Analysis of South Australian Museum's Cetacean Data: Distribution, Seasonal Trends and Circumstance of 'Death'

Consultancy for Department of the Environment, Water, Heritage and the Arts (reference number 2008/05955)

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June 2008

Scope

The scope of the consultancy was to analyse the existing data in the collection and sightings databases of the South Australian Museum. Analyses included biological data (species presence, distribution, seasonal trends) and threats, including those from human activities. Special consideration was given to beaked whales and the type of entanglement in which any cetacean was involved. The 'stranding' and sighting database records accompany the report along with relevant metadata. The consultancy also involved identifying gaps in Gill, Burton and Morrice (2007) Cetaceans, Section 4.25 in The South-west Marine Region: Ecosystems and Key Species Groups Report.

Materials and Methods

A list of scientific and common names of all species inhabiting South Australia is found in Appendix 1.

The size of the databases and the time available to prepare the analyses and report did not permit all corrections to be made to erroneous records (e.g. latitude, longitude) nor re-evaluate some sightings in light of recent taxonomy (e.g. minke whales). However, obvious errors to locations were corrected when producing the maps.

Stranding and other carcass/human interaction records

The stranding database includes records associated with the specimen collection of the Museum (M numbers and temporary accession numbers e.g. 07.135) as well as events involving cetaceans from which no specimens were collected (S numbers). A summary of the records is found in Table 1. A total of 1161 records of accurately-identified animals was available. Specimen record numbers are applied to each individual and so in some cases one event is represented by multiple numbers. For the most part, the database provided with this report has details of events, not individuals, the latter being noted in a separate field in the database.

Information on the cetacean fauna of Western Australia is available in the form of WA Museum records to 2004 (Yamada et al. 2006) as well as my knowledge of the collection.

Sightings of live animals 'at sea'

The sightings database consisted of about 2700 records identified to various levels of taxonomic certainty (see Appendix 2 for definitions). These are summarized in Table

2. Since sightings rely on the quality of the information supplied and the ability of observers, only records accompanied by photographs can be considered truly reliable. However, the process of assigning a taxonomic classification to a record is rigorous (and does not usually rely on the observer's identification except when he or she is experienced) and a name applied means that there is at least some indication that this was the species observed. For this reason, the report often used data from records deemed ID 3.

Species and distributions

The South Australian cetacean fauna consists of 32 species (9 baleen whales and 23 toothed whales and dolphins). With the exception of *Lagenorhynchus obscurus* and *Balaenoptera borealis*, all have been confirmed with Museum specimens (Appendix 1).

Unidentified cetaceans

Sightings of cetaceans that were not identified to species or group were frequently recorded along the coast as well as beyond the continental shelf (Fig. 1). Medium and large-sized animals that were recorded are likely to be species known to be relatively abundant in SA waters e.g. *Physeter macrocephalus*, *Balaenoptera musculus* and *Megaptera novaeangliae*.

Baleen whales

The most commonly sighted (and reported) large cetacean in SA waters is *Eubalaena australis* (Fig. 2, Table 2), usually very close to the coast or in Gulf waters. A few are available for up to 20 nautical miles from the coast in the Great Australian Bight. The most important calving aggregation is found at Head of Bight with less regular aggregations being found near Victor Harbor and Fowler Bay. Coastal environments are used for mating and calving. Tuna spotters flying the Great Australian Bight during summer in the late 1980s and 1990s did not record *E. australis*. Strandings and other human-related events involving *E. australis* are quite rare in SA waters (Kemper *et al*. in press). Several neonates have been found dead at Head of Bight.

Caperea marginata has been sighted and stranded most frequently in the lower Eyre Peninsula, north eastern Kangaroo Island and Encounter Bay regions (Fig. 3). Other sightings are available (Kemper et al. 1997, and unpublished data) that have not been added to the Museum's database and these fit the pattern described above. Kemper (2002) summarizes the distribution of *C. marginata* in Australia and New Zealand and shows a comparatively small number of records in south western Western Australia.

Balaenoptera musculus has been sighted more frequently in SA waters than the Museum's data show (Fig. 4). Surveys by Peter Gill and others have not been added to this report. They show concentrations of records on the continental shelf from the Victorian border to lower Eyre Peninsula. Strandings of *B. musculus* are rare and amongst these are a neonate and a probable Antarctic blue whale (*B. musculus intermedia*) from Streaky Bay in 1918 and a pygmy blue whale (*B. musculus brevicauda*) from Adelaide in 1989. Tuna spotters recorded a few *B. musculus* well offshore in the Great Australian Bight during summer (along with patches of krill), an association noted for the Bonney Coast (Gill 2002).

There are no confirmed sightings of other *Balaenoptera* identified to species level but all five other species are confirmed in the stranding data (Fig. 5). *Balaenoptera bonaerensis* is the most commonly stranded other member of the genus (mostly juveniles, Kemper and Ling 1991) and only one *B. acutorostrata* has been recorded. There is an apparent concentration of records of other *Balaenoptera* species around the lower Eyre Peninsula. Of interest is the inclusion of the tropical/subtropical *B. edeni* in the region and this is likely to be related to the warm Leeuwin Current.

Megaptera novaeangliae is becoming more frequently sighted in SA waters (Kemper 2005), particularly in the central and eastern part of the State (Fig. 6). Many sightings are made close to the coast, no doubt a result of observer effort, but there are also some both on and beyond the continental shelf. It is not known whether both the west and east coast Australian populations are represented in SA and further research is needed to identify affiliations. Strandings of this species are rare in SA and include neonates and juveniles.

Toothed whales and dolphins (other than beaked whales)
Physeter macrocephalus has been frequented recorded in SA (Fig. 7). A number of sightings (mostly by tuna spotters) are available from the waters just beyond the continental shelf in the Great Australian Bight. Evidence of movements of this species in southern Australia suggests an east to west movement along the edge of the shelf (Bannister pers. comm.). The paucity of sighting records for the south east of the State is more likely to be an artefact of reporting effort rather than a real absence of records, as the stranding record shows many carcasses and some live strandings in that region. Note that the 'stranding' near the edge of the shelf well south of Fowler Bay was a floating carcass.

Kogia spp. are relatively common as 'stranding' along the SA coast, particularly from Streaky Bay to Head of Bight and on the Fleurieu Peninsula (Fig. 8). Two sightings have been made near the edge of the shelf. These records were rated as ID 3 and therefore not confirmed but reported by Bob Stanley, an experienced observer during tuna spotting flights. Most 'stranding' records are of *K. breviceps* and therefore confirmed by carcass morphology. A number of *Kogia* spp. records were known live strandings (Fig. 38), which suggests that these species may inhabit the shelf for at least some part of the year. It is noteworthy that there are no records for the far south east of South Australia where the continental shelf is narrow.

Bottlenose dolphins, probably mostly *Tursiops aduncus*, are the most commonly seen small cetacean in near coastal and gulf waters of SA. The data in Fig. 9 do not substantiate this because many of the sighting records from specific projects have not been included in the Museum's database. These can be found in Kemper et al. (2006) and Kemper et al. (2008). The former report shows a concentration of sightings just outside the entrance to Spencer Gulf. *Tursiops truncatus* is believed to inhabit the open ocean coast and offshore environment as deduced from the stranding record (Kemper 2004).

Delphinus delphis is also very abundant in the 'stranding' record for SA (Fig.10) and as with *Tursiops* spp., the sighting data available for this report are not complete. Mike Bossley and graduate students are conducting mark-recapture surveys in Gulf St

Vincent and have recorded a number of resights of individuals. The conclusions from this research are that common dolphins are at least seasonally resident. This finding explains the abundance of *D. delphis* in the stranding record for the South Australian gulfs. Since the species is generally considered primarily pelagic and an inhabitant of deep-water environments, 'populations' occurring in South Australian coastal waters may be unique and therefore warrant conservation management. It is of interest that no *D. delphis* were seen during the Spencer Gulf survey during April 2005 (Kemper et al. 2006).

Figure 11 differentiates some pilot whales as *G. melas* or *G. macrorhynchus*, even though these species are difficult to identify 'at sea'. Sightings of *Globicephala* spp. have been recorded for along the continental slope with a few available also for the far south east of the State. Occasional reports of sightings are made in coastal waters. There have been many 'strandings' of pilot whales along the South Australian coast, particularly where the continental shelf is relatively narrow (e.g. southern Eyre Peninsula, southern Kangaroo Island, south east of South Australia). The pelagic nature of *Globicephala* spp. is probably a factor in this relationship.

Records of *Pseudorca crassidens* are rare in theMuseum's databases. There are two notable mass strandings, one at Merdeyerrah Sandpatch and the other in Gulf St Vincent (Kemper and Ling 1991). *Feresa attenuata* has just recently been recorded in South Australia (March 2008) as a live stranded animal at Denial Bay (Fig. 11). As with *B. edeni*, there may be a relationship with the warm Leeuwin Current.

There are a number of sightings of *Orcinus orca* in SA waters, most of which are along the coast (Fig. 12, Ling 1991). Concentrations of sightings are found along the west coast of the Eyre Peninsula, around Kangaroo Island, in Investigator Strait and lower Gulf St Vincent. Anecdotal information suggests that *O. orca* is commonly seen by fishers in the far south east. In March 1992 a group of *O. orca* was observed (and videod) attacking a group of *P. macrocephalus* in the Great Australian Bight.

Grampus griseus has been sighted once (off the continental shelf in the Great Australian Bight) and stranded three times (Fig. 12). It is a pelagic species and may be widespread in the SW Planning Region. *Lissodelphis peronii* has been both sighted (Clarke 2000) and stranded once. It is a pelagic species in temperate and subantarctic waters, and approaches the coast only where the shelf is narrow (Warneke 2008). There are two South Australian records —one from Kangaroo Island and well south of that Island (Fig. 12).

Phocoena dioptrica has been recorded once in SA, a stranded animal near Victor Harbor (Fig. 8). Its distribution is primarily subantarctic and it is unlikely to be more than a vagrant to the SW Marine Region.

Beaked whales (Family Ziphiidae)
Beaked whales are very difficult to distinguish at sea and for this reason, few sighting records are available. There are sighting records for *Berardius arnuxii* (Kangaroo Island), *Hyperoodon planifrons* (lower Eyre Peninsula) and Ziphiidae along the continental slope south west of Eyre Peninsula (Fig. 13). It is possible that some of the sightings recorded as medium cetacean in Figure 1 are beaked whales but not enough detail was provided to substantiate this. At present, the stranding record is the

best source of information on this group in South Australia. Of the eight species that occur in the State, *Mesoplodon layardii* is the most frequently recorded and events involving this species have been reported along much of the coast (Fig. 13). Some events in the gulfs were live strandings and these demonstrate that at least some animals are alive in shallow waters and have not simply washed in from deepwater environments. Since 1919 when the first beaked whale was recorded, the average number of events per year is 0.7. Between 1980 and 2007 (when reporting has probably been more intense and consistent) there have been 1.9 events per year.

There appear to be more records of beaked whales along the west coast of Eyre Peninsula and Kangaroo Island through to the far southeast than elsewhere in the State, although observer effort may play a part in the paucity of records for the far west of South Australia. The Murray Canyons and Ceduna Canyons may be important factors in beaked whale distribution. No trends were apparent in species distributions although for most species, the number of records was small.

The beaked whale fauna of Western Australia is somewhat different to South Australia. Nine species are present in the collections of the Western Australian Museum and *M. hectori* is known from an inshore sighting (Gales et al. 2002). This is compared to South Australia's eight species (lacking *M. densirostris* and *M. mirus*). More *M. grayi* and *Z. cavirostris* were represented in the WA Museum collections (10 out of 40 beaked whale specimens) and fewer *M. layardii* (5/40) than at the South Australian Museum. Since the continental shelf off Western Australia is much narrower than South Australia, this may indicate that *M. grayi*, *Z. cavirostris* and *M. mirus* are truly deepwater inhabitants. It is also possible that there is a difference between the prey of these species and that the two regions vary in prey fauna. The presence of *M. densirostris* in the Western Australian fauna is a reflection of the tropical and subtropical nature of this species.

Seasonal Trends

Seasonal variation was analysed by summarizing sighting and stranding records according to month of observation for species and species groups. It is important to note that observer effort can affect the number of records from different seasons. For example, summer (especially during school holidays in December and January) is a popular season for people to be at the coast and the chances of seeing a dead whale may be higher then. In addition, many of the offshore observations were made by tuna spotters who flew the Great Australian Bight during summer and early autumn.

Baleen whales

Eubalaena australis followed the pattern reported by others (Kemper et al. 1997) with most sightings recorded during May to October (Fig. 14). Stranding events are relatively uncommon in South Australia and have been recorded in February, July, August and October (Fig. 15).

More sighting records of *Caperea marginata* in South Australia are available but they are not part of the main database and time constraints did not permit their inclusion. However, a review of all Australian and New Zealand records is available (C. Kemper, unpublished data) that shows a summer and autumn peak in sightings and 'strandings'. This may, in part, be related to summer/autumn coastal upwelling

events in some regions, including South Australia (Gill et al. in press). 'Strandings' in South Australia have been recorded in all months except June, July and November.

Megaptera novaeangliae was sighting in all months, with peak numbers in June and July (Fig. 16). Kemper (2005) concluded that this could be related to the northward migration from feed to breeding grounds. There is untested evidence that the number of sightings of *M. novaeangliae* is increasing. Other species in the family Balaenopteridae are less numerous in the database. Sightings may be more frequent in summer and autumn (Fig. 16) whereas strandings peak in September (Fig. 17). Kemper and Ling (1991) concluded that this spring peak was largely related to an increase in 'stranded' juveniles and the fact that strong spring winds in could push dead and weakened animals onto shore.

Toothed whales and dolphins (other than beaked whales)
Sightings of *P. macrocephalus* were more frequent between January and April (Fig. 18), a trend that may have been biased by the fact that tuna spotters were flying during summer in the Great Australian Bight. 'Strandings' were recorded in all months except February, with no obvious peak season for these events (Fig. 19). It is important to note that many sperm whales 'stranded' in South Australia were decomposed carcasses and that the whales may have died a month or more before they washed up.

There were only two sighting records of *Kogia* spp., both in March. Stranding records of *Kogia* spp. (mostly *K. breviceps*) were most numerous from July to November (Fig. 20). These data suggest possible seasonal movements closer to the coast, perhaps in search of prey.

Sighting records of *Tursiops* spp. are not numerous in the South Australian Museum database (Fig. 21) and are probably of little use in the context of the present report. Data are available for Gulf St Vincent and Investigator Strait (M. Bossley, pers. comm.) from other sources. The stranding record shows a peak in summer and early autumn (Fig. 22), perhaps a result of more young animals dying during the calving season (Kemper et al. 2008). A similar pattern was found for *Delphinus delphis* with few sighting records and an autumn peak in strandings (Fig. 23 and 24). There were many neonates and young calves in the stranding record at that time.

Sightings of *Globicephala* spp. were most frequent in March (Fig. 25) but as with *P. macrocephalus*, this may be biased by observer effort. Strandings of *Globicephala* spp. occurred throughout the year with an apparent peak in September (Fig. 26).

The most frequently sighted large delphinid was *O. orca*, with records available for all months except August (Fig. 27). Sightings were most frequent in July, although more data are needed to test if there is a true seasonal bias. There are only five dated strandings in the database with four of these in November and December (Fig. 28). Data for *G. griseus* and *P. crassidens* are too sparse to conclude any seasonal trends (Fig. 27 and 28).

Beaked whales
There were only nine dated beaked whale sightings, most of which were in summer and autumn (Fig. 29). Of note are three *Hyperoodon planifrons* sightings in February

and one in December. A total of 66 dated stranding records of beaked whales were available and of these 59 (89%) occurred during November to April (Fig. 30). Peak months were January and February with very few records during late autumn and winter. The data reflect the numbers of *M. layardii*, since this was the most frequently stranded species. Reasons for peak records in summer and autumn are not known but may be related to movements onto the shelf or an increased abundance of food in their presumed feeding grounds on the shelf slope or nearby canyons [ref for beaked whale feeding needed]. Acoustic monitoring would be a cost-effective way of determining seasonal trends on and off the shelf.

Circumstance of 'death'

The following analysis uses data to the end of 2007 but includes three noteworthy records from 2008—a *C. marginata* vessel collision, a live stranded *F. attentuata* and a *M. layardii* (identity needs confirmation) entangled in rock lobster line and buoys. From a total of 941 records, 583 (62%) were not assigned to a circumstance (U in Table 3). A number of Unknown events were qualified by a description of possible circumstances, either human-related or natural. The remaining 359 events (38%) were divided into categories relating to intentional human-related events (Intentional Killing = I, Captured = C) and unintentional human-related events (Known Entanglement = E, Probable Entanglement = EP, Other Unintentional = OU) and events not directly related to human factors (D, ON, S). These are defined in Appendix 3. The distribution of events in each category is found in Figures 31–38.

Intentional killing and Captured were established as circumstance for 34 events (6%). All except two involved *D. delphis* and *Tursiops* spp. and no additional records were obtained since the year 2000 when Kemper et al. (2005) summarised data for South Australia. Records appeared to be concentrated in the lower Eyre Peninsula and greater Adelaide region (Fig. 31). Of note is that since the formation of the Dolphin Trauma Group in Adelaide after a spat of shootings in 1998 and the subsequent publicity associated with all dolphin deaths in the region, there have been no known intentional killings of dolphins. Information on some of the intentional killings has been published (Gilbert et al. 2000, Byard et al. 2001).

Unintentional human-related events (mostly entanglements) were found in 113 records (19%) involving nine species (Table 3). Notable species were:

E. australis (refer to details in Kemper et al. in press)

C. marginata

- one entangled in a fishing net during the late 1800s near Victor Harbor
- one involved in a probable vessel collision and found dead near Port Lincoln

K. breviceps

- one involved in a probable vessel collision
- one probable entanglement in an inshore net in Fowler Bay

P. macrocephalus

- a vessel collision during 2007 and washed up in the southeast of the State
- two known entanglements in longline
- two probable entanglements in which longline was suspected

Globicephala spp.

- an unconfirmed entanglement from the south east of the State

The remaining unintentional human-related records involved bottlenose and common dolphins, many of which were entanglements in the tuna farming industry near Port Lincoln during the 1990s (Kemper and Gibbs 2001). Management practices incorporating recommendations from the study of Kemper and Gibbs (2001) have apparently reduced the number of fatal interactions. A notable increase in deaths attributed to entanglement in northern Spencer Gulf since 2001 has given cause for concern for resident *T. aduncus*. Non-fatal entanglements in recreational fishing are frequent in the Adelaide region but to date there are only two known cases of mortality. Several dolphins have been found with ingested fishing gear (Table 5).

The South Australian Sardine Fishery operates in lower Spencer Gulf, off Coffin Bay and in Investigator Strait. Purse seining methods resulted in numerous dolphins (probably all *D. delphis*) dying as a result of entanglement until 2005 when a Code of Practice was introduced (Hamer et al. 2007). Many entanglements went unreported and at the same time the number of common dolphin carcasses washing up in the region rose. Most of the dolphins known to have died in the SA Sardine Fishery were not available for Museum's databases.

Many of the Known Entanglements were a result of interactions involving unidentified ropes, lines or nets (Table 4).

Known and Probable Entanglements were numerous around lower Eyre Peninsula, northern Spencer Gulf and northern Encounter Bay but were also recorded in other parts of the State (Fig. 32 and 33). Other Unintentional events are mapped in Fig. 34 and include a fatal vessel collision (passenger ferry) of a *E. australis* (Kemper et al. in press).

Vessel collisions were recorded in a variety of species including large and small cetaceans (Table 5).

Disease and Other Natural categories made up 105 (18%) of records. There is some inconsistency in the database regarding neonatal deaths (sometimes included in Unknown and sometimes in Other Natural). Significant disease findings since 2000 when Kemper et al. (2005) summarised the types recorded to that point are as follows:

- papilloma virus that resulted in the death of an Adelaide *T. aduncus*
- severe arthritis
- chronic lung nematode infections
- hepatic tumour

Of these, the most serious has been the lung nematode disease. During 2005 and 2006 there was an epidemic of this condition in *D. delphis* (Tomo and Kemper, in prep.) and many young dolphins (pre-weaning) died. The cause of the outbreak is not known but it is possible that the animals were 'stressed' in some way and this allowed the parasites to build up in the lungs, reducing breathing capacity.

Live strandings were recorded on 108 occasions (some involved multiple animals), which was 19% of all events assigned to categories of known circumstance. *Delphinus delphis* (26) and *Tursiops* spp. (27) stranded alive more often than other

species but they were also the most numerous in the overall record. Of note were also the following:

- *Kogia* spp. = 12 live strandings out of 31 events (39%)
- *Mesoplodon layardii* = 10 live strandings out of 37 (27%)
- Beaked whales combined = 18 live strandings out of 69 (26%)

Live stranded baleen whales occurred generally along protected coasts (Fig. 35) and *Tursiops* spp. and *D. delphis* are frequent in the gulfs region (Fig. 36). Beaked whales stranded alive more often along the west coast of the Eyre Peninsula than elsewhere, though the sample size is not large (Fig. 37). Live strandings of the remaining species were primarily in the gulfs region (Fig. 38).

Threats to South Australian cetaceans

Pelagic species

Large whale species are at risk of entanglement in longlines (especially *P. macrocephalus* since this species may depredate the longline fishery and several cases are known for South Australia) and the ropes and lines associated with trapping crustaceans in coastal waters. *Eubalaena australis* may be particularly vulnerable to this latter type of entanglement (Kemper et al. in press) as might *M. novaeangliae*. Vessel collision may not be as serious a problem as some other parts of the world but events that occur well offshore are likely not to be detected.

The increase in oil and gas exploration and mining are likely to have an impact on large whales because infrastructure and activity will bring whales into contact with humans more. Disturbance to calving grounds and migration routes could be an important factor for *E. australis*.

There are few data on the levels of toxic contaminants in large whale species. Determining the threat posed to *P. macrocephalus* may be quite important since this is a long-lived predator occupying the top end of the food web.

Other pelagic species will experience different threats. There is some evidence that *Orcinus orca* might be involved in depredation of fishing operations in South Australia. In November and December 1999, two whales died under suspicious circumstances near Port Lincoln and the north coast of Kangaroo Island (Gibbs and Kemper 2004). Unpublished data are also available that implicates depredation, or at least interaction, with the fishing industry in the Great Australian Bight.

Small cetaceans are known to die in active net fishing in South Australian waters. For example, *Tursiops* sp. is a frequently caught dolphin in the Southern Shark Fishery (annual reports by DEWH to IWC) but the effect on the population of (presumably) *T. truncatus* is not known. There have been many *D. delphis* die in the purse seine fishery in Southern Spencer Gulf and Investigator Strait (Hamer et al. 2007). Until population sizes and true mortality rates are known, the threat posed to these species will remain unknown.

Inshore species

Tursiops aduncus is the only obligate inshore cetacean in South Australia and is under threat from a variety of human activities. Intentional killing is probably no longer a major concern. Entanglement in finfish aquaculture farms and active fishing nets may

be a serious threat to some 'populations' (Kemper et al. 2003) and recreational fishing gear is a concern near major centres of human population. Coastal development that leads to habitat loss or degradation is an increasing problem for *T. aduncus* in South Australia yet there is little specific knowledge on how these dolphins would be affected. Levels of some toxic contaminants (e.g. cadmium, zinc, mercury) are high by world standards and pathological consequences have been identified (Lavery et al. 2008).

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Yamada, T. K., Kemper, C., Tajima, Y., Umetani, A., Janetzki, H. and Pemberton, D. (2006) Marine mammal collections in Australia. Pp. 117–126 in Tomida *et al*. (Eds) Proceedings of the 7th and 8th Symposium on Collection Building and Natural History Studies in Asia and the Pacific Rim. National Science Museum Monographs 34: 117-126.

Table 1: Records of strandings and other circumstances (not including sightings of live animals) involving South Australian cetaceans held in Museum database to 2007. Multiple records can represent single event. Number of events = 964. ID 1 and 2 = taxon identification with certainty (1) and probable (2). Pick-up, fossil and unknown age material excluded from some analyses.

Species	All records ID 1+2	Pick-up and fossil records	Unknown Age mat.
Eubalaena australis	30	20	
Caperea marginata	30	4	1
Balaenoptera sp.	5	3	1
Balaenoptera acutorostrata	1		
Balaenoptera bonaerensis	14	1	
Balaenoptera borealis	0		
Balaenoptera edeni	6	1	1
Balaenoptera musculus	10	3	1
Balaenoptera physalus	2		
Megaptera novaeangliae	8	1	2
Delphinus delphis	400	9	10
Globicephala sp.	6		
Globicephala macrorhynchus	16	1	1
Globicephala melas	32		1
Grampus griseus	4		1
Lagenorhynchus obscurus	0		
Lissodelphis peronii	1		
Orcinus orca	9	3	1
Pseudorca crassidens	5	4	
Feresa attenuata	(1)		
Tursiops sp.	79	1	3
Tursiops aduncus	221	8	6
Tursiops truncatus	46	4	5
Phocoena dioptrica	1		
Kogia sp.	3		
Kogia breviceps	35	1	2
Kogia sima	2		
Physeter macrocephalus	66	22	9
Berardius arnuxii	1		
Hyperoodon planifrons	7	1	
Mesoplodon sp.	10		
Mesoplodon bowdoini	4	1	
Mesoplodon grayi	13	2	2
Mesoplodon hectori	3		
Mesoplodon layardii	51	7	
Tasmacetus shepherdi	1		
Ziphius cavirostris	2		
Total	1161	97	47

Table 2: Cetacean sighting records held in South Australian Museum database to 2007. ID 1, 2 and 4 = taxon likely to be correct. ID 3 = identification assigned but some doubt as to taxon. See Appendix 2 for definitions of ID categories.

Taxon	**ID 1, 2 and 4**	**ID 3**
Cetacea	67	12
Large cetacean	129	17
Medium cetacean	33	4
Small cetacean	8	1
Eubalaena australis	1416	160
Caperea marginata	1	3
Balaenopteridae	13	10
Balaenoptera sp.	6	2
Balaenoptera 'bonaerensis'	1	5
Balaenoptera edeni	2	
Balaenoptera musculus	16	15
Balaenoptera physalus	1	4
Megaptera novaeangliae	103	34
Delphinidae	340	4
Delphinus delphis	41	5
Globicephala sp.	20	11
Globicephala melas	13	
Grampus griseus	1	4
Lissodelphis peronii	1	
Orcinus orca	59	23
Pseudorca crassidens		2
Feresa attenuata		
Tursiops sp.	32	10
Tursiops aduncus	9	
Tursiops truncatus	2	2
Kogia sp.		2
Physeter macrocephalus	41	6
Berardius arnuxii	1	1
Hyperoodon planifrons	1	3
Ziphiidae	2	2
Total	2359	342

Table 3: Circumstance of death/event for South Australian cetaceans. I = Intentional killing, C = captured, E = Known Entanglement, EP = Probable Entanglement, OU = Other Unintentional, D = Disease, ON = Other Natural, S = Live Stranding, U = Unknown. Categories defined in Appendix 3. Numbers are events, not individuals.

Species	I	C	E	EP	OU	D	ON	S	U	Total	Comments
Eubalaena australis	1		2		2		1		4	10	I = 1 animal shot at
Caperea marginata			1		1			4	20	26	OU = vessel collision in 2008
Balaenoptera sp.									1	1	
Balaenoptera acutorostrata									1	1	
Balaenoptera bonaerensis								3	10	13	U = includes 1 possible vessel collision
Balaenoptera edeni								1	3	4	
Balaenoptera musculus									7	7	
Balaenoptera omurai									1	1	
Balaenoptera physalus								1	1	2	
Megaptera novaeangliae							1		4	5	
Delphinus delphis	14	1	31	17	4	18	23	26	232	366	
Globicephala sp.				1					5	6	
Globicephala macrorhynchus							1	3	8	12	S = includes 1 mass stranding
Globicephala melas	1			1		1	8	3	16	30	
Grampus griseus								1	2	3	
Lissodelphis peronii									1	1	
Orcinus orca							1	1	3	5	U = includes 2 suspicious circumstances
Pseudorca crassidens							1	2		3	S = includes 2 mass strandings
Feresa attenuata								1		1	S = includes 1 live stranding in 2008

Tursiops sp.	1	1	3	2	1	1	1	12	50	72	U = includes 4 possible entanglements
Tursiops aduncus	11	4	19	14	5	25	18	7	100	203	U = includes 2 suspected shot, 16 suspected entanglements, 1 suspected intentional killing
Tursiops truncatus					1	3	2	8	14	28	
Phocoena dioptrica								1		1	
Kogia sp.								1	2	3	
Kogia breviceps				1	1			9	14	25	U = includes 1 possible entanglement, 2 possible vessel collisions
Kogia sima								2		2	
Physeter macrocephalus			2	2	1			4	33	42	U = includes 5 possible entanglements
Berardius arnuxii								1		1	
Hyperoodon planifrons								1	5	6	U = includes 1 possible entanglement
Mesoplodon sp.								4	3	7	
Mesoplodon bowdoini									3	3	
Mesoplodon grayi								1	8	9	
Mesoplodon hectori								1	2	3	
Mesoplodon layardii			1					10	26	37	E = includes 1 entanglement in 2008
Tasmacetus shepherdi									1	1	
Ziphius cavirostris									2	2	
Total	28	6	59	38	16	48	57	108	583	942	

Table 4: Type of gear involved in cetacean entanglements in South Australia. ( ) = evidence unsubstantiated, not included in total. + = other records are available from Hammer et al. [ref]. **Mesoplodon layardii* entanglement was during 2008.

Species	Craypot line	Rock lobster line	Fisheries longline	Recreational fishing line	Monofilament net	Unknown net/line/rope	Aquaculture net	Purse seine net	Total
Eubalaena australis	1		1						2
Caperea marginata						1			1
Delphinus delphis	2				2	5	12 (4)	13 +	34
Globicephala melas						1			1
Tursiops sp.				1	2	1	1		5
Tursiops aduncus				2		7	15		24
dolphin							3		3
Kogia breviceps						1			1
Physeter macrocephalus			2			7			9
Mesoplodon layardii		1							1*
Total	3	1	3	3	4	23	31	13	81

Table 5: Unintentional human interactions (other than entanglement) involving South Australian cetaceans. Possible events ( ) included if data suggest an interaction took place. *= some data from 2008.

Species	Ingested fishing gear	Vessel collision	Total
Eubalaena australis		2	2
Caperea marginata		1*	1
Balaenoptera bonaerensis		(1)	1
Delphinus delphis		3	3
Tursiops aduncus	3*	4 (2)	9
Kogia breviceps		1 (1)	2
Physeter macrocephalus		1	1
Total	3	16	19

Appendices

Appendix 1: List of scientific and common names of South Australian cetaceans.

BALEEN WHALES

Family Balaenidae

Southern Right Whale - *Eubalaena australis*

Family Neobalaenidae

Pygmy Right Whale - *Caperea marginata*

Family Balaenopteridae

Dwarf Minke Whale - *Balaenoptera acutorostrata*
Antarctic Minke Whale – *Balaenoptera bonaerensis*
Sei Whale - *Balaenoptera borealis* (sighting only)
Bryde's Whale - *Balaenoptera edeni*
Blue Whale - *Balaenoptera musculus*
Fin Whale - *Balaenoptera physalus*
Humpback Whale - *Megaptera novaeangliae*

TOOTHED WHALES

Family Delphinidae

Short-beaked Common Dolphin - *Delphinus delphis*
Short-finned Pilot Whale - *Globicephala macrorhynchus*
Long-finned Pilot Whale - *Globicephala melas*
Risso's Dolphin - *Grampus griseus*
Dusky Dolphin - *Lagenorhynchus obscurus* (sighting only)
Southern Right Whale Dolphin – *Lissodelphis peronii*
Killer Whale - *Orcinus orca*
False Killer Whale - *Pseudorca crassidens*
Pygmy Killer Whale – *Feresa attenuata*
Indo-Pacific Bottlenose Dolphin – *Tursiops aduncus*
Common Bottlenose Dolphin - *Tursiops truncatus*

Family Phocoenidae

Spectacled Porpoise - *Phocoena dioptrica*

Family Kogiidae

Pygmy Sperm Whale - *Kogia breviceps*
Dwarf Sperm Whale - *Kogia sima*

Family Physeteridae

Sperm Whale - *Physeter macrocephalus*

Family Ziphiidae

Arnoux's Beaked Whale - *Berardius arnuxii*
Southern Bottlenose Whale - *Hyperoodon planifrons*
Andrews' Beaked Whale - *Mesoplodon bowdoini*
Gray's Beaked (Scamperdown) Whale - *Mesoplodon grayi*
Hector's Beaked Whale - *Mesoplodon hectori*
Straptooth Whale - *Mesoplodon layardii*
Shepherd's Beaked Whale - *Tasmacetus shepherdi*

Cuvier's Beaked Whale - *Ziphius cavirostris*

Appendix 2: Definitions of reliability of taxonomic identifications used in this report and databases.

Stranding database: 1 = with certainty, 2 = probable, 3 = doubtful, but some evidence that this is the taxon assigned.

Sighting database: 1 = with certainty (usually photos accompany information), 2 = probable, 3 = doubtful but some evidence as to taxon identity, 4 = no descriptive information supplied but likely to be okay because from a reasonably reliable source e.g. South Australian Whale Centre.

Appendix 3: Definitions of Circumstance of 'Death' used in this report and

I - intentional killing, eg, shot, speared/stabbed
C - captured, eg. Marineland of SA
E - known entanglement, eg. aquaculture-tuna, snapper, salmon nets, mussel line, fisheries longline, pilchard purse-seine, shark net
EP - probable entanglement, eg. dorsal fin or flukes cut off/ net marks/ food in oesophagus/ blood in abdomen
OU - other unintentional, eg. boat strike, propeller wounds, acoustic damage, skull fracture/damage, sudden death
D - diseased, eg. significant parasites, heart disease, infection,
ON - other natural, eg. choked on shark, starved, neonatal death, predator (killer whale, shark)
S - live stranding, eg. put back to sea and died, euthanaised, died after stranding
U - unknown, eg. no information, too decomposed, incomplete specimen 'stranding' database.

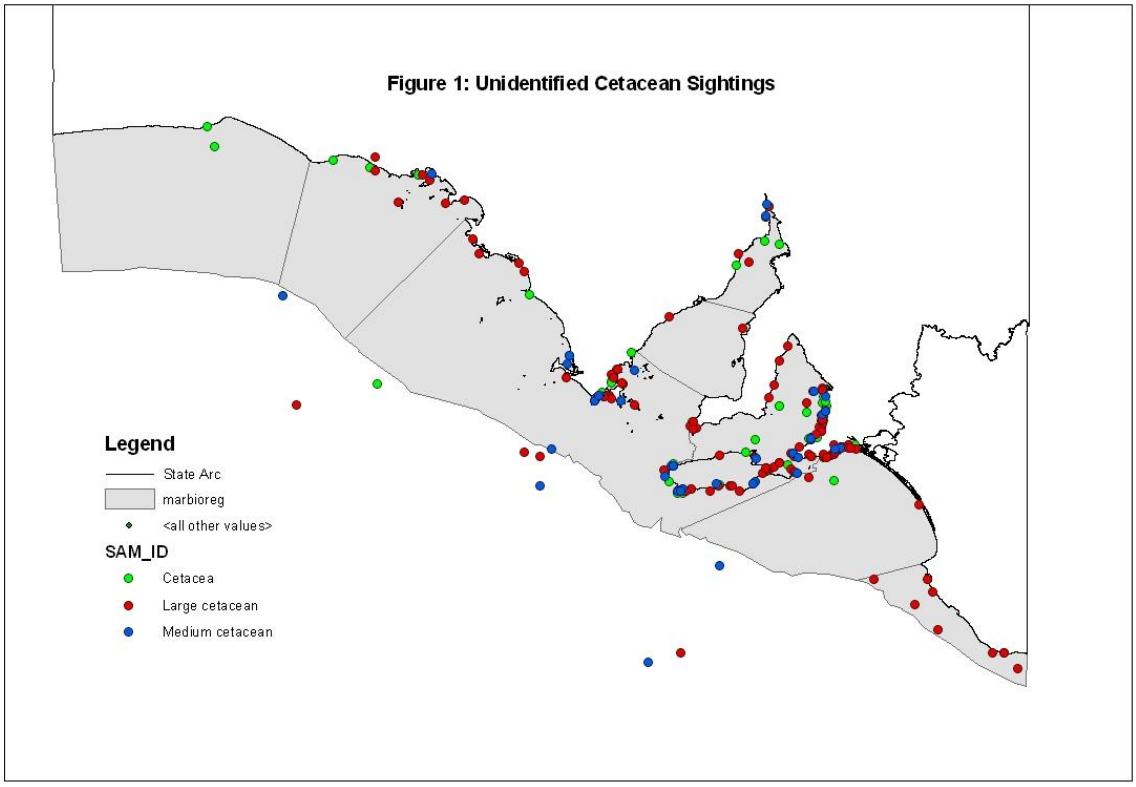


Figure 1: Unidentified Cetacean Sightings
Legend
State Arc
marbioreg
<all other values>
SAM_ID
Cetacea
Large cetacean
Medium cetacean

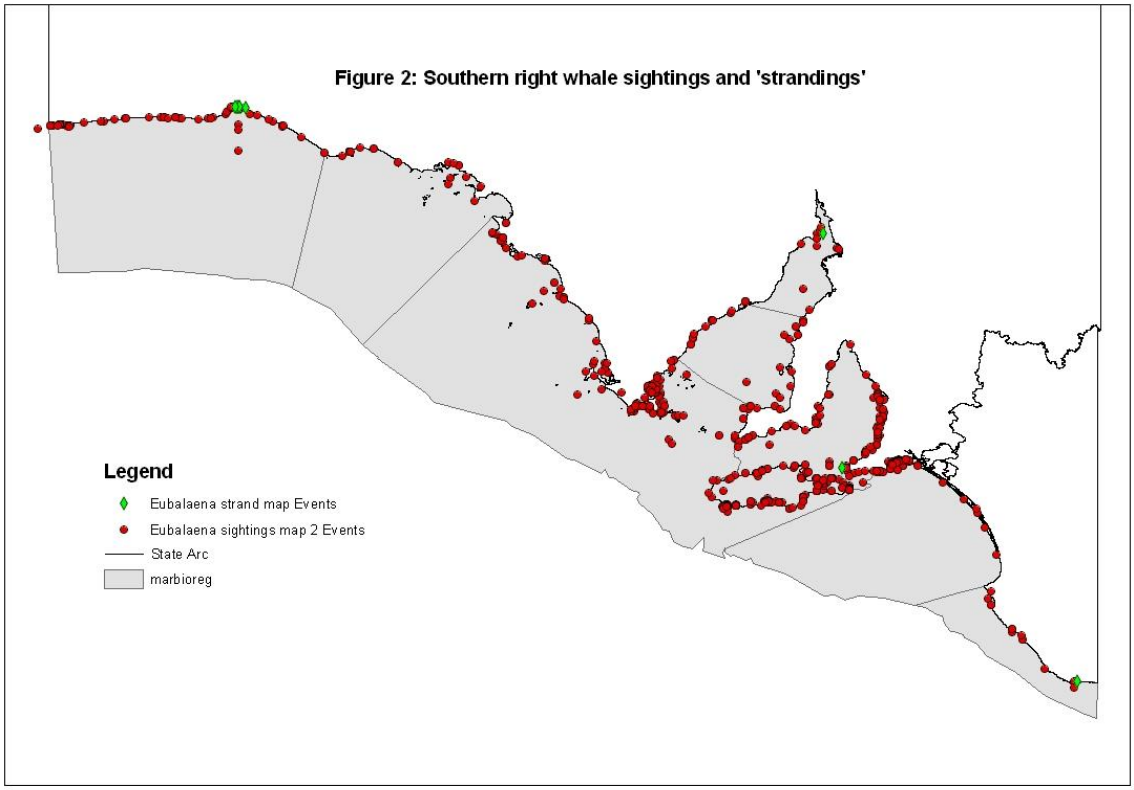


Figure 2: Southern right whale sightings and 'strandings'
Legend
Eubalaena strand map Events
Eubalaena sightings map 2 Events
State Arc
marbioreg

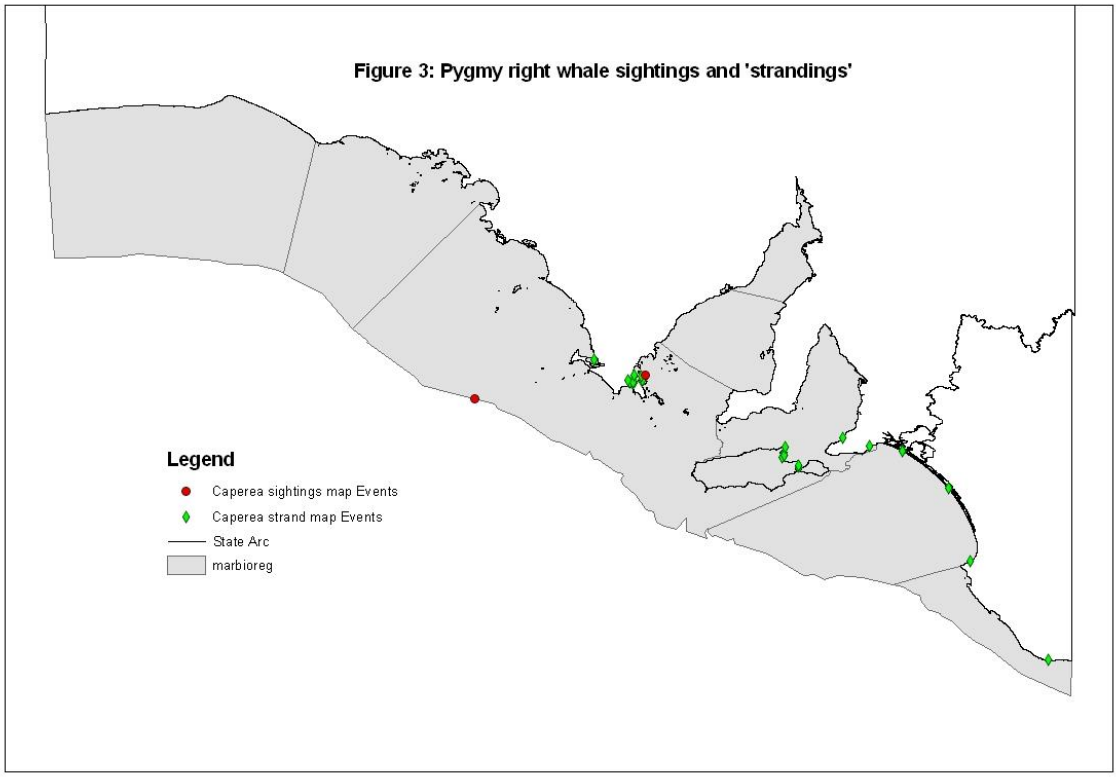


Figure 3: Pygmy right whale sightings and 'strandings'
Legend
Caperea sightings map Events
Caperea strand map Events
State Arc
marbioreg

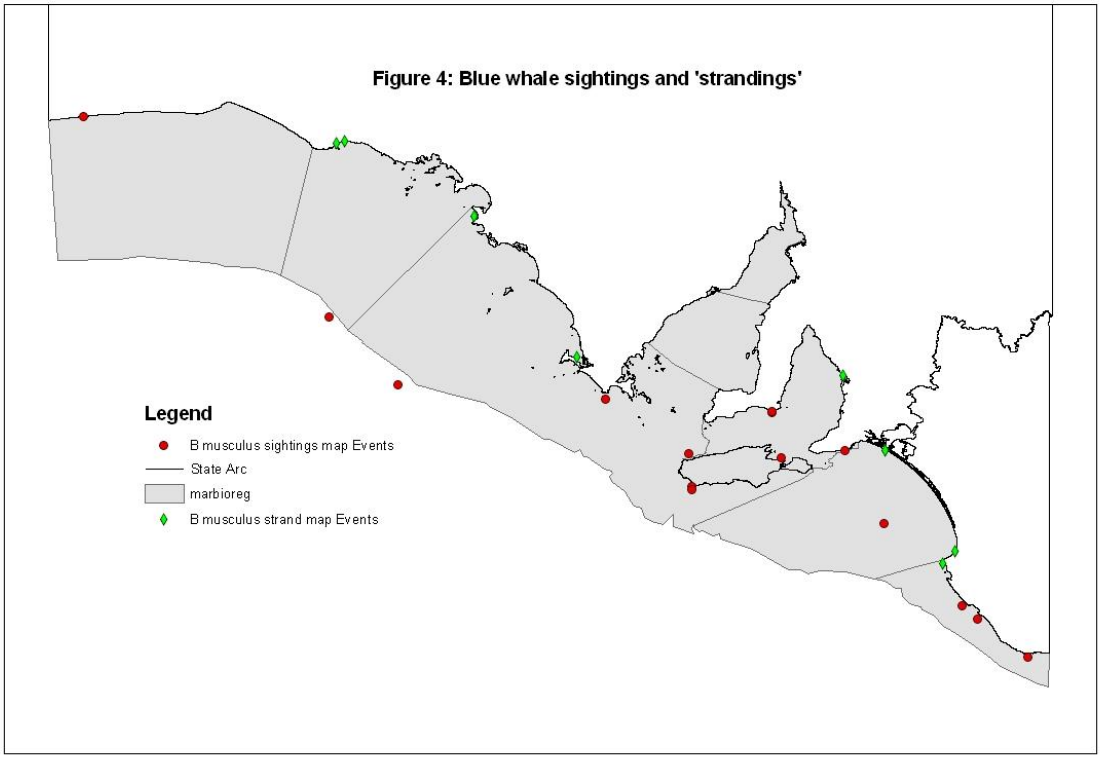


Figure 4: Blue whale sightings and 'strandings'
Legend
B musculus sightings map Events
State Arc
marbioreg
B musculus strand map Events

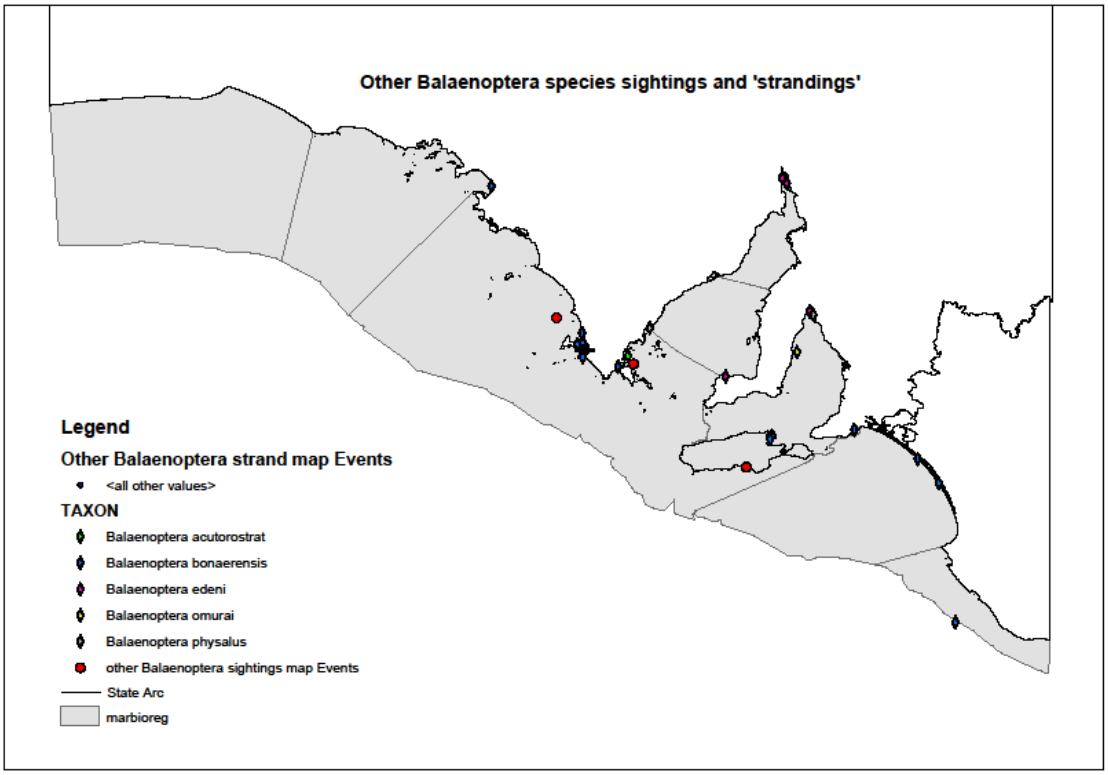

Other Balaenoptera species sightings and 'strandings'
Legend
Other Balaenoptera strand map Events
<all other values>
TAXON
Balaenoptera acutorostrat
Balaenoptera bonaerensis
Balaenoptera edeni
Balaenoptera omurai
Balaenoptera physalus
other Balaenoptera sightings map Events
State Arc
marbioreg

Fig. 4a

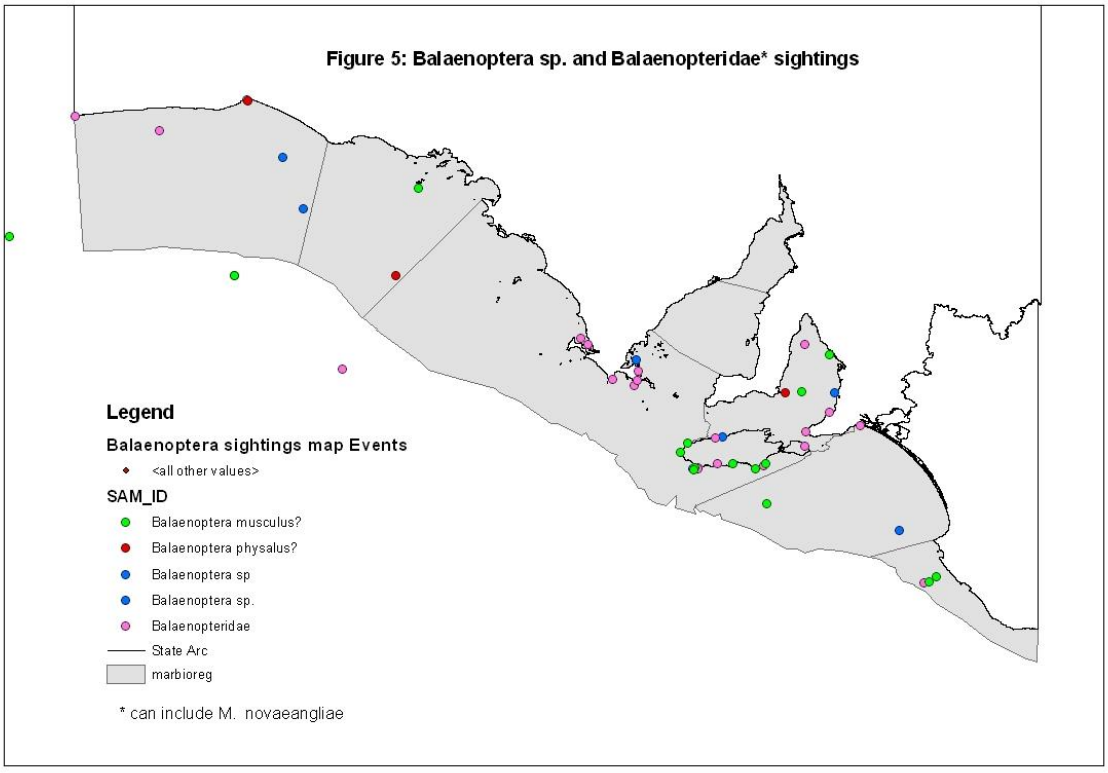


Figure 5: Balaenoptera sp. and Balaenopteridae* sightings
Legend
Balaenoptera sightings map Events
<all other values>
SAM_ID
Balaenoptera musculus?
Balaenoptera physalus?
Balaenoptera sp
Balaenoptera sp.
Balaenopteridae
State Arc
marbioreg
* can include M. novaeangliae

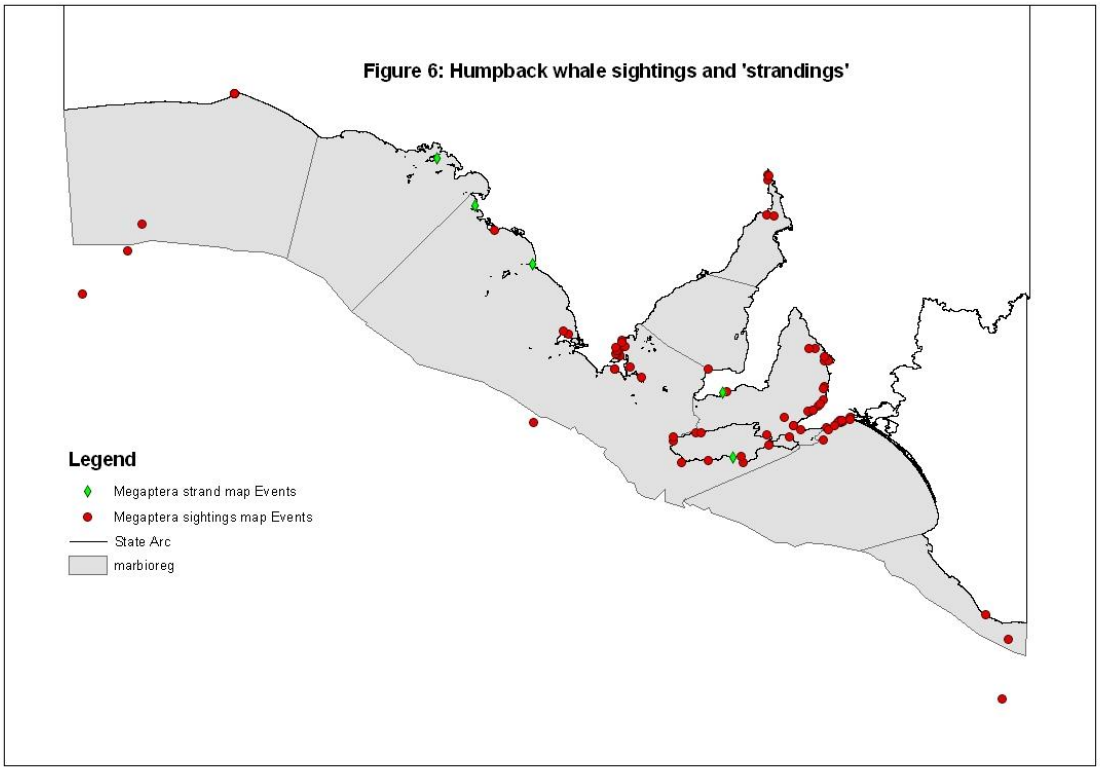


Figure 6: Humpback whale sightings and 'strandings'
Legend
Megaptera strand map Events
Megaptera sightings map Events
State Arc
marbioreg

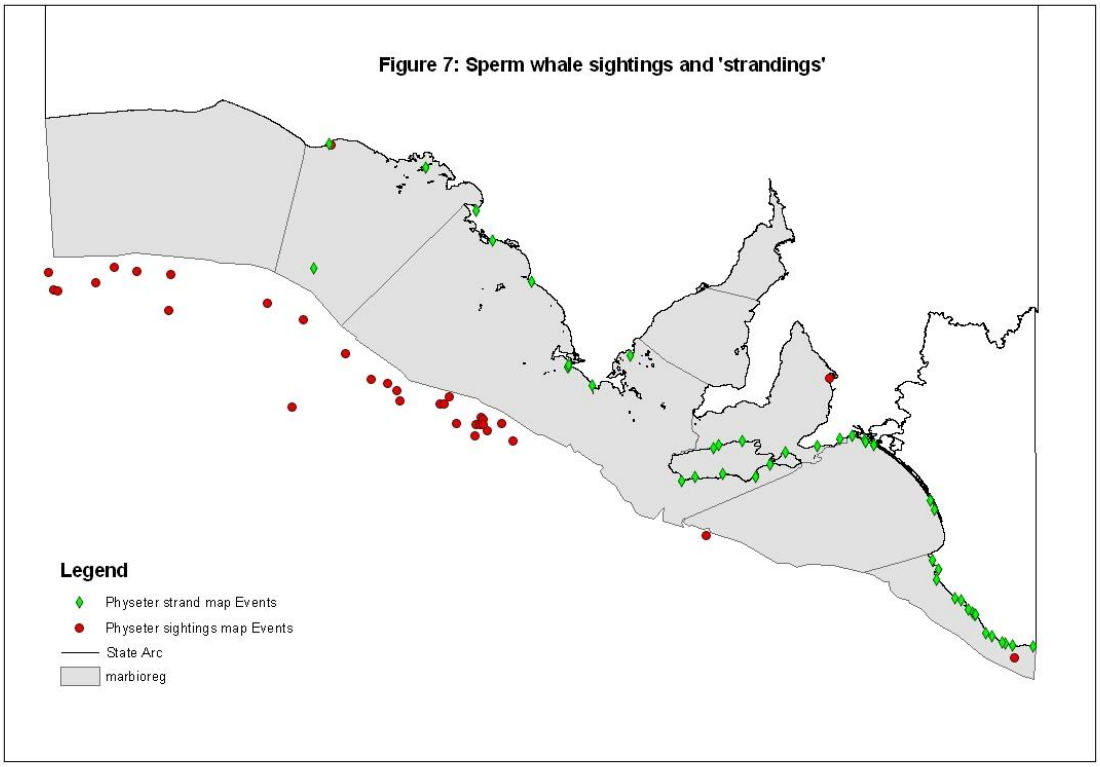


Figure 7: Sperm whale sightings and 'strandings'
Legend
Physeter strand map Events
Physeter sightings map Events
State Arc
marbioreg

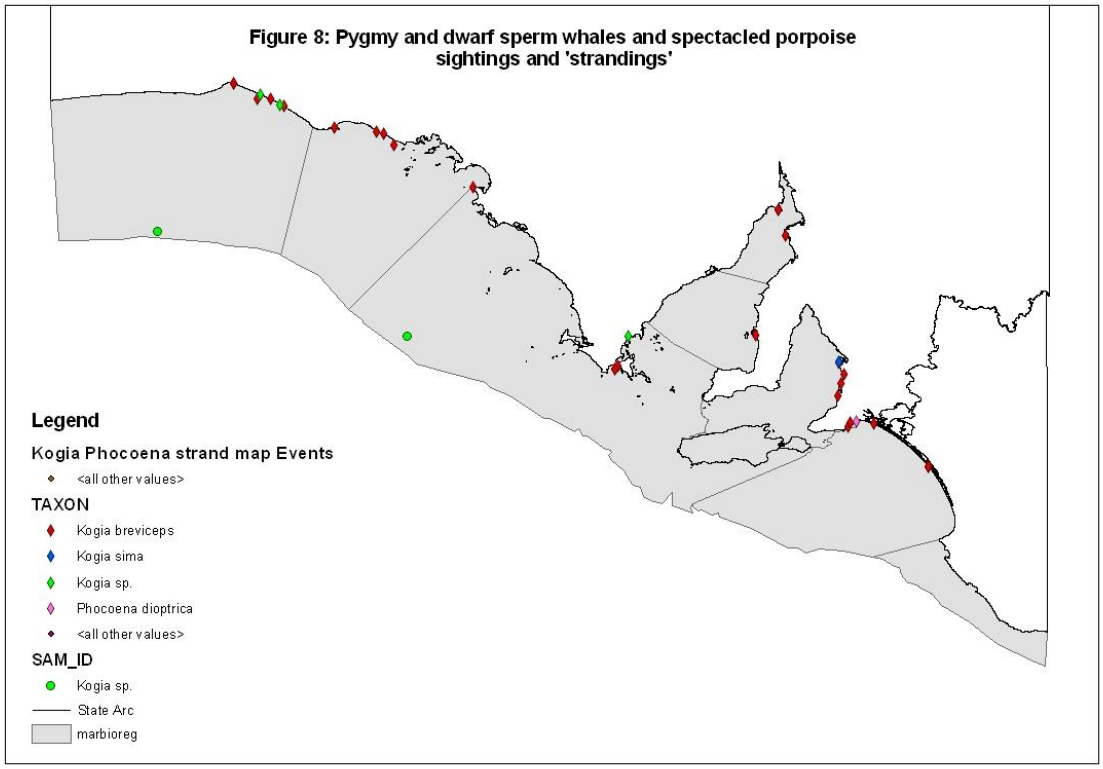


Figure 8: Pygmy and dwarf sperm whales and spectacled porpoise sightings and 'strandings'
Legend
Kogia Phocoena strand map Events
<all other values>
TAXON
Kogia breviceps
Kogia sima
Kogia sp.
Phocoena dioptrica
<all other values>
SAM_ID
Kogia sp.
State Arc
marbioreg

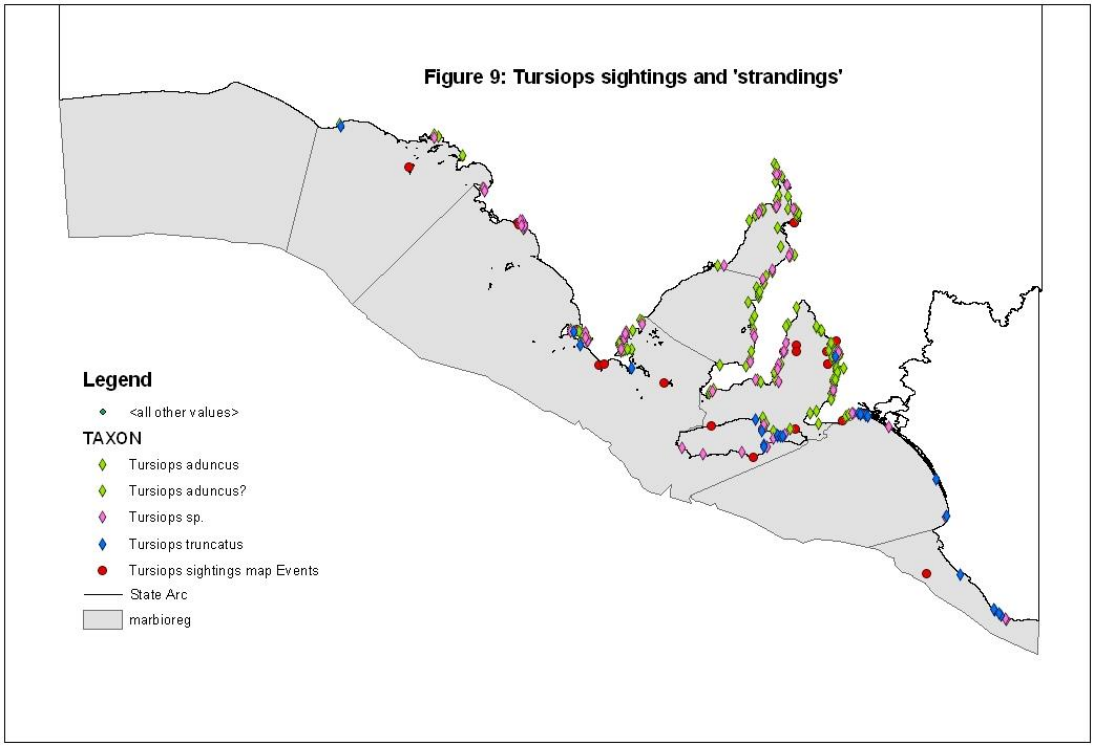


Figure 9: Tursiops sightings and 'strandings'
Legend
<all other values>
TAXON
Tursiops aduncus
Tursiops aduncus?
Tursiops sp.
Tursiops truncatus
Tursiops sightings map Events
State Arc
marbioreg

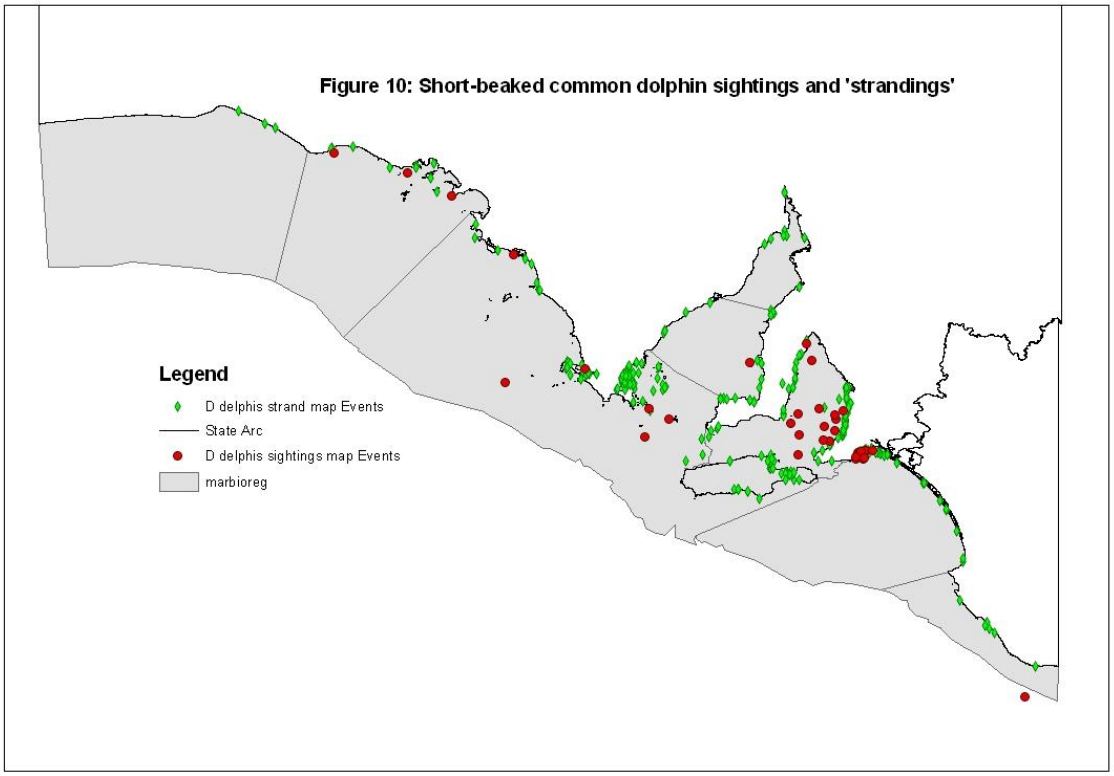


Figure 10: Short-beaked common dolphin sightings and 'strandings'
Legend
D delphis strand map Events
State Arc
D delphis sightings map Events
marbioreg

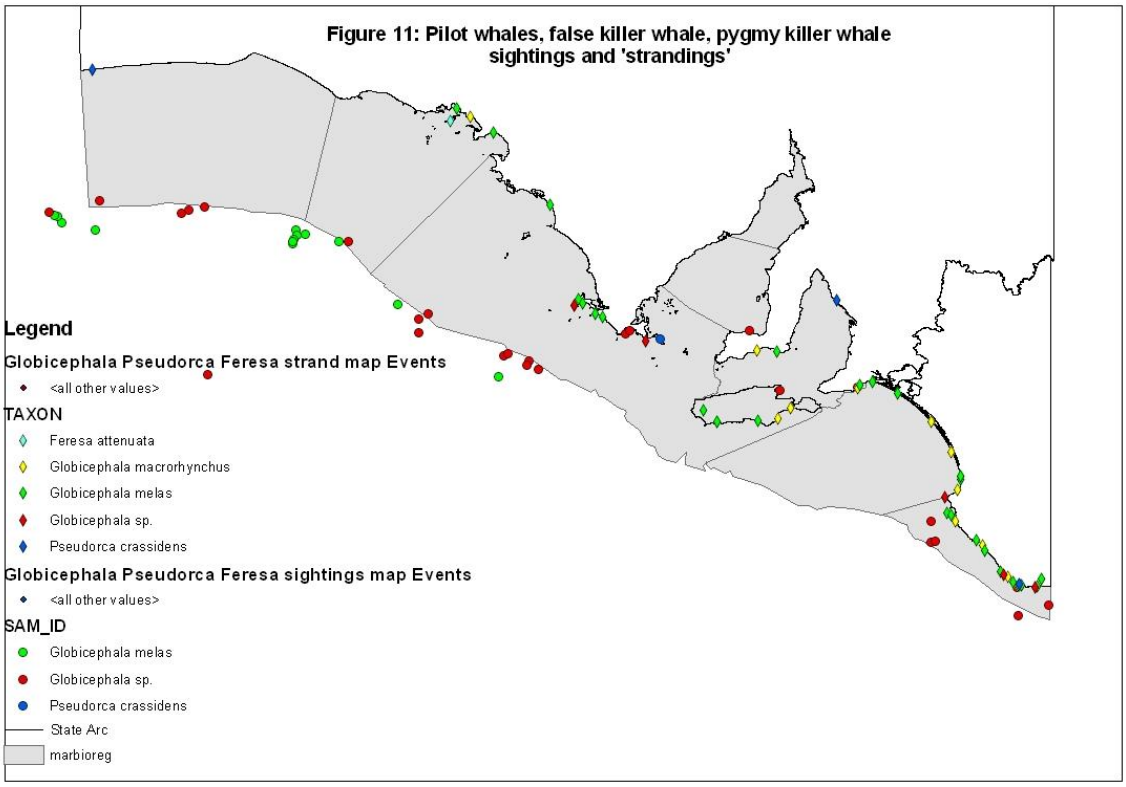


Figure 11: Pilot whales, false killer whale, pygmy killer whale sightings and 'strandings'
Legend
Globicephala Pseudorca Feresa strand map Events
<all other values>
TAXON
Feresa attenuata
Globicephala macrorhynchus
Globicephala melas
Globicephala sp.
Pseudorca crassidens
Globicephala Pseudorca Feresa sightings map Events
<all other values>
SAM_ID
Globicephala melas
Globicephala sp.
Pseudorca crassidens
State Arc
marbioreg

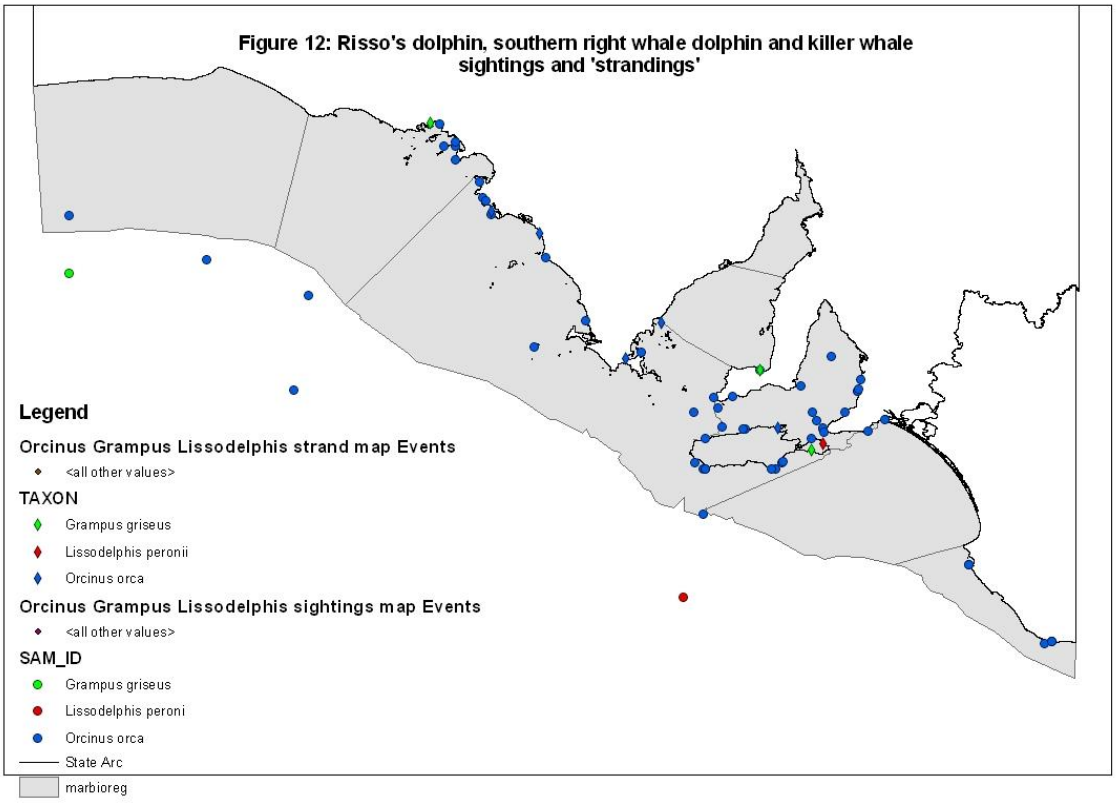


Figure 12: Risso's dolphin, southern right whale dolphin and killer whale sightings and 'strandings'
Legend
Orcinus Grampus Lissodelphis strand map Events
<all other values>
TAXON
Grampus griseus
Lissodelphis peronii
Orcinus orca
Orcinus Grampus Lissodelphis sightings map Events
<all other values>
SAM_ID
Grampus griseus
Lissodelphis peroni
Orcinus orca
State Arc
marbioreg

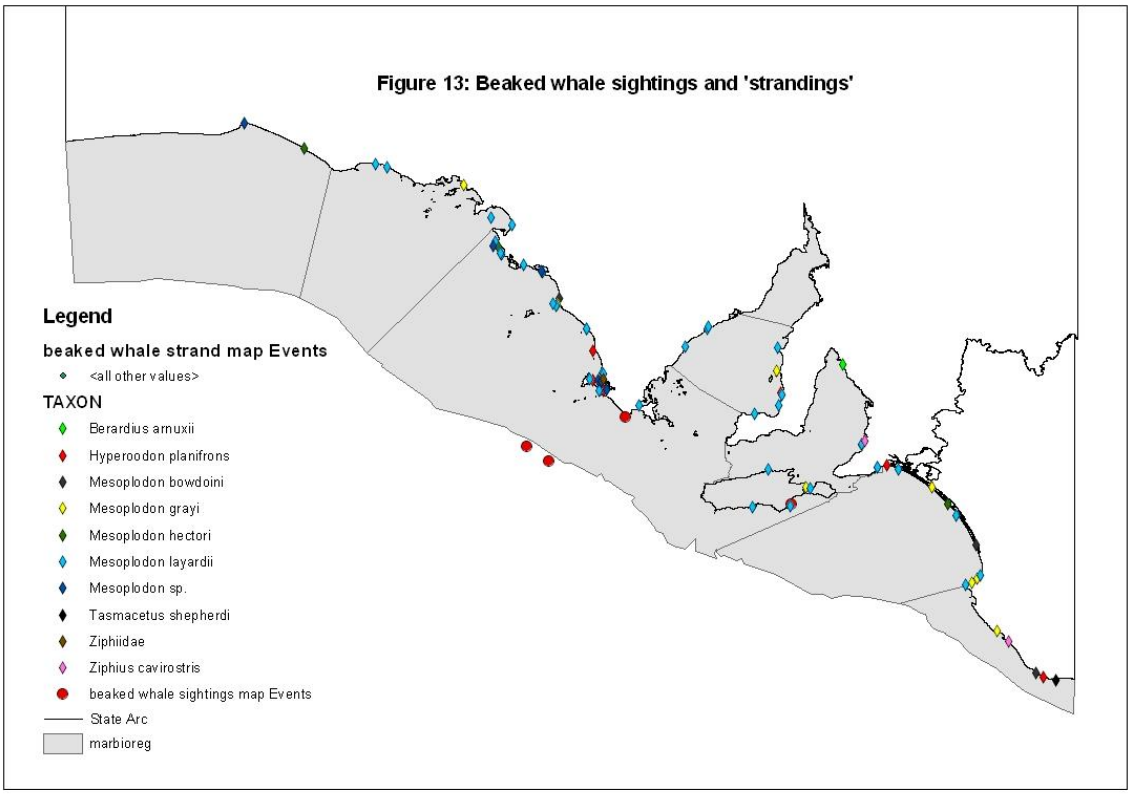


Fig. 14: Southern right whale and pygmy right whale sightings

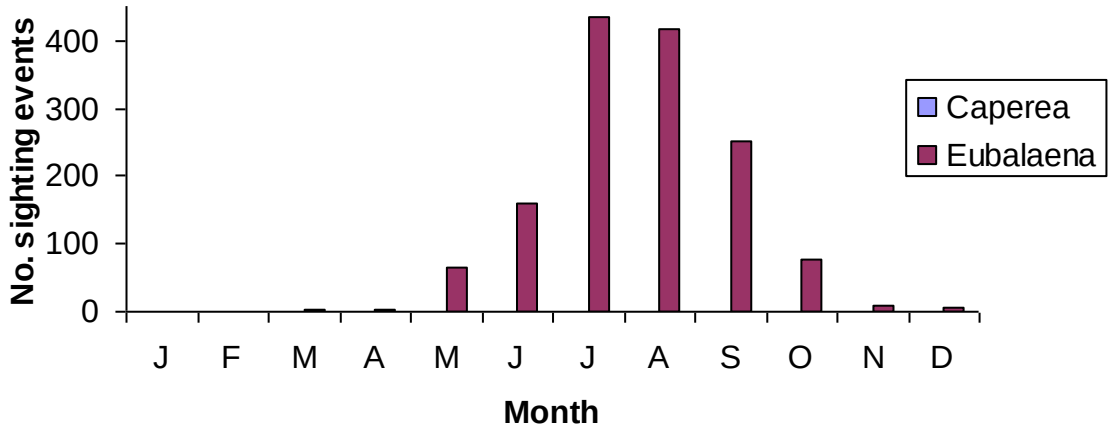


Fig. 15: Southern right whale and pygmy right whale 'strandings'

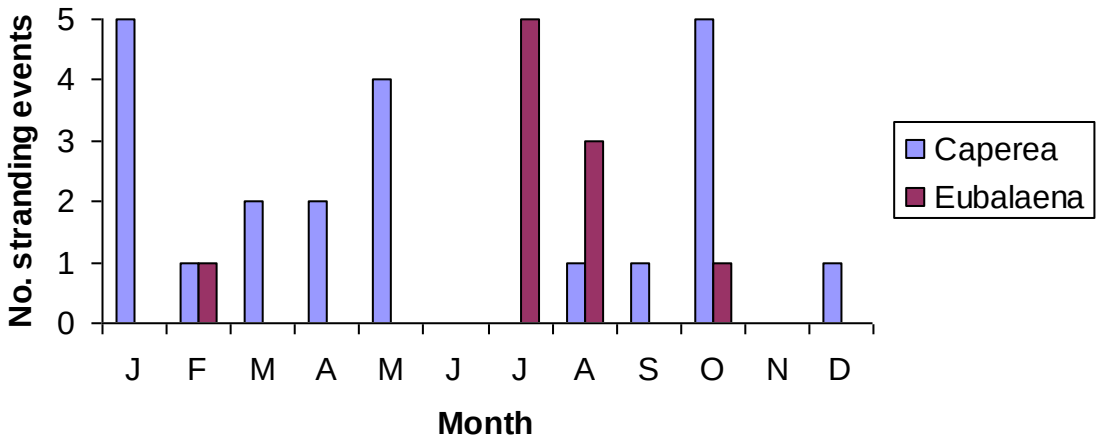


Fig. 16: Rorqual sightings

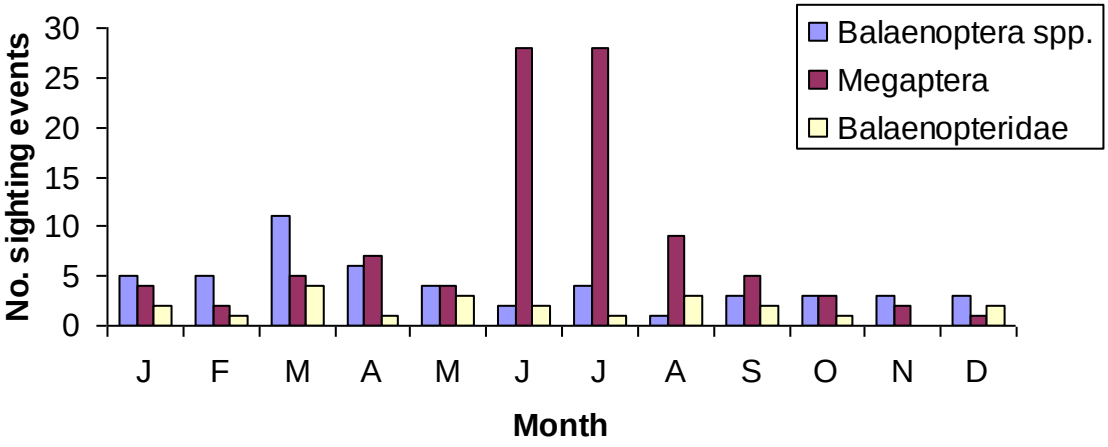


Fig. 17: Rorqual 'strandings'

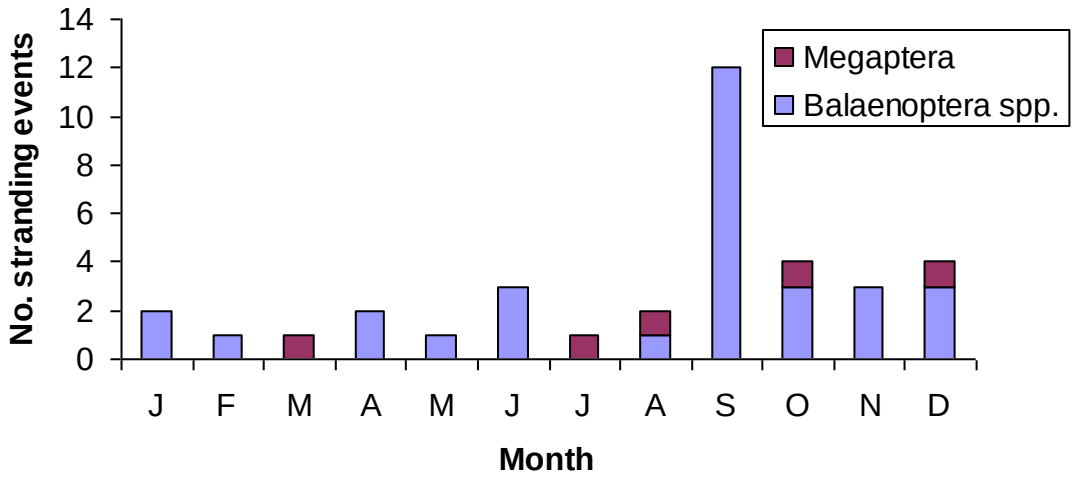


Fig. 18: Sperm whale sightings

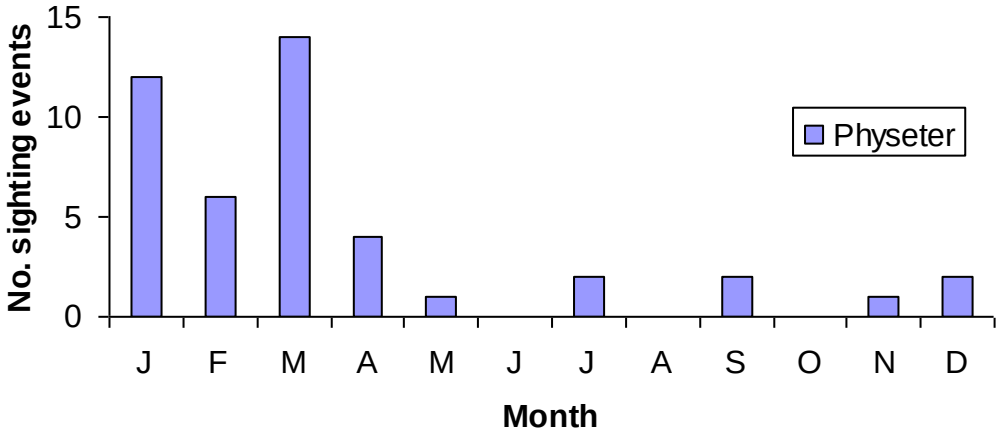


Fig. 19: Sperm whale 'strandings'

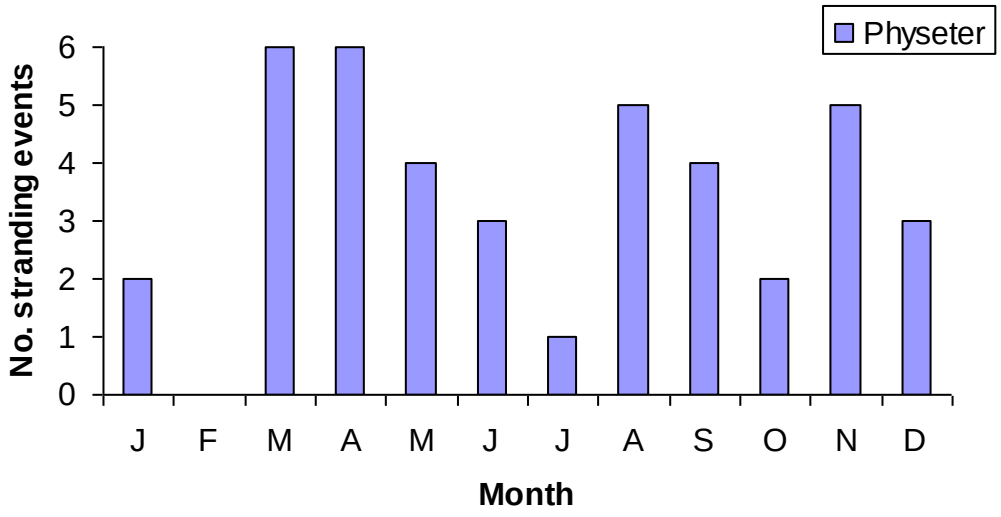
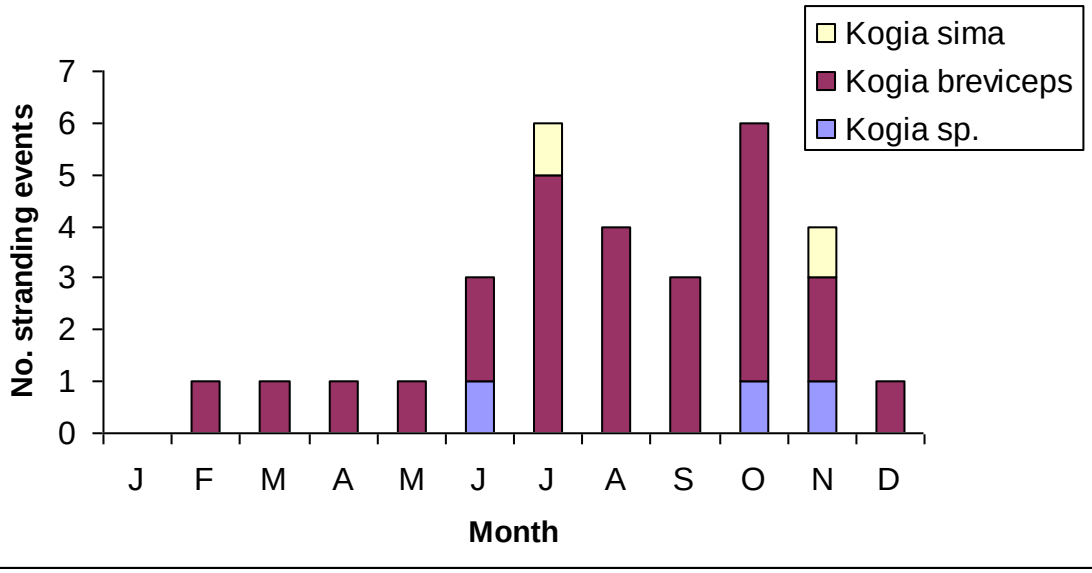


Fig. 20: Pygmy and dwarf sperm whale 'strandings'



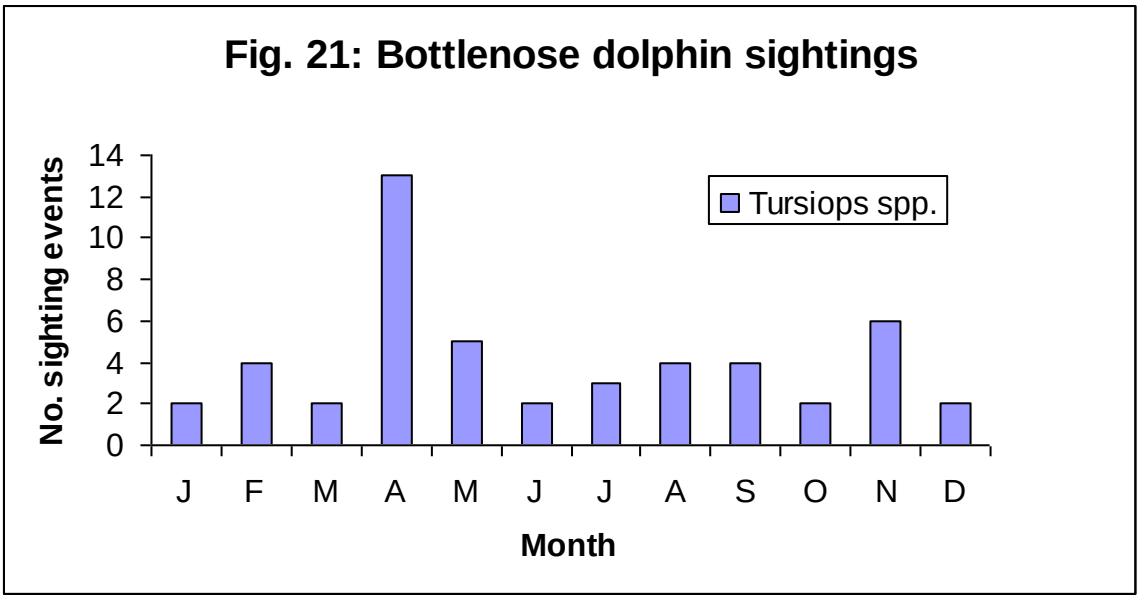


Fig. 21: Bottlenose dolphin sightings
No. sighting events
14
12
10
8
6
4
2
0
J F M A M J J A S O N D
Month
Tursiops spp.

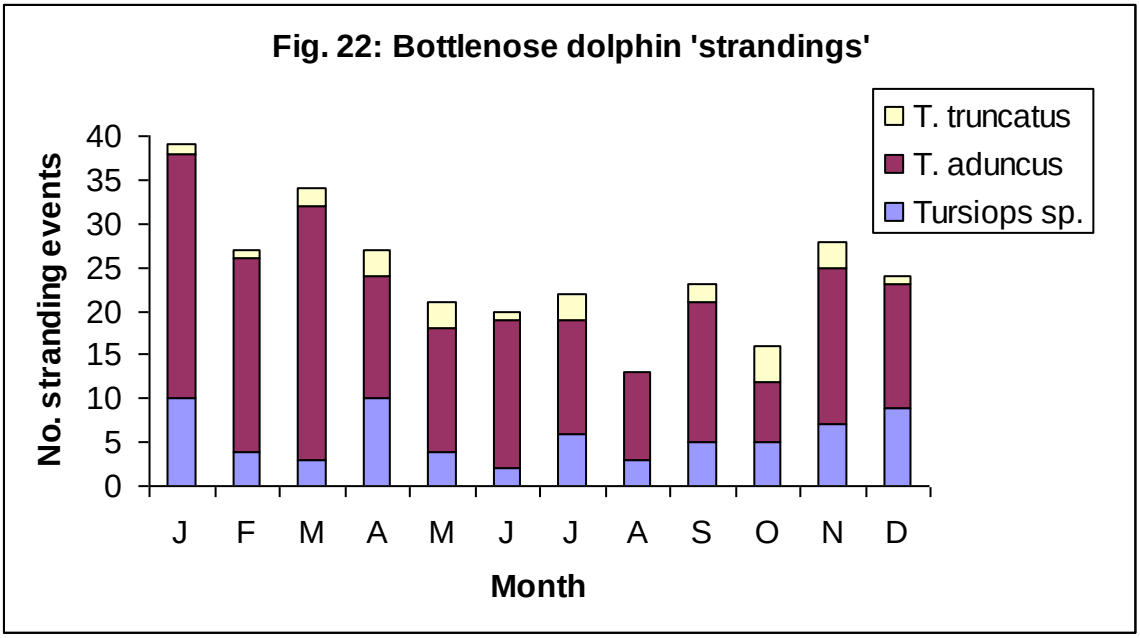


Fig. 22: Bottlenose dolphin 'strandings'
No. stranding events
40
35
30
25
20
15
10
5
0
J F M A M J J A S O N D
Month
T. truncatus
T. aduncus
Tursiops sp.

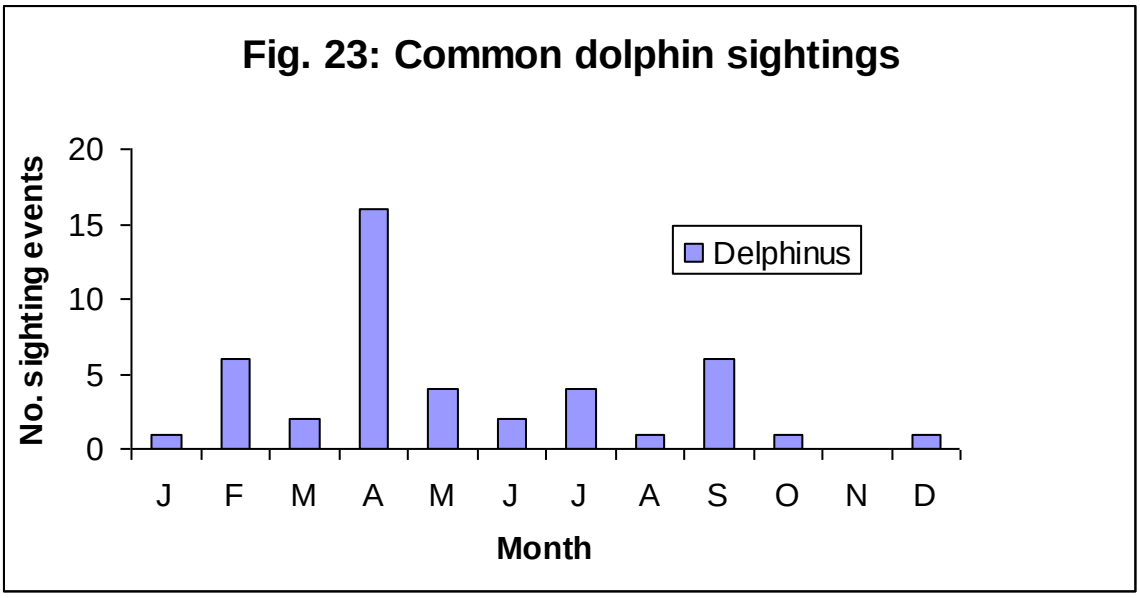


Fig. 23: Common dolphin sightings
No. sighting events
20
15
10
5
0
J
F
M
A
M
J
J
A
S
O
N
D
Month
Delphinus

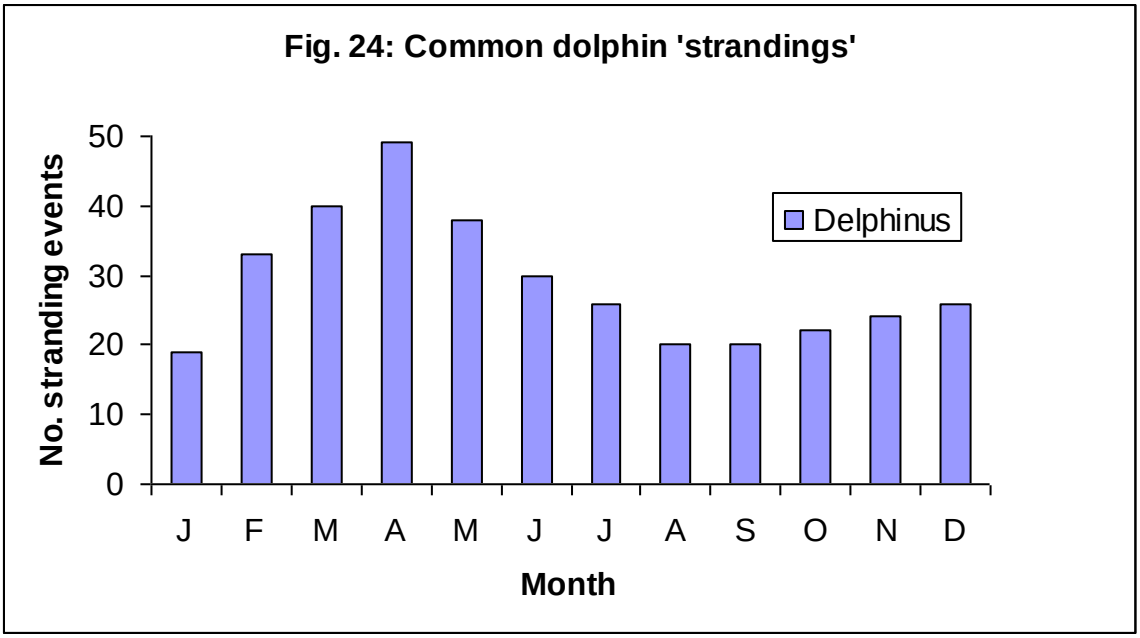


Fig. 24: Common dolphin 'strandings'
No. stranding events
50
40
30
20
10
0
J
F
M
A
M
J
J
A
S
O
N
D
Month
Delphinus

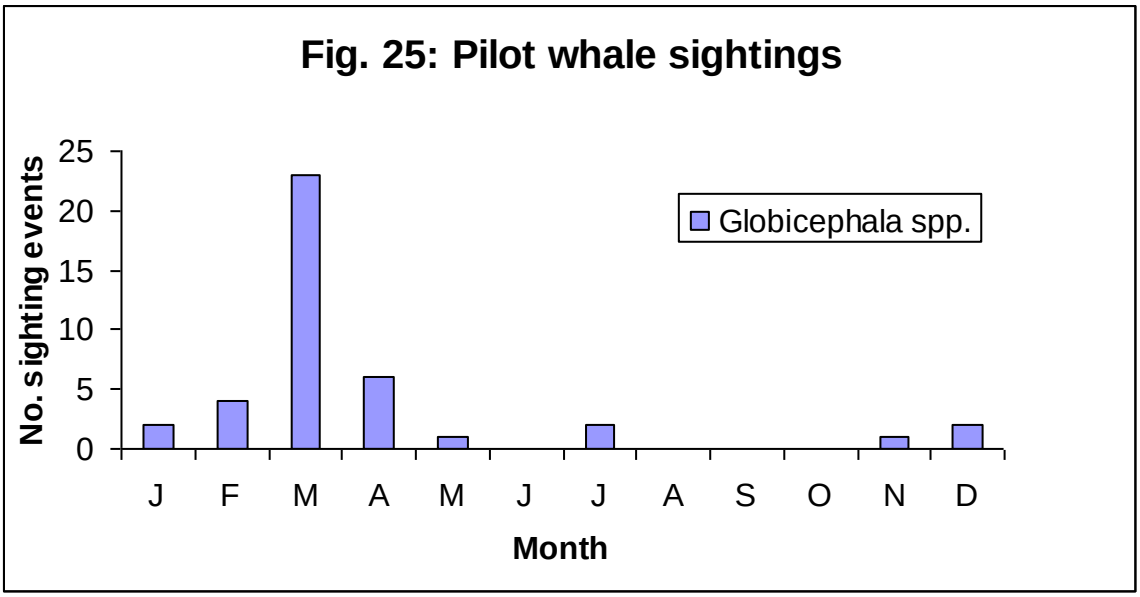


Fig. 25: Pilot whale sightings
No. sighting events
25
20
15
10
5
0
J
F
M
A
M
J
J
A
S
O
N
D
Month
Globicephala spp.

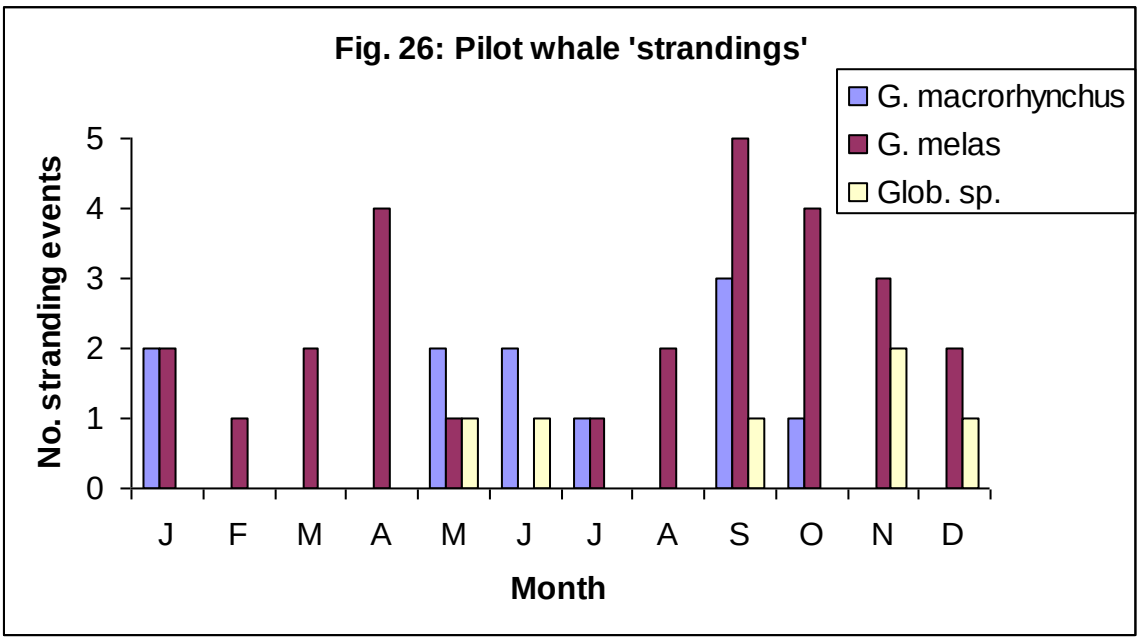


Fig. 26: Pilot whale 'strandings'
No. stranding events
5
4
3
2
1
0
J
F
M
A
M
J
J
A
S
O
N
D
Month
G. macrorhynchus
G. melas
Glob. sp.

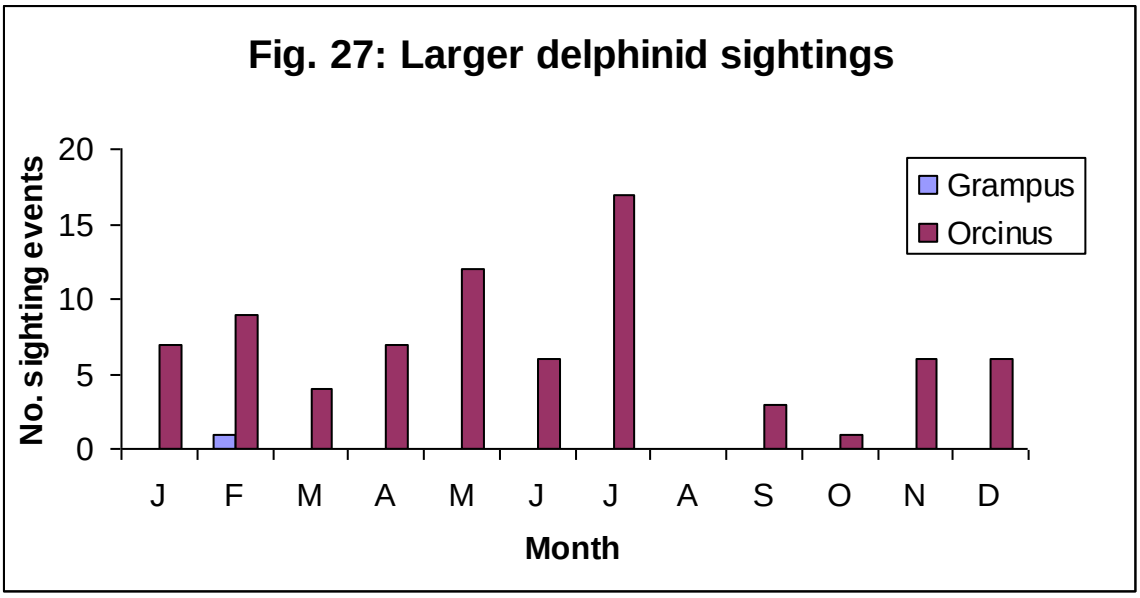


Fig. 27: Larger delphinid sightings
No. sighting events
20
15
10
5
0
J F M A M J J A S O N D
Month
Grampus
Orcinus

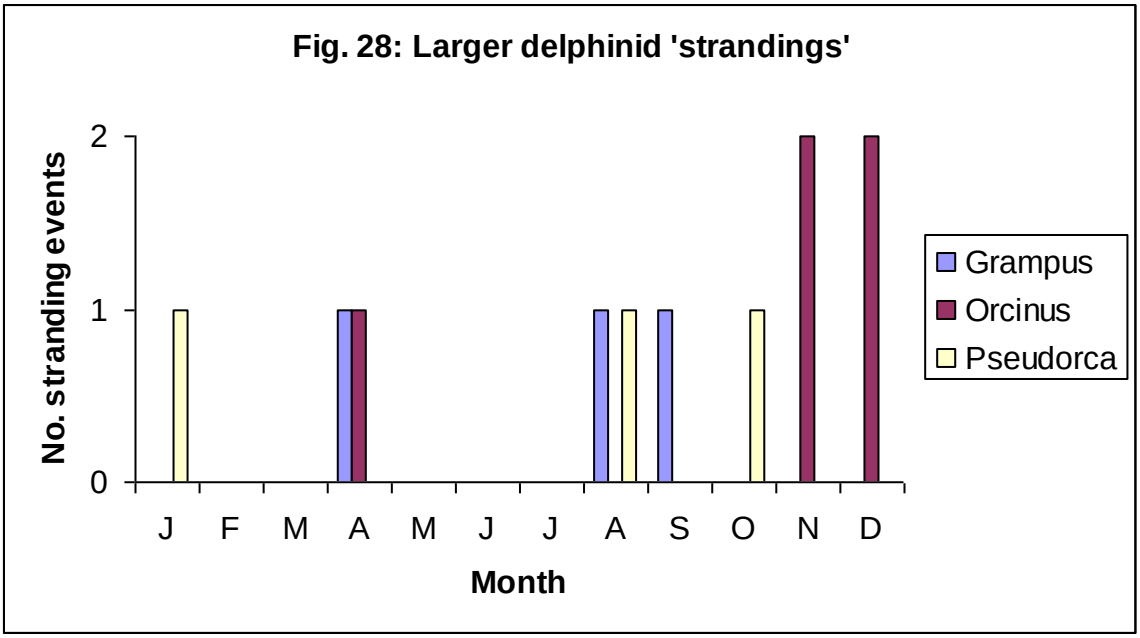


Fig. 28: Larger delphinid 'strandings'
No. stranding events
2
1
0
J F M A M J J A S O N D
Month
Grampus
Orcinus
Pseudorca

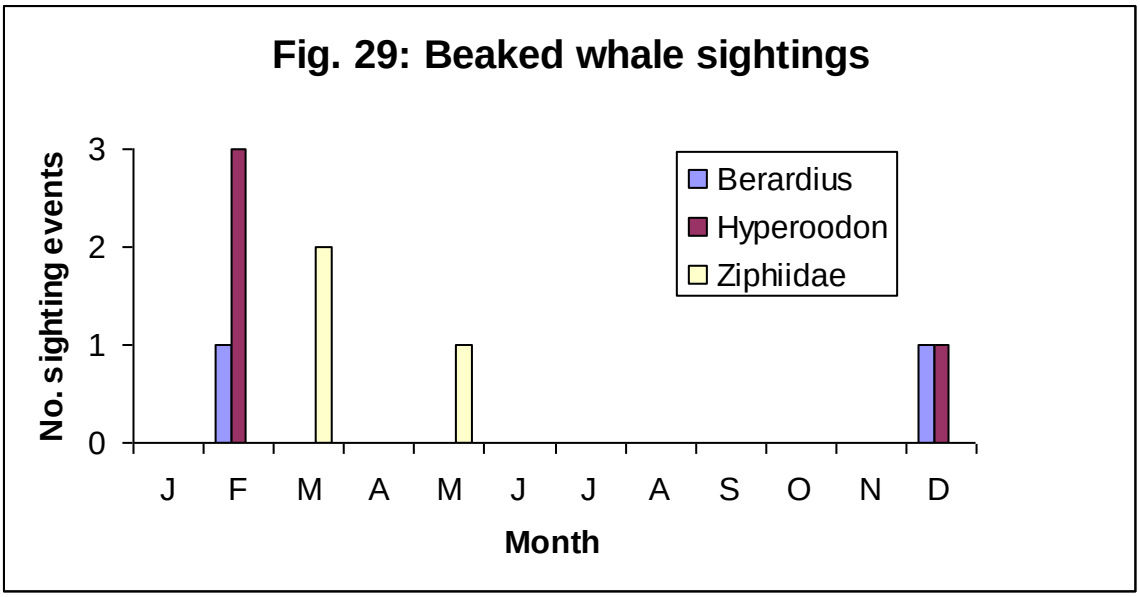


Fig. 29: Beaked whale sightings
No. sighting events
3
2
1
0
J
F
M
A
M
J
J
A
S
O
N
D
Month
Berardius
Hyperoodon
Ziphiidae

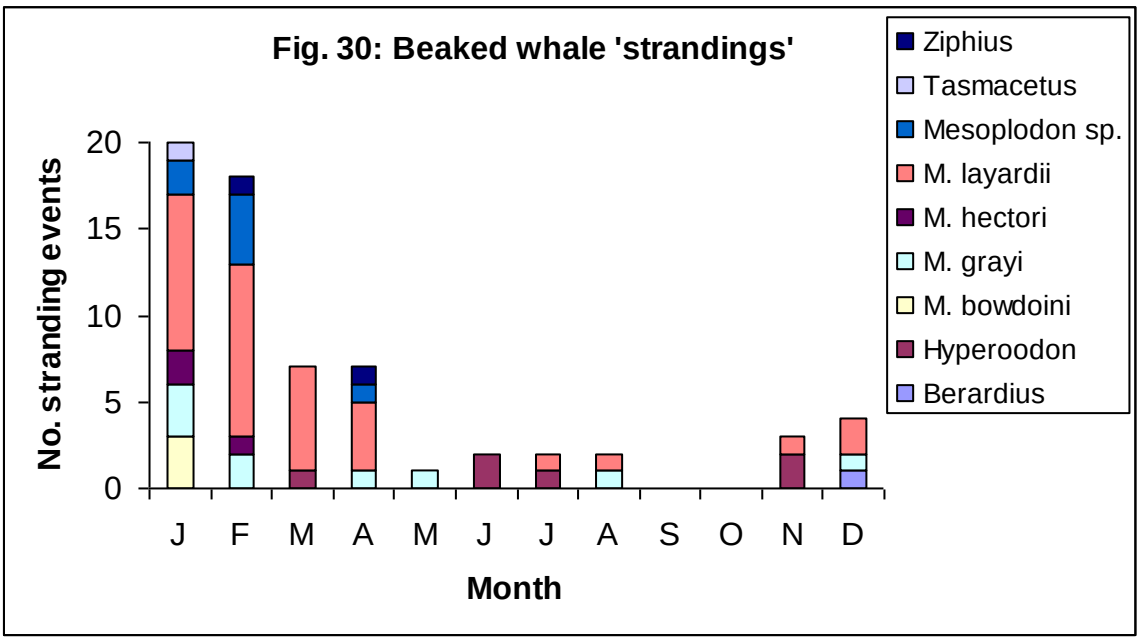


Fig. 30: Beaked whale 'strandings'
No. stranding events
20
15
10
5
0
J
F
M
A
M
J
J
A
S
O
N
D
Month
Ziphius
Tasmacetus
Mesoplodon sp.
M. layardii
M. hectori
M. grayi
M. bowdoini
Hyperoodon
Berardius

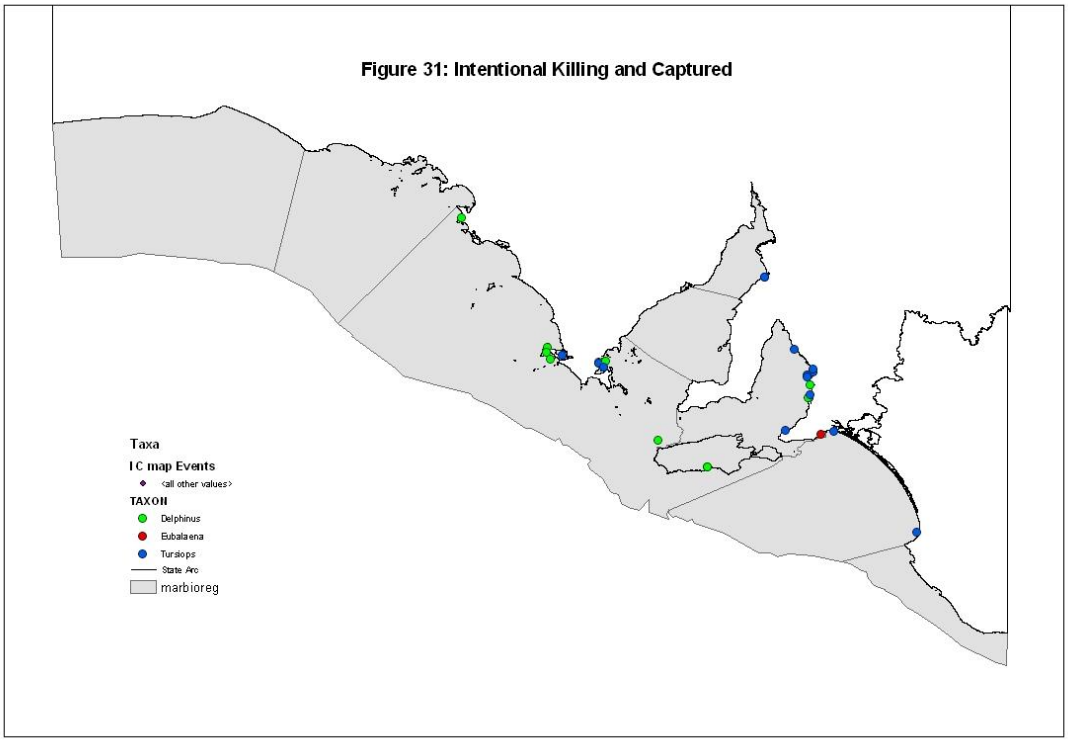


Figure 31: Intentional Killing and Captured
Taxa
IC map Events
<all other values>
TAXON
Delphinus
Eubalaena
Tursiops
State Arc
marbioreg

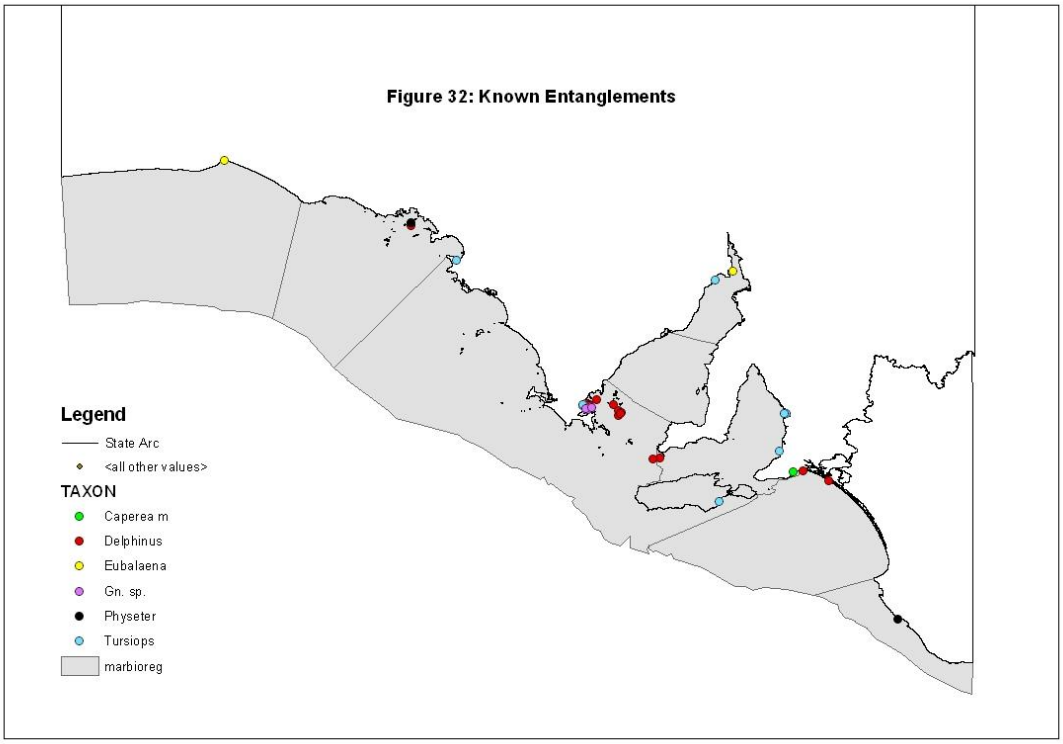


Figure 32: Known Entanglements
Legend
State Arc
<all other values>
TAXON
Caperea m
Delphinus
Eubalaena
Gn. sp.
Physeter
Tursiops
marbioreg

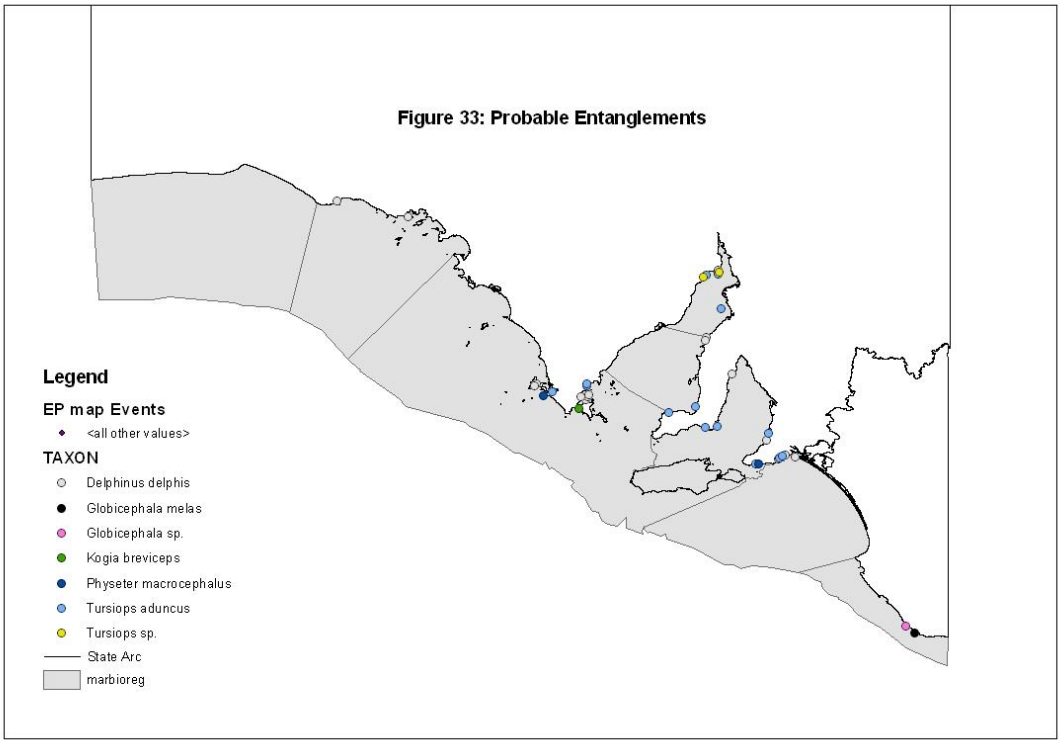


Figure 33: Probable Entanglements
Legend
EP map Events
<all other values>
TAXON
Delphinus delphis
Globicephala melas
Globicephala sp.
Kogia breviceps
Physeter macrocephalus
Tursiops aduncus
Tursiops sp.
State Arc
marbioreg

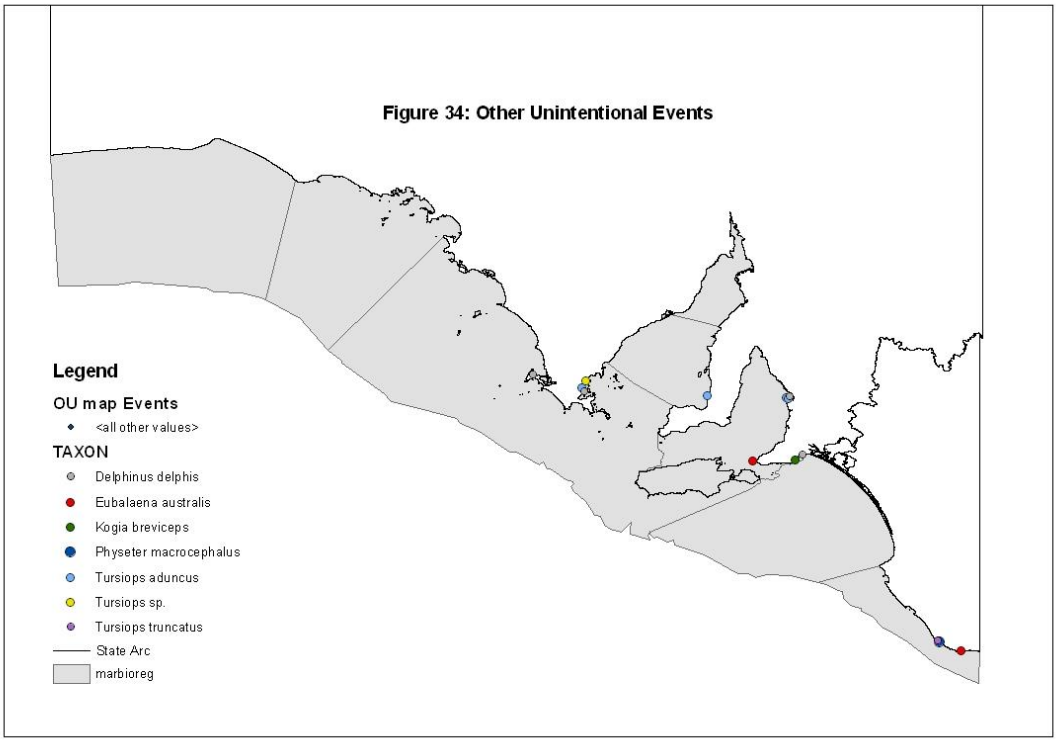


Figure 34: Other Unintentional Events
Legend
OU map Events
<all other values>
TAXON
Delphinus delphis
Eubalaena australis
Kogia breviceps
Physeter macrocephalus
Tursiops aduncus
Tursiops sp.
Tursiops truncatus
State Arc
marbioreg

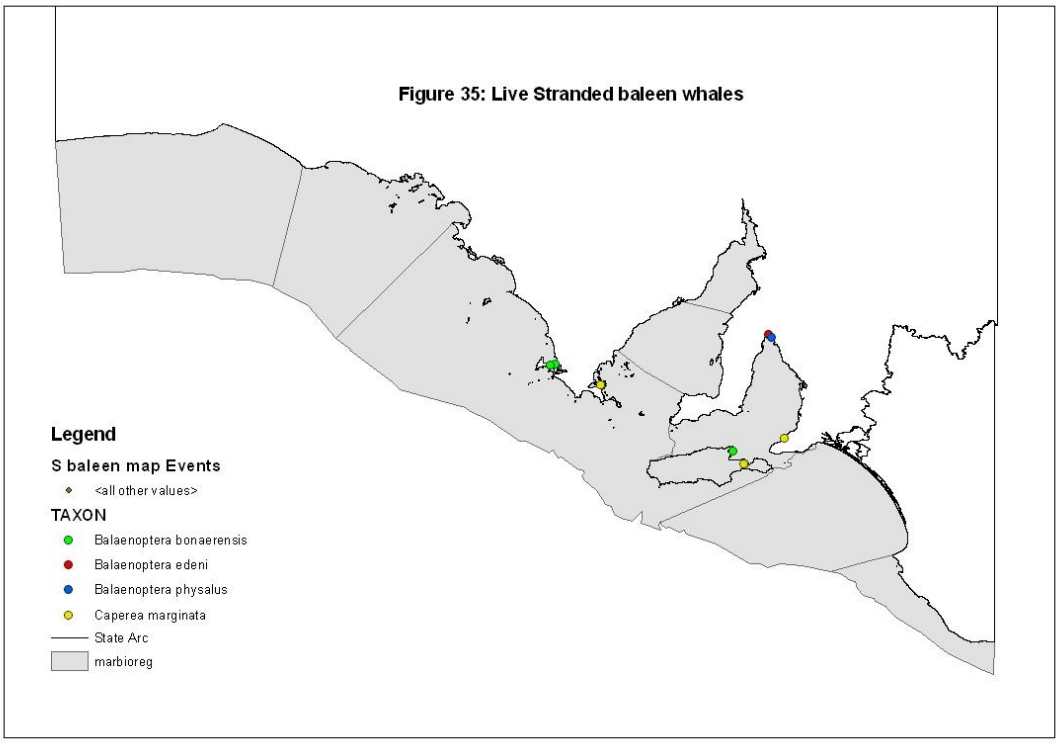


Figure 35: Live Stranded baleen whales
Legend
S baleen map Events
<all other values>
TAXON
Balaenoptera bonaerensis
Balaenoptera edeni
Balaenoptera physalus
Caperea marginata
State Arc
marbioreg

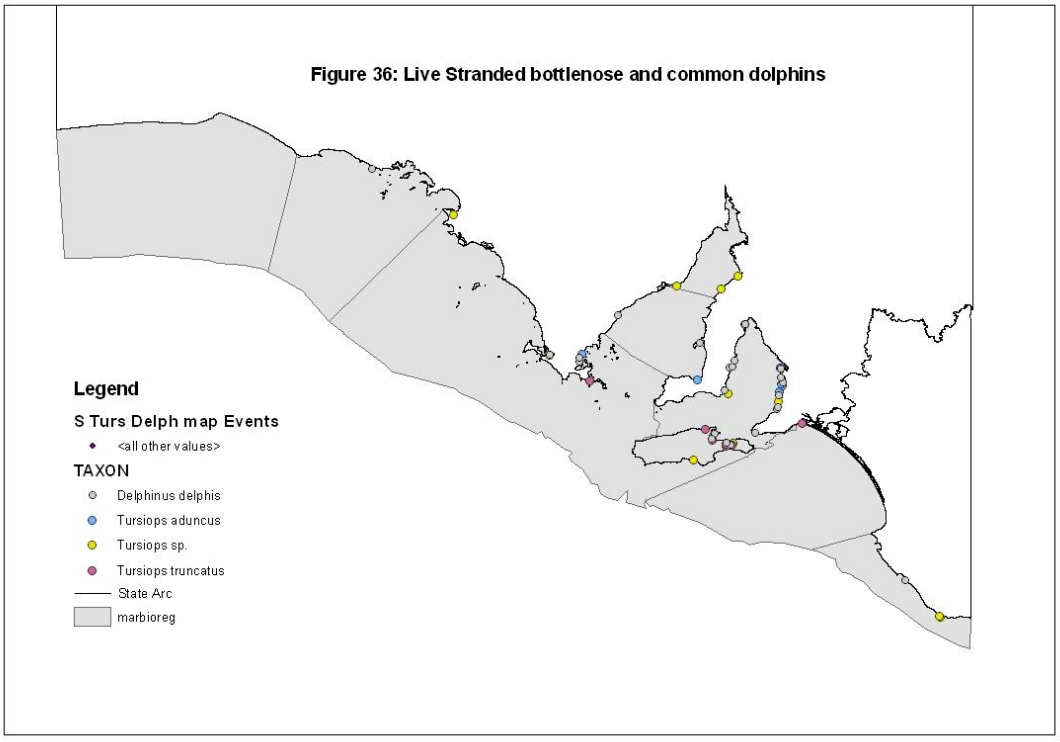


Figure 36: Live Stranded bottlenose and common dolphins
Legend
S Turs Delph map Events
<all other values>
TAXON
Delphinus delphis
Tursiops aduncus
Tursiops sp.
Tursiops truncatus
State Arc
marbioreg

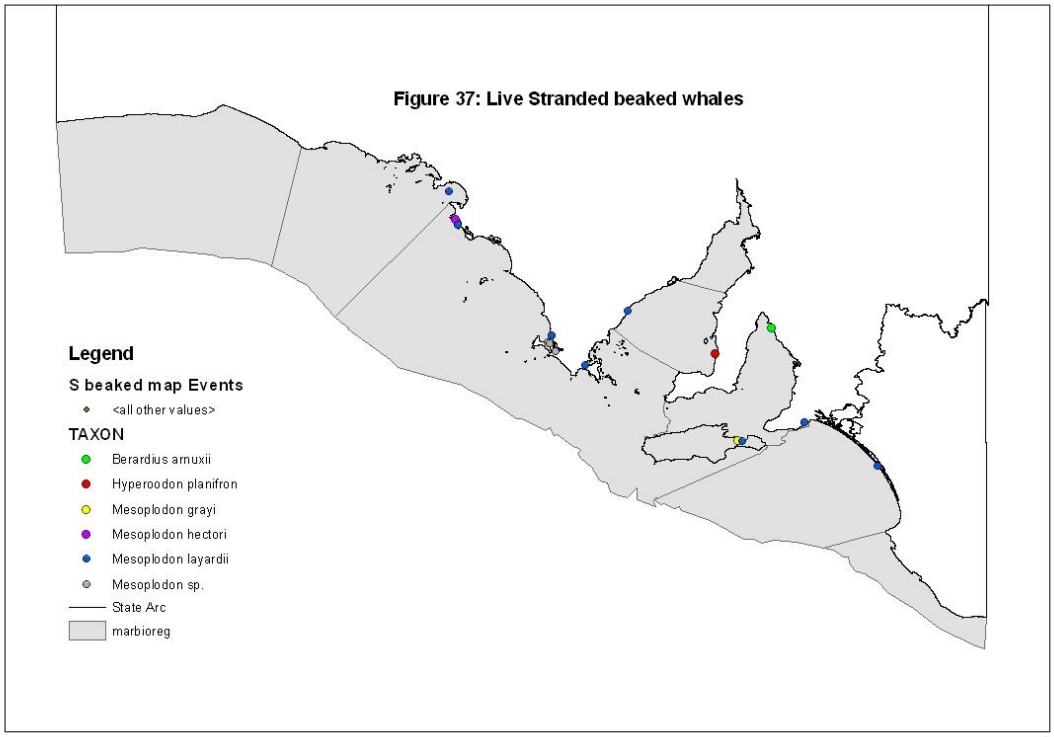


Figure 37: Live Stranded beaked whales
Legend
S beaked map Events
<all other values>
TAXON
Berardius arnuxii
Hyperoodon planifron
Mesoplodon grayi
Mesoplodon hectori
Mesoplodon layardii
Mesoplodon sp.
State Arc
marbioreg

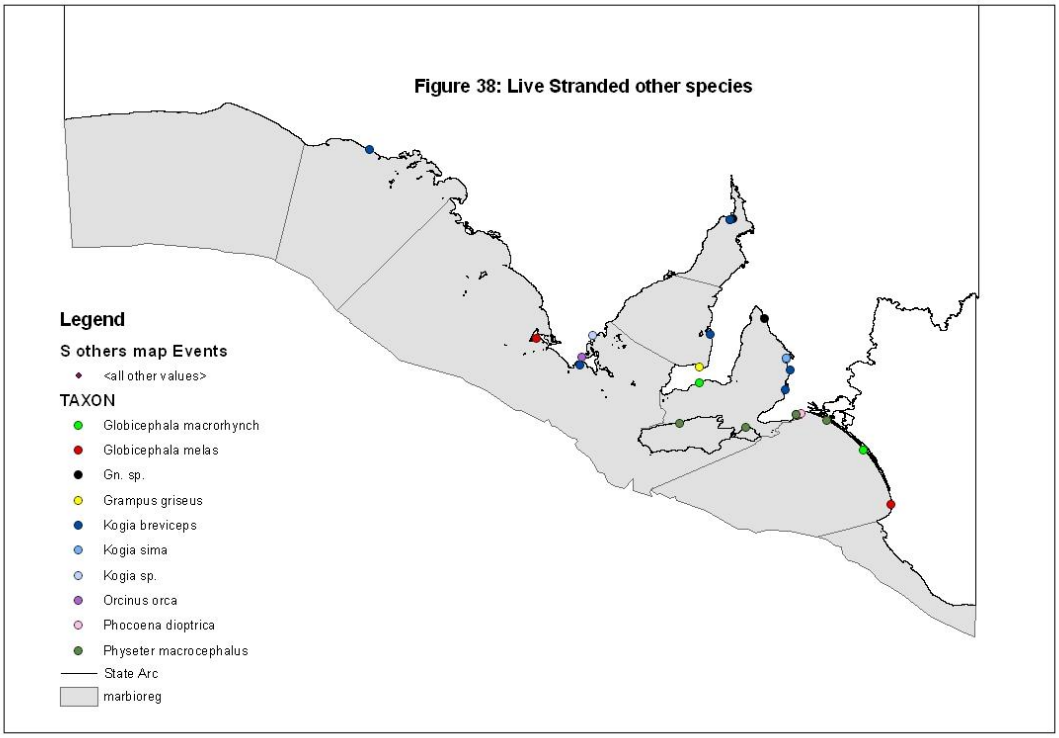


Figure 38: Live Stranded other species
Legend
S others map Events
<all other values>
TAXON
Globicephala macrorhynch
Globicephala melas
Gn. sp.
Grampus griseus
Kogia breviceps
Kogia sima
Kogia sp.
Orcinus orca
Phocoena dioptrica
Physeter macrocephalus
State Arc
marbioreg