Tursiops aduncus – Indo-Pacific Bottlenose Dolphin


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Regional Red List status (2016)	
Ifafa-Kosi Bay subpopulation	**Vulnerable C2a(ii)***
Ifafa-False Bay subpopulation	**Near Threatened B2ab(iii,v)***
Seasonal subpopulation	**Data Deficient***
National Red List status (2004)	
Resident subpopulation	Vulnerable B2ab(ii,iii,v)+C2a(ii)
Migratory subpopulation	Endangered C2a(ii)
Reasons for change	Non-genuine change: New information
Global Red List status (2012)	
T. aduncus	Data Deficient
TOPS listing (NEMBA) (2007)	None
CITES listing (2003)	
T. aduncus	Appendix II
Endemic	No

*Watch-list Data

The Indo-Pacific Bottlenose Dolphin is generally smaller than the Common Bottlenose Dolphin, has a proportionately longer rostrum, and has spots on its belly and lower sides (Wells & Scott 2002).

Taxonomy

Tursiops aduncus (Ehrenberg 1833)

ANIMALIA - CHORDATA - MAMMALIA - CETARTIODACTYLA - DELPHINIDAE - *Tursiops* - *aduncus*

Common names: Indo-Pacific Bottlenose Dolphin (English), Indian Ocean Bottlenose Dolphin (English), Indiese Oseaan-stompneusdolfyn (Afrikaans)

Taxonomic status: Subpopulation

Taxonomic notes: The taxonomic status of regional populations of *Tursiops* (for example off South Africa and western Australia) remains under consideration, and the genus may be split further (Natoli et al. 2004; Moura et al. 2013). Critically, the "aduncus-type" subpopulations found off South Africa are genetically distinct (reciprocally monophyletic) compared to other populations of similar phenotype from elsewhere in the world (and all currently classified as *Tursiops aduncus*).

A migratory stock, moving between Plettenberg Bay and Durban, was assessed separately to the so-called resident stock (nearshore waters less than 50 m depth from Kosi Bay to Mossel Bay) in the 2004 National Assessment (Friedmann & Daly 2004). This was based on Goodwin et al. (1996) who found significant differentiation of mtDNA haplotypes between Eastern Cape and KwaZulu-Natal individuals. Subsequent genetic studies showed significant differentiation between three putative stocks, although none of these comparisons described more than 3% of the genetic variance (Natoli et al. 2008). The identified boundaries distinguished northern and southern 'resident' populations either side of Ifafa, and a third 'migratory' population, sampled 20 km or more south of the KwaZulu-Natal/Eastern Cape border between June and October, for which the full distribution range is not known. Ongoing work at higher resolution is confirming these population boundaries (Gray 2015). Further research is needed to determine the level of connectivity among other regional populations across the broader distributional range. For this reassessment, although this species was split into a migratory and resident subpopulation in the 2004 assessment, subsequent genetic analyses indicate that the distinction should be between coastal populations north and south of Ifafa, with the role of migratory animals to the south still poorly understood.

Assessment Rationale

While two subpopulations were assessed in the previous assessment in 2004: a migratory stock, moving between Plettenberg Bay and Durban and a so-called resident stock (nearshore waters less than 50 m depth from Kosi Bay to Mossel Bay), subsequent molecular studies show significant differentiation between three putative subpopulations: northern and southern 'resident' subpopulations either side of Ifafa, KwaZulu-Natal Province, and a third 'migratory' or transient subpopulation. We label these subpopulations the Ifafa-Kosi Bay, Ifafa-False Bay and seasonal subpopulations, respectively. However, we caution that more molecular work at a higher spatial resolution is necessary to fully delineate the geographical and ecological boundaries of the putative subpopulations. This species should be reassessed once such data become available.

This species is threatened by habitat degradation from pollution and development, competition with fisheries and ongoing bycatch in shark nets and there is thus an inferred continuing decline in the population. It prefers waters less than 30–50 m deep and only occurs within

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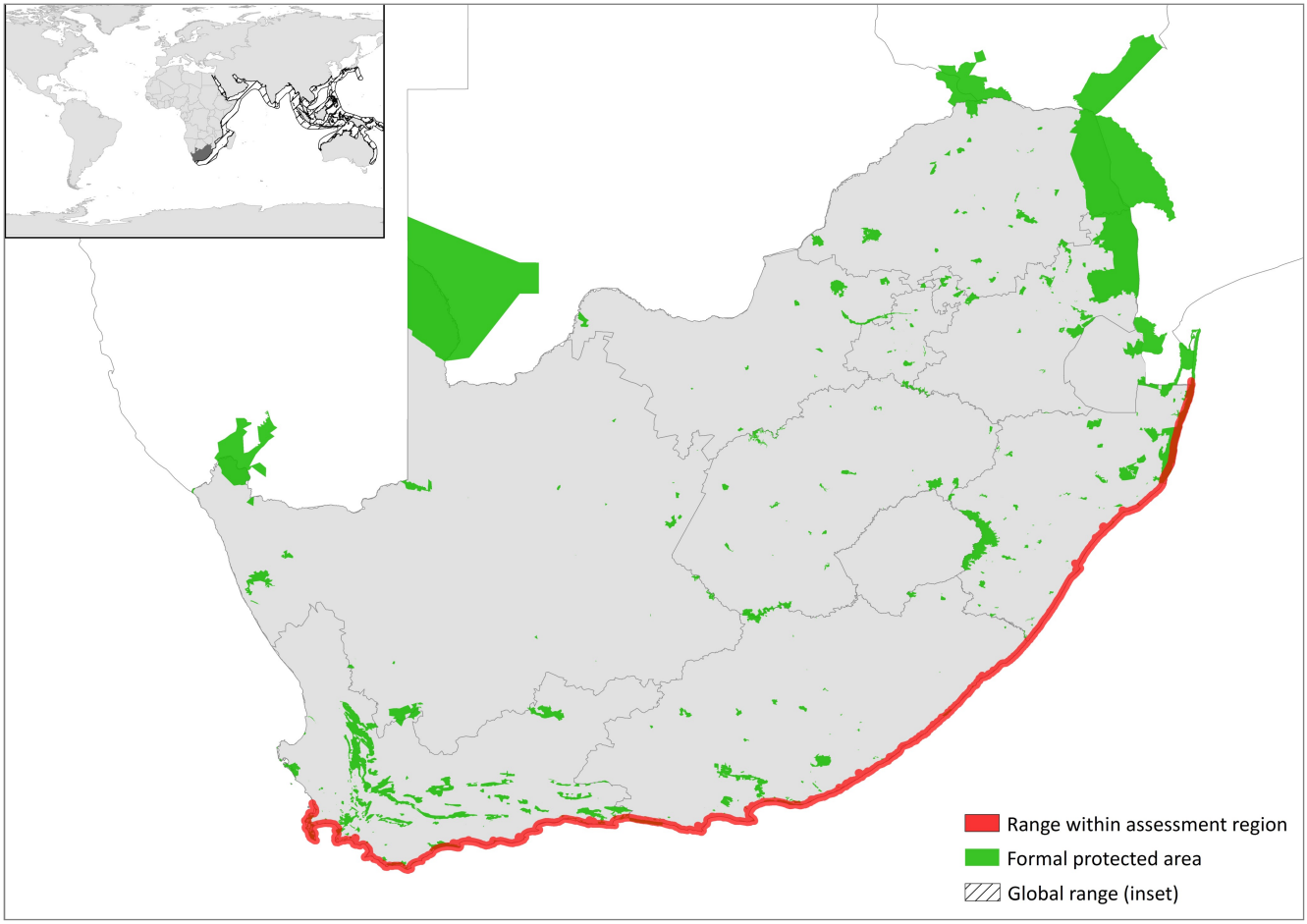

Figure 1. Distribution range for Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*) within the assessment region

Table 1. Countries of occurrence within southern Africa

Country	Presence	Origin
Mozambique	Extant	Native
Namibia	Absent	-
South Africa	Extant	Native

10 km of the shoreline. Correspondingly, the majority of the population occurs within 500 m to 2 km of the coastline. For the Ifafa-Kosi Bay subpopulation, the length of the coastline is 572 km. Therefore the extent of occurrence (EOO) is estimated to be 5,720 km^2 (using 10 km from shore as the limit), while the area of occupancy (AOO) is estimated to be 286–1,144 km^2. Although almost meeting the requirements for Vulnerable B1ab(iii,v)+B2ab(iii,v), they are not fragmented and the number of locations is uncertain. There are probably fewer than 2,500 mature individuals in the subpopulation with all individuals being connected and thus the proportion of individuals in one subpopulation is likely to be 95–100%, which would qualify the subpopulation as Endangered C2a(ii). However, it is poorly understood whether the Mozambique population is part of the same subpopulation or distinct from the northern KwaZulu-Natal animals. Regardless, there is probably substantial dispersal between Mozambique and northern KwaZulu-Natal with resulting rescue effects possible. Thus we list this subpopulation as Vulnerable C2a(ii).

Similarly, the length of the coastline from Ifafa to False Bay is 2,080 km. Therefore the EOO is estimated to be 20,800 km^2, while the AOO is 1,040–4,160 km^2. Although almost meeting the requirements for Vulnerable B1ab(iii,v)+B2ab(iii,v), the population is not fragmented and the number of locations is uncertain. Mature population size is estimated to be over 10,000 individuals. Thus we list as Near Threatened B2ab(iii,v).

The role of migratory or transient animals to the south is still poorly understood. Due to the lack of data on this subpopulation, the conflicting nature of available evidence, and the hypothesis that it is probably a dynamic subset of the Ifafa-False Bay subpopulation, we list as Data Deficient until more tangible evidence emerges to list this subpopulation. For all subpopulations far more basic ecological and distributional data need to be collected.

Regional population effects: There is suspected to be dispersal, and thus potential for rescue effects, between northern KwaZulu-Natal Province and Mozambique.

Distribution

The Indo-Pacific Bottlenose Dolphin has a discontinuous distribution in the warm temperate to tropical Indo-Pacific, from South Africa in the west, along the rim of the Indian Ocean (including the Red Sea, Persian Gulf and Indo-Malay Archipelago as far east as the Solomon Islands and possibly New Caledonia) to the southern half of Japan and southeast Australia, in the east (Möller & Beheregaray 2001; Wells & Scott 2002).

Along the African coast, they range from South Africa to Kenya, including islands such as Zanzibar and Madagascar (Best 2007). Within the assessment region, they range from Cape Agulhas (although they have been sighted in False Bay) to Kosi Bay and into Mozambique

Table 2. Estimates of extent of occurrence (EOO) and area of occupancy (AOO) for Ifafa-False Bay and Ifafa-Kosi Bay subpopulations of Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*) based on 10 km distance from shore limit for extent and 500 m to 2 km distance from shore as a proxy for 30–50 m water depth

		Occurs within 30–50 m depth			*Maximum distance from shore*
		AOO	AOO	AOO	EOO
Coastline segment	length (km)	500 m	1 km	2 km	10 km
False Bay to Ifafa	2,080	1,040	2,080	4,160	20,800
Ifafa to Mozambique border	572	286	572	1,144	5,720

(Best 2007). The Ifafa-Kosi Bay subpopulation may be connected to Mozambique via potential dispersal from Mozambique into the region. Research must identify connectedness with the Mozambique dolphins. Along the Eastern Cape and KwaZulu-Natal coastline, they occur in water less than 30–50 m deep (Ross et al. 1987), and only within 10 km of the shoreline. Correspondingly, the majority of the population occurs within 500 m to 2 km of the coastline. The length of the coastline from False Bay to Kosi Bay is 2,661 km (including estuaries). As such we can calculate extent of occurrence and area of occupancy for the subpopulations (Table 2).

Along the KwaZulu-Natal coast, they appear to have more occupied or preferred areas about 30 km apart, but it is uncertain whether this pertains to home ranges (Cockcroft et al. 1991, 1992). Similarly, differences in organochlorine levels between individuals in areas 70–80 km apart on the KwaZulu-Natal coast suggest discrete subpopulations (Cockcroft et al. 1989). The habit of individuals stealing fish from fishing hooks off Margate, but not in adjacent areas, also suggests limited dispersal or restricted home ranges (Cockcroft et al. 1990). However, the 'seasonal subpopulation' may connect various subpopulations: for example, return trips have been recorded for individuals between Algoa and Plettenberg bays (round trip of 420 km) (Ross 1984). However, the geographical and ecological boundaries of the seasonal subpopulation are poorly understood. As the annual sardine run typically occurs mostly south of Ifafa, this may represent a natural boundary between southern and northern *T. aduncus* subpopulations, supported by the genetic data (Natoli et al. 2008). While the migratory subpopulation is hypothesised to follow the Sardine Run (Cockcroft et al. 1991 cited in Best 2007), there is conflicting evidence for this due to the stomach contents of this subpopulation showing few sardines (S. Plön unpubl. data). However, the latter may be an indication of the Sardine Run changing. Similarly, Friedmann and Daly (2004) suggested that the migratory individuals may originate as far west as Plettenberg Bay and range into southern KwaZulu-Natal Province, but there is no evidence for this. Although it was assumed that the seasonal subpopulation was a vehicle of gene flow between the southern (Eastern Cape) and northern (KwaZulu-Natal) areas, Natoli et al. (2008) suggested that no genetic differentiation would have been detected if this was the case. This suggests that there is not much exchange between north, south and seasonal subpopulations, despite their overlapping range for some period during the austral winter. Thus, more research needs to be done to delineate the boundaries and taxonomic status of the various subpopulations.

Population

Although this species was split into a migratory and resident subpopulation in the 2004 assessment (Friedmann & Daly 2004), subsequent molecular analyses indicate that the distinction should be between coastal subpopulations north and south of Ifafa, with the role of migratory or transient animals to the south still poorly understood.

The population size and trends of the three subpopulations are poorly known and confined to localised estimates. For example, mark-recapture estimates from Algoa Bay on the south coast, Eastern Cape (based on 1,507 mature individuals and 62 juveniles), are between 16,220 and 40,744 individuals (95% confidence intervals), with a mean population size of 28,482 individuals that use the bay (Reisinger & Karczmarski 2010). Although it is unclear how widely these individuals are distributed along the South African coast, this is the largest population estimate to date for this species, suggesting that the Indo-Pacific Bottlenose Dolphins inhabiting the Algoa Bay region represent part of a substantially larger population. However, the data were collected from 1991 and 1994 and a more recent study is necessary to determine population trend. Similarly, between 8,000 and 12,000 individuals use Plettenberg Bay alone (Phillips 2006), which probably overlaps heavily with the Algoa Bay animals and the seasonal subpopulation. Thus, the Ifafa-False Bay subpopulation may be in excess of 40,000 individuals overall. However, estimates of average density from aerial counts indicate that densities on the KwaZulu-Natal South Coast are an order of magnitude less than those off the North Coast and the coast of Transkei (Ross et al. 1989).

For the Ifafa-Kosi Bay subpopulation, there are an estimated 631–848 (95% confidence intervals: 462–1,321) individuals within the Durban Bay area (S. Elwen, unpubl. data). For the KwaZulu-Natal resident stock (both north and south coast), Cockcroft et al. (1992) estimated 520–530 individuals. However, given that estimate from relatively few surveys in Durban Bay alone is nearly up to 1,000 individuals, there are possibly considerably more animals along the entire coast to Kosi Bay. For example, Photopoulou et al. (2011) report three groups per hour passing Cape Vidal at a median group size of 22 individuals.

Model based estimates of generation time are 21 years (Taylor et al. 2007).

Current population trend: Declining

Continuing decline in mature individuals: Yes, due to ongoing mortality in shark nets.

Number of mature individuals in population: Unknown

Number of mature individuals in largest subpopulation: 16,000–40,000

Number of subpopulations: Three, but ongoing molecular work will refine subpopulation boundaries.

Severely fragmented: No

Habitats and Ecology

Indo-Pacific Bottlenose Dolphins generally occur over shallow coastal waters (less than 50 m depth) on the continental shelf or around oceanic islands. They sometimes occur in mixed groups with Humpback Dolphins (*Sousa plumbea*) and other delphinid species. They feed on a wide variety of schooling, demersal and reef fishes, as well as cephalopods (Ross 1984; Cockcroft 1990).

Ecosystem and cultural services: This is the archetype of dolphins and, since most South Africans are unaware of the variety of delphinids, this is typically what they envisage when "dolphins" are mentioned. As such, they are a flagship species. They are also an indicator species: coastal dolphins, as long-lived, long-term residents along the coast, can serve as important sentinels of the health of coastal marine ecosystems (Wells et al. 2004; Lane et al. 2014; Gui et al. 2016). As top-level predators on a wide variety of fishes and squids, they concentrate contaminants through bioaccumulation and integrate broadly across the ecosystem in terms of exposure to environmental impacts (Cockcroft et al. 1989).

Use and Trade

There is local opportunistic medicinal and food use of stranded animals.

Table 3. Threats to the Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*) 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	*5.4.5 Fishing & Harvesting Aquatic Resources*: bycatch from fishery and gill nets.	Cockcroft et al. 1990 Cockcroft et al. 1992 Cliff & Dudley 2011 Lane et al. 2014	Empirical Empirical Empirical Empirical	Regional Regional Regional Regional	Ongoing but may be decreasing.
2	*9.1.3 Domestic & Urban Waste Water*: residential pollution from coastal settlements.	Cockcroft et al. 1989	Empirical	Regional	Ongoing. While no deleterious effects were observed, the toxin levels were twice that found in other small cetaceans and were correlated with decreased testosterone in males.
3	*9.2.3 Industrial & Military Effluents*: industrial pollution from coastal development.	Cockcroft et al. 1989 Gui et al. 2016	Empirical Empirical	Regional Regional	Ongoing
4	*9.3.4 Agricultural & Forestry Effluents*: pesticide and fertiliser pollution from agro-industries.	Cockcroft et al. 1989 Gui et al. 2016	Empirical Empirical	Regional Regional	Ongoing
5	*5.4.2 Fishing & Harvesting Aquatic Resources*: competition with industrial fishing industries. Current stress *1.3 Indirect Ecosystem Effects*: loss of prey base.	-	Anecdotal	-	-
6	*1.2 Commercial & Industrial Areas*: habitat degradation from harbour development and coastal sprawl. Current stress *1.3 Indirect Ecosystem Effects*: decreased occupancy from human disturbance.	-	Anecdotal	-	-
7	*1.3 Tourism & Recreation Areas*: habitat degradation from harbour development and coastal sprawl. Current stress *1.3 Indirect Ecosystem Effects*: decreased occupancy from human disturbance.	-	Anecdotal	-	-
8	*1.1 Housing & Urban Areas*: habitat degradation from harbour development and coastal sprawl. Current stress *1.3 Indirect Ecosystem Effects*: decreased occupancy from human disturbance.	-	Anecdotal	-	-
9	*2.1.3 Annual & Perennial Non-Timber Crops*: habitat degradation from agricultural intensification. Current stress *1.2 Ecosystem Degradation*: siltation of near-shore reefs and loss of nursery grounds for prey species.	-	Anecdotal	-	-

Threats

The species' near-shore distribution makes it vulnerable to habitat degradation and fishery conflicts, which include gillnets and purse seines. Within the assessment region, Indo-Pacific Bottlenose Dolphins are exposed to a wide variety of threats.

1. **Bycatch on gillnets**: They suffer considerable mortality in the large-mesh gillnets set to protect bathers from sharks (Cockcroft 1990, 1992; Dudley 1997; Peddemors 1999; Reeves et al. 2003). Between 1980 and 2005 between 14 and 62 (mean 37) dolphins have been caught annually in the shark nets between Richards Bay and Port Edward (Peddemors et al. 1998; Best 2007). Similarly, Lane et al. (2014) report at least 35 *T. aduncus* collected from nets between 2010 and 2012 with most from Durban and further north. A high proportion (23%) of the Bottlenose Dolphins were reproductively active females (Cockcroft 1990), who have a high reproductive value and are an integral part of maintaining stability in terms of population size (Coulson et al. 2001). The high number of annual catches has been identified as a conservation concern since at least the 1960s (Peddemors 1993), and has been thought to play a central role in the reduction of sighting rates of animals in the region between the 1970s and 1980s (Cockcroft et al. 1990). Historically, bycatch has been a greater threat to the northern subpopulation than to the southern subpopulation.
2. **Pollution**: Accumulation of pollutants and heavy metals, such as toxic xenobiotic chemicals and pesticides, may affect reproduction and survival (Cockcroft et al. 1989; Gui et al. 2016). Pollution was more severe for the north coast subpopulation in KwaZulu-Natal (Cockcroft et al. 1989). A more recent analysis shows continued high levels of PCBs and DDT compounds in the species across most of the species range within South African waters (Gui et al. 2016). Furthermore, these toxins are also transferred from mothers to their calves through lactation where almost 80% of the toxin residue load in a female Bottlenose Dolphin is transferred to the first-born calf and can be potentially fatal to the calf (Cockcroft et al. 1989).
3. **Fisheries competition**: Reduced prey availability caused by environmental degradation and overfishing (Jackson et al. 2001). Unsustainable fishing of reef fishes has reduced habitat suitable for prey fish nursery areas (estuaries). Climate change is also likely to exacerbate shifts in prey base (Potts et al. 2015).
4. **Disturbance**: Direct and indirect disturbance and harassment (for example, boat traffic and commercial dolphin watching and interactive programs) may effectively reduce occupancy and reproductive success.
5. **Habitat degradation**: Marine construction and demolition and other forms of habitat destruction and degradation (including anthropogenic noise). For example, the development of harbours and continued requirement for additional quay space has resulted in continued degradation of estuaries, leading to destruction of important foraging areas. Additionally, farming and water use malpractices have led to siltation of nearshore reefs and estuaries, but this is reversible through education and planting away from river banks.

Although these and other threats are technically challenging to quantify, their cumulative impact may result in longitudinal population declines. Lack of historical data in many cases hampers understanding of long-term trends, possibly resulting in shifting baselines.

Current habitat trend: Declining in quality due to ongoing coastal development and poor agricultural practices upstream of watersheds.

Conservation

This species occurs in several Marine Protected Areas (MPAs), including Maputaland MPA, Trafalgar MPA, Mkambati MPA, Dweza Cwebe MPA and Tsitsikamma MPA. It is listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and protected under the Marine Living Resources Act (No. 18 of 1998). The conservation of the KwaZulu-Natal stock should be prioritised to allow the stock to recover from prolonged exploitation (Goodwin et al. 1996). There are several priority interventions that should be continued within the assessment region:

Table 4. Conservation interventions for the Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*) 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	*2.1 Site/Area Management*: reducing bycatch from shark nets by removal of nets completely, decreasing net length and/or modification of fishing gear.	Cliff & Dudley 2011	Empirical	Regional	Bycatch decreased by increasing mesh size.	KwaZulu-Natal Sharks Board
2	*5.4 Compliance & Enforcement*: stricter regulations on the agriculture and industrial sectors to curb pollution levels; enforce zoning regulations along coastline; enforce penalties transgressing existing laws.	-	Anecdotal	-	-	-
3	*5.2 Policies & Regulations*: establish more stringent regulations and increase penalties for illegal development and pollution.	-	Anecdotal	-	-	-

1. **Reduce bycatch**: Various strategies have been tested to mitigate the unintentional catch in the shark nets. Devices have been added to the nets to make the nets more conspicuous acoustically (for example, air-filled floats, clangers), or to deter the dolphins with sounds (such as pingers), but have not been successful (Peddemors et al. 1990; Cliff & Dudley 2011). Modifying the fishing gear by increasing the mesh size had more success, but was not a viable option (Dudley 1997; Cliff & Dudley 2011). Although not determined statistically, the catch rate of Bottlenose Dolphins may have been lower in the period 2000–2009 than the previous decade (from 45 ± 14 individuals during 1990–1999 to 27 ± 7 individuals during 2000–2009; Cliff & Dudley 2011), possibly due to the reduction of fishing effort (the permanent removal of one or two of the nets) at most beaches, time/area closures (the temporary removal of some nets during the Sardine Run), and gear change (the replacement of some nets with baited hooks (drumlines) which do not catch cetaceans) (Dudley et al. 1998; Dudley & Cliff 2010; Cliff & Dudley 2011). However, reduced catch rates may also indicate a declining population. Overall, ongoing bycatch is still a threat to the dolphins as they have very low intrinsic rates of population growth as a consequence of their life history characteristics: they grow slowly, mature late, and bear only one calf per pregnancy with long inter-calf intervals (Reilly & Barlow 1986).
2. **Regulate agricultural, industrial and urban pollution**: Stricter regulations on the agriculture and industrial sectors should be enforced to curb pollution levels. For example, bio-friendly insecticides should be compulsory. Contaminant analysis should be conducted on each subpopulation to assess the relative level of contaminants. Coastal development needs to be more stringently regulated.
3. **Reduce competition with fisheries**: Near-shore fisheries need to be more stringently regulated and penalties enforced. Similarly, polices surrounding boat-based dolphin watching should be enforced.

Recommendations for managers and practitioners:

- Systematic monitoring of all putative subpopulations/stocks, especially the north and south coast Ifafa subpopulations. The main target of the monitoring should be to gain precise estimates for each subpopulation. Further population genetic data should be produced to extend previous results and more inclusively assess the pattern of subdivision across the species range in southern African waters.
- Monitoring the threat intensity for all putative subpopulations/stocks.
- Increase information sharing between agencies to enhance cooperation and facilitate the implementation of interventions.

Research priorities: Current research projects through Centre for Dolphin Studies (CDS) and Nelson Mandela Metropolitan University (NMMU) include studies on the abundance, distribution and population genetic structure of Indo-Pacific Bottlenose Dolphins (*Tursiops aduncus*) along the southeast coast of South Africa and their implications for spatial management. Durham University is conducting higher resolution analysis of population genetics in the KwaZulu-Natal and Plettenberg Bay region. The occurrence and population connectivity of cetaceans along the Wild Coast, with particular emphasis on the role of marine protected areas, is being assessed by Rhodes University in collaboration with NMMU. Future studies should:

- Conduct further surveys to determine overall population size/trends and geographical extent of the putative subpopulations, which should be expanded to include more effort in tracking the movements of the migratory subpopulation during the summer months.
- Conduct genetic research to clarify the taxonomy of the genus *Tursiops* and to determine significant management units. Studies of numbers and genetics of animals north of Richard's Bay into southern Mozambique is necessary to determine the vulnerability/isolation of the Ifafa-Kosi Bay subpopulation.
- Further research is needed to determine the level of connectivity among other regional populations across the broader distributional range
- Assessing the effectiveness of Marine Protected Areas (MPAs) in conserving threatened subpopulations, especially those in northern KwaZulu-Natal Province. The results of which should feed into developing guidelines for MPA development.

Encouraged citizen actions:

- Use information dispensed by the South African Sustainable Seafood Initiative (SASSI) to make good choices when buying fish in shops and restaurants (wwfsa.mobi, FishMS 0794998795).
- Buy fresh produce that has been grown in pesticide-free environments.
- Save electricity and fuel to mitigate CO_2 emissions and hence rate of climate change.
- Buy local products that have not been shipped.
- Reduce boat speed in coastal environments and do not approach or chase dolphins in boats or skis.
- Report sightings on virtual museum platforms (for example, iSpot and MammalMAP) and/or submit any photographs of dolphin dorsal fins to Centre for Dolphin Studies. Report any stranded dolphins to your nearest museum, or to the Centre for Dolphin Studies.
- When participating in whale/dolphin watching tours, use only official tour operators and ensure regulations are upheld.

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Data Sources and Quality

Table 5. Information and interpretation qualifiers for the Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*) assessment

Data sources	Field studies (literature), Indirect information (literature, expert knowledge)
Data quality (max)	Inferred
Data quality (min)	Suspected
Uncertainty resolution	Expert consensus
Risk tolerance	Precautionary

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