. Probably circumpolar in pelagic waters of the Subantarctic and Antarctic zones, south of the Subtropical Convergence. Most records fall between 45° and 65°S (Rice 1998). Seen to the South East of New Zealand and from outside territorial waters South of Australia. Confirmed record (skull) from Heard Is. and unconfirmed sightings from there. Sighted in the vicinity of Macquarie Is. (Bannister *et al.* 1996; Kasamatsu *et al.* 1988). No population estimates are available but presumably the species is relatively abundant, judging by the frequency of sightings.

Distribution map: EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e42
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e42
Distribution showing presence in the oceanic region (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), south of 45ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. The habitat of the Hourglass Dolphin is pelagic and oceanic, comprising the polar and subantarctic zones in waters in water of about 0-12°C. Most sightings occur at temperatures of <7.0°C. It is rarely seen near land: in Antarctic, usually seen away from pack ice. May be found in cool currents associated with West Wind Drift. No key localities known in Australian or Antarctic waters, but apparent concentrations occur in Whaling Areas* VI and I, and apparently commonly sighted around Heard Is. (Bannister *et al.* 1996). No information is available of movements; prey comprises fish and squid, based on stomach contents of two animals only (Bannister *et al.* 1996); biological overview, based on non-Australian information: maximum weight >94 kg; maximum length >1.74 m (male)and >1.83 m (female) (Biermann and Slijper 1948; Brownell unpublished.; Leatherwood and Reeves 1983). School size ranges from 1-100, with most being up to eight individuals. Acrobatic species; rides bow waves. These dolphins are seen in company with several other cetacean species including Long Finned Pilot Whales, Southern Bottlenose Whale, Arnoux's Beaked Whales, Killer Whales, Southern Right Whale Dolphins, Sei Whales and Fin Whales (Kasamatsu *et al.* 1988). Sounds include clicks and whistles. Few strandings are known (Bannister *et al.* 1996). No information is available for any aspect of reproduction, including: length and weight at birth; age and length at weaning; age and length at sexual maturity; calving interval, season or calving areas; mating season or gestation period (Bannister *et al.* 1996).

Threat Summary: potential threats include incidental catch, impact of present and future fisheries on prey species; global and ocean warming, and depletion and holing of the ozone layer, possibly leading to altered distribution and abundance of prey (Bannister *et al.* 1996).

* Six Antarctic whaling areas were demarcated at the Washington Conference of 1946 (at which the beginnings of the International Whaling Commission were first laid down). These areas lie south of 40°S and extend to the Antarctic continent, or more practically, to the ice edge. Each comprises between 50° and 70° of longitude: Area I, 120°W-60°W; Area II, 60°W-0°; Area III, 0°-70°E; Area IV, 70°E-130°E; Area V, 130°E-170°W; Area, VI 170°W-120°W.

5 Risso's Dolphin (*Grampus griseus)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Grampus griseus*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as NCA(a).

Conservation objectives. Determine distribution and monitor abundance in Australian waters to assess possible impact of threats, particularly the effect of direct and indirect fishing activities; obtain information on diet to determine trophic level and assess possible impact of fishing industry on food resources; establish behavioural and ecological parameters to assess biology of offshore delphinids; determine taxonomic relationships with Indo-Pacific and Indian Ocean specimens to assess likely impact of threats on possible individual populations; minimise possible detrimental effects on population(s), such as fishing activities.

Family Delphinidae; Risso's Dolphin, *Grampus griseus* G. Cuvier, 1812 [64]

EPBC Act Status: Cetacean: Approved Recovery Plan: none
Conservation status: *The Action Plan for Australian Cetaceans* status – no category assigned, because of insufficient information (NCA(a))
IUCN status: Insufficiently known/Data Deficient
CITES Status: Appendix II
Grampus griseus: Census of Australian Vertebrate Species 1609, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and the Southern Ocean Sanctuary.

Taxonomic status. Described as *Delphinus griseus* by Georges Cuvier in 1812. Morphological differences between regions suggest several races worldwide. Australian specimens have not been compared with other regions (Bannister *et al.* 1996), although few Australian specimens are available for taxonomic comparisons with specimens from elsewhere. Iredale and Troughton (1933) established the genus *Grampidelphis* to replace *Grampus*, which they believed, incorrectly, to be the appropriate generic name for the Killer Whale, *Orcinus orca*.

Distribution. All oceans, from equator northwards and southwards to about 50-55°Latitude. In Australia, recorded from all States, other than Tasmania, or the Northern Territory (Bannister *et al.* 1996). Stranding records range from about 23° to 39°S. No estimates of abundance are available but this species is believed to be reasonably abundant throughout the main part of its range. Fraser I. has the only known 'resident' population in Australia (Corkeron and Bryden 1992; Bannister *et al.* 1996).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e64
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e64
Distribution showing presence in the oceanic, slope and shelf regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on

AMBIS version 1), north of 55ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. This species inhabits tropical, subtropical, temperate and subantarctic waters. It has been sighted both inshore and well offshore, although generally considered pelagic and oceanic. South African records appear to be associated with the 1000 m isobath. Sea temperatures range from 15°-30°C. Frequently seen over continental slope (Bannister *et al.* 1996). Seasonal migration has been suggested, for example, off Japan, while searching for prey (Bannister *et al.* 1996). Risso's dolphins feed on pelagic and neritic squids, some octopus and possibly fish (Clarke 1986; Würtz *et al.* 1992). The biological overview is based on limited, non-Australian information. Age and length at physical maturity not known; maximum weight >230 kg; maximum age >17 years; maximum length 4.1 m (Baker 1974; Ross 1984; Bannister *et al.* 1996). Usually gregarious, living in groups of 25 to several hundred but may also be solitary (Leatherwood and Reeves 1983). Sometimes swims in 'echelon formation', lined up abreast at evenly spaced intervals-possibly a useful prey-hunting tactic. Dives long and deep. Displays most of the usual behaviour patterns but not a regular bow-rider. "Pelorus Jack" was a Risso's dolphin that 'led' ships into harbour in Pelorus Sound, New Zealand for many years (Baker 1974). This species has been seen in company with striped dolphins, pilot whales, common dolphins and other pelagic cetaceans. The few Australian strandings were all single animals. Mass strandings are known elsewhere (Bannister *et al.*1996). Weight and length at birth is about 59 kg and 1.1-1.5 m in length; length at weaning is less than 2.12 m; length at sexual maturity ranges from 2.6-3.0 m; the calving interval and mating season are not known; gestation period is about 1 year; calving possibly occurs in summer, although a Victorian newborn was recorded in June; no calving areas are known (Perrin and Reilly 1984; Bannister *et al.* 1996).

Threat Summary: no past threats are known; current threats include possible illegal and incidental catches in northern Australian waters; cause for concern in Sri Lanka because of high proportion (25%) in incidental gill-net fishery catch; captured in small numbers in directed fisheries in several parts of the world, including Indonesia and Solomon Islands.

Potential threats: entanglement in drift-nets set outside Australian Territorial Waters and in lost or discarded netting; pollution (including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea) leading to bio-accumulation of toxic substances in body tissues (Bannister *et al.* 1996).

6 Bottlenose Dolphin (*Tursiops truncatus)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Tursiops truncatus*, in relation to threats or potential threats it faces, is generally limited. However, the species' wide distribution and abundance suggest that it may be less threatened than those classified as NCA(a) and it is recommended that it be re-classified NCA(b).

Conservation objectives. As described in *The Action Plan for Australian Cetaceans*: the objectives are to monitor abundance, especially in key areas, to determine possible impact of threats, such as pollutants and habitat degradation; determine the levels of pollutants in individuals and in prey fish to assess possible impact in different areas; study habitat requirements to assess impacts of degradation; derive a relationship between aerial survey estimates and absolute abundance to be estimated and monitored; compare genetics and morphology between Australian and other regions to assess taxonomic status of Australian animals; establish life history parameters for Australian animals to allow better interpretation of population trends and effects of threats; determine effects of ecotourism operations (e.g., feeding stations) on animals.

Family Delphinidae. *Tursiops truncatus*, Bottlenose Dolphin (Montagu, 1821) [68417]

EPBC Act Status: Cetacean: Approved Recovery Plan: none.
Conservation Status: *The Action Plan for Australian Cetaceans* status – no category assigned, because of insufficient information (NCA(a))
IUCN status: Insufficiently known
CITES Status: Appendix II (based on placement prior to taxonomic changes) / Data Deficient
Tursiops truncatus: Census of Australian Vertebrate Species 1612, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. The genus *Tursiops* has long been regarded as monotypic, with *T. truncatus* as the single cosmopolitan species. Although several other species have been described as new species on morphological grounds, the range of variation across the genus led to most of these being synonymised with *T. truncatus*. A review of these species using genetic techniques showed that *T. aduncus* Ehrenberg 1832 ranks as a full species (LeDuc 1999) (see description for that species for further references). Morphological differences between the two are described by Hale *et al.* (2000). The similarity of *T. aduncus* to *Stenella*, however, indicates that further revision of the Delphinidae is required.

Distribution. Cosmopolitan between about 65ºN and 55ºS, in both coastal and offshore waters. In the Australian region, *T. truncatus* generally occurs further offshore in deeper water than *T. aduncus*. Its distribution is not well known; the few records are from Queensland, New South Wales, Tasmania, South Australia and southwestern Western Australia.

[Map to be included – new species to list] Distribution showing presence in the oceanic, slope and shelf regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), south to 55ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. No information is available on the biology of this species in Australian waters. On the south-east coast of South Africa, where *T. aduncus* and *T. truncatus* occupy similar onshore/offshore habitats to those on southern coast of Australia, the longest animal on record was a 3.27 m long male; other animals between 2.6 m and 2.8 m were sexually immature or maturing; all were distinctly longer than *T. aduncus*. The only female examined was sexually mature, at a length of 2.8 m. Stomach contents of two dolphins included beaks of lycoteuthid squids, and otoliths of the gadid *Merluccius* sp. and *Lepidopus caudatus*. These items suggested capture in deep, cool water (Ross 1984).

7 Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus)*

Recommendation on Conservation Status.
Tursiops aduncus, has been added to the Australian list since the publication of *The Action Plan for Australian Cetaceans*. These dolphins are now recognised as distinct from *T. truncatus*. The level of information available on the biology and habitat of *Tursiops aduncus* in relation to threats or potential threats is generally limited, but the very near-shore distribution of this species makes their habitat vulnerable to environmental degradation and other human impacts. It is therefore recommended that its status be classified as NCA(a).

Conservation objectives. As described in *The Action Plan for Australian Cetaceans*: to determine the distribution and monitor abundance in Australian waters to assess possible impact of threats, particularly effect of direct and indirect fishing activities; to obtain information on diet to determine trophic level and assess possible impact of fishing industry on food resources; to determine taxonomic relationships within and outside the Indo-Pacific region, to assess likely impacts on individual populations; ensure funding provided for monitoring threatened populations in northern Australia.

Family Delphinidae; Indo-Pacific Bottlenose Dolphin, *Tursiops aduncus* Ehrenberg, 1832 [68418]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation status: *The Action Plan for Australian Cetaceans* status – the status of this species was not considered.
IUCN Status: Insufficiently known/ Data Deficient
CITES Status: Appendix II [provisionally following status accorded to *Tursiops truncatus*]
Bonn Convention: listed as migratory species; (Arafura Sea/Timor Sea populations).
Tursiops aduncus: Census of Australian Vertebrate Species 1672, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. The genus *Tursiops* has long been regarded as monotypic, with *T. truncatus* as the single cosmopolitan species. Although several other species have been described (for example, *T. gillii* Dall 1873; *T. aduncus* Ehrenberg 1832; *T. gephyreus* Lahille 1908; and *T. nuuanu* Andrews 1911), in general, these have been synonymised with *T. truncatus.* Subsequently, several studies have supported the acceptance of *T. aduncus* as a full species (Hale *et al.* 2000; Shirakihara *et al.* 2002; Ross, 1977; Wang, Chou and White 1999, 2000, 2001; Zhou 1987; Zhou and Quian 1985). The study by Le Duc *et al.*(1999) on the cytochrome *b* gene showed found that *T. aduncus* forms part of a well-supported clade with the two species of *Delphinus*, *Stenella clymene*, *S. frontalis* and *S. coeruleoalba*, making the genera *Stenella* and *Tursiops* polyphyletic, and indicating in part the need for a comprehensive taxonomic revision of the Delphinidae. The taxonomy of *Tursiops* in Australian waters has been described Ross and Cockcroft (1990). (Note that taxonomic confusion concerning these forms of *Tursiops* has led to papers that cite an

inappropriate species name – papers below are marked as [*T. aduncus*] where that name is applicable).

Discussions with Michael Krützen concerning *Tursiops* in Shark Bay indicated that the taxonomy of this genus required further analysis. He determined that these dolphins match the *aduncus* form morphologically, based on the elongate rostrum and the development of ventral speckling at the onset of sexual maturity. In his analyses of mitochondrial DNA, using four different tree-building methods, he found eight haplotypes within Shark Bay. Six of these formed a well-supported clade within previously published *aduncus* sequences; the other two haplotypes always fell within the *truncatus* clade. Using microsatellites, the allele proportions between animals carrying the *aduncus* haplotypes did not differ from those carrying the *truncatus* haplotypes, suggesting that these animals interbreed and are all part of a large panmictic population. This implies that (a) an introgression event has occurred in the past, (b) that at some stage *aduncus* and *truncatus* forms hybridised, or (c) that complete lineage sorting has not occurred yet. These findings indicate that more work is required to completely assess the species status of these *Tursiops*, using a multi-level approach (morphometrics and several genetic marker systems).

Distribution. *Tursiops aduncus*, as presently recognised, occurs widely in the Indo-Pacific region, from about Cape Agulhas, South Africa, to the Red Sea and eastwards to the Arabian Gulf, India, China and Japan; southwards to Indonesia and New Guinea; and new Caledonia. This species occurs around the whole Australian coast, and frequents a large number of bays and inshore waters in considerable numbers, including parts of the northern coast of Tasmania (Connor *et al.*2001; Hale, Barreto and Ross 2000; Kemper and Gibbs 2001; Krützen *et al.* 2001; Moller *et al.* 2001; Moller and Beheregaray 2001; Nader and Al-Khalili, 1978; Robineau and Rose 1984; Shirakihara *et al.* 2002).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e68418
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e68418
Distribution showing presence in the shelf region (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), in waters less than 20m depth, from the equator to 24ºS on the west coast and 29S on the east coast. The distribution is broadly based on the Species Profile and Threats database account.

Biology. Length at birth in *T. aduncus* from the Eastern Cape, South Africa, ranges from 830 -1120 mm, and weight of ca. 14 kg; weaned at about 18 months, at about 1.8 m long; maximum weight is about 200 kg in males and 180 kg in females; maximum age exceeds 40 years, based on GLGs in teeth; both sexes reach physical maturity and asymptotic length between 12 to 15 years of age in South African populations, at 243 cm in length and 176 kg in males and 238 cm in length and 160 kg in females (Cockcroft and Ross 1989). Age at sexual maturity in females of this population is between 9 and 11 years, 2-3 years earlier than in males. Calves are born through much of the year, with a peak in summer and early autumn; mean length and mass at birth is 103 cm and 13.8 kg, after a gestation period of 12 months; lactation lasts 18-24 months, although a calf may associate with the mother for up to 3 years. Post-pubertal female ovulation rate is 028/year, and the estimated calving interval is approximately 3 years. Dark spots develop on the ventral surface at sexual maturity in more northerly populations, but is expressed less and less towards the south. Mean group size of *T. aduncus* in Moreton Bay ranged from 1-51, with a mean of 16; the range of these dolphins varied from 0.8 km² to 15.1 km², with a mean of 4.3 km² (Corcoran

1997); in Shark Bay, group size averaged 4.5 (non-calves) (Bannister *et al.* 1996). Long-term behavioural studies have shown that the complexity of the social structure of Shark Bay dolphins is unparalleled in the animal kingdom. Different levels of male alliance formation for the purpose of sexual coercion of females occurs in a single population (Connor *et al.* 1992, 1999; Krützen *et al.* 2003); and, to date, this extreme complexity has not been documented anywhere else. Preferred prey species scavenged behind trawlers in Moreton Bay included *Polydactylus plebejus* and *Loligo* species (Corkeron *et al.* 1990). The six most important prey species of *T. aduncus* in South-Eastern South Africa are: the carangid *Trachurus delagoae*, the pomadasyid *P. olivaceum*, the sparid *Pagellus bellotti*, the scombrid *Scomber japonicus*, and the cephalopods, *Sepia officinalis* and *Loligo* species. A further 64 species of fish and cephalopods contributed 40% of the diet, in a study by Cockcroft and Ross (1990). Heithaus (2001) determined that shark attack is evident on 74% of calves in Shark Bay; they bear scars, mostly from tiger sharks, of which about 11-13% were unsuccessful, and he suggested that *T. aduncus* was particularly susceptible to attack in Shark Bay. However, the data could also suggest that survival rates are high, given that scar-bearing calves are survivors. Further, small caracharinid sharks in Shark Bay appeared to bite dolphins in an ectoparasitic manner. For comparison, 36% of *T. aduncus* in Moreton Bay bear shark scars (Corkeron 1990), and 10.3% of this species caught in anti-shark nets off Natal are scarred (Cockcroft *et al.* 1989).

Minimum population estimates for several Australian localities are: Moreton Bay – 334; inshore waters off North Stradbroke Is. – 321; open coastal waters off North Stradbroke Is. – 581 individuals, with estimate of 700-1000 individuals in winter (Chilvers & Corkeron 2003); south-eastern Shark Bay – ca 400; Cockburn Sound, Western Australia – at least 150; Adelaide – at least 140; Jervis Bay, south-eastern Australia – at least 103; Preen *et al.* (1997) conducted aerial surveys over Shark Bay, and estimated that it supports 2000-3000 bottlenose dolphins. The genetic data appear to support such a figure (Michael Krützen, personal communication May 2003). Significant populations of Indo-Pacific Bottlenose Dolphins also occur on the west and southern shores of Australia, but have yet to be counted.

Möller (2000, p 89) showed that the number of *T. aduncus* migrating per generation between the populations in Jervis Bay and Port Stephens in this species is low, estimated at 1.45 individuals per generation, based on Slatkin (1985) or 3.55 individuals using Wright's 1978 method. Further, the proportion of assignments across Jervis Bay and Port Stephens was of 6 individuals (5%), corroborating the hypothesis of low dispersal between the two populations. In addition, assignment tests also indicated low proportions of dolphins from other putative genetic populations into the study areas. This low migration rate reflects a high level of female natal philopatry, in which females stay close to their birthplace throughout their lives, thereby approaching a closed population, which may be susceptible to eventual extinction if threatening conditions developed, such as severe habitat destruction or limited food resources.

Threats summary: incidental, though substantial bycatch in the Taiwanese gill-net fishery in the Arafura Sea and Timor Seas, northern Australia, 1974-1986, in which an estimated 8400 *T. aduncus* comprised 60% of the total dolphin bycatch (Harwood and Hembree 1987). As an inshore species, *T. aduncus* is poorly placed to avoid impacts close to the coast, such as nets to protect bathers, entanglements and death in anti-predator nets set around tuna feedlots in Port Lincoln, South Australia (Kemper and Gibbs 2001); and other netting gear used for fishing; habitat destruction and degradation; illegal killing; pollution

such as pesticides; biomagnification of metals, such as cadmium, in dolphin prey, and consequent kidney damage, in Spencer Gulf and beyond (Long *et al.*, 1997); “swim-with” programs may also pose problems for dolphins, as a number of investigators have looked at such programs with both species of *Tursiops*. Scarpaci *et al.* (2000), showed that whistle production increased significantly greater in the presence of commercial dolphin swim boats in Port Phillip Bay, regardless of the dolphins' behavioural state prior to the arrival of the vessels (see also *T. truncatus* for avoidance behaviour). A population viability analysis undertaken by Hale (2002) for the Port Phillip Bay population of some 80 dolphins, suggested that if two new female recruits to the breeding population were lost per year, the population would be stable for a decade or so, but the chance of extinction is >50% after 25 years, and nearly 100% after 40 years.

8 Pantropical Spotted Dolphin (*Stenella attenuata)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Stenella attenuata*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as NCA(a).

Conservation objectives. Determine distribution and monitor abundance, especially in Australian waters, to assess possible impact of threats, particularly direct and indirect effect of fishing activities; determine taxonomic relationships within and outside Indo-Pacific region to assess likely impact of threats on possible individual populations; obtain information on diet to determine trophic level and assess possible impact of fishing industry on food resources.

Family Delphinidae; Pantropical spotted dolphin, *Stenella attenuata* Gray, 1846 [51]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Status: *The Action Plan for Australian Cetaceans* status – no category assigned, because of insufficient information (NCA(a))
Conservation IUCN Status: / Data Deficient;
Bonn Convention: listed as migratory species (Southeast Asian populations)
CITES Status: Appendix II.
Stenella attenuata: Census of Australian Vertebrate Species 1621, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. The taxonomy of Spotted Dolphins was confused until the recent revision of this group (by Perrin *et al.* 1987). Two species are recognised currently - the Atlantic Spotted Dolphin, *Stenella frontalis*, described by G. Cuvier in 1829, and *Stenella attenuata* Gray 1846, termed the Pantropical Spotted Dolphin. The latter species occurs off Australia (Gilpatrick *et al.* 1978; Perrin *et al.* 1987). *Stenella attenuata* is highly variable (with age and geographically) in size, colour pattern and skeletal characteristics.

Distribution. Occurs in the northern and southern hemispheres, in Pacific, Atlantic and Indian oceans. In Australia, recorded off the Northern Territory, Western Australia, south to Augusta, Queensland and NSW. Erroneous record for Victoria. Seasonal movements North/South are known off Japan and inshore/offshore in the eastern tropical Pacific (Leatherwood and Reeves 1983; Bannister *et al.* 1996).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e51
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e51
Distribution showing presence in the oceanic, slope and shelf regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), north of 34ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. No population estimates for Australian waters. Incidental catch in past offshore gill-net fishery in waters off northern Australia suggests fewer Pantropical Spotted Dolphins than Bottlenose Dolphins or Spinner Dolphins (Harwood and Hembree 1987). Considerable work done on estimating numbers and rates of change in the eastern tropical Pacific. Numbers have declined there, probably as a result of by-catch in purse-seine netting operations (Bannister *et al.* 1996). The habitat is both pelagic and oceanic, but this species is also found on the shelf and along continental slope; it may also be neritic. Multispecies aggregations in the eastern tropical Pacific correlated with a shallow, mixed layer and a thick, oxygen-minimum layer, creating a well-defined, shallow, 100 m deep pelagic habitat. These dolphins show a preference for tropical and subtropical waters, 22°C or greater; occasionally in temperate waters. No key localities are known in Australian waters (Bannister *et al.* 1996). No information is available on movements of Australian populations; seasonal movements occur northwards and southwards Japan, and inshore - offshore in the eastern tropical Pacific (Bannister *et al.* 1996). Pantropical Spotted Dolphins feed mainly on small epipelagic and mesopelagic fish, and squids. Some other foods are taken, such as nemertean worms and crab larvae. Diet varies with region and reproductive state. Lactating females eat a greater proportion of fishes than squids, presumably because the former is higher in calorific value. Diet overlaps greatly with Yellowfin Tuna and a close association has been noted between these species and sea birds in the eastern tropical Pacific (Bannister *et al.* 1996).

The overview of biology is based on non-Australian information: the species has been well studied in the eastern tropical Pacific, but little is known of its biology in Australian waters. Physical maturity occurs at >15 years; maximum length is 2.57 m (male) and 3.4 m (female); maximum weight is 119 kg; maximum age 50 years (Perrin and Hohn 1994). These are gregarious dolphins, and group size ranges from a few individuals to over 1000, and averages <100; offshore pods are usually larger than coastal ones. Often seen with other species of dolphin (including Spinner Dolphins), tuna and sea birds, probably in feeding aggregations. Home range is several hundred km or more; daily movements of 30-50 km are made. These dolphins are very acrobatic and leap high in the air; they also ride bow waves. They feed near the surface. Group strandings are recorded at Augusta, Western Australia, but usually animals strand singly. Predators include humans, sharks and several other cetaceans, including Killer Whale, False Killer Whale, and Pygmy Killer Whales. Sharks are known to take dolphins in association with purse-seining operations (Bannister *et al.* 1996).

The overview of reproductive parameters is based on non-Australian information: length at birth 0.8-0.9 m; age at weaning 1-3 years; sexual maturity attained by males at 12-15 years and 1.9-2.0 m in length; and in females, at 10-12 years and 1.8-2.0 m long; the interval between calves is 2-4 years; the mating season is diffuse, with peaks in spring and autumn, and gestation lasts 11.2-11.5 months; the calving season is equally diffuse, with peaks in spring and autumn. No calving areas are known in Australian waters (Myrick *et al.* 1986; Perrin and Hohn 1994; Perrin and Reilly 1984; Ross 1984; Bannister *et al.* 1996).

Threats summary: incidental bycatch in the Taiwanese gill-net fishery in the Arafura Sea, northern Australia, 1974-1986, in which an estimated 560 *S. attenuata* comprised 4% of the total dolphin bycatch were caught (Harwood and Hembree 1987) in a gill-net fishery operating within Australia's Economic Exclusion Zone (EEZ) in the Arafura and Timor seas. Some captures took place in the 1970's for a New South Wales oceanarium. The impact of the gill-net fishery on this species is likely to have eased, as available

information indicates that such activities have all but ceased in that region (Mick Yates personal communication). Directed fisheries and incidental catch take large numbers in the Philippines, where they used for human consumption; caught in inshore shark nets in low numbers in Qld and NSW; believed to interfere with hook-and-line fisheries and therefore seen as a competitor to the fishing industry drive fishery operates in the Solomon Is. where Pantropical Dolphins are preferred catch (Dawbin 1966). Potential threats: entanglement in drift-nets set outside Australian territorial boundaries and in lost or discarded netting; pollution leading to accumulation of toxic substances in body tissues (Bannister *et al.* 1996).

9 Striped Dolphin (*Stenella coeruleoalba)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Stenella coeruleoalba*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as NCA(a).

Conservation objectives. As presented in *The Action Plan for Australian Cetaceans*: to determine distribution and monitor abundance in Australian waters to assess possible impacts of threats, particularly effect of direct and indirect fishing activities; to obtain information on diet to determine trophic level and assess possible impact of fishing industry on food resources; determine taxonomic relationships within and outside Indo-Pacific region to assess likely impact of threats on possible individual populations; minimise possible detrimental effects on population(s), for example, from fishing activities.

Family Delphinidae. Striped Dolphin, *Stenella coeruleoalba* Meyen, 1833 [52]

EPBC Act Status: Cetacean; Approved Recovery Plan: none
Conservation status: *The Action Plan for Australian Cetaceans* status – no category assigned, because of insufficient information(NCA(a));
IUCN Status: Insufficiently known/ Data Deficient
CITES Status: Appendix I.
Stenella coeruleoalba: Census of Australian Vertebrate Species 1619, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and the Southern Ocean Sanctuary.

Taxonomic status. The Striped Dolphin was first named formally by F. Meyen in 1833, as *Delphinus coeruleoalbus*, for a specimen collected off the River Plate in South America. Despite its widespread occurrence in warm-temperate and tropical waters of the world, no subspecies have been described, although the 16 or so synonyms applied subsequently to this species would provide a ready source of names for such new taxa.

Distribution. A pelagic species, occurring in the northern and southern hemispheres and all oceans, in tropical, subtropical and warm temperate waters, including deep water along the outer edge of the continental slope. No key localities are known in Australian waters (Bannister *et. al*. 1996). Migratory in the North Pacific, where it moves north and south in relation to the warm Kuroshio Current; the same may be true off the coast of South Africa (Perrin *et al.* 1994; Ross 1984; Bannister *et al.* 1996). Strandings are infrequent in Australian waters; four or five records are recorded from Western Australia, including the most southerly, from Augusta, southwestern Western Australia, which is probably related to the southward flow of the warm Leeuwin Current in this region. There are two records from New South Wales, and two from southern Queensland. No population estimates are available for Australia; estimates for Japan and the eastern tropical Pacific were 176 000 - 252 000 and 1.9 million animals , respectively in 1995. The population in the Western Mediterranean Sea was estimated at 117,880 animals in 1991, during the period that the

1990-1992 morbillivirus epizootic developed in the region (Aguilar (2000). There are no data for sightings at sea off Australia (Bannister *et al.* 1996).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e52
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e52
Distribution showing presence in the oceanic and slope regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), north of 34ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. Prey is small (<300 mm length), and includes mesopelagic fish, shrimp and squid. A South African study suggested that animals fed in oceanic waters over the continental slope, with some prey taken nearer to shore before stranding (Perrin *et al.* 1994; Bannister *et al.* 1996). This overview of biological parameters is based on non-Australian information: in the Mediterranean Sea, age and length at physical maturity occurs at 15-20 years of age in males, and 13-18 years of age in females (Calzada *et al.* 1997); the age at sexual maturity is 11-12 years in both sexes in the Mediterranean (Aguilar 2000), and has declined from 9,7 years to 7.2 years in females off Japan, thought to be in response to decrease in numbers caused by the fishery for this species (Perrin *et al.* 1994); maximum age about 58 years; maximum length 2.6 m (male) and 2.5 m (female); asymptotic length in the Mediterranean Sea is 2.00 m and 1.94 m in males and females, respectively (Calzada *et al.* 1997). This species is gregarious, usually in schools of a few hundred, though groups of up to several thousand individuals occur; schools made up of subadults, adults or mixed ages. Subadults may move closer to the coast than adult or mixed schools. Animals are active and conspicuous. Ride bow waves. May feed at depths of about 200 m or may take prey species that normally live at such depths when they come to surface at night (Baker 1990; Perrin *et al.* 1994). Individuals and groups strand – a mass stranding of 24 animals occurred at Augusta, Western Australia, in January 1989. Predators not known, though sharks and Killer Whales, False Killer Whales, Pygmy Killer Whales and Pilot Whales are likely; parasitism may be a major factor in natural mortality. Lungworms noted in several South African specimens, with associated necrotic tissue and enlarged lymph nodes. Morbillivirus, possibly linked with toxic contaminant tissue levels, has resulted in large number of deaths in Mediterranean. Length at birth 0.8-1.0 m ; age and length at weaning 15-36 months at 1.7 m in length; calving interval 1.5-4 years; mating season unknown; gestation ca 12 months; the calving season is prolonged – no calving area(s) known in Australian waters (Perrin and Reilly 1984; Perrin *et al.* 1994; Bannister *et al.* 1996).

Threat Summary: past threats: no information available; current threats: no quantitative information on incidental catch in Australian waters but possibly taken in nets off WA. One recorded in study of gill-net incidental catch in Timor and Arafura seas (Harwood and Hembree 1987); level of direct and indirect catch in Sri Lanka is high and taken in small numbers in the Solomon Is. fishery; taken in large numbers by the Japanese drive fishery, with some concern being expressed by the International Whaling Commission as to the extent of the catch. Potential threats: Entanglement in drift-nets set outside Australian Economic Exclusion Zone and in lost or discarded netting; pollution (including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea) leading to bio-accumulation of toxic substances in body tissues (Bannister *et al.* 1996).

10 Common Dolphin (*Delphinus delphis)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Delphinus delphis*, in relation to threats or potential threats it faces, is generally limited. However, the species' wide distribution and abundance suggest that it may be less threatened than those classified as NCA(a) and it is recommended that its status remain classified as NCA(b).

Conservation objectives. Subsequent to the determination of taxonomic status for southern *Delphinus*, to determine whether other forms of *Delphinus* are present in warmer waters in northern Australian waters; determine levels and effects of toxic contaminants, especially near centres of populations and industrialisation/ agriculture, to assess risk from this threat; determine relative abundance and distribution in Australian waters to assess possible impact of threats, particularly the effect of direct and indirect fishing activities and intentional killing; obtain information on diet to determine trophic level and assess possible impact of fishing industry on food resources; and determine level of incidental and intentional take.

Family Delphinidae;. Common Dolphin, *Delphinus delphis* Linnaeus, 1758 [60]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation status: *The Action Plan for Australian Cetaceans* status: no category assigned, but possibly secure (NCA(b)).
IUCN status: Insufficiently known/Data Deficient
CITES Status: Appendix II
Delphinus delphis: Census of Australian Vertebrate Species 1616, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and the Southern Ocean Sanctuary.

Taxonomic status. *Delphinus delphis* was described by Linnaeus in 1758. Until quite recently, it had been considered to be a single cosmopolitan species. However, studies in the northern Pacific have identified two forms, differing in colour pattern and morphometrics: a short-beaked form, *D. delphis* and a long-beaked form, *D. capensis* (Heyning and Perrin 1994). Morphometric analysis of over 200 Australian *Delphinus* supports the evidence from a genetic study that a single variable, short-beaked species, referable to *D. delphis*, occurs in southern Australia (personal communication C. Bell, C. Kemper and J. Conran). For further information on this taxon, see online description and illustrations at http://www.samuseum.sa.gov.au/dolphins.htm]

Distribution. *Delphinus delphis* occurs in the northern and southern hemispheres, in all oceans, extending southwards to about the Subtropical Convergence. In Australia, recorded in all states and, rarely, in the Northern Territory. The Short-beaked form is recorded from at least Tasmania. No key localities are known in the Australian region (Bannister *et al.* 1996). There are no population estimates for Australian waters. Considered common based on number of strandings and sightings. Population estimates for areas in northern hemisphere indicate declines in some, particularly eastern tropical Pacific where purse-

seine netting results in incidental deaths (Bannister *et al.* 1996). This dolphin occurs in neritic, pelagic and oceanic habitats, from temperate to tropical waters. Preferred water temperatures in the eastern tropical Pacific are 10-28°C. Very few records from tropical regions around Australia, which may not truly reflect distribution, considering its common occurrence in tropical habitats elsewhere. May be associated with high topographical relief of the ocean floor, escarpments and areas of upwelling (Evans 1984; Findlay *et al.* 1992; Gaskin 1968; Bannister *et al.* 1996). Not known to be migratory in Australia, but seasonal movements are recorded off southern California and along the east coast of South Africa (Heyning and Perrin 1994; Ross 1984).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e60
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e60
Distribution showing presence in all of the Australian marine area (based on AMBIS version 1), from the equator south to 45ºS, extending to 47ºS on the east coast of Tasmania. The distribution is broadly based on the Species Profile and Threats database account.

Biology. Strandings are common along the Australian coast, usually single but one mass stranding of 34 animals reported for Victoria and several for Tasmania (up to 109 individuals *en masse*). Cause of mortality is rarely established but includes incidental catches, intentional killing, presumed stillbirths, severe lungworm infection, haemolytic *Pasturella* in lungs, pneumonia, *Nasitrema* infection, congested lungs, bone lesions associated with hepatitis. Predators include Killer Whales. A stranded animal in Western Australia had a stingray barb embedded in its body. These opportunistic predators feed on shoaling and mesopelagic fish, and cephalopods. Diet varies with stock and season; dolphins may follow prey stocks. Prey items tend to be small. Very gregarious; some aggregations observed in Australian waters number thousands, or even 100 000 individuals; the latter may be smaller groups combined into one unit temporarily. These acrobatic dolphins ride bow waves of boats and large whales. Seen with other species of dolphin, including Indo-Pacific Bottlenose Dolphins, as well as larger cetaceans (Fin, Humpback, Blue, Southern Right Whales). Highly mobile and may move long distances. Feed at surface and at depth (at least 280 m). May take advantage of human fishing operations to get prey. Some evidence of competitive interactions with spotted and spinner dolphins. May move inshore or offshore following food. Known to aggregate with tuna possibly in a feeding association. Produce the entire acoustic repertoire of most delphinids (Bannister *et al.* 1996). The following data are based mostly on information from populations outside of Australia. Length at birth is ca 0.8 m; age and length at weaning ranges from 5-19 months and ca 1.5 m; length and age at physical maturity is unknown; maximum weight 163 kg; maximum age 22 years (male), 20 years (female); maximum length 2.32 m (male), 2.18 m (female); age and length at sexual maturity, very variable: 3-12 years and 1.7-2.0 m (male), 2-7 years and 1.5-1.9 m (female); calving interval variable, 1.3-2.6 years; mating season unknown; gestation, 10-11 months; calving season, all year, peaks in spring and autumn; calving area(s), none known in Australian waters (Bannister *et al.* 1996; Evans 1994; Heyning and Perrin 1994; Perrin and Reilly 1984; Ross 1984).

Threat Summary: threats include: previous (and possibly current) use as bait for craypots by some Australian fishers. Captured for oceanarium in northern New South Wales during the 1970s; current threats include intentional killing (usually by shooting); occurs in most states. In South Australia, one conviction was made for killing common dolphins for use as crayfish bait. True extent of intentional and unintentional deaths is unknown because many

cases go unreported. Incidental catches of concern in e. tropical Pacific and possibly other regions. In Australia, deaths in nets have been recorded in South Australia and Tasmania, more commonly in Western Australia; entanglements and death in anti-predator nets set around tuna feedlots in Port Lincoln, South Australia (Kemper and Gibbs 2001); other forms of unintentional deaths and injuries reported. Bio-accumulation evident in moderate levels of organochlorines and some heavy metals in some common dolphins from Australian waters (Kemper *et al.* 1994). Taken in small directed fisheries in several parts of its world range. Potential Threats: entanglement in drift-nets set outside Australian Territorial Waters and in lost or discarded netting. Pollution (including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea) leading to bio-accumulation of toxic substances in body tissues, such as biomagnification of metals, such as cadmium, in dolphin prey, and consequent kidney damage, in Spencer Gulf and beyond (Bannister *et al.*; Long *et al.*, 1997).

11 Fraser's Dolphin (*Lagenodelphis hosei)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Lagenodelphis hosei*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as NCA(a).

Conservation objectives. Determine distribution and abundance in Australian waters to assess possible impact of threats, particularly the effect of direct and indirect fishing activities; obtain information on diet to determine trophic level and assess possible impact of fishing industry on food resources; determine taxonomic relationships within and outside of Indo-Pacific region to assess likely impact of threats on possible individual populations.

Family Delphinidae. Fraser's Dolphin, *Lagenodelphis hosei* Fraser, 1956 [41]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation Status: *The Action Plan for Australian Cetaceans* status – no category assigned, because of insufficient information (NCA(a)).
IUCN status: Insufficiently known / Data Deficient

CITES Status: Appendix II.
Bonn Convention: listed as migratory species
Lagenodelphis hosei: Census of Australian Vertebrate Species 1624, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and the Southern Ocean Sanctuary.

Taxonomic status. Described by Fraser in 1956 on a single skull (Perrin *et al.* 1973); no subgroups recognised (Bannister *et al.* 1996). The affinities of this species to other delphinids is uncertain; morphologically, the skull most resembles that of the Common Dolphin; genetic analysis of the cytochrome b mitochondrial DNA indicates a relationship with the genera *Stenella, Tursiops, Delphinus* and *Sousa*.

Distribution. Fraser's dolphin is no longer considered rare. A population estimate for the eastern tropical Pacific is a maximum of 289 000 animals. No estimates are available for other areas in its range. Seven strandings are recorded in Australia. Found in low latitudes of all three major ocean basins. Distribution in the southwestern Indian Ocean may be localised. Most records lie between 30°N and 30°S. Records outside low latitudes may represent vagrants. Records from South Africa suggest the species may move to the higher latitudes in warmer months. In Australia, strandings are recorded in Western Australia (2), Queensland (1), northern New South Wales (3) and Victoria (1, in Corio Bay at 38°S; Bannister *et al.* 1996). This species ranges from a pelagic or oceanic habitat, along the outer continental shelf or slope and in deep oceanic waters (Mörzer Bruyns 1971), to nearshore, as seen in the Philippines. It inhabits subtropical, tropical and occasionally temperate waters. All sightings in South Africa were over depths exceeding 1000 m deep and associated with the warm Agulhas Current. Found in waters characterised by a stable, shallow mixed layer and thermocline ridging, also upwelling areas. The Corio Bay

stranding occurred in January and was possibly associated with the southward flowing warm Eastern Australian Current. In captivity, Fraser's Dolphin becomes very distressed in shallow water, possibly because it is unaccustomed to this environment. No key localities are known in Australian waters (Bannister *et al.* 1996).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e41
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e41
Distribution showing presence in the oceanic and slope regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), north of 30ºS and deeper than 1000m. The 1000m boundary mapped as 1 degree grid cells with >50% >1000m. The distribution is broadly based on the Species Profile and Threats database account.

Biology. Fraser's Dolphin feeds on mesopelagic fish, squid and crustaceans. Some recorded prey are deep-sea or benthic, suggesting that Fraser's Dolphin either feeds at depth (250-500 m) or when prey surface at night. Possibly a selective feeder on larger prey (Ross 1984; Bannister *et al.* 1996). Fishes appear to form the most important component (Robison and Craddock 1983), even in areas apparently out of its normal range (van Bree *et al.* 1986). The overview of biological data is based on limited, non-Australian information (Perrin *et al.* 1973; Perrin and Reilly 1984; Ross 1984; Jefferson and Leatherwood 1994; Bannister *et al.* 1996). Physical maturity occurs at more than 16 years and a length of 2.52 m (female); maximum weight is 209 kg; maximum age exceeds 16 years; and the maximum length is 2.70 m. School size ranges from less than 10 to about 1000. Considered highly gregarious, the school bond apparently tight. Observed with Striped and Spotted Dolphins, False Killer Whales and Sperm Whales and especially Melon-headed Whales. Swimming behaviour is like other pelagic dolphins, although less acrobatic. In some parts of the world considered shy. Usually strands singly; in Australia one group of three stranded at Corio Bay. Mass stranding of 11 animals occurred in France and 30 stranded in Florida. If these dolphins are as pelagic and highly social as believed, mass strandings are to be expected. Lung lesions caused by nematodes (McColl and Obendorf 1982). Severe bronchopneumonia associated with lungworm, and trematode ova found in blowhole. Wounds from cookie-cutter sharks (*Isistius*) have been recorded. Length at birth is ca 1 m; sexual maturity is reached at >7 years and a length of >2.06 m; mating season and calving interval unknown; gestation inferred as 10-12 months; no strong seasonality for calving; no calving areas known in Australian waters (Bannister *et al.* 1996).

Threat Summary: past threats include attempts to establish captive animals; current threats include incidental capture in gill-net fishery in Philippines (second most frequently caught species there); harpoon fisheries in Indonesia, Sri Lanka, Taiwan and Japan; incidental catches in Sri Lanka and purse-seine deaths in the eastern tropical Pacific. Potential threats include: incidental and illegal captures within Australian waters of northern Australia (Harwood and Hembree 1987); entanglement in drift-nets set outside Australian Territorial Waters and in lost or discarded netting; effects of pollution (including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea) leading to bio-accumulation of toxic substances in body tissues (Bannister *et al.* 1996).

12 Southern Right Whale Dolphin (*Lissodelphis peronii)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Lissodelphis peronii*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as NCA(a).

Conservation objectives. Determine distribution and abundance in Australian waters to assess possible impact of threats, particularly the effect of direct and indirect fishing activities; obtain information on diet to determine trophic level and assess possible impact of fishing industry on food resources; determine taxonomic relationships within and outside of Indo-Pacific region to assess likely impact of threats on possible individual populations.

Family Delphinidae. Southern Right Whale Dolphin, *Lissodelphis peronii*. Lacépède 1804 [44]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation Status: *The Action Plan for Australian Cetaceans* status – no category assigned, because of insufficient information (NCA(a)).
IUCN status: Insufficiently known/ Data Deficient
CITES Status: Appendix II.
Lissodelphis peronii: Census of Australian Vertebrate Species 1630, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and the Southern Ocean Sanctuary.

Taxonomic status. Described by Lacépède in 1804 *as Delphinus peronii*, possibly based on a specimen collected south of Tasmania. Closely related northern species *Lissodelphis borealis* may be conspecific with *L. peronii* (Bannister *et al.* 1996).

Distribution. Found only in the southern hemisphere, where its distribution is circumpolar generally between about 30° and 65°S (low latitudes to 12°S off western South Africa and South America, related to the cold currents); Baker 1981; Cruikshank and Brown 1981; Van Waerebeek *et al.* 1991; Findlay *et al.* 1992). Off southern continental Australia; stranded in Tasmania, several sightings south and south-westward of Tasmania, off south-west Australia and in the Great Australian Bight; these are reported rarely, but may occur more regularly than believed, for example, Clarke (2000). Not recorded from Heard Is. or Macquarie Is. No estimates of population size anywhere in the southern hemisphere. Considered abundant off western South America, observed at sea many times to the southeast of New Zealand. A pelagic species, usually well offshore but if inshore, in deep water. On outer edge of continental shelf. In northern parts of distribution, associated with cold currents and upwelling conditions. Water temperatures range from about 2°-20°C. Possibly associated with West Wind Drift and generally seen between the Subtropical and Subantarctic Convergence. No key localities known in Australian waters (Bannister *et al.* 1996). Northward migration in winter and spring has been suggested off other continents (Cruikshank and Brown 1981; Bannister *et al.* 1996).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e44
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e44
Distribution showing presence in the oceanic, slope and shelf regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), between 30ºS and 65ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. Very few stomachs have been examined. Myctophids and other mesopelagic fish, squid and crustaceans have been recorded; euphausiids are also potential prey. It is unknown whether this species is a surface or deep-layer feeder (Jefferson *et al.* 1994; Bannister *et al.* 1996). The biological overview is based on non-Australian information. Age and length at physical maturity is unknown; maximum weight is 116 kg; maximum age is not known; maximum length reaches 2.97 m in males and 2.3 m in females. Capable of very fast swimming speed with sustained speeds of up to 12 knots. When swimming rapidly, leaps high and dives shallowly; also bowrides. Other behaviours cause water disturbance. Group size reported as 1-1000 individuals (mean ca 200) usually in tight group. Does not display consistent reaction to ships. Commonly reported swimming with many other species, e.g. Pilot Whales, Common Dolphins, Hourglass Dolphins, Dusky Dolphins and large whales (Baker 1981; Leatherwood and Reeves 1983). Only known predator, apart from humans, is the Patagonian Toothfish, but sharks and Killer Whales are likely. Many strandings have been recorded outside Australia. Mass strandings (up to 77 individuals) have been recorded. Only three strandings recorded in Australia, all in Tasmania (Baker 1981). Reported pathologies are heart scars, lung abscesses, lung inflammation, pulmonary oedema, ulceration and brain lesions. The parasite *Nasitrema* is found in air sinuses (Bannister *et al.* 1996). Birth weight and birth length ca 5 kg and ca 0.86 m; no information is available on age or length at weaning; sexual maturity occurs at about 2.5 m (male) and 2.18 m (female); no data are available on calving interval, mating season, or gestation period. Calving occurs in, at least, November and April. No calving area(s) are known.

Threats summary: past threats include sporadic catches by whalers (for meat) in the nineteenth century but never a directed fishery (Bannister *et al.* 1996).

13 Melon-headed Whale (*Peponocephala electra)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Peponocephala electra*, in relation to threats or potential threats it faces, is generally limited. However, the species' wide distribution and abundance suggest that it may be less threatened than those classified as NCA(a) and it is recommended that its status be re-classified as NCA(b).

Conservation objectives. Determine extent of incidental take and fisheries in northern Australian and nearby waters; determine distribution and monitor abundance in Australian waters to assess possible impact of threats, particularly effect of direct and indirect fishing activities; obtain information on diet to determine trophic level and assess possible impact of fishing industry on food resources; determine taxonomic relationships within and outside Indo-Pacific region to assess likely impact of threats on possible individual populations; minimise possible detrimental effects on population(s), for example, from fishing activities.

Family Delphinidae. Melon-headed Whale, *Peponocephala electra* Gray, 1846 [47]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
The Action Plan for Australian Cetaceans status: no category assigned, because of insufficient information (NCA(b);
IUCN status: Insufficiently known/ Data Deficient
CITES Status: Appendix II;
Peponocephala electra: Census of Australian Vertebrate Species 1639, updated 31 December 1998.

Taxonomic status. Originally described as *Lagenorhynchus electra* by Gray in 1846. Recently placed in the monospecific genus *Peponocephala*. No apparent taxonomic confusion and no subspecies recognised. Australian material enabled the redescription of the species (Bannister *et al.* 1996).

Distribution. Northern and southern hemispheres, in the Indian, Pacific and Atlantic oceans between about
35°N and 35°S. In Australian waters, recorded from Western Australia, Queensland (mass stranding of 53 animals), New South Wales (mass strandings of 150-250 animals at Crowdy Head, and 7 animals at Point Plomer) and the Northern Territory (mass stranding of 40 animals at Elcho Is., and a single stranding); other single strandings have been recorded). A stranding at Mundrabilla, in the Great Australian Bight, may be related to the warm Leeuwin Current. The population estimate for the eastern tropical Pacific is 45 000. Apparently common in the Philippines, and may be more common in Australian waters than records suggest (Perryman *et al.* 1994). This species is pelagic, oceanic and primarily tropical or subtropical but can be found in temperate waters. Inhabits warm waters usually >25°C), mainly equatorial. Generally in upwelling areas. No key localities known in Australian waters (Leatherwood and Reeves 1983; Bannister *et al.* 1996). Melon-headed whales are not known to be migratory.

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e47
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e47

Description: Distribution showing presence in the oceanic region (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), in the tropics and temperate zone to 35ºS.
The distribution is broadly based on the Species Profile and Threats database account.

Biology. The diet comprises squid and a variety of small fish (Bannister *et al.* 1996). The biological overview is based on information from Australia and other regions: physical maturity is attained at ca 2.7 m; maximum weight exceeds 100 kg; maximum age is more than 20 years; maximum length is about 2.75 m (Perrin and Reilly 1984). These whales occur in large groups, ranging from herds of 150-1500 animals to groups of less than 40 whales. They are reported to be fast swimmers, breaking the water at a shallow angle, and they also jump clear of the water. They may spy-hop and swim with other dolphins (Fraser's Dolphin, Pantropical Spotted and Spinner Dolphins). Reported as herding other Melon-headed Whales and possibly attacking other dolphins (Bryden *et al.* 1977; Dawbin *et al.* 1970; Leatherwood and Reeves 1983; Perryman *et al.* 1994).

Threat Summary: past threats - none known; current threats: possible illegal and incidental catches in northern Australian waters; incidental catches in gill-nets in Sri Lanka and small numbers taken in the purse-seine nets of the eastern tropical Pacific; captured in low numbers in small cetacean fisheries in several places, including Japan, Indonesia and Sri Lanka. Potential threats include: entanglement in drift-nets set outside the Australian Economic Exclusion Zone and in lost or discarded netting; pollution (including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea) leading to bio-accumulation of toxic substances in body tissues (Bannister *et al.* 1996).

14 Pygmy Killer Whale (*Feresa attenuata)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Feresa attenuata*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as NCA(a).

Conservation objectives. Determine distribution and abundance in Australian waters to assess possible impact of threats, particularly effect of direct and indirect fishing activities; obtain information on diet to determine trophic level and assess possible impact of fishing industry on food resources; determine taxonomic relationships to assess likely impact on threats on possible individual populations; minimise possible detrimental effects on population(s), for example, from fishing activities.

Family Delphinidae. Pygmy Killer Whale, *Feresa attenuata* Gray, 1874 [61]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation Status: *The Action Plan for Australian Cetaceans* status: - no category assigned because of insufficient information (NCA(a))
IUCN status: Insufficiently known/Data Deficient.
CITES Status: Appendix II.
Feresa attenuata: Census of Australian Vertebrate Species 1650, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. Described as *Feresa attenuata* by Gray, 1874 (not 1875, as usually cited; see Rice 1998 for comments). The two skulls known until the 1950s were assigned to different species but subsequent specimens obtained have shown one species with a wide distribution (Bannister *et al.* 1996).

Distribution. The Pygmy Killer Whale is found at low latitudes in the Pacific, Indian and Atlantic oceans between about 35°N and 35°S. In Australia, this species is known from strandings in New South Wales and Western Australia. Five sightings of this species at shelf edge, off Wollongong, New South Wales, between August 2001 to February 2002; from 3 to more than 45 whales per sighting (see Southern Oceans Seabird Study Association - members.ozemail.com.au/~sossa/). Further investigation is required to determine if this area is a key locality for this species. Sighting records are reported for the area northeast of Australia (Bryden 1976; Bannister *et al.* 1996). Population abundance and rates of change in abundance are unknown; the species is believed to be uncommon or rare throughout its range, although it is not uncommon in the gill-net fishery off Sri Lanka. Recorded from tropical and subtropical waters, generally 18°C or greater. Unknown whether this species is pelagic or neritic, possibly the former. Limited evidence suggests this species does not migrate (Ross and Leatherwood 1994; Bannister *et al.* 1996).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e61
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e61

Distribution showing presence in the oceanic and slope region (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), north of 35°S. The distribution is broadly based on the Species Profile and Threats database account.

Biology. Very limited information is available on diet, based on squid beaks and fish otoliths collected from only three stomachs. Behavioural observations suggest it is a predator on other cetaceans including *Stenella* spp. and *Delphinus delphis* escaping from tuna nets. Sardines were eaten by a captive animal (Ross 1984; Bannister *et al.* 1996). The biological overview is based on limited, non-Australian information: length at physical maturity 2.31 m; maximum weight 155 kg; maximum age >14 years. Observed in groups of up to 120 individuals, although generally less than 50. Has been seen with Fraser's Dolphin and Pygmy Right Whale, although the latter seems unusual because of the more temperate water preferences of that species. Reported to herd and attack other small cetaceans. Distinct fright reactions have been shown by other species when in captivity with this species. Described as aggressive, by snapping the jaws, beating flippers and flukes on the water's surface and growling (Ross and Leatherwood 1994; Bannister *et al.* 1996). Known to strand but not in groups. Heavy infestations of stomach nematodes and stomach ulcers are recorded, as are respiratory infections. Stalked barnacles attach to flukes, flippers and dorsal fin (Bannister *et al.* 1996). Length at birth ca 0.8 m; no data on weaning; length at sexual maturity 2.16 m (male) <2.21 m (female); calving interval unknown; mating season, gestation period, calving season and areas not known (Perrin and Reilly 1984; Ross 1984; Ross and Leatherwood 1994; Bannister *et al.* 1996).

Threat summary: past threats still current; likely to include illegal and incidental catches in northern Australian waters; taken in small numbers in directed fisheries in several places, including Indonesia; incidental catches reported in gill-nets off Sri Lanka (ca 2% of catch) and purse-seine nets in eastern tropical Pacific; taken for bait in Sri Lanka. Potential threats include entanglement in drift-nets set outside Australian Territorial Waters and in lost or discarded netting; pollution (including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea) leading to bio-accumulation of toxic substances in body tissues. (Bannister *et al.* 1996).

15 False Killer Whale (*Pseudorca crassidens)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Pseudorca crassidens*, in relation to threats or potential threats it faces, is generally limited. However, the species' wide distribution and abundance suggest that it may be less threatened than those classified as NCA(a) and it is recommended that its status remain classified as NCA(b).

Conservation objectives. Establish basic biological parameters; establish seasonal variation in distribution in relation to reproductive parameters; assess degree of biological threat posed by pollutants; improve definition of range in relation to oceanographic parameters and season; establish indices of abundance.

Family Delphinidae. False Killer Whale, *Pseudorca crassidens* Owen 1846 [48]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
The Action Plan for Australian Cetaceans status: No category assigned, but possibly secure (NCA(b))
IUCN status: Insufficiently known/ Data Deficient
CITES Status: Appendix II
Pseudorca crassidens: Census of Australian Vertebrate Species 1603, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and the Southern Ocean Sanctuary.

Taxonomic status. This species was described by Owen in 1846, based on a subfossil specimen, and subsequently recognised as a living species (Rice 1998). No subgroups are recognised, although considerable differences exist between schools of these whales from Scotland, South Africa and Australia (Kitchener *et al.* 1990; Bannister *et al*. 1996). Although skull morphology in this species is similar to that of Killer whales, False Killer Whales are genetically more similar to Risso's Dolphin, Pygmy Killer Whales and pilot whales (Baird 2002).

Distribution. Circumglobal between latitudes 45°S and 45°N. North-south and inshore seasonal movements appear to occur in the north-eastern Pacific and in some other areas, apparently associated with warm currents and seasonal availability of prey. Widely recorded in Australia by strandings – Western Australia (17 events), South Australia (3), Victoria (2), Tasmania (15), New South Wales (11), Queensland (5), Northern Territory (2) (Bannister *et al.* 1996; Chatto 2000; Nicol 1987). Although widely distributed, apparently nowhere abundant. No population assessments are available for southern hemisphere populations.

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e48
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e48
Distribution showing presence in the oceanic and slope regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS

version 1) from tropics to 45˚S. The distribution is broadly based on the Species Profile and Threats database account.

Biology. False Killer Whales show a preference for tropical (ca 22˚-32°C) to temperate (ca 10˚-20°C) oceanic waters. They approach close to land only where the continental shelf is narrow, possibly attracted to zones of enhanced prey abundance along the continental slope (Bannister *et al.* 1996). Strandings occur in all months, but the majority of school strandings occur from May to September on the southern and southeastern coasts, indicating a seasonal movement inshore or along the continental shelf (Nicol 1987; Bannister *et al.* 1996). These whales feed on squid and large pelagic fish. In parts of the species' range, individuals have been observed to prey on Cod (*Gadus*), Mahimahi (*Coryphaena*), Yellowtail Tuna (*Thunnus*) and Salmon (*Onchorhynchus*), and will attack stressed dolphins escaping from tuna purse-seine nets. Cephalopod remains in stomachs include species of *Todarodes*, *Lycoteuthis*, *Phasmatopsis*, *Gonatopsis*, *Berryteuthis*; *Martialia*, *Illex*, *Moroteuthis* and *Ocythoe*, and the gadoid fish *Macruronus* (Alonzo *et al.* 1999; Bannister *et al.* 1996). The following data are drawn mainly from the northern hemisphere, with some Australian information: age at physical maturity is unknown; maximum weight ca 1.5 tonnes (male), ca 1 tonne (female); maximum length 5.96 m (male), 5.06 m (female); maximum age is not known (Stacey *et al.* 1994), but estimated to be about 57 years in males and 62 years in females - these estimates should be viewed with caution, however, as growth layers in this species have yet to be calibrated (Baird 2002). Length at birth ranges from 1.2 m (Tasmania) -1.8 m; weaning age is ca 18-24 months; age at sexual maturity varies between populations - generally 8-14 years; length at sexual maturity 4-4.5 m (male), ca 3.5 m (Tasmania) and 4.0 m (female); calving interval average 6.9 years (Japan) and increases with age; mating and calving occurs throughout the year, with no seasonal pattern; gestation lasts 15.1-15.6 months (Japan); no calving areas are known for Australian waters (Baker 1990; Purves and Pilleri 1978; Stacey *et al.* 1994; Bannister *et al.* 1996).

False killer whales are highly gregarious, occurring in socially cohesive herds of about 20-50 animals, in which both sexes are equally represented. Large aggregations of ca 100 to 800+ occur, which appear to be temporary associations of several smaller herds, congregating to exploit locally abundant prey. Often seen with other cetaceans, such as bottlenose dolphins, *Tursiops* species. This very fast and athletic species will approach vessels and bow-ride, and is capable of high leaps well clear of the water. A mass stranding in Tasmania in about 1868 included Long-finned Pilot Whales and Killer Whales, but the circumstances are unclear (Nicol 1987). This species is prone to mass stranding, which can result in the death of whole herds, but the impact and significance in terms of population dynamics cannot be assessed without information on population size. Mass strandings on Australian coasts occur relatively frequently, on average one per 2.5 years since 1970, and have involved from ca 20-250 whales, with an average of ca 100. Scars and wounds on some strandings in Victoria indicate attacks by Cookie-cutter Sharks (*Isistius* sp.). False Killer Whales have occasionally been taken incidentally by gill net and tuna purse-seine fisheries and may be vulnerable to predation by Killer Whales (Nicol 1987; Leatherwood and Reeves 1983).

Threat Summary: past threats include: incidental captures in Taiwanese pelagic gill-net fisheries in Australian territorial Waters off northern Australia; some *Pseudorca* captured for oceanaria in southern Queensland. Current threats include culling to protect finfish fishery off western Japan; also incidentally captured in tuna purse-seine and other net and

long-line fisheries elsewhere in Pacific Ocean; possible entanglement in drift-nets lost or discarded in international waters. Potential threats: competition from expanding commercial fisheries; pollution leading to accumulation of toxic substances in body tissues (Bannister *et al.* 1996).

16 Killer Whale (*Orcinus orca)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Orcinus orca*, in relation to threats or potential threats it faces, is generally limited. The Action Plan assigned the category NCA(c) largely on the basis of the population estimate of 70,000 for the Antarctic. However, it is likely that the species is less abundant in waters around Australia. The numerous sightings around Australia may represent few animals moving over considerable distances rather than many animals. It is recommended that its status is re-classified as NCA(b).

Conservation objectives. Determine distribution and abundance in Australian waters to assess possible impact of threats, particularly the effects of direct and indirect fishing activities; determine levels of toxic contaminants to assess possible threat from pollution; obtain information on diet to determine trophic level and assess possible impact of fishing industry on food resources; assess possible detrimental effects on populations(s), for example, from fishing activities, possible future whaling and toxic contaminants.

Family Delphinidae. Killer Whale, *Orcinus orca* Linnaeus, 1758 [46]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
The Action Plan for Australian Cetaceans status: No category assigned, but probably secure (NCA(c))
IUCN status: Insufficiently known/ Data Deficient.
CITES Status: Appendix II
Bonn Convention: migratory species;
Orcinus orca: Census of Australian Vertebrate Species 1600, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and the Southern Ocean Sanctuary.

Taxonomic status. The Killer Whale was described as *Delphinus orca* by Linnaeus in 1758. This species has a large number of synonyms (22), primarily the result of individual and geographic variation in colour pattern and size. There are no widely accepted subspecies. Two synonyms are based on Australasian specimens: *Orca tasmanica,* described by J. Gray in 1871; and *Grampus orca*, described by Iredale and Troughton (1933) (Bannister *et al.* 1996).

Distribution. This species is cosmopolitan, from polar regions to the equator in all oceans. Recorded from all States, with concentrations reported around Tasmania; sightings are frequent in South Australia and Victoria (Ling 1991). Recorded from the Northern Territory on a sighting at Yirrkala in April 1999 (Chatto and Warneke 2000). Frequently seen in the Antarctic south of 60°. Recorded from Heard and Macquarie Is (Kasamatsu *et al.* 1988; Parker 1978). No population estimates are available for continental Australian waters; in the Antarctic south of 60°S, a preliminary population estimate of at least 70 000 animals. A key locality is Macquarie I., where concentrations have been reported and these whales are sighted regularly; more than 324 sightings were recorded there between 1994 and 1999 (Morrice and Van den Hoff 1999). Photo-identification, one confirmed re-sighting and other evidence suggests that these whales return to the island each southern

summer.. Preferred habitat includes oceanic, pelagic and neritic regions, in warm and cold waters. May be more common in cold, deep waters. Off Australia, often seen along the continental slope and on the shelf, particularly near seal colonies. Not known to be migratory but seasonal movements may be made, possibly related to food supply. Transient whales off British Columbia have very large home ranges when compared with resident whales. No information is available for Australian killer whales.

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e46
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e46
Distribution showing presence in the oceanic, slope and shelf regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), from the equator to the Antarctic. The distribution is broadly based on the Species Profile and Threats database account.

Biology. Killer Whales are top-level carnivores. Diet differs seasonally and regionally. In the northeastern Pacific, two groups of Killer Whales exist: resident whales that eat mostly fish; and transient whales, which feed on birds and mammals. The specific diet of Australian Killer Whales is not known but there are reports of attacking dolphins, young Humpbacks, Blue Whales, Sperm Whales, Dugongs and Australian Sea Lions - see also the symbiotic relationship with humans, below. A confirmed report from South Australia described about 13 Killer Whales attacking a pod of Sperm Whales grouped in the protective 'daisy' formation (Bannister *et al.* 1996). Pitman *et al.* (2001) described a similar, successful attack by some 35 Killer Whales on nine Sperm Whales, and their similar protective behaviour, and suggested that such predation may have been an important factor in the development of sperm whale ecology. Smaller prey are also important. A well-documented case records Killer Whales herding Bottlenose and Common Dolphins. In a large sample (362) of Killer Whale stomachs from Antarctica, 60% contained fish, 31% Minke Whale, 9% pinnipeds and 9% squid. As a long-lived, top predator, Killer Whales are potentially threatened by their great susceptibility to accumulating high levels of heavy metals and organochlorines. Killer Whales often hunt in packs, especially when attacking schools of fish and large whales. Age and length at physical maturity are unknown. Adults attain weights of exceeding 4000 kg (male) and >3100 kg (female), and lengths of 9.8 m and 8.5-9.2 m, respectively. Maximum age is estimated at ca 40 years (Heyning and Dahlheim 1988). Although groups of up to several hundred have been observed, group size is usually less than 30, and several studies outside Australian waters have reported mean pod sizes less than 10. Off southern Australia, group size is up to 52, with most sightings less than 10. Long-term studies in the northwestern Pacific have shown that pod composition appears to remain consistent with time - about 20% adult males, 40-50% adult females and 30-40% immatures and juveniles. A social hierarchy exists within the pod. Reported cases of Killer Whales forming a symbiotic relationship with whalers at Eden, New South Wales, whereby Killer Whales received the tongue of Humpback and other whales caught by humans in return for help in procuring the whales. Killer Whales exhibit usual cetacean behaviour patterns of breaching, spy-hopping, lob-tailing and flipper-slapping. Communication is visual, tactile and acoustic. There are no known predators except humans. Natural mortality rate is about 5% per year. The most common disease reported from wild animals is jaw infection as a result of tooth wears and opening up of the tooth pulp cavity; atherosclerosis has been reported. Strandings are uncommon in Australia; they include one mass stranding (nine animals) in Tasmania (Bannister *et al.* 1996). Reproductive information is based on non-Australian data. At birth, Killer Whales weigh ca 180 kg and are about 2.3-2.5 m long; age and length at weaning is 12-15 months

and 4.3 m; males reach sexual maturity at 16 years and 5.2-6.2 m in length; females are sexually mature at ca 10 years old and 4.6-5.4 m in length; calves are born at 3-8 year intervals; mating occurs all year round; gestation lasts 12-17 months and the calving season spans several months. No calving areas are known in Australian waters.

Threats Summary: Levels of pollutants can be high but their effects are unknown (Kemper *et al.* 1994). Neonate stranded in Victoria had moderate levels (28.4 ppm) of total DDT. Hunted in the Antarctic by the USSR whose catches between 1969 and 1980 numbered up to about 1000 per season. Seen as a competitor to fishing and sealing industries and may have been killed by fishers for that reason. Current illegal killing of concern in some areas (e.g. Tasmania) - reliable reports of fishers shooting Killer Whales when they plunder fish catches. Incidental deaths have not been reported in Australian waters. Other threats include reduction of food resources by overfishing of prey species; entanglement in drift nets set outside the Australian Economic Exclusion Zone and in lost or discarded netting. (Bannister *et al.* 1996).

17 Long-finned Pilot Whale (*Globicephala melas)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Globicephala melas*, in relation to threats or potential threats it faces, is generally limited. However, the species' wide distribution and abundance suggest that it may be less threatened than those classified as NCA(a) and it is recommended that its status remain classified as NCA(b).

Conservation objectives. Establish basic biological parameters; investigate seasonal variation in distribution in relation to reproductive parameters; assess degree of biological threat posed by pollutants; undertake field surveys to improve definition of range in relation to oceanographic parameters and season; establish indices of abundance.

Family Delphinidae. Long-finned Pilot Whale, *Globicephala melas*, Traill 1809 [59282]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation status: *The Action Plan for Australian Cetaceans* status: no category assigned, but possibly secure (NCA(b)).
IUCN status: Insufficiently known/Data Deficient.
CITES Status: Appendix II
Globicephala melas: Census of Australian Vertebrate Species 1606, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and the Southern Ocean Sanctuary.

Taxonomic status. Described by Traill in 1809 as *Delphinus melas*. The specific name *melaena* was used in combination with *Globicephala* until recently, when *melas* was reinstated. The southern hemisphere form is recognised as a subspecies, *G. m. edwardi* (Klinowska 1991; Bannister *et al.* 1996).

Distribution. The long-finned Pilot Whale is widespread and apparently common, but no population assessments are available for southern hemisphere populations. It is recorded widely in waters off southern Australia, and at Macquarie and Heard Is, based on sightings and numerous stranding events. The latter, to 1994, include Western Australia (9 events), South Australia (16), Victoria (26), Tasmania (54, including five on the east coast of Flinders Is.), New South Wales (4, including one at Lord Howe Is.), Queensland (1) (McManus *et al.* 1984; Nicol 1987). Occurs in northern and southern hemispheres. It is circumglobal in southern oceans, and anti-tropical in colder waters, north to ca 27°S (with colder inshore currents?). Found near all the major landmasses and in oceanic waters. The southernmost sighting is at 67°41'S (Leatherwood and Reeves 1983; Baker 1990; Sylvestre 1993; Bannister *et al.* 1996). This species inhabits temperate (ca 10-20°C) and subantarctic (ca 1-8°C) deep oceanic waters and zones of higher productivity along the continental slope, apparently venturing into the shallower waters of the shelf (<200 m) in pursuit of favoured prey species. No key localities known in Australian waters (Baker 1990; Bannister *et al.* 1996). *Globicephala melas* is migratory, apparently in relation to seasonal abundance of favoured prey species, particularly cephalopods. Strandings in all states, and at Lord Howe I., but not in the Northern Territory; pattern of events suggests movements

occur to and perhaps along edge of continental shelf off southern Australia, but data are inconclusive.

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e59282
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e59282
Distribution showing presence in the oceanic and slope region (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), south of 27ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. Geographical associations between these whales and squid have been reported widely. Stomach contents confirm that squid are the main prey, although some fish are also taken; for example, whales stranded in Tasmania had eaten both, but cephalopods were clearly preferred, with larger species and individuals selected. These included: *Sepioteuthis australis*, a common neritic species in southern Australia; *Nototodarus gouldi*, predominantly oceanic, but moves into shallower waters in the Tasmanian region; *Sepia apama*, occurs on upper continental slope and shelf; and *Enoploteuthis galaxias*, a small species rare on the continental shelf (Gales *et al.* 1992). *Enoploteuthis galaxias* is also found in Pilot Whale stomachs in Western Australia (Bannister *et al.* 1996). This overview is based mainly on northeastern Atlantic data, but includes some Australian observations. Physical maturity is reached at 25-30 years. The maximum weight is ca 3.0 tonnes in males and ca 1.8 tonnes in females. Maximum age is 46 years (male), and 59 years (female). Maximum length is 7.20 m in males (Tasmania) and 6.00 m in females (Tasmania) (Donovan *et al.* 1993; Bannister *et al.* 1996). These whales are highly gregarious, usually travelling in small, socially cohesive groups ca 10-50, but also encountered in large herds of several hundred and occasionally of 1000+. Most animals remain within natal pod centred on reproductive females; matings occur between pods; no evidence of male dominance or competition, but scars suggestive of intraspecific aggression have been reported. Groups tend to bunch up when travelling and spread out when feeding. Satellite tracked individual (with conspecifics) in North Pacific averaged 80 km/day at average 3.3 km/hr; greatest distance in one day 234 km, greatest speed 16+ km/hr for periods > 3 hr; average 2020 dives/day, average duration 40 sec. Fast active predator; possibly cooperates in herding schools of prey. Capable of deep dives (1000+m), but generally feeds at much shallower depths during dives of 5-10 minutes. Entire herds may rest motionless at the surface; social activities include spy-hopping, tail-slapping; young animals may occasionally breach. Seen in association with Common Dolphins, Bottlenose Dolphins, Southern Right Whale Dolphins (Tasmania) and Sperm Whales (Tasmania), the latter at sea mounts where Orange Roughy (*Hoplostethus atlanticus*) are present. A mass stranding in Tasmania ca 1868 included False Killer Whales and Killer Whales, but the circumstances are unclear (Nicol 1987; Bannister *et al.* 1996). Possible wide variation in mortality rates; more females survive to adulthood (Donovan *et al.* 1993). Prone to mass stranding; number involved and consequent mortality exacerbated by close relatedness within pods and social cohesion. Frequency of mass strandings may be a significant aspect of natural mortality, but is uncertain without information on population size. Mass strandings on Australian coasts have occurred on average once per year since 1970, involving from five to ca 300 individuals, average ca 100. All but three events occurred from September to March; 60% occurred from December to March. Large numbers (1140-4200) of nematode *Stenurus globicephalae* in ear canals, gutteral pouches and auditory sinuses of four large (socially significant?) males from one mass stranding in Tasmania. Known pathogens include *Vibrio alginolyticus* from the anus, blowhole and skin (Bannister

et al. 1996). Length at birth is 1.78 m, at weights of 74 -79 kg (north-eastern Atlantic); 1.38-1.86 m at weights of 55-70 kg (all single dead strandings in Victoria). Weaning occurs at ca 23-27 months, with evidence of prolonged suckling to 7 years (male) and 12 years (female). Various estimates for age and length at sexual maturity: average 17 years and ca 4.0-5.0 m (male), and 5-15 years and ca 3.0-4.0 m (female); calving interval is 3-4 years, increasing with age, with an average interval of 5.1 years; mating occurs in spring and summer (Tasmania). Calves are born throughout the year, but >85% births are from September to March (Tasmania). Gestation lasts 12 months. No calving areas known for Australian waters (Donovan *et al.* 1993; Bannister *et al.* 1996).

Threats Summary. Past threats include: minor incidental takes by pelagic whalers last century; possibly some large catches in Tasmanian waters in the 1800s, otherwise southern hemisphere populations were not significantly exploited commercially. Current and potential threats include possible entanglement in drift nets and other nets set, lost or discarded in international waters; competition from expanding commercial fisheries, especially in mid- to higher latitudes; pollution leading to accumulation of toxic substances in body tissues. Levels of heavy metals in the liver/kidney of a 4.85 m male were Cd 13/12, Cu 5.6/3.0, Zn 31/22 ppm; levels of organochlorines in the blubber of six large individuals 0.4-0.9 ppm, but 1.3 (DDT) and 2.8 ppm (DDE) in the blubber of a 2.6 m juvenile female (Tasmania) (Bannister *et al.* 1996).

18 Short-finned Pilot Whale (*Globicephala macrorhynchus)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Globicephala macrorhynchus*, in relation to threats or potential threats it faces, is generally limited. However, the species' wide distribution and abundance suggest that it may be less threatened than those classified as NCA(a) and it is recommended that its status remain classified as NCA(b).

Conservation objectives. Establish basic biological parameters; investigate seasonal variation in distribution in relation to reproductive parameters; assess degree of biological threat posed by pollutants; undertake field surveys to improve definition of range in relation to oceanographic parameters and season; establish indices of abundance.

Family Delphinidae; Short-finned Pilot Whale, *Globicephala macrorhynchus* Gray, 1846 [62]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation status: *The Action Plan for Australian Cetaceans* status: no category assigned, but possibly secure (NCA(b)).
IUCN status: Insufficiently known/Data Deficient.
CITES Status: Appendix II
Globicephala macrorhynchus: Census of Australian Vertebrate Species 1605, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and the Southern Ocean Sanctuary.

Taxonomic status. Described by Gray in 1846 as *Globicephala macrorhynchus*. Some evidence of genetically distinct populations, off Japan and in the eastern Pacific, but not yet defined and no subgroups formally recognised (Rice 1998; Bannister *et al.* 1996). Specimens of *G. macrorhynchus* have been confused with *G. melas*, the Long-finned Pilot Whale (Bannister *et al.* 1996).

Distribution. Widespread and apparently common (Baker 1990; Leatherwood and Reeves 1983). No information on numbers or trends in southern hemisphere populations. Circumglobal, equatorial to ca 41°S and ca 45°N. Evidence of genetically distinct populations in northern and eastern Pacific Ocean. Distribution in Australian region includes oceanic waters and continental seas. Relatively few stranding events in Australia to 1994. Strandings in Australia in the Northern Territory and all states: Victoria (1); Western Australia (2), South Australia (8), Tasmania (1), New South Wales (3), Queensland (3), Northern Territory (2, other records to be confirmed; Chatto 2000; Chatto and Warneke 2000). Possibly reflects some observer bias and previous confusion with *G. melas* in more southerly parts of range, but equally, records on southern coasts may reflect influence of warm, south-flowing Indian and Pacific Ocean currents (Bannister *et al.* 1996). In the Australian region, Short-finned Pilot Whales occur in tropical (ca 22-32°C) to temperate (ca 10-22°C) oceanic waters, approaching coastal seas. No key localities are known in Australia (Bannister *et al.* 1996). Outside Australia, seasonal inshore -offshore

movements occur of known groups, apparently in response to abundance and spawning of prey; likely but not apparent from meagre data for Australia (Bannister *et al.* 1996).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e62
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e62
Description: Distribution showing presence in the oceanic and slope region (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), north of 41S, with the east and west arms of the distribution joined across the northern coast of Tasmania. The distribution is broadly based on the Species Profile and Threats database account.

Biology. Short-finned Pilot Whales feed mainly on squid, cuttlefish, octopus and some fish. Stomach contents have included cephalopods such as *Loligo reynaudi* and *Lycoteuthis diadema* (southern Africa; Ross 1984), *Loligo opalescens* off California, and *Todarodes pacificus*, *Eucleoteuthis luminosa*, *Ommastrephes bartrami* and the giant octopus *Octopus dofleini* off Japan. Associations have been seen with appearance of the squid *Illex illecebrosus coindeti* off western Africa and with feeding tuna off Puerto Rico. Reported to herd and possibly attack *Stenella* dolphins and Common Dolphins escaping tuna purse-seine nets in the eastern tropical Pacific. Biological data presented here are based on the southern Japanese form (Kasuya and Marsh 1984; Donovan *et al.* 1993). Age and length at physical maturity is ca 17 years and more than 5 m in length; maximum weight is ca 2 tonne (male), and ca 1.5 tonne (female); maximum age is 46 years (male) and 63 years (female); maximum length is 5.89 m (male) and 4.8 m (female). This species is socially cohesive, forming small groups of ca 10-30, but commonly in herds of several hundred; often accompanied by dolphins, especially Bottlenose Dolphins. Male Pilot Whales and dolphins tend to remain at the perimeter of the herd; subadult males protect crèches of young. The mating system is polygynous; males migrate between schools after weaning. Breeding schools are matrilinear kinship groups. Large males can be aggressive towards human swimmers. Capable of diving to at least 600 m. Males at periphery of groups are possibly more prone to attacks by Killer Whales (Bannister *et al.* 1996). Overview of reproductive data based on the southern Japanese form (Kasuya and Marsh 1984; Donovan *et al.* 1993): birth, weight and length, ca 55 kg and ca 1.4 m; age at weaning ca 2+ years; age and length at sexual maturity in males is 14.6 years and 4.0-5.0 m in length (larger males mature earlier), and 9 years and 2.9-3.6 m in length for females; the calving interval is ca 5 years. Females continue breeding until ca 17-34 years old (average 24 years) and produce an average of 4-5 calves. Mating occurs all year round. Gestation lasts 14.9 months. Calving is diffusely seasonal, with a peak in July-August; no calving areas known for Australian waters (Bannister *et al.* 1996).

Threat Summary: past threats include localised fisheries in Caribbean, off Japan, Indonesia and Sri Lanka, but not in Australian waters; current threats include entanglement in drift-nets and other nets set, lost or discarded in international waters; potential threats include: competition from expanding commercial fisheries; pollution leading to accumulation of toxic substances in body tissues (Bannister *et al.* 1996).

19 Shepherd's Beaked Whale (*Tasmacetus shepherdi)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Tasmacetus shepherdi*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as NCA(a).

Conservation objectives. In the event of strandings or incidental captures: contribute to existing data on biological parameters, including species-specific external characteristics; assess degree of biological threat posed by pollutants.

Family Ziphiidae; Shepherds' Beaked Whale, *Tasmacetus shepherdi* Oliver, 1937 (also Tasman Beaked Whale)[55]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation Status: *The Action Plan for Australian Cetaceans* status – no category assigned, because of insufficient information (NCA(a))
IUCN status: Insufficiently known/ Data Deficient
CITES Status: Appendix II
Tasmacetus shepherdi: Census of Australian Vertebrate Species 1598.Updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. A well-defined taxon described by Oliver in 1937. No subspecies are recognised (Bannister *et al.* 1996; Rice 1998).

Distribution. Possibly circumpolar in mid-latitudes of the Southern Hemisphere from 33°to 50°S. Known from only 19 stranded specimens and two unconfirmed sightings, mostly from New Zealand(12),elsewhere from Australia(3, South Australia, Western Australia), Tristan da Cunha(2), Argentina(3)and Chile(1)(Goodall 1978; Mead 1989; Baker 1990;Bannister *et al.* 1996). This species apparently prefers subantarctic (ca 1-8°C) and adjacent temperate(ca 10-20°C) deep oceanic waters. Possible northward movement in summer, approaching continental seas. No key localities are known in Australian waters (Leatherwood and Reeves 1983; Mead 1989b; Bannister *et al.*1996). No information is available on movements by this species (Bannister *et al.*1996).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e55
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e55
Distribution showing presence in the oceanic and slope regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), between 33ºS and 50ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. The diet of this species is poorly known. Rows of sturdy functional teeth in both jaws suggest that *Tasmacetus shepherdi* is more piscivorous than other ziphiids (beaked whales). The bulk of the stomach contents of one Argentinean specimen consisted of

otoliths of an unidentified brotulid fish, an un-identified serranid and *Merluccius hubbsi.* Other remains, of a small crab, *Peltarion spinulosum* (which occurs in near-shore waters to 77 fathoms), and one small squid beak were possibly the prey of ingested fish (Bannister *et al.* 1996). The biological overview is mainly New Zealand data; maximum weight is ca 2-2.5 tonnes, and maximum length is 7.10 m (male) and 6.60 m (female). There are two unconfirmed near-shore sightings, of a lone individual in New Zealand and a group of three in WA. These animals showed their beak when breathing; the blow is inconspicuous. A powerful and active predator, presumed to be able to dive deeply in pursuit of prey. The precise function of the pair of the V-shaped throat grooves (a feature of ziphiids) is unknown, but their arrangement suggests a capacity for distension that may facilitate passage of large whole prey down the oesophagus past the aryteno-epiglottideal tube. One New Zealand specimen (the holotype) showed evidence of severe osteomyelitis of the lumbar vertebrae. No other gross indications of pathology or parasites reported from other specimens. No data have been recorded for any breeding parameter, including birth, weaning or breeding periods (Bannister *et al.* 1996).

Threat Summary: no past threats are known. Current threats include: possible entanglement in drift nets and other nets set, lost or discarded in international waters. Potential threats are: competition from expanding commercial fisheries in higher latitudes and pollution leading to accumulation of toxic substances in body tissues.

20 Arnoux's Beaked Whale (*Berardius arnuxii)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Berardius arnuxii*, in relation to threats or potential threats it faces, is generally limited. However, the species' wide distribution and abundance suggest that it may be less threatened than those classified as NCA(a) and it is recommended that its status remain classified as NCA(b).

Conservation objectives. As presented in *The Action Plan for Australian Cetaceans*: to establish basic biological parameters and seasonal variation in distribution in relation to reproductive parameters; to assess the threat posed by pollutants; to define more closely the range in relation to oceanographic parameters; and to estimate abundance.

Family Ziphiidae. Arnoux's Beaked Whale, *Berardius arnuxii* Duvernoy 1851

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation status: *The Action Plan for Australian Cetaceans* status; no category assigned (NCA(b));
IUCN status: Insufficiently known/Data Deficient;
CITES Status: Appendix I.
Berardius arnuxii: Census of Australian Vertebrate Species 1597, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and the Southern Ocean Sanctuary.

Taxonomic status. The relationship between *Berardius arnuxii* and the North Pacific *B. bairdii* has been uncertain for many years. In part, their taxonomic status reflected the relatively few specimens available for comparison, and the slight morphological differences between them, whereby the most distinctive difference between the two species is the greater length of *B. bairdii*, which grows to 11.5 m in length, versus 9.4 m in *B. arnuxii* (Rice 1998). Genetic comparisons, however, indicate clearly that they are distinct and well-defined species, and that they have been separated for several million years (Dalebout 2002).

Distribution. This species occurs circumglobally from about latitude 34°S southwards to the Antarctic ice. Uncommon over the continental shelf, it is seen widely within temperate (ca 10-20°C), subantarctic (ca 1-8°C) and Antarctic (ca 0-5°C) deep oceanic waters, particularly close to regions carrying higher prey densities, such as sea mounts and submarine escarpments (Balcomb 1989; Brownell 1974; Leatherwood and Reeves 1983), where these whales are presumed to feed at depth. Small schools have been observed occasionally along the ice edge in summer south of the Indian Ocean. Four strandings only are known for Australia (SW Western Australia, South Australia, Tasmania and New South Wales). Their occurrence in summer months may indicate a seasonal movement onshore at this time. Strandings occur far more frequently in New Zealand (49 records), suggesting that that region provides preferred habitat (Baker 1990; Brownell 1974). Possible sightings inshore off South Australia and the South coast of New South Wales have been recorded. Most sightings are in the Tasman Sea and around the East Pacific Rise, which forms part of

the Albatross Cordillera in the South Pacific Ocean. No key localities are known in Australian waters, and information is lacking on population size, sub-populations or trends in numbers (Bannister *et al.* 1996).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/
Description: Indicative distribution showing presence in the oceanic region (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), south of 34°S. The distribution is broadly based on the Species Profile and Threats database account (SPRAT).

Biology. The biology of this species is poorly known. Haast (1870) recorded cephalopods in the diet (Haast 1970), which is likely to be similar to that of *B. bairdii*, and thus include pelagic, mid- and deep-water fishes. Arnoux's Beaked Whales dive deeply for around 15-30 minutes, possibly to depths of 1000 m. or more, and may resurface at a considerable distance from the start of the dive. Age at physical maturity is about ca 20 years, at ca 9 m in length, and their lifespan is probably about 50 years. Sexual maturity is reached at about 8-10 years of age, when males and females are ca 9.0 m and 8.5 m long, respectively; maximum length is about 9.4 m in both sexes. The gestation period is probably similar to that in *B. bairdii*, lasting 17 months, and length at birth is about 4.0 m. These gregarious whales form small groups of up to 16 animals (Paterson and Parker 1994); occasional schools of up to 50 animals off New South Wales have been observed, and one group of about 80 was observed to split up into subgroups of 8-15, which dispersed. They are very shy of vessels. Breaching has been seen observed on several occasions. Two pairs of teeth erupt at the tip of the lower jaw in adults of both sexes, and appear to be used as weapons in agonistic encounters, with resultant heavy scarring in older animals. They are presumed to be subject to attacks by Killer Whales (which are estimated to cause 40% of scarring on *B. bairdii*). Occasionally these whales become trapped in pools formed in sea ice adjacent to the Antarctic continent (Bannister *et al.* 1996).

No threats are known, other than possible entanglement in drift nets and other nets set, lost or discarded in international waters. Potential competition from expanding commercial fisheries, such as those for Orange Roughy and Patagonian Toothfish, as well as cephalopod fisheries, may be of particular importance to this species; accumulation of pollutants in body tissues is possible, although levels are likely to be low (Bannister *et al.* 1996).

21 Longman's Beaked Whale (*Indopacetus pacificus)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Indopacetus pacificus*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as NCA(a).

Conservation objectives. As presented in *The Action Plan for Australian Cetaceans*: to maximise the possibility of obtaining an intact specimen; subsequently, establish species-specific external characteristics; to maximise the collection of biological data; to assess the degree of biological threat posed by pollutants; and to maximise opportunities for cetacean surveys in tropical waters, in relation to range and seasonal variation in distribution; and to estimate abundance. In part, several of these objectives have been achieved in the past 2-3 years, as indicated in the following sections.

Family Ziphiidae. Longman's Beaked Whale, *Indopacetus pacificus* Longman 1926.

EPBC Act Status: Cetacean; approved recovery plan: none.
Conservation status: *The Action Plan for Australian Cetaceans*: no category assigned, because of insufficient information (NCA(a));
IUCN status: Insufficiently known; / Data Deficient

CITES Status: Appendix I.
Indopacetus pacificus: Census of Australian Vertebrate Species 1592, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. Described by Longman in 1926. The taxonomic status of this genus was clarified considerably by the work of Moore (1968) on the two specimens known at that time. The identification of new specimens of this species in the past two years, using genetic techniques, has assisted this process considerably. Attempts to resolve the validity of this genus, based on phylogenetic analyses of short mtDNA fragments available from the specimens known to date, were unsuccessful (Dalebout *et al*. in press, 2002). However, the diagnostic osteological features highlighted by Moore (1968) for *Indopacetus* were also observed in the new specimens. Rib counts and the number of fused cervical vertebrae may also be diagnostic, and rostrum depth at mid-length and melon shape further distinguish this species from beaked whales in the genus *Mesoplodon*. There appear no morphological grounds on which to overturn or reject the use of the genus *Indopacetus*. Further, comparison of the colour pattern of these new specimens with that of tropical bottlenose whales sighted in the tropical Indian and Pacific Oceans provide strong evidence that these unidentified whales represent *I. pacificus*.

Distribution. Until recently, this species was known from two stranding records (Mackay, Queensland, in 1882 and Danane, Somalia in 1955) (Longman 1926; Azzaroli 1972). Additional specimens have been identified from South Africa (2), Kenya (1) and the Maldives (1). The distribution of 'Tropical Bottlenose Whales' extends from tropical

northeastern Africa through Malaysia and Indonesia across the Pacific Ocean to the west coast of northern South America and Baja California, and is clearly linked to the warmer regions of the Pacific and Indian Oceans (Pitman *et al.* 1999). It is likely that the presence of the two *I. pacificus* stranded in Natal reflects the warmth and direction of the southward flowing Agulhas Current in that region. No key localities are known for this species in Australian waters (Bannister *et al.* 1996).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/e72
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e72
Description: Indicative Distribution showing presence in the oceanic region (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), north of 25ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. These whales are oceanic, restricted primarily to tropical deep oceanic waters of the Indian and W. Pacific oceans (Leatherwood and Reeves 1983; Bannister *et al.* 1996), in water temperatures of ca 21-31°C; 74% of sightings were made in water temperatures warmer than 26ºC. Sighting rates of this species on research cruises, however, are low (Pitman *et al.* 1999), suggesting that this species may not be common. Maximum length of adults, estimated from skull length, is ca 7.5 m. Though generally recognised as the least known of all living cetaceans, several other rare beaked whales share this status (Leatherwood and Reeves 1983; Baker 1990; Klinowska 1991). By analogy with other beaked whales, presumed to be capable of deep dives in pursuit of prey, such as deep-water squid and/or fish. It is still uncertain as to whether both sexes develop functional, erupted teeth, rather than only males; these may be used as weapons during agonistic encounters. The length at birth is probably about 2.9 m, based on a freshly stranded male bearing well-defined birth creases, and perhaps a few weeks old (Dalebout *et al.* 2000; Ross 1984).

Threats include: possible entanglement in drift-nets and other nets set, lost or discarded in international waters at low latitudes. The potential for the accumulation of toxic substances in body tissues, even in oceanic beaked whales, was underscored by the presence of 1.2 ppm DDE; TDE 0.4 ppm, DDT 2.99 ppm, Dieldrin, 0.07, t-DDT' 1.6 ppm, DDE/t-DDT' ratio 0.75, in the neonate referred to above; these are presumed to be derived from his mother's milk. PCBs were not detected (Cockcroft *et al.* 1996).

22 Andrew's Beaked Whale (*Mesoplodon bowdoini)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Mesoplodon bowdoini*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as NCA(a).

Conservation objectives. As described in *The Action Plan for Australian Cetaceans*: the objectives are to establish basic biological parameters and improve knowledge of species-specific characteristics; establish seasonal variation in distribution in relation to reproductive parameters; assess the degree of biological threat posed by pollutants; improve definition of range more closely in relation to oceanographic parameters; and to estimate abundance.

Family Ziphiidae. Andrew's Beaked Whale, *Mesoplodon bowdoini* Andrews, 1908

EPBC Act Status: Cetacean; Approved Recovery Plan: none. [73]
Conservation Status: *The Action Plan for Australian Cetaceans* status – no category assigned (NCA(a));
IUCN Status: Insufficiently known/ Data Deficient

CITES Status: Appendix I.
Mesoplodon bowdoini: Census of Australian Vertebrate Species 1594, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. No subspecies have been described or recognised. Analysis of nuclear DNA supports the close relationship between *M. bowdoini* and *M. carlhubbsi*; also *M. layardii* is closely related to both of these species (Dalebout 2000).

Distribution. The majority of records are strandings from temperate waters of the South Pacific and Indian Oceans; two strandings recorded from Tristan da Cunha represent the species in the Atlantic Ocean. Population centres may be far from land. A few strandings lie within this range in Chile and the Falkland Is, with most in New Zealand and South Australia. Strands infrequently - only 10 stranding events in New Zealand, including one from Campbell Is, and 10 events in Australia to 1994 (WA (4), SA (3), Vic. (1), NSW (2), plus one at Macquarie I. (Baker 2001). All ten Australian records occur in January to June; only 4 New Zealand records occur in the same period, but 11 animals stranded in July to December, suggesting that if onshore movements occur at certain seasons, they occur at different times in the two regions. There is no information on population size. Baker (2001) has suggested a summer-autumn breeding season in New Zealand.

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e73
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/. e73
Distribution showing presence in the oceanic and slope regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS

version 1), between 10ºC boundary in February and 20ºC boundary in September. The distribution is broadly based on the Species Profile and Threats database account.

Biology. This overview is based primarily from New Zealand data. Very little new information has been published on this species recently. It apparently prefers deep oceanic temperate waters (ca 10-20ºC). No key localities are known in Australian waters, nor is information on habitat available, though these whales are presumed to feed at depth, mid- and deep-water squid and fish (Baker 1990; Bannister *et al.* 1996). However, shipboard surveys of beaked whales (*Mesoplodon* spp. and *Ziphius cavirostris*) from 1991-1998 along the shelf edge and Gulf Stream waters off the northeast United States showed that these species frequent similar shelf-edge habitats (Waring *et al.* 2001). Beaked whales were present mostly along the colder shelf edge, and associated significantly with canyon habitats. It is likely that such habitats are utilised by beaked whales along much of Australia's extensive coastline, particularly along the more southern shores.

Males attain a maximum length of 4.57 m, and females are slightly larger, reaching a maximum of 4.67 m. Maximum weight is about 1 tonne. The length at birth is ca 1.8 m. Age at weaning or physical maturity is unknown, and maximum age is unknown. These active predators are presumed to be strong swimmers, capable of deep dives in pursuit of prey, but the mode of capture is not known. Only adult males have erupted teeth, consisting of a single pair near the middle of the lower jaw; these appear to be used as weapons during agonistic encounters. Prey is probably seized and disabled between the hard edges of the mandibles and the rostral palate. The pair of V-shaped throat grooves typical of this family may enable distension of the throat, when swallowing larger whole prey down the oesophagus past the aryteno-epiglottideal tube (Baker 1990). Breeding areas and habitat are unknown, and presumed to be oceanic, although the possible inshore movement in spring and summer may be associated with breeding. Sexual maturity is reached at ca 4.3 m in females; Baker (2000) reported on a 4.2 m long female with a 600 mm long-term foetus in May, and a second female, 4.38 m long, bearing a 1.55 m long foetus in September. A perinatal juvenile, 2.30 m long, stranded in early June, leading Baker (2001) to suggest that calves are born in late summer to early autumn; mating season, gestation period and calving interval are unknown (Bannister *et al.* 1996).

Potential threats include: entanglement in drift-nets and other nets set, lost or discarded in international waters; competition from expanding commercial fisheries, particularly on pelagic squids in temperate waters; and pollution leading to accumulation of toxic substances in body tissues (Mead 1989; Baker 1990; Bannister *et al.* 1996).

23 Blainville's Beaked Whale (*Mesoplodon densirostris)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Mesoplodon densirostris*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as NCA(a).

Conservation objectives. As presented in *The Action Plan for Australian Cetaceans*: to establish basic biological parameters and improve knowledge of species-specific external characteristics; establish seasonal variation in distribution in relation to reproductive parameters; assess the degree of biological threat posed by pollutants; improve definition of range more closely in relation to oceanographic parameters; and to establish indices of abundance.

Family Ziphiidae. Blainville's Beaked Whale, *Mesoplodon densirostris* de Blainville 1817 [e74]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation status: *The Action Plan for Australian Cetaceans* status – no category assigned (NCA(a));
IUCN Status: Insufficiently known/ Data Deficient
CITES Status: Appendix II.
Mesoplodon densirostris: Census of Australian Vertebrate Species 1594, updated 31 December 1998.

Marine protected areas managed for, or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. Blainville's beaked whale is a well-established species on morphological grounds. No subspecies have been proposed. De Blainville described the species in 1817 as *Delphinus densirostris*. Its specific status was verified in an analysis of nuclear DNA, which also revealed that it is related most closely to *Mesoplodon stegnejeri* (Dalebout 2002), in a grouping that also included *M. grayi*, *M. peruvianus* and *M. perrini*.

Distribution. Blainville's beaked whale is oceanic and circumglobal in low to mid-latitudes in all oceans in both hemispheres (Mead 1989). It is probably the most widely distributed species of *Mesoplodon* , and strands quite frequently in South Africa (ca 40 events in 20 years; Ross 1984; Bannister *et al.* 1996). Fewer stranding events in Australia (to 1994), possibly because of low observer effort along northern coasts: Western Australia (1), Victoria (1), Tasmania (1), New South Wales (1), Queensland (7) and Lord Howe Is. (1). It is recorded from the northern Tasman Sea. Stranding records from northern and southern Australia (at 40-50°S in Tasmania) except in South Australia and Northern Territory, but data insufficient to infer seasonal occurrence or migration. Strandings on west and east coasts may be linked to south-flowing warm currents, i.e. Leeuwin and East Australian currents, respectively (Ross 1984; Klinowska 1991; Bannister *et al.* 1996). No information is available on population size, security or trends (Klinowska 1991).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e74

UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e74
Distribution showing presence in the oceanic and slope regions(based on AGSO 1996 depth/slope bathymetric classification)of the Australian marine area (based on AMBIS version 1), from the equator south to the winter boundary of the 10ºC isotherm, and in waters >700m deep. The distribution is broadly based on the Species Profile and Threats database account.

Biology. This biological overview is based largely on South African data (Ross 1984). This species prefers tropical (ca 22-32°C) to temperate (ca 10-20°C) oceanic regions. It is sighted in waters 700-1000 m deep, adjacent to much deeper waters of 5000 m. No key localities known in Australian waters (Leatherwood and Reeves 1983; Bannister *et al.* 1996). No information is available on movements of this species (Bannister *et al.* 1996). However, shipboard surveys of beaked whales (*Mesoplodon* spp. and *Ziphius cavirostris*) from 1991-1998 along the shelf edge and Gulf Stream waters off the northeast United States showed that these species frequent similar shelf-edge habitats (Waring *et al.* 2001). Beaked whales were present mostly along the colder shelf edge, and associated significantly with canyon habitats. It is likely that such habitats are utilised by beaked whales along much of Australia's extensive coastline, particularly along the more southern shores. The diet is poorly known and appears to comprise mid- and deep-water squid and fish. The stomach of one South African specimen contained 21 fish otoliths, mostly lanternfishes *Lampanyctus* species, plus a few *Scopelogadus* and *Cepola*(?); another stomach contained single beaks of the squids *Todarodes sagittatus* and *Octopoteuthis* sp. (Ross 1984; Bannister *et al.* 1996). This species is presumed to actively pursue prey, but the mode of capture is not known; it is apparently capable of deep dives. Only adult males have functional teeth, consisting of a single pair of swollen, tusk-like teeth which erupt from a raised pulpit near the middle of the lower jaw; these appear to be used as weapons during agonistic encounters, leading to heavy scarring of older males; scarring of females suggests vigorous intersexual behaviour, possibly active herding by males during breeding period. The rostrum becomes ultra dense in adult males, through secondary ossification. Macleod (2002) suggested its high density and strength prevents damage to the rostrum during aggressive male-male interactions, provides ballast to aid deep diving, and plays a role in sound transmission.

The teeth may support Rabbit-eared Barnacles, *Conchoderma auritum*. Lacking functional gripping teeth, prey may be seized and disabled using the hard edges of the mandibles and the rostral palate. The precise function of the pair of V-shaped throat grooves, characteristic of beaked whales, is unknown, but their arrangement may permit distension of the throat and thus facilitate the swallowing of larger whole prey down the oesophagus past the aryteno-epiglottideal tube (Bannister *et al.* 1996).

Males attain lengths of up to 5.8 m, possibly 6.4 m long, and females grow to lengths of 4.7 m. Maximum weight is about 1 tonne. Groups of three to seven reported off Hawaii, and four to six off Point Lookout, Queensland. Colin Macleod and other researchers from the Center for Cetacean Research and Conservation have been studying this species in the field since 1991 off the Bahamas (see http://www.whaleresearch.org/main_beaked.htm) with considerable success. The species is generally wary of vessels. Adults are frequently wounded and scarred by feeding cookie-cutter sharks (*Isistius* sp.), especially on the flanks and venter around the anogenital region; possibly vulnerable to predation by Killer Whales and False Killer Whales. Internal parasites include nematodes *Anisakis* sp. and acanthocephalans, *Bolbosoma vasculosum*, in stomach and intestine. Sexually maturity is

reached at about 4.5 m in length in males and females, at about 8-9 years of age. The length at birth exceeds more than 1.9 m and 60 kg (based on the largest known foetus). Length at weaning is estimated at less than 2.4 m. Calves are possibly born in late summer. The gestation period is unknown.

No threats are currently known. Potential threats include incidental captures in fisheries, and possible entanglement in drift nets and other nets lost or discarded in international waters; expanding commercial fisheries, especially on pelagic squid at lower latitudes. Pollution may lead to accumulation of toxic substances in body tissues (Bannister *et al.* 1996). These levels might be expected to be low in such deep-diving whales, and do appear to be so, as indicated by two strandings in South Africa: levels of PCBs, DDE, DDT and Dieldrin were, respectively 1.71, 2.79, 0.43, and 0.014 ppm. in a 3.69 m long female, and 0.45, 1.71, N.D., 0.32 and 0.019 ppm in an adult male 4.65 m long. DDE/t-DDT ratios for these two whales were 4.5 and 2.16, respectively (Cockcroft *et al.* 1991). Nevertheless, their presence is indicative of the pervasive nature of such substances and their rapid dissemination through the food chain.

24 Ginkgo-toothed Beaked Whale (*Mesoplodon ginkgodens*)

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Mesoplodon ginkgodens*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as NCA(a).

Conservation objectives. As presented in *The Action Plan for Australian Cetaceans*: to establish basic biological parameters and improve knowledge of species-specific external characteristics; establish seasonal variation in distribution in relation to reproductive parameters; assess the degree of biological threat posed by pollutants; improve definition of range in relation to oceanographic parameters; and to establish indices of abundance.

Family Ziphiidae. Ginkgo-toothed Beaked Whale, *Mesoplodon ginkgodens* Nishiwakiand Kamiya, 1958 [e59564]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation status: *The Action Plan for Australian Cetaceans* status – no category assigned (NCA (a));
IUCN Status: Insufficiently known / Data Deficient
CITES Status: Appendix II.
Mesoplodon ginkgodens. Census of Australian Vertebrate Species 1038, updated 31 December 1998.

Marine protected areas managed for, or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. No subspecies have been described. Based on analysis of nuclear DNA by Dalebout (2002), *M. ginkgodens* is mostly closely related to *M. europaeus*, and more distantly, to *M. mirus*. This species has been recognised in Australia relatively recently, with four stranding events: three in southern New South Wales (of which, two probably comprise a cow and calf pair) and one in western Victoria – see Tidemann (1980), initially identified as *M. bowdoini*.

Distribution. This species is thought to be more common in the western North Pacific than elsewhere. Known only from tropical and warm temperate waters of the Pacific and Indian oceans on either side of the equator to ca 37°S, including Sri Lanka, Strait of Malacca, Taiwan, Kyushu, Honshu, NSW, Chatham Is., southern. California, Baja California and Galapagos Is. (Baker 1990; Leatherwood and Reeves 1983; Mead 1989; Nishiwaki *et al.* 1972; Rice 1998). Thought to be more common in the western North Pacific than elsewhere. Only recently recognised in Australia by four stranding events, three in southern NSW (two of which may comprise a cow and calf pair; see Tidemann 1980, initially identified as *M. bowdoini*) and one in western Victoria. Increasing observer awareness and activity in northern Western Australia, Northern Territory, Queensland and New South Wales are likely to yield further stranded specimens. No information is available on population size (Bannister *et al.* 1996).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e59564

UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e59564
Distribution showing presence in the oceanic region (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), from the equator south to 37ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. This species apparently prefers temperate (ca 10-20°C) and tropical (ca 22-32°C) deep oceanic waters. No key localities are known in Australian waters, nor is information available on movements in this species. This overview is based on the meagre data from Japanese and Australian records, as described by Bannister *et al.* 1996). Physical maturity occurs at ca 4.5 m in length; the maximum weight is ca 1.5 tonnes; and the maximum length is ca 5.0 m. No data are available on feeding, but the diet of these whales is assumed to be mid- and deep-water squid and fish, much as is recorded for other members of this family (Bannister *et al.* 1996). Sexual maturity is attained at ca 4.5 m; no information is available on length or weight at birth, length at weaning, nor calving interval, mating season, length of gestation or calving areas in Australian waters. However, shipboard surveys of sperm whales and beaked whales (*Mesoplodon* spp. and *Ziphius cavirostris*) from 1991-1998 along the shelf edge and Gulf Stream waters off the northeast United States showed that these species frequent similar shelf-edge habitats (Waring *et al.* 2001). Beaked whales were present mostly along the colder shelf edge, and associated significantly with canyon habitats. It is likely that such habitats are utilised by beaked whales along much of Australia's extensive coastline, particularly along the more southern shores.

Threat summary: there are no previously identified threats. Current threats include occasional incidental take in net fisheries; possible entanglement in drift-nets set, lost or discarded in international waters. Potential threats include competition from expanding commercial fisheries, especially on pelagic squids; pollution leading to accumulation of toxic substances in body tissues (Bannister *et al.* 1996).

25 Gray's Beaked Whale (*Mesoplodon grayi*)

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Mesoplodon grayi*, in relation to threats or potential threats it faces, is generally limited. However, the species' wide distribution and abundance suggest that it may be less threatened than those classified as NCA(a) and it is recommended that its status remain classified as NCA(b).

Conservation objectives. As described in *The Action Plan for Australian Cetaceans*: to establish basic biological parameters and improve knowledge of species-specific external characteristics; to establish seasonal variation in distribution in relation to reproductive parameters; assess degree of biological threat posed by pollutants; improve definition of range in relation to oceanographic parameters and season; establish indices of abundance.

Family Ziphiidae. Gray's beaked Whale, *Mesoplodon grayi* von Haast,1876 [e75].

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation Status: *The Action Plan for Australian Cetaceans* status – no category assigned, but possibly secure (NCA (b));
IUCN Status: Insufficiently Known/ Data Deficient
CITES Status: Appendix I.
Mesoplodon grayi: Census of Australian vertebrate Species 1593, updated 31 December 1998.

Marine protected areas managed for, or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. Described by von Haast in 1876. No subspecies are recognised (Bannister *et al.*1996; Rice 1998).

Distribution. Circumglobal at higher latitudes in the southern hemisphere. Widely recorded from strandings in Argentina, Chile, South Africa, New Zealand and Australia, from southern Western Australia to southern New South Wales and Tasmania, and by sightings in the Indian Ocean (Gambell *et al.* 1975), to latitudes as low as 25°S south of Madagascar. Known from the northern hemisphere only by one stranding in the Netherlands, presumably an anomalous vagrant. No absolute measures of abundance are available.

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e75
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e75
Distribution showing presence in the oceanic and slope regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), south of 25ºS and >1800m depth. The distribution is broadly based on the Species Profile and Threats database account.

Biology. Apparently prefers temperate (ca 10-20°C) to subantarctic (ca 1-8°C) oceanic waters, deeper than 1800 m. No key localities are known in Australian waters (Bannister *et al.* 1996). The majority of strandings occur from December to April, suggesting a seasonal

movement inshore (and possibly to lower latitudes?), perhaps associated with calving and mating. The diet is assumed to consist of mid- and deep-water squid and fish, as found in other members of this family. Physical maturity is reached at ca 4.5 m; maximum weight is about 1.5 tonnes; maximum length ca 5.5 m (Ross 1984). Little known about behaviour. Groups of two to three have been sighted or stranded; larger social aggregations also occur, for example, mass strandings of 25 individuals in 1875 and of eight animals in 1982 at the Chatham Is., New Zealand. When rising to blow, this species pokes its long snout out of the water. Probably fast and active in pursuit of prey, but mode of prey capture is unknown; apparently capable of deep dives. Both sexes bear a row of 17-22 small, slim, conical vestigial teeth towards rear of each upper jaw, shallow-rooted and apparently of little functional use. Only adult males have fully functional teeth, consisting of a single pair near middle of lower jaw, which appear to be used as weapons during agonistic behaviour, resulting in heavy scarring of older animals. Lacking functional gripping teeth, prey may be seized and disabled using the hard edges of the mandibles and the rostral palate. The precise function of the pair of V-shaped throat grooves (a feature of beaked whales) is unknown, but their arrangement suggests a capacity for distension, which may facilitate passage of larger whole prey down the oesophagus past the aryteno-epiglottideal tube (Bannister *et al.* 1996). Mortality rates and pathology are poorly known. The frequency of strandings in New Zealand is high (84 events to mid-1986). In Australia, M. grayi is the second most commonly stranded ziphiid (beaked whale) in Australia (48 events) after M. layardii (67 events), distributed as follows: southern Western Australia (16), South Australia (8), Victoria (3), Tasmania (14), New South Wales (7) (McManus *et al.* 1984; Kemper and Ling 1991; Bannister *et al.* 1996). An additional record of this species was identified in Western Australia, based on a DNA sample collected from a free-swimming whale (Gales, Dalebout and Bannister 2002). Severe osteomyelitis has been noted in aged, stranded specimens, possibly contributing to death (Bannister *et al.* 1996). The overview of reproductive data is based mainly on New Zealand animals, with some Australian material (Bannister *et al.* 1996): Length at birth is ca 2.1 m; age and length at weaning is ca 1 year at a length of about 3.6 m; sexual maturity is reached at ca 4.5 m in length. The calving interval is unknown, but possibly 2-3 years. The mating season is unknown, possibly summer, and the length of gestation is unknown. The calving season is in late spring-early summer. No calving areas are known for Australian waters. However, shipboard surveys of beaked whales (*Mesoplodon* spp. and *Ziphius cavirostris*) from 1991-1998 along the shelf edge and Gulf Stream waters off the northeast United States showed that these species frequent shelf-edge habitats (Waring *et al.* 2001). Beaked whales were present mostly along the colder shelf edge, and associated significantly with canyon habitats. It is likely that such habitats are utilised by beaked whales along much of Australia's extensive coastline, particularly along the more southern shores.

Threat summary: current and potential threats include possible entanglement in drift-nets and other nets set, lost or discarded in international waters; competition from expanding commercial fisheries, especially on pelagic squids; and pollution leading to accumulation of toxic substances in body tissues (Bannister *et al.* 1996).

26 Hector's Beaked Whale (*Mesoplodon hectori)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Mesoplodon hectori*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as NCA(a).

Conservation objectives. As described in *The Action Plan for Australian Cetaceans*: to establish basic biological parameters and improve knowledge of species-specific external characteristics; to establish seasonal variation in distribution in relation to reproductive parameters; assess degree of biological threat posed by pollutants; improve definition of range in relation to oceanographic parameters and season; establish indices of abundance.

Family Ziphiidae. Hector's Beaked Whale, *Mesoplodon hectori* Gray, 1871. [e76]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation status: *The Action Plan for Australian Cetaceans* status – no category assigned, because of insufficient information (NCA (a));
IUCN Status: Insufficiently known/ Data Deficient
CITES Status: Appendix II.
Mesoplodon hectori: Census of Australian Vertebrate Species 1595, updated 31 December 1998.

Marine protected areas managed for, or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. Described by John Gray in 1871, as *Berardius hectori*. No subspecies have been recognised (Bannister *et al.*1996; Rice 1998). Specimens from southern California, hitherto classified as *M. hectori*, have been described recently as a new species, *M. perrini* (Dalebout *et al.* 2002). Based on analysis of nuclear DNA, *M. hectori* appear to be most closely related to *M. grayi*, and more distantly, to *M. densirostris*, *M. stegnejeri*, *M. peruvianus* and *M. perrini*.

Distribution. Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e76
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e76
Distribution showing presence in the oceanic and slope regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), between 35ºS and 55ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. This species is recorded circumglobally in mid-latitudes of the Southern Hemisphere, between about 35°S to 55°S. Known from strandings in Argentina, Chile, the Falkland Is., South Africa, New Zealand and in Australia from South Australia (1) and Tasmania (2). An additional record was identified in Western Australia, based on a DNA sample collected from a free-swimming whale (Gales, Dalebout and Bannister 2002). Apparently prefers subantarctic (ca 1-8°C) and temperate (ca 10-20°C) deep oceanic waters, rarely venturing into continental seas – though see Gales *et al.* 2002). No key localities known in Australian waters; nor is any information is available on movements or

habitat in this species (Bannister *et al.* 1996). However, shipboard surveys of sperm whales (*Physeter macrocephalus*) and beaked whales (*Mesoplodon* spp. and *Ziphius cavirostris*) from 1991-1998 along the shelf edge and Gulf Stream waters off the northeast United States showed that these species frequent similar shelf-edge habitats. Beaked whales were present mostly along the colder shelf edge, and associated significantly with canyon habitats. Sperm whales entered warmer off-shelf water. (Waring *et al.* 2001). Records previously identified as *M. hectori* from southern California are now placed in *M. perrini* (see taxonomic status above). No information is available on population abundance or rates of change (Goodall 1978; Ross 1984; Baker 1990; Mead 1989; Bannister *et al.* 1996). The diet of this species is presumed to be mainly mid- and deep-water squid and some fish. The reference to *Octopoteuthis deletron* beaks found in *M. hectori* (Bannister *et al.* 1996) has been retracted, as the whale involved is now classified as *M. perrini* (Dalebout *et al* 2002). The overview is based on the few data available from New Zealand, South Africa and Australia. Physical maturity is reached at a length of ca 4.0 m; maximum weight is ca 800 kg, and maximum length is ca 4.5 m. (Leatherwood and Reeves 1983). This species is presumed to actively pursue prey, but the mode of capture is not known; it is possibly capable of deep dives. Only adult males have functional teeth, consisting of one pair near the tip of the lower jaw, which appear to be used as weapons during agonistic encounters. Lacking functional gripping teeth, prey may be seized and disabled using the hard edges of the mandibles and the rostral palate. The precise function of the pair of V-shaped throat grooves (a feature of beaked whales) is unknown, but their arrangement suggests a capacity for distension, which may facilitate passage of larger whole prey down the oesophagus past the aryteno-epiglottideal tube. No information is available on mortality and pathology; this species may be subject to predation by Killer Whales (Bannister *et al.* 1996). Length at birth is about 1.8 m; length at weaning is not known. Sexual maturity occurs at ca 4.0 m in length. No information is available on calving interval, gestation period, mating and calving season. No calving areas are known for Aust. waters (Bannister *et al.* 1996).

Threats Summary: current and potential threats include possible entanglement in drift nets set, lost or discarded in international waters; competition from expanding commercial fisheries, especially on pelagic squid; pollution leading to accumulation of toxic substances in body tissues (Bannister *et al.* 1996).

27 Strap-toothed Beaked Whale (*Mesoplodon layardii)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Mesoplodon layardii*, in relation to threats or potential threats it faces, is generally limited. However, the species' wide distribution and abundance suggest that it may be less threatened than those classified as NCA(a) and it is recommended that its status remain classified as NCA(b).

Conservation objectives. As described in *The Action Plan for Australian Cetaceans*: to establish basic biological parameters and improve knowledge of species-specific external characteristics; to establish seasonal variation in distribution in relation to reproductive parameters; assess degree of biological threat posed by pollutants; improve definition of range in relation to oceanographic parameters and season; establish indices of abundance.

Family Ziphiidae. Strap-toothed Beaked Whale, *Mesoplodon layardii* Gray, 1865. [e25556]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation status: *The Action Plan for Australian Cetaceans* status– no category assigned, but possibly secure (NCA (b));
IUCN Status: Insufficiently known/ Data Deficient
CITES Status: Appendix II.
Mesoplodon layardii: Census of Australian vertebrate Species 1591, updated 31 December 1998.

Marine protected areas managed for, or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. Described by John Gray in 1871 as *Ziphius layardii*, based on a whale stranded near Cape Town, South Africa. In the same year, Gerard Krefft, of the Australian Museum, described *Mesoplodon guntheri* , based on a stranding in Little Bay, New South Wales, and two years later, Gray described a second strap-toothed beaked whale as a new species, *Mesoplodon longirostris*, based on an Australian specimen. Subsequently, J.D. Ogilby described Krefft's specimen again, in 1892, naming it *Mesoplodon thomsoni*. These three names are all synonyms of *M. layardii* Gray 1871. No subspecies have been recognised (Bannister *et al.*1996; Rice 1998). Based on nuclear DNA analysis, *M. layardii* is most closely related to *M. carlhubbsi* and *M. bowdoini* (Dalebout 2000).

Distribution. Possibly seasonally common off southern Australia, based on frequency of strandings. This species is the most commonly stranded beaked whale in Australia, with 68 events to 1994 on the southern coast of Western Australia (5 events), South Australia (27), Victoria (5), Tasmania (13), New South Wales (14), Queensland (4), as well as on Macquarie Island (2) and Heard I. (1). This species also strands frequently in New Zealand (58 events to mid-1986). Population abundance and rates of change are unknown (Dixon 1980; Nicol 1987; Kemper and Ling 1991; Bannister *et al.* 1996).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e25556
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e25556
Distribution showing presence in the oceanic and slope regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS

version 1), between 35ºS and 55ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. This species apparently prefers deep oceanic waters of temperate (ca 10-20°C) to subantarctic (ca 1-8°C) regions. May feed seasonally in zones of higher productivity adjacent to the continental slope as well as using adjacent
waters for calving. No key localities known in Australian waters (Bannister *et al.* 1996). However, shipboard surveys of beaked whales (*Mesoplodon* spp. and *Ziphius cavirostris*) from 1991-1998 along the shelf edge and Gulf Stream waters off the northeast United States showed that these species frequent similar shelf-edge habitats (Waring *et al.* 2001). Beaked whales were present mostly along the colder shelf edge, and associated significantly with canyon habitats. It is likely that such habitats are utilised by beaked whales along much of Australia's extensive coastline, particularly along the more southern shores. Records of this species south of 38°S occur throughout the year, whereas those north of 38°S appear to be seasonal. The majority of strandings in Australia occur from January to April, indicating a seasonal influx during mid- to late summer (Bannister *et al.* 1996). Most of prey items in stomachs of South African specimens were pelagic squid (93.3% by number); the remainder were unidentified fish otoliths and crustaceans. Some of the 14 species of squid recorded occur at great depth. The predominant species were *Histioteuthis* sp. (Histioteuthidae) and the cranchiid species *Taonius pavo* (48.7 and 16.8% by number, 41.3 and 20.9% by weight, 63.6 and 45.5% by frequency of occurrence, respectively; Bannister *et al.* 1996). This biological overview is based mainly on New Zealand and Australian data. Physical maturity is attained at ca 5.2 m in length; maximum weight is ca 2 tonnes, and maximum length is 6.13 m in males, and 6.25 m in females. The maximum age is not known (Bannister *et al.* 1996). Length at birth is about 2.2-2.4 m and weaning occurs at lengths of about 3.8 m; sexual maturity is attained at a length of ca 5.0 m; mating is thought to occur in summer and calves are born from summer through autumn. The gestation period is inferred to be about 9-12 months; no calving areas known for Australian waters (Bannister *et al.* 1996).

Threats summary: no previous threats are known. Current threats include possible entanglement in drift nets and other nets set, lost or discarded in international waters. Potential threats are: competition from expanding fisheries, especially on pelagic squids; and pollution leading to accumulation of toxic substances in body tissues. (Bannister *et al.* 1996).

28 True's Beaked Whale (*Mesoplodon mirus)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Mesoplodon mirus*, in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as NCA(a).

Conservation objectives. As described in *The Action Plan for Australian Cetaceans*: to establish basic biological parameters and improve knowledge of species-specific external characteristics; to establish seasonal variation in distribution in relation to reproductive parameters; assess degree of biological threat posed by pollutants; improve definition of range in relation to oceanographic parameters and season; establish indices of abundance.

Family Ziphiidae; True's Beaked Whale, *Mesoplodon mirus* True, 1913

EPBC Act Status: Cetacean; Approved Recovery Plan: none
Conservation status: *The Action Plan for Australian Cetaceans* status–no category assigned NCA(a))
IUCN Status: Insufficiently known/ Data Deficient
CITES Status: Appendix II
Mesoplodon mirus: Census of Australian Vertebrate Species 1596, updated 31 December 1998.

Marine protected areas managed for, or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. Described by True in 1913. Slight cranial differences are present between northern and southern populations of this well-defined taxon; if they are geographically isolated, they may warrant subspecific recognition (Ross 1984; Bannister *et al.* 1996). Based on analysis of nuclear DNA, *M. mirus* appears to be most closely related to *M. europaeus* and *M. ginkgodens* (Dalebout 2000).

Distribution. Distribution in the northern hemisphere appears limited to the North Atlantic, northwards from ca 30° to ca 50°N, off USA, Nova Scotia, Ireland and the Outer Hebrides. Southern hemisphere records, including all of the strandings in South Africa and in southern Australia -Western Australia, Victoria. and Tasmania - indicate possibly localised populations. Known southern hemisphere strandings from South Africa (20 events by 1986) and from southern Australia to 1994: Western Australia (2), Victoria (1) and Tasmania (1). No information is available on population abundance or rates of change (Mead 1989; Findlay *et al.* 1992; Bannister *et al.* 1996). Inferred from strandings in northern hemisphere to prefer temperate and adjacent colder oceanic waters. Southern hemisphere records are all in temperate (ca 10-20°C) regions. Assumed to prefer deep oceanic waters. No key localities known in Australian waters (Bannister *et al.* 1996). It is uncertain whether migration occurs, and is probably doubtful, but there may be seasonal movements (Bannister *et al.* 1996).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e54
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e54

Distribution showing presence in the oceanic and slope regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), between the 10ºC isotherm in February and the 20ºC isotherm in September. The distribution is broadly based on the Species Profile and Threats database account.

Biology. The diet of *M. mirus* appears to be squid and small fish. Stomachs of stranded individuals have contained traces of unidentified squids, and one South African specimen contained beaks of the common inshore squid, *Loligo reynaudi* (Ross 1984; Mead 1989; Bannister *et al.* 1996). This biological overview is based mainly on data from the northern hemisphere and some from South Africa. The greatest recorded length is 5.34 m in males, and 5.18 m in females. Physical maturity is reached at about 4.8 m in length. The maximum recorded weight is 1.4 tonnes for a South African adult female. The maximum age is not known. The first live sightings of this species were made off North Carolina, close to the edge of the continental shelf, and are described in some detail by Tove (1995). Little is known of habitat suitable for beaked whales on Australia's coastline. However, shipboard surveys of sperm whales and beaked whales (*Mesoplodon* spp. and *Ziphius cavirostris*) from 1991-1998 along the shelf edge and Gulf Stream waters off the northeast United States showed that these species frequent similar shelf-edge habitats (Waring *et al.* 2001). Beaked whales were present mostly along the colder shelf edge, and associated significantly with canyon habitats. It is likely that such habitats are utilised by beaked whales along much of Australia's extensive coastline, particularly along the more southern shores.

Probably fast and active in the pursuit of prey, but the mode of capture is not known; possibly capable of deep dives. Only adult males have functional teeth, consisting of a single pair at the tip of the lower jaw, which appear to be used as weapons during agonistic encounters. Lacking functional gripping teeth, prey may be seized and disabled using the hard edges of the mandibles and the rostral palate. The precise function of the pair of V-shaped throat grooves (a feature of beaked whales) is unknown, but their arrangement suggests a capacity for distension, which may facilitate passage of larger whole prey down the oesophagus past the aryteno-epiglottideal tube. Does not commonly strand. Parasites recorded: barnacles *Xenobalanus globicipitis* on trailing edge of flukes, and the nematode *Anisakis simplex* in stomachs (Ross 1984; Bannister *et al.* 1996). Length at birth is about 2.2 m; weaning occurs at ca 1 year old, at a length of about 3.5 m. Age at sexual maturity is unknown; physical maturity occurs at about 4.8-5.1 m in length – similar in both sexes (Ross 1984); calving interval and mating season unknown; calving season in summer; gestation period not known; no calving areas known for Australian waters (Bannister *et al.* 1996).

Threats summary: no past threats are known. Current threats include possible entanglement in drift nets and other nets set, lost or discarded in international waters. Potential threats include competition from expanding commercial fisheries, especially on pelagic squids; pollution leading to accumulation of toxic substances in body tissues.

29 Cuvier's Beaked Whale (*Ziphius cavirostris)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Ziphius cavirostris*, in relation to threats or potential threats it faces, is generally limited. However, the species' wide distribution and abundance suggest that it may be less threatened than those classified as NCA(a) and it is recommended that its status remain classified as NCA(b).

Conservation objectives. As described in *The Action Plan for Australian Cetaceans*: the objectives are to establish basic biological parameters and improve knowledge of species-specific characteristics; establish seasonal variation in distribution in relation to reproductive parameters; assess the degree of biological threat posed by pollutants; improve definition of range more closely in relation to oceanographic parameters; and to estimate abundance.

Family Ziphiidae. Cuvier's Beaked Whale. *Ziphius cavirostris* Cuvier, 1823 [56]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation status: *The Action Plan for Australian Cetaceans* status: no category assigned, but possibly secure (NCA(b));
IUCN Status: insufficiently known/ Data Deficient
CITES Status: Appendix II.
Ziphius cavirostris: Census of Australian Vertebrate Species 1587, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. A well-defined taxon, for which no subspecies are recognised (Bannister *et al.* 1996; Rice 1998).

Distribution. Distribution. Widely distributed, apparently local populations, for example, off Japan, and possibly off New Zealand, but no data are available on their size or range. A circumglobal species except in polar waters; also found in the Mediterranean Sea (Heyning 1989). Ranges far from continental landmasses; a summer sighting in the subantarctic South of New Zealand at 52°S, and two strandings at Macquarie I. at 54°S. The most cosmopolitan of the beaked whales, it is recorded in Australian waters by 31 strandings (to 1994), mostly from January to July, suggesting some seasonality of occurrence. Records from Western Australia (5), South Australia (2), Victoria (3), Tasmania (13), New South Wales (2), Queensland (3), Northern Territory (1), including two at Macquarie I. (Nicol 1987). Apparently this species is a year-round resident in some parts of its range, for example, off New Zealand and Japan. Frequently strands on New Zealand coasts (Baker 1990; Bannister *et al.* 1996). The species occurs in tropical (ca 22-32°C) to sub-polar (ca 1-8°C) deep oceanic waters. No key localities are known for Australia (Bannister *et al.* 1996). Although little is known of preferred habitat in Australian waters, shipboard surveys of beaked whales (*Mesoplodon* spp. and *Ziphius cavirostris*) made from 1991-1998 along the shelf edge and Gulf Stream waters off the northeast United States showed that these species frequent similar shelf-edge habitats (Waring *et al.* 2001). Beaked whales were

present mostly along the colder shelf edge, and associated significantly with canyon habitats. It is likely that such habitats are utilised by beaked whales along much of Australia's extensive coastline, particularly along the more southern shores. No information is available on movements in this species (Bannister *et al.* 1996).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e56
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e56
Distribution showing presence in the oceanic and slope regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), north of 62S. The distribution is broadly based on the Species Profile and Threats database account.

Biology. Limited data from Japanese fisheries indicate a wide variety of squid comprised the bulk of the diet of animals taken in waters slightly less than 1000 m, but deep-water fish predominated in stomachs of animals taken in deeper waters; decapod and mysid shrimps were also recorded. Stranded animals on the South African coast contained beaks of ca 15 species of oceanic squid, in at least eight families; otoliths of morid fish *Antimora* sp., crustacean fragments (cf. *Gnathophausia*) and flotsam, including plastic debris, pumice stones and a large seed. The stomach of a large male stranded in Victoria contained beaks of ca 500 individual squid; 15 of these were *Mesonychoteuthis hamiltoni* which comprised 60% of the total estimated intake by weight; histioteuthid squids comprised a further 20% by weight, the remainder representing the families Mastigoteuthidae, Onychoteuthidae and Vampyroteuthidae. These squids occur also in stomachs of this whale elsewhere in the world. Physical maturity is reached 5.9-6.13 m; the maximum weight is about 3.5 tonnes; maximum known age is 47 years (male), and 28 years (female); maximum length 6.93 m (male), 6.60 m (female). Appears to be wary of boats and therefore uncommonly observed at sea. Group size varies from one, most commonly, to seven animals, but larger schools to ca 25 individuals have been reported; lone animals appear to be adult males. Mass strandings of five and six individuals recorded. The diffuse blow is low and directed forward. Breaching has been seen. Often raises flukes out of water before commencing vertical descent. Apparently dives deeply and can remain below for at least 30 minutes. Presumed to actively pursue prey, but mode of capture unknown. Only adult males have functional teeth, consisting of a single pair at the tip of the lower jaw, which appear to be used as weapons during agonistic encounters, leading to heavy scarring of older animals. Lacking functional gripping teeth, prey may be seized and disabled between the hard edges of mandibles and rostral palate. The precise function of the pair of V-shaped throat grooves (a feature of beaked whales) is unknown, but their arrangement suggests a capacity for distension, which may facilitate passage of large whole prey down the oesophagus past the aryteno-epiglottideal tube. Strands quite frequently. Ectoparasitic barnacles *Xenobalanus* sp. on flukes and dorsal fin and *Conchoderma* on erupted apical teeth. Internal parasites include nematodes *Anisakis* sp., *Crassicauda boops* and *C. crassicauda*, and cestodes *Phyllobothrium* sp. Thickened arterial walls (arteriosclerosis) of strandings may be related to the species' deep-diving habit. An adult male from temperate Australian waters was heavily scarred by cookie-cutter shark (*Isistius* sp.) bites. There is a decline in the incidental catch of *Ziphius* in the continuing Japanese *Berardius* fishery. Age and length at sexual maturity occur at about 11 years and ca 5.5 m; mating and calving season is inferred to be all year round, as no seasonal pattern is evident. The gestation period unknown. Length at birth is ca 2.70 m. (Bannister *et al.*1996).

Threats Summary: past threats elsewhere include small-scale fisheries off Japan and Lesser Antilles. Current threats include possible entanglement in drift-nets and other nets set, lost or discarded in international waters; potential competition from expanding commercial fisheries, especially on pelagic squids; pollution leading to accumulation of toxic substances in body tissues.

30 Southern Bottlenose Whale (*Hyperoodon planifrons)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Hyperoodon planifrons*, in relation to threats or potential threats it faces, is generally limited. However, the species' wide distribution and abundance suggest that it may be less threatened than those classified as NCA(a) and it is recommended that its status remain classified as NCA(b).

Conservation objectives. As presented in *The Action Plan for Australian Cetaceans*: to contribute and collate data to establish basic biological parameters and seasonal variation in distribution in relation to reproductive parameters; to assess the biological threat posed by pollutants; to define more closely the range in relation to season and oceanographic parameters; and to estimate abundance.

Family Ziphiidae. Southern Bottlenose Whale, *Hyperoodon planifrons* Flower,1882

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation status: *The Action Plan for Australian Cetaceans*: no category assigned, but possibly secure (NCA(b));
IUCN status: Insufficiently known/ Data Deficient
CITES Status: Appendix I.
Hyperoodon planifrons: Census of Australian Vertebrate Species 1584, updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. Flower described this species in 1882, from a specimen found at Lewis Is, Dampier Archipelago, Western Australia. No subspecies are recognised. Skeletal features from its closely related sibling species, Hyperoodon ampullatus, the Northern Bottlenose Whale, which occurs only in the North Atlantic, distinguish this species. Genetic analyses show clearly that these taxa are distinct and markedly divergent species, which may well have been separated by about 5 million years. The Southern Bottlenose Whale has a higher genetic diversity compared with its northern counterpart, perhaps a result of the intense fishery for *H. ampullatus* (Dalebout 2002).

Distribution. Circumglobal in the Southern Hemisphere, at mid- to high latitudes south of 29°S to the edge of the polar pack ice; the species is commonly sighted in some sectors of the Southern Ocean South of 60°S. Sightings of an undescribed *Hyperoodon* (the so-called Tropical Bottlenose Whale) in central and eastern tropical Pacific and North Pacific waters, from 5°N-15°S, 80-170(W and North Pacific from ca 20-34°N, 130-142°W. are most likely to be the beaked whale *Indopacetus pacificus* (Pitman *et al.* 1999; see description of *Indopacetus*). The relatively few strandings are recorded mainly in New Zealand; Australian strandings occurred in New South Wales (2); Tasmania (1); South Australia (7), Victoria (2) and Western Australia (2, one of which is the type specimen). Apparently this species rarely ventures into continental seas. There is evidence of seasonal occurrence of Southern Africa in summer, based on sightings at sea, but data for southern Australia are inconclusive.

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/
Description: indicative distribution showing presence in the oceanic region (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), south of 29ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. This overview draws on data from southern African, Australian and New Zealand specimens, as well as comparisons with *H. ampullatus*. The age and length at physical maturity is unknown. Males and females reach a maximum of 7.14 m and 7.8 m, respectively and maximum weight is about ca 4 tonnes. Male Northern Bottlenose Whales are thought to reach live for more than 50 years, and the age of females exceeds 37 years. Weight and length at birth is about 150-200 kg and 2.5-2.9 m, respectively. Calves are weaned at about 1 year old (as for *H. ampullatus*) at about 3.7-4.0 m in length. Sexual maturity is estimated to be attained at 9-11 years (as for *H. ampullatus*) and ca 6.5 m long in males. The calving interval is unknown; mating may occur in summer, and calves are born in spring-early summer, after a gestation period of about 12 months (as for *H. ampullatus*). No calving areas are known for Australian waters (Bannister *et al.* 1996). No information is available about population size, possible sub-populations, or trends in numbers, but data accumulated by IWC whale sighting cruises in the Southern Ocean since mid-1980s may yield a population estimate.

These whales have been sighted off Southern Africa and in Antarctic waters in small social groups of 3-10 animals. They are powerful and active predators, and have been observed to remain below the surface for long periods. It is assumed that they dive deeply in pursuit of prey, possibly to more than 1000m, and stay down for periods of more than an hour. The flukes may be shown before a vertical descent. These whales breach on occasion. This species apparently prefers deep oceanic waters in temperate (ca 10-20°C) to Antarctic (ca 0-5°C) regions. No key localities are known in Australian waters (Bannister *et al.* 1996). Stomachs of specimens from Antarctic and Subantarctic waters contained the remains of squid and some krill (*Euphausia superba*), possibly ingested incidentally with normal prey items. The stomach of one South Australian specimen contained a large quantity of squid beaks, cf. *Polypus variolatus*, but their identification is doubtful; the intestine of one South African specimen contained four cephalopod beaks. The stomach of a dependent or recently weaned juvenile from Victoria contained the tunicates *Pyrosoma atlantica* and *Thetys vagina*. The stomach contents of an adult male stranded in New South Wales included numerous beaks from large onychoteuthid squids, other families of cephalopods and numerous large tunicates, providing evidence of deep diving for prey (G. Ross, personal observations). Stable isotope analysis of blubber samples showed that the Northern Bottlenose Whale feeds mainly on squid of the genus *Gonatus* off Newfoundland (Hooker *et al.* 2001), but also on a variety of fish, holothurians, starfish and prawns. Stones, fish-netting and plastic bags have been found in stomachs.

Only adult males have functional teeth, comprising a single pair located at the tip of the lower jaw; they appear to be used as weapons in agonistic encounters, leading to heavy scarring of older animals. The massive forehead (melon) of this species may be used to concentrate bursts of high-energy sound to acoustically stun prey. They lack functional gripping teeth, and prey may be seized and disabled using the hard edges of the mandibles and the rostral palate. The precise function of the pair of V-shaped throat grooves (a feature

of all beaked whales) is unknown, but their arrangement suggests a capacity for distension, which may facilitate passage of larger whole prey down the oesophagus past the aryteno-epiglottideal tube. A young male specimen from Victoria carried whale lice *Platycyamus thompsoni* and scars, possibly from bites by the small shark *Isistius* sp.; it also bore recent tooth rakes possibly caused by a killer whale (Dixon *et al.* 1994). The northern species, *H. ampullatus,* exhibits care-giving behaviour, possibly a defence against attacks by Killer Whales.

Current threats include: incidental captures in pelagic drift-net fishery in the Tasman Sea; entanglement in drift-nets and other nets set, lost or discarded in international waters at higher latitudes. Potential threats include: competition from expanding commercial fisheries, especially for pelagic squids at higher latitudes (Bannister *et al.* 1996).

31 Pygmy Sperm Whale (*Kogia breviceps)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Kogia breviceps*, in relation to threats or potential threats it faces, is generally limited. However, the species' wide distribution and abundance suggest that it may be less threatened than those classified as NCA(a) and it is recommended that its status be re-classified as NCA(b).

Conservation objectives. Investigate identity, distribution, abundance, basic biology and pollutant levels, to provide base-line information on current status of this little-known species; ensure protection against harassment or other disturbance, including fishing operations, to minimise possible detrimental effects.

Family Kogiidae. Pygmy Sperm Whale, *Kogia breviceps* (de Blainville, 1838) [57]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation Status: *The Action Plan for Australian Cetaceans* status: - no category assigned because of insufficient information (NCA(a))
IUCN status: Insufficiently known/ Data Deficient
CITES Status: Appendix II.
Kogia breviceps: Census of Australian Vertebrate Species 1581,updated 31 December 1998.

Marine protected areas managed for or relevant to the species include the Australian Exclusive Economic Zone (200 n miles), and the areas subject to International Whaling Commission regulations - the Indian Ocean Sanctuary and Southern Ocean Sanctuary.

Taxonomic status. Described as *Physeter breviceps* by de Blainville, 1838, and now referred to the genus *Kogia*. No subspecies are currently recognised, but the identity of the closely related Dwarf Sperm Whale, *K. sima*, was only confirmed in 1966 (Handley 1966), and records before then could refer to either (Bannister *et al.* 1996).

Distribution. Cosmopolitan, oceanic distribution, excluding polar regions, with larger distribution range than *K. sima*. No information on population sizes. One of the commonest species to strand in some areas. Recorded (as stranded animals only) from all states but not the Northern Territory. From studies of food organisms elsewhere, this species seems not to approach as close inshore as *K. sima* (Ross 1984; Bannister *et al.* 1996).

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e57
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e57
Distribution showing presence in the oceanic and slope regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), north of 50ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. Found in pelagic habitat in temperate to tropical waters (Ross 1984). Not known to migrate or exhibit strong seasonal movements (Bannister *et al.* 1996). Primary food items reported as squid, pelagic deep-sea prawns, some pelagic fish and crabs (Bannister *et al.* 1996). Main prey over the South African shelf are histioteuthid and lycoteuthid squids

(Ross 1979). Prey size is somewhat larger than that of the Dwarf Sperm Whale (Ross 1979, 1984; Clarke 1986). The overview is based largely on South African data (Bannister *et al.* 1996), with some Australian material (Plön, S. 1999, in litt.). Physical maturity is reached at 14 years and a length of 3.0 m (female) and 12.5 years and 2.8 m (male) Maximum weight is 480 kg (female) or 374 kg (male). The maximum-recorded age is 22.4 years (female) or 16 years (male), and the maximum length recorded is 3.28 m (female), 3.31 m (male), 3.66 m (unknown sex). Sounds associated with echolocation (clicks, buzzes, grating sounds) have been recorded, but apparently not highly vocal. A sound maker in the right nasal passage, the museau de singe, is believed to be associated with sound production, as in other Sperm Whales. Occur individually or in small groups up to six animals; frequently lie almost motionless at surface, a behaviour termed “logging”; said to breach occasionally. Little information on mortality and pathology. Identification at sea difficult. These whales strand relatively frequently, often as cow/calf pairs (Bannister *et al.* 1996). Like the Dwarf Sperm Whale, this species is able to store large volume of dark faecal liquid in the rectum, which is ejected in a long stream when fleeing danger or disturbance, leading to the Japanese name "Rocket Whale" (Yamada 1954). Apparently also used to camouflage a calf in potential danger (Scott and Cordaro 1987). Reproductive data are based largely on South African data (Bannister *et al.* 1996), with some Australian material (Plön, S. 1999, personal communication): weight and length at birth, 30kg and 1.2 m; weaning occurs at 1 year and a length of 180 cm; age and length at sexual maturity are 5 years and 2.62 m (female), and 5 years and 2.42 m (male). The ovulation rate is 0.9/year; the calving interval is1 year. Mating occurs in April through September, and gestation lasts 11 months. Calves are born from March through August, probably in temperate to tropical seas, although exact localities are unknown.

Threats summary: past and potential threats: no commercial catching, but equally, little recognition of threats posed in fisheries for small cetaceans, whether caught deliberately or as by-catch. Current Threats include: possible direct threats from seismic operations; collision with large vessels; entanglement in fishing gear; and pollution, such as increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways, leading to accumulation of toxic substances in body tissues.

32 Dwarf Sperm Whale (*Kogia sima)*

Recommendation on Conservation Status. The level of information available on the biology and habitat of *Kogia sima,* in relation to threats or potential threats it faces, is too limited to support reassessment of its currently assigned status. It is therefore recommended that its status remain as NCA(a).

Conservation objectives. Investigate identity, distribution, abundance, basic biology and pollutant levels, to provide base-line information on current status of this little-known species; ensure protection against harassment or other disturbance, including fishing operations, to minimise possible detrimental effects.

Family Kogiidae. Dwarf Sperm Whale, *Kogia sima* Owen, 1866 [58]

EPBC Act Status: Cetacean; Approved Recovery Plan: none.
Conservation status: *The Action Plan for Australian Cetaceans* status – no category assigned, because of insufficient information (NCA(a))
IUCN status: Insufficiently known/ Data Deficient
CITES Status: Appendix II
Kogia sima: Census of Australian Vertebrate Species 1582, updated 31 December 1998.

Taxonomic status. Although first named by Owen, 1866, species not confirmed as separate from *Kogia breviceps* (Pygmy Sperm Whale) until Handley's (1966) work. No subspecies recognised (Bannister *et al.* 1996). Species name amended to *sima* by Rice (1998) to accord with gender of genus.

Distribution. Occurs in all areas apart from polar or sub-polar seas (Caldwell and Caldwell 1989). Oceanic, but approaches coasts more than Pygmy Sperm Whale. Recorded (as stranded animals) from Western Australia, South Australia, Tasmania, New South Wales and Northern Territory (Chatto 2000); one live sighting from South Australia. No information on population abundance, nor centres or rates of population change (Bannister *et al.* 1996). Oceanic, apart from colder waters, but more coastal than Pygmy Sperm Whale, apparently feeding over the continental shelf, possibly when with calves (Ross 1979). No key localities recognised (Bannister *et al.* 1996). Not known to migrate or exhibit strong seasonal changes in distribution.

Distribution map:EAGIS: Q:/bio_port/biota/fauna/cetaceans/data/ e58
UNIX: /erin/biodiv/data/biota/fauna/cetaceans/data/ e58
Distribution showing presence in the oceanic and slope regions (based on AGSO 1996 depth/slope bathymetric classification) of the Australian marine area (based on AMBIS version 1), north of 50ºS. The distribution is broadly based on the Species Profile and Threats database account.

Biology. Prey comprises large numbers of many different species of small squids; some fish and crustaceans also taken (Bannister *et al.* 1996). Histioteuthid and lycoteuthid squids are important prey, and small cuttlefishes were a prime food resource in a few mother-calf pairs (Ross 1979). Prey is smaller than that of the Pygmy Sperm Whale (Ross 1979, 1984; Clarke 1986). Overview based mainly on South African data (Plön, S. 1999, in litt.): age and length at physical maturity, 11 years and 2.50 m (female), 15 years and 2.60 m (male) ;

maximum weight, 264 kg (female) and 303 kg (male); maximum age, 21.5 years (female) and 17 years (male); maximum length, 2.86 m (female) and 2.62 m (male). Found at the surface in groups of up to 10 animals, possibly in three kinds of pods: cows and calves, immatures, and adults of both sexes. Unobtrusive at sea, often found lying quietly at surface, a behaviour termed “logging”. Little information on mortality and pathology; this species strands much less frequently than Pygmy Sperm Whale (Bannister *et al.* 1996). Stores large volume of liquid faeces in rectum, apparently used to camouflage itself, and its calf, when threatened (Yamada 1954; Scott and Cordaro 1987). Reproduction: overview based mainly on South African data (Plön, S. 1999, in litt.), weight and length at birth, 14 kg and 1.05 m; age and length at weaning, 6 months and 1.3 m; age and length at sexual maturity, 4.5 years and 2.15 m (female) and 2.9 years and 1.97 m (male); ovulation rate 0.65/year Calving interval 1 or 2 years; mating season December-March; gestation 12 months; calving season December to March; calving area, temperate to tropical seas, exact localities unknown (Bannister *et al.* 1996).

Threats summary: past threats included occasional by-catch in fisheries for small cetaceans; current and potential threats include: direct effects of 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 bio-accumulation of toxic substances in body tissues (Bannister *et al.* 1996).

Appendix 3. Summary of Comments and Information submitted to the Review

The information included in this appendix has been compiled in part from submissions by those commenting on the draft, or from requests by the reviewer for specific information to address queries or inconsistencies in the text.

Name	Group	Group	Nature of input/Comments
Arnold, P.		Initial Contact List	Important comments on Spinner Dolphins in northern Great Barrier Reef; also input on specific status of Orcaella species in Australian waters. (See Dobbs below)
Chatto. R.	National Whale Recovery Group	Initial Contact List	Overall enthusiasm for assessing status of small cetaceans along Northern Territory shores, and promoting official interest in the project.
Constantine, R.			Provision of useful information on whale-watching and swim-with programs
Dobbs, K./Stokes, T	National Whale Recovery Group	Initial Contact List	Information provided on Spinner Dolphins in northern Great Barrier Reef (see Arnold above); research required.
Dolman, S.	National Whale Recovery Group	Initial Contact List	Provision of a copy of the recently published "Oceans of Noise", which assisted in developing this topic; discussions also on the development of study sites for beaked whales offshore., and other issues relating to cetacean conservation.
Flaherty, T.	National Whale Recovery Group		Comments on Eucla and other deep-sea canyons off South Australia; relevance of MPAs to small cetaceans.
Gales, N.	National Whale Recovery Group	Initial Contact List	Input of information on beaked whales in the Perth Canyon, as fuel for establishing study sites over deep water canyons; providing access to information currently in press, on a range of issues and impacts facing small cetacean populations.
Hale, P.		Initial Contact List	Access to report on the Swim-with program in Port Phillip Bay; philopatry and its possible impact under changed conditions, as indicated by a population viability analysis
Harcourt, R.		Initial Contact List	Important insight into the significance of philopatry for coastal dolphins to beaked whales in deep water.
Jenner, C.	National Whale Recovery Group		Comments on availability of small cetacean sighting records gathered incidentally during surveys for large whales.
Kemper, C.		Initial contact	The importance of carcase studies and

		list	stranding data; sharing data; acoustic pollution and several other impacts on small cetaceans
Krützen, M.		Initial Contact List	Significant data on genetics of bottlenose dolphins in Shark Bay, and population structure and boundaries.
Menkhorst, P.		Initial Contact List	Discussion on bottlenose dolphins in Victorian lake systems suggests review of species.
Luciana Möller			Provision of data from thesis on *T. aduncus*, pertaining to minimal to no interchange between adjacent populations.
Morrice, M.			Comments and paper on Killer Whale counts and research at Macquarie Island
Parra, G.		Initial Contact List	Valuable input on Irrawaddy (Snubfin) Dolphins, esp. in relation to the presence/absence of philopatry
Perrin, W.F.	South West Fisheries Center, La Jolla, California		Comments and information on Spinner Dolphins; forms and subspecies in the Australian region.
Van Waerebeek, K.	Peruvian Centre for cetacean Research, Lima.		Comments and information on Striped Dolphin off Western Australia.
Waples, K.	National Whale Recovery Group	Initial Contact List	Useful summary of information on whale-watching, relevant to impacts on small cetaceans.
Yates, M.	Aust. Fisheries Management Authority		Summary of current information on status of illegal net-fishing in waters north of Australia, and potential impact on small cetacean populations.