Megaptera novaeangliae – Humpback Whale


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Regional Red List status (2016)	
Megaptera novaeangliae	**Least Concern***
B2 subpopulation	**Vulnerable D1***
National Red List status (2004)	
M. novaeangliae	Near Threatened D1
B2 subpopulation	Not Evaluated
Reasons for change	
M. novaeangliae	Genuine change: Increasing population
B2 subpopulation	Non-genuine change: New information
Global Red List status (2008)	
M. novaeangliae	Least Concern
B2 subpopulation	Not Evaluated
TOPS listing (NEMBA) (2007)	None
CITES listing (1975)	Appendix I
Endemic	
M. novaeangliae	No
B2 subpopulation	Near endemic

*Watch-list Threat

The southern Benguela upwelling region is thought to be a key feeding area for Humpback Whales, which may become threatened by bulk sediment benthic phosphate mining (Barendse et al. 2010). This threat should be monitored.

Taxonomy

Megaptera novaeangliae (Borowski 1781)

ANIMALIA - CHORDATA - MAMMALIA - CETARTIODACTYLA - BALAENOPTERIDAE - *Megaptera* - *novaeangliae*

Common names: Humpback Whale, Bunch, Hump Whale, Hunchbacked Whale (English), Boggelrugwalvis (Afrikaans)

Taxonomic status: Species and subpopulation

Taxonomic notes: Phylogenetic studies have shown that more or less geographically separated populations within different ocean basins reveal maternal lineages which can be identified across hemispheric boundaries, suggesting a degree of historic gene flow between hemispheres (Baker et al. 1994). No subspecies have been identified for this species. However, substantial population structure in the southern hemisphere is evident, and a number of breeding stocks have been identified based on the geographic position of their key breeding grounds. Two of these breeding stocks (Breeding Stocks B and C) migrate through coastal waters of the assessment region.

Assessment Rationale

The overall population of Humpback Whales is estimated to be increasing both globally and within the assessment region. For example, a Bayesian mixed model stock assessment for sub-stocks C1 and C2+3 estimated a post-2006 abundance of > 7,000 for each sub-stock, meaning that C1 is estimated at 85% of pristine level and C2+3 at 55% pristine. Similarly, shore-based surveys at Cape Vidal, KwaZulu-Natal Province, revealed a significant population increase between 9% and 11.5% from 1988 to 2002. This is very similar to increase rates of 11.4–12.2% calculated at the same site between 1988 and 1991, when the best population estimate in 1990 was 1,711 individuals (Findlay & Best 1996; Findlay et al. 2011). There are no major threats that are expected to cause population decline and there are estimated to be currently more than 1,500 mature individuals within the assessment region, which rules out the Near Threatened D1 category from the 2004 national assessment. Thus, we list this species as Least Concern.

On the other hand, the southern B2 subpopulation (assessed separately as they are largely localised to the Benguela system) is considered Vulnerable D1, due to subpopulation estimates of between 350 and 500 mature individuals in 2007, and recovery levels estimated to be much lower (< 15%) than most other southern hemisphere Humpback Whale populations. Without a historical baseline it is difficult to infer a recovery rate and population trend. However, the early depletion of Humpback Whales off the southwestern Cape by 1914 (1,299 were taken between 1909–1916) and no recovery in numbers until full protection (in 1963) suggests that this does represent a unique sub-group of whales that show maternally-derived site fidelity to the Saldanha Bay/St Helena Bay coastal migratory corridor/feeding ground areas in the southern Benguela upwelling system. There is evidence of entanglements and incidental mortalities in the fisheries around these areas and although it unlikely to have a severe impact on the subpopulation, they should be nevertheless be monitored to ensure no population decline .

Recommended citation: Barendse J, Carvalho I. 2016. A conservation assessment of *Megaptera novaeangliae*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

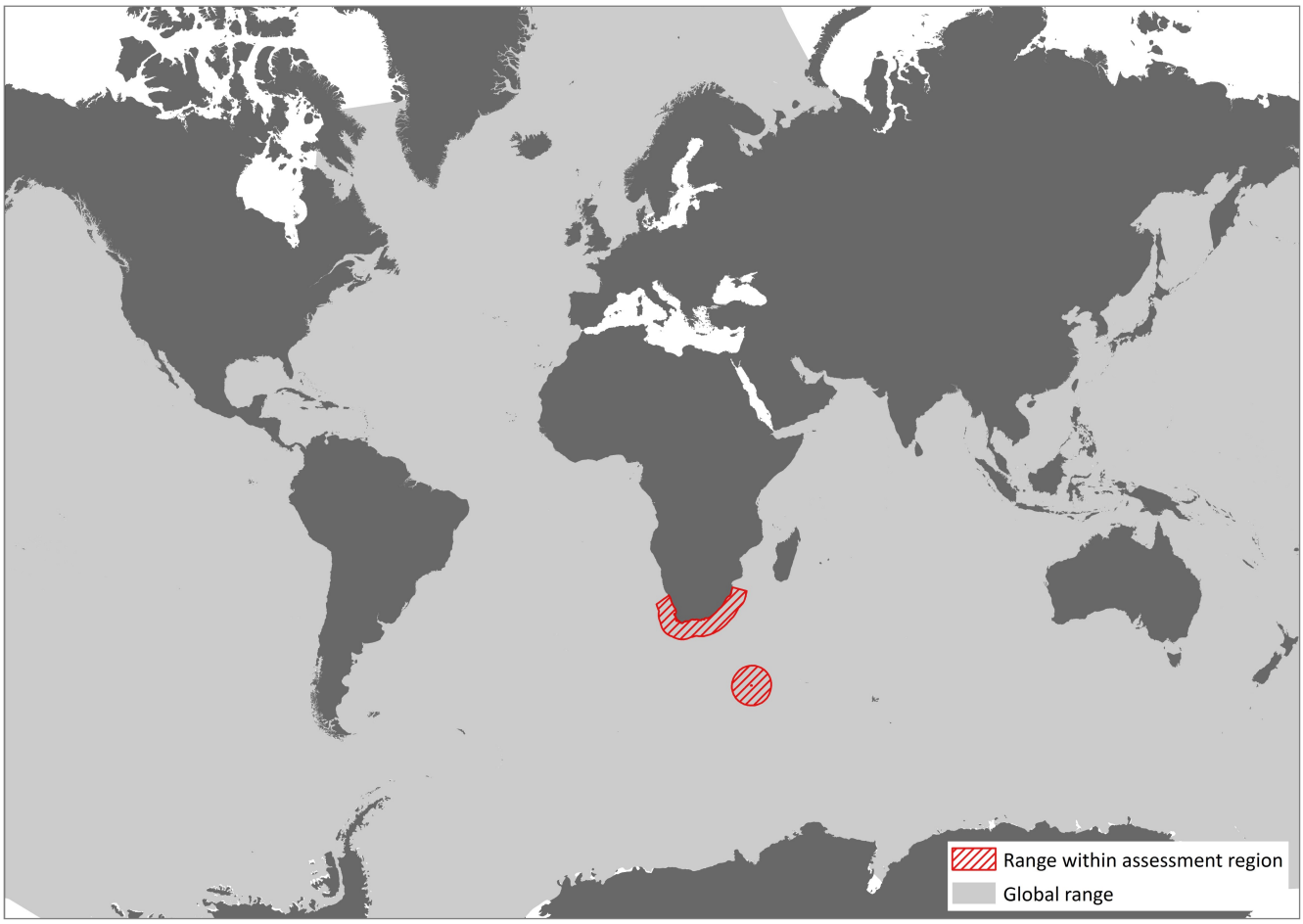

Figure 1. Distribution range for Humpback Whale (*Megaptera novaeangliae*) within the assessment region (IUCN 2012)

In the southern hemisphere overall, there are an estimated 140,000 individuals and they are considered widespread with no major threats at present. However, there is a growing concern about seismic activity relating to hydrocarbon exploration off West Africa which can affect breeding behaviour, and this threat is probably also applicable in Mozambique. There is also the emerging threat of bulk sediment benthic phosphate mining off South Africa and Namibia, and the impacts of such activity on the ecosystem is yet unknown, but likely negative.

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

Distribution

Humpback Whales occur worldwide, within all major ocean basins (Clapham & Mead 1999), migrating seasonally from tropical to polar waters. Most subpopulations, with the exception of the Arabian Sea subpopulation (Mikhalev 1997), migrate from tropical breeding areas (commonly along continental coastlines or sheltered islands) to temperate and high latitude feeding regions (Clapham & Mead 1999), where waters are colder and productivity increases. Humpbacks are abundant throughout the Antarctic in summer south of the ice edge, but not within the pack ice zone (Dalla Rosa et al. 2008). In the winter, southern hemisphere whales aggregate into specific nearshore breeding areas in the Atlantic, Indian and Pacific Oceans, with two subpopulations extending north of the equator off Colombia in the eastern Pacific and in the Bight of Benin in the Atlantic (van Waerebeek et al. 2001). Some wintering grounds are fairly localised (for example, around island groups) and some are more diffuse, such as along the western coast of southern Africa and the southern coast of West Africa (Reilly et al. 2008).

Seven breeding stocks have been identified in the southern hemisphere, and aside from Breeding Stock (BS) A and D, there is evidence of substructure within the stocks, with subunits that are spatially and genetically isolated to varying degrees (Baker et al. 1994; Valsecchi et al. 1997).

Within the assessment region, the species occurs throughout South Africa's Exclusive Economic Zone (EEZ). They use South Africa's coastal waters as migratory corridors, or as a summer feeding ground (BS B; Barendse et al. 2010). Humpback Whale populations are well studied, in comparison to other Balaenopterid species, and, for most breeding stocks, their migratory behaviour has been identified. Two breeding stocks utilise the waters around South Africa as wintering grounds:

- Breeding Stock B (South–eastern Atlantic Ocean) is found along the west coast of Africa (Weir 2010, 2011) northwards to breeding grounds off West Africa (around Gabon), as far as the Gulf of Guinea, and south to South Africa (a precise southerly limit has not been identified). A small component of BS B animals (designated as B2) feeds within the Benguela upwelling (Angola, Namibia and South Africa) during spring and summer and some animals may remain in the area for prolonged periods (sometimes more than a month), rather than migrating directly to the Antarctic.

- Breeding Stock C (South-western Indian Ocean) is located along the eastern coasts of South Africa and Mozambique (C1), as well as the eastern coasts of Madagascar (C3), Mayotte, the Comoros and other western Indian Ocean island groups. The extent of mixing of the C stock wintering off the coasts of Mozambique (the C1 substock), Madagascar (the C3 substock) and the western Indian Ocean island groups (the C2 substock) remains unclear (Reilly et al. 2008).

Although, some spatial or temporal mechanism appears to have caused some slight genetic differences between the B2 subpopulation and the broader population, they are not isolated and genetic exchange does occur (Carvalho et al. 2014). There is also evidence of multiple returns of the same whales and their offspring to the west coast, suggesting maternally derived site fidelity (Barendse et al. 2013; Carvalho et al. 2014). The geographic extent of the feeding is not known but may extend throughout the southern Benguela, with bigger aggregations at prominent coastal upwelling plumes.

Population

Humpback Whale stocks were heavily depleted throughout most of the southern hemisphere in the early 20th century by a combination of coastal catches in their wintering grounds, catches from land stations, and by pelagic fleets in their Antarctic feeding grounds. Approximately 220,000 Humpback Whales were taken in total, of which about 100,000 since 1940. Almost half of these latter whales consisted of illegal takes by the USSR (Zemsky et al. 1996; Allison 2006). Between 1908 and 1963, recorded catches outside the Antarctic (north of 40° S) have been: about 30,000 off the western coast of Africa (primarily Gabon and Angola); and nearly 20,000 off the eastern coasts of southern Africa (KwaZulu-Natal, Mozambique and Madagascar) and in the western Indian Ocean. For Humpback Whales in the South Atlantic, western and northern Indian Oceans, there is strong population structure between Breeding Stocks A, B, C and X (Rosenbaum et al. 2009) and evidence of some substructure within the stocks, with subunits that are spatially and genetically isolated to varying degrees. There have been records of whales "switching" between the Indian and Atlantic Ocean wintering grounds but this is regarded as highly unusual (Pomilla & Rosenbaum 2005; Stevick et al. 2011).

Recent estimates of abundance for the majority of breeding stocks have been acquired using line-transect surveys as well as photographic identification capture-recapture methods. The rate of increase in abundance has been identified from time-series data. For five of these stocks, a rate of increase between 4.5% and 10.5% per year has been revealed (Leaper et al. 2008). The southern hemisphere estimate of 140,000 individuals (Jackson et al. 2015) is probably an underestimate, because there is currently no data for Stock F (South Pacific), or part of Stock B's winter range for a discrete period. Additionally, the entire population does not always migrate to the wintering grounds identified, for example, results revealed an excess of males during a winter census (Reilly et al. 2008).

South of 60°S, in the Antarctic, summer estimates of abundance have been conducted by the International Decade of Cetacean Research, IDCR (presently Southern Ocean Whale and Ecosystem Research, SOWER). Since 1978 and 1979, three sets of circumpolar surveys have been completed, revealing abundance estimates of 7,100 (1978–1984), 10,200 (1985–1991), and 41,800 (1992–2004). These are likely to be underestimates of the southern hemisphere population, due to the fact that not all individuals migrate south of 60°S, and a large proportion of key summer feeding grounds north of this limit have not been assessed (for example South Georgia, the South Sandwich Islands and the waters around Bouvet Island).

In the Indian Ocean, 8,000 Humpback Whales were reportedly caught from Stock C off South Africa and Mozambique between 1908 and 1915. Smaller catches took place off the KwaZulu-Natal coastline from 1920 to 1962, but significantly larger catches off Madagascar took place during two periods between 1937–1939 and 1949–1950 (Angot 1951). A certain degree of whaling in and around the Antarctic region also may have affected BS C during the peak whaling period. Breeding Stock C has certainly recovered since the end of commercial whaling. IWC models suggest recovery of 65–96% pre-exploitation levels for the C1 stock, and Findlay et al. (2011), using shore-based surveys at Cape Vidal, calculated a significant population increase between 9% and 11.5% from 1988 to 2002. This is very similar to increase rates calculated at the same site between 1988 and 1991: 11.4–12.2%, with the best population estimate in 1990 being 1,711 individuals (Findlay & Best 1996). The population in the SW Indian Ocean is probably nearing carrying capacity and the rate of increase is expected to decline (Findlay et al. 2011). Johnston and Butterworth (2009), using a Bayesian mixed model stock assessment for sub-stocks C1 and C2+3, calculated a post-2006 abundance of > 7,000 each, meaning that C1 is estimated at 85% of pristine level and C2+3 at 55% pristine.

Subpopulation B declined considerably in the 19th and 20th centuries as a direct result of whaling in its wintering breeding grounds off the west coast of Africa. Between 1909 and 1960, approximately 30,000 Humpback Whales were documented as caught off the west coast of sub-Saharan Africa (Reilly et al. 2008). The most recent large Humpback whaling operation by Norwegian and French whalers in the waters off Gabon and São Tomé took more than 4,000 Humpbacks between 1951 and 1954, and subsequently 160 were caught off Gabon in 1959 in a final commercial whaling operation. The population dynamics of BS B are largely uncertain, and although numbers may have increased somewhat, it is a unique assemblage, and fairly localised around a critical habitat (Benguela upwelling). Based on genetic dissimilarities, some suggest that two sub-stocks exist: specifically, B1 that spends winter off the west coast of Gabon, the Congo, Cabinda (Angola) and northwards to the Bight of Benin; and B2 with a wintering area that is currently uncertain, although may be south of that of B1 (Best 2011). Individuals off Namibia's west coast have not shown matches with any other site (Elwen et al. 2014), thus supporting the existence of the B2 stock. There are also records of Humpbacks during summer near Cape Verde (Hazevoet et al. 2011), but it is not clear how these relate to the greater B Stock. Movements of 11 individuals that were tracked during migrations from West Africa to Gabon indicate that these stocks are not reproductively isolated (Barendse et al. 2011; Carvalho et al. 2014).

The complex population structure of BS B and lack of data collected from the area between Walvis Bay and northern Angola has hampered accurate overall population

estimates. The most recent estimate based on capture-recapture models for data collected from 2001–2007 of whales making use of the feeding ground along the west coast is about 500 animals (Barendse et al. 2011). Without a historical baseline it is difficult to infer a recovery rate. However, the early depletion of Humpbacks off the southwestern Cape by 1914 (1,299 were taken between 1909 and 1916) and no recovery in numbers (Best & Allison 2010) up to full protection in 1963 suggests that this does represent a unique sub-group of whales that show maternally derived site fidelity to the Saldanha Bay/ St Helena Bay coastal migratory corridor/feeding ground areas (Barendse et al. 2013). Other Humpbacks from Gabon make use of more offshore migratory routes (Rosenbaum et al. 2014). Modelling done for IWC, based on historic catches and capture-recapture, suggests that for "B2" the estimated abundance relative to pristine levels may be between 4.5–12.4%, but there is much uncertainty about which model configuration is appropriate (Müller et al. 2011). This uncertainty has not changed much with the most recent synthesis (Jackson et al. 2015).

The Humpback Whale is better studied than other Balaenopterid species and migratory destinations are well known for some subpopulations. The IWC Scientific Committee suggests that globally Humpback Whale stocks have generally recovered to levels at or above those of their 1940 abundance. However, the IWC is yet to assess populations in the North Pacific and four of the seven southern hemisphere stocks, thus it is currently not possible to accurately compare the global population level to that of the historic 1940 level. However, there is little evidence to suggest that the global population remains below 50% of the 1940 threshold.

Current population trend: The broad population of *M. novaeangliae* is considered to be increasing; however, the subpopulation B2 is currently considered stable.

Continuing decline in mature individuals: No

Number of mature individuals in population: The southern hemisphere estimate of 140,000 is probably an underestimate. Subpopulation B2 is currently estimated at between 350 and 500 individuals.

Number of mature individuals in largest subpopulation: Unknown

Number of subpopulations: Currently two subpopulations (B and C) have been identified migrating through South African waters, which have been further divided into sub-stocks based on genetic dissimilarities.

Severely fragmented: No

Habitats and Ecology

The Humpback Whale migrates seasonally between winter breeding grounds in the tropics and feeding areas predominantly along continental shelves in temperate and high latitude areas (Clapham 2002). In the southern hemisphere summer, Humpbacks feed nearly exclusively on Antarctic krill (*Euphausia superba*), usually around Antarctica (Skinner & Chimimba 2005). However, some feeding activity takes place in the Benguela upwelling system along the migration route west of Africa by Breeding Stock B (Best et al. 1995), where Humpbacks consume another krill species (*E. lucens*) and the amphipod (*Themisto gaudichaudii*) (Barendse et al. 2011). The feeding here appears to be linked to productive upwelling cells at Cape Point, Dassen Island, Cape Columbine, and probably others further north. There is evidence that "knowledge" about the use of the feeding opportunities is transferred by mothers to their calves (Barendse et al. 2013), and whales in B2 demonstrate high fidelity to the region (Barendse et al. 2013; Carvalho et al. 2014), with several animals returning to the region between years and for long periods of time. The relationship between whales feeding here and whales migrating along mid-oceanic routes has not been established. Recent work looking at scarring by cookie-cutter Sharks (*Isistius* spp.) suggests that whales found off west South Africa have spent extended periods in nearshore or cooler waters where wounds (acquired in warmer tropical waters) have had time to heal (Elwen et al. 2014). Feeding at Saldanha Bay and St Helena Bay occurs mainly from October to February, although whales may be present in low numbers throughout the year.

For the broad population, the bulk of their feeding takes place in summer around Antarctica, where the major food source is krill. This resulting energy is converted to reserves in the form of blubber. In some areas outside of their summer feeding zones, Humpback Whales may feed on schooling fish, but they usually only consume limited

Photo 1. A Humpback Whale (*Megaptera novaeangliae*) showing its baleen during suspected feeding activity off the west coast of South Africa

amounts of food while migrating northwards, and on return to the south. In Durban, Bannister and Baker (1967) examined the stomach contents of 25 Humpback Whales; only three of the whales were found to have food in their stomachs, all of which consisted of Euphasiid remnants.

The inshore area associated with the Benguela upwelling (from the coast to about 70 m depth) is used regularly as a feeding area in the spring and summer months by a sub-group of Humpback Whales (B2 Breeding Stock). Feeding aggregations form of up to 20 whales at a time, with more recent evidence of "super-groups" (J. Barendse unpubl. data). Some of the whales may remain in the area for over a month. They are associated with upwelling plumes at Cape Columbine, Dassen Island, Cape Point, Lamberts Bay, Elands Bay and possibly also Lüderitz, but are known to be absent from Saldanha Bay and St Helena Bay. Findlay and Best (1996) reported that individuals of the B2 Breeding Stock may feed opportunistically off the west coast of South Africa during the summer, where one individual was found to have been feeding on stomatopods.

In the southern hemisphere, Humpback Whales will reproduce during the winter months in tropical, coastal waters. With a gestation period of approximately 11.5 months, females usually give birth every two years, but may produce calves annually. Calves grow very quickly and usually reach lengths of 8.8 m by the time of weaning. Mehta et al. (2007) reported that Humpback Whale calves may be subject to predation by Killer Whales (*Orcinus orca*). Males and females become sexually mature once they reach lengths of 11.5 m and 12 m respectively (Skinner & Chimimba 2005). Humpback Whales have a generation time of 22 years (Taylor et al. 2007). This species is known to be extremely vocal at breeding grounds, where they produce a sequence of diverse sounds for durations of between 8 and 30 minutes. Sequences are consistent between individuals at particular breeding grounds, and most commonly come from breeding adult males, announcing their presence (Skinner & Chimimba 2005).

Ecosystem and cultural services: As indicator species, 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 broadscale shifts in ecosystems (Moore 2008).

The B subpopulation is considered a flagship subpopulation of the west coast of South Africa. The location of a Humpback feeding ground so near the shore and so far north in the southern hemisphere is unique (Barendse et al. 2013). The only other comparable situation is at the Antarctic Peninsula. It offers unique research and tourism opportunities.

Use and Trade

Large-scale harvesting of this species has ceased. Low-level hunting continues in a few places but not specifically in the assessment area. For example, the government of Japan announced plans to resume Humpback whaling in the Antarctic from the 2007/08 season, starting with an experimental catch of 50 animals per year under scientific permit. The impact of these catches on small unrecovered stocks of Humpbacks in Oceania that feed in the whaling grounds of Area V is not clear.

Shore-based whale watching in South Africa in 1995 delivered an estimated R5 million in indirect expenditure (Findlay 1997). In 2008, it was estimated that there were > 500,000 whale watchers in South Africa spending > 2.7 million $US directly and > 58.7 million $US indirectly (O'Connor et al. 2009). Boat-based whale watching increased by 14% between 1998 and 2008. Whale watching based on Humpbacks becomes more important during the migration off the KwaZulu-Natal coast.

Threats

In the southern hemisphere overall, there are an estimated 140,000 individuals and they are considered widespread with no major threats at present (Jackson et al 2015). While commercial whaling had a severely detrimental impact on Humpback Whale populations, since the banning of Humpback whaling in 1966, the global population has shown a significant recovery. There are, however, several small-scale populations that have not exhibited this increasing trend, such as the B2 stock.

Like other cetaceans, Humpback Whales are vulnerable to injury and death as a result of ship strikes or entanglements in fishing gear. Globally, Humpback Whales are the second most commonly recorded victims of ship strikes (Fleming & Jackson 2011). In the US Atlantic, between 1999 and 2003, seven Humpback Whales were reported seriously injured or killed as a result of ship strikes and 19 due to entanglements (Fleming & Jackson 2011). In the US Pacific (mostly Alaska) between 1999 and 2001, three Humpbacks were reported fatally injured by ship strikes and 13 were documented as seriously injured or killed as a result of entanglements (Fleming & Jackson 2011). Within the assessment region, Humpbacks are occasionally caught in shark nets off the KwaZulu-Natal coast. Fortunately, these individuals were all released alive. However, entanglement incidents of Humpback Whales in shark nets off the KwaZulu-Natal coast showed an increase of 15.1% per annum between 1990 and 2009 (Meÿer et al. 2011). Considering that this rate of increase is comparable to that of the increase in whale populations, the risk of entanglement is not considered to be a major concern hindering the recovery of Humpback Whale populations (Meÿer et al. 2011). In the majority of regions, the recent increase in Humpback Whale abundance suggests that anthropogenic disturbance and the resulting mortalities do not detrimentally impact population trends. However, a continued increase in whale numbers is expected to result in heightened levels of anthropogenic interaction, thus effective mitigation measures are necessary.

This species may become entangled in trap fisheries and rock lobster traps off the Western Cape, South Africa. Although increases in entanglements are again considered a possible result of increasing population numbers, entanglements may also be impacting the small subpopulation that frequents the west coast in spring and summer. The B2 subpopulation distribution does overlap with rock lobster offshore fisheries along the west coast of South Africa, for example Dassen Island is a specific hotspot of overlap. These fisheries are, however, managed spatially and temporally by an Operational Management Procedure, thus are not stagnant in their positioning and effect on the marine environment. Although there is evidence of entanglements and incidental mortalities at these fisheries, they are not considered a major threat to the subpopulation, but

Table 1. Threats to the Humpback Whale (*Megaptera novaeangliae*) 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	*5.4.3 Fishing & Harvesting Aquatic Resources*: entanglement in shark nets and fishing gear, including trap fisheries. Current stresses *2.1 Species Mortality* and *2.2 Species Disturbance*.	Meÿer et al. 2011	Empirical	Regional	Increasing in tandem with increasing population.
2	*4.3 Shipping Lanes*: ship strikes. Current stresses *2.1 Species Mortality* and *2.2 Species Disturbance*.	Fleming & Jackson 2011	Empirical	Global	Increasing vessel traffic since the 1960s has led to increasing ship strikes, disturbance of breeding, calving, feeding and resting behaviour.
3	*3.1 Oil & Gas Drilling* and *9.2 Industrial & Military Effluents*: energy development, and seismic surveys leading to industrial and noise pollution.	Rosenbaum & Collins 2006 Cerchio et al. 2014	Indirect Indirect	Regional Regional	Potential impacts of the oil and gas industry on breeding and calving habitat.
4	*3.2 Mining & Quarrying*: bulk sediment mining for benthic phosphates.	Benkenstein 2014	Indirect	Regional	Emerging and potentially severe impact on the dynamics of nutrient cycling and productivity.
5	*11.1 Habitat Shifting & Alteration* due to climate change. Current stresses *2.3.8 Indirect Species Effects*: effects on food resources.	Nowacek et al. 2011	Simulation	Regional	Increasing: Antarctic ice sheets projected to diminish, along with krill abundance.
6	*9.6.3 Noise Pollution*: marine noise pollution through boat traffic.	-	Anecdotal	-	Increasing (manageable)
7	5*.4.2 Fishing & Harvesting Aquatic Resources*: historical whaling (no longer a threat). Current stresses *2.3 Indirect Species Effects*: inherent small population size and genetic isolation.	International Whaling Commission	Empirical	Global	Ceased (manageable)

should be monitored accordingly, considering that these smaller subpopulations have not exhibited clear increases in their abundance levels, and thus should still be carefully monitored.

Energy development is also suspected to be a minor threat to this subpopulation. Considering that South African Humpback Whale populations migrate, and have been known to travel through oil and gas fields off South Africa, Namibia, Angola, Equatorial Guinea and the Congo, threats outside of the assessment region should also be considered. For example, a portion of the B2 subpopulation migrates to the Gulf of Guinea, where hydrocarbon development could be a threat to these individuals. The severity depends on oil and gas mining developments and the resultant industrial pollution along the west coast Humpback breeding and migrating areas. The main effect is disturbance due to seismic exploration and shipping activities, but the effects are currently unknown. For example, the population in Gabon rocketed despite the oil and gas industry – so evidence suggests that they may be resilient to hydrocarbon infrastructure. Similarly, they are suspected to not be as susceptible as Blue Whales to marine noise pollution. However, the resulting effects of noise pollution, mud and water discharges, alteration to the faunal composition, and accidental spillage from seismic surveys may increasingly impact critical breeding and calving habitats of this species (Cerchio et al. 2014). In particular, behavioural changes or displacement could negatively affect calf survival and reproductive success (Rosenbaum & Collins 2006). Additionally, wave and wind energy infrastructure could cause disturbance through the farms (permanent disturbance) and setting of underwater cabling (temporary disturbance). An emerging and potentially severe threat in South African and Namibian waters is allocation of rights for bulk sediment mining for benthic phosphates (Benkenstein 2014). The disturbance of sediments and extraction of minerals could potentially impact on the dynamics of nutrient cycling and productivity in yet unknown ways.

A recent decline in the abundance of krill in the Antarctic has been related to a rapid decrease in sea ice, which is linked to the effects of anthropogenic climate change (Nowacek et al. 2011). Increasing whale populations, following centuries of mismanagement and overexploitation, in association with a decline in food availability may lead to considerable inter- and intra-species competition for food in the Southern Ocean. This may result in large-scale disruptions to the feeding ecology of all southern hemisphere stocks which frequent Antarctic breeding grounds in summer (Nowacek et al. 2011).

Current habitat trend: Declining in quality, due to anthropogenic disturbance in the form of marine mining off the west coast of Africa, as well as the rapid loss of sea ice (and the associated food resources) in the Antarctic due to the effects of climate change.

Conservation

Humpback Whale populations declined dramatically during the large-scale whaling operations of the 19th and 20th centuries. In the southern hemisphere, Humpback Whales have been formally protected from commercial whaling since 1963. However, prior to this, whaling was spatially and temporally managed in the Antarctic. Some unwarranted Soviet whaling continued into the 1970s, but the final major catches ceased after 1968 (Reilly et al. 2008). Since then Humpback populations have shown a strong recovery.

Stringent and systematic legislation is necessary for hydrocarbon exploration and seismic surveys currently being conducted off the coast of Gabon, to ensure the conservation of threatened marine species and habitats during development and exploration projects (Rosenbaum & Collins 2006). Several marine sanctuaries in various countries protect Humpback Whales while they move through particular areas. Additionally, they are recorded in Appendix I of both CITES and CMS (Convention on the Conservation of Migratory Species of Wild Animals). Within the assessment region, no additional conservation measures have been identified for this species. However, continued research into the movements, population dynamics and threats faced by this species would assist in conservation management.

Several methods to reduce cetacean bycatch (particularly calves) in shark and fishing nets have been investigated, such as increasing the reflectivity of the net to cetacean sonar, and fitting nets with warning sound alarms. These interventions have not shown major success in reducing cetacean mortalities (Dawson 1991; Jefferson & Curry 1996). However, a reduction in fishing effort, and the periodic spatial and temporal closure of fishing nets, is expected to be more effective in reducing bycatch. Within the assessment region, the KwaZulu-Natal Sharks Board has implemented methods to reduce shark net bycatch, such as limiting the length of nets, replacing nets with baited drumlines, installing nets with whale alarms, and herding animals away from nets to safer areas (Cliff & Dudley 2011). While not specifically designed as a conservation measure for Humpback Whales, they are expected to benefit from the action of lifting nets during the seasonal sardine run, when aerial surveys confirm the arrival of large shoals of sardines. These events usually coincide with the northward migration of Humpbacks along the KwaZulu-Natal coastline in June and July (Dudley & Cliff 2010).

A reduction in ship speed when traveling through high density whale areas, in order to give the whale adequate time to avoid the vessel, as well as to allow the operator time to navigate the vessel out of the whale's path, may be an efficient means of reducing whale mortalities (Clapham 2002). This may however, prove difficult considering the general trend of increasing ship speed for transport efficiency. Secondly, by annually monitoring whale abundance and distribution, authorities may be able to redirect current ship and ferry routes away from high density areas, in order to decrease the rate of collision (Panigada et al. 2006).

The "Blue Economy" is an innovative action plan for the sustainable use of our oceanic resources, aimed at mitigating ecological damage and ensuring that marine biodiversity is protected. By integrating Humpback Whale conservation plans into the scope of the "Blue Economy" action plans, we can ensure a holistic approach to species and habitat management, while simultaneously ensuring economic growth and development.

Recommendations for managers and practitioners:

- Systematic monitoring: design and implement a monitoring programme (acoustic and sightings) that can detect population size and trend estimates.
- Develop best practice guidelines for seismic surveys and enforce regulations.
- Develop mitigation plans for bulk sediment mining for benthic phosphates (Benkenstein 2014).

Research priorities:

- The degree of mixing within Breeding Stock B and the exact location of the proposed B2 breeding ground, or whether there is more than one breeding stock.

Table 2. Conservation interventions for the Humpback Whale (*Megaptera novaeangliae*) 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.	Leaper et al. 2008	Empirical	Regional	For five of the southern hemisphere stocks, a rate of increase between 4.5 % and 10.5 % per year has been recognised.	International Whaling Commission
2	*2.1 Site/Area Management*: modification of rock lobster traps and shark nets to reduce by-catch and space/time management of fishing effort.	Cliff & Dudley 2011	Empirical	Regional	Bycatch rates reduced.	KwaZulu-Natal Sharks Board
3	*5.2 Policies & Regulations*: reduction in ship speed within high density whale areas to reduce ship strikes.	-	Anecdotal	-	-	Department of Environmental Affairs
4	*5.1.2 Law & Policy*: integrate Humpback Whale conservation into "Blue Economy" action plans.	-	Anecdotal	-	-	Department of Environmental Affairs

- Broad-scale sampling of the rest of West Africa, so that the uncertainties regarding the population structure and breeding and feeding locations for the west coast sub-population can be solved. This will require broader scale genetic and photo-ID sampling and possibly satellite tagging. Without this information, it is difficult to infer how vulnerable this subpopulation might be.
- Research efficacy of strategies to reduce ship strikes.
- Potential impacts of new industrial activities like bulk sediment mining linked to the "Blue Economy".

Encouraged citizen actions:

- Whale watching operators could contribute to photo-ID catalogues and behavioural observations.
- Report strandings to relevant authorities.
- Participate as volunteers in Humpback Whale research projects.

Data Sources and Quality

Table 3. Information and interpretation qualifiers for the Humpback Whale (*Megaptera novaeangliae*) assessment

Data sources	*M. novaeangliae*: Field study (unpublished – circumpolar surveys IWC, whaling records; literature) B2 subpopulation: Field study (unpublished – circumpolar surveys IWC, whaling records; literature), indirect information (literature)
Data quality (max)	*M. novaeangliae*: Estimated B2 subpopulation: Estimated
Data quality (min)	*M. novaeangliae*: Estimated B2 subpopulation: Inferred
Uncertainty resolution	*M. novaeangliae*: Confidence intervals B2 subpopulation: Best estimate
Risk tolerance	*M. novaeangliae*: Evidentiary B2 subpopulation: 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.*