# *Balaenoptera musculus* – Blue Whale


Lynsey Smyth

| | |
|---|---|
| **Regional Red List status (2016)** | |
| ***B. m. brevicauda*** | **Data Deficient*** |
| ***B. m. intermedia*** | **Critically Endangered A1abd** |
| National Red List status (2004) | |
| *B. m. brevicauda* | Data Deficient |
| *B. m. intermedia* | Endangered D |
| Reasons for change | |
| *B. m. brevicauda* | No change |
| *B. m. intermedia* | Non-genuine change: New information |
| Global Red List status | |
| *B. musculus* | Endangered A1abd |
| *B. m. brevicauda* (1996) | Data Deficient |
| *B. m. intermedia* (2008) | Critically Endangered A1abd |
| TOPS listing (NEMBA) (2007) | Listing |
| CITES listing (*B. musculus*) (1975) | Appendix I |
| CMS listing (*B. musculus*) (1975) | Appendix I |
| Endemic | No |

*Watch-list Data

These whales only appear blue when seen through the water: in air, their bodies are more aptly described as gunmetal grey with a variable mottling of lighter grey spots scattered over the back and flanks, which may only be seen clearly when the sun is behind the observer (Best 2007).

## Taxonomy

*Balaenoptera musculus brevicauda* (Ichihara 1966)

*Balaenoptera musculus intermedia* (Burmeister 1871)

ANIMALIA - CHORDATA - MAMMALIA - CETARTIODACTYLA - BALAENOPTERIDAE - *Balaenoptera - musculus*

**Common names:** *B. m. brevicauda*: Pygmy Blue Whale (English), *B. m. intermedia*: Antarctic Blue Whale (English), Blue Whale (English)

**Taxonomic status:** Subspecies

**Taxonomic notes:** The subspecific taxonomy of Blue Whales is not yet fully elucidated. The Antarctic form *B. m. intermedia*, sometimes called the "true" Blue Whale, is distinguished by its large body size and Antarctic distribution in summer. The Pygmy Blue Whale *B. m. brevicauda* has a number of morphological characteristics that distinguishes it, including the characteristic "tadpole" body shape (Kato et al. 2002). It occurs in the southern Indian Ocean, excluding the Antarctic, from Africa and Madagascar across to Indonesia, Australia and Tasmania. LeDuc et al. (2007) found that Antarctic Blue Whales were genetically distinct at the population level from Pygmy Blue Whales and southeastern Pacific whales, but no definitive, diagnostic genetic marker for the Antarctic Blue Whale has been found to date. Pending further data, it is preferable to limit the term “Pygmy Blue Whale” to the Indian Ocean populations, and to use geographical names such as Antarctic Blue Whale and North Atlantic Blue Whale instead of “True Blue Whale”. Distinct regional song types, used by both subspecies, can be used in conjunction with genetic and morphometric data to distinguish population structure and thus discern between various subspecies (McDonald et al. 2006).

## Assessment Rationale

There are two Blue Whale subspecies found within the assessment region: the Antarctic Blue Whale *B. m. intermedia* and the Pygmy Blue Whale *B. m. brevicauda*. While the former has a circumpolar distribution and passes through South African waters in winter, the latter is most abundant in the Indian Ocean with only a few records from Durban and the Prince Edward Islands.

Although the Pygmy Blue Whale was historically less depleted than the Antarctic Blue Whale, the extent to which the population has recovered is unknown. Of particular concern is that more than 8,000 Pygmy Blue Whales were taken illegally by Soviet whalers in the 1960s and 1970s. Current population size is unknown. Although there are no major threats to the subspecies at present, it is known only from a few records in the Prince Edward Islands and may be suffering from small population size caused by historical whaling, which may make the subspecies more vulnerable to other threats (for example, climate change). Thus, under a precautionary purview, we list the subspecies as Data Deficient. The subspecies will

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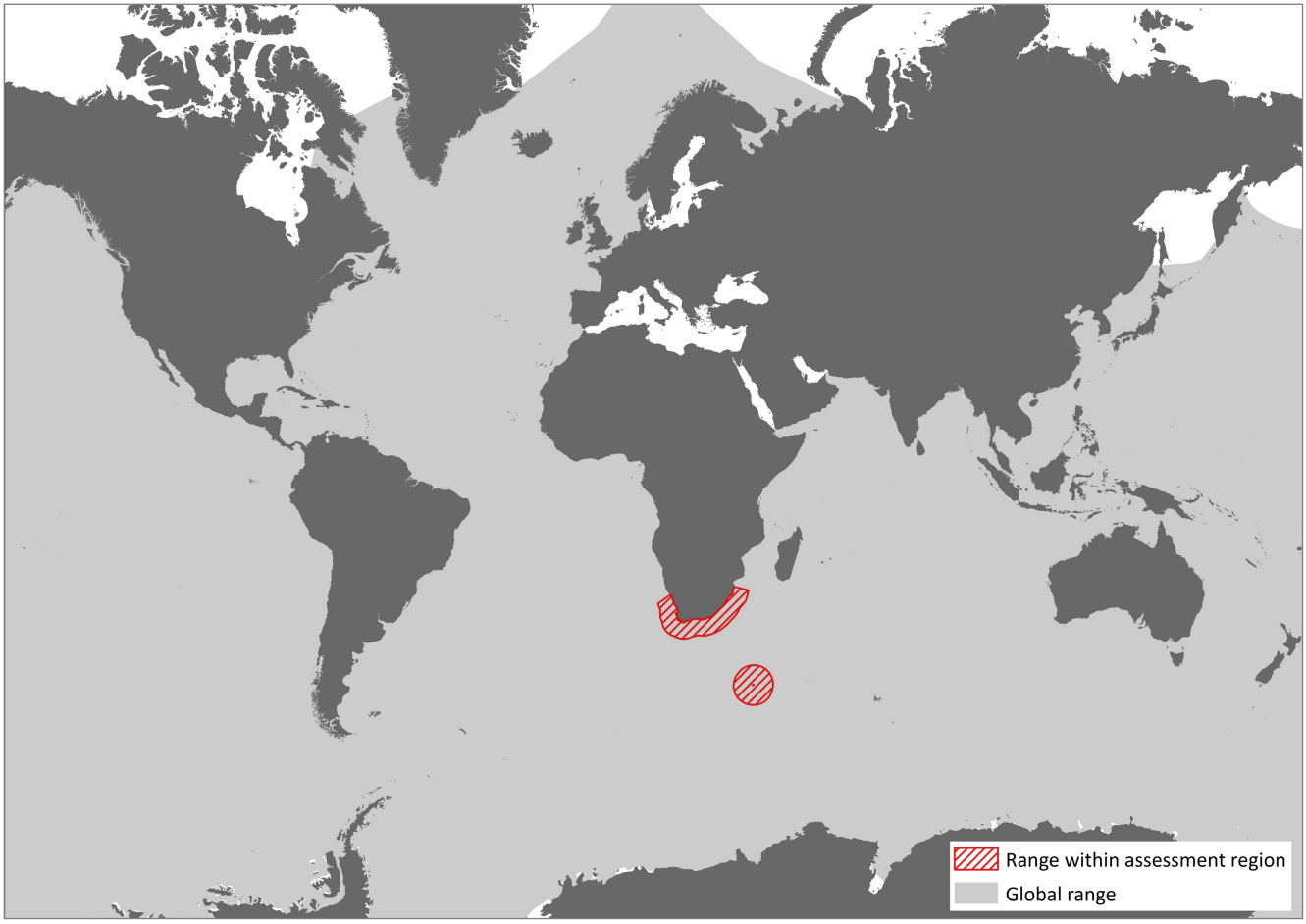


**Figure 1. Distribution range for Blue Whale (*Balaenoptera musculus*) within the assessment region (IUCN 2012)**

most likely be listed Least Concern if future surveys and monitoring data show population recovery and illuminate its distribution more comprehensively. It should be reassessed once such data are available.

The majority of the over 17,000 Blue Whales caught off southern Africa were probably Antarctic Blue Whales. The pre-whaling population of *B. m. intermedia* is estimated at 239,000 and was reduced to 360 individuals in 1973. Although the population has been estimated to be increasing since then, at a mean rate of 7.3% per annum, the current population size is estimated at below 5,000 mature individuals. The current population is thus still less than 3% of its level of three generations ago (at least a 95% decline) (1922–2015), and therefore qualifies for Critically Endangered A1abd based on records of past whaling catches and subsequent estimated population sizes. The population is currently increasing but at a slow rate relative to other whales that have become protected in the same period. Blue Whales exist in localised subpopulations and have call frequency rates at 19–28 Hz, which is the same as seismic surveys. Thus, although there are no major threats, increasing marine noise pollution through seismic surveys may interrupt or affect population recovery within the assessment region. Internationally, the area south of South Africa is an important stronghold for this species. Continued monitoring of population recovery and mitigation of potential noise pollution are recommended.

**Regional population effects**: Blue Whales are highly migratory and wide-ranging. There are no barriers to dispersal, so rescue effects are possible.

# Distribution

Antarctic Blue Whales have a continuous circumpolar distribution and dominated (99.2%) pelagic catches south of 52°S, whereas Pygmy Blue Whales dominated (99.9%) north of 52°S (Branch et al. 2007b). During the austral summer feeding season, the Antarctic Blue Whale is found in polar waters and the Pygmy Blue Whale in temperate waters (Attard et al. 2012). Thus, the ranges of the two subspecies do not overlap in summer but they may overlap in winter if the Antarctic Blue Whale migrates into Pygmy Blue Whale habitat. Overall, the available evidence suggests that Antarctic Blue Whales generally do migrate to northerly locations in winter, although some overwinter in the Antarctic (Branch et al. 2007a). For example, analyses of length frequencies have reinforced the conclusion that Antarctic Blue Whales migrate to South African and Namibian waters in winter (Best 2007; Branch et al. 2007b). Additionally, acoustic data reveal that Antarctic Blue Whales use both the Indian and eastern Pacific Oceans concurrently, indicating that there is not a single migratory destination (Stafford et al. 2004). Pygmy Blue Whales do not migrate as far south in summer as Antarctic Blue Whales, most remaining north of 55°S, especially in the vicinity of Prince Edward and Crozet islands (Best 2007).

Antarctic Blue Whales have been recorded along bands stretching across entire ocean basins but at lower latitudes they are progressively more clustered, localized and compressed along the continental margins (Branch et al. 2007a), which probably reflects the distribution of krill, with large Antarctic Krill *Euphausia superba* at the highest latitudes, mid-sized *Euphausia* species in the mid latitudes

and smaller *Nyctiphanes* species in coastal upwelling systems in the mid and low latitudes. Current sightings are aggregated close to the edge of the pack ice, while past catches extended further north, which may be explained by considering that, when Antarctic Blue Whales were more abundant, they occupied a wider habitat range, but now they are depleted to < 5% of their original abundance and concentrate close to the ice edge where krill is most prevalent (Branch et al. 2007a).

Antarctic Blue Whales occur throughout South Africa's Economic Exclusion Zone (EEZ) from ice-edge to tropical and sub-tropical waters, excluding nearshore waters. However, very little feeding or breeding is believed to occur. Most feeding occurs in high latitudes of the Antarctic, breeding probably occurring in sub-tropical waters. Instead, the regional waters are probably used mainly as migratory corridors. Pygmy Blue Whales are difficult to identify at sea and thus their distribution within the assessment region is largely unknown. They occur across the sub-Antarctic zone of the Indian Ocean (and possibly South East Atlantic and South East Pacific) extending to the equator in winter. They occur throughout the EEZ of South Africa, including nearshore waters. There are only a few records of this subspecies from Durban and the Prince Edward Islands.

They are a wide-ranging and migratory species, especially while in high latitudes (Best 2007). For example, Sremba et al. (2012) documented a female that travelled at least 6,650 km or 131° longitude over four years.

# Population

The Antarctic Blue Whale was extremely abundant in the past. However, whaling from 1928 to 1972 depleted the population from 239,000 (95% CI 202,000–311,000) to 360 (95% CI 150–840) in 1973 (Branch et al. 2004). Sightings remain rare in the Antarctic (0.17–0.52 / 1,000 km) despite considerable effort during dedicated sightings surveys. There are no published population estimates for the assessment region, but 72% of all Antarctic Blue Whale catches were made in the South Atlantic and western Indian Ocean areas, suggesting that the subregion included a significant portion of the entire population (Best 2007). Recorded sightings are also rare (only two since the 1960s) off south-west Africa where large catches were recorded from Saldanha Bay (South Africa) ($n$ = 7,969), Namibia ($n$ = 1,665) and Angola ($n$ = 1,917) (Branch et al. 2007a). Similarly, 2,986 Blue Whales were caught off Durban and 417 from south-east South Africa from 1911 to 1916, which originally comprised Antarctic Blue Whales but by the end of the whaling period most catches and sightings were probably Pygmy Blue Whales (Branch et al. 2007b).

Monitoring subsequent population trends is difficult due to their current scarcity. However, Bayesian models fitted to three sighting series (1968–2001) indicated that the subspecies has been increasing at a mean rate of 7.3% per annum (1.4%–11.6%) (Branch et al. 2004). In 1996, population size was estimated at 1,700 individuals (95% CI 860–2,900), which constitutes 0.7% (0.3%–1.3%) of the pre-exploitation level (Branch et al. 2004). Similarly, the most recent abundance estimate in 1997 is 2,280 individuals (T. Branch unpubl. data), which is only 0.9% (CI 0.7–1.0%) of pre-exploitation levels. Currently, there are fewer than 5,000 mature individuals. Thus, although they have been increasing since illegal whaling ended in 1972, the rate is slow relative to other whales that have gone under protection in the same period and they still need to be protected as their current population size is still a fraction of the pre-exploitation era.

The status of Pygmy Blue Whales is much more uncertain but their original abundance was probably an order of magnitude lower than that of Antarctic Blue Whales, and they are likely less depleted at present (Branch et al. 2007a). No precise population estimates are available from the southern Indian Ocean. Best *et al.* (2003) estimated the population size in a survey area south of Madagascar to be 424 with wide confidence limits (190–930) and suggested, based on the distribution of past catches, that the total population in the southwestern Indian Ocean may be about three times that in the survey area. Catches of this subspecies were much lower than Antarctic Blue Whales, ~13,000 vs. > 330,000; (Branch et al. 2004), and thus we suspect they are less depleted at present than Antarctic Blue Whales. However, more than 8,000 Pygmy Blue Whales were harvested illegally by Soviet whalers in the 1960s and 1970s (Clapham et al. 2008). Furthermore, as there is little baseline data for this subspecies, it is difficult to evaluate the impact of whaling on current population status.

Models project that Blue Whales will continue to increase, while Minke Whales will decrease (following their historical increase due to over-harvesting of Blue Whales), as Blue Whales are better able to tolerate decreased krill abundance (Mori & Butterworth 2004). Generation length is estimated to be 31 years (Taylor et al. 2007).

**Current population trend:** Increasing

**Continuing decline in mature individuals**: No

**Number of mature individuals in population**: < 5,000

**Number of mature individuals in largest subpopulation**: Unknown

**Number of subpopulations**: Unknown

**Severely fragmented:** No

# Habitats and Ecology

The Blue Whale is the largest of the mysticete (baleen) whales, with lengths exceeding 30 m, and is the largest mammal that has ever lived (Skinner & Chimimba 2005). Blue Whales feed on euphausiids and other crustacean meso-zooplankton. Dives are mostly less than 16 m or between 97 and 152 m, up to a maximum of 200 m (Best 2007). They feed both at the surface and also at depth, following the diurnal vertical migrations of their prey to at least 100 m. Antarctic Blue Whales feed predominantly near the edge of the pack ice zone during summer. They generally stay far from the shore (40–60 nautical miles) but occasionally come within a few kilometres, especially in mid-winter (Best 2007)

Antarctic Blue Whales are larger than Pygmy Blue Whales (> 30 m compared to 24 m). Evidence is emerging that Blue Whale songs can be used to determine population structure, as different regions have distinct and temporally stable song types (McDonald et al. 2006).

**Ecosystem and cultural services:** Marine mammals integrate and reflect ecological variation across large spatial and long temporal scales, and therefore they are prime sentinels of marine ecosystem change; migratory mysticete whales may be used to investigate broad-scale shifts in ecosystems (Moore 2008).

**Table 1. Use and trade summary for the Blue Whale (*Balaenoptera musculus*)**

| Category | Applicable? | Rationale | Proportion of total harvest | Trend |
|---|---|---|---|---|
| Subsistence use | No | - | - | - |
| Commercial use | Yes | - | 100% | Ceased since 1966 (officially). |
| Harvest from wild population | Yes | - | 100% | - |

# Use and Trade

Blue Whales were exploited on an industrial scale from 1905 to 1973 using deck-mounted harpoon cannons. Harvesting Blue Whales began in South Georgia and spread to Antarctica with the advent of factory-ships in the 1920s, reaching a peak in 1930/31 when more than 30,000 were taken. Southern hemisphere Blue Whales have been protected under the International Whaling Convention since 1966 but illegal catches from the former USSR continued until 1972, which were primarily Pygmy Blue Whales.

# Threats

Historical over-harvesting of Blue Whales reduced the population by 99% but ceased in 1972 and the population is currently recovering (Branch et al. 2004). There currently are no major direct anthropogenic threats. However, the small population sizes created by whaling makes Blue Whales susceptible to indirect threats, such as demographic stochasticity, inbreeding depression and density dispensation (Allee effects). Recently, Attard et al. (2012) found evidence for hybridisation between *B. m. intermedia* and *B. m. brevicauda* in Antarctica, which may be caused by an increase in the proportion of *B. m. brevicauda* off Antarctica in recent decades due to past whaling or current patterns of climate change. Despite the bottleneck imposed by whaling, the genetic diversity of *B. m. intermedia* remains relatively high (Sremba et al. 2012).

Within the assessment region, an emerging threat is marine noise pollution, especially through seismic surveys (Koper & Plön 2012). Frequency range of calls is between 19 and 28 Hertz, which overlaps with major frequencies of seismic surveys, which could mask calls of Blue Whales and disrupt social structure and breeding.

Climate change may become a threat in the future by altering sheet ice habitats and affect the food supply of this species. A profound reduction in the extent of sea ice in the Antarctic is expected, and possibly a complete disappearance in summer, as mean Antarctic temperatures rise faster than the global average (Turner et al. 2006). The implications of this for Blue Whales are unclear but warrant monitoring.

# Conservation

Blue Whales are protected worldwide, including in the Antarctic, by the International Whaling Commission, and no hunting currently occurs. Catch limits for all commercial whaling have been set at zero since 1986. The species is on Appendix I of both the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Convention on Migratory Species (CMS). Within the assessment region, they are also fully protected within the EEZ and Prince Edward Islands. The cessation of harvesting has allowed the population to recover (Branch et al. 2004), and it is recommended that ship-based surveys be conducted in South African waters to assist in determining the population size, distribution and seasonality for this species.

Additionally, careful management, regulation and enforcement of seismic survey practices will also benefit this species. Current mitigation measures include geographic and temporal restrictions (activity restricted to specific areas or times of year), source-based mitigation

**Table 2. Threats to the Blue Whale (*Balaenoptera musculus*) ranked in order of severity with corresponding evidence (based on IUCN threat categories, with regional context)**

| Rank | Threat description | Evidence in the scientific literature | Data quality | Scale of study | Current trend |
|---|---|---|---|---|---|
| 1 | *5.4 Fishing & Harvesting Aquatic Resources*: past whaling dramatically depleted populations. Current stress | Branch et al. 2004 | Empirical | Regional | Whaling reduced population from 239,000 in 1905 to 360 in 1973. |
| | 2.3.1 Hybridisation: imbalance in proportion of subspecies may be causing hybridisation. | Attard et al. 2012 | Empirical | Regional | Proportion of *B. m. brevicauda* increasing due to past whaling and/ or climate change, which may increase rates of hybridisation. |
| 2 | *9.6.3 Noise Pollution*: marine noise pollution through seismic surveys and boat traffic. | Koper & Plön 2012 | Indirect | Regional | Increasing boat traffic and seismic surveys may negatively impact Blue Whales. |
| 3 | *11.1 Habitat Shifting & Alteration*: climate change may alter resource distribution negatively. Current stress | Turner et al. 2006 | Indirect | Global | Antarctic ice sheets projected to diminish, along with food source. |
| | 2.3.1 Hybridisation: imbalance in proportion of subspecies may be causing hybridisation. | Attard et al. 2012 | Empirical | Regional | Proportion of *B. m. brevicauda* increasing due to past whaling and/ or climate change, which may increase rates of hybridisation. |

**Table 3. Conservation interventions for the Blue Whale (*Balaenoptera musculus*) ranked in order of effectiveness with corresponding evidence (based on IUCN action categories, with regional context)**

| Rank | Intervention description | Evidence in the scientific literature | Data quality | Scale of evidence | Demonstrated impact | Current conservation projects |
|---|---|---|---|---|---|---|
| 1 | *5.1.1 Law & Policy*: maintain hunting ban through International Whaling Commission. | Branch et al. 2004 | Simulated | Regional | Bayesian models fitted to three sighting series (1968–2001) indicated that the subspecies has been increasing at a mean rate of 7.3% per annum (1.4%–11.6%). | - |
| 2 | *2.1 Site/Area Management*: mitigation of seismic surveys and marine noise pollution. | - | Anecdotal | - | - | - |

(sound containment and improvement or replacement of current equipment used), and operational mitigation (to follow a protocol of operation), which will help to simultaneously conserve South Africa's coastal biodiversity and allow industrial developments (Koper & Plön 2012).

**Recommendations for managers and practitioners:**

- Systematic monitoring: design and implement a monitoring programme (acoustic and sightings) that can detect population size and trends.
- Develop best practice guidelines for seismic surveys and enforce regulations.

**Research priorities:**

- Winter survey off Namibia might reveal a breeding ground (Best 1998).
- Continued genetic research to resolve subspecies taxonomy and population structure, which is needed to design an effective monitoring programme.

**Encouraged citizen actions:**

- Reduce boat speed in bays and harbours.
- When participating in whale/dolphin watching tours, ensure regulations are followed.

# Data Sources and Quality

**Table 4. Information and interpretation qualifiers for the Blue Whale (*Balaenoptera musculus*) assessment**

| | |
|---|---|
| Data sources | *B. m. brevicauda*: field study (unpublished – circumpolar surveys IWC, whaling records), indirect information (literature, expert knowledge)<br>*B. m. intermedia*: field study (unpublished – circumpolar surveys IWC, whaling records; literature) |
| Data quality (max) | *B. m. brevicauda*: inferred<br>*B. m. intermedia*: estimated |
| Data quality (min) | *B. m. brevicauda*: suspected<br>*B. m. intermedia*: estimated |
| Uncertainty resolution | *B. m. brevicauda*: expert consensus<br>*B. m. intermedia*: confidence intervals |
| Risk tolerance | *B. m. brevicauda*: precautionary<br>*B. m. intermedia*: evidentiary |

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Details of the methods used to make this assessment can be found in *Mammal Red List 2016: Introduction and Methodology.*