

# *Balaenoptera edeni* – South African Bryde’s Whale



**Common names:** South African Bryde's Whale, Bryde's Whale Complex, Common Bryde's Whale, Pygmy Bryde's Whale, Tropical Whale (English), Bryde se Walvis (Afrikaans)

**Taxonomic status:** Species (offshore form)/subpopulation (inshore form)

**Taxonomic notes:** Internationally and regionally, the taxonomic status and population dynamics of the “Bryde’s Whale complex” remains unconfirmed. Bryde’s Whales are members of the family Balaenopteridae, of which there are now seven defined species. Within the assessment region, Best (1977) described two allopatric forms (inshore and offshore) from South Africa that differ from each other in body size, migrations, reproductive seasonality, fecundity and prey types (Best 2001). These two forms were subsequently referred to as *B. edeni* (Anderson 1878) and *B. brydei* (Olsen 1913) respectively, pending further investigation. However, later comparisons suggest that Olsens’ (1913) description was not specified correctly (Best 2001; Yamada et al. 2008). It is currently accepted (and supported by molecular work; Penry 2010) that Olsen’s description of *B. brydei* from South Africa was based on a combination of both the coastal (inshore) and pelagic (offshore) forms.

The general acceptance and use of the common name “Bryde’s Whale” for *B. edeni* has confused matters further, as too has the discovery of at least two eco-types/allopatric forms within the approximate same geographic locations; for example, off South Africa, southwest Japan and Oman (Best 1977; Mikhalev 2000; Kato et al. 2002). Comparisons of mitochondrial DNA (mtDNA) control region sequences from Bryde’s Whales sampled off South Africa with those already published for other Bryde’s Whale populations and closely related species (Junge 1950; Omura et al. 1981; Árnason & Best 1991; Árnason et al. 1993; Sasaki et al. 2005, 2006), identified the South African offshore form (SE Atlantic stock) as *Balaenoptera brydei* (ordinary type) (Penry 2010). The inshore form was found to be more similar to *B. brydei* than to *B. edeni* (Anderson, 1878) (Penry 2010). Available mtDNA data provides strong support for the South African inshore Bryde’s Whale being a subspecies of *B. brydei*; statistically significant differentiation between the two forms is evident ( $F_{ST} = 0.97$ ) (Penry 2010), although the sample was limited.

The morphological and genetic analysis of additional specimens of the reputed *B. edeni* (*sensu* Sasaki et al. 2006) from more localities is needed before the taxonomic status of the “Bryde’s Whale complex” can be confirmed. Provisionally we use *Balaenoptera edeni* for this assessment, as the IWC (International Whaling Commission), Kato and Perrin (2009) and Kershaw et al. (2013) refer to all Bryde’s Whales as a single species, *Balaenoptera edeni*. However, we recognise that there is much controversy over the taxonomic status of this group, for example Luksenberg et al. (2015), Sasaki et al. (2006) and Penry (2010). Thus, following taxonomic revision, reassessment may be necessary.

## Regional Red List status (2016)

*Balaenoptera edeni* (inshore) **Vulnerable D1\***

*Balaenoptera edeni* (offshore) **Data Deficient\***

## National Red List status (2004)

*Balaenoptera edeni* (inshore) **Vulnerable D1**

*Balaenoptera edeni* (offshore) **Not Evaluated**

## Reasons for change

*Balaenoptera edeni* (inshore) **No change**

*Balaenoptera edeni* (offshore) **Non-genuine change:  
New information**

## Global Red List status (2008)

*Balaenoptera edeni*  
~ Data Deficient

## TOPS listing (NEMBA) (2007)

None

## CITES listing (1983)

Appendix I

## Endemic

No

## \*Watch-list Data

The taxonomic status of this species remains largely controversial. However, recent mitochondrial DNA evidence suggests that the offshore form should, in fact, be regarded as *Balaenoptera brydei*. Additionally, the inshore form was found to be closely related to *B. brydei*, perhaps on a sub-specific level (Penry 2010).

## Taxonomy

*Balaenoptera edeni* (Inshore subpopulation) (Olsen 1913)

*Balaenoptera edeni* (Offshore population) (Anderson 1879)

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

**Synonyms:** *Balaenoptera brydei* (Olsen 1913)

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Figure 1. Distribution range for South African Bryde's Whale (*Balaenoptera edeni*) within the assessment region (IUCN 2012)

## Assessment Rationale

Although the Bryde's Whale complex may be split into a number of species or subspecies pending further genetic analyses, this assessment differentiates between an inshore and offshore form in South African waters, focusing most specifically on the inshore form. The coastal, inshore stock is suspected to consist of fewer than 1,000 mature individuals based on data from a 1982 line transect, ship-based survey that covered the known southern hemisphere summer distribution of the population and resulted in an estimate of  $582 \pm 184$  animals where inclusion of secondary sightings might have increased this estimate by 29%. A mark recapture study in Plettenberg Bay produced an abundance estimate of between 150 and 250 individuals between 2005 and 2008, but how this relates to the total population is unknown. Based on the assumption that the population remains limited to fewer than 1,000 mature individuals, we list the inshore population as Vulnerable D1.

There are currently no assessments available for the offshore stock, which was exploited by land-based whalers from at least 1911 to 1967 as an integral part of the catch, and more extensively between 1969 and 1976 by illegal unregulated pelagic whaling. Being largely restricted to the southern African shelf edge from Cape Point to at least the equator; its environment is likely to have been exposed to oil and gas exploration activities for the last two decades. Given the suspected effects of seismic surveys on fish, it is possible (but completely unsupported by any data) that prey availability to this population may have been adversely affected. There are

no population estimates either before or after exploitation or indications of trend and the offshore stock must be listed as Data Deficient.

This assessment echoes the global situation where the taxonomy (number and identity of species) is not yet resolved. If there is more than one species, the less abundant species may be threatened. If it is all one species, then it should be reclassified as Least Concern. Taxonomic resolution and current estimates of population size and trends for both forms are required and should result in a reassessment once such data are available.

**Regional population effects:** Currently, the inshore form is thought to exhibit non-migratory behaviour, and remains year-round over the continental shelf of South Africa (Best 2001); while the offshore form, occurring off the west coast of Southern Africa, appears to migrate northwards in autumn (Best 2001). There are no apparent barriers to the dispersal of either population.

## Distribution

Substantial uncertainty exists over the geographical range and population sizes of both the offshore and inshore form of *B. edeni*, and in connection, the number of species and/or subspecies. Although morphological differences between these two populations exist (Best 1977, 2001), distinguishing one form from another, while at sea, remains a challenging feat. Furthermore, the offshore form was also often misidentified as the Sei Whale (*Balaenoptera borealis*).

The known distribution of the inshore form is within 20 nautical miles of the coast, over the continental shelf

between Port St Johns and Lambert's Bay, which roughly corresponds to the 200 m depth contour. The inshore form may show a seasonal shift in distribution, with the majority of sightings on the south-east coast of South Africa, between Cape Agulhas (20°E) and East London (~28°E) in summer (Best et al. 1984). These whales were previously shown to move up the west coast in winter; however, observations from the late 1990s appear lower than those during commercial whaling in the 1960s (Best 2001) when high numbers were caught further north in autumn and winter (Best 1977). This shift may reflect changes in the availability of pelagic fish, with a general south and eastward shift in the distribution of pilchard (*Sardinops sagax* and *S. ocellata*) and anchovy (*Engraulis capensis*) in summer (Crawford 1981). Individuals also follow the annual migration of sardine up the east coast of South Africa (commonly known as the "Sardine Run") in winter, but the numbers involved and how far they follow the sardine schools is unclear.

Apart from water temperature, there is no obvious reason that the inshore form should not extend further up the west coast and into Namibian waters; however, sightings are extremely rare. Analyses of the mtDNA control region of an animal stranded in Walvis Bay in 2012 revealed an identical haplotype to animals sampled on the south coast of South Africa (G. Penry unpubl. data). Until a larger sample size has been collected we cannot confirm their residency in Namibian waters. Inshore whales were encountered more commonly during summer and autumn around the region of Plettenberg Bay (south-east coast of South Africa); with peak encounter rates in April (Penry et al. 2011). These results confirm those of Best (2001) who described a seasonal movement of inshore Bryde's Whales down the west coast towards the Agulhas Bank in spring.

The offshore form ranges from 34°S to equatorial regions and occurs mainly off the west coast of South Africa in summer and Gabon in winter. All recorded catches were taken within 300 nautical miles of the coast. Potentially the geographical ranges of these two forms may occasionally overlap, but the degree of genetic differentiation between them suggests that they do not breed (Penry 2010). This supports the suggestion of a distributional separation between these two forms in reproduction, feeding and seasonal migration (Best 1977).

## Population

Recent data on the inshore form (Penry 2010) suggest that the population size is small: closed population = 125 individuals (95% CI 107-155, CV = 0.09); open population individuals = 196 (95% CI 117-437, CV 0.37). However, the actual estimates are based on mark-recapture data collected in the coastal waters in and around Plettenberg Bay on the south coast (Penry 2010). The surveys covered a distance of approximately 55 km along the coast and ranged up to 10 km offshore. Their applicability to the total population is thus unknown. Additionally, molecular analyses suggest that the apparently resident South African inshore form is significantly differentiated from the seasonal offshore form, which is thought to occur at higher population numbers (Best 1996).

Between 1911 and 1967, more than 2,000 Bryde's Whales were documented as caught by whaling operations off the Cape region of South Africa. This included 1,300 individuals caught between 1947 and 1967 (IWC 2006a),

which are expected to have been from the inshore population of Bryde's Whales (IWC 1980a, 1980b). Subsequently, in 1983, the South African inshore population was approximated at  $582 \pm 184$  individuals (Best et al. 1984). Unfortunately, no population estimates are currently available for the rest of the South Atlantic, however, between 1969 and 1976 the majority of the 2,536 "Sei" Whales caught by the pirate whaling ship *Sierra* in the South Atlantic are, in fact, assumed to be Bryde's Whales from the offshore stock (IWC 1980b; Best 1996). This suggests that the offshore population was probably more abundant than the inshore form.

Bryde's Whales were not consistently distinguished from Sei Whales in International Whaling Statistics, but in some cases a breakdown of "Sei" Whale catches into the two species can be determined from original records, or approximated, based on current knowledge of the geographical and seasonal occurrence of Sei and Bryde's Whales, or from the compositions of later catches in the same area and season (IWC 1997, 2006b). Population estimates of Bryde's Whales in the southern hemisphere are in urgent need of reassessment. Historic estimates of abundance revealed the following approximations: in the southern Indian Ocean – 13,854; in the western South Pacific – 16,585; and in the eastern South Pacific – 13,194 (IWC 1981). These estimations were not founded on recently approved survey methods, and consequently a "zero catch limit" was set by the IWC for all Bryde's Whales, until a satisfactory estimation of population size has been established (IWC 1983).

**Current population trend:** Unknown

**Continuing decline in mature individuals:** Unknown

**Number of mature individuals in population:** < 1,000

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

**Number of subpopulations:** Within the assessment region, there are considered to be two subpopulations, one inshore and the other offshore; with a third occurring in the south-west Indian Ocean, south of Madagascar during summer, but seldom extending to South Africa's East coast (Best 2001).

**Severely fragmented:** No

## Habitats and Ecology

Bryde's Whales are presumably able to satisfy their nutritional and reproductive needs within their warm, temperate distribution, freeing them from the need to make extensive latitudinal migrations (Bannister 2002). Although pelagic populations (for example, the SE Atlantic population) undertake limited migrations towards the equator in winter and higher latitudes in summer, coastal populations do not migrate as such and their movements are primarily alongshore, most likely governed by the distribution of their prey. Year round occurrence has been reported from the coastal areas of south-western Japan, south eastern Brazil and South Africa. Bryde's Whales feed at a constant and high rate throughout the year (Best 1967) and feeding events commonly involve multi-species aggregations (Best 2007; Penry et al. 2011). The South African inshore population is dependent on year round prey availability and feed predominantly on small pelagic fish (for example, anchovy and pilchard).

The South African inshore population is resident over the Agulhas Bank (Best 2007) but shows a seasonal shift in distribution, with the majority of sightings on the southeast coast of South Africa, between Cape Agulhas and East London in the southern hemisphere summer and autumn (Best 2007; Penry et al. 2011). Off South Africa, aggregation size of Bryde's Whales was positively correlated with the occurrence of feeding behaviour. During winter there are increased sightings of Bryde's Whales further north along the East Coast, frequently in groups with Common Dolphins (*Delphinus capensis*) and Cape Gannets (*Morus capensis*) (Best et al. 1984; Best 2001; O'Donoghue et al. 2010). This appears to coincide with the annual north-eastward migration of sardines into KwaZulu-Natal waters (Fréon et al. 2010; Penry et al. 2011). In general, Bryde's Whales do not display reproductive seasonality. However this is more apparent in offshore/pelagic populations. Penry et al. (2011) found no seasonality in the occurrence of calves off South Africa. The inshore form is polyoestrous and has a high frequency of ovulation, possibly due to the year round abundance of food (Best 2007). The period for lactation is not known.

The offshore form lives on the edge of the continental shelf and migrates seasonally between the equator in the southern hemisphere winter and about 34°S in summer (Best 1996). Breeding can occur year-round but is more seasonal than the inshore form, peaking in autumn/early winter. The form is also less piscivorous than the inshore form, with euphausiids being regularly consumed and the fish eaten being more mesopelagic in nature: there also seems to be a marked seasonality in prey type, with euphausiids being relatively unimportant in autumn and winter but predominating in summer (Best 2001). Because of its year-round presence in temperate and tropical waters this population is subjected to an unusually high level of attack by what are believed to be cookie-cutter Sharks (*Isistius* spp.), to such an extent that the scars eventually obliterate the whale's natural pigmentation over large areas of the flanks and belly (Best 1977).

**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 broadscale shifts in ecosystems (Moore 2008). The inshore Bryde's population is the largest, resident predator in South African coastal waters. They are principally dependent on our small pelagic fish stocks for their prey, and suitable/safe habitat for breeding. Unlike most other large baleen whales that migrate between disparate feeding and breeding areas, the SA inshore form may have largely sympatric feeding and breeding areas with its range. Ecosystem services include revenue through tourism, food web stabilization and ecosystem indicators.

## Use and Trade

Bryde's Whales were possibly less impacted by commercial whaling than some other large whale species, although proper stock assessments are lacking in most areas and not straightforward given the (often) doubtful catch series involved. There has been no known direct whaling of this species in South African waters since 1976, however, some level of bycatch is possible by longline fisheries, but is undocumented and probably small.

## Threats

Both inshore and offshore stocks were subjected to some whaling in the past, but no specific estimates of depletion exist. The Bryde's Whale was the incidental beneficiary of IWC area restrictions on factory ship whaling that were originally designed to protect the low-latitude winter breeding grounds of other baleen whale species (Tønnessen & Johnsen 1982). This benefit was lost to the offshore population in 1969, when an illegal and unregulated pelagic operation commenced whaling in the southeast Atlantic (Best 1996). No direct takes are known in the area since 1976.

Like most cetaceans, Bryde's Whales are occasionally by-caught in fishing gear, but they do not appear to be especially susceptible within South African waters. In 2014, a Bryde's Whale (presumably from the inshore population) was entangled and subsequently died in experimental octopus fishery lines in Plettenberg Bay, and a second in June 2016 in False Bay in the same fishery gear (G. Penry unpubl. data). The possible expansion of this fishery is a cause for concern along the South African coastline. Records of vessel strikes are also rare in South Africa. The inshore form potentially competes with pelagic fisheries (sardine, anchovies) (*sensu* Clapham et al. 1999). Given the suspected effects of seismic surveys on fish (Gordon et al. 2003; Koper & Plön 2012), it is possible (but completely unsupported by any data) that prey availability to this population may have been adversely affected. Disturbances from ecotourism ventures during the "Sardine Run", while Bryde's Whales are feeding on bait balls (roughly spherical, tightly packed formations of fish), have also been reported. Although increased water temperatures may be favourable for Bryde's Whales, which prefer subtropical and tropic waters (MacLeod 2009), climate change and natural environmental stochasticity may exacerbate existing prey depletions (Burns & Baker 2000).

In summary, few immediate threats to the South African inshore Bryde's Whale are apparent. This is not to say that there are none, just that they have not been well assessed. Apart from the potential reduction in prey resources, the relatively small size of the population and its genetic isolation is probably its greatest threat due to demographic, genetic and environmental stochasticity.

**Current habitat trend:** Decline in habitat quality due to climate change.

## Conservation

The "Sardine Run" appears to be a critically important natural phenomenon for many marine predators. The dense shoals of sardine during this migration provide relatively easy access to a valuable, high protein food source. Thus, the inshore population of Bryde's Whales are considered largely dependent on this annual phenomenon and fisheries should be regulated accordingly. As such, the main intervention for this species is to estimate population sizes and unravel the discrepancy around the taxonomy of the offshore and inshore stocks. Subsequently, the inclusion of the species' energetic requirements (based on the findings of Best et al. 1984) in setting Total Allowable Catch limits (TACs) for the pelagic fishery would benefit the South African inshore population. Additionally, an ecosystem approach to fisheries management is necessary. This is expected to also benefit many other marine species. Additionally, the

**Table 1. Threats to the South African Bryde's Whale (*Balaenoptera edeni*) 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	5.4.2 Fishing & Harvesting Aquatic Resources: historical whaling (no longer a threat). Current stress 2.3 Indirect Species Effects: inherent small population size and genetic isolation.	Best et al. 1984 Penry 2010	Indirect Indirect	National Regional	Ceased and manageable if sufficient protection is given to the population and the more severe threats are controlled/prevented.
2	5.4.4 Fishing & Harvesting Aquatic Resources: competition with pelagic fisheries. Current stress 2.3.8 Indirect Species Effects: depletion of food resources.	-	Anecdotal	-	Increasing
3	11.1 Habitat Shifting & Alteration: climate change altering resource distribution. Current stress 2.3.8 Indirect Species Effects: depletion of food resources.	Burns & Baker 2000	Simulation	International	Increasing
4	6.1 Recreational Activities: ecotourism disturbance during the "Sardine Run", and along the whole coastline.	-	Anecdotal	-	Increasing but manageable if correct mitigation is implemented.
5	5.4.4 Fishing & Harvesting Aquatic Resources: entanglement in coastal fisheries (for example, octopus lines). Current stresses 2.1 Species Mortality and 2.2 Species disturbance.	-	Anecdotal	-	Increasing but manageable if correct mitigation is implemented.
6	4.3 Shipping Lanes: ship strikes Current stress 2.1 Species mortality.	-	Anecdotal	-	Increasing but manageable if correct mitigation is implemented.
7	9.6 Noise Pollution: marine noise pollution through seismic surveys and boat traffic. Current stress 2.3.8 Indirect Species Effects: depletion of food resources.	Gordon et al. 2003 Koper & Plön 2012	Review Review	International National	Possibly increasing

identification of specific breeding and feeding areas of the inshore stock may prove beneficial to the conservation of this population. However, habitat utilisation is poorly known for the offshore stock, therefore no key areas can be identified.

Bryde's Whales are listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) – and are subject to international agreement/trade controls, thus international trade of Bryde's Whale material is currently illegal. Additionally, the International Whaling Commission recognises the Bryde's Whale as "protected since the moratorium apart from some special permit catches in the North Pacific".

**Recommendations for managers and practitioners:**

- Critical habitats need to be identified (breeding areas, important temporal and spatial feeding patterns and/or areas): satellite tagging could assist here.

- Systematic monitoring: Ship-based line transect sampling to establish population size and trends. This includes the need for a range-wide abundance estimate.
- Sightings submissions: Continual update of the photo-ID catalogue, in particular maximising the amount of data by involving commercial whale watching operators along the coast. Establishment of a national online data-basing system for citizen science, whale watch/sardine run operators, and research groups to upload sightings and photo-ID data with the aim of producing a population estimate every two years to identify trends in abundance.
- Regulation of the "Sardine Run" diving operators and their activities. Several anecdotal reports are that divers disrupt bait balls resulting in the predator dispersing without securing a meal. This is of concern for several predators that depend on the

**Table 2. Conservation interventions for the South African Bryde's Whale (*Balaenoptera edeni*) 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	3.1.1 Harvest Management: inclusion of Bryde's Whale energetic requirements in setting Total Allowable Catch limits (TACs) for the pelagic fishery.	-	Anecdotal	National	-	-

dense shoals during the “run”. Following formal investigation into the severity of this threat, stricter permitting conditions and clear codes of conduct should be drawn up and implemented.

**Research priorities:** The Southern African Bryde’s Whale Project was initially implemented by the Centre for Dolphin Studies (Plettenberg Bay, South Africa) and St Andrews University, Scotland. Current research priorities include:

Bryde’s – type whales in general:

- There is an urgent need for estimates of current population size throughout their entire known range due to the number of different stocks and populations that exist and the scarcity of information available for each. A ship-based line transect survey is probably the most reliable method to use.
- Satellite tagging of individuals throughout their range to determine movements and spatial distribution of individuals. For example, is there panmixia or do individuals have preferred home ranges?
- Need to confirm stock separation through genetic sampling of the offshore population to determine whether they are separate species or subspecies from the inshore.
- Determination of their current dietary composition through collection of stomach contents from stranded animals and stable isotope analyses from biopsy samples collected from free ranging individuals. How does it compare to that 30 years previously? Are they able to adapt to changing prey availabilities?
- Additional research into the value of Marine Protected Areas (MPAs) as a management tool for pelagic fisheries.
- Global comparison of all available molecular data (mtDNA and nDNA) on Bryde’s type whales for the purposes of taxonomic resolution of the complex. This is going to require collaboration, possibly with one person identified as the project coordinator by the IUCN/IWC/Society for Marine Mammalogy (SMM) taxonomy committee.
- Population size, distributional limits and genetic identity (requiring a large sample size from all areas/countries within their range).

Specific priorities for the inshore form:

- The extent of their distributional limits: distribution may extend further up the west coast, into Namibian waters (satellite tagging or ship based survey of extended range).
- Movements: recent photo-ID work suggests surprisingly limited coastwise mixing between bays (c.500 km apart), and satellite tagging of a number of individuals throughout the range could illuminate the degree of “residency” of individuals.
- Range-wide ship-based line transect surveys replicating those completed 30 years ago (Best et al. 1984) is needed for a valid comparison of current population size estimates.
- Routine stable isotope analyses to detect trophic level changes in their dietary contribution. Has their prey type shifted from a small-pelagic fish-based diet to one that includes euphausiids.
- Data types – Satellite tagging, biopsy sampling for genotype mark-recapture, ship-based line transect

survey, photo-ID data from small boat surveys throughout their range, and routine stable isotope analyses.

Specific priorities for the offshore form:

- Estimate of current population size and trend estimates.
- Genetic differentiation from other pelagic populations.
- Identification of threats and threat severity.
- Biopsy sampling to confirm genetic relationship between inshore population and other pelagic populations (for example, North Atlantic and Eastern Indian Ocean).

**Encouraged citizen actions:**

- Uploading location sightings to virtual museum platforms will help in determining the spatial and temporal distribution of the population. This is particularly important for areas on the eastern and western limits of the current known range (approx. East London and Table Bay, respectively). This is only possible for the inshore form because the offshore population is generally inaccessible to citizens. Specifically, citizens can contribute by sending good quality ID photos taken on whale watching and/or pelagic bird trips to [brydeswhaleproject@gmail.com](mailto:brydeswhaleproject@gmail.com). For questions or comments on Bryde’s sightings in South African waters, visit “The Southern African Bryde’s Whale Project” Facebook page.
- Similarly, commercial whale-watching operators and sardine run operators must be encouraged to submit records of location, numbers and if possible ID photos to the same address.
- Reduce boat speed in bays and harbours.
- When participating in whale/dolphin watching tours, ensure regulations are followed.
- Report any stranding, entanglement or ship strikes to the relevant local authorities.

## Data Sources and Quality

**Table 3. Information and interpretation qualifiers for the South African Bryde’s Whale (*Balaenoptera edeni*) assessment**

Data sources	Field survey (literature, unpublished), indirect information (expert knowledge)
Data quality (max)	Estimated
Data quality (min)	Suspected
Uncertainty resolution	Best estimate – inshore form Expert consensus – offshore form
Risk tolerance	Evidentiary – inshore form Precautionary – offshore form

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